University of Catania

PhD in Geological, Biological and Environmental Sciences

Department of Biological, Geological and Environmental Sciences

PhD thesis

Vegetation prodrome of Sicily

Candidate

Salvatore Cambria

Tutor

Prof. Gianpietro Giusso del Galdo

XXXII cycle: 2017-2019

Summary

INTRODUCTION

The phytosociology is a synthetic science with a pronounced interdisciplinary character, which brings together theoretical and applicative aspects at the same time, providing a complex ecological vision of plant communities. In fact, this discipline takes into account the phytocoenoses, the trophic base of ecosystems, studying the numerous environmental and anthropic factors that affect their structure, floristic composition, dynamic processes and ecological requirements. In the last decades the progressive deterioration of natural environments due to the anthropic disturbance in its various manifestations, such as fires, urbanization, intensive grazing or climate change, and at the same time the need for their conservation, have given great applicative importance to phytosociology, as its theoretical results constitute a fundamental basis for any intervention of ecological management, environmental restoration and conservation of biodiversity. For this purpose, the studies and numerous publications concerning this topic have represented a considerable expansion of the knowledge on the vegetation of the various areas of the planet. In particular, the realization of more or less complete phytosociological studies aimed at listing and reviewing all the plant communities present in a well defined territory has led to the publication of numerous "Vegetation Prodrome", which according to Gèhu (2006), can be defined as "preliminary work aimed at developing a detailed classification system for plant communities present in a given territory". Recently, numerous examples of this type of monographic work have been published for several European countries or regions, among them it is possible to mention Pott (1995), Bardat et al. (2004), Chytrý (2007-2013), Rivas-Martinez et al. (2011), Costa et al. (2012) Loidi (2017), etc. As regards Italy, there are currently no detailed works of this kind, apart from the checklist of the higher rank syntaxa (classes, orders and alliances) published by Biondi et al. (2014). Furthermore, the book "The vegetation of Italy" (Blasi ed., 2010) represents an interesting synthesis concerning the entire national territory, based on the concept of vegetation series using the sinphytosociological method. As concerns synthetic works about Sicily vegetation, it is currently possible to find in literature only some syntaxonomic checklists, often rather dated and related to limited areas of the island (see Brullo et al., 1996, 2001; Guarino et al., 2017) and a vegetation map at regional level (Gianguzzi et al., 2016). Therefore, the present study attempts to fill a gap in the knowledge of vegetation in Sicily, providing a more complete and up-to-date view of the phytocoenoses present on the island, taking into account the most recent phytosociological contributions of Italian and European authors. This work assumes particular importance in Sicily, the largest island in the Mediterranean sea, whose topographical, climatic, pedological and geological variety gives to it a remarkable environmental variety and biodiversity, now increasingly at risk and threatened by human activities. Really, the demand for a synthetic reference work not only for

phytosociology scholars but also for all the professional figures involved at various levels in the conservation of nature constitutes the ultimate objective of this work. Although further investigations are required, also through the use of modern statistical techniques, especially for some high-rank syntaxa and the simplification and reduction of numerous and sometimes unnecessary associations until now described, a critical review and classification of the plant communities occurring on the island is here presented. Besides, the orographic, geological, pedological, climatic and floristic characteristics of Sicily are examined in the introductory part, as well as the history of phytosociological studies in the island.

MATERIAL AND METHODS

This phytosociological investigation regards all the classes of Sicily vegetation. It was performed through a critical analysis of the literature data concerning the different types of vegetation published by numerous authors over the last decades. We tried to adapt the higher rank classification on the basis of the arrangement proposed by the EuroVegChecklist (Mucina et al., 2016), in order to support the nomenclatural stability and coherence of classes, orders and alliances. However, in some cases it was not possible, particularly when this classification shows some nomenclatural mistakes, discrepancies with our view or results not applicable to the communities occurring in Sicily. For each syntaxon a sheet with some paragraphs has been provided. Firstly, the nomenclatural aspects were taken into consideration, indicating the correct name of the syntaxon, basing on the phytosociological nomenclature code (Weber et al., 2000), and eventual synonyms (indicating the article of the code on the basis of which the name must be considered invalid, illegitimate or a simple synonym). Furthermore, immediately after the name of the syntaxon, a brief description is proposed for a rapid identification of the community, where the common english name of the characteristic species and the main ecological-structural features are reported. The following entries are the nomenclatural type (holotypus, lectotypus or neotypus), if it has been designated (when possible the designation is here proposed), the characteristic and differential species (species that allow to characterize and/or differentiate a syntaxon from the others) and the geographical distribution (both global and regional). Only for the associations a synthetic phytosociological table of unpublished or literature relevés is provided, indicating the authors, year, number of table and reléves for the pubblished data. For tables with less than 5 reliefs, the number of surveys in which each taxon occurs is indicated in brackets. If there are more than 5 reliefs, each species has a value that goes from I to V, based on the percentage of the reliefs in which it is present (I = 0-20%; II = 20-40%; III= 40- 60%; IV= 60-80%; V= 80-100%). The taxa are arranged according to their syntaxonomical category (characteristic species of association and of higher rank syntaxa or other species and sometimes also transgressive taxa of other classes). As concerns the unpublished phytosociological surveys, they were performed following the Zurich-Montpellier Sigmatist School approach (Braun-Blanquet 1964) and later integrations (Gèhu & Rivas-Martinez 1981, Gèhu 2006, Biondi 2011, Pott 2011). The authors, year and locality are reported. The nomenclature used for the flora follows Giardina et al. (2007), Pignatti (2017-2019) and Bartolucci et al. (2018). As regards the “Structure and Ecology” paragraph, the main physiognomic and floristic characteristics of syntaxon and its ecological requirements are presented, as well as the nomenclatural and syntaxonomical comments when needed. In the “Syndynamism” paragraph the catenal and dynamic relationships are treated, giving particular emphasis to the stages of degradation and

evolution of the syntaxon. Finally, each syntaxon was associated with a reference habitat, based on the EUNIS habitats classification (2007) used in the European Red List of habitats (https://forum.eionet.europa.eu/european-red-list-habitats/library/index_html).

1. PHYSIOGRAPHIC CHARACTERS

1.1. Orography and landscape

Sicily is located in the central part of the Mediterranean Sea, separated from the Italian Peninsula by the Strait of Messina and washed by the Ionian Sea (eastward), the Tyrrhenian Sea (northward) and the Channel of Sicily (southward), which separates Sicily from Africa. It is the largest Mediterranean island, having an extension of 25711 km^2. Its territory consists mainly of hills and mountains, which represent respectively the 50.11% and 37.73% of the whole territory, while the plains constitute only the 14.16% (Venturella, 2004). The great topographic and geographic variety makes this island a very heterogeneous territory. In particular, the northern part of Sicily is characterized by a mountain chain, extending from east to west, sometimes known as the "Sicilian Apennine" and including some small ranges with different orographic and geological features, as Peloritani (1374 m a.s.l.), Nebrodi (1847 m), Madonie (1989 m), Palermo and Trapani mountains (1333 m). The central-southernand south-western parts have a more flat or hilly landscape with extensive cereal fields and olive groves, only interrupted by the irregular chains of Sicani (1613 m) and Erei mountains (1193 m). The central-eastern part is dominated by the volcanic building of the Mt. Etna (3350 m), which is the highest elevation in Sicily, while the south-eastern part shows a very characteristic orography with the limestone (or volcanic) plateau of Hyblaean range (986 m) furrowed by deep canyons (locally called "cave"). The only relevant alluvial plain is the "Piana di Catania" which is the most important agricultural area in Sicily for *Citrus* crops. Despite an extensive hydrographic network, except for some longer rivers as Simeto (average flow of 18 m^3/sec), Alcantara, Platani and Salso, most of Sicilian watercourses are temporary and show a marked seasonal gap, alternating winter floods with summer drought. It is caused by the low rainfall, the short persistance of snow and the relatively small extension of basins. This particular trend is responsible for the characteristic valleys known as "fiumare", wide river-beds with gravelly incoherent soils, which are found above all in north-eastern part. Even the permanent natural lakes with freshwater are quite rare in Sicily and largely replaced by the typical Mediterranean temporary ponds, while the coastal salty marshes are frequent in the north-western and south-eastern areas. As regards the coastal topography, along the Thyrrenian side more or less extended high

and rocky stretches are alternated with small sandy bays, while the southern and eastern coasts are characterized by long sandy beaches and brief low reefs. The regional territory includes also some small islands with very diferrent geographical characteristics, as the Aeolian Islands (Stromboli, Panarea, Lipari, Vulcano, Salina, Filicudi and Alicudi), Pantelleria, Ustica, the Aegadian (Favignana, Levanzo and Marettimo) and the Pelagian archipelagos, which includes Linosa and Lampedusa.

1.2. Geology

For its long geological histoy and geomorphological variety, Sicily is one of the more interesting area in the Mediterranean territories. The geological structure of the island currently observable is the result of complex dynamics that start around 250 million years ago, at the beginning of the Triassic, when Sicily was mostly submerged and was located on the western margins of the Pangea super-continent (Beltrando et al., 2010; Lentini & Carboni, 2014; Santagati & Asero, 2018). The distension fractures, which cause the progressive fragmentation of Pangea, led to the separation of Africa from Europe and consequently to the extension of the Neo-Tetidean Ocean and the opening of some basins in its western sector. At the end of the Jurassic the future Mediterranean area was constituted by a continental residue of Pangea (Panormide block) interposed between the Ionic and the Alpine-Tetidean basins. The area where Sicily would later form was still submerged and located on the edge of the African plate. In the lower Cretaceous, about 130 million years ago, due to the detachment of South America from Africa, the latter changed direction, going up to clash with the great Eurasian plate. Thus the Neo-Tetidean ocean was closed on its eastern side, originating the Mediterranean Sea. About 55 million years ago (Eocene), the thrust of the African plate determined the impressive orogenetic processes that led to the formation of a large mountain range from southern Spain to the Middle East. This event originated the Alps and also some other reliefs, such as the Peloritani and the Aspromonte, which reached their present position only a long time later. The subsequent opening of the Provencal Basin, following a series of deep fractures extended from Liguria to Spain, led to the detachment of the Sardinian-Corsican block, consisting of a fragment of the mountain range formed during the Eocene and of the nearby area including Corsica and Sardinia. The subsequent tectonic movements caused the breaking of the fragment, giving origin to Peloritani, Aspromonte and Sila. Furthermore, the progressive

enlargement of the Provencal Basin led the oceanic crust of the Alpine-Tetidean basin to go under the eastern margin of Sardinian-Corsican block. The result was the beginning of the orogenetic processes that led to the formation of the Apennines. About 15 million years ago (middle Miocene) the oceanic crust of the Alpine-Tetidean basin was exhausted and consequently the subduction stopped and the Sardinian-Corsican block collided directly with the continental crust of the Panormid Block. Thus, Corsica and Sardinia reached their current position. Although the formation of Sicily was not directly influenced by the Sardinian-Corsican block movement, it had dragged the future Peloritani Mountains with it. The subsequent fracturing of the Sardinian-Corsican block caused the formation of the Tyrrhenian and the Italian peninsula. The opening of the new basin determines the detachment and the push towards the east of the Alpine chain fragment including Apennini, Aspromonte, Sila and Peloritani, as well as the Panormide block. The result was the progressive narrowing of the Ionian Basin. Following the exhaustion of the oceanic crust, the Panormide Block was in direct collision with the African plate, leading to the formation of the marine reliefs that will constitute the northern chain of Sicily, which represents the central stretch of a long mountain system that extends from the Apennines to North Africa. At the end of the Miocene the northern part of Sicily was still largely submerged, while to the south the deposition of limestones on the African platform had determined the emergence of some portions of the Hyblaean. At the beginning of the Pliocene the formation of the long Apennine-Maghrebid chain continued and the mountains of northern Sicily advanced towards their current position, while the Calabro-Peloritan arch slid towards south-east. 7 million years ago, some fractures opened in the north-eastern area of Hyblaean and determined the rising of magma. This volcanic activity continued and extended northwards, reaching the area of Catania 1.5 million years ago (Schellart, 2010). Another geological event had remarkable consequences on the formation of Sicily, in fact during the Messinian (about 6.5 million years ago) due to the temporary closure of the Strait of Gibraltar, the Mediterranean sea dried up, leading to the deposition of considerable quantities of evaporitic rocks that today constitute the “Gessoso-Solfifera” series of central-southern Sicily. At the end of the Pleistocene the formation of the northern mountain range of Sicily was completed with the final positioning of the Peloritani. The areas between the northern chain and the Hyblaean also began to emerge due to tectonic movements. At the end of the Pleistocene, Sicily was almost completely emerged and very similar to the current one, although the

alternation of glacial and interglacial phases caused significant changes on the morphology of the coasts (Abate et al., 1998; Agnesi, 2004). However, the construction of the Etna volcanic cone occurred only later, about 500 thousand years ago, due to the geological forces still in place for the continuous opening of the Tyrrhenian basin (Diaz Moreno et al., 2018). The current altitude reached by Etna does not derive only from the quantity of volcanites that accumulated over time but also from the tectonic uplift that still today insists on the area, causing the raising of about 1300 m of the ancient pre-Etna seabed. Following these dynamics, current Sicily shows a remarkable variety of geological substrates (fig. 1), which can be briefly summarized as follows (Catalano, 2004). The Peloritani mountains, which make up the easternmost part of the northern chain, are made up of metamorphic rocks, as schists, phyllads and gneiss or sometimes also calcareous and arenaceous sedimentary rocks (only on the Ionian side). The strong erosion that affect the slopes of these mountains determines the transport of large quantities of debris downstream, which make up the pebbly bed of the river-beds locally called "fiumare". The Nebrodi mountains form an impressive orographic mass with a smooth and regular appearance. They are formed by quartzose sandstones, clays and siltose deposition belonging to the Numidian Flysch, but more rarely also limestones. The mountains of the Madonie reach the highest altitudes of the island after Etna and consist of sedimentary rocks, such as limestone and dolomite (to a lesser extent also quartzarenites), frequently interrupted by outcroppings of salty clay and layers of halite. The geomorphology of these carbonate reliefs is typically rugged and jagged with steep cliffs, sheer walls and valleys. To the west, there are some irregularly distributed reliefs with modest altitude but with a rugged orography (Palermo and Trapani mountains), mainly constituted by dolomites and limestone overlapping a basal complex with calcareous sands and clays. The central-western part of the island is characterized by the Sicani Mountains, formed by calcarenitic rocks and marls. The central-southern portion of the island, mainly hilly, is widely constituted by Miocene clays mixed with evaporitic sediments referable to the Messianian “Gessoso-Solfifera” formation, whitish marls of late Pliocene and yellowish Plio-Pleistocenic calcareous sandstones. In the south-eastern corner, the Hyblaean mountains are a carbonatie platform formed by Mesozoic limestone and only in the north-eastern portion also by alkaline basaltic flows and calcareous tuff of Pliocene. Finally in the north-east there is Etna volcano, which is composed of basalts and tuffs over an area of about 1190 km^2. As concerns the circum-Sicilian islands, some of them have a

relatively recent volcanic origin (Aeolian Islands, Ustica, Pantelleria and Linosa), others have a more ancient history and consist of limestone and dolomitic rocks (Egadi Islands and Lampedusa).

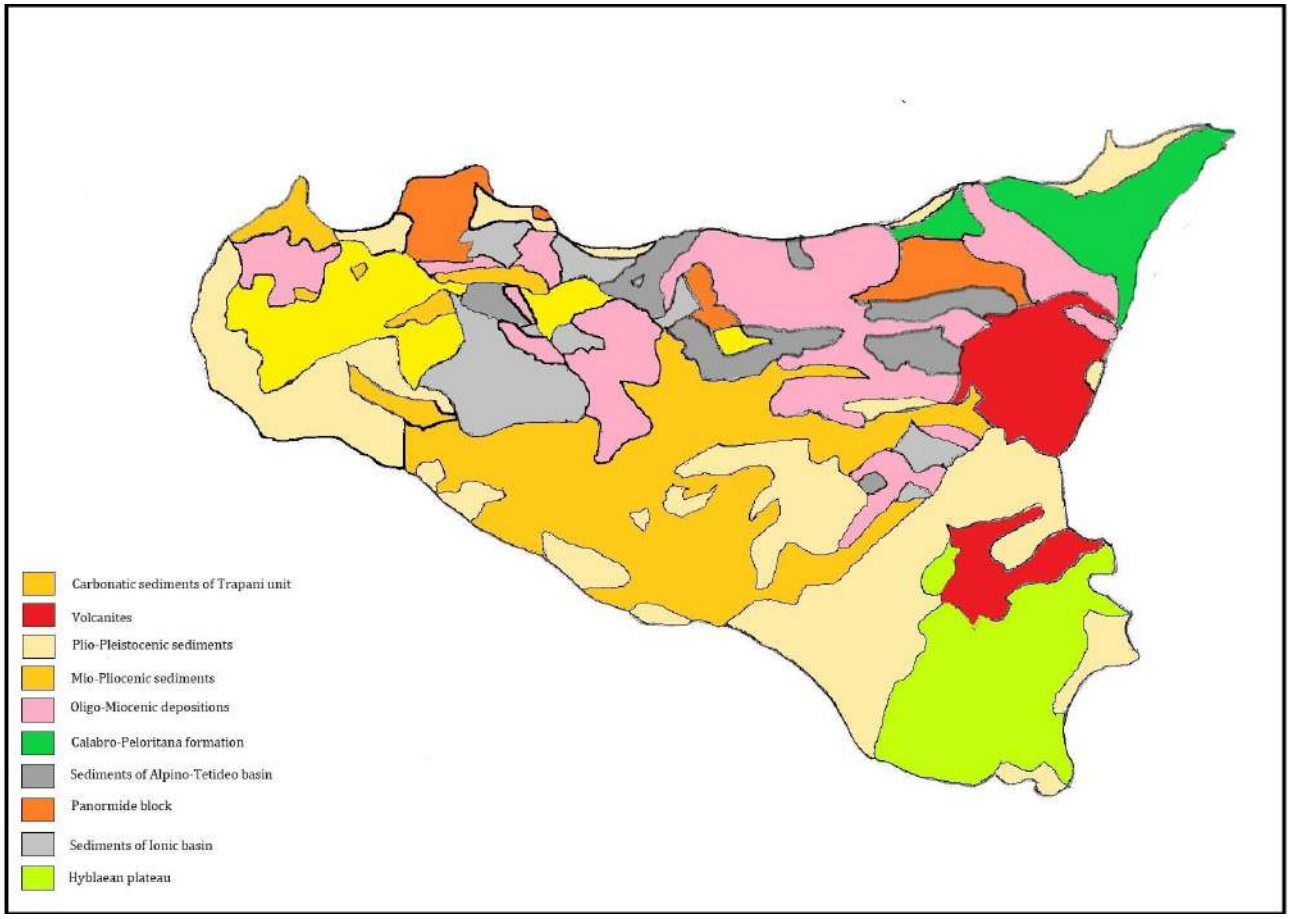


Fig. 1 Geological map of Sicily, from Santagati & Asero (2018), modified.

1.3. Soils

The complex geologic composition together with the various climatic conditions produce an extremely various soils landscape (Venturella, 2004). Besides, a further factor is represented by human activities, which influence the development of the profiles and alteringits integrity through tillages, pastures, cutting of woods and fire. Therefore, the soils of Sicily are very different and more or less developed (Fierotti et al., 1988). However, most of the Sicilian soils are young and with a not much developed profile or quite lacking, being considered “azonal”. Their properties are remarkably influenced by morphologic factors and by the nature of parent rock (lithosols, regosols and alluvial soils).

The “intrazonal” soils (rendzinas, calcicbrown soils, red soils) have an highest degree of evolution and are conditioned by water actions and salts presence. Also the “Zonal” soils and in particular vertisols are well represented in Sicily. Generally, the Sicilian soils present a clayey granulometry and are poor of humus, as well as with a low content of phosphorus and nitrogen. The pH amount is generally sub-alkaline, but sometimes the reaction can be more decidedly basic for the higher content of sodium and magnesium salts. According to some authors (Fierotti et al., 1988; Venturella, 2004), the types of soil occurring on the island are briefly discussed.

In the hilly Sicilian inland, the soils development is directly affected by morphology, particularly in the case of the so-called “soils chain”. It consists of different type of soils developed on the same substratum, such as regosols, brown soils and vertisols.

Regosols: It is a soils with a clayey nature, developing on clays or marl clays. This soil has a subalkaline-alkaline reaction swing and the amount of fertilizing elements and organic matter is very low. However, the evolution on loose substrata produce changes in its physical characteristics. Infact, the texture varies from sandy to sandy-loam and the reaction is either neutral or subacid.

Brown soils: These vertic soils have a grey colour due to the presence of montmorillonitic clay (Bellanca et al. 1980). The clay content generally varies between 30-40 % or more. They are rich in potassium and lack of organic matter, nitrogen and assimilable phosphorous.

Vertisols: They are mineral soils with a clay content more than 30%, having a brown or black colour. Their structure is characterized by the presence of swelling clays and in particular of smectites, which forms deep cracks in dry season. The surfaces present little undulations and holes, where the soil surface is broken and successively sinking. Vertisols have subalkaline reaction (pH 7.5-8.0) and often present a content of free carbonates. The water retention is always high and for these reasons they keep the humidity longer.

On the higher mountains of Sicily the pedological processes are not strongly influenced by morphology as in hilly environments, but these rather young soils

are more affected by parent rock and climate. They appear at the first stage of development and are represented by different pedological types.

Rock outcrops: They are often almost barren, but in some cases are covered by a scarce herbaceous vegetation or woods.

Lithosols: The rocks outcrops are often associated with some soils at their very early stages of development and which evolved over limestone rocks (Madonie and Hyblaean), vulcanites (Etna), metamorphic rocks (Peloritani) and more rarely also in hilly and flat environments (Fierotti, 1975; Fierotti et al., 1988). This type of soil, named lithosols, is characterized by a stony superficial horizon, never exceed 10-15 cm in depth It is strongly inlfuenced by the parent rocks and has a low content of fertilizing elements, except for the lithosols evolving on vulcanites are rich in potassium and phosphorous. On Nebrodi and Peloritani mountains the lithosols are often associated with brown soils, while on the Madonie and Sicani they occurr with brown and redsoils.

Protorendzinas: It is the young stage of the more evolved rendzinas, occurring in limestone environments of Madonie, Sicani and Hyblaean plateau. This soil differs from lithosols for their more thick A horizon. It has a very dark brown colour, due to organic matter, partly transformed in humus.

Rendzinas: It is a more evolved soil, where the A horizon thickness can reach 50 cm. The texture varies from clay-loamy to loamy. Even the rendzinas have a very dark brown colour because of their richness in organic matter. The reaction is more subalkaline than protorendzinas because of limestones content.

Protoranker and ranker: These soils are associated with lithosols and brown soils on the metamorphic soils of Peloritani. They are not very easily characterized, but shows an A horizon not more than 40 cm thick and has a brown-dark colour due to the presence of humus. They have a subacid reaction.

Andic brown soils: They are brown soils originated on the volcanic rocks of Etna Mount and Monte Lauro (Hyblaean), occurring also in the Aeolian Archipelago and Pantelleria. These soils have a blackish colour, because of their

high content in humus. They present a good water retention and subacid reaction.

Other types of brown soils: In south-eastern Sicily on the Hyblaean plateau, a different type of brown soils has been found. It represent the most well-structured soil of this type in Sicily, considering the profile deepness (sometimes also 1 m) and the high content of fertilizing elements. The reaction is subalkaline and the colour is brown. These soils are also present on the Sicani and in other scattered areas of Sicily. In the higher Peloritani an Nebrodi stands, which are characterized by rainfall higher than 800-900 mm, brown soils present an acid character due to the total absence of carbonates and to a deepness which sometimes is more than 60 cm.

The coastal plains are characterized by redsoils, alluvial soils and hydromorphic soils, while the belt nearest to the sea is sometimes covered by dunelands, particularly on the southern coast.

Redsoils: They occurr on the calcarenitic platform of the western coastal belt, while are rarely found also in the calcareous mountain systems. In Sicily, these soils are strongly affected by erosion and anthropic disturbance, so that is difficult to find integral profiles. Therefore, the redsoils are not deeper than 40-50 cm, presenting a clayey-sandy texture. They have a low content of organic matter, the reaction is neutral or subalkaline and the fertilizing elements are in scarce quantity (Averna 1953, Petronici & Averna 1959).

Alluvial soils: They are frequent in all the major coastal plains and sometimes also in some inland areas near rivers. Their physical characteristics are markedly influenced by the geological composition and size of the alluviums. So, texture is very various, changing from highly permeable sandy to impermeable compact clayey (Fierotti 1988). From a general point of view, alluvial soils are deep, well structured and with a variable organic matter content. The reaction is sub alkaline and the content in nutrients is insufficient.

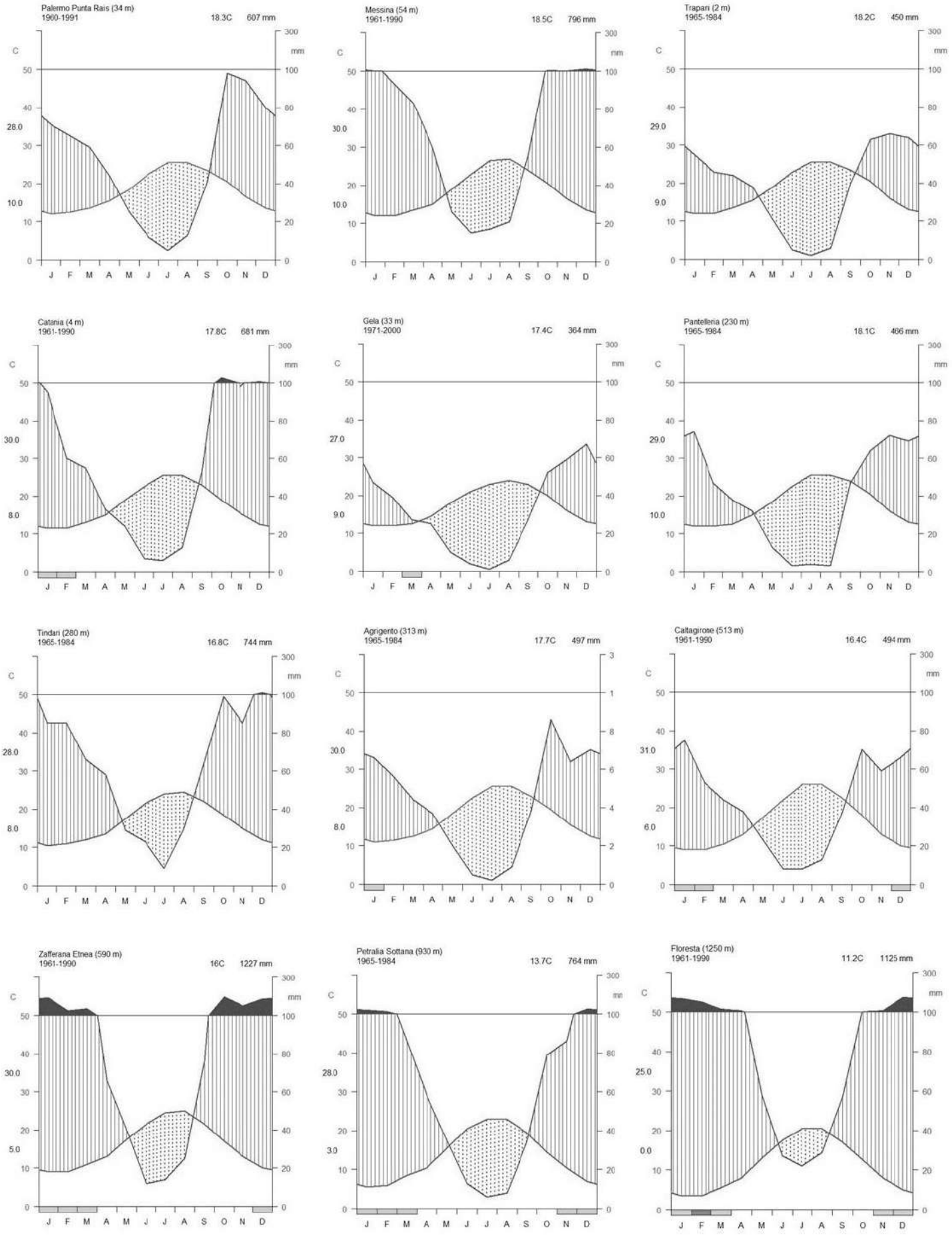
Hydromorphic soils: These soils are linked to depressed areas, sometimes below the sea level, as in the salt-marshes of the south-eastern part. Their features are strongly affected by the seasonal changes of the water-table, that during the winter period can reach the surface causing asphyxiation of the soil.

Dunelands: They are depositions of marine and/or eolic sands, which can reach heights of 50 meters.

1.4. Climate and Bioclimate

All the territory of Sicily has a Mediterranean climate with rainy winters and dry summers, showing remarkable differences for average annual temperature and rainfall according to altitude and exposure (fig. 2). It was analyzed in detail by several authors (Duro et al., 1996; Zampino et al., 1997; Cartabellota et al., 1998; Drago, 2000, 2005) during the last decades. The typical Mediterranean trend can be found in the coastal belts and in the littoral plains, where the annual mean temperature is around 18-19°C. Generally, the temperatures are strongly influenced not only by the altitude, but also by the distance from the sea and by the exposure. The southern coast experiences slightly higher temperatures than the northern part, while the inner lowlands have colder winters, with not rare frosts, and very hot summers sometimes with peaks above 45-46°C. Probably, also for the almost complete absence of woody covering in some inner areas this very hot conditions are more pronounced. As expected, by increasing the altitude the temperatures tend to decrease, until reaching an average of 5-7 ° C at around 2000 meters. January is the coldest month: the mean temperature is higher than 10-11°C in the coastal places, while the temperature goes down to lower values in the inland and in the higher zones far from the sea, until some degrees below 0°C at 3000 m. Conversely, July is the warmest month: the mean temperature value is 25/26°C along the coast, while it is around 18-20°C in the mountainous system where the daily thermic excursions is more accentuated. Even the annual thermic excursion is more remarkable in mountains and inner areas, while is quite modest along the coasts. Moreover, Sicily is characterized by scarce relative air humidity and by very dry winds coming from Africa, locally known as “Scirocco”, which affects both coastal and inner areas mostly during the spring and summer periods. Also the north-western winds ca be very strong, particularly during the winter, affecting particularly the north coast, while the Northern mountain chain partly shelter central and southern Sicily from the action of Northern cold winds. As regards precipitations, they are generally not very abundant and irregular, being concentrated in few day (about seventy) during the period October-March.

Fig. 2 Walter & Leith climate diagrams of various Sicilian localities, data from metereological stations belonging to SIAS network.



Sometimes, they have a violent character with dangerous consequence, paricularly on the clay soils of the Sicilian inland. The higher annual rainfalls, often more than 1300 mm, are reported on the North-Eastern mountains (Peloritani and Nebrodi) and on the eastern side of Etna Mount. Elsewhere, the precipitations are lower and generally below 1000 mm also in the mountains, except for the higher part of Madonie and Sicani mountains. Along the coast, the annual mean amount is lower than 700-600 mm, decreasing from east towards west and with strong differences between the northern part and the southern one, where the annual rainfall falls to less than 400-500 mm, particularly in Agrigento and Gela areas. Even more low values are found in some small islands of Sicily channel like Linosa and Lampedusa, where the average values are around 300 mm. The appearance of snow is very frequent during the winter above 1000 m a.s.l., persisting for a long time only on the peaks of the Madonie and Etna, where it is still possible to find it until the beginning of July. The duration of dry period is variable between three and five months. The longest dry period (May-September) is registered above sea-level while it progressively diminish towards higher altitudes.
According to the bioclimatic classification of Rivas-Martinez et al. (2004, 2011), Sicily falls in the Mediterranean pluviseasonal oceanic and xeric oceanic bioclimates with some different thermotypes and ombrotypes (Brullo et al., 1996; Bazan et al., 2015; Guarino & Pasta, 2017), as shown in the figure 3.

- **Inframediterranean** (T= 18-20°C, It= 500-450), with upper semiarid (Lampedusa) and upper dry (Linosa and Pantelleria) ombrotypes.
- **Lower thermomediterranean** (T= 16-18°C, It= 449-400), with lower dry (southern coast from Licata to Pachino), upper dry (Egadi islands, western coast from San Vito Lo Capo to Licata and south-eastern coas from Pachino to Augusta), lower subhumid (North-western coast from S. Vito Lo Capo to Cefalù, Ionian coast from Augusta to Acireale, North eastern Hyblaean area and Aeolian islands) and upper subhumid (north coast from Cefalù to Messina) ombrotypes.
- **Upper thermomediterranean** (T = 16-18°C, It= 399-350) with lower dry (Catania), upper dry (hills of Southern Sicily and Hyblaean area), subhumid (inlands of Trapani and Agrigento, hilly and coastal areas from Messina to Giardini Naxos) and lower humid (Palermo mountains, foothills of northern Peloritani and eastern side of Etna from Acireale to Giardini) ombrotypes.

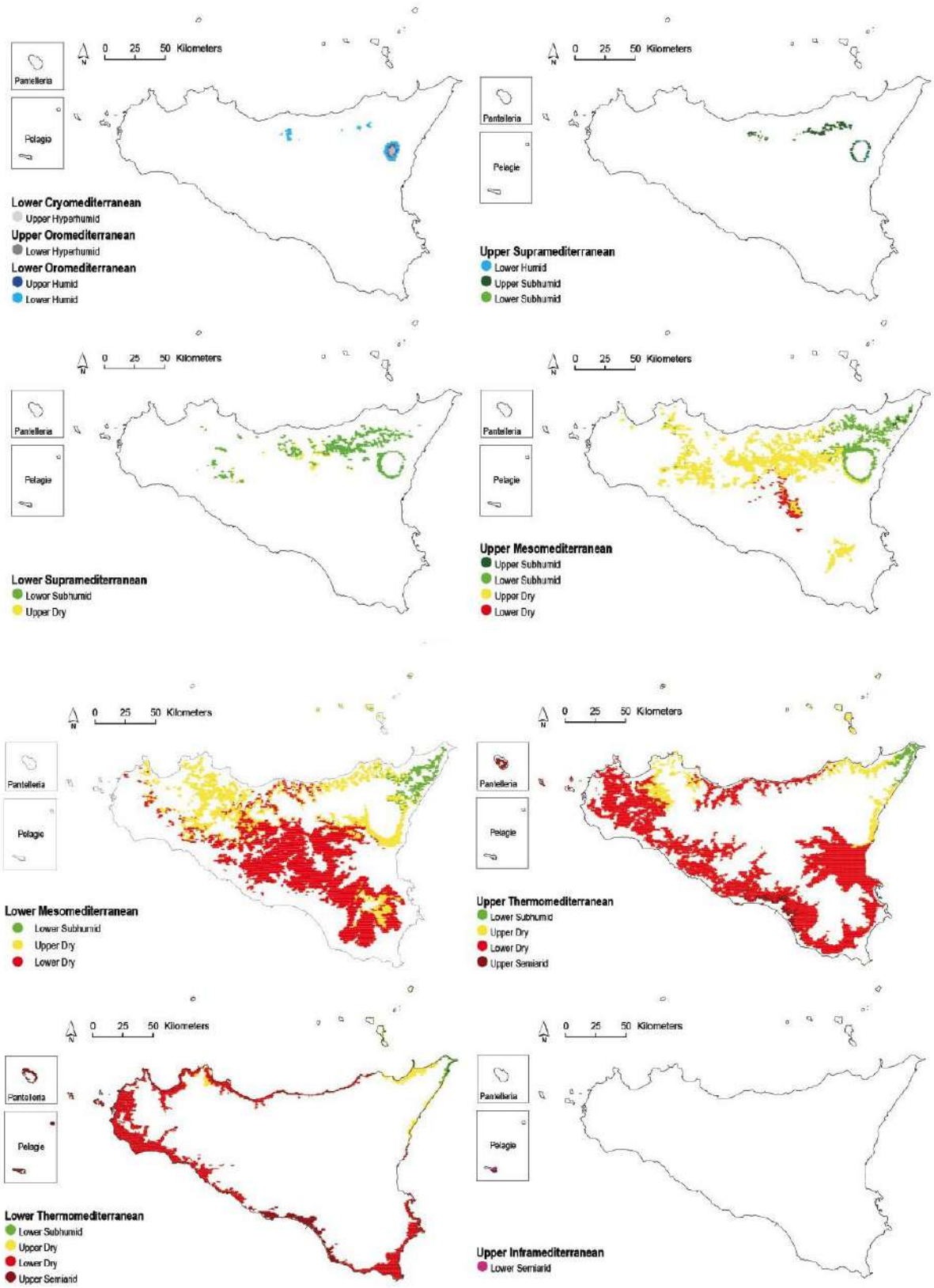


Fig. 3 Bioclimatic belts of Sicily (from Bazan et al., 2015).

- **Mesomediterranean** (T= 13-16°C, It= 349-210) with upper dry and lower subhumid (Mountains of western and Central Sicily, southern side of Madonie and Nebrodi, southern Hyblaean area), lower humid (northern flanks of Nebrodi and Peloritani, top of Hyblaean plateau) and upper humid (eastern flanks of Etna and Peloritani) ombrotypes.
- **Supramediterranean** (T= 8-13°C, It= 209-70) with subhumid/lower humid (top of Madonie, Sicani, Nebrodi and Western slopes of Etna) and upper humid (top of Peloritani and eastern slopes of Etna) ombrotypes.
- **Oromediterranean** (T= 4-8°C, It= 69- -10) with humid (Etna, between 2000 and 2800 m a.s.l.) ombrotype.
- **Cryo-oromediterranean** (T= 2-4°C, It= -11- -100) with upper humid (Etna, above 2800 m) ombrotype.

2. FLORA AND VEGETATION

2.1. Chorological and phytogeographical aspects

The remarkable variety of physiographic features of Sicily analyzed in the previous chapter has important consequences on the richness of its biodiversity and in particular on the flora. According to the most recent floristic checklist by Raimondo et al. (2010), in Sicily there are 3252 specific and infraspecific taxa, native, adventitious and naturalized, divided into 880 genera and 134 families. Among these, the richest are Asteraceae (371 intraspecific taxa) Poaceae (300), Fabaceae (295) and Brassicaceae (141). The richest genera are: *Trifolium* (64 taxa), *Limonium* (45), *Allium* (37), *Ophrys* (33), *Silene* (32), *Centaurea* (31), *Anthemis* (19), *Brassica* (18), *Linaria* (16), *Dianthus* and *Helichrysum* (13), *Micromeria* (11) and *Genista* (10). The pteridophytes are represented by 64 taxa, while the Gymnosperms are only 14. 3173 taxa belong to the Angiosperms, divided between Dicotyledons (2463) and Monocotyledons (710). The biological spectrum shows instead the prevalence of therophytes (36.87%), followed by hemicriptophytes (27.34%), geophytes (12.85%), chamaephytes (8.52%), phanerophytes (8.15%), nano-phanerophytes (3.47%), hydrophytes (2.37%) and helophytes (0.43%). Besides the strictly Sicilian species, those present in the small adjacent islands, including the Maltese archipelago, are also considered. From the chorological point of view, the Circum-Mediterranean element clearly prevails (46.88%), followed by the Eastern (13.14%), the Western (9.75%), the boreal (8.58%) and the southern (8.55%). The cosmopolitans are represented by 426 taxa (13.1%). The exotic component is of 408 taxa. Overall, considering its central position, Sicily can be considered as a crossroad of the Mediterranean flora (Guarino et al, 2017). In fact, here many thermo-xerophilous species reach their northern limit (e. g. *Reamuria vermiculata*, *Rhus pentaphylla*, *Ziziphus lotus*), while some mesophilous species reach the southern limit (e.g. *Fagus sylvatica* and *Allium ursinum*). The island also represents an important east-west distribution limit, as evidenced by the mix of western species (e.g. *Chamaerops humilis* and *Cistus crispus*) and eastern (e.g. S*arcopoterium spinosum* and *Salvia fruticosa*). At the same time, the insularity and the geographical segregation have led to the differentiation of a rich endemic flora, including also some relicts from the phytogeographic point of view. Endemism (included entirely in the Mediterranean element) is 15.44%, of which 9.90% (about 350 taxa according to recent estimates) is exclusive to Sicily, 3.69% is shared with Southern Italy, while the endemisms shared with few other areas of the Mediterranean amount to 1.85% (fig. 4). The hierarchical level of Sicilian endemisms is generally at a specific or subspecific level and is concentrated in certain genera such as *Dianthus*, *Limonium*, *Centaurea, Allium, Erysimum, Astragalus, Brassica, Anthemis, Genista, Viola* and *Hieracium*, within which different examples of schizo-

endemism can be found, deriving from the geographical isolation and occupation of specific niches. There are also some Tertiary relics, known as paleo-endemisms, among which can be mentioned *Petagnaea gussonei* and *Siculosciadium nebrodensis*, belonging to two endemic monotypical genera, as well as *Abies nebrodensis*, *Cytisus aeolicus*, *Erica sicula* subsp. *sicula*, *Pseudoscabiosa limonifolia*, *Ptilostemon greuteri*, *Rhamnus lojaconoi* and *Zelkova sicula*. Overall, as evidenced by Brullo et al. (1995), about a quarter of the Sicilian flora has a considerable biogeographical and taxonomic interest.

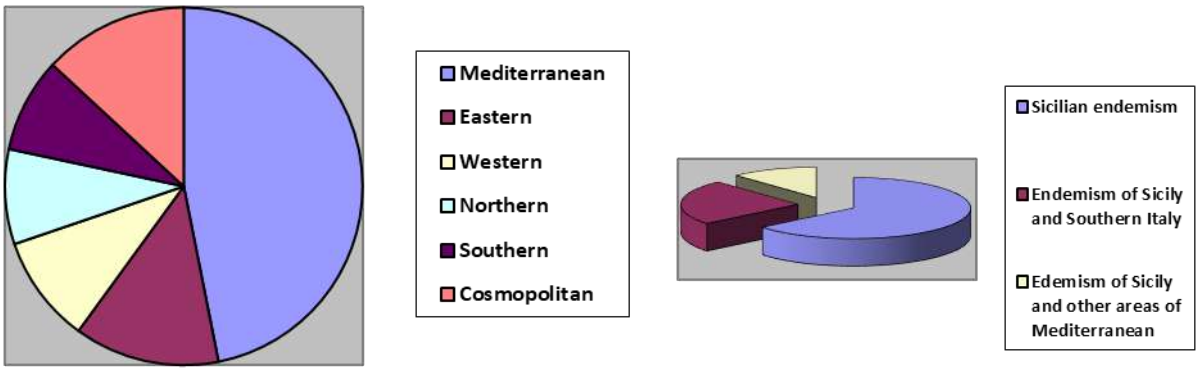


Fig. 4 Chorological and endemic species spectrum

From a phytogeographic point of view, Sicily belongs to the Olartic Kingdom, the Mediterranean region and the Italo-Tyrrhenian province, which includes the Sicilian domain, which is in turn divided into the Eusiculo and Pelagico sectors (including Malta and the Pelagie Islands). Moreover, each sector includes several districts (fig. 5), which are briefly described below (Brullo et al., 1995).

- **Peloritano district:** It includes the north-eastern portion of Sicily with the Peloritani mountain range whose peaks do not exceed 1300 m asl (Montagna Grande, 1374 m) and consists mainly of metamorphic rocks and more rarely limestone. The most characteristic environment of these mountains is represented by the alluvial valleys known as “fiumare”, crossed by streams generally with a irregular seasonal trend. From a floristic point of view, the importance of this area lies above all in the narrow gorges rich in relict elements and in the presence of species widespread in the continent but absent in the rest of the island, reflecting the repeated contacts with Calabria during the Pleistocene.

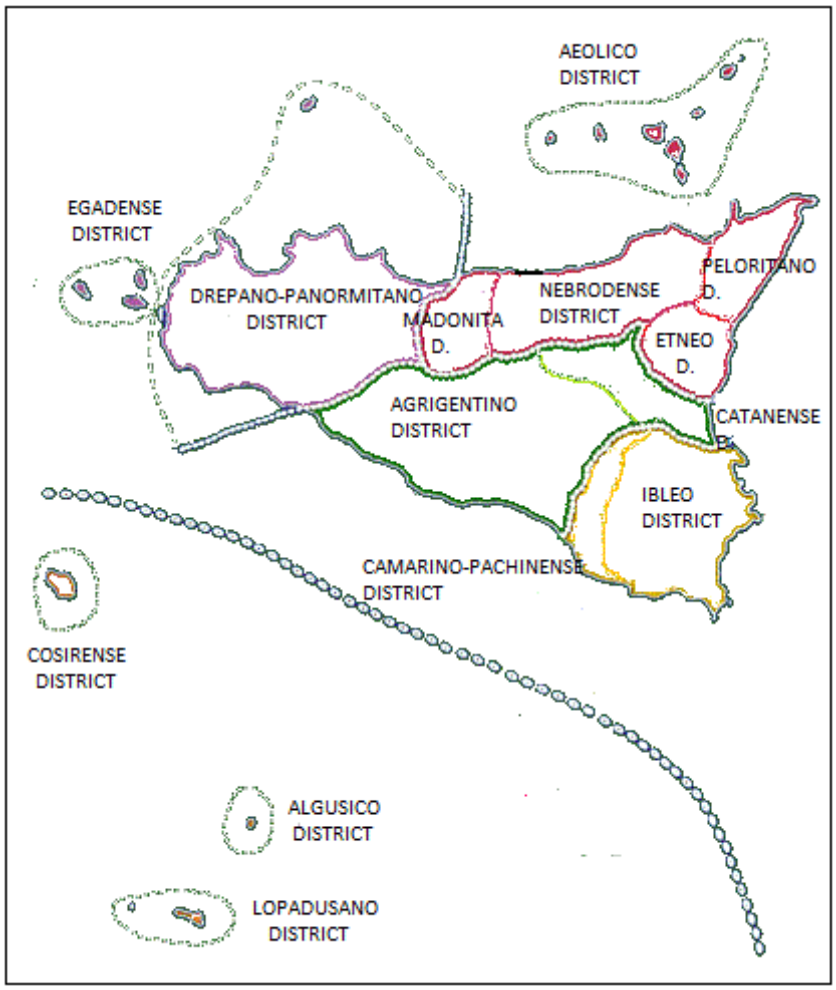


Fig. 5 Map of phytogeographical districts of Sicily from Brullo et al. (1995).

Exclusive endemic species (fig. 6): *Anthemis messanensis, Asperula peloritana, Brassica raimondoi, Cardamine dubia, Centaurea panormitana* subsp. *sequenzae, Colymbada tauromenitana, Festuca morisiana* subsp. *sicula, Festuca humifusa, Hieracium hypochoeroides* subsp. *montis-scuderii, Limonium jonicum, Limonium sibthorpianum, Limonium tauromenitanum, Linaria multicaulis* var. *messanensis, Plantago peloritana, Salix gussonei, Serapias francavillae, Silene peloritana, Stipa valdemonensis, Thapsia garganica* subsp. *messanensis, Thymus praecox* subsp. *parvulus, Trifolium uniflorum* subsp. *savianum*, *Vicia brulloi*.

Not endemic species that are exclusive of this district in Sicily: *Adenocarpus commutatus, Anthemis chia, Anthemis tomentosa, Arctium nemorosum, Aristolochia lutea, Artemisia variabilis, Bellis margaritaefolia, Cardamine chelidonia, Carduus cephalanthus, Centaurea deusta* subsp. *divaricata, Cistus crispus, Conringia orientalis, Cosentinia vellea subsp. bivalens, Cytisus scoparius, Echinops spinosissimum, Epilobium dodonaei, Erucastrum virgatum, Fritillaria messanensis, Hypochoeris pinnatifida, Petasites hybridus, Pteris cretica, Ruta angustifolia, Senecio gibbosus, Silene*

cretica, Silene tenuiflora, Tilia platyphyllos, Tolpis grandiflora, Tricholaena teneriffae, Tuberaria lignosa, Viola messanensis, Woodwardia radicans.

- **Nebrodense district:** This district includes the chain of Nebrodi and their coastal and hilly flanks, bordered to the west by the Madonie and to the east by the Peloritani. These reliefs have a height between 1400-1800 m and culminate in the summit of Monte Soro (1847 m). They consist mainly of the alternation of sandstones and clays (numidic flysh) and limited to the eastern sector by metamorphic rocks, with isolated outcrops of Mesozoic limestones. It is probably the poorest area of endemism in Sicily but has the higher forest cover in the island. The turkish oak woods and the beech-woods are particularly widespread and extensive, offering shelter to numerous northern species, which here find their only Sicilian stands. Another peculiar aspect is given by the humid mountain environments, represented mainly by the numerous natural lakes scattered throughout the territory with a characteristic hygrophilous flora. Exclusive endemic species: *Carduus rugulosus, Fraxinus excelsior* subsp. *siciliensis, Malus crescimannoi, Petagnaea gussonei, Pyrus ciancioi, Pyrus vallis-demonis, Salix nebrodensis.*
  Not endemic species that are exclusive of this district in Sicily: *Alopecurus aequalis, Anthyllis barba-jovis, Aristolochia clematis, Bidens aurea, Bupleurum rollii, Callitriche hamulata, Callitriche lenisulca, Carex digitata, Carex intricata, Cerastium dubium, Circaea lutetiana, Dianthus armeria, Dianthus deltoides subsp. deltoides, Epipactis palustris, Equisetum palustre, Gagea lutea, Glechoma hirsuta, Marrubium incanum, Ononis hispida, Persicaria amphibia, Picnomon acarna, Polygonatum gussonei, Potamogeton filiformis, Potamogeton perfoliatus, Rhynchocorys elephas, Scleranthus annuus* subsp. *verticillatus, Sparganium emersum, Spirodela polyrrhiza, Taxus baccata, Turritis pseudoturritis, Utricularia australis, Wolffia arrhiza.*
- **Madonita district:** The Madonie mountain range is located in the central-northern part of the island, being in continuity to the east with the Nebrodi mountains. The great plant diversity of this area, which has no equal in the rest of the island, is explained by the peculiar geological nature of these mountains, whose central part consists of limestone and dolomite, but above all for the great variety of environments from the sea level to almost two thousand meters of altitude (Pizzo Carbonara, 1979 m). The wooded areas are very significant, although less extensive than the Nebrodi ones, with the presence of beech, deciduous oaks, holm oaks and cork oaks. However, also rocky environments, screes, marshes, rivers, ravines, garrigues, pastures and peatlands complete the high environmental richness of this area. On the whole, the flora of Madonie area consists of 1500 taxa, representing about 50% of the entire Sicilian

flora (Raimondo et al., 2004). Endemism consists of 170 entities making this area the richest in endemic plants on the island.
Exclusive endemic species (fig. 7): *Abies nebrodensis*, *Adenostyles nebrodensis*, *Allium nebrodense*, *Alyssum nebrodense*, *Arabis madonia*, *Armeria nebrodensis*, *Asperula gussonii*, *Astragalus nebrodensis*, *Bupleurum elatum*, *Campanula marcenoi*, *Dianthus minae*, *Draba olympicoides*, *Epipactis cupaniana*, *Evacidium discolor*, *Festuca pignattorum*, *Genista cupanii*, *Genista demarcoi*, *Genista madoniensis*, *Helianthemum nebrodense*, *Helichrysum nebrodense*, *Hesperis cupaniana*, *Hieracium murorum* subsp. *atrovirens*, *Hieracium racemosus* subsp. *pignattianum*, *Hieracium schmidtii* subsp. *madoniense*, *Hieracium schmidtii* subsp. *nebrodense*, *Jurinea bocconei*, *Laserpitium siculum*, *Ophrys cephalodaetana*, *Pimpinella tragium* subsp. *glauca*, *Pyrus castribonensis*, *Rhamnus lojaconoi*, *Senecio candidus*, *Siculosciadium nebrodense*, *Sideritis sicula*, *Silene minae*, *Silene saxifraga* subsp. *lojaconi*, *Sorbus madoniensis*, *Sternbergia exscapa*, *Viola nebrodensis.*
Not endemic species that are exclusive of this district in Sicily: *Allium permixtum*, *Anacyclus radiatus*, *Anthemis cretica* subsp*. columnae*, *Artemisia alba*, *Buglossoides incrassata*, *Campanula trichocalycina*, *Cardamine monteluccii*, *Carex laevigata*, *Carex pallescens*, *Carex paniculata*, *Carex tumidicarpa*, *Cerinthe auriculata*, *Chenopodium bonus-henricus*, *Colchicum triphyllum*, *Corydalis intermedia*, *Cotoneaster nebrodensis*, *Cynoglossum nebrodensis*, *Daphne oleoides*, *Dianthus gasparrinnii*, *Eleocharis nebrodensis*, *Ephedra major*, *Ferulago campestris*, *Gagea fistulosa*, *Galium bernardii*, *Helianthemum canum*, *Herniaria permixta*, *Iberis carnosa*, *Lotus corniculatus*, *Juncus compressus*, *Minuartia condensata*, *Minuartia graminifolia*, *Myosotis stricta*, *Myosurus minimum*, *Ornithogalum comosum*, *Orthilia secunda*, *Potentilla inclinata*, *Prunus cerasus*, *Ptilostemon niveus*, *Rhamnus infectorius*, *Ribes uva crispa*, *Rosa serafini*, *Scleranthus marginatus*, *Silene monachorum*, *Scrophularia vernalis*, *Sorbus umbellatus*, *Thesium parnassi*, *Thlaspi rivale*, *Verbascum rotundifolium*, *Vicia glauca.*

- **Drepano- Panormitano district:** This district includes a very large and quite heterogeneous territory, comprising several small calcareous mountain ranges (Palermo Mt., Sicani, Rocca Busambra and Trapani Mt.), the north-western Tyrrhenian coast and the westernmost portion of the southern coast within the Trapani province, as well as the island of Ustica. The highest altitude is reached by Rocca Busambra with 1613 m, followed by Monte Cammarata (1578 m), the top of the Sicani Mountains, while the mountains of Palermo and Trapani do not exceed 1300 m. The whole territory is strongly degraded from the forestal point of view, but still retains a considerable contingent of rare and endemic species, sometimes with point distribution, located mostly on the limestone cliffs.

Fig. 6 Endemic species of Peloritani district: A. *Adenocarpus commutatus* Guss.; B. *Anthemis messanensis* Brullo; C. *Brassica raimondoi* Brullo et al.; D. *Trifolium savianum* Guss.

Fig. 7 Endemic species of Madonie district: A. *Asperula gussonei* Boiss.; B. *Draba turgida* É. Huet & A. Huet; C. *Hesperis cupaniana* Guss.; D. *Siculosciadium nebrodense* (Guss.) C. Brullo et al.

Exclusive endemic species (fig. 8): *Allium panormitanum, Anthemis ismelia, Armeria gussonei, Botriochloa panormitana, Brassica rupestris* subsp*. hispida, Brassica trichocarpa, Brassica villosa* subsp*. bivoniana, Brassica villosa* subsp*. brevisiliqua, Brassica villosa* subsp*. drepanensis, Brassica villosa* subsp*. villosa, Calendula maritima, Celtis asperrima, Centaurea erycina, Centaurea macracantha, Centaurea panormitana* subsp*. todari, Centaurea panormitana* subsp*. ucriae, Centaurea panormitana* subsp*. umbrosa, Centaurea saccensis, Centaurea sicana, Clinopodium raimondoi, Crepis spathulata, Dianthus borbonicus, Dianthus paniculatus, Erica sicula* subsp*. sicula, Erodium soluntinum, Eryngium crinitum, Gagea lacaitae, Galium litorale, Galium pallidum, Genista gasparrinii, Helichrysum panormitanus, Helichrysum preslianum, Hieracium busambarense, Hieracium cophanense, Hieracium lucidum, Isoetes todaroana, Limonium cophanense, Limonium densiflorum, Limonium flagellare, Limonium furnarii, Limonium halophilum, Limonium lylibeum, Limonium mazarae, Limonium melancholicum, Limonium panormitanum, Limonium poimenum, Limonium selinunthinum, Limonium todaroanum, Muscari lafarinae, Ophrys pallida, Ptilostemon greuteri, Pyrus sicanorum, Schoenoplectus philippi, Scilla cupani, Silene crassiuscula, Silene erycina, Silene kemoniana, Silene nefelites, Solenopsis mothiana, Sorbus busambarensis, Thymus paronychioides, Trifolium strangulatum, Valantia deltoidea, Verbascum siculum, Viola tineorum, Viola ucriana.*

Not endemic species that are exclusive of this district in Sicily: *Allium subvillosum, Alyssum siculum, Anemone palmata, Arabis hirsuta, Aristida coerulescens, Bassia laniflora, Buglossoides minima, Calendula arvensis* subsp*. hydruntina, Cardopatum corymbosum, Carex panormitana, Centaurea aspera, Cephalaria joppensis, Cerastium lacaitae, Chaenorhinum rubrifolium, Cicendia filiformis, Convolvulus cneorum, Crepis spathulata, Cynomorium coccineum, Cyperus michelianus, Damasomium polyspermum, Damasonium bourgaei, Delphinum emarginatum* subsp*. emarginatum, Desmazeria sicula, Euphorbia bivonae, Filaginella uliginosa* subsp*. prostrata, Gagea ambliopetala, Gagea chrysantha, Gagea granatellii, Gagea mauritanica, Halocnemum strobilaceum, Helianthemum intermedium, Hippocrepis glauca, Hymenolobus pauciflorus, Hymenolobus procumbens, Ipomea saggitata, Jasminum fruticans, Jonopsidium albiflorum, Ligustrum vulgaris, Limonium avei, Lonas annua, Lotus biflorus, Lotus coniugatus, Medicago muricoleptis, Minuartia verna* subsp*. verna, Parapholis marginata, Parietaria mauritanica, Petasites pyrenaicus, Phagnalon metlesicsii, Phagnalon sordidum, Polygonum equisetiforme, Pycnocomon rutaefolia, Quercus trojana, Scrophularia frutescens, Scrophularia umbrosa, Smyrnium dimartinoi, Spergularia tunetana* subsp*. appendiculata, Stipa barbata, Trifolium brutium, Trifolium ornithopodioides, Typha lexmanni, Valerianella echinata.*

- **Agrigentino district:** It includes the vast central-western sector of Sicily, falling in the provinces of Agrigento, Enna and Caltanissetta. It includes a large part of the southern coast from Sciacca to Gela, characterized by marly outcrops, as well as the inner part of the island characterized by the Gessoso-Solfifera formation and extensive clayey surfaces, often articulated in characteristic gullies. It comprises also the Erei mountains, a small mountain range consisting mainly of sandstones that culminates in 1192 m of Monte Altesina. This area has some natural lakes, as Lake Pergusa, the largest in Sicily. The whole sector is almost devoid of natural woody vegetation, due to the presence of large areas planted with wheat or other crops. However, there are also some exclusive endemic species and many xerophytes, often shared with the nearby North African territories.
  Exclusive endemic species: *Allium agrigentinum, Anthemis muricata, Anthyllis hermanniae* subsp*. sicula, Astragalus raphaelis, Cerinthe major* subsp*. elegans, Herniaria fontanesii subsp*. *empedocleana, Helianthemum sicanorum, Limonium calcarae, Limonium catanzaroi, Limonium optimae, Limonium opulentum, Linum collinum, Orobanche thapsoides, Puccinellia gussonei, Salsola agrigentina, Scabiosa parviflora, Senecio leucanthemifolius* subsp*. pectinatus, Silene agrigentina, Suaeda kocheri.*
  Not endemic species that are exclusive of this district in Sicily: *Asphodelus tenuifolius, Chaenorrhinum rubrifolium, Cornus mas, Cucubalus baccifer, Fumana scoparia, Nepeta tuberosa, Reaumuria vermiculata, Sedum gypsicola, Silene nicaeensis var. perennis, Zannichellia peltata.*
- **Camarino-Pachinense district:** This district occupies the south-eastern corner of the island, including the wide coastal stretch and part of the inner areas close to the last southern reliefs of Hyblaean and Erei mountains. From the geological point of view, this territory is characterized by the presence of quaternary substrates, such as marls, clays, calcarenites and extensive sandy deposits. The inland is characterized by hills with an altitude below 400 m a.s.l. The particular climatic conditions allow the development of a large number of entities with predominantly North African distribution. The woody vegetation is represented by very peculiar communities, generally absent in the rest of the island, as those ones with *Pinus halepensis* and *Quercus suber*. Even the dune environments are relevant and still host a very interesting flora.
  Exclusive endemic species: *Astragalus kamarinensis, Limonium hyblaeum, Limonium pachynense, Limonium pavonianum, Muscari gussonei, Senecio glaucus* subsp. *hyblaeus, Serapias orientalis* subsp*. siciliensis, Tuberaria villosissima* var. *sicula.*
  Not endemic species that are exclusive of this district in Sicily: *Anthemis abrotanifolia, Avena insularis, Chenopodium botryodes, Cistus clusii, Cutandia divaricata, Cyperus alopecuroides, Gagea trinervia, Helianthemum*

lippii, Helianthemum sanguineum, Leptochloa fusca subsp*. uninervia, Linum maritimum, Lobularia libyca, Loeflingia hispanica, Malcolmia africana, Rhus pentaphylla, Rhus tripartita, Romulea melitensis, Salsola vermiculata, Stachys arenaria, Tamarix arborea, Valerianella vesicaria.*

- **Ibleo district:** It includes the southern Ionian coast and the Hyblaean plateau, which reach its maximum altitude with Monte Lauro (986 m), as well as the nearby hilly range of Climiti mountains. This area have a considerable interest both for the presence of exclusive endemic species and for the frequency of eastern Mediterranean species. The landscape is characterized by an extensive limestone platform, crossed by deep river valleys known as "cave", that represent the most typical environment of this area. Volcanic substrates are found only in the north-eastern sector near Monte Lauro.
  Exclusive endemic species (fig. 9): *Anthemis pignattiorum, Cyperus papyrus* subsp*. siculus, Epipactis hyblaea, Erica multiflora* subsp*. hyblaea, Ferulago nodosa* subsp*. rigida, Foeniculum giganteum, Helichrysum archimedeum, Helichrysum hyblaeum, Limonium syracusanum, Myosotis tinei, Odontites bocconei* subsp*. angustifolia, Ophrys laurensis, Taraxacum caramanicae, Trachelium lanceolatum, Urtica rupestris, Zelkova sicula.*
  Not endemic species that are exclusive of this district in Sicily: *Arabis sagittata, Aristolochia altissima, Calendula suffruticosa* subsp*. gussonei, Fontanesia phillyraeoides, Gladiolus vexillaris, Hydrocotyle vulgaris, Oenanthe silaifolia, Origanum onites, Prunus webbii, Putoria calabrica, Salvia fruticosa, Sarcopoterium spinosum, Stachys cretica* subsp*. salviifolia, Valantia hispida.*
- **Catanense district:** This small district is identified with the alluvial plain formed by the sediments of the Simeto river, the main watercourse of Sicily with an extended hydrographic basin from the Nebrodi mountains to the Ionian sea just south of Catania. The substrates are predominantly clayey or volcanic. The flora of this strongly populated area is particularly endagered and degradated.
  Exclusive endemic species: *Limonium catanense, Linum catanense.*
  Not endemic species that are exclusive of this district in Sicily: *Carduus acicularis, Cerastium diffusum* subsp*. gussonei, Corispermum leptopterum, Crucianella latifolia, Dichantium annulatum, Ipomea imperati, Ononis pubescens, Puccinellia fasciculata, Stenotaphrum secundatum, Valerianella rimosa.*
- **Etneo district:** Etna is one of the areas with a greatest naturalistic interest in Sicily, because of its volcanic nature and also for the remarkable altitude of 3343 m, making it the highest active volcano in Europe. Clearly, the vegetation is considerably affected by the volcanic activity, determining a variety of plant species, including some exclusive endemic species, which have found specific adaptations to tolerate the hard conditions of volcano.

Forest vegetation has been greatly reduced at the lowest altitudes by human disturbance, while it still covers considerable areas at higher altitudes, particularly with black-pine forests. In Sicily only on Etna is possible to observe a real vegetation belt above the timberline, represented by the pulvinate vegetation dominated by *Astragalus siculus* until 2400-2500 m and by sparse herbaceous communities arriving at 3000 m. Above this altitude there is a total disappearance of vascular plants both for climatic reasons and for the volcanic activity. Because of the rather recent volcanic nature (around 600,000 years), Etna does not host very old relict species and has not allowed the differentiation of a large number of endemisms. However its flora is characterized by some neo-endemisms and some entities that are differentiated only at a sub-specific rank. From the ecological point of view, the Etna vegetation gives the opportunity to observe the different stages of plant colonization.

Exclusive endemic species: *Adenocarpus bivonae, Allium aetnense, Anthemis aetnensis, Asparagus aetnensis, Astragalus siculus, Bellardiochloa variegata* subsp*. aetnensis, Betula aetnensis, Buglossoides splitbergeri, Centaurea giardinae, Celtis aetnensis, Erysimum aetnense, Hieracium aetnense, Hieracium pallidum, Kali basalticum, Linaria multicaulis* subsp*. aetnensis, Rumex aetnensis, Scleranthus aetnensis, Scleranthus vulcanicus, Senecio aetnensis, Senecio ambiguus, Senecio glaber, Sternbergia colchiciflora* subsp*. aetnensis, Tillaea basaltica, Viola aethnensis*.

Not endemic species that are exclusive of this district in Sicily: *Acer platanoides, Alyssum minutum, Asplenium septentrionale, Bombycilaena erecta, Calamagrostis epigejos, Cardamine glauca, Chenopodium hybridum, Epilobium angustifolium, Epipactis meridionalis, Epipactis placentina, Genista aetnensis, Micropyrum tenellum, Pinus nigra* subsp*. calabrica, Populus traemula, Potentilla argentea, Ranunculus penicillatus, Robertia taraxacoides, Sedum aetnense, Teesdalea nudicaulis, Thalictrum minus* subsp*. minus.*

- **Eolico district:** The Aeolian archipelago, located near the north-eastern coasts of Sicily, includes seven major islands plus some rocks and islets, all of a volcanic nature. Although the relatively recent origin of this archipelago (about 800 thousand years ago), did not allow the differentiation of a large number of endemisms, it presents some more or less weakly differentiated species derived from taxa with W-Mediterranean distribution. However, it hosts also some biogeographic dilemmas, such as *Cytisus aeolicus* and *Eokochia saxicola*. Moreover, the ecological variability, due to the discrete altitudinal development of some islands (Fossa delle Felci Mt. in Salina, 962 m a.s.l.), guarantees the presence of a fairly rich and diversified vegetation.

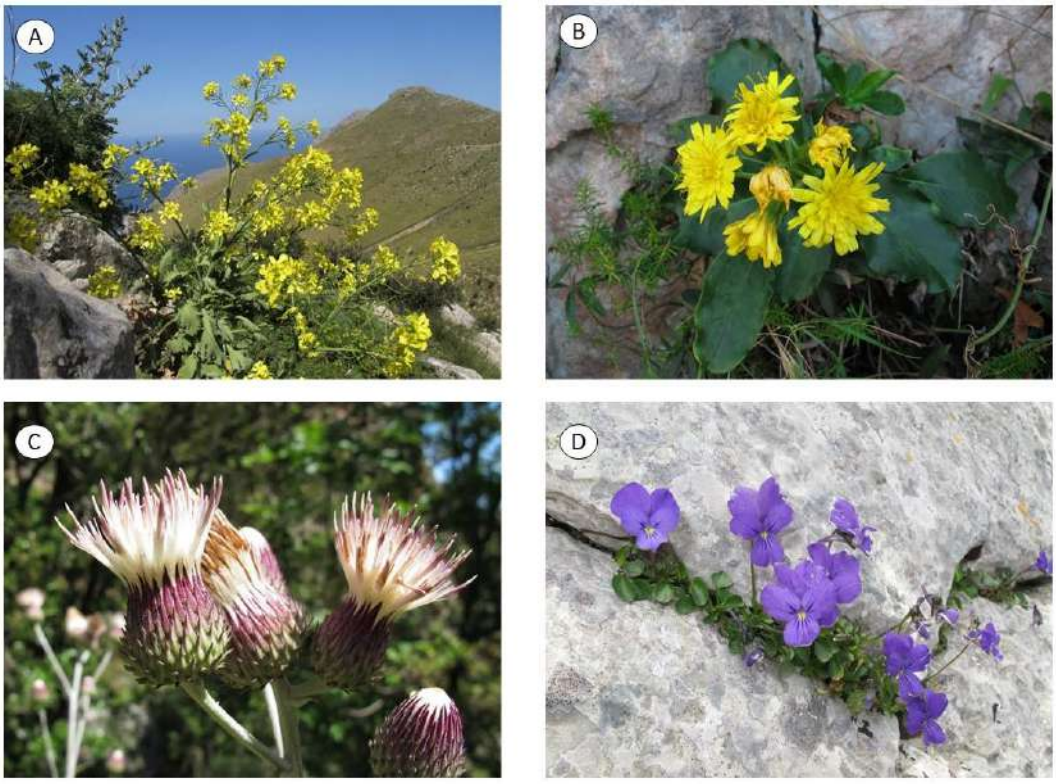


Fig. 8 Endemic species of Drepano-Panormitano district: A. *Brassica drepanensis* (Caruel) Ponzo; B. *Hieracium lucidum* Guss.; C. *Ptilostemon greuteri* Raimondo & Domina; D. *Viola ucriana* Erben & Raimondo.

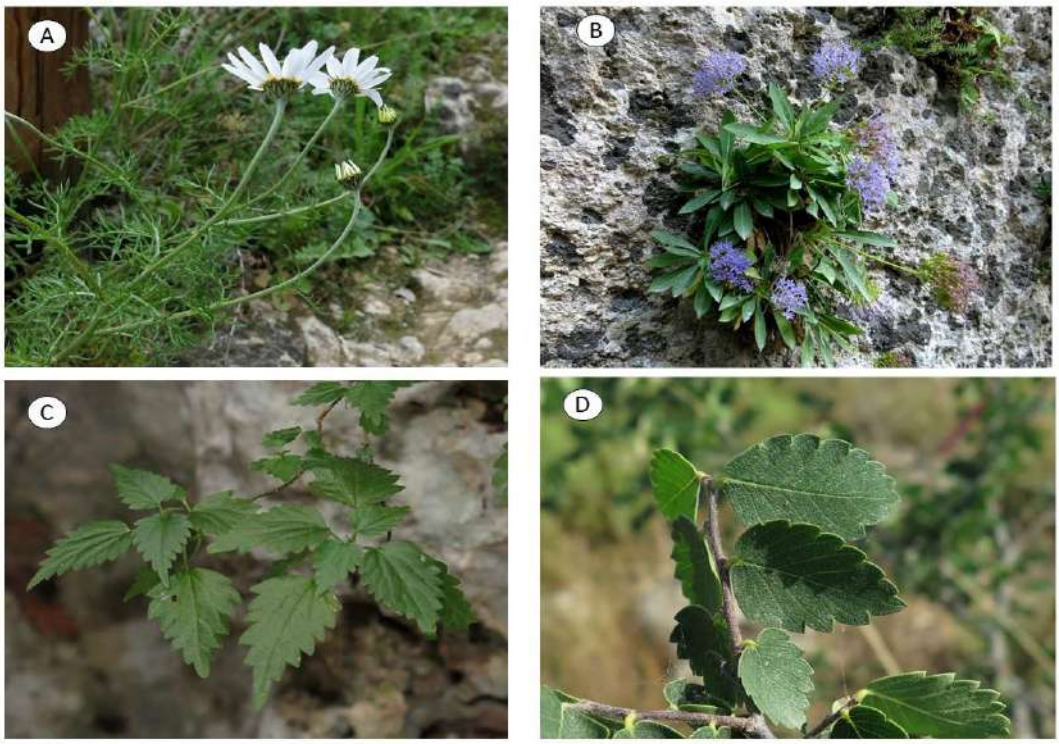


Fig. 9 Endemic species of Hyblaean district: A. *Anthemis pignattiorum* Guarino et al.; B. *Trachelium lanceolatum* Guss.; C. *Urtica rupestris* Guss.; D. *Zelkova sicula* Di Pasquale et al.

Exclusive endemic species: *Anthemis aeolica, Bituminaria basaltica, Centaurea aeolica, Cytisus aeolicus, Daucus foliosus, Erysimum brulloi, Genista tyrrhena* subsp*. tyrrhena, Silene hicesiae.*

Not endemic species that are exclusive of this district in Sicily: *Eokochia saxicola, Citrullus colocynthis, Clematis flammula, Helichrysum litoreum, Malcolmia ramosissima, Wahlenbergia nutabunda.*

- **Egadense district:** The Aegadian archipelago, located north-west of Sicily, consists of Favignana, Levanzo and Marettimo. All three islands are mainly calcareous and dolomitic: Favignana is the largest but has modest reliefs culminating in the 314 m of Monte S. Caterina, Levanzo is instead the smallest and reaches 270 m with Pizzo Monaco. But the true naturalistic jewel of the Egadi Islands is represented by Marettimo, the westernmost island that looks like a mountain of 689 m on the sea and hosts several exclusive endemic species, due to its greater isolation. Besides, it is characteriized also by some entities absent in Sicily but occurring in Latium and Tuscan coasts. The state of conservation of the vegetation, especially in Favignana, is critical, while in the other two islands, despite the almost total deforestation of the past, a dense Mediterranean maquis is being restored. The chasmophilous flora of limestone cliffs is of great relevance, similarly to north-western Sicily.

  Exclusive endemic species: *Allium aethusianum, Allium franciniae, Brassica macrocarpa, Bupleurum dianthifolium, Centaurea aegusae, Euphorbia papillaris, Helichrysum rupestre* subsp*. messerii, Limonium aegusae, Limonium tenuiculum, Prospero hierae, Scilla hughii, Senecio aegadensis, Thymus nitidus.*

  Not endemic species that are exclusive of this district in Sicily: *Aristolochia navicularis, Daphne sericea, Erodium maritimum, Lagurus ovatus* subsp*. vestitus, Ophrys holosericea* subsp*. apulica, Thymelaea tartonraira*.
- **Cosirense district:** The district includes the only island of Pantelleria, located in the Sicily channel, about 60 km from the Tunisian coasts and more than 90 km from the Sicilian coasts. The island has a volcanic nature, showing a relatively recent origin, but around 45,000 years ago a great eruption completely covered the island eliminating plant life. However, this did not prevent the differentiation (in some cases not yet completed) of some neoendemisms, but in relation to the surface of the island, which is the greatest of circumsicilian islands, the flora is not very rich, counting "only" 597 intraspecific taxa. However, there are many species with a south-western Mediterranean distribution that are completely missing or very rare in Sicily. Moreover, Pantelleria is the only circumsiciliana island to present a still relatively extensive forest cover (mainly with *Pinus pinaster*) and in general a remarkable environmental variety, with the presence of interesting temporary ponds, cliffs, woods, grasslands, etc.

Exclusive endemic species: *Genista aspalathoides* var*. gussonei, Helichrysum rupestre* var*. errerae, Limonium cosyrense, Limonium parviflorum, Limonium secundirameum, Matthiola incana* subsp*. pulchella, Medicago truncatula* var*. cosyrensis, Senecio leucanthemifolius* subsp*. cosyrensis, Serapias cossyrensis, Trifolium nigrescens* var*. dolychodon*.

Not endemic species that are exclusive of this district in Sicily: *Andryala rothia* subsp*. cosyrensis, Asplenium marinum, Asplenium obovatum* subsp*. lanceolatum, Brassica insularis, Calicotome rigida, Carex illegitima, Limodorum trabutianum, Ophrys sphegifera, Persicaria attenuata, Pimpinella lutea, Pinus pinaster subsp. hamiltonii, Rosa rugosa, Schoenoplectus litoralis* subsp*. thermalis, Tillaea alata.*

- **Algusico district:** Linosa, although conventionally considered together with Lampedusa and Lampione one of the Pelagie islands, is actually well differentiated from the latter in many respects, including geological, vegetational and floristic characters, justifying its inclusion in an autonomous phytogeographical district. Infact, it is an island of volcanic origin, consisting of several volcanic buildings with altitudes not exceeding 200 m (Mount Vulcano, 195 m), interspersed with small, widely cultivated flat areas. Despite the small size and relatively recent origin, the island hosts a certain number of endemic taxa: these are neo-endemisms, sometimes not yet well differentiated from the species present in the neighboring territories. Moreover, compared to Lampedusa, the anthropic impact was less destructive and it is possible to still find some good examples of thermophilous shrubby vegetation.

  Exclusive endemic species: *Erodium neuradifolium* var*. linosae, Galium murale* var*. calvescens, Limonium algusae, Pancratium linosae, Vallantia calva, Valantia muralis* var*. intricata.*

  Not endemic species that are exclusive of this district in Sicily: *Astragalus warionis, Castellia tuberculosa, Heliotropium dolosum, Lotus peregrinus, Ononis serrata, Onopordon tauricum, Patellifolia patellaris, Silene apetala, Spergula fallax, Volutaria lippii.*
- **Lopadusano district:** It includes the island of Lampedusa and the small islet of Lampione, belonging to the Pelagian Archipelago. The two limestone islands are part of the African platform and even geographically they are closer to Tunisia than to the southern coasts of Sicily. The particularly dry climate and the low altitude of the islands (the highest point is Monte Albero Sole with 133 m) probably never allowed the development of forest formations, while originally the islands should be covered by a dense juniper maquis. From the floristic point of view, some endemisms and entities with a prevalent North African diffusion are frequent, often having their only European stand here.

  Exclusive endemic species: *Allium hemisphaericum, Allium lopadusanum, Allium pelagicum, Anthemis lopadusana, Bellevalia pelagica, Chiliadenus*

lopadusanus, Cistus x skambergii, Daucus lopadusanus, Dianthus rupicola subsp*. lopadusanus, Diplotaxis scaposa, Euphorbia pycnophylla, Limonium albidum, Limonium intermedium, Limonium lopadusanum, Scilla dimartinoi, Suaeda pelagica, Thapsia pelagica.*

Not endemic species that are exclusive of this district in Sicily: *Allium hirtovaginatum, Caralluma europaea* subsp*. europaea, Carlina involucrata, Cistus parviflorus, Echinops spinosus, Hypericum aegyptiacum, Launea nudicaulis, Linaria reflexa* subsp*. lubbockii, Ophrys scolopax* subsp*. scolopax, Paronychia arabica* subsp*. longiseta, Silene muscipula, Teucrium creticum.*

2.2. General characters of vegetation and dynamic series

The considerable territorial extension, the lithomorphological and climatic diversity, the paleogeographic events, the multiplicity of cultures and the high demographic density, make the plant landscape of Sicily particularly diversified and of great biogeographical, historical and conservation value. At the same time, the vegetation of the island shows the signs of the millennial presence of man and of its intense exploitation over natural resources, so much so that in the present time the only well-preserved environments are relegated to less accessible places, such as cliffs, screes, rocky ledges, very steep slopes, windy ridges and the summit areas of Etna. According to Bazan et al. (2010), these areas only cover a surface of about 7300 ha, representing the 0.29% of the whole island territory. From the phytosociological point of view, the best preserved plant communities are those belonging to *Rumici-Astragaletea*, *Scrophulario-Helichrysetea*, *Asplenietea trichomanis* and partly *Crithmo-Limonietea* classes (Brullo et al., 2002; Guarino & Pasta, 2017). Forest vegetation is also relatively well conserved, although sporadically subject to fires, intensive grazing and coppicing. Actually, it is relegated to the mountainous areas, covering 72,000 ha, the 2.9% of the island, but it was probably much more widespread before man's arrival. Most of the island is today characterized by extensive urban areas (especially along the coasts) and secondary or synanthropic habitats, such as reforestation, shrubbery, garrigue, maquis, dry grasslands and nitrophilous communities. The latter are predominant in large areas of the island, covering almost 50% of the total territory due to the considerable agricultural development (Brullo & Guarino, 2007; Brullo et al., 2007). The most common cultivations are hard-wheat fields, but also olive

groves, pistachio and almond plantations, which are common in the Sicilian rural landscape. Intensive agriculture, mainly represented by citrus groves, orchads and vineyards, is widespread in over 25% of the territory. All this contributes greatly to the trivialization of the flora and to the spread of exotic species, some of which, such as *Opuntia ficus-indica* and *Pennisetum setaceum*, have now become part of the island's landscape.

For a more extensive and coherent analysis of the vegetation of a complex and heterogeneous territory as Sicily, the use of the symphitosociological approach may be useful, allowing to detect some interesting ecological correlations between vegetation and environmental features. This method, which was developed originally by Rivas-Martinez (1976) and later revised by Tüxen (1978, 1979a), Gèhu (1979, 1988) and Rivas-Martinez (1983, 1985), takes into consideration the dynamic and catenal relationships between the associations. According to Rivas-Martinez (2005), Rivas-Martinez & coaut. (2011), Pedrotti (2013) and Loidi (2017), the basic units of vegetation complexes is represented by the *sigmetum* (= series). This concept indicates a local assembly of communities that have the potential to develop towards a well defined single climax. It is possible to distinguish climatophilous and edaphophilous series, which can be edaphoxerophilous or edaphohygrophilous. The climatophilous series are correlated with the mesoclimate and rainfall, as well as with the degree of soil evolution. As regards the edaphophilous series, the natural edaphic evolution is blocked by dry soils (edaphoxerophilous series) or by more or less wet soils (edaphohygrophilous series). In both cases the most mature stage usually is represented by woody vegetation. In Sicily it is possible to identify different series in relation to the bioclimatic belt and the geo-pedological characteristics of the territory (Bazan et al., 2010; Guarino & Pasta, 2017). The main series of the inframediterranean thermotype is represented by the *Periploco-Juniperero turbinatae sigmetum*, which is restricted to insular coastal places (Lampedusa, Linosa and Pantelleria), colonizing volcanic and calcareous substrates. The more mature stage is represented by a thermoxerophilous maquis dominated by *Juniperus turbinata* and *Periploca angustifolia*. The *Periploco angustifoliae-Euphorbio dendroidis sigmetum* is restricted to less evolved calcareous soils. The less evolved stages are represented by the xeric garrigues of *Cisto-Ericion*, as well as by ephemeral meadows of *Plantagini-Catapodion marini*. Regarding the lower thermo-mediterranean belt, the lower dry ombrotype is characterized by the evergreen sclerophyll and summer-deciduous maquis belonging to *Oleo-Ceratonion*

alliance, as the *Calicotomo infestae-Rhoo tripartitae sigmetum* (South-Eastern Sicily), occurring on very dry calcareous soils, the *Pistacio lentisci-Chamaeropo humilis sigmetum*, spread in North-Western Sicily on calcareous substrates, the *Chamaeropo humilis-Querceto calliprini* sigmetum, occurring on sandy soils of southern Sicily and the *Myrto communis-Pistacio lentisci sigmetum*, spread in different areas with basophilous substrates and with a less marked thermophilous character. The more degradates stages are represented by the dry grasslands of *Hyparrhenietum hirto-pubescentis* and *Penniseto setacei-Hyparrhenietum hirtae*. The upper dry ombrotype is represented by the *Oleo-Euphorbio dendroidis sigmetum*, largely distributed on cliffs and steep slopes, having a primary role in the coastal areas of Ionian coast. The lower subhumid ombrotype is interested by the *Pinus pinea* woodlands (*Cisto crispi-Pino pineae sigmetum*), which is characterized by shrub layer rich in acidophilous species, as *Cistus crispus* and *Tuberaria lignosa*. Its degradation stages are represented by *Cisto-Lavanduletea* garrigues and dry grasslands with *Ampelodesmos mauritanicus* or *Tricholaeana teneriffae*. This series is restricted to the metamorphic substrates near Messina. The upper thermomediterranean bioclimate shows the occurrence of thermophilous evergreen forests, as those ones occurring on limestone and belonging to *Pistacio lentisci-Querco ilicis* and *Rhamno alaterni-Querco ilicis sigmetum*. The less evolved stages includes the garrigue of *Cisto-Ericion* (e.g. *Erico-Micromerietum fruticulosae* in NW Sicily and *Rosmarino-Coridothymetum capitati* in southern Sicily), as well as dry grassland of *Helictotricho-Ampelodesmetum mauritanicae* and *Trachynietalia* ephemeral meadows. They grow respectively on shallow and rocky soils of all the island and humid coastal stands of the North-Western sector. In the sandy soils of fossil dunes of southern Sicily the previous series are replaced by the *Junipero-Quercetum calliprini*, a dense maquis with arboreal specimens of *Quercus calliprinos*. The inner sandy deposit around Niscemi and Calatagirone (SE Sicily) are interested by the *Stipo bromoidis-Querco suberis sigmetum*. The *Coridothymo capitati-Helichrysetum stoechadis* represents a degradation stage of this series, followed by the psammophilous meadows of *Vulpietalia*. On the lower slopes of Madonie and Nebrodi, the most mature vegetation is represented by the acidophilous cork oak woodlands belonging to *Genisto aristatae-Querco suberis sigmetum*. Only on the marly surfaces near Vittoria small *Pinus halepensis* woodlands occurs, representing the more mature stage of *Thymo capitati-Pino halepensis sigmetum*. The degradation stage are represented by the garrigue of *Cisto-Ericion*. A different pine-wood occurs on the volcanic soils of Pantelleria

island, belonging to *Genisto aspalathoidis-Pino hamiltonii sigmetum*. The *Oleo sylvestris-Querco virgilianae sigmetum* occurs between the thermomediterranean and the lower mesomediterranean belt, colonizing different substrates. This deciduous wood could be potentially widespread over large surfaces, but is actually quite rare and often replaced by *Cisto-Ericion* garrigue or *Avenulo cincinnatae-Ampelodesmetum mauritanicae* grasslands in secondary stands. Only in the deep valleys of Hyblaean area, the *Doronico orientalis-Querco ilicis sigmetum* is found. As regards the lower mesomediterranean belt, the upper dry ombrotype is characterized by the *Querco leptobalanae sigmetum*, occurring on acidic soils of Western Sicily. Even the *Erico arboreae-Querco virgilianae* shows similar requirements, but is restricted to North-Eastern Sicily. The degradation stages of this series are represented by the *Cytisetea striato-scoparii* communities, as the *Calicotomo-Adenocarpetum commutati*. The further degradation leads to the establishment of acidophilous ephemeral meadows of *Helianthemetea guttatae*. The upper medomediterranean belt shows many forest communities belonging to *Quercetea ilicis* and partly also to *Querco-Fagetea*. The sub-humid ombrotype, occurring only in North-Eastern Sicily, is characterized by the acidophilous series of *Agropyro-Querco congestae sigmetum* and *Arabido turritae-Querco congestae*, both occurring in the eastern side of Etna and also Peloritani. The degradation stages are represented by the mantle vegetation of *Pruno-Rubion ulmifolii* and also by *Cytisetea striato-scoparii* communities. In narrow valleys and gorges the series of *Aceri obtusati-Ostryo carpinifoliae sigmetum* is represented. The Upper Dry ombrotype is localized on the southern and western slopes of Etna, as well as in the southern side of Madonie and Nebrodi. The vegetation series is referred to *Festuco heterophyllae-Querco congestae sigmetum*, whose more mature stage is represented by a mesophilous wood dominated by *Quercus congesta* and other oaks. On siliceous sandy soils, the *Querco gussonei sigmetum* is dominant on the Nebrodi mountains, being progressively replaced by the *Arrhenathero-nebrodensis-Querco cerridis sigmetum* in the supramediterranean belt. Its secondary stages are represented by *Pruno-Rubion ulmifolii* scrubs and mesophilous herbaceous communities of *Plataginion cupanii*. In the highest part of Hyblaean plateau the *Mespilo germanicae-Querco virgilianae* occurs on volcanic substrates. The head series is a mesophilous deciduous wood with a dense shrubby layer of *Mespilus germanica*, while the secondary aspects are represented by the *Rubo ulmifolii-Crataegetum monogynae*. A more widespread series is represented by the

Teucrio siculi-Querco ilicis sigmetum, occurring along the north slopes of mountains with acidic soils. Its secondary stages includes shrublands with *Erica arborea* and *Calicotome infesta*, as well as *Cistus* garrigues and ephemeral meadows in very degradated stands. On Madonie, Sicani and Palermo mountains, the *Aceri campestris-Querco ilicis sigmetum* is occurring. It is linked to calcareous and dolomitic screes and shallow soils. The degradated stands are represented by *Pruno-Rubion ulmifolii* mantle vegetation and later also by the pulvinate community of *Cerastio-Astragalion nebrodensis* (e.g. *Seslerio siculae-Helictotrichetum convoluti*). The supramediterranean belt occurs only in Nebrodi, Madonie and Etna. The lower Supramediterranean with Upper dry ombrotype is linked only to *Tuecrio-Querco ilicis sigmetum*, limitedly to few areas of Madonie and western Nebrodi. The lower subhumid ombrotype includes some forest communities of *Querco-Fagetea* class. In the mountain ridges of Nebrodi the most widespread aspect is the *Quercus cerris* wood belonging to *Arrhenathero-nebrodensis-Querco cerridis sigmetum*. The series includes also the mantle vegetation of *Pruno-Rubion* and the meadows of *Plantaginion cupanii*. On the more humid northern slopes of Nebrodi mountains the previous vegetation is replaced by the *Ilici aquifolii-Quercetum cerridis sigmetum,* which is strictly correlated with the *Ilici aquifolii-Querco austrothyrrenicae sigmetum* occurring on the northern Madonie reliefs. Both these two communities are linked to siliceous soils and very humid stands. The less mature stages of the above mentioned series are represented by the orophilous scrubs of *Crataegetum laciniatae* and by mesophilous garrigues of *Genistetum cupanii*. The final step of degradation is given by mesophilous meadows of *Cynosuro-Leontodontetum siculi*. The *Ilici aquifolii-Querco leptobalani* replaces the previous one on more sloped surfaces with less humid conditions. The beech-forest of *Mellito albidae-Fago sylvaticae sigmetum* represent an extra-zonal aspect restricted to some very humid valleys of Peloritani, while this kind of vegetation is clearly dominant in the upper supramediterranean belt of the three most importan mountains of Sicily. The beech-forest communities are well differentiated for their edaphic requirements and floristic composition. On Etna Mt., in the lower Humid horizon, this vegetation is represented by the *Epipactido meridionalis-Fago sylvaticae sigmetum*, whose head series is characterized by a marked floristic poverty. Even the *Cephalanthero longifoliae-Betulo aetnensis* sigmetum occurs in the same belt, colonizing more incoherent soils, as volcanic sands. In the Sicilian Apennine, this belt is mainly represented by the Upper sub-humid ombrotype,

which is characterized by the *Anemono-Fago sylvaticae sigmetum*. The head series is a mature beech-forest with a rich nemoral floristic set, occurring on siliceous soils. The secondary stages are represented by shrubby communities of *Crataego-Prunetea* and *Armerion nebrodensis* (only in the Madonie Mt.) and by *Cynosuro-Leontodontetum* meadows. In the calcareous substrates of Madonie this series is replaced by the *Luzulo siculae-Fago sylvaticae*. The latter is replaced by the *Hieracio nebrodensis-Fago sylvaticae sigmetum* in humid calcareous gorges. In the Madonie mountains, these beech forests can have catenal contacts with the very peculiar vegetation belonging to the edapho-xerophilous series of *Junipero hemisphaericae-Abieto nebrodensis sigmetum*, occurring on less evolved soils with quartzarenites outcrops. Its more mature stage is a piooner vegetation with scattered trees of *Abies nebrodensis* and a dense shrubby layer with *Juniperus communis* subsp. *hemisphaerica*. In the very humid stands of Nebrodi characterized by colder and oceanic conditions, the beech forests are replaced by *Taxus baccata* community, belonging to *Ilici aquifolii-Taxo baccatae sigmetum*. Sometimes, the rocky and well humified slopes with acidic soils of Nebrodi and Madonie are interested by the mesophilous holm oak forests of *Geranio versicoloris-Querco ilicis sigmetum*. The lower subhumid ombrotype occurs in the north-eastern slopes of Etna, where the mosophilous oak woods of *Agropyro panormitani-Querco congestae sigmetum* can be found. This series is replaced by the *Vicio cassubicae-Querco cerridis sigmetum* at higher altitudes, while in sheltered and shady valleys the *Agropyro panormitani-Populo tremulae sigmetum* is occurring. In more xeric conditions, always in the Etna Mt., the black pine-wood of *Daphno laureolae-Pino calabricae sigmetum* can be found. Its head series is a closed forest with some nemoral species in the herbaceous layer. The oromediterranean belt is represented only on Etna Mt. above 1800-2000 m, where is occupied by orophilous pulvinate communities belonging to *Rumici-Astagaletea* class, among which the *Astragaletum siculi* is the more widespread. Finally, the cryomediterranean thermotype occurs only in the upper areas of Etna Mt., where it is represented by very sparse *Rumici-Astragaletea vegetation* and by volcanic desert or recent lava. Another kind of series is represented by permaseries or permasigmetum, which consist of perennial and stable plant communities occurring in stands with extremely specialized environmental conditions, such as coastal reefs (*Crithmo-Limonietea* class), dunes (*Euphorbio-Ammophiletea*), cliffs (*Asplenietea trichomanis*), salt marshes (*Sarcocornietea fruticosae*), etc. It is a permanent and mature vegetation (edaphoclimax), quite poor under the floristic profile.

In addition to the examined dynamic series, is possible to identify some geosigmeta, which are considered the basic unit of the landscape phytosociology. The geosigmetum can be defined as a system of contiguous sigmeta in catenal contact along an edaphic gradient inside of a bioclimatic belt of a given territory. For example, the hygrophilous geosigmetum of riparian vegetation is represented by several shrubby and arboreal communities belonging to *Populion albae*, *Platanion orientalis*, *Tamaricion africanae*, *Rubo-Nerion oleandri* and *Salicion albae*. Even the halophilous communities of coastal marshes and the psammophilous vegetation of coastal dunes constitute their proper geosigmetum with a remarkable ecological role in the Sicilian landscape. Finally, the geopermasigmetum is useful for study the catenal approach between the adiacent sets of permasigmeta, clearly correlated with different micro-topographic and edaphic conditions.

2.3. Paleobiogeography

The reconstruction of the vegetation occurring in the past ages on the Mediterranean territory presents not a few difficulties, especially due to the relative lack of fossils for the oldest periods and for the complexity of the geological processes that led to the formation of the current basin. For the older tertiary flora, an important support to these studies, in addition to pollen and leaf fossils, is given by the analysis of the current distribution of the more ancient species, which often have been preserved in some "refuge" areas quite distant from the Mediterranean, such as western Asia, the Atlantic islands, the Caucasus, etc. (Pignatti, 1978). According to various authors (Milne & Abbott, 2002; Thompson. 2005; Henne et al., 2015), the Mediterranean flora of the Tertiary period presented a marked tropical character, being dominated by evergreen woody species belonging to families such as Lauraceae, Oleaceae, Rhamnaceae, Magnoliaceae, Hamamelidaceae and Arecaceae, which constituted forests similar to those observable today in tropical Africa or in south-east Asia (Bessedik et al., 1984). The tropical vegetation began to be impoverished towards the middle Miocene (14-15 Ma) due to climatic fluctuations, but it had a definite collapse following the closure of the Strait of Gibraltar about 6 million years ago during the Messinian, which caused the gradual drying of the Mediterranean and its conversion into a hyper-salty basin without connections to the Atlantic. The increase in salinity was associated with a progressive drying up of the climate (Bocquet et al., 1978), determining the disappearance of the

floristic tropical element. At the same time, xerophilous species began to spread from the steppes and savannahs of North Africa and the Middle East, often characterized by a pulvinate habitus, such as some groups of *Astragalus* and *Centaurea*, which are conserved today mainly under conditions of marked edaphic dryness even at high altitude, like windy ridges or cliffs near the sea. The sea, reduced to a patchy mosaic of salty deserts, saltmarshes and hypersalted, highly alkaline lakes (Hsu et al., 1973), was colonized by halophilous communities dominated by taxa of *Limonium*, *Salsola*, *Suaeda*, *Limoniastrum*, etc. Furthermore, the increase in erosion and the emergence of large areas of the continental scarp, combined with tectonic uplift processes, led to the emergence of numerous new dry habitats that were colonized by pioneer species, sometimes with a short cycle, such as steppe grasses and therophytes (Bertolani-Marchetti & Cita, 1975; Bocquet et al., 1978). Overall, the geological and climatic processes that started during the Messinian played a fundamental role in the evolution of the current Mediterranean vegetation, through the elimination of physical barriers (such as the sea) between the living organisms and the climatic variations that favored the isolation and geographical segregation of populations (Guarino, 2006). The new opening of the Strait of Gibraltar led to the re-establishment of a subtropical flora (but without the most tropical elements of the Tertiary) during the beginning of the Pliocene (4 Ma), at least in the warmer areas with low altitudes, where the climatic conditions were warm-humid (Pignatti, 1978; Thompson, 2005). This vegetation, called "lauriphyllic" is still partially observable in the Atlantic islands of Macaronesia (Azorre, Madeira and Canaries) (fig. 10b), while it has disappeared from the Mediterranean, where however some relict species are preserved, such as for example *Laurus nobilis* and *Rhamnus lojaconoi* in Sicily, as well as some big-size ferns as *Woodwardia radicans* or *Pteris vittata*. The medium altitudes were covered by a deciduous mixed forest, more or less similar to tha one currently observable in the Caucasian region (fig. 10c) and including trees belonging to genera such as *Castanea*, *Zelkova*, *Carpinus*, *Quercus*, *Acer*, *Taxus*, *Tillia* and *Rhododendron*, often known as "Colchich relicts" (Denk et al., 2001). In Sicily the most interesting example of this flora is certainly represented by *Zelova sicula* (fig. 10a), located in two small stands on the Hyblaean mountains, where it is no longer able to produce seeds and can propagates only by vegetative way (Garfi & Buord, 2012). Finally, the higher forest belt was represented by coniferous woods, dominated by various species of *Abies*, *Cedrus*, *Pinus* and *Cupressus*, of which some relevant examples are still persist especially in the mountains of

Spain, North Africa, Balkans and Anatolian Peninsula (fig. 10d). Regards Sicily, similar formations are represented by the black pine woods on Etna and by the few specimens of *Abies nebrodensis* on the Madonie. However, this last taxon may have originated more recently, perhaps due to hybridization processes between *Abies alba* and *Abies numidica* during the climate crises of Pleistocene, while its decline would be mainly the result of human activity in historical times (Parducci et al., 2001). The Mediterranean sclerophyllic species, belonging to genera such as *Quercus*, *Arbutus*, *Olea*, *Phyllirea*, *Nerium*, *Myrtus* and *Pistacia*, probably have been originated yet during the end of the Miocene at least in the southern part of the basin (Bertoldi et al., 1989), but became dominant in the vegetation of the whole area only after the modification of cyclonic circulation of oceanic masses and the establishment of a Mediterranean climate regime about 2-3 million years ago (Suc, 1984). Since the end of Pliocene and the beginning of Pleistocene the rapid climatic variations between glacial periods (cold and dry) and more humid and warm interglacial periods led to many variations in the vegetation, passing from herbaceous communities of steppe type to forest and woodland aspects, such as widely recorded by the fossil pollens of this period. In any case, during the Quaternary period the Mediterranean character of the vegetation becomes more pronounced, with the spread of evergreen oak forests, alternating with *Cistus* garrigues and maquis (Pons & Suc, 1980; Brenac, 1984). In Sicily, during the coldest intervals, beech-woods began to spread over the mountains, replacing the ancient conifer communities (Bertolani-Marchetti et al., 1984), together with other species with a more northern range that reached lower lalitudes, as *Populus traemula* and *Betula pendula* (from which is derived *Betula aetnensis* for geographical isolation). The last glacial maximum of southern Europe was 20,000 years ago and had dramatic consequences on Mediterranean flora and vegetation (Pons, 1984), so much so that it could only survive in a few glacial refugia, such as the Balkan Peninsula, southern Spain, Greece, Sicily and the North Africa (Thompson, 2005; Suc et al., 2018), from which later have been re-colonized the other territories. However, during this period the predominant vegetation in these areas was represented by extensive arid steppes with *Artemisia*, which were the result more of the strong aridity than of the low temperatures (Kaiser, 1969; Van Campo, 1984), while the forests with evergreen oaks and other woody communities were restricted to humid narrow valleys and gorges near the sea.

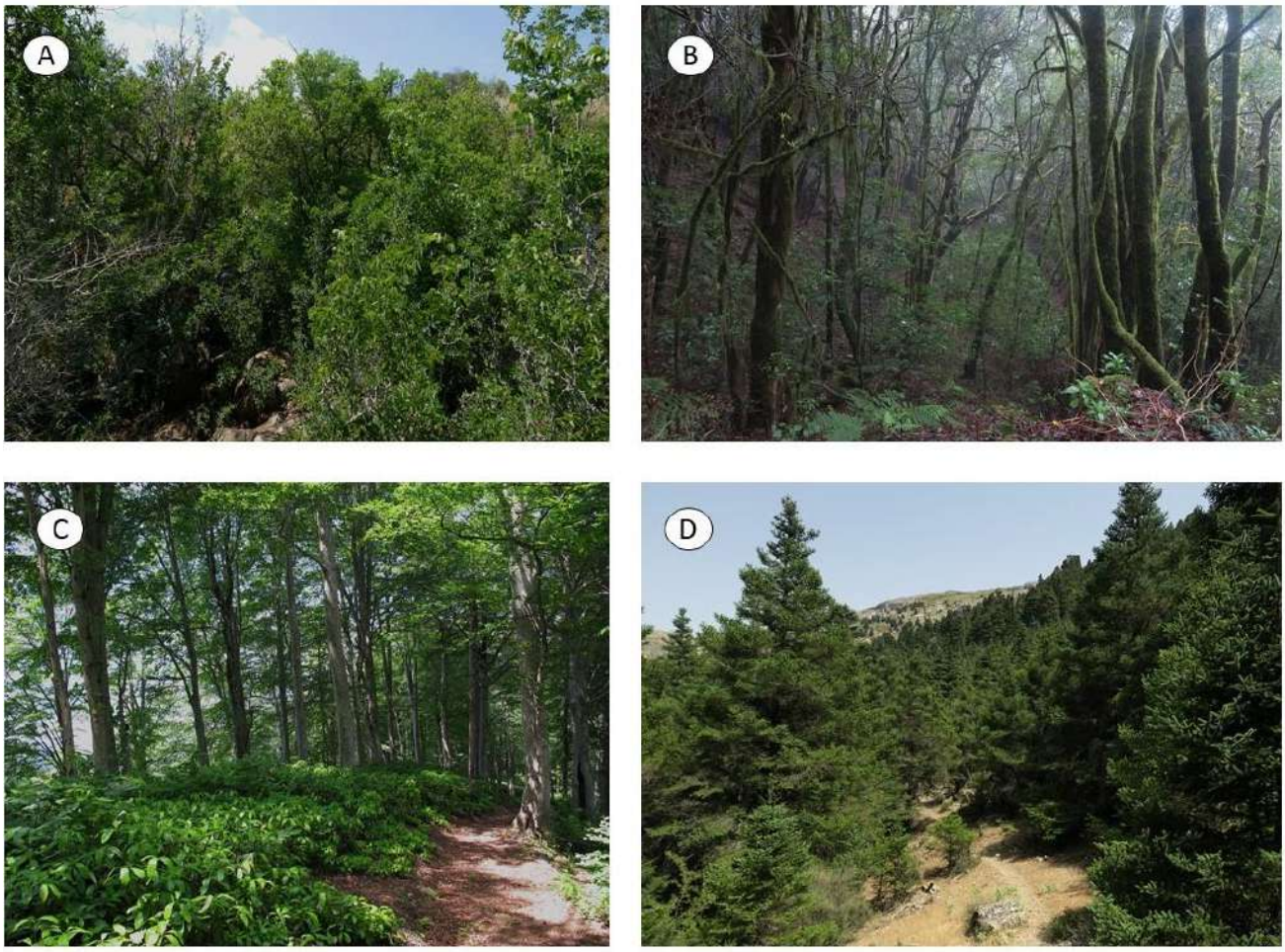


Fig. 10: A- Relictual *Zelkova sicula* stands in the Hyblaean mountains; B- Laurel forests ("Laurisilva") in the Canary Islands; C- Colchic forests in Southern Georgia; D- *Abies pinsapo* woodlands in southern Spain.

Moreover, during the quaternary glaciations some species of mattorals and garrigues found refuge in the cliffs and rocky walls (Snogerup, 1971). Numerous casmophytes, generally called paleoendemisms, have been preserved until now in these habitats, among them *Ptilostemon greuteri*, *Bupleurum elatum*, *Iberis semperflorens* and *Hieracium lucidum* in Sicily. Most of these species shows a woody habitus, reflecting a frequent evolution trend of Mediterranean flora, which started from the ancient nano-phanerophytic or chamaephytic life growth with a Tertiary origin and arrived to the more modern therophytic form, today largely widespread in the Mediterranean (Pignatti, 1979; Suc, 1984). However, their presumed origin in the Tertiary remains controversial, in fact as evidenced by Guarino & Pasta (2018) recent geological studies have shown that Sicily had not yet emerged in the lower Pliocene (except for some areas of Peloritani and Hyblaean), suggesting the need of further studies in order to ascertain time and place of differentiation for the above mentioned species. Another significant

process that took place during the ice ages of Quaternary was the lowering of the sea level, which together with tectonic phenomena determined frequent connections of Sicily with Malta and Calabria (Pedley et al., 1978; Broquet, 2016), favoring the migration of Appenino-Balkan and North African species in the island. The man arrival in Sicily (20,000-30,000 years ago) has greatly altered the natural environment, changing the essential features of landscape with agricultural activities, deforestation, fire, cutting, grazing, urbanization and the introduction of invasive alien species. Human activity was very clearly recorded by pollen fossils of Sicilian lakes, since his first appearance coincides with the progressive rarefaction of woody communities, particularly in the central and southern part (Sadori & Narcisi, 2001; Noti et al., 2009; Calò et al., 2012), while in the same period the *Fagus* and *Quercus* forests are still well preserved in the supra-mediterranean belt of Nebrodi and their exploitation seems more recent (Bisculm et al., 2012).

3. HISTORY OF PHYTOSOCIOLOGICAL STUDIES IN SICILY

The term "phytosociology" was used for the first time by the Polish botanist Joseph Paczoski in 1896, having however a quite different meaning from that currently used and not identifying a specific method for the study of social phenomena among plants. Between the end of the nineteenth century and the first half of the twentieth century, various geobotanical schools were established in the study of vegetation, including the so-called "Zurich-Montpellier School" or also known as the "European School", founded by Josias Braun-Blanquet in Montpellier (France). The first edition of his fundamental work "Pflanzensoziologie" dates back to 1928, followed by two new editions in 1951 and 1964. This author proposed a methodology for vegetation survey that will be internationally accepted and at the same time has contributed to define more clearly some fundamental concepts of phytosociology. As regards Sicily, the study of plant communities began timidly between the thirties and fifties of the of the 20th century, thanks to sporadic investigations mainly concerning the coastal vegetation, as the contributions by Frei (1937), Pignatti (1951), Molinier & Molinier (1955) and Pirola (1959, 1961), as well as few pioneering studies on the inner areas, regarding orophilous communities, woods, scrubs and pastures (Baccarini, 1901; Frei, 1940; Albo, 1959, 1961; Gentile, 1958, 1962; Gentile & Di Benedetto, 1961). However, the start of phytosociological studies in the modern sense in Italy and later also in Sicily began in the sixties thanks to the work of Pignatti, Tomaselli and Giacomini (Pedrotti, 2015). The presence of the latter for a short period at the University of Catania favored the beginning of the first phytosociological studies in Sicily, including the study on the thermophilous garrigues of Santo Pietro wood by Furnari (1965) and the contribution on the mountain vegetation of Etna by Poli (1965). Even some botanists from Palermo University started to work with phytosociology and in particular can be mentioned the studies on the coastal vegetation of Pantelleria (Di Martino, 1963), Palma di Montechiaro (Sortino, 1967), Castellamare del Golfo (Sortino & Giaccone, 1968) and Licata (Sortino & Di Martino, 1974). Furthermore, Gentile (1969a, 1969b, 1970) realized the first phytosociological studies on the forest vegetation of the Sicilian mountains, on the pastures and on the grassland of the *Lyge-Stipetea*. However, the great blooming of phytosociological studies on the vegetation of Sicily occurred mainly in the following decades, particularly thanks to the botanists of Catania University and covered almost all the types of vegetation occurring in the island. Among the numerous contributions, must be

cited the investigations regarding the coastal salt-marshes (Brullo & Furnari, 1976), hygrophilous vegetation of mountain stands (Brullo et al., 1994), maquis and garrigues (Brullo et al., 1997; Brullo & Spampinato, 1998), forest communities (Bartolo et al. , 1990; Brullo et al., 2008; Brullo et al., 2012), nitrophilous and infesting vegetation (Brullo & Marcenò, 1985), riparian woodlands (Brullo & Spampinato, 1990), coastal halophilous vegetation of the *Crithmo-Limonietea* (Bartolo & Brullo, 1993), chasmophilous communities (Brullo et al., 2004), dry grasslands of *Lygeo-Stipetea* (Brullo et al., 1997, 2010), perennial communities of *Parietarietea judaicae* (Brullo & Guarino, 1998, 2002), therophytic meadows of *Malcolmietalia* (Brullo & Marcenò, 1974; Brullo & Scelsi, 1996), ephemeral communities of the temporary ponds belonging to *Isoeto-Nanojuncetea* class (Brullo & Minissale, 1998), psammophilous vegetation (Brullo et al., 2001), etc. Other studies were dedicated to specific geographical areas of the island, such as those on the Hyblaean mountains (Brullo et al., 1996), Pantelleria (Brullo et al., 1977), Nebrodi (Barbagallo et al., 1979; Brullo & Grillo, 1978), Marettimo island (Brullo & Marcenò, 1982), Monte Cofano (Barbagallo et al., 1979), Madonie (Raimondo, 1980; Brullo, 1984), Peloritani (Bartolo et al., 1994), south-eastern coast (Bartolo et al., 1984), Simeto river (Brullo et al., 1988), Gela coast (Brullo et al., 1998), Linosa (Brullo & Siracusa, 1996), Lampedusa (Bartolo et al., 1990), Palermo mountains (Marcenò & Colombo, 1982), Aeolian Islands (Barbagallo et al., 1983), Torre Salsa (Giusso et al., 2008), etc. During the last decades, a new approach based on a more complex view of the dynamic relations between plant communities, has led to the development of synphytosociology. One of the most interesting results of this type of study in Italy was the publication of the volume “La Vegetazione d’Italia” by Blasi (2010), including the maps of vegetation series. Finally, the coming of modern methods, such as statistical analysis or the use of remote sensing and mapping techniques with GIS software, has given new vigor to phytosociological studies on the island, leading to the realization of a vegetation map of Sicily (Gianguzzi et al., 2016), as well as to numerous studies that allow to deepen the syntaxonomy and ecology of some vegetation types through the use of multivariate numerical analysis (Gianguzzi et al., 2011, 2015, 2016; Sciandrello et al., 2015; Minissale et al., 2017).

SYNTAXONOMICAL SCHEME

CHARETEA INTERMEDIAE F. Fukarek 1961
CHARETALIA INTERMEDIAE Sauer *1937*
CHARION VULGARIS (Krause & Lang 1977) Krause 1981
Charetum vulgaris Corillion 1957
Tolypelletum glomeratae Corillion 1957
CHARION CANESCENTIS Krausch 1964
Lamprothamnetum papulosi Corillion 1957

LEMNETEA MINORIS R.Tx. ex O.Bolòs & Masclans 1955
LEMNETALIA MINORIS R.Tx. ex O.Bolòs & Masclans 1955
LEMNION MINORIS R.Tx. ex O.Bolòs & Masclans 1955
Lemnetum gibbae Miyawaki & J. Tx. 1960
Lemnetum minoris Soò 1927
Wolffietum arrhizae Myawaki & J.Tx. 1960
Lemno-Spirodeletum polyrrhizae Koch 1954
LEMNION TRISULCAE Hartog & Segal 1964 em. Tüxen & Schwabe-Braun ex Tüxen 1974
Lemnetum trisulcae Hartog 1963

POTAMETEA PECTINATI Klika in Klika & Novak 1941
POTAMETALIA PECTINATI Koch 1926
POTAMION PECTINATI (Koch 1926) Libbert 1931
Potametum perfoliati Miljan 1933
Potametum pectinati Cartensen 1955
Potametum pusilli Soó 1927
Potametum crispis Soò 1927
Groenlandietum densae Segal ex Schipper et al. in Schaminée et al. 1995
NIMPHAEION ALBAE Oberd. 1957
Potamo pectinati-Myriophylletum spicati Rivas Goday 1964 corr. Conesa 1990
Myriophylletum verticillati Gaudet ex Šumberová in Chytrý 2011
Potamo natantis-Polygonetum natantis Knapp & Stoffers 1962
POTAMION POLYGONIFOLII Den Hartog & Segal 1964
Myriophylletum alterniflori Chouard 1924
CALLITRICHO HAMULATAE-RANUNCULETALIA AQUATILIS Passarge ex Theurillat in Theurillat et al. 2015
RANUNCULION AQUATILIS Passarge 1964
Ranunculo saniculifolii-Callitrichetum brutiae Brullo, Grillo & Terrasi 1976
Ranunculetum baudotii Br.-Bl. in Br.-Bl., Roussine & Nègre 1952
Ranunculetum aquatilis Géhu 1961
RANUNCULION FLUITANTIS Neuhäuls 1959
Ranunculetum penicillati Brullo & Spamp. 1990
Potamogetono crispi-Ranunculetum trichophylli Imchenetzky 1926
ZANNICHELLIETALIA PEDICELLATAE Schaminée, Lanjouw & Schipper ex Mucina & Theurillat in Mucina et al. 2016
ZANNICHELLION PEDICELLATAE Schaminée et al. 1990 em. Pott 1992
Zannichellietum obtusifoliae Brullo & Spamp. 1990
Najadetum marinae Fukarek 1961
UTRICULARIETALIA MINORIS Den Hartog & Segal 1964
UTRICULARION VULGARIS Passarge 1964

Utricularietum australis Müller & Görs 1960
CERATOPHYLLION DEMERSI Den Hartog & Segal ex Passarge 1996
Ceratophylletum demersi Corillion 1957

HALODULO WRIGHTII-THALASSIETEA TESTUDINUM Den Hartog *ex* Rivas-Martínez et al. 1999
THALASSIO-SYRINGODETALIA FILIFORMIS Knapp ex Borhidi et al. 1979
CYMODOCEION NODOSAE Den Hartog ex Mucina et al. 2016
Cymodoceetum nodosae Giaccone & Pignatti 1967
Halophiletum stipulaceae Augier ex Brullo in Brullo et al. 2019

ZOSTERETEA MARINAE Pignatti 1953
ZOSTERETALIA MARINAE Béguinot ex Pignatti 1953
ZOSTERION MARINAE Br.-Bl. & R.Tx. ex Pignatti 1953
Zosteretum marinae van Goor ex Pignatti 1953
NANOZOSTERION NOLTII Den Hartog ex Mucina 2016
Nanozosteretum noltii Pignatti 1953
POSIDONIETALIA Den Hartog ex Mucina 2016
POSIDONION OCEANICI Br.-Bl. ex Molinier 1960
Posidonietum oceanicae Molinier 1960

RUPPIETEA MARITIMAE J.Tx. 1960
RUPPIETALIA J. Tx. ex Den Hartog & Segal 1964
RUPPION MARITIMAE Br.-Bl. ex Westhoff in Bennema, Sissingh & Westhoff 1943
Enteromorpho intestinalidis-Ruppietum maritimae Westhoff *ex* R.Tx. & Böckelmann 1957
Chaetomorphato limi-Ruppietum cirrhosae Br.-Bl. in Br.-Bl. et al. 1952 nom. corr. Berg in Dengler et al. 2004
Ruppietum drepanensis Brullo & Furnari 1976
Rielletum notarisii Cirujano, Velayos & P. Garcia 1993

BIDENTETEA TRIPARTITAE R.Tx., Lohmeyer & Preising ex von Rochow 1951
BIDENTETALIA TRIPARTITAE Br.-Bl. & R.Tx. ex Klika & Hadac 1944
BIDENTION TRIPARTITAE Nordhagen 1940 em. R.Tx. in Poli & J.Tx. 1960
Bidentetum tripartitae Miljan 1933
CHENOPODION RUBRI (R.Tx. in Poli & J. Tx. 1960) Hilbig & Jage 1972
Polygono lapathifolii-Xanthietum italici Pirola & Rossetti 1974
Polygono orientalis-Chenopodietum rubri Sciandrello 2009

MONTIO FONTANAE-CARDAMINETEA AMARAE Br.-Bl. & R.Tx. ex Klika & Hadać 1944
MONTIO FONTANAE-CARDAMINETALIA AMARAE Pawlowski in Pawlowski et al. 1928
CARDAMINO AMARAE-MONTION FONTANAE Br.-Bl. 1926
Montio-Philonotidetum fontanae (Br.-Bl. 1915) Büker & R.Tx. in Büker 1942
CARICION REMOTAE Kästner 1941
Carici remotae-Osmundetum regalis Brullo, Scelsi & Spamp. 2001
CRATONEURIOM COMMUTATI Koch 1928
Cratoneuretum commutati Aichinger 1933

PLATYHYPNIDIO-FONTINALETEA ANTIPYRETICAE Philippi 1956
LEPTODICTYETALIA RIPARII Philippi 1965
FONTINALION ANTIPYRETICAE W.Koch 1936

Fontinaletum antipyreticae Kaiser ex Frahm 1971
PLATYHYPNIDION RUSCIFORMIS Philippi 1956
Oxyrrhynchietum rusciformis Gems ex v. Hübschmann 1953
CINCLIDOTION FONTINALOIDIS Philippi 1956
Fissidenti-Ciclidotetum nigricantis Allorge ex v. Hübschmann 1967
Hyophiletum ehrenbergi v. Hübschmann ex Marstaller 1987
Leptodictyo riparii-Fissidentetum crassipedis Allorge ex Philippi 1956
BRACHYTHECION RIVULARIS Hertel 1974
Brachythecio-Hygrohypnetum luridi Philippi 1956
HYGROHYPNETALIA Krajina 1933
RACOMITRION ACICULARIS v. Krusenstjerna 1945 ex Philippi 1956
Scapanietum undulatae Schwickerath 1944

ISÖETO-NANOJUNCETEA Br.-Bl. & R. Tx. ex Westoff, Dijk & Passarge 1946
ISÖETALIA Br.-Bl. 1935
ISÖETION Br.-Bl. 1935
Isöetetum durieui Br.-Bl. 1935
Pulicario-Scirpetum savii Brullo & Di Martino 1974
Isöeto-Ranunculetum parviflori Brullo, Di Martino & Marcenò 1977
Crassulo vaillantii-Elatinetum gussonei Bartolo, Brullo, Minissale & Spamp. 1990
Lythyro hyssopifoliae-Elatinetum macropadae ass. nov. provv.
Brizo minoris-Isolepidetum cernui Guglielmo, Sciandrello & Spamp. 2012 nom. inval.
Isoeto velatae-Crassuletum vaillantii Poiron & Barbero 1965
PRESLION CERVINAE Br.-Bl. ex Moor 1937
Ranunculo lateriflori-Antinorietum insularis Brullo, Grillo & Terrasi 1976
Myosuro minimi-Ranunculetum lateriflori Raimondo 1980
Ranunculetum pratensis-lateriflori ass. nov. provv.
Ranunculo lateriflori-Callitrichetum brutiae Brullo & Minissale 1998
CICENDIO FILIFORMIS-SOLENOPSION LAURENTIAE Brullo & Minissale 1998
Archidio phascoidis-Isoetetum velatae Brullo & Minissale 1998
Anagallido parviflorae-Molinerielletum minutae Brullo, Scelsi, Siracusa & Tomaselli 1998
Kickxio cirrhosae-Solenopsietum laurentiae Brullo & Minissale 1998
Junco pygmaei-Pilularietum minutae Minissale, Molina & Sciandrello 2017
NANOCYPERETALIA Klika 1935
NANOCYPERION FLAVESCENTIS Koch 1926
Plantago intermediae-Cyperetum fusci Sciandrello, D'Agostino & Minissale 2013
VERBENION SUPINAE Slavnic 1951
Heliotropio supini-Heleochloetum schoenoidis Rivas Goday 1956
Glino-Verbenetum supini Rivas Goday 1964
Verbeno supinae-Gnaphalietum luteo-albi Rivas Goday 1970
Coronopo-Sisymbrelletum dentatae Minissale & Spamp. 1987
Damasonio bourgeai-Crypsietum aculeatae Rivas-Martínez & Costa in Rivas-Martínez *et al.* 1980 corr. Silva & Costa 2012
Heleochloo schoenidis-Chenopodietum botryoidis Brullo & Sciandrello 2006
Pulicario grecae-Damasonietum bourgei Minissale, Santo & Sciandrello 2011
Ranunculo trilobi-Lythretum tribracteati Sciandrello 2005

SCHEUCHZERIO PALUSTRIS-CARICETEA FUSCAE R. Tx. 1937
CARICETALIA NIGRAE Koch 1926
CARICION FUSCAE Koch 1926

Carici tumidicarpae-Solenopsietum bivonae ass. nov. provv.

PHRAGMITO-MAGNOCARICETEA Klika in Klika & Novák 1941
PHRAGMITETALIA COMMUNIS W. Koch 1926
PHRAGMITION COMMUNIS W. Koch 1926
Phragmitetum communis Savič 1926
Bolboschoenetum glauci Grechushkina., Sorokin & Golub 2011
Schoenoplectetum lacustris Chouard 1924
Typhetum angustifoliae Pignatti 1953
Typhetum latifoliae Nowiński 1930
Typhetum domingensis Brullo, Minissale & Spamp. 1994
Typho angustifoliae-Phragmitetum australis (R. Tx. & Preising 1942) Rivas Martinez et al. 1991
Typho angustifoliae-Schoenoplectetum glauci Br.-Bl.& O.Bolòs 1958 *corr*. Molina & Moreno 2003
Iridetum pseudoacori Eggler ex Brzeg & Wojterska 2001
Polygono salicifolii-Phragmitetum australis Barbagallo, Brullo & Furnari 1979
Soncho maritimi-Cladietum marisci (Br.-Bl. & O. Bolòs 1958) Cirujano 1980
AGROSTIO SCABRICULMIS-ELYTRIGION ATHERICAE Brullo & Siracusa 2000
Elytrigio athericae-Puccinellietum fasciculatae Brullo & Siracusa 2000 corr.
Schenodoro interrupti-Juncetum subulati Brullo & Siracusa 2000 corr.
Schenodoro interrupti-Caricetum divisae Brullo & Siracusa 2000 corr.
Schenodoro interrupti-Elytrigietum athericae Brullo in Brullo et al. 1988 corr.
NASTURTIO-GLYCERIETALIA FLUITANTIS Pignatti 1953
GLYCERIO-SPARGANION NEGLECTI Br.-Bl. & Sissing in Boer 1942
Sparganietum erecti Philippi 1973
Eleocharido palustris-Alismetum lanceolati Minissale & Spamp. 1987
Eleocharido palustris-Sparganietum neglecti Brullo, Minissale & Spamp. 1994
Helosciadietum nodiflori Maire 1924
Nasturtietum officinalis Gilli 1971
Apio nodiflorae-Glycerietum plicatae Brullo & Spamp. 1990
MAGNOCARICETALIA Pignatti 1953
MAGNOCARICION ELATAE Koch 1926
Cyperetum longi Micevski 1957
Cypero badii-Caricetum otrubae R.Tx. in R.Tx. & Oberd. 1958
Caricetum ripariae Soó ex Máthé & Kovacs 1959
Caricetum hispidae Brullo & Ronsisvalle 1975
Carici distantis-Schoenetum nigricantis Brullo, Minissale, Scelsi & Spamp. 1993
Caricetum pendulo-panormitanae Gianguzzi, Cusimano, Ilardi & Romano 2013
BOLBOSCHOENETALIA MARITIMI Hejny in Holub et al. 1967
SCIRPION MARITIMI Dahl & Hadac 1941
Scirpetum maritimi Van Langendonck 1931
Cypero laevigati-Schoenoplectetum thermalis Brullo, Di Martino & Marcenò 1977
Scirpetum maritimo-littoralis Br.-Bl. in Br.-Bl. et al. 1952
Schoenoplectus litoralis-Cyperetum distachyi (Barbagallo, Brullo & Furnari 1990) Brullo & Sciandrello 2006
Festuco arundinaceae-Cyperetum distachyi Brullo & Sciandrello 2006
Scirpo maritimi-Cyperetum alopecuroidis Brullo & Sciandrello 2006
OENANTHETALIA AQUATICAE Hejný ex Balátová-Tuláčková et al. 1993
ALOPECURO-GLYCERION SPICATAE Brullo, Minissale, Spamp. 1994
Oenantho fistulosae-Glycerietum spicatae Brullo & Grillo 1978

Glycerio spicatae-Oenanthetum aquaticae Brullo, Minissale & Spamp. 1994
Glycerio-Callitrichetum obtusangulae Brullo, Minissale & Spamp. 1994

EUPHORBIO PARALIAE-AMMOPHILETEA AUSTRALIS Géhu & Rivas-Martinez in Rivas-Martinez et al. 2011
AMMOPHILETALIA AUSTRALIS Br.-Bl. 1933
AMMOPHILION AUSTRALIS Br.-Bl.1921 corr. Rivas-Martínez et al. 1990
SPOROBOLENION ARENARII Géhu & Géhu-Frank ex Géhu & Biondi 1994
Eryngio maritimi-Sporoboletum arenarii (Arènes ex Géhu & Biondi 1994) Rivas-Martínez & Cantò 2002
ELYTRIGIENION JUNCEAE Rivas-Martínez, Costa, Castroviejo & Valdes Bermajo 1980
Launeo fragilis-Elytrigietum junceae ass. nov. provv.
Pancratietum linosae Brullo & Siracusa 1996, corr.
Calendulo maritimae-Elytrigietum junceae Brullo, Giusso, Siracusa & Spamp. 2002
AMMOPHILENION AUSTRALIS (Br. Bl. 1921) Rivas-Martinez & Géhu in Rivas Martinez et al. 1990
Launeo fragilis-Ammophiletum australis ass. nov. provv.
CRUCIANELLETALIA MARITIMAE Sissingh 1974
ONONIDION RAMOSISSIMAE Pignatti 1952
Centaureo sphaerocephalae-Ononidietum ramosissimae Br.-Bl. & Frei in Frei 1937
Seselio maritimi-Crucianelletum maritimae Brullo, Miniss. & Siracusa 1996
Centaureo sphaerocephalae-Anthemidetum maritimae Brullo, Giusso, Siracusa & Spamp. 2001

CAKILETEA MARITIMAE R. Tx. & Preising in R. Tx. 1950
EUPHORBIETALIA PEPLIDIS R. Tx. 1950
EUPHORBION PEPLIDIS R. Tx. 1950
Salsolo tragi-Cakiletum maritimae Costa & Mansanet 1981 corr.
Salsolo tragi-Euphorbietum paraliae Pignatti 1952 corr.
Cakilo maritimae-Xanthietum italici Pignatti 1953
Atriplicetum hastato-tornabenii O. Bolòs 1962
Salsolo tragi-Euphorbietum peplis Géhu et al. 1984 corr.
Glaucio flavi-Matthioletum tricuspidatae Blasi, Fascetti, Veri & Bruno 1983

CRITHMO MARITIMI-LIMONIETEA Br.-Bl. in Br.-Bl., Roussine & Negre 1952 nom. mut.
CRITHMO MARITIMI-LIMONIETALIA Molinier 1934 nom. mut.
CRITHMO-LIMONION Molinier 1934 nom. mut.
Limonietum cosyrensis Brullo, Di Martino & Marcenò 1977
Limonietum secundiramei Brullo, Di Martino & Marcenò 1977
Limonietum bocconei Barbagallo, Brullo & Guglielmo 1979
Limonietum hyblaei Bartolo, Brullo & Marcenò 1982
Limonietum syracusani Bartolo, Brullo & Marcenò 1982
Limonietum tenuiculi Brullo & Marcenò 1983
Asparago stipularis-Limoniastretum monopetali Bartolo, Brullo & Marcenò 1982
Limonietum minutiflori Barbagallo, Brullo & Signorello 1983
Limonietum flagellaris Bartolo & Brullo 1993
Limonietum algusae Bartolo & Brullo 1993
Limonietum pavoniani Bartolo & Brullo 1993
Limonietum tauromenitani Bartolo & Brullo 1993
Limonietum jonici Bartolo & Brullo 1993
Limonietum selinuntini Bartolo & Brullo 1993

Crithmo maritimi-Limonietum melancholici Brullo, Marcenò & Romano 1996
Crithmo maritimi-Limonietum virgati Pirone 1995
Crithmo maritimi-Limonietum cophanensis ass. nov.provv.
Hyoseridetum taurinae Brullo et al. 1997
HELICHRYSION LITOREI Biondi ex Biondi in Biondi et al. 2013
Thymelaeo hirsutae-Helichrysetum conglobati Bartolo, Brullo & Marcenò 1982 corr.
Matthiolo pulchellae-Helicrhysetum errerae Brullo, Di Martino & Marcenò 1977
Senecioni siculae-Helichrysetum messerii Brullo & Marcenò 1983
Senecioni bicoloris-Helichrysetum litorei Barbagallo, Brullo & Signorello 1983
Senecioni siculae-Lycietum intricati Brullo & Siracusa 1996
Pallenio maritimi-Helichrysetum brulloi ass. nov. provv.
CRUCIANELLION RUPESTRIS Brullo & Furnari 1988
Limonietum lopadusani Bartolo, Brullo, Minissale & Spamp. 1990
Limonietum albidi Bartolo & Brullo 1993
Limonietum mazarae Bartolo & Brullo 1993
Chiliadenetum lopadusani Bartolo, Brullo, Minissale & Spamp. 1990
Crucianello rupestris-Helichrysetum conglobati ass. nov. provv.
ANTHYLLIDION BARBAE-JOVIS Brullo & De Marco 1989
Anthyllido barbae-jovis -Erucastretum virgati Brullo & Minissale 1997

JUNCETEA MARITIMI Br.-Bl. in Br.-Bl., Roussine & Nègre 1952
JUNCETALIA MARITIMI Br.Bl. ex Horvatić 1934
JUNCION MARITIMI Br.Bl. ex Horvatić 1934
Inulo longifoliae-Juncetum maritimi Brullo in Brullo et al. 1988 corr.
Caricetum divisae Br.Bl. in Br.-Bl., Roussine & Nègre 1952
Juncetum maritimo-acuti Horvatić 1934
Limonio virgati-Juncetum acuti Brullo & Di Martino *ex* Brullo & Furnari 1976
Spartino versicolori-Juncetum maritimi O. Bolòs 1962
Juncetum subulati Caniglia et al. ass. nov.
PLANTAGINION CRASSIFOLIAE Br.-Bl. in Br.-Bl., Roussine & Negre 1952
Schoeno nigricantis-Plantaginetum crassifoliae Br.-Bl. in Br.-Bl., Roussine & Negre 1952
Holoschoenetum globiferi Pirola 1959
Imperato cylindricae-Juncetum littoralis Brullo & Furnari 1976 corr.

SALICORNIETEA FRUTICOSAE Br.-Bl. & R. Tx. ex A. Bolòs y Vayreda & O. Bolòs in A. Bolòs y Vayreda 1950
SALICORNIETALIA FRUTICOSAE Br.-Bl.1933
SALICORNION FRUTICOSAE Br.-Bl. 1933
Junco subulati-Sarcocornietum fruticosae Brullo & Furnari 1988
SARCOCORNION ALPINI (Rivas-Martínez et al. 1990) Brullo, Giusso, Minissale, Siracusa & Spamp. 2002
Aeluropo lagopoidis-Sarcocornietum alpini Brullo in Brullo *et al.* 1988 *corr.* Barbagallo *et al.* 1990
Junco subulati-Sarcocornietum alpini Brullo & Sciandrello in Giusso et al. 2008
SUAEDION VERAE Brullo & Furnari 1988
Halimiono portulacoidis-Suaedetum verae Molinier & Tallon 1970 corr. Géhu in Géhu & al. 1984
ARTHROCNEMION GLAUCI Rivas-Martínez & Costa 1984
Arthrocauletum meridionalis-Juncetum subulati Brullo & Furnari 1976 corr.
Sphenopo divaricati-Arthrocauletum meridionalis ass. nov. provv.

Aeluropo lagopoidis-Limonietum intermedi Bartolo & Brullo, Miniss. & Spamp. 1990
Limonio densiflori-Arthocauletum meridionalis ass. nov. provv.
INULION LONGIFOLIAE Brullo & Furnari 1988 corr.
Agropyro scirpei-Inuletum longifoliae Brullo in Brullo et al. 1988 corr.
LIMONIASTRIETALIA GUOYNONIANI Guinochet 1951
LIMONION FERULACEI (Pignatti 1953) Beefting 1968
Sarcocornio fruticosae-Limonietum ferulacei Pignatti 1952
Limonio dubii-Lygetum spartii Brullo & Di Martino 1974 corr. Brullo & Furnari 1988
Limoniastro monopetali-Limonietum lilybei Brullo & Di Martino 1974 corr. Brullo & Furnari 1988
HALOCNEMION CRUCIATI Biondi, Casavecchia, Estrelles & Soriano 2013
Arthrocaulo meridionalis–Halocnemetum cruciati Biondi, Casavecchia, Estrelles & Soriano 2013 corr.

THERO-SALICORNIETEA (Pignatti 1953) stat. nov.
THERO-SALICORNIETALIA Pignatti 1953
SALICORNION PATULAE Géhu & Géhu-Franck 1984
Suaedo spicatae-Salicornietum patulae Brullo ass. nov.
SALICORNION EMERICI Géhu & Géhu-Franck 1984
Salicornietum emerici O. Bolòs ex Brullo & Furnari 1976
THERO-SALICORNION Br.-Bl. 1933
Suaedetum spicatae Pignatti 1953 corr.
Salsoletum sodae Pginatti 1953
Cressetum creticae Brullo & Furnari 1976
MICROCNEMION CORALLOIDIS Rivas-Martinez 1984
Halopeplidetum amplexicaulis Burollet 1927

SAGINETEA MARITIMAE Westhoff, Van Leeuwen & Adriani 1962
FRANKENIETALIA PULVERULENTAE Rivas-Martínez ex Castroviejo & Porta 1976
FRANKENION PULVERULENTAE Rivas-Martínez ex Castroviejo & Porta 1976
Isolepido cernuae-Saginetum maritimae Brullo 1988
Parapholidetum filiformis Brullo, Scelsi & Siracusa 1994
Sphaenopo divaricati-Spergularietum maritimae Sciandrello 2007
Spergulario salinae-Hordeetum marini Biondi, Filigheddu & Farris 2001
Rumicetum palustris Bonanno 2008
SILENO SEDOIDIS-CATAPODION BALEARICI de Foucault & Bioret 2010 corr.
Frankenio pulverulentae-Anthemidetum secundirameae Brullo & Scelsi 1998
Frankenio pulverulentae-Spergularietum bocconei Brullo & Scelsi 1998
Desmazerio pignattii-Senecionetum pygmaei Brullo & Scelsi 1998
Frankenio pulverulentae-Catapodietum balearici Brullo & Siracusa ass. nov. provv.
Polypogonetum subspathacei Gamisans 1992
PHOLIURO-SPERGULARION Pignatti 1952
Spergulario rubrae-Limonietum avei Brullo & Di Martino 1974 *corr.* Brullo 1988
Limonio avei-Hymenolobetum procumbentis Brullo, Scelsi & Siracusa 1994
Limonio avei-Parapholidetum marginatae Brullo, Scelsi & Siracusa 1994
GAUDINIO FRAGILIS-PODOSPERMION CANI Brullo & Siracusa 2000
Podospermo cani-Parapholidetum pycnanthae Brullo & Siracusa 2000
Chamaemelo praecocis-Leontodentetum muelleri Brullo & Siracusa 2000
Brassico amplexicaulis-Astragaletum raphaelis Brullo et al. ass. nov. provv.
Senecioni pectinati-Scabiosetum parviflorae Brullo et al. ass. nov. provv.
Chamaemelo fuscati-Rostrarietum hispidae Brullo et al. ass. nov. provv.

Sphaenopo divaricati-Spergularietum diandrae Brullo & Siracusa 2000

ADIANTETEA CAPILLI-VENERIS Br.-Bl. in Br.-Bl., Roussine & Negre 1952
ADIANTETALIA CAPILLI-VENERIS Br.-Bl. ex Horvatic 1934
ADIANTION CAPILLI-VENERIS Br.-Bl. ex Horvatic 1934
Eucladio verticillati-Adiantetum capilli-veneris Br.-Bl. *ex* Horvatic 1934
Eucladio verticillati-Didymodonetum tophaccei Hébrard 1973
Adianto capilli veneris-Cratoneuretum filicini Brullo, Lo Giudice & Privitera 1989
Adianto capilli veneris-Cratoneuretum commutati Brullo, Lo Giudice & Privitera 1989
Conocephalo conici-Woodwardietum radicantis Brullo, Lo Giudice & Privitera 1989
Adianto capilli veneris-Pteridetum vittatae Brullo, Lo Giudice & Privitera 1989
Adianto capilli veneris-Osmundetum regalis Brullo, Lo Giudice & Privitera 1989
Thamnobryo alopecuri-Phyllitidetum scolopendrium Brullo, Privitera & Puglisi 1993
Homalio lusitanicae-Adianthetum capilli-veneris Puglisi 1994
Adianto capillis veneris-Solenopsietum bivonae ass. nov. provv.
ASPLENIETEA TRICHOMANIS (Br.-Bl. in Meier & Br.-Bl. 1934) Oberd. 1977
ASPLENIETALIA GLANDULOSI Br.-Bl. & Meier 1934 in Meier & Br.-Bl. 1934
DIANTHION RUPICOLAE Brullo & Marcenò 1979
Scabioso creticae-Centauretum ucriae Brullo & Marcenò 1979
Bupleuro dianthifolii-Scabiosetum limonifoliae Brullo & Marcenò 1979
Brassico rupestris-Centauretum saccensis Bazan, Ilardi & Raimondo 2006
Anthemido cupanianae-Centauretum busambarensis Brullo & Marcenò 1979
Putorio calabricae-Micromerietum microphyllae Brullo & Marcenò 1979
Brassico tinei-Diplotaxietum crassifoliae Brullo & Marcenò 1979
Erucastretum virgati Brullo & Marcenò 1979
Diantho aeolici-Centauretum aeolicae Barbagallo, Brullo & Signorello 1983 corr.
POTENTILLETALIA CAULESCENTIS Br.-Bl. in Br.-Bl. & Jenny 1926
SAXIFRAGION AUSTRALIS Biondi & Ballelli ex. Brullo 1984
Asperuletum gussonei Brullo 1984
CHEILANTHETALIA MARANTO-MADERENSIS Saenz de Rivas & Rivas-Martínez 1979
PHAGNALO SAXATILIS-CHEILANTHION MADERENSIS Loisel 1970 corr. Perez & al. 1989
Phagnalo saxatilis-Cheilanthetum maderensis Loisel 1970 corr. Perez & al. 1989
Cosentinietum bivalentis Brullo in Brullo et al. 2004
Sedo dasyphilli-Cheilanthetum maderensis Sciandrello, D'Agostino & Minissale 2013
Sedo albi-Cosentinietum velleae Sciandrello, D'Agostino & Minissale 2013

POLYPODIETEA VULGARIS Jurko & Peciar ex Boscaiu, Gergely & Codoreanu in Ratiu et al. 1966
ANOMODONTO-POLYPODIETALIA CAMBRICI O.Bolòs & Vives in O.Bolòs 1957
POLYPODION SERRATI Br.-Bl. in Br.-Bl., Roussine & Négre 1952
Polypodietum serrati Br.-Bl. in Br.-Bl., Roussine & Négre 1952
Polypodio-Ranunculetum rupestris Barbagallo, Brullo & Signorello 1983
Homalothecio sericei-Poetum bivonae Brullo, Marcenò & Siracusa 2004
Polypodio serrulati-Cheilanthetum acrosticae Brullo, Marcenò & Siracusa 2004 corr.
Selaginello denticulatae-Cymbalarietum pubescentis Brullo, Marcenò & Siracusa 2004
BARTRAMIO STRICTAE-POLYPODION CAMBRICI O.Bolòs & Vives in O.Bolòs 1957
Bartramio strictae-Polypodietum serrulati Brullo & Siracusa in Brullo & al. 2004
Scorpiuro circinnati-Anogrammetum leptophyllae Brullo & Siracusa in Brullo & al. 2004
Bartramio strictae-Dryopteridetum pallidae Brullo & Siracusa in Brullo & al. 2004
Anogrammo leptophyllae-Selaginelletum denticulatae Molinier 1937

POHLIO CRUDAE-ASPLENION SEPTENTRIONALIS Brullo & Siracusa in Brullo & al. 2004
Pohlio crudae-Cystopteridetum dickieanae Brullo & Siracusa in Brullo & al. 2004
Brachytecio velutini-Asplenietum trichomanis Brullo & Siracusa in Brullo & al. 2004
Asplenio septentrionalis-Dryopteridetum villarii Brullo & Siracusa in Brullo & al. 2004

PARIETARIETEA JUDAICAE Oberd. 1977
TORTULO-CYMBALARIETALIA Segal 1969
PARIETARION JUDAICAE Segal 1969
Oxalido corniculatae-Parietarietum ramiflorae Br.-Bl. 1966
Capparietum rupestris O.Bolòs & Molinier 1958
Centranthetum rubri Oberd. 1969
Centrantho rubri-Hypericetum majoris Rivas-Martínez 1969 corr. Brullo & Guarino 1999
Cymbalario muralis-Trachelietum caerulei Rivas-Martínez 1969
Hyosciamo albi-Parietarietum judaicae Segal 1969
Antirrhinetum siculi Bartolo & Brullo 1986
Antirrhinetum tortuosi Caneva & al. 1995
Fico caricae-Erigeronetum mucronati Segal 1969
CYMBALARIO-ASPLENION QUADRIVALENTIS Segal 1969
Asplenio-Parietarietum judaicae Segal 1969
Sedo dasyphylli-Ceterachetum officinarum Hruska *ex* Brullo & Guarino 1998
Asplenio trichomanis-Umbilicetum horizontalis Brullo & Guarino 2002
Cheirantho cheiri-Parietarietum judaicae Oberd. 1957

SCROPHULARIO-HELICHRYSETEA ITALICI Brullo, Scelsi & Spamp. 1998
SCROPHULARIO-HELICHRYSETALIA SICULI Brullo 1984
LINARION PURPUREAE Brullo 1984
Arenario grandiflorae-Rumicetum scutati Raimondo 1980
Senecionetum rupestris Brullo & Marcenò in Brullo 1984 corr.
Centrantho rubri-Senecionetum ambigui Brullo & Marcenò in Brullo 1984
Rumici scutati-Cardaminetum grecae Brullo, Scelsi & Spamp. 1998
Scutellario rubicunda-Melicetum cupanii Brullo, Scelsi & Spamp. 1998
Arrhenathero nebrodensis-Euphorbietum rigidae Brullo & Siracusa ass. nov. provv.
EUPHORBION RIGIDAE Brullo & Spamp. 1990
Loto commutati-Helichrysetum siculi Brullo & Spamp. 1990 corr.
Ononido ramosissimae-Helichrysetum siculi Brullo & Spamp. 1990 corr.
Calendulo fulgidae-Helichrysetum siculi Brullo & Spamp. 1990 corr.
Senecioni gibbosi-Helichrysetum siculi Brullo & Spamp. 1990 corr.
Echinopo spinosissimi-Helichrysetum siculi Brullo, Scelsi & Spamp. 1998 corr.
Schrophulario bicoloris-Senecionetum bicoloris Brullo, Scelsi & Spamp. 1998
Sedo sediformis-Centranthetum rubri Gianguzzi & La Mantia 2008

ARTEMISIETEA VULGARIS Lohm., Preising & R.Tx. *ex* von Rochow 1951
ARCTIO LAPPAE-ARTEMISIETALIA VULGARIS Dengler 2002
ARCTION LAPPAE R.Tx. 1937
Urtico dioicae-Arrhenatheretum elatioris Raimondo 1980 *em.* Brullo & Marcenò 1985
Cerintho minoris-Chenopodietum boni-henrici Brullo & Marcenò 1985
Verbasco rotundifoli-Sambucetum ebuli Brullo & Marcenò 1985
Urtico dioicae-Cirsietum italici Brullo & Marcenò 1985
CARTHAMETALIA LANATI Brullo in Brullo & Marcenò 1985

ONOPORDION ILLYRICI Oberd. 1954
Scolymetum maculato-grandiflori Brullo & Marcenò 1985
Onopordo illyrici-Cirsietum scabri Brullo & Marcenò 1985
Pteridio aquilini-Tanacetum siculi Brullo & Marcenò 1985
Bonannietum graecae Brullo & Marcenò 1985
Phlomido herba-venti-Salvietum sclareae Brullo & Marcenò 1985
Phlomido herba-venti -Nepetetum apuleii Brullo & Marcenò 1985
Glaucio flavi-Onopordetum horridi Brullo & Marcenò 1985
Glaucio flavi-Scolymetum hispanici Bartolo, Brullo Minissale & Spamp. 1990
Carlino siculae-Feruletum communis Gianguzzi, Ilardi & Raimondo 1996
SILYBO MARIANI-URTICION PILULIFERAE Sissing ex Br.-Bl. & O. Bolòs 1958
Silybo mariani-Urticetum piluliferae Br.-Bl. in Br.-Bl. *et al.* 1936

EPILOBIETEA ANGUSTIFOLIII R.Tx & Preising ex von Rochow 1951
GALEOPSIO-SENECIONETALIA SYLVATICI Passarge 1981
EPILOBION ANGUSTIFOLII (Rübel 1933) Soó 1933
Epilobio angustifoliae-Atropetum belladonae Br.-Bl. ex R.Tx. 1950
Calamagrosto epigeji-Epilobietum angustifolii Brullo & Siracusa ass.nov.
CIRCAEO-STACHYETALIA SYLVATICAE Passarge 1967
MYCELIDO-STACHYION SYLVATICAE Passarge 1967
Petagnietum saniculifoliae Brullo & Grillo 1978
Rhynchocoryetum elephantis ass. nov.provv.
CONVOLVULETALIA SEPIUM R. Tx. ex Moor 1958
CYNANCHO-CONVOLVULION SEPIUM Rivas Goday & Rivas-Martinez ex Rivas-Martinez 1977
Calystegio silvaticae-Arundinetum donacis Brullo, Scelsi & Spamp. 2001
GALIO APARINE-ALLIARIETALIA PETIOLATAE Oberd. in Görs & Müller 1969
ANTHRISCION NEMOROSAE Brullo in Brullo & Marcenò 1985
Anthrisco nemorosae-Chaerophylletum temuli Brullo, Scelsi & Spamp. 2001
Lepidio nebrodensis-Smyrnietum perfoliati Brullo & Marcenò 1985
Anthrisco nemorosae-Heracletum cordati Brullo & Marcenò 1985
BALLOTO-CONION MACULATI Brullo in Brullo & Marcenò 1985
Urtico dioiceae-Sambucetum ebuli Br.-Bl. in Br.-Bl., Roussine & Négre 1952
Galio aparines-Conietum maculati Rivas-Martínez *ex* Lopez 1978
Balloto uncinatae-Melissetum romanae Brullo, Minissale, Scelsi & Spamp. 1993
Angelico sylvestris-Urticetum dioicae Minissale & Spamp. 1990

PEGANO HARMALAE-SALSOLETEA VERMICULATAE Br.-Bl & O.Bolòs 1958
SALSOLO VERMICULATAE-PEGANETALIA HARMALAE Br.-Bl. & O. Bolòs 1954
SALSOLO OPPOSITIFOLIAE-SUAEDION FRUTICOSAE Rigual 1972
Asparago albi-Salsoletum oppositifoliae Brullo, Giusso, Guarino, Miniss., Sciandr. & Spamp. 2012
Atriplici halimi-Halimionietum portulacoidis Brullo, Giusso, Guarino, Miniss., Sciandr. & Spamp. 2012
Capparido siculae-Salsoletum oppositifoliae Brullo, Giusso, Guarino, Miniss., Sciandr. & Spamp. 2012
Halimiono portulacoidis-Salsoletum oppositifoliae Brullo, Guarino & Ronsisvalle 1998
Limonio calcarae-Suaedetum verae Brullo, Giusso, Guarino, Miniss., Sciandr. & Spamp. 2012
Salsoletum agrigentinae Brullo, Guglielmo & Pavone 1985
Salsolo oppositifoliae-Limonietum catanzaroi Brullo, Guglielmo & Pavone 1985

Salsolo oppositifoliae-Limonietum opulenti Brullo, Grillo & Scalia 1980
Salsolo oppositifoliae-Suaedetum pelagicae Bartolo. Brullo, Miniss. & Spamp. 1990
Suaedo verae-Limoniastretum monopetali Bartolo, Brullo, Miniss. & Spamp. 1990
Thapsio pelagicae-Salsoletum oppositifoliae Brullo, Giusso, Guarino, Miniss., Sciandr. & Spamp. 2012
ARTEMISION ARBORESCENTIS Géhu & Biondi in Géhu et al. 1986
Atriplici halimi-Artemisietum arborescentis Biondi 1988
Coronillo valentinae-Artemisietum arborescentis Brullo, Giusso, Guarino, Miniss., Sciandr. & Spamp. 2012
Limonio optimae-Salsoletum oppositifoliae Brullo, Giusso, Guarino, Miniss., Sciandr. & Spamp. 2012
Lycio europaei-Artemisietum arborescentis Brullo, Giusso, Guarino, Miniss., Sciandr. & Spamp. 2012
Lycio intricati-Salsoletum oppositifoliae Brullo, Giusso, Guarino, Miniss., Sciandr. & Spamp. 2012
Medicagini arboreae-Salsoletum oppositifoliae Brullo, Giusso, Guarino, Minis., Sciandr. & Spamp. 2012

NICOTIANO GLAUCAE-RICINETEA COMMUNIS Brullo et al. 2020
NICOTIANO GLAUCAE-RICINETALIA COMMUNIS Rivas-Martínez, Fernández-González & Loidi 1999
NICOTIANO GLAUCAE-RICINION COMMUNIS Rivas-Martínez, Fernández-González & Loidi 19
Tropaeolo majoris-Ricinetum communis Rivas-Martínez et al. 1993
Nicotiano glaucae-Ricinetum communis de Foucault 2013
Ipomaeo purpureae-Ricinetum communis ass. nov. provv.

POLYGONO-POETEA ANNUAE Rivas-Martínez 1975
POLYGONO ARENASTRI-POETALIA ANNUAE R.Tx. in Gèhu, Richard & R.Tx. 1972 corr. Rivas Martinez et al. 1991
POLYCARPION TETRAPHYLLI Rivas-Martínez 1975
Euphorbio chamaesyces-Oxalidetum corniculatae Lorenzoni 1964
Crassulo tillaeae-Saginetum apetalae Rivas-Martínez 1975
Polycarpo tetraphylli-Spergularietum rubrae Brullo & Marcenò 1976
Trisetario aureae-Crepidetum bursifoliae Brullo 1979
Arabidopsio thalianae-Cardaminetum hirsutae Brullo 1979
Galio muralis-Cotuletum australis Guarino, Lo Cascio, Mustica & Pasta 2018

PAPAVERETEA RHOEADIS Brullo, Scelsi & Spamp. 2001
APERETALIA SPICAE-VENTI R.& J. Tx. in Malato-Beliz *et al.*1960
SCLERANTHION ANNUI (Kruseman & Vlieger 1939) Sissingh in Westhoff et al. 1946
Legousio speculum-veneris-Brizetum minoris Brullo & Furnari 1982 in Barbagallo et al. 1982
PAPAVERETALIA RHOEADIS Hüppe & Hofmeister ex Theurillat et al. 1995 em. Brullo, Scelsi & Spamp. 2001
RIDOLFION SEGETI Négre ex Rivas-Martínez et al. 1999
Capnophyllo peregrini-Medicaginetum ciliaris Di Martino & Raimondo 1976
Calendulo tripterocarpae-Hypecoetum procumbentis Bartolo, Brullo, Miniss. & Spamp. 1990
ROEMERION HYBRIDAE Rivas-Martinez, Fernàndez Gonzàlez & Loidi in Loidi et al. 1997

Legousio hybridae-Biforetum testiculatae Di Martino & Raimondo 1976
Adonido cupanianae-Anthemidetum incrassatae Bartolo et al. 1983
Vicio bithynicae-Ranunculetum arvensis Bartolo et al. 1983
Rapistro rugosi-Melilotetum infestae Bartolo *et al.* 1983
Valerianello dentatae-Medicaginetum scutellatae Ferro 1988
Lolio rigidi-Raphanetum raphanistri Ferro 2005

CHENOPODIETEA Br.-Bl. in Br.-Bl. et al. 1952
POLYGONO-CHENOPODIETALIA POLISPERMI R.Tx. & Lohmeyer in R.Tx.1950 em. J.Tx. in Lohmeyer et al. 1962
FUMARION WIRTGENII-AGRARIAE Brullo in Brullo & Marcenò 1985
Diplotaxietum vimineo-erucoidis Brullo & Marcenò 1985
Fumario densiflorae-Veronicetum hederifoliae Brullo & Marcenò 1985
Fumario parviflorae-Geranietum tuberosi Brullo & Marcenò 1985
Sileno coloratae-Lobularietum libycae Brullo & Marcenò 1985
Raphano raphanistri-Erucetum sativae Brullo & Marcenò 1985
Ammio maji-Torilidetum nodosae Brullo & Marcenò 1985
Herniario glabrae-Sperguletum arvensis Brullo & Marcenò 1985 corr. Ferro 2005
Loto subbiflori-Anthemidetum incrassatae Brullo & Marcenò 1985
Fumarietum parviflorae-bastardii Bartolo, Brullo, Miniss. & Spamp. 1990
Fumario parviflorae-Resedetum luteae Bartolo, Brullo, Miniss. & Spamp 1990
SOLANO NIGRI-POLYGONETALIA CONVOLVULI (Sissingh in Weshtoff *et al.* 1946) O. Bolòs 1962
CHENOPODION BOTRYOS Brullo & Marcenò 1980
Heliotropietum bocconei Brullo & Marcenò 1980
Heliotropietum dolosi Brullo & Marcenò 1980
DIPLOTAXION ERUCOIDIS Br.-Bl. in Br.-Bl. et al.1936 em. Brullo & Marcenò 1980
Chrozophoro tinctoriae-Kickxietum integrifoliae Brullo & Marcenò 1980
Amarantho lividi-Eragrostietum barrelieri Brullo & Marcenò 1985
Chrozophoro tinctoriae-Heliotropietum dolosi Bartolo, Brullo, Miniss. & Spamp 1990
PANICO-SETARION VIRIDIS Sissingh in Weshtoff et al. 1946
Setario glaucae-Echinochloetum colonum A.& O. Bolòs ex O. Bolòs 1956
Setario ambiguae-Cyperetum rotundi Brullo, Scelsi & Spamp. 2001
Amarantho graecizantis-Setarietum verticillati Ferro 2005
BROMETALIA RUBENTI-TECTORUM (Rivas Goday et Rivas-Martinez 1973) Rivas-Martinez & Izco 1977
FEDIO GRACILIFLORAE-CONVOLVULION CUPANIANI Brullo & Spamp. 1986
Chamaemelo fusci-Silenetum fuscatae Brullo & Spamp. 1986
Ononido alopecuroidis-Vicietum siculi Brullo & Marcenò 1985
Vulpio ligusticae-Tetragonolobetum biflori Brullo & Spamp. 1986
Hedysaro coronarii-Lathyretum hirsuti Brullo & Spamp. 1986
Lotetum angustissimo-conimbricensis Brullo & Spamp. 1986
HORDEION LEPORINI Br.-Bl. in Br.-Bl. et al. 1936 corr. O. de Bolòs 1962
Hordeo leporini-Sisymbrietum orientalis Oberd. 1954
Malvo parviflorae-Chrysanthemetum coronarii Ferro 1980
Hordeo leporini-Vulpietum ligusticae Brullo 1983
Carduetum marmorati Brullo 1983 corr. Brullo et al. 2018
Hypochoerido hispidae-Plantaginetum serrariae Brullo 1983
Centauretum napifoliae Brullo 1983
Hordeo leporini-Senecionetum squalidi Brullo 1983
Hordeo leporini-Erodietum acaulis Brullo 1983

Senecioni cosyrensis-Hordetum leporini Brullo 1983
Hordeo leporini-Centauretum macracanthae Brullo 1983
Chrysanthemo coronarii-Silybetum marianae Brullo 1983
Hordeo leporini-Onopordetum illyrici Brullo & Marcenò 1985
Hordeo leporini-Carduetum argyroae Brullo & Marcenò 1985
Evaco asterisciflorae-Filaginetum congestae Bartolo, Brullo, Miniss. & Spamp 1990
Volutario lippii-Hordeetum leporini Brullo & Siracusa 1996
Hordeo leporini-Sisymbrietum erysimoidis Brullo & Scelsi 1998
Lavatero creticae-Chrysanthemetum coronarii Ferro e Zizza in Ferro 2005
ECHIO PLANTAGINEI-GALACTITION TOMENTOSAE O. Bolòs & Molinier 1969
Hedysaro coronarii-Lavateretum trimestris Maugeri 1975
Eruco sativae-Chamaemeletum mixtae Brullo 1983
Galactito elegantis-Isatidetum canescentis Brullo 1983
Galactito elegantis-Knautietum hybridae Brullo 1983
Linario multicaulis-Euphorbietum terracinae Brullo 1983
Meliloto siculi-Hordetum marini Brullo 1983
Senecioni delphinifolii-Stachyetum hirtae Brullo 1983
Theligono cynocrambis-Smyrnietum rotundifolii Brullo 1983
Trifolio glomerati-Vicietum bithynicae Brullo 1983
Vicio pseudocraccae-Echietum pustulati Brullo 1983
Centauretum schouwii Brullo 1983
Convolvuletum tricoloris Brullo 1983
Convolvulo pentapetaloidi-Carduetum corymbosi Brullo 1983
Phleo echinati-Silenetum tenuiflorae Bartolo, Miniss., Sorbello & Spamp. 1988
Plantagini afrae-Carrichteretum annuae Bartolo, Brullo, Miniss. & Spamp 1990
Hippocrepido ciliatae-Astragaletum epiglottis Bartolo, Brullo, Miniss. & Spamp 1990
Chrysanthemo coronarii-Hyppocrepidetum multisiliquosae Brullo & Siracusa 1996
Reichardio picroidis-Stipetum capensis Rivas-Martínez, Costa & Loidi 1992
Loto halophili-Stipetum capensis Miniss. & Sciand. 2005
Plantago afrae-Galactitetum elegantis Ferro & Privitera 2010
Achilleo ligusticae-Galactitetum tomentosae Ferro 2005
URTICO-SCROPHULARIETALIA PEREGRINAE Brullo in Brullo & Marcenò 1985
ALLION TRIQUETRI O. Bolòs 1967
Acantho mollis-Smyrnietum olusatri Brullo & Marcenò 1985
Delphinio staphysagriae-Stellarietum cupanianae Brullo & Marcenò 1985
Succowio balearicae-Smyrnietum olusatri Bartolo, Brullo, Minissale & Spamp. 1990
Fumario flabellatae-Parietarietum judaicae Bartolo, Brullo, Minissale & Spamp. 1990
Succowio balearicae-Castellietum tuberculosae Brullo & Siracusa 1996
Geranio robertiani-Smyrnietum olusatri Ferro 2005
Parietario judaicae-Achyranthetum siculae Brullo & Siracusa ass.nov.
VERONICO-URTICION URENTIS Brullo in Brullo & Marcenò 1985
Fumario capreolatae-Stellarietum neglectae Maugeri ex Brullo & Marcenò 1985
Bromo sterili-Brassicetum sylvestris Brullo & Marcenò 1985
CHENOPODIETALIA MURALIS Br.-Bl. in Br.-Bl. et al. 1936 em. Rivas-Martínez 1977
CHENOPODION MURALIS Br.-Bl. in Br.-Bl. et al. 1936 em. Brullo in Brullo & Marcenò 1985
Chenopodietum muralis Br.-Bl. in Br.-Bl. et al. 1936
Amarantho muricati-Chenopodietum ambrosioidis O. Bolòs 1967
Amarantho viridis-Chenopodietum muralis Bartolo, Brullo, Minissale & Spamp. 1990
Xanthio italici-Erigeronetum canadensis Bonanno & Lo Giudice 2009
MALVION PARVIFLORAE (Rivas-Martínez 1978) Brullo in Brullo & Marcenò 1985

Lavateretum arboreae Br.-Bl. & Molinier 1935
Lavatero creticae-Malvetum nicaeensis Brullo et al. 2019
Chenopodio muralis-Parietarietum diffusae Brullo & Marcenò 1985
MESEMBRYANTHENION CRYSTALLINI Rivas-Martínez et al. 1993
Mesembryanthemetum crystallino-nodiflori O. Bolòs 1957
Mesembryanthemetum crystallini Sunding 1972
Mesembryanthemo crystallini-Paronychietum argenteae Brullo & Siracusa 1996
Mesembrianthemo crystallini-Hyosciametum albi Brullo & Siracusa 1996
GERANIO PURPUREI-CARDAMINETALIA HIRSUTAE Brullo in Brullo & Marcenò 1985
VALANTIO MURALIS-GALION MURALIS Brullo & Marcenò 1985
Torilido nemoralis-Cerastietum pentandri Brullo & Marcenò 1985
Laguro vestiti-Erodietum maritimi Brullo & Marcenò 1985
Cruciato pedemontanae-Buglossoidetum splitgerberi Brullo & Marcenò 1985
Geranio purpurei-Saxifragetum bulbiferae Brullo & Marcenò 1985
Valerianello eriocarpae-Cerastietum glomerati Brullo & Marcenò 1985
Sedetum litoreo-stellati Brullo & Marcenò 1985
Parietario lusitanicae-Veronicetum cymbalariae Brullo & Marcenò 1985
Valantio muralis-Polycarpetum alsinifolii Brullo & Marcenò 1985
Ranunculo parviflori-Senecionetum lividi Brullo & Marcenò 1985
Galio murali-Sedetum cepaeae Brullo & Marcenò 1985
Valerianello carinatae-Cerastietum luridi Brullo & Marcenò 1985
Valantio muralis-Solenopsidetum mothianae Brullo, Scelsi & Siracusa 1994 corr.
Galio murali-Catapodietum zwierleinii Bartolo, Brullo, Minissale & Spamp. 1990
Valerianello puberulae-Galietum calvescentis Brullo & Siracusa 1996
Erophilo vernae-Sedetum hispanici Brullo & Siracusa in Brullo & al. 2007
Geranio purpurei-Cardaminetum graecae Brullo & Siracusa in Brullo & al. 2007
Cardamino hirsutae-Stachyetum arvensis Brullo & Siracusa in Brullo & al. 2007
Sedo stellati-Campanuletum dichotomae Brullo, Guarino & Siracusa in Brullo & al. 2007
Saxifrago tridactylitis-Hornungietum petraeae Brullo & Guarino in Brullo & al. 2007
Parietario lusitanicae-Hornungietum pauciflorae ass. nov. provv.

POETEA BULBOSAE Rivas Goday & Rivas-Martínez in Rivas-Martínez 1978
POETALIA BULBOSAE Rivas Goday & Rivas-Martínez in Rivas Goday & Ladero 1970
TRIFOLIO SUBTERRANEI-PERIBALLION Rivas Goday 1964
Trifolio nigrescentis-Poetum bulbosae (Ladero, Biondi, Mossa & Amor 1992) Galán De Mera, Morales Alonso & Vicente Orellana 2000
Poo bulbosae-Trifolietum subterranei Rivas Goday 1964

HELIANTHEMETEA GUTTATI Rivas Goday & Rivas-Martínez 1963
HELIANTHEMETALIA GUTTATI Br.-Bl. in Br.-Bl. & Wagner 1940
HELIANTHEMION GUTTATI Br.-Bl. in Br.-Bl. & Wagner 1940
Trifolio nigrescentis-Andryaletum cosyrensis Brullo, Di Martino & Marcenò 1977
Tolpidetum gussonei Ferro & Furnari 1970
Tolpidetum grandiflorae Brullo & Furnari in Barbagallo et al. 1982
Bupleuro semicompositi-Tuberarietum guttatae Bartolo, Brullo & Marcenò 1982
Tuberario guttati-Aphanetum microcarpae Barbagallo, Brullo & Signorello 1983
Tuberario guttati-Senecionetum lividi Barbagallo, Brullo & Signorello 1983
Coleostepho myconis-Trisetarietum aureae Brullo, Minissale, Scelsi & Spamp. 1993
Tuberario guttati-Anemonetum palmatae Brullo, Scelsi & Siracusa 1994
Trifolio bocconei-Tuberarietum guttatae Brullo et al.1998
Tuberario guttati-Plantaginetum bellardii Aubert & Loisel 1971

Airo caryophyllaeae-Micropyretum tenelli Brullo, Scelsi & Spamp. 2001
Airo caryophyllaeae-Oglifetum heteranthae Brullo, Scelsi & Spamp. 2001
Trifolio suffocati-Trisetarietum aureae Minissale & Sciandrello 2010
Asterolino lini-stellati-Tuberarietum guttatae Ferro, Privitera & Puglisi 2006
Galio divaricati-Tuberarietum guttatae Ferro, Privitera & Puglisi 2006
Loto conimbricensis-Tuberarietum plantagineae Sciandrello, D'Agostino & Minissale 2013
Radiolo linoidis-Kichxietum cirrhosae Brullo, Di Martino & Marcenò 1977
Bellido annuae-Solenopsidetum laurentiae Brullo, Scelsi & Siracusa 1994
Rumici bucephalophori-Ophioglossetum lusitanici Médail, Pavon, Lo Cascio & Pasta 2016
CRASSULO TILLAEAE-SEDION CAESPITOSI De Foucault 1999
Crassulo tillaeae-Erodietum botrytis Ferro & Furnari 1970
Crassulo tillaeae-Sedetum cosyrensis Brullo, Di Martino & Marcenò 1977
Herniario cinereae-Crassuletum tillaeae Brullo, Scelsi & Siracusa 1994
VULPIETALIA Pignatti 1953
ALKANNO-MARESION NANAE Rivas Goday ex Rivas Goday & Rivas-Martínez 1963 corr. Diaz-Garretas et al. 2001
Vulpio membranaceae-Leopoldietum gussonei Brullo & Marcenò 1974
Lomelosietum rutifoliae Brullo, Di Martino & Marcenò 1974
Sileno nicaeensis-Chamaemeletum mixti Brullo in Brullo et al. 1988
Onobrychido caput-galli-Cerastietum gussonei Brullo & Grillo 1985
Anthemido peregrinae-Centauretum conocephalae Brullo & Grillo 1985
Maresio ramosissimae-Walenbergietum nutabundae Brullo & Grillo 1985
Loto peregrini-Ononidetum serratae Brullo & Grillo 1985
Cutandio maritimae-Parapholietum marginatae Bartolo, Brullo, Minissale & Spamp. 1990
Bupleuro semicompositi-Ononidetum reclinatae Brullo, Scelsi & Siracusa 1994
Vulpio membranaceae-Cutandietum divaricatae Brullo & Scelsi 1998
Vulpio membranaceae-Romuletum rollii Brullo & Scelsi 1998
Vulpio membranaceae-Hormuzakietum aggregatae Brullo, Guarino & Ronsisvalle 1998
Centrantho calcitrapae-Catapodietum hemipoae Brullo, Guarino & Ronsisvalle 1998
Sileno coloratae-Ononidetum variegatae Gèhu & Gèhu-Franck 1986
Airo cupanianae-Bryetum argentei Bonanno & Lo Giudice 2009
Sileno nicaeensis-Maresietum nanae Minissale & Sciandrello 2010
FILAGINI ASTERISCIFLORAE-LINARION HUMILIS Minissale & Sciandrello 2015
Filago asterisciflorae-Tuberiaretum siculae Brullo & Grillo 1985
Alkanno tinctoriae-Nonetum vesicariae Brullo & Scelsi 1998
Filagini asterisciflorae-Loeflingietum hispanicae Minissale & Sciandrello 2015
Rostrario litoreae-Tuberarietum villosissimae Minissale & Sciandrello 2015
Astragalo kamarinensis-Coronilletum repandae Minissale & Sciandrello 2015

STIPO-TRACHYNIETEA DISTACHYAE Brullo in Brullo, Scelsi & Spamp. 2001
BRACHYPODIETALIA DISTACHYI Rivas-Martínez 1978
TRACHYNION DISTACHYAE Rivas-Martínez 1978
Thero-Sedetum caerulei Brullo 1975
Vulpio ciliatae-Trisetarietum aureae Brullo 1975
Astragalo sesamaei-Medicaginetum rectae Sciandrello, D'Agostino & Minissale 2013
Trifolio scabri-Hypochoeridetum achyrophori Lapraz ex Biondi, Izco, Ballelli & Formica 1997
STIPION RETORTAE O. de Bolòs 1957

Trigonello monspeliacae-Stipetum capensis Tomaselli 1999
Ononido breviflorae-Stipetum capensis Brullo, Guarino & Ronsisvalle 1998
SEDO-CTENOPSION GYPSOPHILAE Rivas Goday & Rivas-Martínez ex Izco 1974
Filagini eriocephalae-Chaenorrhinetum rubrifolii Brullo, Marcenò, Minissale & Spamp. 1989
STIPO-BUPLEURETALIA SEMICOMPOSITI Brullo in Brullo, Scelsi & Spamp. 2001
PLANTAGINI-CATAPODION MARINI Brullo 1985
Anthemido secundirameae-Desmazerietum siculae Brullo 1985
Filagini cossyrensis-Daucetum lopadusani Brullo 1985
Sileno sedoides-Bellietum minuti Brullo 1985
Oglifetum lojaconoi Brullo 1985
Plantagini coronopi-Erodietum linosae Brullo 1985
Sedo litorei-Valantietum calvae Brullo 1985
Catapodio marini-Sedetum litorei Bartolo, Brullo, Minissale & Spamp. 1990
Paronychio arabicae-Crassuletum tillaeae Bartolo, Brullo, Minissale & Spamp. 1990
Atractylido cancellatae-Neatostenetum apuli Brullo, Scelsi & Siracusa 1994
Catapodio marini-Valantietum intricatae Brullo & Siracusa 1996
Anthemido secundirameae-Allietum lehmanii Brullo & Scelsi 1998
Echinarietum todaroanae Brullo, Scelsi, Siracusa & Tomaselli 1998
Onobrychido caput-galli-Psiluretum incurvi Brullo & Scelsi 1998
Podospermo cani-Plantaginetum deflexae Brullo, Guarino & Ronsisvalle 1998
Parapholido incurvae-Asphodeletum tenuifolii Brullo, Guarino & Ronsisvalle 1998
Sagino maritimae-Crassuletum tilleae Brullo, Guarino & Ronsisvalle 1998

LYGEO SPARTI-STIPETEA TENACISSIMAE Rivas-Martinez 1978
LYGEO-STIPETALIA Br.-Bl. & O. Bolòs 1958
MORICANDIO-LYGEION SPARTI Brullo, De Marco & Signorello 1990
Eryngio dichotomi-Lygeetum sparti Gentile & Di Benedetto 1961
Tripolietum sorrentinoi Brullo 1985
Lavatero agrigentinae-Lygeetum sparti Brullo 1985
Phagnalo annotici-Lygeetum sparti Biondi & Mossa 1993
CYMBOPOGONO-BRACHYPODIETALIA RAMOSI Horvatić 1963
HYPARRHENION HIRTAE Br.-Bl., P. Silva & Rozeira 1956
HYPARRHENENION HIRTAE Brullo, Minissale & Spamp. in C. Brullo et al. 2010
Hyparrhenietum hirto-pubescentis A. & O.Bolòs & Br.-Bl. in A. & O.Bolòs 1950
Ferulo communis-Hyparrhenietum hirtae Brullo & Siracusa 1996
Ferulago nodosae-Hyparrhenietum hirtae Minissale, Sciandrello & Spamp. 2007
Cachryo pungentis-Hyparrhenietum hirtae Brullo, Minissale, Sciandrello in C. Brullo et al. 2010
Hyparrhenio hirtae-Festucetum humifusae Brullo & Guarino in C. Brullo et al. 2010
Stipo gussonei-Hyparrhenietum hirtae Brullo & Scuderi in C. Brullo et al. 2010
Thapsietum pelagicae C. Brullo & Brullo in C. Brullo et al. 2010
Euphorbio terracinae-Hyparrhenietum hirtae Brullo & Siracusa 1996
Oryzopsio pauciflorae-Hyparrhenietum hirtae Bartolo, Brullo, Minissale & Spamp. 1990
Sanguisorbo verrucosae-Magydaretum pastinaceae Bartolo, Brullo, Minissale & Spamp. 1990
PANICO REPENTIS-HYPARRHENENION HIRTAE (Brullo & Siracusa 2000) C. Brullo et al. 2010
Imperato cylindricae-Hyparhenietum hirtae Brullo & Siracusa 2000
Dichantio annulati-Hyparhenietum hirtae Brullo & Siracusa 2000
Phalarido coerulescentis-Hyparrhenietum hirtae Scuderi in C. Brullo et al. 2010

ARISTIDO CAERULESCENTIS-HYPARRHENENION HIRTAE (Brullo, Scelsi & Spamp. 1997) C. Brullo et al. 2010

Tricholaeno teneriffae-Hyparrhenietum hirtae (Wildpret & Rodriguez in Rivas Martinez et al. 1993) Brullo, Scelsi & Spamp. 1997

Cenchro ciliaris-Hyparrhenietum hirtae Wildpret & Rodriquez in Rivas-Martínez *et al.* 1993

Botriochloo panormitanae-Hyparrhenietum hirtae Brullo, Scelsi & Spamp. 1997

Penniseto setacei-Hyparrhenietum hirtae Gianguzzi, Ilardi & Raimondo 1993

AVENULO CINCINNATAE-AMPELODESMION MAURITANICI Minissale 1995

Helichryso hyblaei-Ampelodesmetum mauritanici Minissale 1995

Helictotricho convoluti-Ampelodesmetum mauritanici Minissale 1995

Seselio tortuosi-Ampelodesmetum mauritanici Minissale 1995

Galio aetnici-Ampelodesmetum mauritanici Minissale 1995

Astragalo huetii-Ampelodesmetum mauritanici Minissale 1995

Astragalo monspessulani-Ampelodesmetum mauritanici Minissale 1995

Arrhenathero nebrodensis-Helictotrichetum convoluti Brullo, Scelsi, Siracusa & Tomaselli 1998

Avenulo cincinnatae-Brachypodietum phoenicoidis Brullo, Minissale & Spamp. in Brullo et al. 2010 *Avenulo cincinnatae-Stipetum siculae* Brullo, Minissale & Spamp. in Brullo et al. 2010

subass. *matthioletosum fruticulosae* Brullo, Minissale & Spamp. in Brullo et al. 2010

subass. *hyparrhenietosum hirtae* Brullo, Minissale & Spamp. in Brullo et al. 2010

Avenulo cincinnatae-Stipetum barbatae Brullo, Giusso & Scuderi in Brullo et al. 2010

PHLOMIDO LYCHNITIDIS-BRACHYPODION RETUSI Mateo ex Theurillat & Mucina 2016

Pulicario odorae-Brachypodietum retusi Ferro & Ladero 1999

Coronillo glaucae-Brachypodietum retusi C. Brullo, Brullo, Giusso & Tomaselli 2006

Helminthotheco aculeatae-Brachypodyetum retusi C. Brullo, Brullo, Giusso & Tomaselli 2006

Diantho graminifoli-Brachypodietum retusi Brullo, Giusso & Scuderi in Brullo et al. 2010

Cachryo siculae-Brachypodietum retusi Brullo, Giusso & Scuderi in Brullo et al. 2010

BROMO-ORYZOPSION MILIACEAE O.Bolòs 1970

Centrantho rubri-Euphorbietum ceratocarpae Brullo 1984

Thapsio garganicae-Feruletum communis Brullo 1984

Diplotaxio tenuifoliae-Oryzopsietum miliaceae Brullo 1984

Sinapio pubescentis-Oryzopsietum miliaceae Brullo 1984

Tricholaeno teneriffae-Oryzopsietum miliaceae Brullo 1984

Euphorbietum cupanii Brullo 1984

Boerhaavio viscosae-Oryzopsietum miliaceae Brullo 1984

Dittrichio viscosae-Ferulaginetum campestris Brullo 1984

Mantisalco salmanticae-Oryzopsietum miliaceae Bartolo, Brullo, Minissale & Spamp. 1990

Lathyro sphaerici-Oryzopsietum miliaceae Brullo & Siracusa 1996

Centauretum sonchifoliae Brullo & Siracusa in C. Brullo et al. 2010

Dauco maximi-Oryzopsietum miliaceae O.Bolòs 1975

ARUNDION COLLINAE Brullo, Giusso, Guarino & Sciadrello in Brullo et al. 2010

Euphorbio ceratocarpae-Arundinetum collinae Brullo, Giusso, Guarino & Sciandrello in Brullo et al. 2010

POLYGALO MEDITERRANEAE-BROMION ERECTI (Biondi et al. 2005) Di Pietro in Di Pietro et al. 2015

Lolio pluriflori-Brachypodietum rupestris Gianguzzi, Caldarella & Di Pietro 2018
Tanaceto siculi-Brachypodietum rupestris Gianguzzi, Caldarella & Di Pietro 2018

MOLINIO-ARRHENATHERETEA R.Tx.1937
HOLOSCHOENETALIA Br.-Bl. ex Tchou 1948
DACTYLORHIZO SACCIFERAE-JUNCION STRIATI Brullo & Grillo 1978
Dactylorhizo sacciferae-Juncetum effusi Brullo & Grillo 1978
Caricetum intricato-oederi Brullo & Grillo 1978
CIRSIETALIA VALLIS-DEMONIS Brullo & Grillo 1978
PLANTAGINION CUPANII Brullo & Grillo 1978
Hypochoerido cretensis-Lotetum conimbricensis Brullo, Grillo, Terrasi 1976
Cynosuro cristati-Leontodontetum siculi Brullo & Grillo 1978
Genisto aristatae-Potentilletum calabrae Brullo & Grillo 1978
Armerio nebrodensis-Plantaginetum cupanii Brullo & Marcenò in Brullo 1984
Micromerio canescentis-Trifolietum savianii Brullo, Guarino & Minissale 2000
POTENTILLO-POLYGONETALIA AVICULARIS R. Tx. 1947
POTENTILLION ANSERINAE R. Tx. 1947
Lolio perennis-Plantaginetum majoris (Link.) Beger emend. Sissingh 1969
MENTHO LONGIFOLIAE-JUNCION INFLEXI T. Müller & Görs ex de Foucault 2009
Junco inflexi-Menthetum longifoliae Lohm. 1953 ex Oberd. 1957
Eleocharido nebrodensis-Juncetum compressi Raimondo 1980
Teucrio siculi-Cirsietum italici Brullo & Marcenò 1983
Teucrio siculi-Lotetum tenuis Brullo & Marcenò 1983
Carici otrubae-Juncetum inflexi Minissale & Spamp. 1987
Epilobio hirsuti-Agropyretum repentis Minissale & Spamp. 1987
Cirsio triunfetti-Eupatorietum cannabini Brullo & Spamp. 1990
Phalarido coerulescentis-Agropyretum repentis Brullo & Spamp. 1990
Kickxio commutatae-Teucrietum scordiodis Minissale, Musumarra & Sciandrello 2006
TRIFOLION MARITIMI Br.-Bl. ex Br.-Bl. et al. 1952
Kickxio commutatae-Trifolietum bocconei Brullo & Marcenò 1983
PASPALO-HELEOCHLOETALIA Br.-Bl. ex Rivas Goday 1956
PASPALO-AGROSTION SEMIVERTICILLATI Br.-Bl. in Br.-Bl. Roussine & Negre 1952
Paspalo paspaloidis-Polypogonetum viridis Br.-Bl. 1936
Lippio nodiflorae-Panicetum repentis O. Bolòs 1957

RUMICI-ASTRAGALETEA SICULI Pignatti & Nimis in Pignatti-Wikus et al. 1980
RUMICI-ASTRAGALETALIA SICULI Pignatti & Nimis in Pignatti-Wikus et al. 1980
RUMICI-ASTRAGALION SICULI Poli 1965
Astragaletum siculi (Frei 1940) Gilli 1943 corr. Brullo et al. 2005
Senecioni aetnensis-Anthemidetum aetnensis Frei 1940
Festuco circummediterraneae-Bellardiochloetum aetnensis Frei 1940 corr. Brullo et al. 2005
Phleo ambigui-Secaletum stricti Siracusa 1998
Festuco circummediterraneae-Populetum tremulae Brullo & Siracusa in Brullo et al. 2005
Cerastio tomentosi-Hieracietum pallidi Brullo & Siracusa in Brullo et al. 2005
ERYSIMO-JURINEETALIA BOCCONEI Brullo 1984
CERASTIO-ASTRAGALION NEBRODENSIS Pignatti & Nimis ex Brullo 1984
Lino punctati-Seslieretum siculae Pignatti & Nimis in Pignatti *et al.* 1980 corr. Brullo et al. 2005
Astragaletum nebrodensis Pignatti & Nimis in Pignatti et al. 1980
Prangetum ferulaceae Raimondo 1980 corr.

Carduncello pinnati-Thymetum spinulosi Brullo & Marcenò in Brullo 1984
Sideritido siculae-Artemisietum albae (Raimondo 1980) Brullo & Giusso in Brullo et al. 2005
Seslerio siculae-Melicetum cupanii Brullo & Giusso in Brullo et al. 2005
Peucedanetum nebrodensis Brullo & Giusso in Brullo et al. 2005
Seslerio siculae-Helictotrichetum convolutae Brullo & Cormaci in Brullo et al. 2005
Festuco rubrae-Seslerietum siculae Brullo & Cormaci in Brullo et al. 2005
Helichryso italici- Onosmetum canescentis Brullo & Guarino in Brullo et al. 2005
Plantagini humilis-Asperuletum peloritanae Brullo & Guarino in Brullo et al. 2005 corr.
ARMERION NEBRODENSIS Brullo 1984
Genistetum cupanii Pignatti & Nimis in Pignatti et al. 1980
Plantagini humilis-Armenietum nebrodensis Pignatti & Nimis in Pignatti et al. 1980.

CISTO-LAVANDULETEA STOECHADIS Br.-Bl. in Br.-Bl., Molinier & Wagner 1940
LAVANDULETALIA STOECHADIS Br.-Bl. in Br.-Bl., Molinier & Wagner 1940
CALICOTOMO VILLOSAE–GENISTION TYRRHENAE Biondi 1997
Cistus salvifolii-Genistetum madoniensis Marino et al. 2012
Genisto aristatae–Cistetum salvifolii Gianguzzi, Cusimano, Ilardi & Romano 2015

CISTO-MICROMERIETEA Oberd. 1954
CISTO-ERICETALIA Horvatic 1958
CISTO ERIOCEPHALI–ERICION MULTIFLORAE Biondi 1997
Rosmarino officinalis-Coridothymetum capitati Furnari 1965
Erico multiflorae-Micromerietum fruticulosae Brullo & Marcenò 1983
Erico multiflorae-Polygaletum preslii Marcenò & Colombo 1982
Coridothymo capitati-Helichrysetum stoechadis Barbagallo 1983
Coridothymo capitati-Pinetum halepensis De Marco & Caneva 1985
Cistetum salvifolio-clusii Bartolo, Giardina, Minissale & Spamp. 1987
Hyparrhenio hirtae-Helianthemetum sessiliflori Brullo, Giardina, Minissale & Spamp. 1987
Coridothymo capitati-Cistetum parviflori Bartolo, Brullo, Minissale & Spamp. 1990 corr.
Helichryso archimedei-Ericetum multiflorae Brullo, Minissale, Scelsi & Spamp. 1993 corr.
Thymelaeo hirsutae-Rosmarinetum officinalis Brullo, Minissale & Spamp. 1997
Sileno siculae-Helichrysetum hyblaei Brullo *et al.* 1998
Diplotaxio crassifoliae-Reamurietum vermiculatae Brullo, Guarino & Ronsisvalle 2000
Coronillo valentinae-Coridothymetum capitati Brullo, Guarino & Ronsisvalle 2000
Genistetum tyrrhenae Brullo, Di Martino & Marcenò 1977 corr. Brullo 1994
Genisto aspalathoidis-Rosmarinetum officinalis Gianguzzi 1999
Genistetum gasparrinii Gianguzzi, Cusimano, Ilardi & Romano 2015
Genistetum demarcoi Gianguzzi, Cusimano, Ilardi & Romano 2015

CYTISETEA SCOPARIO-STRIATI Rivas-Martínez 1974
CYTISETALIA SCOPARIO-STRIATI Rivas-Martínez 1974
VIOLO MESSANENSIS-ADENOCARPION BRUTII Mucina in Mucina et al. 2016 corr. Guarino & Pasta 2017
Calicotomo infestae-Adenocarpetum commutati Bartolo, Brullo & Pulvirenti 1994

CRATAEGO-PRUNETEA SPINOSAE R.Tx. 1962
PRUNETALIA SPINOSAE R.Tx. 1952
BERBERIDO AETNENSIS-CRATAEGION LACINIATAE Gianguzzi et al. 2011

Crataegetum laciniatae Brullo & Marcenò in Brullo 1984
Clematido vitalbae-Prunetum cupanianae Raimondo, Marino & Schicchi 2010
Junipero hemisphaericae-Prunetum cupanianae Raimondo et al. 2010 corr. Guarino et al. 2017
Roso siculae-Prunetum spinosae Gianguzzi, Cuttonaro, Cusimano & Romano 2016
Lonicero xylostei- Prunetum cupaniani Gianguzzi, Caldarella, Cusimano & Romano 2011
PYRO SPINOSAE-RUBETALIA ULMIFOLII Biondi, Blasi & Casavecchia in Biondi et al. 2014
PRUNO SPINOSAE-RUBION ULMIFOLII O. Bolòs 1954
Rubo ulmifolii-Tametum communis R. Tx. in R. Tx. & Oberd. 1958
Rubo ulmifolii-Crataegetum monogynae O. Bolòs 1962 corr. Rivas-Martinez 2011
Roso sempervirentis-Rubetum ulmifolii Blasi, Di Pietro & Fortini 2000
Scutellario rubicundae-Urticetum rupestris Brullo, Minissale, Scelsi & Spamp. 1993
Rubo ulmifolii-Aristolochietum altissimae Brullo, Minissale, Scelsi & Spamp. 1993
Rubo ulmifolii-Dorycnietum recti Brullo, Minissale, Scelsi & Spamp. 1993
Spartio juncei-Rubetum ulmifolii Pérez-Latorre & Cabezudo in Pérez-Latorre et al. 2008
Clematido cirrhosae-Rubetum ulmifolii Gianguzzi & La Mantia 2008
subass. *calystegietosum sylvaticae* Gianguzzi & La Mantia 2008
subass. *rhoetosum coriariae* Gianguzzi & La Mantia 2008
Calicotomo infestae-Pyretum spinosae Gianguzzi & La Mantia 2008
Euphorbio meuselii-Rubetum ulmifolii Vicente Orellana, Galán de Mera & Gianguzzi 2018
Euphorbio characiae-Prunetum spinosae Gianguzzi, Cuttonaro, Cusimano & Romano 2016
LAURO NOBILIS-SAMBUCETALIA NIGRAE Biondi et al. 2014 in Biondi et al. 2014
LAURO NOBILIS-SAMBUCION NIGRAE Biondi et al. 2014 in Biondi et al. 2014
Hyperico majoris-Rubetum ulmifolii Gianguzzi, Cuttonaro, Cusimano & Romano 2016

NERIO-TAMARICETEA Br.-Bl. & O.Bolòs 1958
TAMARICETALIA AFRICANAE Br.-Bl. & O.Bolòs 1958
TAMARICION AFRICANAE
Tamaricetum gallico-africanae ass. nov.provv.
Tamaricetum africano-arboreae Brullo & Sciandrello 2006
RUBO ULMIFOLII-NERION OLEANDRI O.Bolòs 1985
Tamarici africanae-Viticetum agni-casti Brullo & Spamp. 1997
Spartio juncei-Nerietum oleandri Brullo & Spamp. 1990
Rubo ulmifolii-Nerietum oleandri Bolòs 1956

JUNIPERO-PINETEA SYLVESTRIS Rivas-Martinez 1965 nom. inv. propos. Rivas- Martínez et al. 2002
BERBERIDO CRETICAE-JUNIPERETALIA EXCELSAE Mucina in Mucina et al. 2016
BERBERIDO AETNENSIS-PINION LARICIONIS (Brullo, Giusso & Guarino 2001) Mucina & Theurilllat 2016
Cerastio tomentosi-Juniperetum hemisphaericae Pignatti & Nimis in Pignatti et al. 1980
Junipero hemisphaericae-Abietetum nebrodensis Brullo & Giusso in Brullo et al. 2001
Bellardiochloa aetnensis-Juniperetum hemisphaericae Brullo & Siracusa in Brullo et al. 2001
Junipero hemisphaericae-Pinetum calabricae Brullo & Siracusa in Brullo et al. 2001

SALICETEA PURPUREAE Moor 1958

SALICETALIA PURPUREAE Moor 1958
SALICION ALBAE Soò 1951
Salicetum albo-purpureae (I. & V. Karpati 1961) Barbagallo, Brullo & Fagotto 1979
SALICION PEDICELLATAE Rivas-Martinez et al. 1984
Salicetum albo-pedicellatae Brullo & Spamp. 1990

ALNO GLUTINOSAE-POPULETEA ALBAE P. Fukarek & Fabijanić 1968
POPULETALIA ALBAE Br.-Bl. *ex* Tchou 1949
POPULION ALBAE Br.-Bl. ex Tchou 1949
Ulmo canescentis-Salicetum pedicellatae Brullo & Spamp. 1990
Agropyro-Salicetum pedicellatae Brullo & Spamp. 1990
Fraxino angustifoliae-Salicetum nebrodensis ass. nov. provv.
Roso sempervirentis-Populetum nigrae Pedrotti & Gafta 1992
PLATANION ORIENTALIS I. & V. Karpati 1961
Platano-Salicetum pedicellatae Barbagallo, Brullo & Fagotto 1979
Platano-Salicetum gussonei Brullo & Spamp. 1990
OSMUNDO-ALNION (Br.-Bl. et al. 1956) Dierschke & Rivas-Martínez in Rivas-Martínez 1975
Osmundo-Salicetum pedicellatae Brullo & Spamp. 1990

QUERCO ROBORIS-FAGETEA SYLVATICAE Br.-Bl. & Vlieger in Vlieger 1937
FAGETALIA SYLVATICAE Pawlowski in Pawlowski *et al.* 1928
GERANIO VERSICOLORIS-FAGION SYLVATICAE Gentile 1970
DORONICO ORIENTALIS-FAGENION SYLVATICAE (Ubaldi et al. ex Ubaldi 1995) Di Pietro, Izco & Blasi 2004
Anemono apenninae-Fagetum sylvaticae (Gentile 1969) Brullo 1984
Melitto albidae-Fagetum sylvaticae Ubaldi et al. ex Ubaldi 1995
Luzulo siculae-Fagetum sylvaticae Brullo, Guarino, Minissale, Siracusa & Spamp. 1999
Hieracio modoniensis-Fagetum sylvaticae C. Brullo, Brullo, Giusso & Sciandrello 2012
Ilici aquifolii-Taxetum baccatae Brullo, Minissale, Signorello & Spamp. 1996
Arrhenathero nebrodensis-Quercetum cerridis Brullo, Minissale, Signorello & Spamp. 1996
Ilici aquifolii-Quercetum cerridis Raimondo, Schicchi & Bazan 2009
Ilici aquifolii-Quercetum austrothyrrenicae Brullo & Marcenò in Brullo 1984 *corr.*
Geranio versicoloris-Quercetum ilicis Maniscalco & Raimondo 2003
Sorbo graecae-Aceretum pseudoplatani Gianguzzi & La Mantia 2004
Ilici aquifolii-Quercetum leptobalani Maniscalco & Raimondo 2009
Conopodio capillifolii-Quercetum congestae Maniscalco & Raimondo 2009
QUERCETALIA PUBESCENTI-PETRAEAE Klika 1933
PINO-QUERCION CONGESTAE Brullo, Scelsi, Siracusa & Spamp. 1999
Epipactido meridionalis-Fagetum sylvaticae Brullo, Guarino, Minissale, Siracusa & Spamp. 1999
Rubo aetnici-Fagetum sylvaticae Brullo, Guarino, Minissale, Siracusa & Spamp. 1999
Hieracio criniti-Aceretum aetnensis Brullo & Siracusa in Brullo et al. 2012
Vicio cassubicae-Quercetum cerridis Brullo & Marcenò 1985
Agropyro panormitani-Quercetum congestae Brullo *et al.* 1999
Doronico orientalis-Castanetum sativae Brullo & Siracusa 2012
Agropyro panormitani-Populetum tremulae Brullo & Siracusa 2012
Daphno laureolae-Pinetum calabricae Brullo & Siracusa 2012
Cephalanthero longifoliae-Betuletum aetnensis Brullo & Siracusa 2012

QUERCETEA ILICIS Br.-Bl. *ex* A. & O. Bolòs 1950
QUERCETALIA ILICIS Br.-Bl. *ex* Molinier 1934
QUERCION ILICIS Br.-Bl. ex Molinier 1934
Pistacio lentisci-Quercetum ilicis Brullo & Marcenò 1985
Rhamno alaterni-Quercetum ilicis Brullo & Marcenò 1985
Doronico orientalis-Quercetum ilicis Barbagallo, Brullo & Fagotto 1979
Aceri campestri-Qurcetum ilicis Brullo 1984
Ostryo carpinifoliae-Quercetum ilicis Lapraz 1975
Oleo oleaster-Quercetum virgilianae Brullo 1984
Celtido aetnensis-Quercetum virgilianae Brullo & Marcenò 1985
Sorbo torminalis-Quercetum virgilianae Brullo, Miniss., Signorello & Spamp. 1996
Lauro nobilis-Quercetum virgilianae Brullo, Costanzo & Tomaselli 2001
Bupleuro fruticosi-Quercetum ilicis Sciandrello, D'Agostino & Minissale 2013
Thalictro calabrici-Quercetum virgilianae La Mantia et al.
Ampelodesmo mauritanici-Quercetum ilicis Gianguzzi, Cuttonaro, Cusimano & Romano 2016
ERICO ARBOREAE-QUERCION ILICIS Brullo, Di Martino & Marcenò 1977
ERICO ARBOREAE-QUERCENION ILICIS Brullo, Di Martino e Marcenò 1977
Erico arboreae-Quercetum ilicis Brullo, Di Martino & Marcenò 1977
Stipo bromoidis-Quercetum suberis Barbagallo 1983
Mespilo germanicae-Quercetum virgilianae Brullo & Marcenò 1985
QUERCENION DALECHAMPII Brullo 1984
Genisto aristatae-Quercetum suberis Brullo 1984
Doronico orientalis-Quercetum suberis Brullo, Miniss., Signorello & Spamp. 1996
Teucrio siculi-Quercetum ilicis Gentile 1969 *em.* Brullo & Marcenò 1985
Sorbo graecae-Quercetum ilicis Brullo, Gianguzzi & La Mantia 2009
Erico arboreae-Quercetum virgilianae Brullo & Marcenò 1985
Arabido turritae-Quercetum congestae Brullo & Marcenò 1985
Festuco heterophyllae-Quercetum congestae Brullo & Marcenò 1985
Aceri obtusati-Ostryetum carpinifoliae Brullo & Marcenò 1985
Quercetum leptobalanae Brullo 1984
Quercetum gussonei Brullo & Marcenò 1985
Vicio elegantis-Quercetum congestae Brullo & Marcenò 1985
QUERCETALIA CALLIPRINI Zohary 1955
OLEO SYLVESTRIS-CERATONION SILIQUAE Br.-Bl. ex Guinochet in Guinochet & Drouineau 1944
Euphorbietum dendroidis Guinochet in Guinochet e Drounieau 1944
Pistacio lentisci-Chamaeropetum humilis Brullo & Marcenò 1985
Chamaeropo humilis-Sarcopoterietum spinosi Barbagallo, Brullo & Fagotto 1979
Teucrio fruticantis-Rhamnetum alaterni Brullo, Miniss., Scelsi & Spamp. 1993
Myrto communis-Pistacetum lentisci (Molinier 1954) Rivaha+s-Martínez 1975
Rhamno oleoidis-Pistacietum lentisci Miniss., Musumarra & Sciandr. 2006
Ephedro fragilis-Lycetum europaei Brullo & Marcenò 1985
Asparago acutifolii-Ziziphetum loti Gianguzzi, Ilardi & Raimondo 1996
Chamaeropo humilis-Quercetum calliprini Brullo & Marcenò 1985
Pyro amygdaliformis-Calicotometum infestae Gianguzzi & La Mantia 2008
Salvio fruticosae-Phlomidetum fruticosae Barbagallo, Brullo & Fagotto 1979

Calicotomo infestae-Juniperetum turbinatae Brullo, Gianguzzi & La Mantia 2009
Erico arborae-Pinetum halepensis De Marco e Caneva 1985
Pistacio lentisci-Pinetum halepensis De Marco & Caneva 1985
Hippocrepido emeri-Bupleuretum fruticosi Brullo, Miniss., Scelsi & Spamp. 1993
Genisto aspalathoidis-Pinetum hamiltonii Brullo, Di Martino & Marcenò 1977 corr. Gianguzzi 1999
Calicotomo villosae-Artemisietum arborescentis Ferro 2005
Ampelodesmo mauritanici-Juniperetum turbinatae Gianguzzi, Ilardi, Caldarella, Cusimano, Cuttonaro & Romano 2012
Cisto salviifolii-Calicotometum infestae Sciandrello, D'Agostino & Minissale 2013
Micromerio consentinae-Phlomidetum fruticosae Sciandrello, D'Agostino & Minissale 2013
Pistacio tarebinthi-Celtidetum aetnensis Gianguzzi, Cusimano & Romano 2014
Calicotomo infestae-Paliuretum spinae-christi Casavecchia, Biscotti, Pesaresi & Biondi 2015
Asparago pastoriani-Chamaeropetum humilis Raimondo & Bazan 2008
Calicotomo infestae-Quercetum calliprini Minissale & Sciandrello 2013
Asparago albi-Artemisietum arborescentis Gianguzzi, Cuttonaro, Cusimano & Romano 2016
Euphorbio characiae-Anagyridetum phoetidis Gianguzzi, Cuttonaro, Cusimano & Romano 2016
Calicotomo infestae-Paliuretum spinae-christi Casavecchia, Biscotti, Pesaresi & Biondi 2015

PERIPLOCION ANGUSTIFOLIAE Rivas-Martínez 1975
Periploco angustifoliae-Euphorbietum dendroidis Brullo, Di Martino & Marcenò 1977
Periploco angustifoliae-Juniperetum turbinatae Bartolo, Brullo, Minissale & Spamp. 1990
Calicotomo infestae-Rhoetum tripartitae Bartolo, Brullo e Marcenò 1982
Periploco angustifoliae-Rhoetum tripartitae Brullo, Gianguzzi, La Mantia & Siracusa 2009
Lycio intricati-Pistacietum lentisci (Brullo, Guarino & Ronsisvalle 2000) Brullo nom. nov.
Asparago horridi-Retametum gussonei Brullo, Guarino & Ronsisvalle in Brullo et al. 2001 corr.

JUNIPERION TURBINATAE Rivas-Martínez 1975 corr. Rivas-Martínez 1987
Ephedro fragilis-Juniperetum macrocarpae Bartolo, Brullo & Marcenò 1982
Junipero turbinatae-Quercetum calliprini Bartolo, Brullo & Marcenò 1982
Piptathero-Juniperetum turbinatae Minissale & Sciandrello 2013

ERICION ARBOREAE Rivas-Martínez 1987
Erico arboreae-Arbutetum unedonis Molinier 1937
Erico arboreae-Myrtetum communis Quezel, Barbero, Benabid, Loisel e Rivas-Martinez 1988

ASPARAGO ACUTIFOLII-LAURION NOBILIS Gianguzzi, Cuttonaro, Cusimano & Romano 2016)
Acantho mollis-Lauretum nobilis Giancuzzi, D'Amico & Romano 2010
Rhamno lojaconoi–Lauretum nobilis Marino, Castiglia, Bazan, Domina & Guarino 2013

PINETALIA HALEPENSIS Biondi, Blasi, Galdenzi, Pesaresi & Vagge in Biondi et al. 2014

PISTACIO LENTISCI-PINION HALEPENSIS Biondi et al. in Biondi et al. 2014
Pistacio lentisci-Pinetum halepensis De Marco & Caneva 1985
Thymo capitati-Pinetum halepensis De Marco & Caneva 1985
Genisto tyrrhenae-Pinetum halepensis Biondi & Pesaresi in Biondi et al. 2017.
Genisto aspalathoidis-Pinetum hamiltonii Brullo, Di Martino & Marcenò 1977 corr. Gianguzzi 2009

PINION PINEAE Feinbrun 1959
Cisto crispi-Pinetum pineae Bartolo, Brullo & Pulvirenti 1994
Cisto cretici-Pinetum pineae Brullo, Minissale, Siracusa, Scelsi & Spamp. 2002

1. Class: ***Charetea intermediae*** F. Fukarek 1961

Submerged vegetation with stoneworts of calm, fresh or brackish waters, rich in species of the genus *Chara*.

Synonyms: *Charetea fragilis* Fukarek 1961 (art. 8), *Charetea* Krausch ex W. Krause & Lang in Oberd. 1977, nom. illeg. (art. 31, Note 1).

Lectotypus: *Charetalia hispidae* Krausch ex W. Krause 1997.

Characteristic and differential species: *Chara aspera* Deth. ex Willd., *Chara contraria* A. Br. ex Kütz*, Chara globularis* Thuill.*, Chara vulgaris* L., *Chara fragilis* Desvaux, *Nitella batrachsperma* (Thuillier) A.Braun, *Lamprothamnium papulosum* (K.Wallroth) J. Groves, *Tolypella glomerata* (Desvaux) Leonhardi.

Geographical distribution: The class has a wide Holarctic distribution, including most of Europe (Pott, 1992; Hrivnák et al., 2005; Iakushenko & Borysova, 2012), Central and East Asia (Chepinoga et al., 2013; Varshney & Rzóska, 1973), as well as the Mediterranean area (Rivas Martinez et al., 2001; Brullo et al., 2002; Felzines & Lambert, 2012; Barinova & Romanov, 2015). In Sicily, the class occurs in much of the territory, particularly on fresh or brackish waters, where it was recorded from Vendicari, salt marshes of south-eastern Sicily (Bartolo et al. 1982, Guglielmo et al., 2012), Piana del Signore near Gela (Sciandrello, 2007), Hyblean Mountains (Minissale et al., 2007), Capo Feto (Brullo, 1978), Pantelleria (Calvo & Gianguzzi 2000), Stagnone di Marsala (Pasta, 2004), Sicani Mountains (Marino et al., 2005) and along the Morello river (Veneziano 2011).

Structure and ecology: The class gathers all the seaweed communities dominated by submerged charophytes that colonize stagnant or slightly flowing, little or no polluted waters through the rhizoids which anchor them to the substrate. They constitute dense algal beds that can grow indifferently in freshwater or also in brackish, slightly acidic or alkaline ones, of oligotrophic to mesotrophic type, on the bottom of ponds, lakes, water troughs or along streams (Felzines & Lambert, 2012).

Syndinamism: The *Charetea intermediae* class is constituted by pioneer communities, often monospecific, that constitute the deeper layer of submerged vegetation. Eutrophication and the resulting turbidity of the water can cause the disappearance or scarcity of these permanent communities, favoring the devlopment of aquatic macrophytes and helophytes (Pott, 1992).

Habitat reference: C1.2a Oligotrophic to mesotrophic waterbody with Characeae; C1.5 Permanent inland saline and brackish waterbody.

1.1. Order: ***Charetalia intermediae*** Sauer 1937

Seaweed communities of nutrient-poor waters, mainly colonized by species of the genus *Chara*

Synonyms: *Charetalia hispidae* Sauer 1937 (40a, corr.illeg.); *Charetalia* Sauer 1937 nom. nud. (art. 2b, 8); *Lamprothamnietalia papulosi* van Raam & Schaminée in Schaminée, Weeda & Westhoff 1995 (art. 3b), *Charetalia* F. Sauer ex F. Fukarek 1961 p.p.; *Charetalia* Krausch 1964, nom. illeg. (art. 31, Note 1); *Charetalia fragilis* Sauer 1937 (40a, corr.illeg.).

Lectotypus: *Charion fragilis* F. Sauer ex Dambska 1961.

Characteristic and differential species: *Chara hispida* (L.) Hartm, *Chara virgata* Kütz. *Chara aspera* Willd., *Chara vulgaris* L.

Geographical distribution: The distribution of the order falls into that one of the class, preferring the more continental areas with a less direct oceanic influence (Pott, 1992).

Structure and ecology: The order includes the algal communities that colonize nutrient-poor waters with medium to high conductivity, both in the inland areas and along the coastline, where they can also grow in brackish environments (Felzines & Lambert, 2012).

Syndynamism: The human disturbance and the consequent eutrophication can determine the replacement of the original seaweed communities with some aspects of aquatic vegetation related to *Potametea* class (Kłosowski et al., 2006).

Habitat reference: See class.

1.1.1. Alliance: ***Charion vulgaris*** (Krause & Lang 1977) Krause 1981

Annual algal vegetation of temporary shallow waters rich in species of the genus *Chara.*

Synonyms: *Thero-Charenion asperae* W. Krause 1969 ("*Thero-Charion asperae*" pro suball. (art. 3e, 41b) = *Tolypellion* pro syn., nom. inval. (art. 3a, Rec. 46F); *Charenion vulgaris* W. Krause ex W. Krause & Lang in Oberd. 1977 ("*Charion vulgaris*" pro suball. (art. 3e, 41b)), nom. illeg. (art. 29c).

Holotypus: *Charetum vulgaris* Corillion 1957.

Characteristic and differential species: *Chara vulgaris* L., *Tolypella glomerata* (Desv. In Loisel.) Leonh., *Tolypella intricata* (Trent. Ex Roth) Leonh., *Tolypella prolifera* (Ziz ex Br.) Leonh., *Lychno-thamnus barbatus* (Meyen) Leonh.

Geographical distribution: The alliance is well represented in northern-central Europe and in the Mediterranean area (Caffrey et al., 2006). In Sicily occurs in the whole territory.

Structure and ecology: The alliance includes the ephemeral algal communities characterized by annual species that grow in the shallow temporary pools of fresh or brackish water. The communities at issue prefer calcareous or clayey substrata and alkaline waters, of mesotrophic to slightly eutrophic type. The Characeae tend to constitute a dense and species-poor vegetation, affecting the chemistry of the waters, which at the end of the growing season can result hypertrophic (Felzines & Lambert, 2012).

Syndynamism: The associations of this alliance show a markedly pioneer character, colonizing temporary pools. The anthropogenic disturbance can cause the loss of these communities and its replacement with other plant communities(Caffrey et al., 2006).

Habitat reference: C1.2a Oligotrophic to mesotrophic waterbody with Characeae.

1.1.1.1. ***Charetum vulgaris*** Corillion 1957

Submerged grasslands of common stonewort in freshwater.

Lectotypus: rel. 5, tab. 1, Passarge (1983).

Characteristic and differential species: *Chara vulgaris* L.

Phytosociological table: No relevès.

Geographical distribution: The association has a wide distribution in Europe, North America and West Asia (Bazzichelli & Abdelahad, 2009). In Sicily it is represented throughout the territory, especially inland and is known for the Hyblaean area (Brullo et al., 1996), Sicani and Madonie mountains (Raimondo et al., 2004; Marino et al., 2005), near Enna (Veneziano, 2011), etc.

Structure and ecology: The *Charetum vulgaris* is a monospecific community of *Chara vulgaris*, which colonizes ephemeral ponds, depressions or temporary streams with alkaline and poorly salted waters. It is a very dense vegetation with values of coverage greater than 70%, consisting of medium-sized rhizophytes (about 70 cm), which typically finds its optimum during the winter period (January-March), but sometimes may persist even during the summertime. It can take catenal contact with *Lemnetea* or *Potametea* communities and sometimes with helophytic vegetation of *Pharagmitetea* class (Pott, 1995).

Syndynamism: The vegetation at issue is a pioneer community of temporary ponds, whose presence indicates a low level of pollutants. The change of the water system, including its transformation into a permanent basin or its drying, as well as its progressive eutrophication, can determine its disappearance or replacement with other plant communities.

Habitat reference: See alliance.

1.1.1.2. ***Tolypelletum glomeratae*** Corillion 1957

Submerged grasslands with clustered stonewort of slightly salty coastal marshes.

Holotypus: rel. 1, p. 374, Corillion (1957).

Characteristic and differential species: *Tolypella glomerata* (Desv.) Leonh.

Geographical distribution: The association is widely distributed in Europe, generally in coastal areas (Giury, 2017), while in Sicily it occurs in some brackish environments near the coast such as Piana del Signore near Gela (Sciandrello, 2007).

Structure and ecology: The surfaces flooded only during the winter by weakly salt and alkaline waters, are colonized by an algal communities, whose physiognomy is given by *Tolypella glomerata*, which is often associated with other species of *Chara* genus. It is an ephemeral and pioneer association, which prefers meso-eutrophic waters and muddy-silty bottoms (Sciandrello, 2007).

Syndynamism: The *Tolypelletum glomeratae* is a pioneer association, linked to the ephemeral ponds that are submerged only during the winter. The alteration of its sensitive environment can determine its disappearance in favor of other more adaptable communities.

Habitat reference: See alliance.

1.1.2. Alliance: ***Charion canescentis*** Krausch 1964

Seaweed communities of Characeae in coastal marshes.

Synoyms: *Halo-Charion* Krausch 1964, pro syn. (art. 2d, 3a); *Charion canescentis* Krausch ex W. Krause 1969; *Rhodo-Charenion asperae* W. Krause 1969 (art. 41b).

Lectotypus: *Charetum canescentis* Corillion 1957.

Characteristic and differential species: *Chara canescens* Desv. & Loisel., *Chara horrida* Wahl., *Lamprothamnium papulosum* (Wallr.) J. Gr., *Tolypella hispanica* Nordst., *Tolypella nidifica* (O. Müll.) Leonh., *Tolypella salina* R. Corillion.

Geographical distribution: The alliance is fragmentary quoted in northern-central Europe and in the Mediterranean area (Pott, 1995; Felzines & Lambert, 2012). In Sicily it is recorded only in the salt marshes of Vendicari (Brullo & Furnari, 1976).

Structure and ecology: The communities belonging to this alliance are represented by poor-species grasslands dominated by charophytes well adapted to brackish environments. Occasionally, various algal species of the *Cystoseiretea* occur, such as *Ulva* sp. pl., *Chaetomorpha* sp. pl. and *Cystoseira* sp. pl. (Corbetta, 1970).

Syndynamism: The cenoses belonging to this alliance occurs only in coastal environments with low anthropic impact, any disturbing action can determine their disappearance favoring the expansion of the *Ruppietea* and *Potametea* communities.

Habitat reference: C1.5 Permanent inland saline and brackish waterbody.

1.1.2.1. ***Lamprothamnetum papulosi*** Corillion 1957

Submerged algal vegetation with foxtail stonewort of brackish waters.

Lectotypus: rel. 1, p. 40, Corillion (1953).

Characteristic and differential species: *Lamprothamnium papulosum* (K.Wallroth) J. Groves.

Phytosociological table: 3 el.

Geographical distribution: The association is distributed sporadically in southern Europe (Rivas-Martinez et al., 2001; Felzines & Lambert, 2012), while in Sicily is widely represented in the coastal salt marshes of the South-eastern part (Bartolo et al . 1982, Guglielmo et al., 2012) and also near Marsala and Trapani, including Capo Feto (Brullo & Furnari, 1976).

Structure and ecology: The *Lamprothamnetum papulosis* is a submerged community that colonizes the bottoms of brackish coastal salt marshes with sandy substrates and is characterized by the dominance of *Lamprothamnium papulosum*, which is sometimes associated with other charophytes, such as *Chara galioides*, *Tolypella glomerata* and *Tolypella salina*. Generally, it grows at fairly modest depth (10-60 cm) and can tolerate waters with a high degree of salinity (even higher than the seawater). It constitute dense algal populations with high coverage values, finding their optimum during the winter period. In the South-eastern Sicily, as Vendicari, it makes contact with the *Enteromorpho intestinalidis-Ruppietum maritimae* and the *Potametum pectinati* (Brullo & Furnari, 1976).

Syndynamism: The association prefers less disturbed salt marshes with oligotrophic waters, while it tends to decline where is initiated the sedimentary process and disappears completely on slime-clay bottoms and in the deepest basins (up to 2.5 mm), being replaced respectively by *Enteromorpho intestinalidis-Ruppietum maritimae* and *Potametum pectinati* (Wilhelm et al., 2007). The surfaces occupied by *Lamprothamnetum papulosis* during the spring-summer period tend to dry up, favoring the settlement of annual communities related to *Salicornietum patulae*.

Habitat reference: See alliance.

2. Class: ***Lemnetea minoris*** R. Tx. ex O.Bolòs & Masclans 1955

Pleustophytic vegetation that colonizes freshwater or slightly brackish waters.

Synonyms: *Lemnetea* R. Tx. 1955, nom. nud.; *Lemnetea* Koch & R. Tx.(in litteris 1954) ex Oberd. 1957, nom. illeg. (art. 31 note 1); *Hydrocharito-Lemnetea* Oberd. et al. 1967 nom. inval. (art. 3b); *Hydrocharito-Lemnetea* Soò 1968 nom. superfl. (art. 29c); *Lemno-Potametea* De Lange 1972 p.p., nom. ined. (Def. I, part. 1).

Lectotypus: *Lemnetalia minoris* Koch & R. Tx. 1955, nom illeg., but the typification remains valid (art. 17).

Characteristic and differential species: *Lemna minor* L., *Lemna trisulca* L.

Geographical distribution: The class has a cosmopolitan distribution, lacking only in the Arctic, Antarctic and desert areas, with maximum distribution in North America (Scoppola, 1982). In Sicily, the class occurs in almost all the territory, mainly in the lakes, ponds and sometimes streams, both in coastal areas and inland. In particular, the communities belonging to this class are well represented in the humid environment of Nebrodi (Brullo et al., 1994) and more sporadically in Madonie and Sicani Mountains, including Ficuzza wood (Gianguzzi & La Mantia, 2004), in some coastal ponds of western and North-eastern of the island (Minissale & Spampinato, 1990; Gianguzzi & La Mantia, 2008) and in the natural lakes of the Central area (Marcenò & Raimondo, 1977).

Structure and ecology: The *Lemnetea minoris* class gathers the pleustophytic communities that colonize the still or weakly flowing waters, generally shallow, of rivers, ponds, canals and streams, usually with a low salinity (<0.5 g/L), but some species (*Lemna gibba*) can tolerate a certain degree of salinity (up to 5 g/L). The oligotrophic and acidic waters do not allow the development of these cenosis that instead find their optimum in mesotrophic or eutrophic waters with a pH between 6 and 9. Generally, they are species-poor communities, monolayer, constituted by not rooting hydrophytes, submerged or floating, in which one or two species are very dominant over the other ones (Sburlino et al., 2004). From the floristic point of view, the grater part of taxa occurring in this vegetation belongs to the genus *Lemna*, however are also represented other genera and families such as *Spirodela* and *Wolffia* (*Lemnaceae*), *Hydrocharis* (*Hydrocharitaceae*), *Ceratophyllum* (*Ceratophyllaceae*), *Utricularia* (*Lentibulariaceae*) and also some pteridophytes (*Salviniaceae*) and hepatics (*Riccia*, *Ricciocarpus*). The dominant species of the community determine its physiognomy: the micropleustophytes consist of one or a few poorly differentiated small leaves (eg. *Lemnaceae*); the mesopleustophytes instead are provided with well-differentiated leaves, floating and which do not form rosettes, such as *Salvinia* sp. pl. and *Azolla* sp. pl.; finally, the macropleustophytes are larger in size, with divided leaf lamina and are submerged or floating under the water surface (*Utricularia* and *Ceratophyllum*). These species are usually annual o short-lived plants, very sensitive to low temperatures, which tend to disappear entirely or partially during the winter (Felzines, 2012).

Syndynamism: The associations belonging to *Lemnetea minoris* class represent a permanent vegetations and are generally not subjected to dynamic-successional phenomena, except if the human intervention alters the water regime. The greatest threat that affects this vegetations is represented by the processes of silting caused by the accumulation of sediment on the bottom, often resulting from human disturbance, that if particularly intense can cause the habitat disappearance and the establishment of other vegetation types (Aleffi & Cortini Pedrotti, 1996; Sburlino et al., 1996). Even the exotic species and in particular *Azolla filiculoides* and *Lemna minor,* can lead to an impoverishment of these plant communities, especially in disturbed coastal habitats (Felzines, 2012). From the catenal point of view, these communities come into contact with helophytic vegetation of *Phragmito-Magnocaricetea* class and with the rhyzophytic cenosis of *Potametea* class (Brullo et al. 2001).

Habitat reference: C1.2b Mesotrophic to eutrophic waterbody with angiosperms.

2.1. Order: ***Lemnetalia minoris*** R.Tx. ex O.Bolòs & Masclans 1955

Pleustophytic vegetation that colonizes freshwater or slightly brackish waters.

Synonyms: *Lemnetalia* R. Tx. 1955, nom. nud.; *Lemnetalia* Koch & R. Tx. (in litteris 1954) ex Oberd. 1957, nom. illeg. (art. 31 note 1); *Hydrocharitetalia* Rübel 1933 nom. nud.

Lectotypus: *Lemnion minoris* Koch & R. Tx. 1955, nom illeg., but the typification remains valid (art. 17).

Characteristic and differential species: *Lemna minor* L., *Wolffia arrhiza* (L.) Horkel ex Wimm., *Spirodela polyrhiza* (L.) Schleid*., Azolla filiculoides* Lam.

Geographical distribution: This syntaxon shows a sub-cosmopolitan distribution and is the only one present in Europe (Loidi et al., 1995).

Structure and ecology: The order groups the communities of micro- and meso-pleustophytes, belonging to *Lemnaceae* or to other families (including some ferns, such as *Azolla filiculoides*), generally free-floating on the water surface (Felzines, 2012).

Syndynamism: See class.

Habitat reference: See class.

2.1.1. Alliance: ***Lemnion minoris*** R. Tx. ex O.Bolòs & Masclans 1955

Pleustophytic vegetation of hypertrophic or eutrophic waters.

Synonyms: *Lemnion minoris* R. Tx. 1955, nom. nud.; *Lemn[i]o–Salvinion* Slavnic 1956; *Lemnion minoris* Koch & R. Tx. (in litteris 1954) ex Oberd. 1957, nom. illeg. (art. 31 note 1); *Lemnion gibbae* De Lange 1972, nom. ined.; *Lemnion gibbae* R. Tx. & Schwabe in R. Tx. 1974 p.p., nom. illeg. (art. 29c); *Lemno-Salvinion natantis* Slavnic 1956 nom. illeg. (art. 29c).

Lectotypus: *Lemnetum minoris* Oberd. ex T. Müll. & Görs 1960.

Characteristic and differential species: *Lemna gibba* L., *Wolffia arrhiza* (L.) Horkel ex Wimm.

Geographical distribution: The alliance is present in all the European territory. In Sicily it is widespread throughout the island.

Structure and ecology: This syntaxon gathers all the communities of floating species that colonize the eutrophic freshwater, with a high value of nitrogenous substances and rich in ions such as phosphates and nitrates. They are monospecific or species-poor associations, which are dominated by different taxa belonging to the *Lemnaceae* family and sometimes also by the fern *Azolla filiculoides* (Brullo et al., 2001; Felzines, 2012).

Syndynamism: The communities of *Lemnion minoris*, being well adapted to eutrophic waters, can tolerate better than other ones of the class the human disturbance, although in this case the alteration of water regime and exotic species can represent a threat. The communities of this alliance are often in contact with coenoses of *Potametea* and *Phragmito-Magnocaricetea* Classs (Biondi & Blasi, 2015).

Habitat reference: See class.

2.1.1.1. ***Lemnetum gibbae*** Miyawaki & J. Tx. 1960

Community with fat duckweed of eutrophic or hypertrophic waters.

Synonyms: *Lemnetum minori-gibbae* (Miyawaki & J. Tx. 1960) H. Passarge *1992,* nom. superfl. (art. 29c); *Lemno-Spirodeletum polyr[r]hizae* Koch 1954 *lemnetosum gibbae* Koch 1954, nom. nud.; *Lemno -Azolletum* Br.-Bl.. in Br.-Bl. et al. 1952 *lemnetosum gibbae* O. Bolòs & Masclans 1955.

Neotypus: rel. a3, tab. 5, Schwabe-Braun & R. Tx. (1981), designated by Passarge (1992).

Characteristic and differential species: *Lemna gibba* L.

Phytosociological table: From Minissale & Spampinato (1990), table 1, 2 rel.
Char. association: *Lemna gibba* (2),
Char. alliance, order and class: *Lemna minor* (2), *Azolla filiculoides* (2).

Geographical distribution: The association is frequent throughout the Europe (Miyawaki & Tuxen, 1960). In Sicily it is mainly known for some coastal areas such as Monte Cofano (Gianguzzi & La Mantia, 2008) and Pantano Gurna near Riposto (Minissale & Spampinato, 1990), while inland is quoted in the Sicani Mountains (Bazan & Marino, 2005), Ficuzza (Gianguzzi & La Mantia, 2004), Trapani (Scuderi, 2007) and Soprano lake near Caltanissetta (Marcenò & Raimondo, 1977).

Structure and ecology: It is an association characterized by the dominance of *Lemna gibba*, which characterized physiognomically it,, forming dense floating colonies that can sometimes cover most of the humid environment (Gianguzzi & La Mantia, 2008). *L. gibba* can form monospecific community or be associated with other pleustophytes, such as *Lemna minor* and *Azolla filiculoides*, colonizing small ponds with muddy bottom or even artificial channels. It can also grows in the small basins that are located near the mouths of waterways, on condition that they are markedly sunny and with eutrophic or hypertrophic waters, indicating a certain degree of pollution of organic or mineral origin. Generally, this vegetation prefers waters with basic or sub-acid ph (5.9-9) and can also grow in brackish habitats (Felzines, 2012). The *Lemnetum gibbae* sometimes presents catenal contacts with communities of *Potametea* class, such as the *Ranunculetum penicillati* (Minissale & Spampinato, 1990).

Syndynamism: Within the *Lemnion minoris* alliance, this association is the most well adapted to warm and disturbed waters (Sburlino et al., 2004). It is a stable community, where *Lemna gibba* tends to become clearly dominant over the other species (and in particular to *Lemna minor*), thanks to its greater resistance with respect to limiting factors such as salinity and summer drying. Sometimes, for its characteristic "tympanum shape" which allows it to rise above the others pleustophytes, giving it a significant competitive advantage (Wilmanns, 1988). However, the populations of Pantano Gurna are subject to the rapid expansion of the neophyte *Azolla filiculoides*, that in a few years has come to occupy large surfaces of the channels, forming dense carpets that tend to suffocate the other pleustophytic species, including *Lemna gibba* (Minissale & Spampinato, 1990).

Habitat reference: See class.

2.1.1.2. ***Lemnetum minoris*** Soò 1927

Community with lesser duckweed of eutrophic freshwater.

Synonyms: *Lemnetum minoris* Rübel 1933, nom. nud.; *Lemnetum minoris* Oberd. 1956, nom. nud.; *Lemnetum minoris* Oberd. ex T. Müll. & Görs 1960, nom. illeg. (art. 31 note 1)*; Callitricho–Lemnetum minoris* Passarge 1978, nom. superfl. (art. 29c).

Holotypus: Rel. pg. 81, (Soò 1927).

Characteristic and differential species: *Lemna minor* L.

Phytosociological table: From Brullo et al. (1994), table 3 , 2 rel.
Char. association: *Lemna minor* (2),
Char. alliance, order and class: *Lemna gibba* (1).

Geographical distribution: The association has a cosmopolitan distribution (Landolt, 1986), in Sicily is widespread in most of the mountain area, where it is quoted from Nebrodi (Brullo et al., 1994), Hyblaean area (Brullo et al., 1996), Trapani (Scuderi, 2006), Sicani (Bazan & Marino, 2005) and Madonie Mountains (Raimondo et al., 2004).

Structure and ecology: The community dominated by *Lemna minor* have been variously interpreted as an association (Tüxen, 1974; Gehu & Pedrotti, 1992; Schratt, 1993; Rivas-Martínez et al., 2001) or as a phytocoenon (Müller, 1977; Scoppola, 1982; Pott, 1995; Brullo et al., 1994), due to the considerable ecological range of the differential species *Lemna minor*, which is constantly present in other associations of the order (Sburlino et al., 2004). This vegetation colonizes eutrophic freshwater, generally rich in nitrogenous substance, as well as phosphates and nitrates. But it does not tolerate high concentrations of carbon dioxide and calcium, and can grow in either sunny or shady sides (Sburlino et al., 2004). From the floristic point of view, *Lemna minor* is often associated with other pleustophytes such as *L. gibba* and *L. trisulca*, but with low coverage values. Generally, the dominant species tends to form a

dense and monospecific layer that covers ephemeral pools, small ponds or channels and loops of streams (Brullo et al., 2001).

Syndynamism: It is a floristically impoverished vegetation with a marked pioneer character, which grows mainly in ponds subjected to a complete summer desiccation that prevents the natural evolution toward more mature communities, such as the *Lemnetum trisulcae*, the *Wolffietum arrhizae* and the *Lemno-Spirodeletum polyrrhizae* (Brullo et al., 1994).

Habitat reference: See class.

2.1.1.3. ***Wolffietum arrhizae*** Myawaki & J. Tx. 1960

Community with spotless watermeal of eutrophic waters.

Synonyms: *Wolffio-Lemnetum gibbae* Bennema in Bennema et al. 1943 p.p., nom. ined.; *Lemno minoris-Wolffietum arrhizae* (Miyawaki & J. Tx. 1960) H. Passarge 1992, nom. illeg. (art. 29c); *Lemno-Spirodeletum* Koch 1954 *wolffietosum arrhizae* Segal 1965, nom. nud.

Lectotypus: P. 61, tab. 6, Tüxen (1972), designated by Passarge (1992).

Characteristic and differential species: *Wolffia arrhiza* (L.) Horkel ex Wimm.

Phytosociological table: From Brullo et al. (1994), table 1, 11 rel.
Char. association: *Wolffia arrhiza* (V),
Char. alliance, order and class: *Lemna minor* (V), *Lemna gibba* (IV), *Lemna trisulca* (I).

Geographical distribution: The association is sporadically represented in central-western and southern Europe (Felzines, 2012), while in Sicily it is quite rare, being surveyed only from few stands in Nebrodi Mountains, such as Laghetto Zilio, Urio Quattrocchi and some ponds of Contrada Pantana (Brullo et al., 1994).

Structure and ecology: The *Wolffietum arrhizae* colonizes the small mountain lakes or ponds, between 900 and 1800 m, with calm and shallow waters, persistent in the summer and characterized by a significant presence of organic material, resulting mainly from grazing. In fact, this vegetation prefers eutrophic waters with a neutral pH (7-8), whose physiognomy is given by *Wolffia arrhiza* which generally has high coverage values. It is a species-poor and two-layered community, where sometimes other pleustophytes occur, such as *Lemna gibba*, *L. trisulca* and *L. minor* (Felzines, 2012). The association finds its optimum in the summer period, when it occupies all surfaces let loose by the vegetation of *Potametea* class (also because the expansion of the floating vegetation determines unfavorable light conditions for submerged species), covering large surfaces (Szalma & Bodrogközy, 1985; Brullo et al., 1994).

Syndynamism: The community at issue is a permanent vegetation, which generally has not successional dynamics. However, human disturbance may lead to changes in the hydrological regime of the basin where the plant community occurs. Therefore it can promote the

development of less specialized communities such as *Lemnetum minoris* or some aspects of *Potametea* class, while the increase of nitrates, also caused by man-made pollution, can lead to the gradual disappearance of *Wolffia arrhiza* and to the establishment of *Lemnetum gibbae* (Brullo et al., 1994).

Habitat reference: See class.

2.1.1.4. ***Lemno-Spirodeletum polyrrhizae*** Koch 1954

Community with greater duckweed of meso-eutrophic waters.

Synonyms: *Lemno-Spirodeletum* Slavnić 1956 (phantom name); *Spirodeletum polyrhizae* Kehlhofer ex R. Tx. & Schwabe in R. Tx. 1974 (nom. nud.).

Lectotypus: rel. 1, tab. 3, Koch (1954), designated by Passarge (1992).

Characteristic and differential species: *Spirodela polyrrhiza* (L.) Schleid.

Phytosociological table: From Brullo et al. (1994), table 2, 2 rel.
Char. association: *Spirodela polyrrhiza* (2),
Char. alliance, order and class: *Lemna minor* (2), *Wolffia arrhiza* (2), *Lemna trisulca* (1).

Geographical distribution: The association is represented mainly in the Atlantic and Central Europe, while it is very rare in the Mediterranean area (Scoppola, 1982), in Sicily is only localized in the Nebrodi Mountains and in particular in some ponds of Contrada Pantana (Brullo et al., 1994).

Structure and ecology: It is a rare and relict cenosis, in which the pleustophytic pool is enriched by the occurrence of *Spirodela polyrrhiza*, a very rare taxon in Sicily and also in the whole Mediterranean area. In addition to this species, a significant role in defining the structure of this plant community is given by *Lemna minor*, *L. trisulca* and *Wolffia arrhiza*. It differs from *Wolffietum arrhizae* not only for its floristic set, but also for its ecological requirements, since this community prefers meso-eutrophic waters with a limited presence of nutrients and tends to colonize the deeper part (up to 3 m) of the pond. Moreover, the association shows a marked mesophilous character, being able to grow only in mountainous stands (above 900 m), at least in the Mediterranean territories (Brullo et al., 1994).

Syndynamism: It is a permanent vegetation, not subject to dynamic-successional phenomena. However it is an association particularly sensitive to water level changes and to the competition with the vegetation of the *Potametea* class (Felzines, 2012).

Habitat reference: See class.

2.1.2. Alliance: ***Lemnion trisulcae*** Den Hartog & Segal 1964 em. R. Tx. & Schwabe-Braun ex R. Tx. 1974

Community with floating pleustophytes of oligotrophic waters.

Synonyms: *Riccio fluitantis-Lemnion trisulcae* Schwabe & R. Tx. 1981 nom. inval. (art. 29).

Lectotypus: *Lemnetum trisulcae* Den Hartog 1963

Characteristic and differential species: *Lemna trisulca* L.

Geographical distribution: The alliance occurs in almost all the European territory, particularly in the Atlantic area (Felzines, 2012).

Structure and ecology: This alliance gathers the pleustophytic communities of nutrient-poor waters with neutral or subacid pH (Sburlino et al., 2004). Generally, this vegetation has a two-layered structure, which is characterized by the occurrence of *Lemna trisulca* and different bryophytes belonging to *Riccia* genus in the infra-aquatic layer, while the upper layer is constituted by various species of *Lemna* genus and *Wolffia arrhiza* (Biondi & Blasi, 2015). However, some authors (Šumberová, 2011; Felzines, 2012; Mucina et al., 2016) prefer to include this alliance in the *Lemnion minoris*, considering this two syntaxa very similar from the floristic point of view, despite their different ecological requirements.

Syndynamism: Unlike the *Lemnion minoris* vegetation, the communities of this alliance grow only in slightly or not polluted waters. Therefore, the human disturbance can determine the impoverishment or disappearance of them, favoring more adaptable cenosis, as those ones belonging to the *Lemnion minoris*.

Habitat reference: See class.

2.1.2.1. ***Lemnetum trisculcae*** Den Hartog 1963

Community with star duckweed of meso-eutrophic waters.

Synonyms: *Lemnetum trisulcae* Kelhofer 1915, nom. nud.; *Lemnetum trisulcae* Soò 1927, nom. nud.; *Lemnetum trisulcae* Knapp & Stoffers 1962, nom. inval. (art. 3c); *Lemnetum trisulcae* (Knapp & Stoffers) R. Tx. 1974, nom. illeg. (art. 31 note 1); *Lemnetum minori-trisulcae* (Den Hartog) H. Passarge 1992, nom. superfl. (art. 29c).

Lectotypus: rel. 2, tab. 2, Den Hartog (1963), designated by Wolff et al. (1994).

Characteristic and differential species: *Lemna trisulca* L.

Phytosociological table: From Brullo et al. (1994), table 4, 5 rel.

Char. association: *Lemna trisulca* (V),

Char. alliance, order and class: *Lemna minor* (V), *Wolffia arrhiza* (II), *Lemna gibba* (II), *Spirodela polyrrhiza* (I).

Geographical distribution: The association is distributed in the Atlantic Europe and Mediterranean (Scoppola, 1982). In Sicily it is known from Contrada Pantana and Campanito lake in the Nebrodi Mountains (Brullo et al., 1994), Ciane river near Syracuse (Barbagallo et al., 1979), Ficuzza (Caldarella, 2012) and Monte Altesina near Enna (Licitra, 2011).

Structure and ecology: From the floristic point of view, the association is dominated by *Lemna trisulca*, a species with sciaphilous requirements that prefers nutrient-poor freshwater with a low degree of mineralization (Meriaux, 1978; Sburlino et al. 1985; Landolt & Kandeler, 1987; Pott, 1995). In Sicily *L. trisulca* shows a wide ecological range, being equally able to colonize ponds with mesotrophic and shallow waters (Brullo et al., 1994), artificial lakes (Santos, 2011) and the stretches of streams slowly flowing with clear waters (Barbagallo et al., 1979). The community is characterized by a two-layered structure, where *Lemna trisulca* constitute a dense vegetation just below the surface, often anchored to the submerged part of rizophytes and helophytes, while the surface is colonized by pleustophytes, such as *L. minor*, *L. gibba*, *Wolffia arrhiza*, as well as by suffering specimens of *L. trisulca.* In running water it tend to form monospecific populations, anchored to the rooted plants (Sburlino et al., 1985, 2004). The *Lemnetum trisulcae* shows catenal contacts with the vegetation of *Phragmito-Magnocaricetea* that colonize the banks of the humid environment or with submerged vegetation of *Potametea* class. From the syntaxonomic point of view some authors (Scoppola, 1982; Sburlino et al., 2004) does not recognize the validity of this association, since the differential species (*Lemna trisulca*) is frequent in many other syntaxa, attributing it partly to *Lemno-Spirodeletum polyrhizae*. Instead Schwabe-Braun & Tüxen (1981) consider the *Lemnetum trisulcae* as a valid syntaxon and divided it into two sub-associations. The subass. *typicum* prefers slowly flowing waters with a very low degree of organic matter, while the subass. *spirodeletosum* grows in stagnant waters with a higher content of organic matter.

Syndynamism: Although also this association represents a permanent vegetation, it is particularly sensitive to human disturbance that can determine its disappearance, as evidenced by Caldarella (2012) for the Gorgo del Drago near Ficuzza. In this place, the persistent drying of the pond has led to the disappearance of almost all types of aquatic vegetation, including those ones related to the class *Lemnetea*, and their replacement with impoverished aspects of *Isoëto-Nanojuncetea* class, as well as periodic algal blooms in the part of pond recently restored.

Habitat reference: See class.

3. Class: ***Potametea pectinati*** Klika in Klika & Novak 1941

Vegetation of aquatic plants rooted in the bottom.

Synonyms: *Potametales* Klika in Klika & V. Novák 1941 (art. 41b); *Potametea* R. Tx. & Preising 1942 (art. 8); *Nymphaeetea* Klika in Klika & Hadač 1944 (art. 2b); *Potametea* R. Tx. & Preising ex Oberdorfer 1957 (art. 31); *Stratiotetea* Den Hartog & Segal 1964 (art. 29c);

Ceratophylletea Den Hartog & Segal 1964 (art. 8), *Utricularietea neglectae* Den Hartog & Segal 1964 (art. 29c); *Charo-Potametea* Kezpczynski & Ceynowa-Gieldon 1972 p.p.; *Lemno-Potametea* De Lange 1972 p.p. (art. 1); *Trapetea* Wiegleb 1982 (art. 2b); *Potametea colorati* Wiegleb 1982 (art. 2b); *Potametea cutifolii* Wiegleb 1982 (art. 2b); *Callitrichetea stagnalis* Wiegleb 1982 (art. 2b); *Ranunculetea hederacei* Wiegleb 1982 (art. 2b).

Holotypus: *Potametalia pectinati* Koch 1926.

Characteristic and differential specie: *Callitriche stagnalis* Scop., *Ceratophyllum demersum* L., *Myriophyllum spicatum* L., *M. verticillatum* L., *Potamogeton lucens* L., *P. natans* L., *P. pusillus* L., *P. pectinatus* L., *P. crispus* L., *P. perfoliatus* L., *Ranunculus trichophyllus* Chaix, *Sparganium emersum* Rehmann..

Geographical distribution: The class has a wide distribution in the northern part of Eurasia and North America (Pott, 1995; Chepinoga et al., 2013). In Sicily it is quite represented in all coastal and mountainous areas where there are wetlands with more or less permanent waters also during the summer.

Structure and ecology: Previously, Braun-Blanquet et al. (1952) grouped all hydrophytic communities in a single class (*Potametea*), which included two orders: *Potametalia* (freshwater communities) and *Zosteretalia* (communities of more or less salty waters). Later, Tüxen (in Bolòs & Masclans, 1955), emphasizing the differential physiognomic characters, split the *Potametalia* order in the *Potametea* and *Lemnetea* classes. The *Potametea* brings together the vegetation characterized by the dominance of rooting hydrophytes with vegetative portions floating on the water surface or completely submerged, that colonize freshwater or slightly brackish environments. The physiognomy of these communities is given by perennial species (rarely annual), usually linked to wetlands persistent all year round and quite deep water, but sometimes also by species that can tolerate a partial summer drying (Šumberovà, 2011). The morpho-functional classification, proposed by Den Hartog & Segal (1964) and Wiegleb (1991), recognize within the *Potametea* class different types of communities definied by the dominant plants life-form: vallisnereids (acaulescent hydrophytes, with flaccid, elongated and more or less linear radical leaves, all submerged, such as *Vallisneria spiralis*, *Sagittaria sagittifolia*, *Sparganium emersum* subsp. *fluitans*, etc.); elodeids (caulescent hydrophytes with all leaves submerged and undivided, bringing the reproductive organs above or under the water, such as *Potamogeton* sp. pl. and *Callitriche* sp. pl.); myriophyllids (caulescent hydrophytes with all leaves submerged and finely divided, bringing only the reproductive organs above the water, such as *Ranunculus trichophyllus*, *Myriophyllum* sp. pl., etc.); batrachids (caulescent hydrophytes with laminar floating leaves of small dimensions and submerged leaves, divided or entire, such as *R. aquatilis*, *R. peltatus*, *Callitriche* sp. pl.); nympheids (more or less caulescent hydrophytes, with well developed laminar leaves, floating on the surface, and submerged leaves present or absent, such as *Nuphar lutea*, *Nymphaea alba*, *Potamogeton natans*, etc.). The growth forms, together with the floristic and ecological features, are the most important criteria for the syntaxa classification of lower level (Sburlino et al., 2008). From the nomenclatural point of view, some authors (Pott, 1995; Mucina et al., 2016) prefer to use the full name *Potamogetonetea pectinati,*

although the International Code of Phytosociological Nomenclature (Weber et al., 2000) allows the use of shorter forms as *Potametea*.

Syndynamism: The communities belonging to *Potametea* class represent a permanent vegetation, thanks to the persistence of water all year round. However the natural filling of ponds and lakes, or more often the human disturbance of these very vulnerable habitats can determine their disappearance or led to the replacement with other more adaptable plant communities (Romero Bujàn & Vázquez, 1996).

Habitat reference: A2.5d Mediterranean and Black Sea coastal salt marsh; C1.2b Mesotrophic to eutrophic waterbody with angiosperms; C1.5 Permanent inland saline and brackish waterbody; C2.2b Permanent non-tidal, fast, turbulent watercourse of plains and montane regions with *Ranunculus* spp.; C2.3 Permanent non-tidal, smooth-flowing watercourse.

3.1. Order: ***Potametalia pectinati*** Koch 1926

Vegetation of aquatic plants rooted in the bottom.

Synonyms: *Potametalia* Br.-Bl. 1931 (art. 2b); *Hydrocharitetalia* Rübel 1933 nom. illeg. (art. 29c); *Magnopotametalia* Den Hartog & Segal 1964 (art. 29c); *Luronio-Potametalia* Den Hartog & Segal 1964; *Parvopotametalia* Den Hartog & Segal 1964 (art. 29c); *Callitricho-Ranunculetalia* Passarge 1978 (art. 29); *Nymphaeetalia albo-tetragonae* Passarge 1978 (art. 29); *Callitricho-Potametalia* Schaminée, Lanjouw & Schipper 1990 (art. 29); *Nupharo-Potametalia* Schaminée, Lanjouw & Schipper 1990 (art. 5); *Ranunculo-Myriophylletalia* Passarge 1996 (art. 3b); *Luronio- Potametalia* Den Hartog & Segal 1964; *Luronio-Potametalia* Den Hartog & Segal 1964 (art. 3f)*; Luronio-Potametalia* Den Hartog & Segal ex Westhoff & Den Held 1969 (art. 29c); *Trapetalia* Segal 1965 (3b); *Luronio-Potamogetonetalia polygonifolii* (Den Hartog & Segal 1964) Rivas-Martinez 1973 (art. 29); *Potamogetonetalia crispi* (Den Hartog & Segal 1964) Rivas-Martinez 1973 (art. 29); *Potamogetonetalia lucentis* (Den Hartog & Segal 1964) Rivas-Martinez 1973 (29); *Nymphaeetalia* Passarge 1978 (art. 29c); *Nymphaeetalia albo-tetragonae* Passarge 1978 (Rec. 10, art. 40); *Ranunculetalia* Schmidt 1981 (art. 29c).

Lectotypus: *Potamion pectinati* (Koch 1926) Görs 1977.

Characteristic and differential species: *Myriophyllum spicatum* L., *Potamogeton lucens* L., *P. natans* L., *P. pusillus* L., *P. pectinatus* L., *P. crispus* L., *P. perfoliatus* L., *Zannichellia palustris* L., *Zannichellia peltata* Bertol.

Geographical distribution: See class.

Structure and ecology: The order includes the hydrophytic plant communities dominated by rooted macrophytes (mainly elodeids and nympheids) that colonize stagnant or flowing waters characterized by a low degree of trophism and in particular from eutrophic to

mesotrophic waters (Costa et al., 2012, Biondi et al., 2014). Some authors (Westhoff & Den Held, 1969; Cirujano et al., 1986; Pèrez Raya & Lòpez Nieto, 1991; Raimondo et al., 2011) prefer to distinguish the *Luronio-Potametalia* order Den Hartog & Segal 1964, which includes only the communities characterized by the dominance of procumbent rizo-helophytes and submerged rizhophytes, such as *Potamogeton natans*, *Alopecurus aequalis*, *Glyceria spicata* and *Lytrum portula*, that colonize the shallow and nutrients-poor waters. However, according to some recent literature data (cfr. Rivas-Martinez et al., 2001; Bardat et al., 2004; Šumberovà, 2011, Mucina et al., 2016, etc.) it can be considered only a synonym of *Potametalia pectinati*.

Syndynamism: See class.

Habitat reference: A2.5d Mediterranean and Black Sea coastal salt mars; C1.2b Mesotrophic to eutrophic waterbody with angiosperms; C1.5 Permanent inland saline and brackish waterbody.

3.1.1. Alliance: ***Potamion pectinati*** (Koch 1926) Libbert 1931

Communities with submerged or partly floating rhizophytes, of stagnant (or slightly flowing) freshwaters, occurring in mesotrophic to eutrophic waters.

Synonyms: *Potamion pectinati* (Koch 1926) Görs in Oberd. 1977 (art. 22); *Potamion eurosibiricum* Koch 1926 (art. 34a); *Potamion eurosibiricum* Br.-Bl. 1931 (art. 2b); *Potamion* Miljan 1933 (art. 31); *Potamion eurosibiricum* Nordhagen 1936 nom. nud. (art. 2b, 8); *Potamion eurosibiricum* Nordhagen 1937 (2b, 34a); *Potamion lucentis* Vollmar 1947 nom. nud. (art. 2b, 8); *Potamion pusilli* Vollmar 1947 nom. nud. (art. 2b, 8); *Magno-Potamion eurosibiricum* Vollmar 1947 (34a); *Eu-Potamion* (Koch 1926) Oberd. 1957 (art. 29, 34b); *Potamogetonion pectinati* Koch 1926 em. Oberd. 1957 (art. 2b, 8); *Magnopotamion* (Vollmar 1947) Den Hartog & Segal 1964 nom. nud. (art. 2b, 8); *Magnopotamogetonion lucentis* (Vollmar 1947) Den Hartog & Segal 1964 (sensu Passarge 1996a) (Rec. 10, art. 40); *Potamogetonion pusilli* (Vollmar 1947) Den Hartog & Segal 1964 nom nud. (art. 2b, 8); *Trapion natantis* Segal 1965 nom. nud. (art. 2b, 8); *Elodeion* De Lange 1972 (art. 1); *Potamogetonion crispi* (Den Hartog & Segal 1964) Rivas-Martinez 1973 (art. 29); *Potamogetonion lucentis* (Den Hartog & Segal 1964) Rivas-Martinez 1973 (art. 29); *Potamion lutescentis* (Koch 1926) Rivas-Martinez 1973 sensu Costa et al. 2012 (art. 2b, 8); *Potamion natantis* Lakušić 1975 (art. 2b); *Potamion perfoliati* Lakušić 1975 (art. 2b); *Potamogetonion pectinati* Koch 1926 corr. Gòrs in Oberd. et al. 1977 (art. 2b, 8); *Potamion pusilli* Hejný in Hejný & Husàk 1978 (art. 29c); *Potamion pusilli* Wiegleb 1982 (art. 2b, 5); *Potamion pusilli* Wiegleb ex Vahle in Preising et al. 1990 (art. 3f); *Ranunculo-Myriophyllion* Passarge 1992 (art. 3g); *Potamogetonion pusilli* (Koch 1926) Julve 1993 (art. 3b); *Elodeo-Potamion crispi* Passarge 1996 (art. 8); *Potamogetonion natanto-obtusifolii* Passarge 1996 (art. 29c); *Parvopotamion* (Vollmar 1947) Den Hartog & Segal 1964 (art. 29c).

Lectotypus: *Nymphaeo albae-Nupharetum luteae* Nowinski 1928.

Characteristic and differential species: *Groenlandia densa* (L.) Fourr., *Potamogeton pectinatus* L.*, P. perfoliatus* L.

Geographical distribution: The alliance has a wide distribution in the European territories (Biondi & Blasi, 2015), while in Sicily it is not very common, despite being reported in numerous locations of the island, where permanent and sufficiently deep humid environments occur (Marcenò & Raimondo, 1977; Brullo et al., 1994, 1998; Raimondo et al, 2000; Brullo & Sciandrello, 2006; etc.).

Structure and ecology: The alliance includes the associations dominated by elodeids and sometimes also by myriophyllids , that colonize the deepest part of the permanent ponds with fresh or brackish waters. The structure of this vegetation is defined by the presence of hydrophytes with submerged leaves belonging to the genus *Potamogeton*, which can grow in slightly current waters, such as the parts of rivers with a low dynamism and the surfaces of ponds and lakes more exposed to wind, waves and currents (Sburlino et al., 2008). However, these communities are mainly linked to stagnant and quite deep (0.5-5 m) waters, characterized by a certain degree of trophism (Costa et al., 2012). According to Den Hartog & Segal (1964) and Passarge (1978) the alliance *Parvopotamion* must be distinguished from *Potamion pectinati* on the base of the characteristic species size, bringing together the communities with small elodeids (Parvopotamidi). However, this classification is rejected by several authors (Rivas-Martinez et al., 2001; Bardat et al., 2004; Mucina et al., 2016).

Syndynamism: The alliance gathers communities usually permanent and with a large ecological range, but some of them show also a pioneer character, being able to colonize disturbed environments or newly formed basins (Schratt, 1993).

Habitat reference: See order.

3.1.1.1. ***Potametum perfoliati*** Miljan 1933

Community with perfoliate pondweed of stagnant and shallow freshwater.

Synonyms: *Potametum pectinato-perfoliati* Den Hartog & Segal 1964 p. p.; *Potametum perfoliato-lucentis* Blaženčić & Blaženčić 1989 p. p.; *Potametum perfoliati* Passarge 1964 p. p.

Lectotypus: Not designated.

Characteristic and differential specie: *Potamogeton perfoliatus* L.

Phytosociological table: From Brullo et al. (1994), table 7, 5 rel.
Char. association: *Potamogeton perfoliatus* (V).

Geographical distribution: The association is present in Central Europe (Pott, 1995; Šumberovà, 2011) and Northern Asia (Chytrý et al., 1993). In Sicily it is very rare, being reported only for Nebrodi Range at Fosso di Piano Jannu (Brullo et al., 1994).

Structure and ecology: The silty bottoms of shallow ponds (0.5-1 m), with mesotrophic or eutrophic waters, are colonized by monospecific vegetation of *Potamogeton perfoliatus*, a very rare species in Sicily (Giardina et al., 2007), attributable to *Potametum perfoliati*. This association in central Europe is differentiated by the presence of *Potamogeton pectinatus* (Passarge, 1964; Oberdofer, 1977), which is instead totally absent in the Sicilian stand, characterized by remarkable termophilous requirements (100 m altitude) and floristic poverty (Brullo et al., 1994). In these places the *Potametum perfoliati* takes catenal contact with the *Typhetum dominguensis*, which grows on the banks of the lake.

Syndynamism: It is a permanent association linked to quite eutrophic, which seems to be favored by a moderate increase in nutrients (Landucci et al., 2011).

Habitat reference: See order.

3.1.1.2. ***Potametum pectinati*** Cartensen 1955

Community with sago pondweed of salt marshes with hypertrophic waters.

Synonyms: Gesellschaft von *Potamogeton pectinatus* var. *scoparius* Carstensen 1955 (art. 3c); *Myriophyllo verticillati-Potametum pectinati* Costa et al. 1986 p. p.*; Potametum pectinati* Stevanović 2003 ass. prov.

Lectotypus: Not designated.

Characteristic and differential specie: *Potamogeton pectinatus* L.

Phytosociological table: From Brullo & Sciandrello (2006), table 1, 4 rel.

Char. association: *Potamogeton pectinatus* (4).

Char. alliance, order and class: *Myryophyllum verticillatum* (3), *Potamogeton crispus* (4), *Ceratophyllum submersum* (2).

Other species:; *Chara* sp. (2).

Geographical distribution: The association is found in all European countries, North Africa, East Asia and North America (Šumberovà, 2011). In Sicily it is strictly linked to the brackish coastal swamps, such as the Gorghi Tondi and Lago Preola (Brullo & Ronsisvalle, 1975), the Biviere di Gela (Brullo & Sciandrello, 2006), the marshes of South-eastern Sicily (Bartolo et al., 1982) and is also present in some artificial lakes of central Sicily (Marcenò & Raimondo, 1977; Sciandrello 2009).

Structure and ecology: The submerged aquatic vegetation that colonizes the basins with slightly brackish water, with a high content of phosphates and nitrogenous substance, is represented by *Potametum pectinati*. The community is generally constitute by monospecific populations of *Potamogeton pectinatus*, which is sometimes associated with other elodeids such as *Najas marina*, *Potamogeton crispus*, *Myriophyllum verticillatum*, *Ceratophyllum subemersum*, etc., arranged in a rather sparsely way (Brullo & Sciandrello, 2006). The cenosis

prefers silty-clay bottoms and shallow stagnant waters (deep from 30 cm up to 2 m), reaching its maximum vegetative development during the summer period (Sciandrello 2009), while only rarely can grow in running water and in particular at the mouths of rivers (Brullo & Ronsisvalle, 1975). The *Potametum pectinati* colonizes the central portion of the basins, where it can have catenal contacts with the communities of the *Ranunculion fluitantis* alliance and with those ones of the *Lemnetea minoris* class, while on the banks can come into contact with the vegetation of *Phragmitetea* class (Brullo & Ronsisvalle, 1975).

Syndynamism: The occurrence of this association is considered indicative of poorly oxygenated waters and subject to a strong organic pollution (Ceschin & Salerno, 2008). However, it is exclusive of submerged surfaces even during the summer period, so any human intervention that determines a change in the water system of the basin can cause its disappearance.

Habitat reference: See order.

3.1.1.3. ***Potametum pusilli*** Soó 1927

Community with small pondweed of deep and eutrophic waters.

Synonyms: *Potametum panormitano-graminei* Koch 1926 (art. 36, nomen ambiguum); *Potametum berchtoldii* Krasovskaja 1959; *Potamo pusilli-Ceratophylletum demersi* Janković 1974 p. p.; *Potametum pusilli* Hejný 1978 (phantom); *Potametum berchtoldii* Wijsmen et al. 1995.

Lectotypus: Not designated.

Characteristic and differential species: *Potamogeton pusillus* L.

Phytosociological table: 2 unpublished rel., Contrada Anguillara, Calatafimi, 3/06/2017.
Char. association: *Potamogeton pusillus* (2).

Geographical distribution: The association is widespread in the temperate zones of Eurasia and North America (Šumberovà, 2011). In Sicily it is only known in the western part for some artificial basins of Contrada Anguillara near Calatafimi.

Structure and ecology: The deeper part of lakes or small artificial basins are sometimes colonized by monospecific populations of *Potamogeton pusillus*, a species that prefers sunny exposure and clayey bottoms. This vegetation, referred to *Potametum pusilli*, is closely linked to rather disturbed environments characterized by waters with high values of nutrient content and a fairly high pH (Brouwer et al., 2002).

Syndynamism: This plant community can be considered one of the first stages of plant colonization of artificial or natural reservoirs subject to significant anthropogenic

disturbance, covering extensive surfaces of the lake during the summer period (Šumberova, 2011).

Habitat reference: See order.

3.1.1.4. ***Potametum crispi*** Soò 1927

Community with curled pondweed of shallow stagnant waters, of eutrophic to hypertrophic type.

Synonyms: *Potametum crispi* Kaiser 1926 (art. 3d); *Myriophyllo-Potametum* Soó 1934 *potametosum crispi* Slavnić 1956; *Ceratophyllo-Potametum crispi* Horvatić & Micevski 1960 pro parte; *Potametum crispi* Zutshi 1975.

Lectotypus: Not designated.

Characteristic and differential species: *Potamogeton crispus* L.

Phytosociological table: 2 unpublished rel., Bacino Cimia, Mazzarino, 20.07.2017.
Char. association: *Potamogeton crispus* (2).
Char. alliance, order and class: *Potamogeton pectinatus* (1), *Potamogeton nodosus* (1).

Geographical distribution: The association has a wide distribution in the temperate areas of Europe and Mediterranean (Hultén & Fries 1986; Rivas-Martinez et al., 2001), while in Sicily it was surveyed only in the Bacino Cimia (Mazzarino), but it is probably more widespread.

Structure and ecology: The association at issue is characterized by the dominance of *Potamogeton crispus*, a sumbmerged macrophyte that prefers stagnant or slowly flowing water. This is a quite impoverished vegetation, where *P. crispus*, which often has high coverage indices, is associated with a few other species such as *P. pectinatus*, *P. nodosus*, etc. This community is linked to shallow waters (not more than 1 m) and rich in nutrients, sometimes also polluted by toxic substances (Šumberovà, 2011).

Syndynamism: The presence of *Potametum crispus* is ensured by a strong eutrophication of water, generally associated with human activities (Hejný et al., in Květ et al., 2002). Therefore, in fishermen's basins, the growth of *Potamogeton crispus* was favored by man for the oxygenation of water (Šumberova, 2011).

Habitat reference: See order.

3.1.1.5. ***Groenlandietum densae*** Segal ex Schipper et al. in Schaminée et al. 1995

Community with opposite-leaved pondweed of shallow stagnant waters, of mesotrophic to eutrophic type.

Synonyms: *Groenlandietum densae* O. Bolós 1957 (phantom name); *Groenlandietum densae* (Oberdorfer 1957) Korneck 1962 (phantom name); *Groenlandietum densae* Segal 1965 (nom. nud., art. 2b); *Potamogeton densus*-Gesellschaft Korneck 1969 (art. 3c).

Lectotypus: Not designated.

Characteristic and differential species: *Groenlandia densa* (L.) Fourr.

Phytosociological table: From Brullo et al. (1994), table 8, 5 rel.

Char. association: *Groenlandia densa* (V).

Char. alliance, order and class: *Callitriche stagnalis* (III), *Apium inundatum* (II), *Ranunculus omiophyllus* (II), *Callitriche obtusangula* (II), *Callitriche truncata* subsp. *occidentalis* (II), *Ranunculus peltatus* (II), *Potamogeton natans* (II), *Myriophyllum alterniflorum* (I).

Other species: *Glyceris spicata* (V), *Veronica beccabunga* (III), *Juncus striatus* (III), *Apium nodiflorum* (II), *Utricularia australis* (II), *Alopecurus aequalis* (II).

Geographical distribution: The association is widespread in central Europe and in the Mediterranean area (Šumberovà, 2011), while in Sicily is relatively rare and limited to mountain areas of Nebrodi (Barbagallo et al., 1979a; Brullo et al., 1994; Gianguzzi 1999a), Madonie and Sicani (Gianguzzi et al., 2007).

Structure and ecology: *Groenlandia densa* is a quite rare species in Sicily (Giardina et al., 2007), colonizing the small mountain ponds with muddy bottoms, where characterizes the *Groenlandietum densae* association. This community, typical of shallow freshwaters, shows a marked floristic poverty, though sometimes other species of *Potametalia* occur, such as *Potamogeton natans*, *Ranunculus peltatus*, *Apium inundatum*, *Callitriche obtusangula*, *C. stagnalis* and *C. truncata* (Gianguzzi , 1999a). From the catenal point of view, this vegetation may be in contact outward with the *Oenantho fistulosae-Glycerietum spicatae* or with *Caricetum intricato-oederi* if colonizes small muddy ponds inside the humid pastures, while towards the center of the pond can be replaced by the *Utricularietum australis* (Brullo et al., 1994).

Syndynamism: It is a rare community threatened with extinction in much of its geographical range (Sand-Jensen et al., 2000; Riis & Sand-Jensen, 2001; Schubert et al., 2001), since the water eutrophication tends to favor the settlement of some algal communities and of *Lemnetea* vegetation, which making a dense biomass, affect the photosynthetic capacity of *Groenlandia densa* (Šumberovà, 2011).

Habitat reference: See order.

3.1.2. Alliance: ***Nymphaeion albae*** Oberd. 1957

Community with floating rhizophytes (nympheids), of stagnant (or slightly running) waters, quite deep, of mesotrophic to eutrophic type.

Synonyms: *Potamion eurosibiricum* W. Koch 1926 p. p. (art. 34); *Potamion* (W.Koch 1926) Libbert 1931 p.p.; *Parvo-Potamion eurosibiricum* Vollmar 1947 (art. 34a); *Parvopotamion* (Vollmar 1947) Den Hartog & Segal 1964 (art. 29c); *Nymphoidion peltatae* Passarge 1992 (art. 7c.); *Utriculario minoris-Nymphaeion candidae* Vahle in Preising et al. 2012 (art. 29c).

Lectotypus: *Nymphaeo albae-Nupharetum luteae* Nowinski 1928.

Characteristic and differential species: *Myriophyllum spicatum* L., *Myriophyllum verticillatum* L., *Persicaria amphibia* (L.) Gray, *Potamogeton natans* L.

Geographical distribution: The alliance is mainly present in western and central Europe, while it is quite rare in the Mediterranean area (Gehu & Biondi, 1988; Buchwald & al., 2000; Sburlino & al., 2008; Mucina et al., 2016). In Sicily it is sporadically distributed in the permanent freshwater basins of the major island mountain systems such as Nebrodi, Etna, Hyblaean and Sicani (Minissale & Spampinato, 1985; Brullo et al., 1994, 1996; Gianguzzi et al., 2007).

Structure and ecology: The *Nymphaeion albae* alliance includes the communities dominated by rooting macrophytes with laminar floating leaves that colonize eutrophic stagnant waters, or more rarely slowly running, up to 5 m deep and with muddy bottoms (Schratt, 1993). From the physiognomic point of view, the community is characterized mainly by nympheids and submerged species, less frequently also by pleustophytes (Sburlino et al., 2008). It is also a vegetation with mesophilous requirements and in fact in Sicily occurs only in mountain stands or along the freshest streams.

Syndynamism: The communities belonging to the *Nymphaeion albae* alliance represent a permanent vegetation. However, they are very sensitive to high temperatures and to the increase of pollution that can change the amount of organic matter present in the waters (Šumberovà, 2011). In Sicily some of the characteristic species of the alliance, such as *Nymphaea alba* L. and *Nuphar lutea* (L.) Sm., have become extinct from long time, while others (*Myriophyllum spicatum*, *Persicaria amphibia*, etc.) are rare and limited to one or few localities (Giardina et al., 2007; Raimondo et al., 2011), mainly due to the drying of several lakes for the growing demand of water for civil, agricultural and industrial uses (Raimondo, 2006).

Habitat reference: See order.

3.1.2.1. ***Potamo pectinati-Myriophylletum spicati*** Rivas Goday 1964 corr. Conesa 1990

Community with spiked water-milfoil of stagnant and eutrophic waters.

Synonyms: *Myriophylletum spicati* Soó 1927 nom. nud. (art. 2b); *Potamo pusilli-Myriophylletum spicati* Ranđelović & Zlatković in Ranđelović & Blaženčić 1996.

Lectotypus: Not designated.

Characteristic and differential species: *Myriophyllum spicatum* L.

Phytosociological table: From Minissale et al. (2007), table 25, 3 rel.
Char. association: *Myriophyllum spicatum* (3).
Char. alliance, order and class: *Potamogeton nodosus* (2).
Other species: *Chara vulgaris* (2), *Chaetomorpha mediterranea* (2).

Geographical distribution: The association has a wide distribution in Eurasia, including the Mediterranean area (Rivas-Martinez et al., 2001; Šumberovà, 2011) and also North and South America (Casper & Krausch, 1981; Hultén & Fries, 1986). In Sicily, this plant communities is only known for Lago Gurrida (Minissale & Spampinato, 1985), a small wet environment in Etna Mount, and along the Anapo River in the Hyblaean Plateau (Minissale et al., 2007).

Structure and ecology: As several associations belonging to *Potametea* class, also *Potamo pectinati-Myriophylletum spicati* is characterized by marked floristic poverty, consisting of almost monospecific populations of *Myriophyllum spicatum,* that grows together with only few other hydrophytes which find their optimum during the summer period and in particular *Potamogeton pectinatus*, *P . nodosus* and some charophytes (Minissale & Spampinato, 1985; Minissale et al., 2007). It is a submerged vegetation with thermophilous requirements colonizing quite deep water (70-130 cm or more), persisting during the summer period, characterized by a neutral pH and sometimes even by a certain degree of salinity (Melendo et al. , 2003). In Sicily the association is linked to artificial lakes and to the deeper loops of rivers with clay or sandy substrata, preferring turbid waters because of abundant presence of organic matter, at least in part derived from cattle grazing in the surroundings (Minissale & Spampinato, 1985). From the catenal point of view, it can take contact with the *Ranunculion fluitantis*, hydrophytic communities that colonize the water surface and with the *Phragmitetum* vegetation or with other formations of *Phragmito-Magnocaricetea* class that colonize the banks of damp environment (Kadid et al., 2013).

Syndynamism: The *Potamo pectinates-Myriophylletum spicati* is regarded as a pioneer community which colonizes the disturbed environments due to the high presence of organic matter, where it constitutes a permanent vegetation, while in oligotrophic waters tends to be replaced by *Myriophylletum verticillati* (Minissale & Spampinato, 1985; Šumberovà, 2011).

Habitat reference: See order.

3.1.2.2. ***Myriophylletum verticillati*** Gaudet ex Šumberová in Chytrý 2011

Community with whorled water-milfoil of clear waters.

Synonyms: *Myriophylletum verticillati* Gaudet 1924 (art. 2b), *Myriophylletum verticillati* Soó 1927 (art. 2b), *Ceratophylleto-Myriophylletum verticillati* Janković 1974 ass. prov. (art. 3b).

Holotypus: Rel. from locality no. 102, pg. 150, Černohous & Husák (1986).

Characteristic and differential species: *Myriophyllum verticillatum* L.

Phytosociological table: From Brullo et al. (1994), table 5, 13 rel.

Char. association: *Myriophyllum verticillatum* (V).

Char. alliance: *Potamogeton natans* (V).

Char. order and class: *Utricularia australis* (III), *Callitriche obtusangula* (II), *Potamogeton pusillus* (II), *Ranunculus omiophyllus* (I).

Other species: *Chara sp.* (I), *Oenanthe aquatica* (I), *Glyceria spicata* (I).

Geographical distribution: The association has been reported for the temperate and subtropical zones of Europe, Asia and North America (Casper & Krausch, 1981; Pott, 1995; Tomaselli et al., 2006; Šumberovà, 2011, etc.), while in Sicily is only known for Nebrodi Mountains (Brullo et al., 1994; Gianguzzi., 1999a) and Hyblaean Plateau (Brullo et al., 1996).

Structure and ecology: The central part of the small mountain lakes and more rarely also the bends of the rivers, with peaty bottom and quite deep water (from 60 cm to 3 m), are colonized by a community with summer development, dominated *by Potamogeton natans* and *Myriophyllum verticillatum*, sometimes associated with other hydrophytes (elodeids and nympheids), such as *Utricularia australis*, *Callitriche obtusangola* and *Potamogeton pusillus* (Brullo et al., 1994). The association, which prefers clear and calm mesotrophic waters, with a high content of calcium and magnesium (Felzines, 1983), has been referred to *Myriophylletum verticillati*. According to Brullo et al. (1994) and Marchiori & Sburlino (1997) the syntaxon can be attributed to the alliance *Nymphaeion alba*e, since of its floristic set and structural characteristics. Otherwise, other authors (Golub et al., 1991; Brzeg & Wojterska, 2001; Ceschin & Salerno, 2008; Šumberová, 2011; Lastrucci et al., 2015) prefer to refer it to the alliance *Potamion pectinati* for dominance of elodeids . The cenosis takes catenal contacts with the *Potamo-Utricularietum australis* going towards less deep waters, or sometimes with helophytic vegetation that grows on the banks, such as the *Scirpetum lacustris* or the *Oenantho fistulosae-Glycerietum spicatae*, as well as with the floating vegetation of *Lemnetea minoris* and *Ranunculion fluitantis* (Brullo et al., 1994; Lastrucci et al., 2015).

Syndynamism: Dynamically, the *Myriophylletum verticillati* represents a transitional aspect to more mature vegetation dominated by nympheids (Lastrucci et al., 2015), that in Sicily is represented only by *Polygono-Potametum natantis*, association exclusive of deeper waters. However, unlike the *Potamo pectinates-Myriophylletum spicati*, the community at issue does not represent a pioneer vegetation, in fact it does not tend to colonize the artificial basins or in any case those ones of new formation, but rather prefers more stable and relatively undisturbed ponds (Šumberovà, 2011).

Habitat reference: See order.

3.1.2.3. ***Potamo natantis-Polygonetum natantis*** Knapp & Stoffers 1962

Floating vegetation with amphibious bistort.

Synonyms: *Polygonetum natantis* Soó 1927 nom. nud. (art. 2b), Stad. *Polygonum amphibium* Tímár 1950 (art. 3d), *Polygonum amphibium aquaticum*-Gesellschaft Görs in Oberd. et al. 1977, *Polygonetum natantis* Soó ex Brzeg et Wojterska 2001.

Lectotypus: Not designated.

Characteristic and differential species: *Persicaria amphibia* (L.) Gray (=*Polygonum natans* (Michaux) Eaton)

Phytosociological table: From Brullo et al. (1994), table 6, 7 rel.
Char. association: *Persicaria amphibia* (V).
Char. alliance: *Potamogeton natans* (V), *Myriophyllum spicatum* (IV).
Char. order and class: *Potamogeton pusillus* (V).

Geographical distribution: The association is distributed mainly in central and eastern Europe and in the Atlantic area (Rodwell, 1995; Pott, 1995; Sanda et al., 1999; Dubyna, 2006; Šumberová, 2011), but it occurs also also in Asia (Takamura et al., 2003; Taran & Tjurin 2006) and North America (Christy, 2004). In Sicily it must be considered a very rare community, being known only for the Biviere di Cesarò in the Nebrodi Mountains (Brullo et al., 1994; Gianguzzi., 1999a) and for the Carcaciotto and Carcaci Gurghi in the Sicani Mountains (Gianguzzi et al., 2007).

Structure and ecology: The *Potamo natantis-Polygonetum natantis* is a community linked to the deepest part (up to 5-6 m) of less disturbed mountain lakes, where *Persicaria amphibia* tends to constitute a more or less dense vegetation, often associated with other nympheids and especially to *Potamogeton natans* (Brullo et al., 1994). Soo (1964) distinguishes two different aspects of this association: the subass. *polygonetosum* who colonizes the shallow waters near the banks and the subass. *potametosum* which it is instead linked to the central parts of the deeper basin, where *P. amphibia* fo. *natans* finds its optimum with its characteristic floating leaves. Both formations described prefer calm waters and with a limited content of organic substance (oligo-mesotrophic) and clayey or gravelly bottom (Šumberová, 2011). From the catenal point of view in the «Biviere di Cesarò» lake, it comes into contact with the *Scirpetum lacustris*, growing along the banks or with the floating islands consisting of *Salix pedicellata* (Brullo et al., 1994).

Syndynamism: It is a permanent vegetation, representing the most mature community that can colonize the deeper parts of the lake, while in more disturbed contexts may be replaced by monospecific populations of *Potamogeton natans*, species well adapted to eutrophication (Šumberovà, 2011).

Habitat reference: See order.

3.1.3. Alliance: ***Potamion polygonifolii*** Den Hartog & Segal 1964

Vegetation with rooted hydrophytes of shallow meso-oligotrophic waters.

Synonyms: *Potamion alpini* Lakusïc 1975 (art. 2b); *Junco-Potamion polygonifolii* Passarge 1996; *Potamion graminei* (Den Hartog & Segal) Westhoff & Den Held 1969 nom. illeg. (art. 29); *Potamion* (Koch 1926) Libbert 1931 p.p.

Lectotypus: Not designated.

Characteristic and differential species: *Apium inundatum* (L.) Rchb.; *Ranunculus omiophyllus* Ten; *Potamogeton gramineus* L., *Myriophyllum alterniflorum* DC.

Geographical distribution: The alliance is well represented in central and western Europe, while it is much more sporadic in the Mediterranean area (Biondi & Blasi, 2015). In Sicily, this syntaxon is known only for the Nebrodi Mountains (Brullo et al., 1994).

Structure and ecology: Previously, the *Potamion polygonifolii* was included in the *Luronio-Potametalia* order, since it comprises the communities dominated by rhyzophytes and elophytes linked to shallow waters with a low degree of nutrients. In particular, the alliance brings together the communities that colonize medium-altitude basins, characterized by sandy-pebbly bottoms and shallow meso-oligotrophic waters (generally deep lesser than 1 m) (Bardat et al., 2004). The physiognomy of these communities is defined by submerged rooted hydrophytes (elodies), often associate with floating leaves hydrophytes (nympheids) (Biondi & Blasi, 2015). Mucina et al. (2016) refer some communities of *Potamion polygonifolii* to the *Littorellion uniflorae* (*Littorelletea uniflorae* class).

Syndynamism: The communities of the alliance at issue tend to replace the *Nymphaeion albae* vegetation in the less deep part of ponds and small lakes. They can be considered a permanent vegetation, though it is potentially sensitive to anthropic disturbances.

Habitat reference: See order.

3.1.3.1. ***Myriophylletum alterniflori*** Chouard 1924

Community with alternateflower watermilfoil of shallow waters.

Synonyms: *Myriophyllum alterniflorum* consociès Pearsall 1918; *Myriophylletum alterniflori* Lemée 1937 em. Siss. 1943 p.p.*; Myriophylletum alterniflori* Steusloff 1939*; Myriophyllo-Littorelletum* Jeschke 1959 p. p.; *Chara-Myriophyllum* association Spence 1964; *Callitricho hamulatae-Myriophylletum alterniflori* (Steusloff 1939) Weber-Oldecop 1967 p. p.; *Myriophyllo alterniflori-Callitrichetum brutiae* Cirujano et al. 1986 p. p.*; Myriophyllo alterniflori-Potametum trichoidis* Velayos et al. 1989 p. p.

Lectotypus: Not designated.

Characteristic and differential species: *Myriophyllum alterniflorum* DC.

Phytosociological table: From Brullo et al. (1994), table 9, 11 rel.

Char. association: *Myriophyllum alterniflorum* (V).

Char. alliance, order and class: *Potamogeton natans* (V), *Callitriche obtusangula* (IV), *Utricularia australis* (III), *Myriophyllum verticillatum* (II), *Potamogeton pusillus* (I), *Callitriche hamulata* (I).

Other species: *Glyceria spicata* (II), *Oenanthe aquatica* (I), *Lythrum portula* (I), *Chara* sp. (I), *Ranunculus aquatilis* (I).

Geographical distribution: The association is distributed in the Atlantic and Central Europe (Felzines, 1983). In Sicily it is known from the Nebrodi Mountains (North Sicily) and in particular from Urio Quattrocchi, ponds of Contrada S. Nicola and Contrada Pantana (Brullo et al., 1994). A relevè referable to this vegetation is reported by Sortino et al. (1977) from Madonie massif.

Structure and ecology: In the small mountain ponds (about 900-1000 m a.s.l.) the *Myriophylletum verticillati* towards the shores is replaced by a plant community dominated by *Myriophyllum alterniflorum*, growing together with *Potamogeton natans* which shows high values of coverage (Brullo et al., 1994). This association, referred to the *Myriophylletum alterniflori*, like sandy bottoms and shallow waters, since *Myriophyllum alterniflorum*, the syntaxon diagnostic species, has a rather superficial rooting system that makes it very sensitive to current water, while tollerates quite well nutrient-poor basins (Haslam, 1978).

Syndynamism: The association in the ponds of Nebrodi mountain is mainly linked to small lakes where there is no abrupt rise in the water depth at the banks, allowing the development of the community that prefers shallow water. Sometimes the anthropic intervention, with the aim to enlarge the basin, has resulted in a significant increase of the water level near the shores, take to direct catenal contact the submerged vegetation (e.g. *Utricularietum australis* or *Myriophylletum verticillati*) with the amphibious communities of the *Eleocharido palustris-Alismetum lanceolati*.

Habitat reference: See order.

3.2. Order: ***Callitricho hamulatae-Ranunculetalia aquatilis*** Passarge ex Theurillat in Theurillat et al. 2015

Vegetation of submerged macrophytes (buttercup, water-starwort and watermilfoil) of temporary ponds or watercourses.

Synonyms: *Parvopotametalia* Den Hartog & Segal 1964 (p.p.); *Callitricho-Batrachietalia* Den Hartog & Segal 1964 (phantom); *Callitricho-Batrachietalia* Den Hartog & Segal ex Passarge 1978 (art. 2b); *Callitricho-Potametalia* Lanjow & Schaminée in Schaminée et al. 1995 (art. 2b, 29c).

Holotypus: *Ranunculion aquatilis* Passarge ex Theurillat in Theurillat et al. 2015

Characteristic and differential species: *Callitriche* sp. pl., *Potamogeton nodosus* Poir., *Ranunculus aquatilis* L., *Ranunculus peltatus* Schrank subsp. *peltatus*, *Ranunculus peltatus* subsp. *fucoides* (Freyn) Munòz, *Ranunculus trichophyllus* Chaix.

Geographical distribution: The communities belonging to this order have a wide European distribution, but in Sicily they are generally sporadic and with a little diversification.

Structure and ecology: The aquatic plant communities of shallow waters, current or stagnant, where the macrophytes of batrachid type (generally belonging to *Callitriche* and *Ranunculus* genera) play a dominant physiognomic role, are attributed to the *Callitricho hamulatae-Ranunculetalia aquatilis*.

Syndynamism: The communities referring to this order shows a permanent character in the area with a low anthropic disturbance.

Habitat reference: C2.2b Permanent non-tidal, fast, turbulent watercourse of plains and montane regions with *Ranunculus* spp.

3.2.1. Alliance: ***Ranunculion aquatilis*** Passarge 1964

Vegetation with batrachids of shallow stagnant waters.

Synonyms: *Callitricho-Batrachion* Den Hartog & Segal 1964 (art. 22); *Ranunculion peltati* Schaminée, Lanjouw & Schipper 1990 (art. 29).

Holotypus: *Ranunculetum aquatilis* Géhu 1961.

Characteristic and differential species: *Callitriche stagnalis* Scop., *Ranunculus aquatilis* L., *Ranunculus peltatus* Schrank subsp. *peltatus*, *Ranunculus peltatus* subsp. *fucoides* (Freyn) Munòz, *Ranunculus trichophyllus* Chaix.

Geographical distribution: The alliance is distributed mainly in central and western Europe, where it is characterized by a greater diversity, but is also represented in the Mediterranean area (Cirujano, 1980; Rivas-Martínez et al. 2001; Della Bella et al. 2005; Lastrucci et al. 2010; Šumberová, 2011). In Sicily, the *Ranunculion aquatilis* includes only three associations that are quite localized, being known only for Hyblaean Plateau (Brullo et al., 1976), Piana del Signore wetland near Gela (Sciandrello, 2007) and some stands in the Trapani area (Gianguzzi & La Mantia, 2008; Troia et al., 2016).

Structure and ecology: The temporary ponds, ditches, channels, marshes and small pools with shallow waters, generally subject to summer desiccation, are colonized by some very peculiar communities dominated by small hydrophytes of batrachid type, mainly represented by taxa belonging to *Ranunculus* sect. Batrachium and to *Callitriche* genus (Den Hartog & Segal, 1964; Sburlino et al., 2008; Costa et al., 2012). From the syntaxonomical point of view, these communities are referred to *Ranunculion aquatilis* alliance, formerly known as *Callitricho-Batrachion* Den Hartog & Segal 1964.

Syndynamism: The plant communities belonging to this alliance represent typical ephemeral communities, since their presence is linked to the waters of small and temporary pools. This vegetation finds its optimum between the late winter and early spring, when the humid environment is at its maximum filling. During the fall and early winter, when the pool is still partially dried, the batrachid communities are replaced by communities of *Isoeto-Nanojuncetea* class, which sometimes can also grow along the outer edge of wet environment, taking also catenal contact with the communities of *Ranunculion aquatilis* (Scuderi, 2007).

Habitat reference: See order.

3.2.1.1. ***Ranunculo saniculifolii-Callitrichetum brutiae*** Brullo, Grillo & Terrasi 1976

Batrachid hygrophilous vegetation with sanicula-like buttercup.

Lectotypus: Rel. 14, tab. 4, Brullo et al. (1976), here designated.

Characteristic and differential species: *Callitriche brutia* Petagna*, Ranunculus peltatus* Schrank subsp. *saniculifolius* (Viv.) C.D.K.Cook.

Phytosociological table: From Brullo et al. (1976), table 4, 14 rel.
Char. association: *Callitriche brutia* (V)*, Ranunculus peltatus* subsp. *saniculifolius* (IV).
Char. alliance, order and class: *Potamogeton pusillus* (IV), *Potamogeton coloratus* (II).
Other species: *Chara* sp. (II), *Glyceria plicata* (II), *Juncus inflexus* (I), *Typha angustifolia* (I).

Geographical distribution: This association, endemic of Sicily, was found only in the Hyblaean area and in particular in the upper part of Monte Lauro (Brullo et al., 1976).

Structure and ecology: The most wide and deep pools that occur in the basaltic substrates of the cacuminal area of Monte Lauro (about 900 m of altitude), are colonized by a peculiar vegetation, consisting of small hygrophilous species, such as *Callitriche brutia* and *Ranunculus peltatus* subsp. *saniculifolius*, sometimes associated with other taxa of the order, such as *Potamogeton pusillus* and of the class, as *P. coloratus* (Brullo et al., 1976). The *Ranunculo saniculifolii-Callitrichetum brutiae* shows some floristic and ecological affinities with various communities described in the Iberian territory, such as the *Callitricho stagnalis-Ranunculetum saniculifolii* Galán in A.V. Pérez, Galán, P. Navas, D. Navas, Y. Gil & Cabezudo 1999 and the *Ranunculetum saniculifolii* Rivas Martinez, Fernàndez Gonzàlez, Loidi, Lousä & Penas 2001.

Syndynamism: This community is linked to waters that persist during the summer and up to 1-1.5 m deep, while in shallower pools, subject to summer desiccation, is replaced by the *Ranuncolo-Antinorietum insularis* (Brullo et al., 1976).

Habitat reference: See order.

3.2.1.2. ***Ranunculetum baudotii*** Br.-Bl. in Br.-Bl., Roussine & Nègre 1952

Vegetation with baudot buttercup of brackish waters.

Synonyms: *Potamogetono pectinati-Ranunculetum baudotii* Klement 1953 ex Passarge 1992 (syntax. syn.)*; Callitricho-Ranunculetum baudotii* O. de Bolòs, Molinier & P. Montserrat 1970 corr. (syntax. syn.).

Holotypus: Rel. pg. 79, Br.-Bl. et al. (1952).

Characteristic and differential species: *Ranunculus peltatus* Schrank subsp. *baudotii* (Godr.) C. D. K. Cook

Phytosociological table: From Sciandrello (2007), table 1, 8 rel.
Char. association: *Ranunculus peltatus* subsp. *baudotii* (V).
Other species: *Chara hispidula* (V), *Chetomorpha mediterranea* (V), *Ruppia maritima* (IV).

Geographical distribution: This association is distributed in Europe, particularly in the central-western part (Hocquette 1926. Pott, 1995; Rodwell, 1995; Rivas-Martinez et al. 2001) and also in North Africa (Šumberová, 2011). In Sicily it is quite rare, currently known only for Piana del Signore near Gela (Sciandrello, 2007) and probably for Trapani area (Gianguzzi & La Mantia, 2008).

Structure and ecology: The ponds and channels characterized by lightly brackish waters, generally not far from the coast, are colonized by a hydrophytic vegetation dominated by *Ranunculus peltatus* subsp. *baudotii*, an aquatic macrophyte with leaves both floating and submerged (Šumberová, 2011). In particular, this community is referred to *Ranunculetum baudotii*, an association that prefers sandy-loamy bottom and waters that are deep at least 50 cm and subject to summer drying, in which the dominant species is often associated with other sub-halophilous hydrophytes, such *Ruppia maritima*, *Chara hispidula* and *Chethomorpha mediterranea* (Sciandrello, 2007).

Syndynamism: The *Ranunculetum baudotii* is a vegetation linked to relatively superficial waters, subject to significant variations in level during the year that allow the germination of the seeds (Bonis et al., 1995). The natural filling or the sediments from anthropogenic sources can cause its disappearance, initially in favor of *Lemnetea minoris* community and later of the helophytic vegetation linked *to Phragmito-Magnocaricetea* class, whose development is often prevented by grazing (Watt et al., 2007).

Habitat reference: See order.

3.2.1.3. ***Ranunculetum aquatilis*** Géhu 1961

Vegetation with pond water crowfoot of freshwaters.

Synonyms: *Batrachietum aquatili-peltati* Sauer 1937 (phantom name); *Ranunculus aquatilis*-Bestände Sauer 1947*; Ranunculetum aquatilis* Sauer 1947 (phantom name); *Ranunculetum*

peltati Sauer 1947 (phantom name); *Batrachio aquatilis-Callitrichetum hamulatae* Rydlo & Husák 1992 p. p.

Lectotypus: Not designated.

Characteristic and differential species: *Ranunculus peltatus* Schrank subsp. *peltatus*.

Phytosociological table: 2 unpublished rel., Pantani Anguillara, 10.04.2016.
Char. association: *Ranunculus peltatus* subsp*. peltatus* (2).
Other species: *Glyceria notata* (2), *Alisma lanceolatum* (2).

Geographical distribution: This association is mainly represented in Western Europe (Rodwell, 1995; Ferrez et al., 2009), but it is also known from the Mediterranean area (Pedrotti et al., 1979; Gradstein & Smittenberg, 1977; Rivas-Martinez et al., 2001), the Balkans (Randjelovic & Blaženčić, 1996), central Asia (Hilbig, 2000) and North America (Hultén & Fries, 1986). In Sicily it is known from Trapani area (Troia et al., 2016), but is probably also present in other parts of the island.

Structure and ecology: In the ponds with fresh water, sometimes persistent during the summer, the *Ranunculetum baudotii* is replaced by another community that is referred to *Ranunculetum aquatilis*. From the floristic point of view, it is a rather poor vegetation, where *Ranunculus peltatus* subsp. *peltatus* (= *R. aquatilis* s.l.) play a predominant role, sometimes associated with other hydrophytes, such as *Glyceria notata*, *Alisma lanceolatum*, *Ranunculus trichophyllus* and *Callitriche stagnalis* (Gianguzzi & La Mantia, 2008). This vegetation finds its optimum between the end of the winter and early spring, when the dominant species presents a showy flowering and tends to occupy most of the pond (Pedrotti et al., 1979), often coming in catenal contact with the helophytic vegetation of *Phragmito-Magnocaricetea* class (Troia et al., 2016). From the syntaxonomic point of view, some authors (Pott, 1995; Rennwald, 2000) prefer to treat the communities with *R. peltatus* and *R. aquatilis* as two separate associations, while others (Doll, 1991; Dimopoulos et al., 2005) include also the plant community dominated by *R. trichophyllum* in the *Ranunculetum aquatilis*.

Syndynamism: This association is one of the first stages in the plant colonization of small ponds, for example immediately after the drainage. Otherwise, it may represent a permanent vegetation in the ponds where mechanical interruption of the sediments flow occurs (Šumberová, 2011).

Habitat reference: See order.

3.2.2. Alliance: ***Ranunculion fluitantis*** Passarge 1964

Submerged vegetation of running waters, with oligotrophic to eutrophic type.

Synonyms: *Potamion* (Koch 1926) Libbert 1931 p.p. (syntax. syn.); *Callitricho-Batrachion* Den Hartog & Segal 1964 p.p. (syntax. syn.); *Batrachion fluitantis* Neuhäusl 1959 nom. mut. (art. 45).

Holotypus: *Ranunculetum fluitantis* Allorge 1922.

Characteristic and differential species: *Potamogeton nodosus* Poir.; *Ranunculus penicillatus* (Dumort.) Bab.; *Ranunculus trichophyllus* Chaix.

Geographical distribution: The alliance shows its greatest diversity in central and western Europe (Gèhu, 1961; Rodwell, 1995; Izco et al., 2000; Rivas-Martinez et al., 2001), while it is considerably less widespread in the eastern part of this continent (Matuszkiewicz, 2007; Dubyna, 2006). In Sicily the *Ranunculion fluitantis* communities are rather rare, bein mainly reported for North-Eastern Sicily (Brullo & Spampinato, 1990; Minissale & Spampinato, 1990).

Structure and ecology: Rivers or streams characterized by clear and slightly eutrophic waters are colonized by a peculiar hydrophytic vegetation referring to the *Ranunculion fluitantis* alliance. This syntaxon brings together plant communities dominated by various batracoid or nymphoid species, belonging to different genera, such as *Callitriche*, *Potamogeton* and *Ranunculus*, which prefer running waters, persistent also during the summer (Meriaux, 1983).

Syndynamism: The associations referred to this alliance represent a permanent vegetation in absence of anthropic disturbance. However, an increase in the amount of organic matter dissolved in water can cause an alteration in the community floristic composition, for example by favoring some algal species, while modification of the water regime may result in its complete disappearance (Šumberová, 2011).

Habitat reference: See order.

3.2.2.1. ***Ranunculetum penicillati*** Brullo & Spampinato 1990

Vegetation with stream water-crowfoot of clear and cold running waters.

Holotypus: rel. 4, tab. 28, Brullo & Spampinato (1990).

Characteristic and differential species: *Ranunculus penicillatus* (Dumort.) Bab.

Phytosociological table: From Brullo & Spampinato (1990), table 28, 8 rel.
Char. association: *Ranunculus penicillatus* (V).
Char. alliance: *Ranunculus trichophyllus* (IV), *Potamogeton nodosus* (I).
Char. order and class: *Callitriche stagnalis* (V), *Potamogeton crispus* (II), *Berula erecta* (II).
Other species: *Apium nodiflorum* (IV), *Veronica anagallis-aquatica* (IV), *Nasturtium officinale* (II).

Geographical distribution: It is a community mainly distributed in central and western Europe, while in the Mediterranean it is much more sporadic, as it can only grow in stands with very peculiar ecological conditions (Brullo & Spampinato, 1990). In Sicily, this association is only reported for two stands in the northen-eastern part, along Fiumefreddo river and in the artificial canals of Gurna valley at Mascali (Minissale & Spampinato, 1990).

Structure and ecology: The clear and well-oxygenated waters of streams and ditches, which maintains a fairly low temperature even during the summer, are colonized by a particular hydrophilic vegetation, where *Ranunculus penicillatus* shows a dominant role from the physiognomic point of view. The floristic composition of this vegetation is also defined by other species of the *Ranunculion fluitantis* alliance and related order, such as *Callitriche stagnalis*, *Ranunculus trichophyllus*, *Potamogeton nodosus* and *P. pectinatus*, as well as some typical species of the shores, such as *Helosciadium nodiflorum*, *Berula erecta* and *Nasturtium officinale* with peculiar morphological adaptations to current waters (Brullo & Spampinato, 1990). From the catenal point of view, the *Ranunculetum penicillati* take contact along the shores with the *Polygono salicifolii-Phragmitetum* and with the pleustophytic vegetation of the *Lemnetea minoris* class.

Syndynamism: Potentially, this association represents a permanent community. However, the modification in the water systems of streams can affect its conservation. In fact the massive water withdrawals since 1989 in Fiumefreddo river, and the consequent summer drying, have led to its almost total disappearance from this stand (Minissale & Spampinato, 1990).

Habitat reference: See order.

3.2.2.2. ***Potamogetono crispi-Ranunculetum trichophylli*** Imchenetzky 1926

Vegetation with threadleaf crowfoot of stagnant or slowly flowing waters.

Synonyms: *Ranunculus trichophyllus-Callitriche polymorpha* Assoziation Soò 1927 (art. 2b); *Potamogetono-Ranunculetum trichophylli* G. Montserrat 1986 nom. prov. (art. 3b); *Callitricho-Ranunculetum trichophylli* Soò 1949 syntax. syn. (art. 3a); *Ranunculetum trichophylli* Melendo, Cano & F. Valle 2003 syntax. syn. (art. 3a); *Ranunculetum trichophylli* (Soò 1949) Julve 2006 syntax. syn. (art. 3a).

Lectotypus: Not designated.

Characteristic and differential species: *Ranunculus trichophyllus* Chaix.

Phytosociological table: 2 rel. unpublished., small lakes of Monte Colla near Floresta, 5.5.2014.

Char. association: *Ranunculus trichophyllus* (2).

Geographical distribution: The association has an almost cosmopolitan distribution and in Europe it is reported in many countries, such as Spain (Rivas-Martinez et al., 2001), France (Ferrez et al., 2009), Germany (Berg et al., 2004), Poland (Nowak & Nowak, 2007), Austria (Grabherr & Mucina, 1993), Italy (Tomaselli et al., 2006; Lastrucci et al., 2010), Serbia (Lakušić et al., 2005), etc. In Sicily the *Potamogetono crispi-Ranunculetum trichophylli* was reported generically by Brullo et al. (2002) as *Ranunculetum trichophylli* Soò 1927, showing a wide distribution in hilly and mountainous territories of the island.

Structure and ecology: The stagnant or slowly flowing waters of ditches, ponds and small artificial lakes, characterized by clayey bottoms and rich in organic matter that make the water quite turbid, are sometimes colonized by almost monospecific populations of *Ranunculus trichophyllus*, a basophilous species well adapted to the aquatic environment with leaves completely submerged (Šumberová, 2011). This community is referred to the *Potamogetono crispi-Ranunculetum trichophylli*, a vegetation linked to shallow (not more than 0.5 m) and cool waters, usually meso-oligotrophic but sometimes subject to considerable eutrophication and able to tolerate summer drying (Melendo et al., 2003).

Syndynamism: *Ranunculus trichophyllus* is a pioneer species that quickly colonizes newly formed ponds and especially artificial environments. For this reason, the association at issue generally represents one of the first stages in the colonization of humid environments, although often due to anthropic disturbance and in particular for the pollution and turbidity of waters, tends to become a permanent community (Barrat-Segretain & Bornet, 2000).

Habitat reference: See order.

3.3. Order: ***Zannichellietalia pedicellatae*** Schaminée, Lanjouw & Schipper ex Mucina & Theurillat in Mucina et al. 2016

Vegetation with rooted submerged macrophytes (elodeids) of meso-eutrophic brackish or fresh waters.

Synonyms: *Zannichellietalia pedicellatae* Schaminée, Lanjouw & Schipper 1990 (art. 2b); *Zannichellietalia pedicellatae* Rodwell et al. 2002 (art. 2b, 5).

Holotypus: *Zannichellion pedicellatae* Schaminée, Lanjouw & Schipper ex Passarge 1996.

Characteristic and differential species: *Najas marina* L., *Zannichellia palustris* L.

Geographical distribution: This order shows a cosmopolitan distribution, mainly in temperate areas, while in Sicily it is slightly diversified and quite rare.

Structure and ecology: The communities referred to *Zannichellietalia pedicellatae* order are linked to brackish (sometimes fresh), stagnant or current waters, and are characterized by the dominance of some elodeids, generally belonging to the genus *Zannichellia*. Some authors (Rivas Martinez et al., 2001; Biondi et al., 2014) suggest to consider *Zannichellietalia*

pedicellatae as synonym of *Ruppietalia maritimae* Tüxen ex Den Hartog & Segal 1964, although recently Mucina et al. (2016) re-evaluated the order, attributing it to the *Potametea pectinati* class.

Syndynamism: Associations belonging to this order represent a permanent vegetation in the absence of anthropic disturbance.

Habitat reference: C1.5 Permanent inland saline and brackish waterbody; C2.3 Permanent non-tidal, smooth-flowing watercourse.

3.3.1. Alliance: ***Zannichellion pedicellatae*** Schaminée, Lanjouw & Schipper ex Passarge 1996

Vegetation with perennial or annual elodeids of brackish or fresh waters.

Synonyms: *Zannichellion pedunculatae* Segal 1963*; Najadion marinae* Lakùsic 1975 (art. 2b)*; Najadion* Passarge 1978 (art. 2b); *Zannichellion palustris* Passarge 1978 (art. 2b); *Zannichellion pedicellatae* Schaminée et al. 1990 (art. 2b); *Zannichellion pedicellatae* Schipper et al. 1995 (art. 5).

Holotypus: *Zannichellietum pedicellatae* Nordhagen 1954

Characteristic and differential species: See order.

Geographical distribution: See order.

Structure and ecology: The alliance at issue brings together the plant communities dominated by one or few species of deep-rooted hydrophytes that colonize brackish or fresh waters, often subject to significant changes in salinity and with a high degree of eutrophication (Pott, 1995).

Syndynamism: See order.

Habitat reference: See order.

3.3.1.1. ***Zannichellietum obtusifoliae*** Brullo & Spampinato 1990

Vegetation with horned pondweed of calm or slowly flowing waters.

Synonyms: *Chareto-Zannichellietum palustris* Sortino et al. 1974, nom. provv.

Holotypus: rel. 4, tab. 27, Brullo & Spampinato (1990).

Characteristic and differential species: *Zannichellia obtusifolia* Talavera & al.

Phytosociological table: From Barbagallo et al. (1979), table 27, 6 rel.
Char. association: *Zannichellia obtusifolia* (V).

Char. order and class: *Myriophyllum spicatum* (IV), *Potamogeton crispus* (II), *Potamogeton natans* (I).

Other species: *Chara vulgaris* (IV), *Veronica anagallis-aquatica* (I), *Apium nodiflorum* (I), *Chlorophycea* sp. (I), *Cyanophycea* sp. (I).

Geographical distribution: This association represents a southern vicariant of the *Parvo-Potamo-Zannichellietum pedicellatae* Soó 1947 (= *Zannichellietum palustris* Lang 1967), a syntaxon known from western and central Europe (Meriaux, 1978; Pott, 1995; Rivas-Martinez et al., 2009), and and also from Russia (Korotkov et al., 1991; Jamalov et al., 2004). In Sicily it is known from Hyblaean Mountains (Barbagallo et al., 1979b; Brullo & Spampinato, 1990); Piana del Signore near Gela (Sciandrello, 2007) and Sicani Mountains along the high course of Sosio and Platani rivers (Sortino et al., 1974; Brullo & Spampinato, 1990).

Structure and ecology: The muddy bottoms of the river stretches with low hydrodynamism and sloping, are colonized by a peculiar submerged vegetation referred to *Zannichellietum obtusifoliae*. The association prefers shallow waters (20-50 cm), fresh or slightly salt, generally calm or sometimes slowly flowing. From a floristic point of view, this community is characterized by the dominance of *Zannichellia obtusifolia*, associated with only few other typical hydrophytes of the *Potametea* class, such as *Myriophyllum spicatum*, *Potamogeton crispus P. natans*, *Chara vulgaris* and other algal species (Brullo & Spampinato, 1990). This vegetation can show catenal contact with monospecific populations of *Potamogeton natans* in the deepest stretches and with different hygrophilous communities settling on the edge of the watercourse, as *Cyperetum longi* and *Helosciadietum nodiflori*, while in presence of higher dynamism it is replaced by various types of bryophytic vegetation, as *Oxyrrhychietum rusciformis* Kaiser ex Hubschman 1953. that colonizes the large submerged rocks (Barbagallo et al., 1979b).

Syndynamism: *Zannichellietum obtusifoliae* is a mainly spring-summer vegetation, so its presence is closely linked to permanent water even during the period of aridity, condition that occurs only in a few streams of Sicily. In fact, if there is a marked summer drying, it is replaced by other aspects such as the *Ranunculion aquatilis* communities in freshwater or by *Enteromorpho intestinalidis-Ruppietum maritimae* Westhoff ex R.Tx. & Böckelmann 1957 in presence of salt waters (Sciandrello, 2007).

Habitat reference: See order.

3.3.1.2. ***Najadetum marinae*** Fukarek 1961

Vegetation with spiny water nymph of shallow fresh waters rich in nitrates.

Synonyms: *Najadetum marinae* Libbert 1932 (phantom); *Najadeto-Potametum acutifolii* Slavnić 1956; *Potamo-Najadetum* Horvatić et Micevski in Horvatić 1963 p. p.; *Najadetum marinae* Philippi 1969.

Lectotypus: Not designated.

Characteristic and differential species: *Najas marina* L.

Phytosociological table: From Sciandrello (2009), table 2, 6 rel.
Char. association: *Najas marina* (V).
Char. class: *Myriophyllum verticillatum* (IV), *Potamogeton crispus* (III).

Geographical distribution: The syntaxon at issue has a cosmopolitan distribution in temperate and subtropical areas of all continents, while in Italy it is more common in the central and southern parts (Iberite et al., 1995; Ceschin & Salerno, 2008). In Sicily, the association is very rare, being only reported for the Cimia artificial lake near Mazzarino in Central Sicily (Sciandrello, 2009).

Structure and ecology: The shallow water basins, with a high amount of minerals and nitrates, are sometimes covered by a dense partially submerged vegetation with *Najas marina*. It is often associated with other hydrophytes typical of *Potametea* class, such as *Potamogeton crispum* and *Myriophyllum verticillatum*. This community, referred to *Najadetum marinae*, grows on silty-clay bottoms of sunny lakes and has its optimum during the summer period (Sciandrello, 2009).

Syndynamism: From the dynamic point of view, some communities of *Charetea* and *Potametea* (e.g. *Ceratophylletum demersi*) tend to be replaced by the *Najadetum marinae* if increase the concentrations of nitrates in the water (Ceschin & Salerno, 2008).

Habitat reference: See order.

3.4. Order: ***Utricularietalia minoris*** Den Hartog & Segal 1964

Vegetation with utricularides and ceratophyllides of stagnant water, from oligotrophic to eutrophic type.

Synonyms: *Lemno-Utricularietalia vulgaris* Passarge 1978 (syntax. syn.).

Holotypus: *Utricularion vulgaris* Passarge 1964

Characteristic and differential species: *Ceratophyllum demersum* L., *Utricularia australis* R. Br.*, U. vulgaris* L.

Geographical distribution: The order has a wide distribution in temperate zones of all the world, while in Sicily its occurrence is limited to the mountainous areas of the northern part (Minissale & Spampinato, 1987; Brullo et al., 1994; Raimondo et al., 2004).

Structure and ecology: This order includes the aquatic vegetation communities characterized by the dominance of peculiar hydrophytes (utricularides and ceratophyllides sensu Den Hartog & Segal, 1964), without a true radical system and able to remain submerged throughout most of the vegetative season, excluding the reproductive period, when they expose flower scapes to the surface. Generally, it is a vegetation closely linked to ponds or

small lakes with moderately to weakly acidic nutrient-poor waters, only rarely growing also in eutrophic waters (Müller, 1977; Schratt, 1993; Pott, 1995). From a syntaxonomical point of view, the arrangement is still controversial. In fact, some authors (see Mucina et al., 2016) do not recognize the validity of *Utricularietalia* minoris, proposing the attribution of its syntaxa to the *Lemnetalia* order (*Lemnetea* class), highlighting the significant presence of pleustophytes in the floristic set of these communities. However, for the peculiar structure and ecology of these phytocenoses, the definition of an autonomous order within the *Potametea* class results more consistent, as reported by many authors (Rivas-Martinez et al., 2001; Matuszkiewicz 2007; Biondi et al 2014).

Syndynamism: The communities belonging to *Utricularietalia minoris* show a permanent character, but their presence is allowed by water with a low content of organic matter and therefore represent a good environmental conservation index (Lukàcs & Tóthmérész 2009).

Habitat reference: C1.4 Permanent dystrophic waterbody.

3.4.1. Alliance: ***Utricularion vulgaris*** Passarge 1964

Vegetation with bladderworts of oligotrophic stagnant waters.

Characteristic and differential species: *Utricularia australis* R. Br.*, U. vulgaris* L.

Holotypus: *Lemno minoris-Utricularietum vulgaris* Soó ex Passarge 1964.

Geographical distribution: See order.

Structure and ecology: The shallow ponds characterized by limpid oligotrophic or dystrophic (more rarely mesotrophic) waters, that don't dry during the summer period, are colonized by communities dominated by *Utricularia australis* or *U. vulgaris*. These coenoses, referring to the *Utricularion vulgaris* alliance, prefer mountain areas, generally above 1000 m of altitude, with a quite significant amount of rainfall (Šumberová, 2011). Their physiognomy is defined by the occurrence of utricularids, peculiar hydrophytes with over-water flowers, finely divided leaves and vesicles suitable for the capture and digestion of microorganisms and small aquatic invetebrates (Sburlino et al., 2004), often associated with pleustophytes or more rarely with nympheids.

Syndynamism: See order.

Habitat reference: See order.

3.4.1.1. ***Utricularietum australis*** Müller & Görs 1960

Vegetation with southern bladderworts of stagnant waters of mesotrophic to oligotrophic type.

Synonyms: *Lemno-Utricularietum neglectae* (Müller & Görs 1960) Passarge 1978 (nom. superf., art. 29c); *Potamo-Utricularietum australis* (Müller & Görs 1960) Passarge 1996; *Potamo-Utricularietum australis* Br.-Bl. in Br.-Bl., Roussine & Nègre 1952 corr. Rivas-Martinez et al. 2002 (nom. ambig., art. 36); *Utricularia-Potametum natantis* Raimondo, Marino & Schicchi 2011 (syntax. sin., art. 3a).

Lectotypus: rel. 6, tab. 1, Passarge (1978).

Characteristic and differential species: *Utricularia australis* R. Br.

Phytosociological table: From Brullo et al. (1994), table 13, 18 rel.

Char. association: *Utricularia australis* (V).

Char. class: *Potamogeton natans* (V)*, Myriophyllum verticillatum* (II)*, Potamogeton pusillus* (II)*, Callitriche obtusangula* (II), *Myriophyllum alterniflorum* (II)*, Apium inundatum* (I), *Callitriche hamulata* (I)*, Groenlandia densa* (I), *Potamogeton filiformis* (I).

Other species: *Glyceria spicata* (I), *Lythrum portula* (I), *Alopecurus aequalis* (I), *Eleocharis palustris* (I).

Geographical distribution: The association, showing an almost cosmopolitan distribution in the temperate areas, in Sicily is very rare and localized on the Nebrodi (Monte Soro area) and Madonie mountains (Brullo et al., 1994).

Structure and ecology: The lacustrine surfaces localized in the meso-supramediterranean belt (generally at an altitude of 1000 m above sea level) are sometimes colonized by a peculiar hydrophytic vegetation whose physiognomy is defined by the dominance of *Utricularia australis*, often associated with *Potamogeton natans* and *P. pusillus* (Fig 21 and 22). This plant community, referred to the *Utricularietum australis*, prefers stagnant oligo-mesotrophic waters, with a depth of 0.5-2 m. It has catenal contacts with the *Myriophylletum verticillati* towards the deepest part of the basin (where present), while on the banks it is replaced by the *Myriophylletum alterniflori* or by communities of the *Alopecuro-Glycerion spicatae* (Brullo et al., 1994). Raimondo et al. (2011) attributed the community characterized by the dominance of *Utricularia vulgaris* from the Nebrodi Mountains to another association, named *Utricularia-Potametum natantis*, which however for its floristic-structural and ecological characteristics does not clearly distinguishes from the syntaxon at issue. Under the nomenclatural profile, the name *Potamo-Utricularietum* Br.-Bl. in Br.-Bl., Roussine & Nègre 1952 has the priority over *Utricularietum australis*, since older, but the author does not specify the species of *Utricularia* and in the area form where the association was reported there are more taxa belonging to this genus. Later, Rivas-Martinez et al. (2002) have corrected the name, arbitrarily indicating *Utricularia australis* in the syntaxon name, while in the original relevès of Br.-Bl. only *U. vulgaris* is reported, which also has lower coverage values than *Hydrocharis morsus-ranae*, making the interpretation of this syntaxon really doubtful (Šumberová, 2011).

Syndynamism: See order.

Habitat reference: See order.

3.4.2. Alliance: ***Ceratophyllion demersi*** Den Hartog & Segal ex Passarge 1996

Vegetation with hornwort of eutrophic waters.

Synonyms: *Ceratophyllion demersi* Soò 1928 (nom. nud. art. 2b, 7); *Ceratophyllion demersi* Hartog & Segal 1964 (nom. nud., art. 2b, 7).

Holotypus: *Ceratophylletum demersi* Hild 1956.

Characteristic and differential species: *Ceratophyllum demersum* L.*, C. submersum* L..

Geographical distribution: The associations belonging to this alliance have a wide distribution in the European territory (Sburlino et al., 2004), while in Sicily they are known from the Hyblaean territory (Barbagallo et al., 1979a; Pavone et al., 2007) and Madonie Mountains (Raimondo et al., 2004).

Structure and ecology: This alliance brings together all the communities characterized by the dominance of large pleustophytes, the ceratophyllides, which can grow indifferently on the surface or on the bottom of the pond. However, in the second case they do not develop a true root systems, but only rhizoids useful for anchoring to the soil. They are well adapted to the water life with a low transparency and tolerate a high concentration of nutrients, reaching their optimum in mesotrophic to eutrophic waters (Felzines, 2012). From a structural point of view, the syntaxa of the *Ceratophyllion demersi* clearly differ from the other pleustophytic communities, since often the species belonging to *Ceratophyllum* genus (e.g. *C. demersum*, *C. submersum*) grow in benthic form at the bottom of the lakes, where constitute dense monospecific communities and only occasionally associated with other species. In particular, when the species of the genus *Ceratophyllum* have a benthic ecology, only few species occur, such as *Myriophyllum spicatum*, *Potamogeton pectinatus* and sometimes some carophytes. Conversely, when they show a floating habitus near the banks of the lakes or in canals and rivers, there are other pleustophytes, such as *Lemna minor* and *L. gibba* and also nympheids (*Potamogeton* sp.pl.) and helophytes (Biondi & Blasi, 2015). Anyway, the syntaxonomic classification of the alliance remains controversial, as for instance Schratt (1993) includes it in the *Lemnetea* class, since he considered it a predominantly pleustophytic vegetation, while many authors (Mŭller, 1977, Pott 1995) prefer to place it within the *Potametea*. Finally, Felzines (2012) attributes the communities dominated by *Ceratophyllum* sp. pl. to the sub-alliance *Ceratophyllenion demersi*, within the *Hydrocharition morsus-ranae* Rübel ex Klika in Klika & Hadaë 1944 (*Lemnetea* class).

Syndynamism: Some communities belonging to this alliance are expanding due to water eutrophication, but they are still uncommon and localized communities.

Habitat reference: See order.

3.4.2.1. ***Ceratophylletum demersi*** Corillion 1957

Sumbmerged vegetation with rigid hornwort of eutrophic and shallow waters.

Synonyms: *Ceratophyllum demersi* soz. Soó 1927 (nom. nud., art. 2b); *Ceratophylletum demersi* Eggler 1933 (nom. nud., art. 2b); Gesellschaft mit *Ceratophyllum demersum* ex Hild 1956 (art. 3c); *Ceratophylletum demersi* Oberd. 1977; *Ceratophylletum demersi* den Hartog et Segal 1964 (nom. nud., art 2b).

Lectotypus: rel. pg. 646, Passarge (1995)

Characteristic and differential species: *Ceratophyllum demersum* L.

Phytosociological table: From Barbagallo et al. (1979), table 5, 3 rel.

Char. association: *Ceratophyllum demersum* (3).

Char. class: *Myriophyllum verticillatum* (3)*, Zannichellia palustris* (3)*, Potamogeton crispus* (2), *Potamogeton natans* (1).

Other species: *Enteromorpha intestinalis* (3)*, Enteromorpha prolifera* (3), *Nasturtium officinale* (2),

Geographical distribution: This association is quoted from the Ciane river near Syracuse and Madonie mountains (Barbagallo et al., 1979a; Raimondo et al., 2004; Pavone et al., 2007).

Structure and ecology: The *Ceratophylletum demersi* is linked to waters with a high content of nutrients and not deeper than 1 m, generally in stands shaded by pleustophytes or tree plants (Seliskar, 1983). It prefers the calm waters of shallow lakes and also of rivers and canals, where it forms a dense submerged or semi-submerged mass (sometimes below the pleustophytic layer), consisting mainly of *Ceratophyllum demersum*, often associated with other hydrophytes of *Potametea* class, such as *Myriophyllum verticillatum*, *Zannichellia palustris*, *Potamogeton crispus* and *P. natans*, as well as various carophytes (Barbagallo et al., 1979a). Some authors (Mŭller, 1977, Pott 1995) do not recognize the association rank of this community, considering it a simple grouping, since the characteristic species (*C. demersum*) frequently occurs in other communities.

Syndynamism: The eutrophication of the aquatic environment favors the settlement of this community, which however does not tolerate the mechanical disturbance of the pond. In absence of human actions, the community assumes a pioneering role, allowing the purification of the waters that later can be colonized by more mature aspects (Fair & Meeke, 1983). Moreover, *Ceratophyllum demersum* is a species with markedly sciaphilous requirements, thus the degradation of the tree vegetation (for example the riparian forest) can cause its disappearance, favoring more heliophilous aspects (Best & Van Der Werf, 1986).

Habitat reference: See order.

4. Class: ***Halodulo wrightii-Thalassietea testudinum*** Den Hartog ex Rivas-Martínez, Fernàndez Gonzàlez & Loidi 1999

Vegetation of eel-grass swards on muddy and sandy substrates of subtropical and tropical seas fringing Atlantic Ocean.

Synonyms: *Halophilo-Cymodoceetea* Knapp 1968 (art. 2b); *Halodulo-Thalassietea* Den Hartog 1976 (art. 2b).

Holotypus: *Thalassio testudinum-Syringodietalia filiformis* Borhidi, Muñiz & Del Risco in Borhidi 1996 (art. 4a.).

Characteristic and differential species: *Cymodocea nodosa* (Ucria) Asch.

Geographical distribution: The class has a distribution centred in the warm seas of tropical areas, while more sporadically it is found in the subtropical territories, such as Red Sea, Persian Gulf, Bermuda, Mexico, Canary Islands, etc. Its presence is even rarer in temperate seas, where its development is possible only under the influence of hot currents (Mucina et al., 2016).

Structure and ecology: The syntaxon brings together the marine communities of the infralittoral belt, consisting mainly of cormophytes and macrotallites, which colonize the sandy and muddy bottoms of the calm waters near the coast, but also lagoons and estuaries, at depths of approx 15-20 m (Costa et al., 2012). These communities are quite common in submerged sandbanks, generally surrounded by deeper waters and may represent the submarine extension of sandy coasts or are anchored to rocky substrates distant from the coast, sometimes in areas protected by the *Poseidonia oceanica* meadows (Biondi et al., 2010). From the floristic point of view, this vegetation is generally characterized by the dominance of *Cymodocea nodosa*, associated with various species belonging to the genus *Caulerpa*, such as *C. prolifera*, a widespread algae in tropical and subtropical seas (Cormaci et al., 2014; Wynne, 2017).

Syndynamism: The seagrass communities of the *Halodulo wrightii-Thalassietea testudinum* may have catenal contacts with several aspects of the infralittoral belt vegetation, such the photophilous ones of *Cystoseiretea* or even with the sciaphilous ones of the *Lithophylletea* class. Sometimes, they have serial relationships with the *Posidonion oceanicae* vegetation, representing a stage in the dynamic series of the *Posidonietum oceanicae* (Biondi et al., 2010).

Habitat reference: A5.53 Seagrass beds (other than *Posidonia*) on Mediterranean infralittoral bottoms.

4.1. Order: ***Thalassio-Syringodetalia filiformis*** Knapp ex Borhidi et al. 1979

Infralittoral and benthic vegetation of eel-grass swards on muddy and sandy substrates.

Synonyms: *Thalassio-Syringodetalia filiformis* Knapp 1964 (art. 2b); *Halophilo-Cymodoceetalia* Knapp 1968 (art. 2b); *Thalassietalia* Den Hartog 1976 (art. 2b).

Holotypus: *Syringodio-Thalassion* Borhidi in Borhidi et al. 1979.

Geographical distribution: See class.

Characteristic and differential species: See class.

Structure and ecology: See class.

Syndynamism: See class.

Habitat reference: See class.

4.1.1. Alliance: ***Cymodoceion nodosae*** Den Hartog ex Mucina in Mucina et al. 2016

Pioneer vegetation with eel-grass swards on muddy and sandy substrates of the sublittoral belt.

Synonyms: *Cymodoceion nodosae* Den Hartog 1976 (art. 2b); *Syringodio-Thalassion testudinum* Borhidi 1996 (sensu Rivas-Martınez et al. 1999).

Holotypus: *Cymodoceetum nodosae* Giaccone & Pignatti 1967.

Characteristic and differential species: *Cymodocea nodosa* (Ucria) Asch., *Halophila stipulacea* (Forssk.) Asch.

Geographical distribution: The communities belonging to this alliance are distributed in the tropical and subtropical areas of the Atlantic and Mediterranean sea (Costa et al., 2012).

Structure and ecology: The alliance at issue includes the pioneer vegetation with *Cymodocea nodosa,* which colonizes the seabeds with muddy and sandy substrata, from the supralittoral zone up the infralitoral ones, reaching depth of 10-12 m in the calmest sandy coasts (Costa et al., 2012). Previously, the communities with *Cymodocea nodosa* had been included within the *Syringodio-Thalassion testudinum* Borhidi 1996, while, according to Den Hartog (2003), this alliance comprises only some communities that are distributed in the Gulf of Mexico and the Caribbean Sea.

Syndynamism: See class.

Habitat reference: See class.

4.1.1.1. ***Cymodoceetum nodosae*** Giaccone & Pignatti 1967

Pioneer vegetation with eel-grass swards on sandy substrata.

Synonyms: Associàtion à *Cymodocea nodosa* Feldmann 1938; *Cymodoceo nodosae-Zosteretum marinae* (Feldmann 1938) Br.-Bl., Roussine & Nègre 1952.

Lectotypus: rel. 71, tab. 6, Giaccone & Pignatti (1967), designated by Giaccone et al. (1994).

Characteristic and differential species: *Cymodocea nodosa* (Ucria) Asch.

Phytosociological table: From Sortino (1967), rel. pg. 101, facies a *Cymodocea major*.

Char. association and class: *Cymodocea nodosa* (1).

Other species: *Zostera noltii* (1), *Ceramium tenerimmum* (1), *Ectocarpus confervoides* (1), *Erythrotrichia carnea* (1), *Polysifonia opaca* (1), *Scytosiphon lomentaria* (1).

Geographical distribution: The association is well represented in the Mediterranean Sea and in the Atlantic Ocean, from the south of Portugal to Mauritania (Borum & Greve, 2004). In Sicily the populations of *Cymodocea nodosa* are frequent in the sea around the coasts of many stands on the island, such as Trapani, Palermo, Syracuse, Linosa, Palma di Montechiaro and also in the adjacent small archipelagos (Giardina et al., 2007). Its presence is less common on the lagoons and salt marshes, as those one of Marinello (Licandro et al., 2011), Trapani (Ponzo, 1900) and Stagnone near Marsala (Calvo et al., 2009).

Structure and ecology: Dense meadow of *Cymodocea nodosa*, generally associated with numerous algal species occurs usually on the sandy-silty bottoms of the infralittoral belt, at a depth of 5-10 m, exceptionally up to 35 m (Sortino, 1967). This paucispecific association, referred to *Cymodoceetum nodosae*, prefers substrates with poorly oxidized fine sands or even muddy sands (Giaccone & Pignatti, 1967). It is particularly frequent in the seabeds near inlets and ports, but it has been reported also in the lagoons quite deep and directly connected with the sea, being able in this last case to come into contact with some species of the *Ruppietea maritimae* class, such as *Ruppia maritima* and *R. cirrhosa* (Licandro et al., 2011). According to Augier (1982), it is possible to identify two facies within the *Cymodoceetum nodosae*: the first is exclusive to the warmer areas of the Mediterranean and is characterized by *Caulerpa prolifera*, while the facies with *Halophila stipulacea*.

Syndynamism: *Cymodocea nodosa* is generally considered a species with a markedly pioneer requirements (Caye & Meinesz, 1986; Marba et al., 1996). In particular, it shows a remarkable adaptability to variations in environmental conditions that allows it to colonize unstable surfaces and incoherent substrates with a low degree of organic matter, sometimes subject to considerable hydrodynamics or landslides, in which *Poseidonia oceanica* is not able to grows (Cancemi et al., 2002). Moreover, the occurrence of the *Cymodoceetum nodosae*, thanks to the action of its rhizomes favors the stabilization of the substratum for the following settlement of *Poseidonia oceanica* (Sortino, 1967).

Habitat reference: See class.

4.1.1.2. ***Halophiletum stipulaceae*** Augier ex Brullo in Brullo et al. 2020

Vegetation with broadleaf seagrass of deep seabeds with sandy substrata.

Synonyms: *Halophiletum stipulaceae* Augier 1982 ass. provv.; *Cymodocietum nodosae* facies a *Halophila stipulacea* Licandro et al. 2011, nom. inval.

Holotypus: Rel. 3, tab.11, Licandro et al. (2011).

Characteristic and differential species: *Halophila stipulacea* (Forssk.) Asch.

Phytosociological table: From Licandro et al. (2011), table 11, 2 rel.
Char. association: *Halophila stipulacea* (2).
Char. alliance: *Cymodocea nodosa* (2).
Other species: *Ruppia cirrhosa* (2).

Geographical distribution: *Halophila stipulacea*, the taxon characterizing this association, is native to the Indian Ocean, so in the Mediterranean area it must be considered an exotic species. It is considered one of the oldest lessepsian migrants (Fritsch, 1895), firstly spreading in the eastern Mediterranean area (Ledoyer, 1966; Harmelin, 1969; Den Hartog, 1970; Haritonidis & Diapoulis, 1990) and later also in the central-western part , including the sea around Sicily. On the island this vegetation has been reported mainly in the eastern coast near the lakes of Marinello, Riposto, Catania, Naxos and Vulcano (Villari, 1988; Biliotti & Abdelahad, 1990; Alongi et al., 1993; Cancemi et al., 1994; Acunto et al., 1995; Di Martino, 2001; Licandro et al., 2011), while in the western part it is currently known only for Termini Imerese (Romano, 2004).

Structure and ecology: The vegetation with *Halophila stipulacea* was recorded for the first time by Augier (1982) as *Halophiletum stipulaceae* ass. provv., whereas only later Meinesz et al. (1983) report the *Halophiletum stipulaceae* to the rank of association, but it is a *nomen nudum.* Recently, Brullo et al. (2020) describe validly this syntaxon as a new association. It is a community that is linked to the sandy seabed with very fine sediments, at depths ranging from 3 to 30 (-50) m. In stations with shallow water *Halophila stipulacea* is often mixed with *Cymodocea nodosa* and *Caulerpa prolifera*, while with increasing depth and inclination it tends to form dense, more or less monophytic meadows (Acunto et al., 1995).

Syndynamism: The progressive spread of this vegetation in the Mediterranean area seem to be linked to the increase in the average water temperature observed in the last decades (Francour et al., 1994). *Halophila stipulacea* shows an ecology similar to that one of *Cymodocea nodosa*, with which it often competes, causing a significant impoverishment of the *Cymodoceetum nodosae* (Sghaier et al., 2014).

Habitat reference: See class.

5. Class: ***Zostheretea marinae*** Pignatti 1953

Vegetation of seagrass meadows on muddy or sandy submerged substrates of lagoon, estuaries and coastal platforms.

Synonyms: *Posidonietea* nom. nud. Den Hartog 1976 (art. 2b), *Posidonietea* Den Hartog ex Gèhu in Bardat et al. 2004 (art. 2b), *Posidonietea oceanicae* Den Hartog ex Mucina in Mucina et al. 2016 (syntax. syn.).

Holotypus: *Zosteretalia* Bèguinot ex Pignatti 1953.

Characteristic and differential species: *Posidonia oceanica* (L.) Delile, *Zostera marina* L., *Zostera noltii* Hornem.

Geographical distribution: This class is represented in all the temperate sea coasts of Europe, including the Atlantic Ocean (Mucina et al., 2016).

Structure and ecology: The class groups the seagrass plant communities occurring in the sea bottoms from the eulittoral to the infralittoral belts or in the lagoons with deep waters (0.3 up 35 m). Their structure is definied by seagrass, which root on sandy and muddy bottoms (Costa et al., 2012). The class *Posidonietea*, invalidly described by Den Hartog 1976, is here referred by Mucina et al. (2016).

Syndynamism: These communities represent a permanent vegetation, apparently not subject to serial dynamism.

Habitat reference: A5.53 Seagrass beds (other than Posidonia) on Mediterranean infralittoral sand; A5.535 Posidonia beds in the Mediterranean infralittoral zone.

5.1. Order: ***Zosteretalia marinae*** Béguinot ex Pignatti 1953

Sea-grass meadows of the sandy-muddy sublittoral of temperate sea coasts.

Synonyms: *Zosteretalia* Bèguinot 1941 (art. 2b); *Nanozosteretalia* Den Hartog 2003 (art. 2b, 5).

Holotypus: *Zosterion* Br.-Bl. & R. Tx, ex Pignatti 1953.

Characteristic and differential species: *Zostera marina* L., *Zostera noltii* Hornem.

Geographical distribution: The communities of the *Zosteretalia marinae* order are mainly distributed in the temperate-cold sea coasts of Europe, including the Arctic ones and the Atlantic Ocean, becoming more sporadic in the Mediterranean area (Costa et al., 2009; Mucina et al., 2016) .

Structure and ecology: The banks of muddy sands located in areas less subject to sea currents and with shallow waters (not more than 5 m deep) are colonized by the marine

meadows belonging to this order (Pignatti, 1953, Minissale et al., 2010). From a structural point of view, the physiognomy of these communities is determined by the presence of "Magnozosterids", peculiar marine cormophytes characterized by large linear leaves and non-persistent basal sheaths, such as several species of *Zostera* genus (Den Hartog & Van der Velde, 1988).

Syndynamism: See class.

Habitat reference: A5.53 Seagrass beds (other than Posidonia) on Mediterranean infralittoral sand.

5.1.1. Alliance: ***Zosterion marinae*** Br.-Bl. & R. Tx. ex Pignatti 1953

Vegetation of perennial seagrass meadows of the sandy-muddy bottoms in the eulittoral and infralittoral belt.

Synonyms: *Zosterion* Christiansen 1934 (art. 2b); *Zosterion* Br.-Bl. & R. Tx. 1943 (art. 2b), *Zosterion balticum* Luther 1951 (art. 34a).

Holotypus: *Zosteretum marinae* van Goor ex Pignatti 1953.

Characteristic and differential species: *Zostera marina* L.

Geographical distribution: The communities belonging to this alliace result mostly distributed in the Atlantic Ocean and in the Mediterranean basin, reaching also the Arctic sea (Biondi et al., 2014).

Structure and ecology: The alliance at issue comprises the communities dominated by perennial marine cormophytes and in particular by *Zostera marina*. This is a vegetation that grows on sandy or muddy bottoms in calm and shallow waters with salinity over 1,5%-2,0% (Den Hartog, 2003; Biondi et al., 2014).

Syndynamism: See class.

Habitat reference: See order.

5.1.1.1. ***Zosteretum marinae*** van Goor ex Pignatti 1953.

Community with common eelgrass of marine waters slightly oxygenated and subject to intake of fresh water.

Synonyms: *Zosteretum marinae* Borgesen 1905 ex van Goor 1921 (phantom name); *Zosteretum marinae* (Borgesen 1905) Harmsen 1936.

Lectotypus: Not designated.

Characteristic and differential species: *Zostera marina* L.

Phytosociological table: No relevés.

Geographical distribution: The association, occuring throughout Europe (Rodwell, 1991), in Sicily is recorded only for the coast around the small island of «Isola Grande dello Stagnone» near Marsala (Brullo & Di Martino, 1974).

Structure and ecology: The paucispecific community dominated by *Zostera marina*, which is sometimes associated which some algal species of the *Enteromorpha* genus, is reffered to the *Zosteretum marinae*. This association grows on the sandy-gravelly sea beds with moderate depths (1-4 m), affected by the contribution of fresh waters that maintain a rather low salinity, generally near estuaries or canals (Rodwell, 2000, Minissale 2010).

Syndynamism: Although it is a permanent community from the dynamic point of view, the introduction of alien species can cause a change in its natural habitat. Infact, in the 1930s the distribution of *Zostera marina* showed a notable decline in the European seabeds, probably due to the attack of a protozoan and a fungus (Butcher, 1941), while today the main threat is represented by some exotic algae such as *Sargassum muticum*, a Japanese native that tends to occupy the same environments of *Zostera marina* (Rodwell, 2000).

Habitat reference: See order.

5.1.2. Alliance: ***Nanozosterion noltii*** Den Hartog ex Mucina 2016

Vegetation of short-lived seagrass meadows of the sandy-muddy sea sublittoral of the cold-temperate and cool-temperate sea coasts.

Synonyms: *Nanozosterion* Den Hartog 2003 (art. 2b, 5).

Lectotypus: *Zosteretum nanae* Pignatti 1953

Characteristic and differential species: *Zostera noltii* Hornem.

Geographical distribution: The communities belonging to this alliance are distributed in all the sea coasts of Europe and in the Atlantic Ocean (Mucina et al., 2016).

Structure and ecology: The *Nanozosterion noltii* regards the vegetation dominated by ephemeral marine cormophytes and in particular by *Zostera noltii*. This species constitutes meadows on the bottoms with calm waters and sandy or muddy substrata (Den Hartog, 2003).

Syndynamism: See order.

Habitat reference: See order.

5.1.2.1. ***Nanozosteretum noltii*** Pignatti 1953

Ephemeral vegetation with dwarf eelgrass of calm waters.

Synonyms: *Zosteretum noltii* Harmsen 1936 nom. nud. (art. 2b, 8).

Lectotypus: Not designated.

Characteristic and differential species: *Zostera noltii* Hornem.

Phytosociological table: No relevés.

Geographical distribution: The *Zosteretum noltii* is known for most of the European seas (Gèhu 1975, Rodwell, 2000). The association is reported generically for the coasts of Sicily by Minissale et al. (2010), where *Zostera noltii,* characteristic species of this syntaxon, is quoted in various locality on the island, such as Palermo, Trapani and Palma di Montechiaro (see Giardina et al., 2007).

Structure and ecology: This association is represented by almost pure communities of *Zostera noltii*, a short-lived plant, whose leaves whose leaves create a delicate intertwining, only a few inches high, covering muddy bottoms made up of fine sediments subject to reductive processes (Pignatti, 1953). This vegetation is linked to calm seawaters, between the upper mesolittoral and the infralittoral belt, sometimes dry for more or less long periods, due to low tides. It occurs also in lagoon and marshes (Rodwell 2000).

Syndynamism: *Zostera noltii* is a species well adapted to abrupt ecological variations, such as prolonged periods of drying and considerable variations in salinity. Conversely, it tends to become more sporadic and to be replaced by other marine phanerogams when more stable conditions occur, especially in the deeper waters (Caniglia et al., 1992).

Habitat reference: See order.

5.2. Order: ***Posidonietalia marinae*** Den Hartog ex Mucina 2016

Perennial seagrass meadows of the sandy-rocky sublittoral of warm-temperate sea coasts.

Synonyms: *Halobenthalia* Chapman 1959 p. p. (art. 3d); *Posidonietalia* Den Hartog 1976 (art. 2b); *Posidonietalia oceanicae* Den Hartog ex Géhu in Bardat et al. 2004 (art. 2b).

Lectotypus: *Posidonion oceanicae* Br.-Bl. ex Molinier 1960.

Characteristic and differential species: *Posidonia oceanica* (Delile) L.

Geographical distribution: The order is distributed throughout the Mediterranean basin and in the adjacent areas of the Atlantic Ocean (Rivas-Martinez et al 2001, Biondi et al., 2014). In Sicily it is quite frequent in the sea surrounding the island, particularly along the north-western and south-eastern coasts (Calvo et al., 1995).

Structure and ecology: This syntaxon groups the seagrass communities of the infralittoral zone that are dominated by some peculiar fanerophytes with coriaceous leaves and sheaths that persist as fibrous bundles, such as *Posidonia oceanica* (Den Hartog & Van der Velde, 1988). This vegetation prefers the sandy or rocky bottoms of warm seas with quite salt waters (about 3,6%-3,9%) and up to 35-40 m deep (Rivas Martinez et al., 2001; Biondi et al., 2014).

Syndynamism: The communities belonging to *Posidonietalia marinae* represent the most advanced stage of benthic vegetation in the Mediterranean sea and are currently threatened by anthropic activities and in particular by boat anchors and trawlers, as well as by abusive discharges in marine-coastal waters (Biondi et al. , 2014).

Habitat reference: A5.535 Posidonia beds in the Mediterranean infralittoral zone.

5.2.1. Alliance: ***Posidonion oceanici*** Br.-Bl. ex Molinier 1960

Perennial sea-grass meadows of the sandy-rocky sublittoral of warm-temperate sea coasts.

Synonyms: *Posidonion* Br.-Bl. 1931 (art. 2b); *Posidonion oceanicae* Br.-Bl. 1933 (art. 2b); *Posidonion oceanicae* Br.-Bl. in Br.-Bl. et al 1947 (art. 2b); *Posidonion oceanicae* Br.-Bl. in Br.-Bl. et al. 1952 (art. 2b).

Holotypus: *Posidonietum oceanicae* Molinier 1960.

Characteristic and differential species: *Posidonia oceanica* (Delile) L.

Geographical distribution: See order.

Structure and ecology: See order.

Syndynamism: See order.

Habitat reference: See order.

5.2.1.1. ***Posidonietum oceanicae*** Molinier 1960

Neptune grass beds of Mediterranean sea.

Synonyms: *Posidonietum oceanicae* Br.-Bl. 1931 (nom. nud.); *Posidonietum oceanici* Br.-Bl. in Br.-Bl. et al 1947; *Posidonietum oceanici* (Br.-Bl. in Br.-Bl. et al. 1952) Wolff 1968 (syntaxa syn.).

Lectotypus: rel. 1, tab. 8, Molinier (1960).

Characteristic and differential species: *Posidonia oceanica* (Delile) L.

Phytosociological table: From Sortino (1967), pag. 104, 1 rel.

Char. association: *Posidonia oceanicae* (1).

Other species: *Melobesia farinosa* (1), *Melobesia lejolisii* (1), *Melobesia membranacea* (1), *Ectocarpus confervoides* (1), *Castagnea mediterranea* (1), *Ceramium tenuissimum* (1), *Acrosorium uncinatum* (1).

Geographical distribution: See order.

Structure and ecology: The *Posidonietum oceanicae* is a community dominated by the marine macrophyte *Posidonia oceanica*, which constitutes dense meadows in the infralittoral belt (often near its lower limit) on the seabed characterized by coarse sands and well oxidized sediments. It finds its optimum at a depth of 10-20 m, although it can also be developed at greater depths (Giaccone et al., 1994). However, this association is quite adaptable to different substrata, developing equally on sandy, muddy, gravelly bottoms or even on small rocky surfaces, but always requires sediments with a sufficient proportion of organic matter (Molinier & Picard, 1952). It also tolerates different conditions of hydrodynamism and temperature, however it is very demanding for salinity that must be between 3,6% and 3,9% (Minissale et al., 2010). The *Posidonia oceanica* meadows represent a highly complex ecosystem from the ecological point of view, supporting a high biodiversity and several other communities, such as the epiphytic algal formations that develop on the leaves and the sciaphilous aspects linked to the rhizomes (Molinier, 1960; Van der Ben 1971).

Syndynamism: The *Posidonietum oceanicae* represents the climax stage of benthic vegetation with phanerogams in the Mediterranean area (Molinier & Picard, 1952). However, the frequent disturbance caused by human activities has produced a drastic decline of this important coenosis in many areas (Péres, 1984; Pergent-Martini, 1994). It determines the development of other less demanding communities, such as the *Cymodoceetum nodosae* and the *Caulerpetum racemosae,* an association found near Syracuse, whose presence is at least partly linked to the discharges from the nearby industries (Giaccone & Di Martino, 1995). In addition to numerous anthropogenic causes, the disappearance of the *Posidonietum* can also be partially attributed to natural phenomena, such as the increase in hydrodynamism that determines a greater sedimentation speed that can not be compensated by the growth of the rhizomes, leading to the rarefaction of the community and to its substitution with the *Cymodoceetum nodosae* (Augier & Boudouresque, 1970). According to Sortino (1967), the succession leading to the final settlement of *Posidonia oceanica* meadows comprises several stages: the first one is represented by the community of *Padina pavonia,* which prepares a mobile and humid substrate suitable for the development of rhizomes and roots of phanerogams, in particular of *Cymodocea nodosa*, which can also grow where there are significant landslides sufficient to sediment the substrate without going through the *Padina pavonia* stadium.; the second one is characterized by *Cymodocea nodosa*, which tends to enrich in the humus component the substratum, due to the leaves decomposition, preparing the soil for the development of the *Posidonietum*. After the settlement of the first plants of *Posidonia oceanica*, a strong sedimentation begins thanks to the action made from the leaves to catch the sediments particles carried by the sea currents. The rhizomes of *Posidonia* are gradually covered by debris and begin to increase vertically, favoring the accumulation of

sediments that are retained by the roots and constituting large platforms that can reach almost the sea surface.

Habitat reference: See order.

6. Class: ***Ruppietea maritimae*** J.Tx. 1960

Submerged rooted herbaceous vegetation of brackish waters.

Synonyms: *Ruppietea* J. Tx. 1960 (art. 2b); *Eleocharitetea parvulae* Segal 1965 (art. 3b); *Eleocharitetea parvulae* Segal 1968 (art. 3b); *Rielletea helicophyllae* Cirujano, Velayos & P. Garcia 1993 (syntax. syn.).

Holotypus: *Ruppion maritimae* Br.-Bl. ex Westhoff in Bennema, Sissingh & Westhoff 1943.

Characteristic and differential species: *Althenia filiformis* Petit, *Riella notarisii* (Mont.) Mont., *Ruppia maritima* L., *R. cirrhosa* (Petagna) Grande, *R. drepanensis* Tineo.

Geographical distribution: The class at issue is widely distributed in all temperate areas of the northern hemisphere (Costa et al., 2012). In Sicily the communities of this syntaxon are closely linked to the salt marshes of the coastal areas, particularly those of the south-eastern and western part (Brullo & Furnari 1971, 1976; Brullo & Di Martino, 1974), but more sporadically occurs also in the northern coast, as near Tindari (Licandro et al., 2011).

Structure and ecology: The *Ruppietea maritimae* class groups all the communities characterized by the dominance of submerged rooted hydrophytes, which colonize the surfaces flooded at least temporarily by shallow (15-40 cm) and poorly polluted brackish waters (Pott, 1995; Mucina et al., 2016). From the floristic point of view, these communities are rather impoverished and their physiognomy is determined by one or a few cormophytes (usually belonging to the genus *Ruppia* L.) and more rarely also bryophytes (Costa et al., 2012).

Syndynamism: The communities belonging to this class generally results permanent and their settlement is favored by shallow waters with a high salt content but subject to considerable fluctuations. In contrast, the deeper internal basins with low salinity variations (generally below 4%) are more often colonized by communities dominated by other hydrophites, such as *Potamogeton pectinatus* (Verhoeven, 1980).

Habitat reference: C1.5 Permanent inland saline and brackish waterbody.

6.1. Order: ***Ruppietalia maritimae*** J. Tx. ex Den Hartog & Segal 1964

Submerged rooted herbaceous vegetation of temperate brackish waters of Europe.

Synonyms: *Zosteretalia* Br.-Bl. & R. Tx. 1943 (art. 2b); *Zosteretalia* Br.-Bl. & R. Tx. in Br.-Bl. et al. 1952 nom. ambig. (art. 36); *Ruppietalia maritimae* J. Tx. 1960 (art. 2b); *Zannichellio-Ruppietalia* Schaminée & Den Hartog in Schaminée, Weeda & Westhoff 1995 nom. illeg. (art.

29); *Rielletalia helicophyllae* Cirujano, Velayos & P. García 1993 (syntax. syn.), *Eleocharitetalia parvulae* Segal 1968 nom. nud. (art. 2b, 8).

Holotypus: *Ruppion maritimae* Br.-Bl. ex Westhoff in Bennema, Sissingh & Westhoff 1943.

Characteristic and differential species: See class.

Geographical distribution: See class.

Structure and ecology: The *Ruppietalia maritimae* is the only European order of this class (Mucina, 2016).

Syndynamism: See class.

Habitat reference: See class.

6.1.1. Alliance: ***Ruppion maritimae*** Br.-Bl. ex Westhoff in Bennema, Sissingh & Westhoff 1943

Vegetation of small, filiform hydrophytes of brackish waters with winter-spring development, sometimes dried in summer.

Synonyms: *Ruppion maritimae* Br.-Bl. 1931 (art. 2b); *Ruppion maritimae* Br.-Bl. & de Leeuw 1936 (art. 2b); *Ruppion maritimae* Br.-Bl. ex Soò 1947 (art. 31); *Ruppion maritimae* Br.-Bl. in Br.-Bl. et al. 1952 (art. 31); *Eleocharition parvulae* Segal 1965 (syntax. syn.); *Eleocharition parvulae* Segal 1968 (art. 31); *Scirpion parvuli* Segal 1968 (phantom); *Althenio-Ruppion* Den Hartog 1981 (phantom); *Althenio-Ruppion* Den Hartog 1985 (art. 2b); *Ruppion cirrhosae* Lovrić in Lovrić & Rac 1987 (art. 2b); *Riellion parvulae* Cirujano et al. 1993 (phantom); *Riellion helicophyllae* Cirujano, Velayos & P. Garcia ex Rivas-Martínez et al. 1999 (syntax. syn.).

Holotypus: *Ruppietum maritimae* Hocquette 1927.

Characteristic and differential species: See class.

Geographical distribution: See class.

Structure and ecology: The syntaxa dominated by filiform submerged hydrophites that grow in the brackish waters of lagoons, salt marshes, canals and dams, are referred to the *Ruppion maritimae* alliance. These communities can tolerate significant variations of the salt content (sometimes higher than that one of the sea) during the year and also the summer drying (Costa et al., 2012). The ephemeral annual communities with aquatic bryophytes and small rushes, that colonizs the coastal salt marshes subjected to alternating phases of emergence and immersion from the tides, are framed by some authors (Rivas-Martinez et al., 2001; Biondi et al., 2014) within the *Riellion helicophyllae* alliance. Conversely, Mucina et al. (2016) refers them to the alliance at issue.

Syndynamism: See class.

Habitat reference: See class.

6.1.1.1. ***Enteromorpho intestinalidis-Ruppietum maritimae*** Westhoff ex R. Tx. & Böckelmann 1957

Submerged vegetation with beaked tasselweed of deep brackish waters.

Synonyms: *Ruppietum maritimae* Iversen 1934 (art. 31); *Enteromorpha intestinalis-Ruppia rostellata* ass. Westhoff in Bennema, Sissingh & Westhoff 1943 (art. 1).

Lectotypus: Not designated.

Characteristic and differential species: *Enteromorpha intestinalis* (Linnaeus) Nees., *Ruppia maritima* L.

Phytosociological table: From Sciandrello (2007), table 3, 3 rel.; Guglielmo et al. (2012), 1 rel.

Char. association and class: *Ruppia maritima* (4), *Enteromorpha intestinalis* (1).
Other species: *Chara hispida* (3), *Chaetomorpha mediterranea* (2), *Ranunculus baudotii* (1).

Geographical distribution: The association is known for most of the Mediterranean area and in particular for Spain (Rivas-Martinez et al., 2001), Portugal (Costa et al., 2012), Southern Italy (Tomaselli et al., 2010b, Tomaselli & Sciandrello, 2017), Sardinia (Biondi & Bagella, 2005), Croatia (Jasprica et al., 2015), etc. In Sicily it is known for Piana del Signore near Gela (Sciandrello, 2007) and the marshes of south-eastern Sicily (Brullo & Furnari, 1971, Guglielmo et al., 2012).

Structure and ecology: This association usually occurs in the coastal marshes with muddy bottoms and relatively deep waters (up to 1 m), sometimes subject to a short period of drying during the summer period (Sciandrello, 2007; Tomaselli et al., 2010b). It is a vegetation with a strictly halophilous character, being linked to waters with a high salinity rate. From the floristic point of view, the *Enteromorpho intestinalidis-Ruppietum maritimae* is a very impoverished community, consisting in most cases in monophitic populations of *Ruppia maritima*, which is sometimes associated with *Althenia filiformis* and *Enteromorpha intestinalis*.

Syndynamism: The vegetation at issue has a mainly winter and spring development, while during the summer, when the surfaces are dried, it is replaced by therophytic aspects dominated by some Chenopodiaceae belonging to the *Thero-Salicornietea* class (Sciandrello, 2007). In the sandy substrata, the *Enteromorpho intestinalidis-Ruppietum maritimae* is replaced by the *Lamprothamnietum papulosis*, but where the sedimentation process is more intense *Ruppia maritima* tends to replace *Lamprothamnium papulosum*, which can completely disappear in the muddy bottoms (Brullo & Furnari, 1971).

Habitat reference: See class.

6.1.1.2 ***Chaetomorphato limi-Ruppietum cirrhosae*** Br.-Bl. in Br.-Bl. et al. 1952 nom. corr. Berg in Dengler et al. 2004

Submerged vegetation with spiral ditchgrass of shallow brackish waters.

Synonyms: ass. *Ruppia maritima* Hocquette 1927 nom. dub. (art. 43); *Ruppietum spiralis* Hocquette 1927 corr. Iversen. 1934 (art. 3c); *Ruppietum cirrhosae* Hocquette 1927 corr. Iversen 1934 nom. mut. (art. 45).

Lectotypus: Rel. pg. 80, Braun-Blanquet et al., (1952).

Characteristic and differential species: *Ruppia cirrhosa* (Petagna) Grande

Phytosociological table: From Guglielmo et al. (2012), tab. *Ruppietum spiralis*, 4 rel.
Char. association: *Ruppia cirrhosa* (4).
Char. order and class: *Althenia filiformis* (4), *Ruppia maritima* (2).
Other species: *Chara* sp. (2), *Lamprothamnium papulosum* (2), *Enteromorpha intestinalis* (2).

Geographical distribution: This syntaxon shows a wide European and Mediterranean distribution in agreement with the wide range of *Ruppia cirrhosa* (Ludwig & Schnittler, 1996; Ribera et al., 1997; Hernández et al., 2010; Christia et al., 2011; Milchakova, 2011; Sfriso, 2011; Kontula & Fürhapter, 2012), which is its differential species. In Sicily the association is present mainly in the Trapani area (e.g. Stagnone Islands) and in the coastal marshes of the south-eastern part (Brullo & Di Martino, 1974; Brullo & Furnari 1976).

Structure and ecology: The coastal lagoons with silty bottoms and the channels that connect the saltworks to the sea, characterized by shallow waters (dry during the summer) with large fluctuations in salinity (4-15%), are colonized by a peculiar submerged vegetation referred to the *Chaetomorphato limi-Ruppietum cirrhosae* (Brullo & Furnari, 1976). It consists of dense populations of *Ruppia cirrhosa* often covered by epiphytic algae (Brullo & Di Martino 1974).

Syndynamism: The occurrence of this community is closely related to waters with a high salt concentration. In fact, where the salinity is less than 4% *Ruppia cirrhosa* tends to disappear completely, allowing the development of the communities dominated by *Potamogeton pectinatus*. The latter condition occurs for example in lagoons and lakes without a direct connection with the sea due to the distance from the coast or for hydrographic reasons (Brullo & Furnari, 1976).

Habitat reference: See class.

6.1.1.3. ***Ruppietum drepanensis*** Brullo & Furnari 1976

Submerged vegetation with lesser tassel-pondweedof brackish waters, drying for a long period during the summer.

Holotypus: Rel. pg. 5, Brullo & Furnari (1976).

Characteristic and differential species: *Ruppia drepanensis* Tineo

Phytosociological table: From Brullo & Furnari (1976), rel. pg. 5.

Char. association: *Ruppia drepanensis* (1).

Geographical distribution: This associations is restricted to the Western Mediterranean area (Italy, Spain, Portugal, Tunisia, Algeria and Morocco), where *Ruppia drepanensis* occurs (Cirujano & García-Murillo, 1990). In Sicily this vegetation is known for the wet environments of the Western part, from Trapani to Marsala, and also in Favignana (Aegadian Archipelago) and Stagnone islands (Brullo & Furnari, 1976).

Structure and ecology: The *Ruppietum drepanensis* replaces the previous association in the salt marshes with hypersaline waters and subject to a long period of drying, showing a marked termophilous character (Minissale et al., 2010).

Syndynamism: The syntaxon represents a permanent vegetation, however the increase in the turbidity of the water due to a sensitive eutrophication of the basin can determine the rarefaction or even its disappearance (Santamaria, 1995).

Habitat reference: See class.

6.1.1.5. ***Rielletum notarisii*** Cirujano, Velayos & P. Garcia 1993

Submerged bryophytic vegetation of shallow brackish waters.

Holotypus: Rel. 15, tab. 3, Cirujano et al., (1993).

Characteristic and differential species: *Riella notarisii* (Mont.) Mont.

Phytosociological table: No releves.

Geographical distribution: Actually, This syntaxon is known for Spain (Cirujano et al., 1993), France (Bardat & Hauguel, 2002) and Southern Italy (Puntillo & Puntillo 2014). In Sicily it is a very rare community, being surveyed only from the locality of Piana del Signore near Gela (Privitera & Puglisi, 1997; Sciandrello, 2007).

Structure and ecology: The *Rielletum notarisii*, previously referred to the *Riellion helicophyllae* alliance (Cirujano et al., 1993), represents a rare bryophytic community differentiated from the hepatic *Riella notarisii*. This species tends to constitute fairly thick meadows not taller than 1-2 cm, in submerged or in any case impregnated surfaces with brackish water, appearing as a thin gelatinous layers (Privitera & Puglisi, 1997). This

community grows on small sandy-muddy soils subject to a long period of drying from the beginning of spring (Sciandrello, 2007).

Syndynamism: The syntaxon represents a permanent vegetation localized in coastal salt marshes, replacing the *Enteromorpho intestinalidis-Ruppietum maritimae* in the stands with very shallow waters.

Habitat reference: See class.

7. Class: ***Bidentetea tripartitae*** R.Tx., Lohmeyer & Preising ex von Rochow 1951

Summer-annual pioneer vegetation of seasonally flooded nutrient-rich river alluvia, lacustrine banks and heavily nutrientloaded anthropogenic habitats.

Synonyms: *Bidentetea tripartitae* R. Tx. et al. in R. Tx. 1950 (art. 2b); *Rudereto-Manihotetea utilissimae* sensu O. Bolòs 1988, non *Rudereto-Manihotetea pantropicalia* Lèonard in Taton 1949 (pseudonym).

Holotypus: *Bidentetalia tripartitae* Br.-Bl. & R. Tx. ex Klika & Hadac 1944.

Characteristic and differential species: *Bidens aurea* (Aiton) Sherff, *B. frondosa* L., *B. tripartita* L.

Geographical distribution: This class is distributed in the boreo-temperate territories of North America, Europe, and Asia (Pott, 1995; Jarolímek et al., 1997; Taran & Tjurin, 2006), while it tends to be less diversified and floristically impoverished in the Mediterranean (Tüxen 1979). In Sicily the plant communities of the *Bidentetea tripartitatae* are not very widespread and are restricted to some streams of Sicani and Hyblaean Mountains (Brullo & Spampinato, 1990) as well as to the shores of some lakes and reservoirs (Brullo & Sciandrello, 2006 ; Sciandrello, 2009; Guarino & Pasta, 2017).

Structure and ecology: It is a pioneer vegetation localized on surfaces rich in nutrients and subject to long periods of submersion (Brullo & Spampinato, 1990). The communities of this class colonize the banks of seasonal watercourses, ponds and reservoirs that during the summer tend to dry up (Guarino & Pasta, 2017). The structure of this vegetation is given mainly by some summer therophytes belonging to the genus *Bidens* and also by other nitrophilous species (sometimes alien), such as *Amaranthus retroflexus*, *Cyperus fuscus*, *Persicaria lapathifolia*, *Xanthium orientale*, etc. These communities can take contact with the hydrophilous vegetation of the watercourses as with those ones of the *Isoeto-Nanojuncetea* linked to the temporary ponds, or of the *Phragmito-Magnocaricetea,* as well as with the synanthropic vegetation of the *Artemisietea vulgaris* and *Chenopodietea* classes (Biondi et al. ., 2010).

Syndynamism: The communities of this class are often expanding due to the widespread eutrophication of water and the manumission of streams and ponds. In fact, it led to the replacement of the most demanding communities, such as those ones belonging to the *Isoeto-*

Nanojuncetea, with impoverished nitrophilous coenoses rich in alien species, such as those ones of the *Bidentetea*, whose possible evolution towards more mature stages is prevented by the owerflow of streams or lakes that periodically affected large surfaces for a long period (Šumberová, 2011).

Habitat reference: C3.5a Periodically exposed shore with stable, eutrophic sediments with pioneer or ephemeral vegetation.

7.1. Order: ***Bidentetalia tripartitae*** Br.-Bl. & R. Tx. ex Klika & Hadac 1944

Pioneer annual vegetation of seasonally flooded nutrient-rich soils.

Synonyms: *Bidentetalia tripartitae* Br.-Bl. & R. Tx. 1943 (art. 2b); *Chenopodietalia rubri* Felzines & Loiseau 2006 (syntax. syn.).

Holotypus: *Bidention tripartitae* Nordhagen 1940 em. R. Tx. in Poli & J. Tx. 1960

Characteristic and differential species: *Bidens tripartita* L., *Echinochloa crus-galli* (L.) Beauv., *Persicaria hydropiper* (L.) Delarbre**.**

Geographical distribution: See class

Structure and ecology: The order groups together the pioneer communities of seasonally flooded silty-pebbly surfaces, rich in nutrients, prevalently in Central and Northern Europe (Mucina et al., 2016).

Syndynamism: See class.

Habitat reference: See class.

7.1.1. Alliance: ***Bidention tripartitae*** Nordhagen 1940 em. R. Tx. in Poli & J .Tx. 1960

Summer-annual pioneer vegetation of periodically nutrient-rich river banks and drained muddy bottoms of eutrophic lakes.

Synonyms: *Bidention tripartitae* Nordhagen 1940 (art. 3d); *Alopecurion aequalis* Eber 1975.

Holotypus: *Bidentetum tripartitae* Koch 1926.

Characteristic and differential species: *Bidens tripartita* L.

Geographical distribution: This alliance is widely distributed in the temperate Europe (Šumberová, 2011). In Sicily, it is quite rare and localized.

Structure and ecology: The *Bidention tripartitae* groups the nitrophilous pioneer communities of the clayey and muddy-loam substrata, subject to periodic flooding and able to

retain water for a long time. From the physiognomic point of view, the structure of these communities is defined by annual herbaceous species with late summer-autumn development, belonging to *Bidens*, *Persicaria*, *Ranunculus*, *Rumex* and *Xanthium* genera. These plants can reach a height of 50-150 cm, producing a remarkable biomass (Šumberová, 2011). Sometimes they exhibit specific adaptations for living in muddy soils that are water-soaked and poor in oxygen, such as the production of adventitious roots useful for fixing in the mud (Hejný, 1997). From the catenal point of view, the communities of the *Bidention tripartitae* can come into contact with the vegetation of the *Chenopodion rubri* alliance, which colonizes substrates with coarser granulometry and subject to a quick drying (Biondi et al., 2014).

Syndynamism: This pioneer vegetation tends to have a constant recurrence since the end of the summer in the surfaces just dried up, although from year to year it can change its position according to the level of the water and the duration of the submersion period. The ability of these communities to constitute the first phase of colonization of the emerged soils is linked to the remarkable production of seeds by the species that characterize this vegetation, allowing a rapid colonization of bare surfaces (Biondi et al., 2014).

Habitat reference: See class.

7.1.1.1. ***Bidentetum tripartitae*** Miljan 1933

Hygro-nitrophilous vegetation with three-lobe beggarticks of silty-clayey surfaces.

Synonyms: *Bidentetum tripartitae* Koch 1926 nom. amb. (art. 36); *Bidenti tripartitae-Polygonetum lapathifolii* Klika 1935; *Polygono hydropiperis-Bidentetum* (Koch 1926) Lohmeyer in R. Tx. (pro parte).

Lectotypus: Not designated.

Characteristic and differential species: *Bidens tripartita* L.; *Persicaria lapathifolia* (L.) Delarbre.

Geographical distribution: This association is frequent in central-western Europe, while it becomes progressively more rare in the Mediterranean and in Asia (Šumberová, 2011). In Sicily it is quite rare, being limited to some rivers such as Oreto, Sosio, etc. (unpublished data).

Structure and ecology: This association is characterized by the dominance of *Bidens tripartita* or also by *Persicaria lapathifolia*, nitrophilous terophytes which constitute a high and dense vegetation, though quite poor from the floristic point of view. It grows on the banks of rivers and artificial reservoirs and sometimes even along the wet uncultivated lands, preferring silty-clayey substrata, often with a significant sandy component and abundant nutrients (Šumberová, 2011). However, the *Bidentetum tripartitae* can tolerate poorly nutrient and relatively dry soils, showing in this case a marked dwarfism (Hejný 1997).

Syndynamism: See alliance.

Habitat reference: See class.

7.1.2. Alliance: ***Chenopodion rubri*** (R. Tx. in Poli & J. Tx. 1960) Hilbig & Jage 1972

Annual hygro-nitrophilous vegetation of sandy or gravelly substrata.

Synonyms: *Chenopodion fluviatile* R. Tx. in Poli & J. Tx. 1960 (art. 34a)*; Chenopodion rubri* Oberd. et al. 1967 (art. 2b); *Chenopodion rubri* Soò 1968 (art. 2b); *Chenopodion rubri* Soò 1969 (art. 2b); *Chenopodion rubri* (R. Tx. in Poli & J. Tx. 1960) Kopecký 1969 (phantom)*; Chenopodion rubri* (R. Tx. in Poli & J. Tx. 1960) Dobrescu & Kovàcs 1972 (art. 31); *Chenopodion glauci* Hejný 1974 (syntax. sinonimo.); *Chenopodion rubro-polyspermi* Passarge 1978 (art. 2b); *Xanthion italici* Felzines & Loiseau 2006 (syntax. syn.).

Holotypus: *Chenopodietum rubri* Tímér 1950.

Characteristic and differential species: *Amaranthus retroflexus;*, L., *Cyperus fuscus* L., *Paspalum distichum* L., *Polypogon viridis* (Gouan) Breistr., *Xanthium orientale* subsp. *italicum* (Moretti) Greuter.

Geographical distribution: This alliance is represented in central and southern Europe (Šumberová, 2011), going towards East until central Asia (Hilbig, 2000). In Sicily it is quite common in several streams and reservoirs (Sciandrello, 2009, Guarino & Pasta, 2017).

Structure and ecology: The syntaxon groups the plant communities dominated by annual species belonging to the genera *Atriplex* and *Chenopodium*, which grow on soils with coarse sediments, rich in nitrates and sometimes slightly salty (Hejný et al., 1979). It is a late-summer-autumn vegetation colonizing the periodically flooded gravelly-sandy shores of artificial reservoirs and watercourses, subject to a rapid drying in summer. The *Chenopodion rubri* is in catenal contact with the therophytic vegetation of the *Bidention tripartitae*, linked to substrata with fine sediments and with greater water inertia. It can also come into contact with the hydrophytic vegetation of the streams, both with the herbaceous vegetation of the *Paspalo-Agrostion semiverticillati* and with the riparian vegetation of *Alno- Populetea* (Biondi et al., 2014).

Syndynamism: Similarly to the *Bidention tripartitae*, the communities of *Chenopodion rubri* also show a pioneer character and tend to undergo considerable spatial variations over time. On the surfaces subject to intense mechanical disturbance this vegetation is replaced by aspects related to the *Paspalo-Agrostion semiverticillati* (Guarino & Pasta, 2017).

Habitat reference: See class.

7.1.2.1. ***Polygono lapathifolii-Xanthietum italici*** Pirola & Rossetti 1974

Nitrophilous vegetation with italian cocklebur of wet gravelly surfaces.

Lectotypus: Rel. 9, tab. 1, Pirola & Rossetti (1974), here designated.

Characteristic and differential species: *Persicaria lapathifolia* (L.) Delarbre; *Xanthium orientale* subsp. *italicum* (Moretti) Greuter.

Phytosociological table: From Barbagallo et al. (1979), tab. 5, 5 rel.

Char. association: *Xanthium orientale* subsp*. italicum* (V), *Persicaria lapathifolia* (V).

Char. order and class: *Echinochloa crus-galli* (V), *Paspalum distichum* (V), *Polypogon semiverticillatum* (V), *Polygonum hydropiper* (IV).

Other species: *Atriplex hastata* (V), *Rumex pulcher* (V), *Solanum nigrum* (V), *Eupatorium cannabinum* (V), *Sonchus oleraceus* (IV), *Mentha longifolia* (IV), *Heliotropium europaeum* (IV), *Apium nodiflorum* (IV), *Polygonum aviculare* (IV), *Plantago major* (III), *Urtica dioica* (III), *Urtica membranacea* (III), *Portulaca oleracea* (III)*, Oenanthe pimpinelloides* (III), *Anagallis arvensis* (III), *Lythrum junceum* (II), etc.

Geographical distribution: The association is recorded from several waterways of central and northern Italy (Pirola & Rossetti, 1974; Biondi et al., 1999; Pirone et al., 2009). In Sicily it is quite widespread throughout the island, being reported for the watercourses of the Hyblaean Plateau (Barbagallo et al., 1979b), Verdura and Platani rivers in the western part (Brullo & Spampinato, 1990) and some artificial basins of central Sicily (Sciandrello, 2009).

Structure and ecology: This association colonizes the gravelly or pebbly surfaces characterized by a high presence of nitrates, along the banks of rivers and artificial basins. It is a peculiar herbaceous vegetation dominated by *Xanthium orientale* subsp. *italicum* and *Persicaria lapathifolia*, often with high coverage values, which grows together with other therophytes and hemicriptophytes with summer and autumnal development, such as *Polypogon viridis*, *Bidens tripartita*, *Solanum nigrum*, *Echinochloa crus-galli*, as well as numerous synanthropic species of *Stellarietea* class. Usually, it is frequent in correspondence of fluvial stands polluted by discharges of various origins, sewers and landfills but also on surfaces subject to anthropic activities such as gravel extraction or alluvia rebuilding (Brullo & Spampinato, 1990). In artificial basins this community tends to occupy the outer surfaces that emerge first at the beginning of summer, being only slightly damp during the arid period (Sciandrello, 2009). This vegetation, previously referred to the *Paspalo-Agrostion semiverticillati* alliance, has some floristic and ecological affinities with the *Xanthio-Polygonetum persicariae* 0. Bolòs 1957, association described from Spain, but it is differentiated by the absence of *Persicaria lapathifolia* (Barbagallo et al. al., 1979b). Along the watercourses with gravel-bed (fiumare), the *Polygono lapathifolii-Xanthietum italici* can come into contact with the riparian vegetation of the *Salicetum albo-purpureae* or with the glareicolous aspects dominated by *Helichrysum italicum* subsp. *siculum,* located just above (Brullo & Spampinato, 1990), while in artificial basins this community shows catenal contacts with the thermophilous thickets of the *Tamaricetum gallicae* outwards and with the *Verbeno supinae-Gnaphalietum luteo-albi* in the inner humid shores (Sciandrello, 2009).

Syndynamism: The dynamism of this vegetation is strongly linked to the winter floods of the watercourse and to the anthropic disturbance that generally prevent its evolution towards

more evolved stages (Pirone et al., 2009). In the stands highly disturbed by grazing or mechanical activities, this community can be replaced by a thick reptant vegetation dominated by *Paspalum distichum* (Sciandrello, 2009).

Habitat reference: See class.

7.1.2.2. ***Polygono orientalis-Chenopodietum rubri*** Sciandrello 2009

Hygro-nitrophilous vegetation with eastern knotweed of clayey-loam substrata.

Holotypus: rel. 3, tab. 5, Sciandrello (2009).

Characteristic and differential species: *Chenopodium rubrum* L., *Persicaria orientalis* (L.) Spach, *Rumex palustris* Sm.

Phytosociological table: From Sciandrello (2009), tab. 5, 6 rel.

Char. association and alliance: *Chenopodium rubrum* (V)*, Rumex palustris* (V), *Persicaria orientalis* (V).

Char. order and class: *Persicaria lapathifolia* (V), *Echinochloa crus-galli* (V).

Other species: *Lythrum junceum* (V), *Symphyotrichum squamatum* (V), *Atriplex prostrata* subsp. *latifolia* (V)**,** *Phragmites australis* (V)**,** *Tamarix gallica* (V), *Pulicaria dysenterica* (III), *Mentha aquatica* (III), *Mentha suaveolens* (II), *Paspalum distichum* (II), *Polypogon monspeliensis* (II).

Geographical distribution: The association is actually known only for Comunelli lake, near Butera (Sciandrello, 2009).

Structure and ecology: This association colonizes the banks of artificial basins with silty-clayey and nitrate-rich soils. It is a vegetation linked to surfaces subjected to a long period of submersion and which maintain a certain degree of humidity even in summer. From the physiognomic point of view, this vegetation is characterized by the occurrence of large therophytes such as *Chenopodium rubrum* and *Persicaria orientalis* two rather rare species in Sicily (Giardina et al., 2007), which are associated with *Rumex palustris* and other taxa of *Bidentetea tripartite* class, such as *Persicaria lapathifolia* and *Echinochloa crus-galli* (Sciandrello, 2009).

Syndynamism: This community represent an edaphic vicariant of the *Polygono lapathifolii-Xanthietum italici* for the silty-clayey substrata with greater water retention.

Habitat reference: See class.

8. Class: ***Montio fontanae-Cardaminetea amarae*** Br.-Bl. & R. Tx. ex Klika & Hadać 1944

Vegetation of water springs.

Synonyms: *Montio-Cardaminetea* Br.-Bl. & R. Tx. 1943 (art. 2b); *Montio-Cardaminetea* Br.-Bl. & R. Tx. in Br.-Bl. 1948 (art. 31); *Montio-Cardaminetea* Br.-Bl. & R. Tx. ex Klika 1948 (art. 31); *Montio-Cardaminetea* Br.-Bl. & R. Tx. in Br.-Bl. et al. 1952 (art. 31); *Aconito-Cardaminetea* Hadać 1956 pro parte (art. 35).

Holotypus: *Montio fontanae-Cardaminetalia amarae* Pawáowski in Pawáowski, Sokoáowski & Wallisch 1928 (art. 10a).

Characteristic and differential species: *Athyrium filix-femina* (L.) Roth*, Carex remota* L.*, Chaerophyllum hirsutum* L.*, Lysimachia nemorum* L.*, Montia fontana* L.*, Conocephalum conicum* (L.) Dumort.*, Philonotis fontana* (Hedwig) Bridel & Bryol.

Geographical distribution: This class shows its greater diversification in the mountain and alpine areas of the Euro-Siberian territories, while in the Mediterranean it is restricted to the supra-, oro- and cryo-mediterranean belts (Brullo et al., 2001). In Sicily this vegetation results scattered only in the mountain belts of Nebrodi, Madonie and Etna.

Structure and ecology: The fontinal vegetation which grows near springs, waterfalls and streams, is framed within the *Montio fontanae-Cardaminetea amarae* class. These communities find their optimum in mountain areas and are linked to running waters that are cold, nutrient-poor, well-oxygenated and persistent throughout the year. Their physiognomy is given mainly by bryophytes, which are sometimes associated with very specialized small heliophytes, often with a relictual meaning (Zechmeister & Mucina, 1994; Diaz Gonzalez & Prieto, 1994; Rivas Martinez et al., 2001). As the distance from the source increases, the waters become less cold and oxygenated, while the concentration of nutrients increases, favoring the vascular plants that become progressively dominant on the bryophytic component (Bogenrieder & Eschenbach, 1996). The *Montio-Cardaminetea* communities therefore tend to to be replaced by other aspects of vegetation, such as those belonging to *Scheuchzerio palustris-Caricetea* and *Galio-Urticetea* classes. In the Mediterranean area this syntaxon is represented only on the highest mountains, while in the hilly and submontane stands it is vicaried by the *Adiantetea* class, which includes the hygrophilous vegetation of wet cliffs subject to costant dripping (Brullo et al., 2001).

Syndynamism: The communities belonging to this class represent a permanent vegetation, which however are subject to seasonal water changes. In fact, for example, a greater water supply can favor the development of the submerged bryophytic vegetation of the *Platyphypnidio-Fontinaletea antipyreticae* (Brullo et al., 2001).

Habitat reference: C2.1a Base-poor spring and spring brook; C2.1b Calcareous spring and spring brook..

8.1. Order: ***Montio fontanae-Cardaminetalia amarae*** Pawlowski in Pawlowski et al. 1928

Vegetation of cold oligotrophic water-spring.

Synonyms: *Epilobietalia alsinifolii Nordhagen* 1936 (phantom); *Epilobietalia alsinifolii* Nordhagen 1937 (art, 2b); *Cardamino-Cratoneuretalia* Maas 1959 (syntax. syn.); *Cratoneuro-Philonotidetalia* Geissler 1976 (art. 2b, 3b).

Holotypus: *Cardamino amarae-Montion fontanae* Br.-Bl. 1926.

Characteristic and differential species: See class.

Geographical distribution: The order is distributed from the temperate to arctic zones and in the oromediterranean belt of Europe (Mucina et al., 2016).

Structure and ecology: According to the traditional classification by Hadač (1983), the *Montio-Cardaminetea* class included only two orders: *Montio-Cardaminetalia* on siliceous substrata and *Cardamino-Cratoneuretalia* Maas 1959 on limestone. Hinterlang (1992) instead considers the first order as closely related to forest stands, while described the *Cardamino-Chrysosplenietalia* for low-altitude vegetation. However, the communities of the Mediterranean area are generally referred only to the *Montio-Cardaminetalia amarae* order (Brullo et al., 2001; Rivas Martinez et al., 2001; Costa et al., 2012).

Syndynamism: See class.

Habitat reference: See class.

8.1.1. Alliance: ***Cardamino amarae-Montion fontanae*** Br.-Bl. 1926

Heliophilous vegetation of cold oligothrophic water springs.

Synonyms: *Montio-Cardaminion* Pawłowski et al. 1928 (art. 31); *Montion* Maas 1959 (art. 29).

Lectotypus: *Montio fontanae-Bryetum schleicheri* Büker & R. Tx. in Büker 1942

Characteristic and differential species: *Montia fontana* L. subsp. *chondrosperma* (Fenzl) Walters, *Scapania undulata* (L.) Dum., *Veronica beccabunga* L.

Geographical distribution: This alliance is mainly distributed in the mountains of Central and South-Western Europe, reaching its greater diversity on the Alps and the Pyrenees (Costa et al., 2012; Mucina et al., 2016).

Structure and ecology: The stands with sub-acid soils and sunny exposures, located near sources and streams with oligotrophic, limpid and cold waters, are colonized by some peculiar plant communities referred to the *Cardamino amarae-Montion fontanae* alliance (Zechmeister & Mucina, 1994). From a structural point of view, their physiognomy is defined by a very compact bryophytic layer on which some vascular plants are inserted in a scattered manner.

This vegetation is present only in mountain areas, often subject to long snow periods, mainly in the supra- and oro-mediterranean belt with humide or hyper-humide ombrotypes (Brullo et al., 2001).

Syndynamism: See class.

Habitat reference: C2.1a Base-poor spring and spring brook.

8.1.1.1. ***Montio-Philonotidetum fontanae*** (Br.-Bl. 1915) Büker & R. Tx. in Büker 1942

Fontinal vegetation with water blinks.

Synonyms: *Montietum fontanae* Br.-Bl. 1915.

Lectotypus: Not designated.

Characteristic and differential species: *Philonotis fontana* (Hedwig) Bridel & Bryol.

Phytosociological table: No relevés.

Geographical distribution: This association is widespread in the mountains of southern Europe (Privitera & Puglisi, 1995; Brullo et al., 2001), including Sicily where it is particularly common in the north-eastern area (unpublished data).

Structure and ecology: The *Montio-Philonotidetum fontanae* is a hygrophilous and heliophilous community, linked to markedly acid substrata located along the banks of watercourses or in the wet rocks near small waterfalls. From the bioclimatic point of view, this vegetation finds its optimum in the supramediterranea belt with humide or hyper-humide ombrotype. Its physiognomy is determined by several bryophytes, including *Philonotis fontana*, accompanied by few heliophilous vascular plant, such as *Montia fontana* (Brullo et al., 2001).

Syndynamism: This community is replaced by the *Scapanietum undulatae* in surfaces long submerged by running waters (Brullo et al., 2001).

Habitat reference: See alliance.

8.1.2. Alliance: ***Caricion remotae*** Kästner 1941

Sciaphilous vegetation of cold oligothrophic water springs.

Synonyms: *Caricion remotae* Kästner 1940 (phantom); *Cardaminion* Maas 1959 (syntax. syn.); *Ranunculo repentis-Impatiention noli-tangere* Passarge 1967 (art. 29c).

Holotypus: *Caricetum remotae* Kästner 1941.

Characteristic and differential species: *Athyrium filix-femina* (L.) Roth, *Cardamine flexuosa* With., *Carex remota* L., *Pellia epiphylla* (L.) Corda.

Geographical distribution: The alliance at issue is mainly distributed in central and eastern Europe, with sporadic occurrence in the Mediterranean (Brullo et al., 2001). In Sicily it is present only on the mountains of the northern part, such as Nebrodi and Madonie.

Structure and ecology: The *Caricion remotae* groups the hygrophilous communities consisting of large phanerogams linked to the cold waters of streams and springs in shady stands of forest environments. These communities grow mainly on acidic, muddy and damp soils, often due to the presence of underground springs (Šumberová, 2011). In the Mediterranean area this type of vegetation is restricted to the mountain belt, where it is localized within the *Fagetalia* forest (Brullo et al., 2001).

Syndynamism: See class.

Habitat reference: C2.1a Base-poor spring and spring brook.

8.1.2.1. ***Carici remotae-Osmundetum regalis*** Brullo, Scelsi & Spampinato 2001

Fontinal vegetation with royal fern and remote sedge.

Holotypus: Rel. 1, tab. 145, Brullo et al. (2001).

Characteristic and differential species: *Osmunda regalis* L.

Phytosociological table: From Petronici et al. (1978), p. 22-23, 1 rel.

Char. association and alliance: *Osmunda regalis* (1), *Carex remota* (1), *Pellia epiphylla* (1).

Char. order and class: *Athyrium filix-femina* (1), *Brachythecium rivulare* (1), *Conocephalum conicum* (1).

Other species: *Sphagnum subsecundum* (1), *Lophocolea bidentata* (1), *Pellia fabbroniana* (1), *Blechnum spicant* (1), *Pteridium aquilinum* (1), *Juncus effusus* (1), *Juncus articulatus* (1), *Poa trivialis* (1), *Mentha aquatica* (1).

Geographical distribution: This association was described by Brullo et al. (2001) for the northern slope of Aspromonte massif (Calabria), while in Sicily can be attributed to this syntaxon one relevé surveyed in the Madonie massif by Petronici et al. (1978) .

Structure and ecology: In correspondence of small springs, whose slowly flowing waters saturate the siliceous soils with little permeability and low slope ("margi"), a peculiar hygrophilous community occurs. This vegetation, referred to the *Carici remotoe-Osmundetum regalis*, is dominated mainly by large size ferns, such as *Osmunda regalis*, *Blechnum spicant* and *Athyrium filix-femina*, which are associated with few phanerogams (*Carex remota*, *Juncus effusus*, etc.) and several bryophytes, such as *Sphagnum subsecundum*, *Scapania undulata*, *Pellia epiphylla*, etc., which constitute a thick moss layer (Petronici et al., 1978; Brullo et al., 2001). This community, with distinctly oceanic requirements, is linked to the meso-, supra-

mediterranean belts with humid or hyperhumid ombrotype, where it is grows within the oak forest of *Ilici-Quercetum austrothyrrenicae* or more rarely in the beech woods of the *Anemono-Fagetum*.

Syndynamism: This community results very sensitive to anthropic disturbance deriving from grazing and above all from drainage, which can lead to its substitution with dense populations of *Pteridium aquilinum*, a species better adapted to the drier soils (Petronici et al., 1978).

Habitat reference: See alliance.

8.1.3. Alliance: ***Cratoneurion commutati*** Koch 1928

Vegetation of moss-rich calcareous water springs of mountain stands.

Synonyms: *Palustriellion commutatae* Koch 1928 nom. mut. propos. (art. 45)*; Cratoneuro-Saxifragion aizoidis* Nordhagen 1936 (phantom); *Cratoneuro-Saxifragion aizoidis* Nordhagen 1937 (art. 2b); *Endocarpion* Br.-Bl. 1948 (art. 2b); *Cochlearion alpinae* Br.-Bl. in Br.-Bl. & R. Tx. 1952; *Arabidion jacquinii* Julve 1993 (art. 2b, 3b); *Cochlearion pyrenaicae* Bardat in Bensettiti et al. 2002 (art. 2b, 3b); *Cochlearion pyrenaicae* Bardat in Bardat et al. 2004 (art. 2b, 3b).

Lectotypus: *Cratoneuretum commutati* Aichinger 1933.

Characteristic and differential species: *Palustriella commutata* (Hedw.) Ochyra (= *Cratoneuron commutatum* (Brid.) G. Roth).

Geographical distribution: This alliance occurs in central and western Europe, while it is rare in the Mediterranean, being restricted to mountain area (Zechmeister & Mucina, 1994).

Structure and ecology: The syntaxon groups bryophytic, hygrophilous and basiphilous communities, linked to stands with cold and limpid waters, where travertinization occurs. In fact, this last phenomenon is favored by *Cratoneuron commutatum*, the characteristic species of this alliance, at the base of which calcium carbonate is deposited. The moss does not limit its action to the chemical process, but also contributes to the formation of tufogenic rocks (Šumberová, 2011).

Syndynamism: The communities of *Cratoneuron commutatae* are a permanent and very specialized vegetation, not subject to dynamic processes (Brullo et al., 2001).

Habitat reference: C2.1b Calcareous spring and spring brook.

8.1.3.1. ***Cratoneuretum commutati*** Aichinger 1933

Basiphilous fontinal vegetation with curled hookmoss.

Synonyms: *Pinguiculo vulgaris-Cratoneuretum* Oberdorfer 1957 (syntax. syn.).

Lectotypus: Not designated.

Characteristic and differential species: *Palustriella commutata* (Hedw.) Ochyra.

Phytosociological table: No relevès.

Geographical distribution: This association is widely distributed in the Atlantic and Central Europe, while it is quite rare in the Mediterranean territory (Brullo et al., 2001). Basing on unpublished data, in Sicily it was observed in the valley of Anapo river (Hyblaean area).

Structure and ecology: The *Cratoneurion commutatae* is constituted by a thick moss layer covering the tufaceous deposits placed near the springs with calcareous, limpid and cold waters. From a structural point of view, it is a predominantly bryophytic vegetation dominated by *Cratoneuron commutatum*, which is associated with *Didymodon tophaceus*, *Hymenostylium recurvirostrum*, *Gymnostomum calcareum*, *Pellia endiviifolia*, *Pellia epiphylla*, *Southbya tophacea*, *Bryum pallens*, *Orthothecium rufescens* and only few phanerogams (Brullo et al., 2001).

Syndynamism: In the submerged muddy stands this association takes contact with the amphibious communities belonging to the *Sparganio-Glycerion*. In the vertical dripping rocks it is replaced by the *Homalio lusitanicae-Adiantetum*, association of *Adiantetea*.

Habitat reference: See alliance.

9. Class: ***Platyhypnidio-Fontinaletea antipyreticae*** Philippi 1956

Bryophytic vegetation linked to running watercourses and waterfalls.

Synonyms: *Brachythecietea plumosi* von Hübschmann 1957 (syntax. syn.); *Fontinalietea antipyreticae* von Hübschmann 1957 (syntax. syn.); *Hygrohypnetea* von Hübschmann 1957 (art. 2b).

Lectotypus: *Leptodictyetalia riparii* Philippi 1956.

Characteristic and differential species: *Brachythecium rivulare* Schimp., *Chiloscyphus polyanthos* (L.) Corda, *Cladophora glomerata* (L.) Kützing, *Dichodontium pellucidum* (Hedw.) Schimp., *Hygroamblystegium fluviatile* (Hedw.) Loeske, *Lemanea catenata* Kützing. *Platyhypnidium ripariodes* (Hedw.) Dixon.

Geographical distribution: The class shows a wide distribution in the temperate areas of the whole world from the plain to the mountain (Brullo et al., 2001), also in Sicily it is quite widespread throughout the island mainly along the streams (Privitera, 1990; Privitera & Puglisi, 1996, Minissale et al., 2007, Pasta et al., 2008).

Structure and ecology: This syntaxon groups all the communities of aquatic bryophytes that colonize rivers, streams, springs and waterfalls (Brullo et al., 2001). It is a submerged or amphibious vegetation, linked to fresh current watercourses, sometimes subject to summer

drying. The physiognomy of these communities is defined by a few species of bryophytes that can grow in different substrata from the plains to the mountains. They usually colonize stones and pebbles in the riverbeds, as well as boulders and walls, which are submerged only occasionally (Privitera & Puglisi, 1996).

Syndynamism: The vegetation of the *Platyhypnidio-Fontinaletea antipyreticae* is well adapted to the water dynamism and its seasonal variation. It shows an heliophilous character, taking contact in surfaces subject to periodic submersions or dripping with the hygrophilous aspects of the *Montio-Cardaminetea* or *Adiantetea* (Brullo et al., 2001).

Habitat reference: C2.3 Permanent non-tidal, smooth-flowing watercourse.

9.1. Order: ***Leptodictyetalia riparii*** Philippi 1956

Bryophyte vegetation in mesotrophic and eutrophic waters of rivulets and rivers at low altitudes.

Synonyms: *Fontinalietalia antipyreticae* von Hübschmann 1957

Lectotypus: *Cinclidotion fontinaloidis* Philippi 1956.

Characteristic and differential species: *Fontinalis antipyretica* Hedw., *Hygroamblystegium tenax* (Hedw.) Jenn., *Hygrohypnum luridum* (Hedwig) Jennings, *Leptodictyum riparium* (Hedw.) Warnst., *Oxyrrhynchium speciosum* (Brid.) Warnst., *Solenostoma sphaerocarpum* (Hook.) Steph.

Geographical distribution: This order shows a Circumboreal distribution (Brullo et al., 2001).

Structure and ecology: This syntaxon includes the submerged or amphibian bryophytic vegetation that occurs along the watercourses in calcareous or siliceous substrata, from the coastal belt to the mountain one (Privitera & Puglisi, 1996).

Syndynamism: The communities of *Leptodictyetalia riparii* may have catenal contacts with the hygrophilous vegetation of the *Adiantetea*, which colonizes the walls affected by dripping waters (Brullo et al., 2001).

Habitat reference: See class.

9.1.1. Alliance: ***Fontinalion antipyreticae*** W. Koch 1936

Submerged bryophyte vegetation in mesotrophic and eutrophic waters of slowly flowing rivulets and rivers at low altitudes.

Synonyms: *Fissidention crassipedis* W. Koch 1936 (syntax. syn.); *Fissidention crassipedis* (W. Koch 1936) Philippi 1956.

Holotypus: *Fontinali-Pachyfissidentetum crassipedes* W. Koch 1936.

Characteristic and differential species: *Fontinalis antipyretica* Hedw.

Geographical distribution: This alliance has a boreal distribution (Privitera, 1990).

Structure and ecology: The alliance groups the permanently submerged bryophytic communities, which colonize watercourses with low hydrodynamism, growing on rocks or submerged trunks (Bardat & Hauguel, 2002).

Syndynamism: See order.

Habitat reference: See class.

9.1.1.1. ***Fontinaletum antipyreticae*** Kaiser ex Frahm 1971

Submerged bryophyte vegetation with greater water-moss,of slowly flowing eutrophic waters

Synonyms: *Fontinaletum antipyreticae* Kaiser 1926 (art. 2b).

Lectotypus: Rel. 10, tab. pg. 7, Frahm (1971).

Characteristic and differential species: *Fontinalis antipyretica* Hedw.

Phytosociological table: From Privitera (1990), tab. 1, 6 rel.
Char. association and alliance: *Fontinalis antipyretica* (V).
Char. order and class: *Platyhypnidium riparioides* (V)*, Cladophora glomerata* (III), *Fissidens crassipes* (III).
Other species: *Bryum pseudotriquetrum* (III), *Fissidens taxifolius* (II).

Geographical distribution: The association is widely distributed throughout the northern hemisphere, while in Sicily it is restricted to the meso- and termomediterranean belt, where it was found in the Anapo river valley (Hyblaean mountains) and near San Fratello in the Nebrodi area (Privitera, 1990).

Structure and ecology: The *Fontinaletum antipyreticae* colonizes the submerged rocky surfaces in the stands with poor slope of streams and river with well-oxygenated waters and low hydrodynamism. From the floristic point of view, it is a fairly poor vegetation, in which some reptant bryo-chamaephytes, such as *Fontinalis antipyretica* and *Rhynchostegium riparioides*, have a dominant role, together with *Fissidens crassipes*, *F. taxifolius* and *Bryum pseudotriquetrum* (Privitera, 1990). Sometimes, some filamentous algae occurs too, such as *Cladophora glomerata*.

Syndynamism: See class.

Habitat reference: See class.

9.1.2. Alliance: ***Platyhypnidion rusciformis*** Philippi 1956

Amphibious bryophytic vegetation of running waters

Synonyms: *Rhynchostegion riparioidis* Waldheim ex von Hübschmann 1957.

Holotypus: *Oxyrrhynchietum rusciformis* Gams ex v. Hübschmann 1953.

Characteristic and differential species: *Platyhypnidium ripariodes* (Hedw.) Dixon.

Geographical distribution: This alliance has a Circumboreal distribution.

Structure and ecology: The alliance groups the amphibian vegetation dominated by bryophytes that are well adapted to highly dynamic watercourses and able to tolerate short periods of drying.

Syndynamism: See class.

Habitat reference: See class.

9.1.2.1. ***Oxyrrhynchietum rusciformis*** Gams ex v. Hübschmann 1953

Bryophytic vegetation with long-beaked water feathermoss of shallow waters with high dynamism.

Synonyms: *Rhynchostegietum riparioidis* Gams 1927; *Rhynchostegium rusciformis* ass. Kaiser 1926 nom. nud.; *Platyhpnidietum riparioiidis* Kaiser ex v. Hübschmann 1953 nom. mut.

Lectotypus: Rel. 139, tab. 5, v. Hübschmann (1953), designated by Marstaller (2006).

Characteristic and differential species: *Palustriella commutata* (Hedw.) Ochyra (= *Cratoneuron commutatum* (Brid.) G. Roth).

Phytosociological table: From Privitera & Puglisi (1996), tab. 5, 31 rel.

Char. association and alliance: *Rhynchostegium riparioides* (V).

Char. order and class: *Cladophora glomerata* (II), *Fissidens crassipes* (I), *Fontinalis antipyretica* (I), *Racomitrium aciculare* (I), *Scapania undulata* (I), *Brachythecium rivulare* (I), *Amblystegium riparium* (I), *Lemanea catenata* (I).

Other species: *Bryum pseudotriquetrum* (III), *Rhynchostegium confertum* (II), *Fissidens taxifolius* (I), *Philonotis marchica* (I), *Cratoneuron filicinum* (I), etc.

Geographical distribution: The association is widely distributed throughout the Euro-Asian region and also in South America. In Sicily it is quite frequent along the streams of northern Sicily (Madonie, Nebrodi and Peloritani) and also in the rivers of the Hyblaean mountains (Privitera & Lo Giudice, 1981; Privitera, 1990; Privitera & Puglisi, 1996; Pasta et al., 2008).

Structure and ecology: The *Oxyrrhynchietum rusciformis* is a bryophytic community that colonizes rocky surfaces submerged by very shallow waters and with strong dynamism. It is a purely amphibious vegetation, characterized by the dominance of *Rhynchostegium riparioides*, a reptant bryophyte which constitutes a dense population able to tolerate long periods of drying. This species is associated with numerous characteristic taxa of the high rank syntaxa, among them *Cladophora glomerata*, *Fissidens crassipes*, *Fontinalis antipyretica*, *Racomitrium aciculare*, *Scapania undulata*, *Amblystegium riparium*, etc. The association mainly occurs in the thermo- and mesomediterranean belt, at altitudes of 200-1350 m, preferring rivers or seasonal streams with clear waters and characterized by a high acclivity (Brullo et al., 2001). A peculiar ecological variant of the association is represented by the subass. *porelletosum cordaeanae* Privitera 1990, which is distinguished by the occurrence of *Porella cordaeana* and for the more markedly mesic character, being represented only in beechwood above 1300 m of altitude in the Nebrodi range.

Syndynamism: See class.

Habitat reference: See class.

9.1.3. Alliance: ***Cinclidotion fontinaloidis*** Philippi 1956

Heliophilous bryophytic vegetation of basic waters with high hydrodynamism.

Synonyms: *Fissidention crassipedis* Koch 1936 nom. dub.; *Cinclidoto-Fissidention crassipedis* von Hübschmann 1957.

Lectotypus: *Cinclidotetum fontinaloidis* Gams ex von Hübschmann 1953.

Characteristic and differential species: *Bryum gemmiparum* De Not., *Cinclidotus riparius* (Host ex Brid.) Arn., *Fissidens crassipes* Wilson ex Bruch & Schimp. subsp. *crassipes*, *F. rufulus* Schimp., *Hyophila involuta* (Hooker) A. Jaeger.

Geographical distribution: See order.

Structure and ecology: This alliance includes the basiphilous bryophyte communities that colonize the rocky substrates affected by eutrophic waters with a strong hydrodynamism in sunny stands (Bardat & Hauguel, 2002). Usually, these habitats are temporarily submerged and are represented by rivulets and rivers at low altitudes.

Syndynamism: See class.

Habitat reference: See class.

9.1.3.1. ***Cinclidotetum fontinaloidis*** Gams ex v. Hübschmann 1953

Bryophytic vegetation with fountain lattice-moss running waters with high mineral content.

Synonyms: *Fissidenti-Cinclidotetum riparii* Allorge ex von Hübschmann 1967, *Fissidenti-Cinclidotetum riparii* Allorge 1921 nom. inval.; *Fissidenti-Ciclidotetum nigricantis* Allorge ex von Hübschmann 1967.

Lectotypus: Rel. 6, tab. 4, Hübschmann (1953), designated by Marstaller (1987).

Characteristic and differential species: *Cinclidotus fontinaloides* (Hedw.) P. Beauv. (=*Cinclidotus riparius* (Host ex Brid.) Arn.).

Phytosociological table: From Lo Privitera (1990), tab. 3, 10 rel.

Char. association and alliance: *Cinclidotus fontinaloides* (V), *Fissidens crassipes* (II), *Bryum gemmiparum* (II)**.**

Char. order and class: *Rhynchostegium riparioides* (IV), *Amblystegium tenax* (I)**,** *Cladophora gomerata* (I)**,** *Amblystegium riparium* (I)**,** *Brachythecium rivulare* (I)**,** *Fontinalis antipyretica* (I)., *Lemanea catenata* (I).

Other species: *Cratoneuron filicinum* (I)**,** *Rhynchostegium confertum* (I), etc.

Geographical distribution: The association is quoted from western and central Europe (Hübschmann, 1986), while in the Mediterranean it has been reported only in Sicily, where it occurs along the Alcantara river and the Vicaretto stream in the Madonie massif (Lo Giudice & Privitera, 1984; Privitera, 1990).

Structure and ecology: The rocky or pebbly siliceous substrata, subject to fast flowing waters with high mineral content, are colonized by an amphibious vegetation dominated by *Cinclidotus riparius*, which is referred to the *Fissidenti-Ciclidotetum nigricantis*. This community, linked to stands in the thermo and mesomediterranean belts (0-600 m a.s.l.) with subhumid ombrotype, can tolerate prolonged periods of dryness. From the structural point of view, the *Cinclidotetum fontinaloidis* is characterized by a caespitose component, represented by *Cinclidotus fontinaloides*, and by a reptant component represented by *Rhynchostegium riparioides*. The floristic set of this association also includes numerous species typical of the syntaxa of higher rank, such as *Fissidens crassipes*, *Amblytegium riparium*, *Cladophora glomerata*, *Amblytegium tenax* and sporadically also *Brachythecium rivulare* and *Fontinalis antipyretica* (Puglisi & Privitera, 2012).

Syndynamism: See class.

Habitat reference: See class.

9.1.3.2. ***Hyophiletum ehrenbergii*** von Hübschmann ex Marstaller 1987

Basophilous bryophytic vegetation with Ehrenberg's barbula moss of running waters.

Synonyms: *Hyophiletum eherenbergii* von Hübschmann 1957 nom. inval.

Neotypus: Rel. pg. 131, Marstaller (1987).

Characteristic and differential species: *Barbula bolleana* (J. K. A. Müller) Brotherus (= *B. ehrenbergii* (Lorentz) M. Fleisch; *Hyophila ehrenbergii* (Lorentz) J.J. Amann).

Phytosociological table: From Privitera (1990), tab. 4, 5 rel.

Char. association and alliance: *Barbula ehrenbergii* (V), *Bryum gemmiparum* (V), *Fissidens crassipes* (V).
Char. order and class: *Cladophora glomerata* (III), *Fontinalis antipyretica* (III), *Amblystegium tenax* (II), *Rhynchostegium riparioides* (II).
Other species: *Eurhynchium speciosum* (III), *Pellia endiviifolia* (III).

Geographical distribution: The association is recorded from Upper Rhine, southern France (Hübschmann, 1986) and south-eastern Spain (Gil & Ruiz, 1985). In Sicily it was found only in the riverbed of Hyblaean area near Syracuse (Privitera, 1990; Puglisi, 1997).

Structure and ecology: It is an amphibious vegetation dominated by caespitose bryo-chamaephytes, such as *Barbula ehrenbergii* and *Bryum gemmiparum*, which grow along the rivers on the calcareous rocky surfaces periodically submerged. This association is also enriched by the occurrence of some reptant bryophytes, such as *Fissidens crassipes*, *Fontinalis antipyretica* and *Rhynchostegium riparioides*, which, however, do not contribute significantly in defining its physiognomy (Privitera, 1990).

Syndynamism: See class.

Habitat reference: See class.

9.1.3.3. ***Leptodictyo riparii-Fissidentetum crassipedis*** Allorge ex Philippi 1956

Submerged bryophyte vegetation with kneiff's feather moss of slowly flowing waters.

Synonyms: *Leskeo-Leptodictyetum riparii* (von Krusenstjerna 1945) von Hübschmann 1957; ass. à *Fissidens crassipes* Jovet 1932; *Fissidens crassipes-Cynclodotus riparius* ass. Allorge 1921; *Oxyrrhynchietum rusciformis* Gams 1927.

Lectotypus: Rel. 3, tab. 4, Philippi (1956), designated by Marstaller (1987).

Characteristic and differential species: *Leptodictyum riparium* (Hedw.) Warnst. (=*Amblystegium riparium* (Hedw.) Schimp.).

Phytosociological table: From Privitera & Puglisi (1996), tab. 2, 11 rel.

Char. association and alliance: *Amblystegium riparium* (V), *Fissidens crassipes* (IV), *Rhynchostegium riparioides* (III).

Char. order and class: *Cladophora glomerata* (IV), *Fontinalis antipyretica* (II).

Other species: *Lophocolea bidentata* (II), *Rhynchostegium confertum* (I).

Geographical distribution: This association is recorded from France, Germany and Holland (Allorge, 1921; Philippi, 1956; Hubschmann, 1957), reaching its southern boundary in Sicily, where it is spread in the streams of the north-eastern area, along the Alcantara and Fiumefreddo river, as well as it occurs in the Anapo river in the Hyblaean Mountains (Privitera, 1990; Privitera & Puglisi, 1996).

Structure and ecology: The rocks or the submerged trunks and roots of watercourses with low hydrodynamism, preferably in the swamped areas, are colonized by a peculiar bryophyte vegetation dominated by the reptant moss *Amblystegium riparium*. This community, referred to the *Leptodictyo riparii-Fissidentetum crassipedis*, is also characterized by the occurrence of *Fissidens crassipes* and other species typical of the order and related class, such as *Cladophora glomerata*, *Fontinalis antipyretica* and *Rhynchostegium riparioides* (Privitera & Puglisi, 1996).

Syndynamism: See class.

Habitat reference: See class.

9.1.4. Alliance: ***Brachythecion rivularis*** Hertel 1974

Amphibious bryophytic vegetation of running watercourses, linked to neutral of basic waters.

Lectotypus: *Brachythecietum rivularis* Herzog ex Walters 1969.

Characteristic and differential species: *Brachythecium rivulare* Schimper., *Didymodon spadiceus* (Mitt.) Limpr.

Geographical distribution: See order.

Structure and ecology: The alliance brings together the neutral-basophilous bryophytic communities with a marked amphibian character, which grow along the watercourses from sea level to the mountain plain (Tomaselli et al., 2011). According to Bardat & Hauguel (2002), the communities of the *Brachythecion rivularis* can be referred at least in part to the *Montio-Cardaminetea* class.

Syndynamism: See class.

Habitat reference: See class.

9.1.4.1. ***Brachythecio rivularis-Hygrohypnetum luridi*** Philippi 1965

Amphibious basiphilous bryophytic vegetation with river ragged moss of surfaces temporarily submerged by running waters.

Synonyms: *Brachythecietum rivularis* Herzog ex Walther 1969; *Brachythecietum rivularis* v. Krusenstjerna 1945 non. nud.; *Hygrohypnetum palustris* Gams 1927; *Cratoneuretum filicini* Hertel 1974.

Neotypus: Rel. 4, tab. 8, Mamczarz (1978), designated by Marstaller (1987).

Characteristic and differential species:, *Brachythecium rivulare* Schimper, *Hygrohypnum luridum* (Hedwig) Jennings.

Phytosociological table: From Privitera & Puglisi (1996), tab. 5, 2 rel.

Char. association, subassociation and alliance: *Brachytecium rivulare* (2), *Amblystegium riparium* (2), *Rhynchostegium riparioides* (2).

Char. order and class: *Cladophora glomerata* (1).

Other species: *Rhynchostegium confertum* (1).

Geographical distribution: This association in Sicily is represented by subass. *amblystegietosum riparii* Marstaller 1987, where was surveyed along the Alcantara river near Gaggi at 90 m of altitude (Privitera & Puglisi, 1996). According to Marstaller (1987), this community occurs also in Germany.

Structure and ecology: The rocky surfaces of the more sheltered sections of watercourses, which are periodically flooded, are colonized by the *Brachythecio-Hygrohypnetum luridi*. From the floristic point of view, this vegetation is characterized by the dominance of pleurocarps, such as *Brachythecium rivulare*, *Rhynchostegium riparioides* and *Cladophora glomerata*, while the subass. *amblystegietosum riparii* Marstaller 1987 is distinguished by the significant occurrence of *Amblystegium riparium* (Privitera, 1990; Privitera & Puglisi, 1996).

Syndynamism: See class.

Habitat reference: See class.

9.2. Order: ***Hygrohypnetalia*** Krajina 1933

Aquatic, acidophilous and orophilous vegetation with bryophytes.

Synonyms: *Brachythecietalia plumosi* Philippi 1956.

Lectotypus: *Hygrohypnion dilatati* Krajina 1933.

Characteristic and differential species: *Racomitrium aciculare* (Hedw.) Brid.

Geographical distribution: This order shows a wide Eurasian distribution (Brullo et al., 2001). Communities of this syntaxon were recorded in Sicily by Privitera (1990), Brullo & Spampinato (1990) and Privitera & Puglisi (1994).

Structure and ecology: This order groups the bryophytic communities, submerged or amphibious, which grow on siliceous substrata. It is a markedly orophilous vegetation, linked to the waters of streams and mountain springs with high dynamism (Brullo et al., 2001).

Syndynamism: See class.

Habitat reference: See class.

9.2.1. Alliance: ***Racomitrion acicularis*** v. Krusenstjerna 1945 ex Philippi 1956

Aquatic, acidophilous and orophilous vegetation with bryophytes of streams with high hydrodynamism.

Synonyms: *Scapanion undulatae* Philippi 1956.

Holotypus: *Scapanietum undulatae* ohne author.

Characteristic and differential species: *Scapania undulata* (L.) Dumort.

Geographical distribution: See order.

Structure and ecology: See order.

Syndynamism: See class.

Habitat reference: See class.

9.2.1.1. ***Scapanietum undulatae*** Schwickerath 1944

Bryophytic, lithophilous and acidophilous vegetation with water earwort of cold and well-oxygenated running waters.

Synonyms: Ass. à *Racomitrium aciculare* et *Scapania undulata* Allorge 1921; *Scapanietum undulatae* Philippi 1956; *Solenostonetum pumili* Philippi 1965; ass. à *Scapania undulata* et *Fontinalis antipyretica* Lecointe & Provost 1970; *Fontinalietum squamosae* Hertel 1974 ass. provv. p.p..

Lectotypus: Rel. 11, tab. 2, Schwickerath (1944), designated by Marstaller (1987).

Characteristic and differential species: *Scapania undulata* (L.) Dumort.

Phytosociological table: From Privitera (1990), tab. 6, 6 rel.

Char. association and alliance: *Scapania undulata* (V)**.**
Char. order and class: *Rhynchostegium riparioides* (V)**,** *Racomitrium aciculare* (V).
Other species: *Cratoneuron filicinum* (V)**,** *Bryum pseudotriquetrum* (IV)**,** *Fissidens curnovii* (I).

Geographical distribution: This syntaxon is widespread in central and northern Europe (Hübschmann, 1986), Spain (Allorge, 1947, Gil & Varo, 1981), and also in Asia, North Africa and Macaronesian Archipelago. In Sicily it was surveyed between 1300 and 1400 m of altitude in the Madonie massif, along a stream in Contrada Pomieri (Brullo & Spampinato, 1990; Privitera, 1990).

Structure and ecology: The association occurs on siliceous rocky substrata, such as granites and metamorphites, usually along mountain streams with cold and clear waters. This association is characterized by the dominance of reptant species, such as *Scapania undulata* and *Rhynchostegium riparioides*, to which *Racomitrium aciculare* and a few other species are associated, including *Cratoneuron filicinum* and *Bryum pseudotriquetrum*, as well as some algae (Brullo et al., 2001).

Syndynamism: The association colonizes the rocky surfaces affected by running waters in shady stands under the canopy of riparian woodland belonging to *Agropyro panormitani-Salicetum pedicellatae* Brullo & Spampinato 1990, while at the edges of the watercourses it is replaced by the *Montio-Cardaminetea* communities (Brullo et al., 2001).

Habitat reference: See class.

10. Class: ***Isöeto-Nanojuncetea*** Br.-Bl. & R. Tx. ex Westoff, Dijk & Passarge 1946

Ephemeral vegetation of temporary ponds.

Synonyms: *Isoeto-Littorelletea* Br.-Bl. & Vlieger in Vlieger 1937 pro parte (art. 35); *Isoeto-Nanojuncetea* Br.-Bl. et Tx. 1943 (art. 2b); *Isoeto durieui-Juncetea bufonii* Br.-Bl. & R. Tx. ex Westhoff et al. 1946 (phantom); *Isöeto-Nanojuncetea* Br.-Bl. & R. Tx. in Br.-Bl. et al. 1952; *Isoetetea velatae* de Foucault 1988 (syntax. syn.); *Juncetea bufonii* de Foucault 1988 (art. 29); *Serapiadetea linguae* de Foucault 1999 (phantom); *Serapiadetea linguae* de Foucault 2001 (art. 3b); *Serapiadetea cordigero-linguae* de Foucault 2012 (syntax. syn.).

Lectotypus: *Isoetetalia* Br.-Bl. 1935.

Characteristic and differential species: *Antinoria insularis* Parl., *Elatine macrapoda Gaudinia fragilis* (L.) P. Beauv., *Juncus bufonius* L., *Juncus capitatus* Weigel, *J. hybridus* Brot., *J. pygmaeus* Rich. ex Thuill., *J. tenageja* Ehrh., *Lythrum hyssopifolia* L., *L. tribracteatum* Spreng., *Mentha pulegium* L., *Myosurus minimus* L.., *Poa infirma* Kunth, *Polypogon subspathaceus* Req., *Pulicaria vulgaris* L., *Ranunculus sardous* Crantz, *Veronica anagalloides* Guss.

Geographical distribution: The class is widely distributed in the Mediterranean area and also in the Macaronesian islands and in central Europe (Brullo & Minissale, 1998; Deil, 2005). In Sicily the *Isoeto-Nnaojuncetea* communities are quite widespread and well diversified, although localized and often threatened with disappearance.

Structure and ecology: The class groups the amphibian ephemeral communities linked to seasonally submerged surfaces. From the floristic point of view, it is a quite rich vegetation, where some very specialized therophytes and small hygrophytes with a very short biological life play a dominant role, sometimes associated with some hemicryptophytes and small geophytes, often rare and exclusively linked to this environment (Šumberová, 2011). As regards their ecology, these communities are able to colonize the humid depressions, submerged only for short periods, on all kind of substrata from the plain to the mountain belt. Their high diversification derives mainly from the different type of substrata, from the extension of the surface and from the time in which it remains submerged. However, their most common habitat is represented by small temporary ponds at low altitudes, where the impermeable soil led to the stagnation of water during the winter, becoming completely dry during the summer. Morevore, some *Isoeto-Nanojuncetea* communities are related to the stretches of streams with slowly flowing waters or to peculiar cultural environments, such as rice fields (Brullo & Minissale, 1998).

Syndynamism: The vegetation belonging to this class is represemted by a permanent communities, if disturbing factors are lacking, but become progressively less frequent due to the degradation of wetland (Hejný in Moravec et al., 1995; von Lampe, 1996; Täuber, 2000) . However, it should be emphasized that due to the ephemeral nature of this vegetation it is possible to observe a very marked seasonal succession. In fact, the *Isoeto-Nnaojuncetea* communities often show a development limited to a few months or even weeks, depending on the duration of the submersion period, being substituted during the dry period by other less specialized therophytic aspects, such as those of the *Tuberarietea guttatae* and *Bidentetea tripartitae* classes. From the catenal point of view, this vegetation can come into contact with the helophytes communities of the *Phragmito-Magnocaricea* or with the meso-hygrophilous meadows of the *Molinio-Arrhenatheretea* towards the shores of the humid environment, whereas if there are deeper waters it is in contact inward with the hydrophytic vegetation of the *Potametea* (Brullo et al., 2001).

Habitat reference: C1.6b Mediterranean temporary waterbody; C3.5a Periodically exposed shore with stable, eutrophic sediments with pioneer or ephemeral vegetation; C3.5c Periodically exposed saline shore with pioneer or ephemeral vegetation.

10.1. Order: ***Isöetetalia*** Br.-Bl. 1935

Annual thermo-hygrophilous vegetation with spring development of the seasonally submerged surfaces.

Synonyms: *Isoetetalia* Br.-Bl. 1931 (art. 2b); *Cyperetalia orientalis* Müller-Stoll et Pietsch in T. Müller 1963 (art. 2b, 3b); *Isoetetalia velatae* Br.-Bl. 1935 corr. Rivas Goday 1970 (phantom); *Isoetetalia velatae* (Br.-Bl. 1936) de Foucault 1988 (art. 29); *Isoetetalia durieui* Br.-Bl. 1935 corr. O. de Bolòs et al. 1990 (art. 40a, corr. illeg.).; *Serapiadetalia cordigero-linguae* de Foucault 2012 (syntax. syn.).

Lectotypus: *Isoetion* Br.-Bl. 1935

Characteristic and differential species: *Airopsis tenella* (Cav.) Coss. & Durieu*., Briza minor* L.*, Bulliarda vaillantii* (Willd.) DC.*, Catabrosa aquatica* (L.) P. Beauv., *Centaurium maritimum* (L.) Fritsch., *Damasonium alisma* Mill. subsp. *alisma*, *D. alisma* subsp. *bourgaei* (Coss.) Maire*,, D. polyspermum* Coss.*, Isoetes longissima* Bory, *Isolepis cernua* (Vahl) Roem. & Schult*., Lotus angustissimus* L., *Lotus hispidus* Desf., *L. parviflorus* Desf., *Lythrum borysthenicum* (Schrank) Litv., *Myosotis sicula* Guss*., Oenanthe silaifolia* M. Bieb., *Pilularia minuta* Durieu ex A. Braun*, Ranunculus muricatus* L.*, Romulea ramiflora* Ten.*, Trifolium filiforme* L., *Veronica acinifolia* L.

Geographical distribution: This order is usually distributed in the Mediterranean territories, with a sporadic occurrence in the Euro-Atlantic and Submediterranean countries (Brullo & Minissale, 1998).

Structure and ecology: The syntaxonomic classification of the *Isoeto-Nanojuncetea* class is particularly discussed, arousing the interest of many authors who have proposed different classification schemes (Koch, 1926; Braun-Blanquet, 1967; Rivas-Goday, 1970; De Foucault, 1988; , 1992; Rivas-Martinez et al., 1994, etc.). The traditional classification of Rivas-Goday (1970), also followed by Rivas-Martinez et al. (1994) and Brullo-Minissale (1998), identifies two orders within the class at issue: *Isoetalia* and *Nanocyperetalia*. The firstone gathers the hygrophilous and thermophilous vegetation with spring development that colonizes the temporary oligotrophic ponds in the Mediterranean environment, while the second one the communities aving a summer-autumnal optimum.

Syndynamism: See class.

Habitat reference: C1.6b Mediterranean temporary waterbody.

10.1.1. Alliance: ***Isöetion*** Br.-Bl. 1935

Thermo-hygrophilous vegetation with spring development of small ponds.

Synonyms: *Isoetion* Br.-Bl. 1931 (art. 2b); *Isoetion velatae* Br.-Bl. 1935 corr. Rivas Goday 1970 (phantom); *Antinorio agrostideae-Isoetion velatae* (Br.-Bl. 1936) de Foucault 1988 (art. 29); *Crassulo vaillantii-Lythrion borysthenici* de Foucault 1988 (syntax. syn.); *Ophioglosso lusitanici-Isoetion histricis* de Foucault 1988 (art. 29); *Serapiadion* Aubert et Loisel 1972 (syntax. syn.).

Lectotypus: *Isoetetum durieui* Br.-Bl. 1935

Characteristic and differential species: *Aira elegantissima* Schur*; Isoetes duriei* Bory*, I. histrix* Bory, *Lotus conimbricensis* Brot*., Ranunculus trilobus* Brot.

Geographical distribution: This alliance is mainly distributed in the western Mediterranean area, with sporadic occurrence in the Balkans and Turkey (Pietsch, 1973).

Structure and ecology: This alliance groups the annual hygrophilous communities of warm Mediterranean environments that colonize small areas subject to rapid drying since the beginning of spring (Brullo & Minissale, 1998).

Syndynamism: See class.

Habitat reference: See order

10.1.1.1. ***Isöetetum durieui*** Br.-Bl. 1935

Ephemeral hydrophitic vegetation with Durieu quillworts of temporary ponds.

Synonyms: ass. à *Isoetes durieui* et *Juncus capitatus* Br.-Bl. 1931 (art. 2b); ass. à *Isoetes durieui* et *Juncus capitatus* Br.-Bl. 1935 (synt. syn.); *Ranunculo lateriflori-Antinorietum insularis* Brullo, Grillo & Terrasi 1976 subass. *isoetetosum dueiui* Brullo, Grillo & Terrasi 1976 p.p.

Lectotypus: Rel. 10, *Isoetetum durieui*, Braun Blanquet (1935), here designated.

Characteristic and differential species: *Isoetes duriei* Bory,

Phytosociological table: From Marcenò & Trapani (1976), tab. 1, 10 rel.; Brullo et al. (1976), tab. 3, rel. 2-6; 2 rel. unpublished.

Char. association and alliance: *Lotus conimbricensis* (IV), *Isoetes duriei* (IV),

Char. order and class: *Juncus capitatus* (V), *Juncus bufonius* (IV), *Mentha pulegium* (IV), *Ranunculus lateriflorus* (II), *Lotus angustissimus* (II), *Trifolium filiforme* (II), *Bulliardia vaillanti* (I), *Lythrum hyssopifolia* (I).

Other species: *Aira cupaniana* (III), *Cynosurus cristatus* (III), *Moenchia erecta* (III), *Bellis perennis* (II), *Trifolium campestre* (II), *Anagallis arvensis* (II), etc.

Geographical distribution: The association was observed in the western Mediterranean area (Rivas-Goday, 1970; Molina, 2005), while in Sicily it was surveyd in the Piana degli Albanesi ponds by Marcenò & Trapani (1976), Monte Lauro (Brullo et al., 1976) and Madonie (unpublished data). It is possible to refer to this association also the relevés 2-7 of the tab. 3, published by Brullo et al. (1976) and attributed by them to *Ranunculo lateriflori-Antinorietum insularis* subass. *isoetetosum dueiui*.

Structure and ecology: This community colonizes small areas flooded during the winter period, but dried until from the beginning of spring (March-April), mainly on siliceous substrata (Bolòs, 1996). It is a vegetation characterized by the dominance of *Isoetes durieui* and *Juncus capitatus*, associated with a few other small species, such as *Juncus bufonius*, *Mentha pulegium*, *Ranunculus muricatus*, , *Lotus conimbricensis*, *Lotus angustissimus*, etc. (Marcenò & Trapani, 1976).

Syndynamism: The *Isöetetum durieui* is an ephemeral community that grows shortly during the winter and early spring on submerged surfaces, being replaced during the summer and autumn periods by some *Paspalo-Helochloetalia* communities.

Habitat reference: See order

10.1.1.2. ***Pulicario-Scirpetum savii*** Brullo & Di Martino 1974

Hygrophilous vegetation with low bulrush of small wet pools.

Lectotypus: Rel. 11, tab. 17, Brullo & Di Martino (1974), here designated.

Characteristic and differential species: *Damasonium alisma* Mill. subsp. *bourgaei* (Cosson) Maire*, D. polyspermum* Coss., *Isolepis cernua* (Vahl) Roem. & Schult.; *Pulicaria vulgaris* Gaertn. var. *graeca* (Sch.-Bip.) Fiori.

Phytosociological table: From Brullo & Di Martino (1974), tab. 17, 11 rel.

Char. association: *Isolepis cernua* (V), *Pulicaria vulgaris* var. *graeca* (V), *Damasonium polyspermum* (III).

Char. alliance: *Lotus conimbricensis* (I),

Char. order and class: *Polypogon subspathaceus* (V), *Centaurium maritimum* (V), *Lythrum hyssopifolia* (V), *Mentha pulegium* (V), *Juncus capitatus* (V), *Juncus pygmaeus* (III), *Spergularia rubra* (III), *Juncus bufonius* (II), *Lythrum borysthenicum* (I), *Damasonium alisma* subsp. *bourgaei* (I), *Callitriche brutia* (I).

Other species: *Polypogon maritimus* (V), *Juncus subulatus* (II), *Parapholis incurva* (I), *Plantago coronopus* (I), etc.

Geographical distribution: The association has been described from the island "Grande dello Stagnone" (Marsala), where it was surveyed only in the southern part (Brullo & Di Martino, 1974).

Structure and ecology: The *Pulicario-Scirpetum savii* grows in the small wet pools of the rocky surfaces, colonizing the deepest part, where the water lasts longer. From the floristic point of view, this community is characterized by the occurrence of several microphytes with an early blooming and in particular by the high coverage of *Isolepis cernua*, which is associated with *Pulicaria vulgaris* var. *graeca*, *Damasonium polyspermum* and *D. alisma* subsp. *bourgaei*. Several taxa of the order and the class occur, such as *Juncus capitatus*, *Lythrum hyssopifolia*, *Mentha pulegium*, *Polypogon subspathaceus*, *Juncus pygmaeus*, *Lythrum borysthenicum* and *Gaudinia fragilis*. The occurrence of *Lotus conimbricensis* allows to refer the association to the *Isoetion* alliance (Brullo & Di Martino, 1974; Brullo & Minissale, 1998).

Syndynamism: This association comes into contact with the halophilous vegetation of *Salicornio-Limonietum ferulacei* subass. *juncetusum subulati*, which prefers the outer surfaces subject to rapid drying. However, it can be replaced by populations of *Callitriche brutia* In the deeper waters. The raising of the ground level determines the progressive shift of this community towards *Tuberarietea* vegetation (Brullo & Di Martino, 1974).

Habitat reference: See order

10.1.1.3. ***Isöeto-Ranunculetum parviflori*** Brullo, Di Martino & Marcenò 1977

Hygrophilous vegetation with smallflower buttercup and low bulrush of small volcanic wet pools.

Holotypus: rel. 8, tab. 12, Brullo, Di Martino & Marcenò (1977).

Characteristic and differential species: *Ranunculus parviflorus* L.

Phytosociological table: From Brullo et al. (1977), tab. 12, 9 rel..
Char. association: *Ranunculus parviflorus* (V).
Char. alliance: *Isoetes durieui* (V)**,** *Ranunculus trilobus* (V)**.**
Char. order and class: *Ranunculus muricatus* (V), *Juncus bufonius* (V)**,** *Lythrum hyssopifolia* (V)**,** *Lotus angustissimus* (V)**,** *Mentha pulegium* (III), *Callitriche brutia* (I).
Other species: *Myosotis ramosissima* (V), *Cardamine hirsuta* (IV), *Coleostephus myconis* (IV), *Geranium robertianum* (III), *Poa annua* (III), *Galium murale* (III), *Stellaria media* (III)**,** *Carex distachya* (III)**,** *Allium subhirsutum* (III), *Sherardia arvensis* (III)**,** *Trifolium nigrescens* (III)**,** *Cerastium semidecandrum* (III)**.**

Geographical distribution: The association occurs only on the island of Pantelleria and in particular on the summit of Monte Gibele (Brullo et al., 1977).

Structure and ecology: The *Isöeto-Ranunculetum parviflori* is linked to the small depressions of the volcanic rocks, which are flooded during the winter. From the floristic point of view, it is characterized by the dominance of *Ranunculus parviflorus* and *Isoetes duerieui*, to which are associated some species of alliance and higher rank, such as *Ranunculus trilobus*, *Juncus bufonius*, *Lythrum hyssopifolium*, *Lotus angustissimus*, *Mentha pulegium*, etc. In particular, Brullo et al. (1977) distinguished two aspects of this association: subass. *isoetetosum* representing the typical form of syntaxon and the subass. *callitrichetosum*, which replaces the previous one in the most damp stands, where the water persists for a longer period.

Syndynamism: In the driest sites this vegetation is replaced by the meadows with acidophilous terophytes of the *Trifolio-Andryaletum cosyrensis*.

Habitat reference: See order

10.1.1.4. ***Crassulo vaillantii-Elatinetum gussonei*** Bartolo, Brullo, Minissale & Spampinato 1990

Hygrophilous vegetation with maltese waterwort of wet pools in rocky outcrops .

Holotypus: rel. 6, tab. 25, Bartolo et al. (1990).

Characteristic and differential species: *Elatine gussonei* (Sommier) Brullo, Lanfr., Pavone & Ronsisv., *Bulliardia vaillantii* (Willd.) DC.

Phytosociological table: From Bartolo et al. (1990a), tab. 25, rel. 9.

Char. association: *Elatine gussonei* (V), *Bulliardia vaillantii* (V).

Char. order and class: *Lythrum hyssopifolia* (V), *Juncus bufonius* (IV), *Polypogon subspathaceus* (IV), *Poa infirma* (I).

Other species: *Plantago coronopus* (IV), *Cichorium pumilum* (II), *Bromus mollis* (II), *Parapholis incurva* (I), *Asteriscus aquaticus* (I), *Triglochin barrelieri* (I), *Medicago polymorpha* (I).

Geographical distribution: The association, originally described from the Lampedusa island (Bartolo et al., 1990a), occurs also in the Maltese Archipelago (Minissale & Sciandrello, 2016; Brullo et al., 2019).

Structure and ecology: The small ephemeral pools of the calcareous rock, which are flooded only during the winter, are colonized by a peculiar amphibious community dominated by *Elatine gussonei*. The floristic set includes only few others therophytes, such as *Bulliardia vaillantii*, *Juncus bufonius*, *Polypogon subspathaceus*, *Lythrum hyssopifolia*, etc. (Bartolo et al., 1990a). It is a vegetation with a marked thermophilous character, which shows its optimum in March-April, just before the drying out of the pools in which it grows. Recently, *Elatine gussonei* has been quoted from Sicilian mainland (Kalinka et al., 2014; Molnàr et al., 2014; Minissale & Sciandrello, 2016, 2017b) and also from other Mediterranean localities (Molnàr et al., 2015; Sramkó et al., 2016; Takács et al., 2017). According to these authors, the new populations of *Elatine gussonei*, previously known in literature as *E. macropoda* Guss., are differentiated from the latter especially for the seed morphology. It is our opinion that this character is not sufficient for a correct identification, since it presents a certain variability, as emphasized also by molecular data (Sramkó et al., 2016). Therefore, it is opportune to deepen these taxonomic investigations basing on other diacritical characters, as well as on karyology, since Kalinka et al. (2014) have shown that the chromosomal number of *E. gussonei* is different from that of the other *Elatine* species. For the moment we believe appropriate to attribute to *Elatine gussonei* only the populations of Lampedusa and Malta, keeping the name of *E. macropoda* to the other Mediterranean populations.

Syndynamism: In the pools where the water persists for a shorter time, the *Crassulo-Elatinetum gussonei* is replaced by the therophytic vegetation of the *Thero-Sedetum caerulei*, while in deeper pond the hydrophilous communities of the *Ranunculion aquatilis* or the algal vegetation with *Chara vulgaris* and *Cladophora glomerata* are more represented .

Habitat reference: See order

10.1.1.5. ***Lythyro hyssopifoliae-Elatinetum macropadae*** ass. nov. provv.

Hygrophilous vegetation with southern waterwort of wet pools in rocky outcrops.

Synonyms: *Elatinetum macropodae* Pasta et al. 2008, not Br.-Bl. 1935.

Holotypus: Rel. 3, tab. 7, Pasta et al. (2008).

Characteristic and differential species: *Elatine macropoda* Guss., *Bulliardia vaillantii* (Willd.) DC.

Phytosociological table: From Pasta et al. (2008), tab. 7, 3 rel.; 24 unpublished reléves from Modica, Ragusa, Rosolini, Favignana and Isola Grande dello Stagnone.

Char. association: *Elatine macropoda* (V), *Bulliardia vaillantii* (V).

Char. order and class: *Lythrum hyssopifolia* (IV), *Juncus bufonius* (IV), *Poa infirma* (III), *Mentha pulegium* (III), *Callitriche brutia* (II), *Polypogon subspathaceus* (II), *Juncus capitatus* (II), *Catabrosa aquatica* (I), *Romulea ramiflora* (I), *Isolepis cernua* (I), *Juncus hybridus* (I), *Damasonium alisma* subsp. *bourgeui* (I), *Gaudinia fragilis* (I).

Other species: *Lythrum junceum* (II), *Plantago coronopus* (II), *Chamaemelum fuscatum* (II), *Spergularia rubra* (I), etc.

Geographical distribution: This association is distributed in several Sicilian localities, mainly in the western and southern-eastern parts, as well as in the island of Favignana (Egadean Archipelago) and Stagnone (Marsala).

Structure and ecology: It can be considered a vicariant in Sicilian mainland of *Crassulo vaillantii-Elatinetum gussonei*, occurring in Lampedusa and Malta. Both the associations are localized in the calcareous rocky pools, which are flooded only during winter and early spring. The community at issue is characterizated by the dominance of *Elatine macropoda* and *Bulliardia vaillantii*, which grows together with other hygrophytes, such as *Lythrum hyssopifolia*, *Juncus bufonius*, *J. capitatus*, *Poa infirma*, *Mentha pulegium*, *Catabrosa aquatica*, etc. As already highlighted in the remarks reported for the previous association, the populations of *Elatine* occurring in south-eastern and western Sicily (including Favignana and Stagnone) are for now attributed to *E. macropoda*, although in contrast to what has been pointed out by the above-mentioned authors.

Syndynamism: In the pools where the water persists for a shorter time, the *Lythro hyssopifoliae-Elatinetum macropodae* is replaced by the therophytic vegetation of the *Thero-Sedetum caerulei*, while in deeper pond the hydrophilous community of *Callitricho brutiae-Crassuletum vaillantii* usually occurs.

Habitat reference: See order.

10.1.1.6. ***Brizo minoris-Isolepidetum cernui*** Guglielmo, Sciandrello & Spampinato 2012 nom. inval. (art. 5)

Vegetation with little quakinggrass of shaded wet surfaces

Holotypus: Not indicated.

Characteristic and differential species: *Briza minor* L.; *Isolepis cernua* (Vahl) Roem. & Schult.

Phytosociological table: From Guglielmo et al. (2012), 9 rel.

Char. association: *Briza minor* (V), *Isolepis cernua* (V).

Char. order and class: *Juncus hybridus* (V), *Blackstonia acuminata* (IV), *Lythrum hyssopifolia* (III), *Mentha pulegium* (II), *Juncus foliosus* (II).

Other species: *Anagallis arvensis* (V), *Centaurium tenuiflorum* (V), *Imperata cylindrica* (V), *Polypogon maritimus* (IV), *Lythrum junceum* (III), *Parapholis filiformis* (III), *Trifolium squarrosum* (III), *Polypogon monspeliensis* (III), *Plantago coronopus* (III), etc.

Geographical distribution: This syntaxon has been reported by Guglielmo et al. (2012) for the salt marshes of southern-eastern Sicily.

Structure and ecology: This association occurs inside of the halo-hygrophilous communities of *Juncetea maritimi* class, that colonizes the shores of salt marshes. It is characterized by small hygrophilous therophytes, among them *Briza minor*, *Isolepis cernua*, *Juncus hybridus*, *J. foliosus*, *Blackstonia acuminata* and *Lythrum hyssopifolia*, which are linked to seasonal submerged surfaces. This vegetation shows it optimum between the end of winter and the beginning of spring.

Syndynamism: This community is replaced by hygrophilous meadows with *Polypogon subspathaceus* in the wet depressions with sunny exposure and conditions of greater halophily.

Habitat reference: See order.

10.1.1.7. ***Isoeto velatae-Crassuletum vaillantii*** Poiron & Barbero 1965

Hygrophilous vegetation with veiled quillwort and narrow-leaved mossy stonecrop.

Synonyms: Association à *Isoetes velata* et *Crassula vaillantii* Poiron & Barbero 1965.

Lectotypus: Rel. 4, tab. pg. 439, Poiron & Barbero (1965), here designated.

Characteristic and differential species: *Bulliardia vaillantii* (Willd.) DC., *Isoetes longissima* Bory.

Phytosociological table: From Minissale et al. (2017), tab. 1, 7 rel.

Char. association: *Isoetes longissima* (V), *Bulliardia vaillantii* (IV).

Char. order and class: *Ranunculus lateriflorus* (V), *Lythrum hyssopifolia* (V), *Juncus hybridus* (III), *Mentha pulegium* (III), *Callitriche brutia* (III), *Pilularia minuta* (III), *Lotus angustissimus* (III), *Eryngium pusillum* (III), *Poa infirma* (III), *Juncus pygmaeus* (II).

Other species: *Veronica anagallis aquatica* (IV), *Glyceria spicata* (III), *Anthemis cotula* (III), *Trifolium resupinatum* (II), *Eleocharis palustris* (I).

Geographical distribution: The association has been described from south-eastern France by Poiron & Barbero (1965) and recently surveyed in Sicily in the Hyblaean Plateau, on volcanic substrata near Cozzo Ogliastri and Cozzo Fico (Minissale et al., 2017).

Structure and ecology: A community dominated by *Isoetes longissima* and *Bulliardia vaillantii* occurs on rocky volcanic pools, subject to a long period of flooding and dried only in late spring, at 350-400 m of altitude. It was referred by Minissale et al. (2017) to *Isoeto velatae-Crassuletum vaillantii*, which differs from the typical association described from south France by Poiron & Barbero (1965) for the occurrence of *Ranunculus lateriflorus*, while for the rest is very similar.

Syndynamism: The *Isoeto velatae-Crassuletum vaillantii* is replaced by the *Ranunculo lateriflori-Callitrichetum brutiae* in the central part of the ponds subject to a longer flooding period, while outward the less deep stands, which are dry until the end of winter, are colonized the *Junco pygmaei-Pilularietum minutae*.

10.1.2. Alliance: ***Preslion cervinae*** Br.-Bl. ex Moor 1937

Thermo-hygrophilous vegetation with late development of surfaces subject to flooding during the spring

Synonyms: *Preslion cervinae* Br.-Bl. 1931 (art. 2b); *Menthion cervinae* Br.-Bl. ex Moor 1937 nom. mut. propos. (art. 45).

Holotypus: *Preslietum cervinae* Br.-Bl. ex Moor 1937

Characteristic and differential species: *Callitriche brutia* Petagna*, C. platycarpa* Kütz., *Juncus foliosus* Desf., *Preslia cervina* L., *Ranunculus lateriflorus* DC., *R. ophioglossifolius* Vill.., *Veronica anagalloides* Guss.

Geographical distribution: The alliance is widespread in the Mediterranean territories (Biondi & Blasi, 2015) and it is well represented in Sicily.

Structure and ecology: It groups hygrophilous communities with thermophilous requirements, which are localized in the wetlands flooded throughout the spring (Brullo & Minissale, 1998). It is a vegetation dominated by piooner reptant rhizophytes linked to damp depressions with quite deep waters and able to persist until May-June, although completely dry in the summer (Costa et al., 2012).

Syndynamism: The phytocoenoses belonging to *Preslion cervinae* represent a very specialized vegetation, which assumes a permanent character in absence of disturbance. However, the phenomena of interruption or alteration of the water balance can threaten this communities, leading to a reduction of the amphibian and hygrophilous components to the benefit of the annual xerophytes and consequently favoring the settlement of the thermo-

xerophilous vegetation of the *Tuberarietea guttatae* class. Conversely, the perturbations that instead cause a prolongation of the period of submergence, favor the settlement of the perennial hygrophilous species, leading to the development of *Molinio-Arrhenateretea* or *Phragmito-Magnocaricetea* communities. Moreover, these communities are often in contact with each other, giving rise to complex vegetation mosaics determined primarily by the humidity gradient (Biondi & Blasi, 2015).

Habitat reference: See order.

10.1.2.1. ***Ranunculo lateriflori-Antinorietum insularis*** Brullo, Grillo & Terrasi 1976

Vegetation with sessile flowers buttercup of mountain ponds with shallow waters on volcanic rocks.

Synonyms: *Ranunculo lateriflori-Antinorietum insularis* Brullo, Grillo & Terrasi 1976 subass. *isoetetosum dueiui* Brullo, Grillo & Terrasi 1976 p.p.

Lectotypus: Rel. 16, tab. 3, Brullo et al. (1976), here designated.

Characteristic and differential species: *Antinoria insularis* Bory, *Myosotis tineoi* C.Brullo & Brullo, *Ranunculus lateriflorus* DC.

Phytosociological table: From Brullo et al. (1976), tab. 3 (rel. 8-17), 10 rel.

Char. association: *Antinoria insularis* (V), *Myosotis tineoi* (II).

Char. alliance: *Ranunculus lateriflorus* (V), *Callitriche brutia* (III).

Char. order and class: *Lythrum hyssopifolia* (V)**,** *Mentha pulegium* (V), *Isoetes duriei* (IV), *Lotus angustissimus* (IV), *Bulliardia vaillantii* (IV), *Trifolium filiforme* (IV), *Gaudinia fragilis* (IV), *Eryngium pusillum* (III)**,** *Isoetes longissima* (III), *Poa infirma* (III). *Ranunculus muricatus* (III), *Juncus bufonius* (II), *Juncus capitatus* (II), *Lotus conimbricensis* (II), *Polypogon subspathaceus* (II), *Ranunculus trilobus* (II), *Juncus pygmeus* (II).

Other species: *Trifolium tomentosum* (II), *Trifolium campestre* (II), *Trifolium squarrosum* (II), *Trifolium leucanthum* (I), *Anagallis arvensis* (I), *Myosotis ramosissima* (I).

Geographical distribution: This association is currently localized in the summit areas of Monte Lauro in the Hyblaean area (Brullo et al., 1976).

Structure and ecology: It occurs exclusively in the volcanic rocky pool at about 900 m of altitude, which are submerged until the end of spring. Physiognomically, it is differentiated by the dominance by *Ranunculus lateriflorus* and *Antinoria insularis*, growing together with several other amphibious hygrophytes, such as *Bulliardia vaillantii*, *Callitriche brutia*, *Lythrum hyssopifolia*, *Trifolium filiforme*, *Isoetes durieui*, *I. longissima*, *Juncus* sp. pl., etc. The occurrence in this association of *Myosotis tineoi*, a rare Hyblaean endemism closely related to *M. sicula*, is of considerable interest. Previously, this association was recorded also from Nebrodi range by Brullo & Grillo (1978), who, however, considered it as a distinct subassociation, named it

veronicetosum serpillyfoliae. On the basis of new investigations, this syntaxon is treated now as an indipendent association (*Ranunculetum pratensis-lateriflori*).

Syndynamism: This association is replaced by the *Hypochaerido-Lotetum conimbricensis* belonging to *Molinio-Arrhenatheretea* class, which is linked to not submerged surfaces, while the stands subject to a longer period of flooding with deepest waters are colonized by the *Ranunculo-Callitrichetum brutiae*. Unfortunately, in the last decades the territory in which it was located was profoundly altered by human activities, which led to its rarefaction and floristic impoverishment.

Habitat reference: See order.

10.1.2.2. ***Myosuro minimi-Ranunculetum laterifolii*** Raimondo 1980

Vegetation with tiny mousetail and sessile flowers buttercup of mountain depressions with shallow waters on calcareous rocks.

Holotypus: Rel. 1, tab. 2, Raimondo (1980).

Characteristic and differential species: *Myosurus minimus* L., *Ranunculus marginatus* d'Urv., *Sagina subulata* (Sw.) C. Presl., *Spergularia madoniaca* Lojac.

Phytosociological table: From Raimondo (1980), tab. 2, 2 rel.; 12 unpublished relevés from Madonie.

Char. association: *Myosurus minimus* (IV), *Spergularia madoniaca* (IV), *Sagina subulata* (III), *Ranunculus marginatus* (I).

Char. alliance: *Antinoria insularis* (V), *Ranunculus lateriflorus* (V).

Char. order and class: *Mentha pulegium* (IV), *Poa infirma* (IV), *Juncus bufonius* (III), *Trifolium filiforme* (II), *Ranunculus muricatus* (II), *Lotus angustissimus* (I), *Lyhtrum borysthenicum* (I).

Other species: *Polygonum aviculare* (III), *Plantago cupanii* (III), *Eleocharis nebrodensis* (II), *Cynosurus cristatus* (II), *Polygonum aviculare* (II), *Spergularia bocconii* (II), *Oenanthe pimpinelloides* (II), *Trifolium campestre* (II), *Trifolium leucanthum* (II), *Glyceria spicata* (I), etc.

Geographical distribution: Basing on literature (Raimondo, 1980) and unpublished data, the association occurs exclusively in the Madonie Massif, where it is quite rare and localized in the small wetlands of mountain belt.

Structure and ecology: It is a very peculiar vegetation linked to the central part of damp depressions of mountain environment (1200-1600 m), characterized by impermeable silty-clay soils. These stands are often covered by a layer of snow during winter and flooded by shallow waters in spring, when are colonized by a precocious community dominated by hygrophilous microphytes, such as *Ranunculus lateriflorus*, *Myosurus minimus*, *Spergularia madoniaca*, *Sagina subulata*, *Ranunculus marginatus*, *Trifolium filiforme*, *Antinoria insularis*., etc. This association is closely related with the *Ranunculo lateriflori-Antinorietum insularis*,

which for their ecology and floristic set must be included within *Preslion cervinae*. However, the community at issue differs very well from the previous one for its localization on carbonatic substrata and for the occurrence of some rare species exclusive of these habitats (Raimondo, 1980).

Syndynamism: The association is replaced in the less damp stands by a meso-hygrophilous community, represented by *Eleocharido nebrodensis-Juncetum compressi*, which externally is in contact with the mesophilous meadows of *Cynosuro cristati-Plantaginetum cupanii* (Raimondo, 1980).

Habitat reference: See order.

10.1.2.3. ***Ranunculetum pratensis-lateriflori*** ass. nov. provv.

Vegetation with sessile flowers buttercup and meadows buttercup of mountain siliceous wet depressions.

Synonyms: *Ranunculo lateriflori-Antinorietum insularis* Brullo, Grillo & Terrasi 1976 subass. *veronicetosum serpyllifoliae* Brullo & Grillo 1978.

Holotypus: Not designated.

Characteristic and differential species: *Barbarea bracteosa* Guss., *Ranunculus pratensis* C. Presl., *Veronica serpyllifolia* L.

Phytosociological table: From Brullo & Grillo (1978), tab. 7, rel. 11.

Char. association: *Ranunculus pratensis* (V), *Barbarea bracteosa* (IV), *Veronica serpyllifolia* (IV).

Char. alliance: *Antinoria insularis* (V), *Ranunculus lateriflorus* (V).

Char. order and class: *Mentha pulegium* (IV), *Lotus angustissimus* (IV), *Myosotis sicula* (III)**,** *Poa infirma* (III)**,** *Lythrum borysthenicum* (III)**,** *Trifolium filiforme* (III), *Juncus bufonius* (II).

Other species: *Spergularia bocconii* (IV), *Polypogon viridis* (III), *Oenanthe fistulosa* (III), *Apium inundatum* (II), *Lyhtrum junceum* (II), *Polygonum aviculare* (II), *Potentilla reptans* (II), *Cynosurus cristatus* (I).

Geographical distribution: The association was surveyd in the Nebrodi range by Brullo & Grillo (1978), where it occurs only in mountain belt.

Structure and ecology: It is an orophilous vegetation linked to small wet depressions at an altitude of 1400-1700 m, covered by snow during the winter and flooded in the spring (Brullo & Grillo, 1978). These stands are colonized by small hygrophytes, mainly represented by *Ranunculus lateriflorus*, *R. pratensis*, *Antinoria insularis*, *Trifolium filiforme*, *Mentha pulegium*, *Myosotis sicula*, *Lotus angustissimus*, etc. Previously, it was attributed by Brullo & Grillo (1978) to *Ranunculo lateriflori-Antinorietum insularis* and in particular to the subass. *veronicetosum serpyllifoliae*, differentiated by *Ranunculus pratensis*, *Barbarea bracteosa* and *Veronica*

serpyllifolia. On the basis of current knowledges, these last species are proposed as characteristic of a new association quite related to *Ranunculo lateriflori-Antinorietum insularis*. This new association, proposed as *Ranunculetum pratensis-lateriflori*, differs from the latter, apart from the floristic set, also for the ecology, since it is linked to siliceous substrata and for its distribution at higher altitudes.

Syndynamism: This association is replaced in the deeper depressions with waters persistent during almost all the year by a perennial vegetation, represented by *Oenantho-Glycerietum spicatae* (Brullo & Grillo, 1978). In the raised stands not subject to flooding, it is instead in contact with the mesophilous meadows of *Cynosuro cristati-Leontodontetum siculi*.

Habitat reference: See order.

10.1.2.4. ***Ranunculo lateriflori-Callitrichetum brutiae*** Brullo & Minissale 1998

Vegetation with sessile flowers buttercup and pedunculate water-starwort of volcanic rock pools with shallow waters

Synonyms: *Ranunculo lateriflori-Antinorietum insularis* subass. *ranunculetosum lateriflori* Brullo, Grillo & Terrasi 1976; *Callitricho-Crassuletum vaillantii* subass. *ranunculetosum lateriflori* Brullo, Scelsi, Siracusa & Tomaselli 1998.

Holotypus: rel. 21, tab. 3, Brullo et al. (1976).

Characteristic and differential species: *Bulliardia vaillantii* (Willd.) DC.

Phytosociological table: From Brullo et al. (1976), tab. 3, 7 rel.; Brullo et al. (1998c), tab. 2, 7 rel.

Char. association: *Bulliardia vaillantii* (V).

Char. alliance_ *Callitriche brutia* (V), *Ranunculus lateriflorus* (V).

Char. order and class: *Juncus bufonius* (V), *Mentha pulegium* (V), *Polypogon subspathaceus* (V), *Lythrum hyssopifolia* (V), *Lythrum borysthenicum* (IV), *Ranunculus trilobus* (IV), *Juncus capitatus* (III), *Gaudinia fragilis* (III), *Poa infirma* (III).

Other species: *Polygonum aviculare* (V), *Trifolium tomentosum* (IV), *Spergularia bocconei* (IV).

Geographical distribution: The association is known exclusively for the cacuminal areas of Monte Lauro, on the Hyblaean mountains (Brullo et al., 1976).

Structure and ecology: This vegetation occur in wide pools on basaltic substrata, subject to prolonged submersion with waters deep 1-1.5. It is an association of the *Preslion cervinae* both for its ecology and high coverage values of *Callitriche brutia* and *Ranunculus lateriflorus* Brullo & Minissale (1998). Floristically, it is differentiated by the costance and dominance of *Bulliardia vaillantii*, growin with several species of *Isoeto-Nanojuncetea*.

Syndynamism: This vegetation replaces the *Ranunculo-Antinorietum insularis* or the *Anagallido parviflorae-Molinierielletum minutae* in the surfaces submerged during almost the whole year (Brullo et al., 1976, 1998c).

Habitat reference: See order.

10.1.3. Alliance: ***Cicendio filiformis-Solenopsion laurentiae*** Brullo & Minissale 1998

Thermo-hygrophilous vegetation of siliceous wetlands, wet until late spring, rich in microphytes.

Synonyms: *Cicendion* auct. medit. non Br. Bl. 1967.

Holotypus: *Laurentio-Anthocerotetum dichotomi* Br.-Bl. 1935

Characteristic and differential species: *Anagallis parviflora* Hoffmanns. & Link, *Centunculus minimus* L., *Cicendia filiformis* (L.) Delarbre, *Hypericum australe* Ten., *Kickxia cirrhosa* (L.) Fritsch, *Ophioglossum lusitanicum* L., *Radiola linoides* Roth, *Solenopsis laurentia* (L.) C. Presl. subsp. *laurentia*.

Geographical distribution: The alliance is well represented in the western and central Mediterranean, while it results more rare in the Atlantic area (Biondi & Blasi, 2015).

Structure and ecology: This alliance groups spring therophytic communities with acidophilous requirements, occurring on waterlogged soils of large hallows, flooded until late spring and dried up in summer (Brullo & Minissale, 1998). These surfaces are covered by a silty-clay layer, often rich in sandy component, usually localized inside woods or shrublands clearings. From a structural point of view, these communities are characterized by microphytes, often growing on bryophyte carpets (Biondi & Blasi, 2015). This syntaxon is considered by Mucina et al. (2016) as synonym of *Cicendion* (Rivas Goday in Rivas Goday & Borja 1961) Br. Bl. 1967. Really, the latter was at first described by Rivas Goday (see Rivas Goday & Borja 1961) as a suballiance of the *Nanocyperion flavescentis*, considering as nomenclatural type the *Cicendietum filiformis* Allorge 1922, association described from North France rich in elements of *Nanocyperetalia*, while the characteristic species of *Isoetetalia* are totally absent. In fact, this association, showing a summer phenology, is linked to temperate bioclimate, thus it is floristically and ecologically very different from the typical mediterranean associations belonging to *Cicendio filiformis-Solenopsion laurentiae* (Brullo & Minissale, 1998; Biondi et al., 2014). Besides, contrary to what has been stated by Mucina et al. (2016), the *Radiolion linoidis* Pietsch 1973 must be considered a synonym of *Cicendion*, as emphasized by Brullo & Minissale (1998), since the two syntaxa are floristically and ecologically perfectly overlapping, having moreover both as nomenclatural type the same association (*Cicendietum filiformis*).

Syndynamism: The communities belonging to this alliance show more sciaphilous and hygrophilous requirements than those ones of the *Isoetion* (Brullo & Minissale, 1998).

Moreover, they takes catenal contact in more dry surfaces with the ephemeral meadows of *Helianthemetea guttati*.

Habitat reference: See order.

10.1.3.1. ***Archidio-Isoetetum velatae*** Brullo & Minissale 1998

Vegetation with veiled quillwort of wet pools on volcanic rocks

Holotypus: Rel. pg. 281, Brullo & Minissale (1998).

Characteristic and differential species: *Archidium alternifolium* (Dicks. ex Hedw.) Mitt.

Phytosociological table: From Brullo & Minissale (1998), rel. pg. 281; 4 unpublished rel.
Char. association: *Archidium alternifolium* (V).
Char. alliance: *Solenopsis laurentia* subsp. *laurentia* (V), *Angallis parviflora* (V).
Char. order and class: *Isoetes longissima* (V), *Juncus bufonius* (V), *Mentha pulegium* (IV), *Isoetes histrix* (IV), *Lythrum hyssopifolia* (IV), *Juncus capitatus* (IV), *Juncus pygmaeus* (IV), *Isoetes durieui* (III), *Centaurium maritimum* (III).
Other species: *Triglochin laxiflorum* (V), *Oenanthe pimpinelloides* (V), *Ranunculus flabellatus* (V), *Aira cupaniana* (IV). *Centaurium tenuiflorum* (III), etc.

Geographical distribution: This association is known only for Cozzo Ogliastro near Sortino (Hyblaean mountains).

Structure and ecology: The *Archidio-Isoetetum velatae* is a rare community, which colonizes the wet pools on the volcanic rocks, at 500 m a.s.l. From the floristic point of view, the bryophyte *Archidium alternifolium* has high index of coverage, growing together with *Triglochin laxiflorum*, *Isoetes longissima* and some typical species of *Cicendio-Solenopsion laurentiae* alliance, such as *Anagallis arvensis* subsp. *parviflora* and *Solenopsis laurentia*.

Syndynamism: See alliance.

Habitat reference: See order.

10.1.3.2. ***Anagallido parviflorae-Molinerielletum minutae*** Brullo, Scelsi, Siracusa & Tomaselli 1998

Vegetation with *small hair grass* of wet depression on volcanic rock, subject to short period of submersion.

Holotypus: Rel. 4, tab. 1, Brullo et al. (1998).

Characteristic and differential species: *Molineriella minuta* (L.) Rouy.

Phytosociological table: From Brullo et al. (1998), tab. 1, 25 rel.

Char. association: *Molineriella minuta* (V), *Anagallis parviflora* Hoffmgg. & Link (V).

Char. alliance: *Isoetes duriei* (V), *Lotus conimbricensis* (IV).

Char. order and class: *Lythrum hyssopifolia* (V), *Juncus bufonius* (V), *Juncus capitatus* (V), *Polypogon subspathaceus* (V)*, Poa infirma* (V), *Bulliarda vaillantii* (IV), *Mentha pulegium* (IV), *Lotus angustissimus* (IV), *Romulea ramiflora* (IV), *Juncus pygmaeus* (IV), *Centaurium maritimum* (II), *Juncus hybridus* (I).

Other species: *Coleostephus myconis* (V), *Bellis annua* (V), *Euphorbia exigua* (IV), *Medicago tuberculata* (IV), *Allium obtusiflorum* (IV), *Plantago lagopus* (IV), *Ranunculus paludosus* (III), etc.

Geographical distribution: The association is known exclusively for Bosco Pisano, near Buccheri (Hyblaean plateau).

Structure and ecology: This community prefers the silty substrata in the depressions of the basaltic rock that are submerged only during the autumn and winter period. It is a highly specialized hygrophilous vegetation with late winter-spring development, whose physiognomy is defined by two rare therophytes, such as *Molineriella minuta* and *Anagallis parviflora*, associated with numerous species typical of the syntaxa of higher rank, such as *Isoetes duriei*, *Lotus conimbricensis*, *L. angustissimus*, *Lythrum hyssopifolia*, *Juncus pygmaeus*, *J. capitatus*, etc. According to Brullo et al. (1998), within the association two aspects can be distinguished: 1) subass. *typicum* that occupies the surfaces subject to a shorter period of submersion; 2) subass. *crassuletosum vaillantii* that is linked to depressions humid for a longer period and is floristically differentiated by the high coverage values of *Bulliarda vaillantii*.

Syndynamism: This association is replaced in more wet conditions by the *Callitricho brutiae-Crassuletum vaillantii*, while in xeric surfaces it is in cotanct with the *Helianthemetea guttati*.

Habitat reference: See order.

10.1.3.3. ***Kickxio cirrhosae-Solenopsietum laurentiae*** Brullo & Minissale 1998

Acidophilous vegetation with sharp leaved fluellen and dwarf solenopsis of damp and shaded drepressions.

Synonyms: *Laurentio-Juncetum capitati* Brullo, Scelsi & Siracusa 1994, non Rivas Goday & Borja 1968.

Holotypus: rel. 4, tab. 11, Brullo et al. (1994), designated by Brullo & Minissale (1998).

Characteristic and differential species: *Kickxia cirrhosa* (L.) Fritsch.

Phytosociological table: From Brullo et al. (1994), tab. 11, 10 rel..

Char. association: *Kickxia cirrhosa* (V).

Char. alliance: *Cicendia filiformis* (V)*, Radiola linoides* (V), *Solenopsis laurentia* (V), *Anagallis parviflora* (IV), *Centunculus minimus* (IV)*, Ophioglossum lusitanicum* (III).

Char. order and class: *Centaurium maritimum* (V), *Lotus parviflorus* (V), *Juncus capitatus* (V), *Lythrum hyssopifolia* (IV), *Polypogon subspathaceus* (IV), *Juncus bufonius* (IV), *Gaudinia fragilis* (II), *Briza minor* (I).

Other species: *Euphorbia pterococca* (III).

Geographical distribution: The association is currently known only for Isola Grande dello Stagnone, near Marsala (Brullo et al., 1994).

Structure and ecology: The *Kickxio cirrhosae-Solenopsietum laurentiae* colonizes the small wet depressions, which are characterized by a short period of submersion during the winter period and dry since the beginning of the spring. It is an acidophilous vegetation linked to shady stations and protected by the large tufts of *Lygeum spartum*, where many microphites occur, such as *Cicendia filiformis*, *Centunculum minimus*, *Anagallis parviflora*, *Radiola linoides*, *Ophioglossum lusitanicum*, *Kickxia cirrhosa* and *Solenopsis laurentia* (Brullo et al., 1994). Moreover, this community is enriched by the presence of some species typical of *Isoetalia* and of *Isoeto-Nanojuncetea*, such as *Lotus parviflorus*, *Juncus capitatus*, *J. bufonius*, *Centaurium maritimum*, etc. This association was ascribed by Brullo et al. (1994) to *Laurentio-Juncetum capitati* Rivas Goday & Borja 1968, an association described from Iberian Peninsula (Rivas Goday, 1970), which differs from that one at issue for its ecology and the floristic set.

Syndynamism: This community, with the progressive reduction of humidity, is replaced by a therophytic vegetation belonging to *Helianthemetea guttatae*, represented by *Bellido annuae-Solenopsidetum laurentiae* (Brullo et al., 1994).

Habitat reference: See order.

10.1.3.5. ***Junco pygmaei-Pilularietum minutae*** Minissale, Molina & Sciandrello 2017

Hygrophilous vegetation with dwarf pillwort of temporarily flooded surfaces.

Holotypus: rel. 8, tab. 1, Minissale et al. (2017).

Characteristic and differential species: *Pilularia minuta* Durieu

Phytosociological table: From Minissale et al. (2017), tab. 1, 9 rel.

Char. association: *Pilularia minuta* (V),

Char. alliance: *Cicendia filiformis* (III)**,** *Solenopsis laurentia* (III),

Char. order and class: *Juncus pygmaeus* (V), *Lythrum hyssopifolia* (V)**,** *Mentha pulegium* (V), *Juncus hybridus* (V), *Isoetes longissima* (IV), *Ranunculus lateriflorus* (III)**,** *Lotus angustissimus* (III), *Poa infirma* (II), *Bulliarda vaillantii* (III), *Lyhtrum borysthenicum* (II), *Callitriche brutia* (II).

Other species: *Eleocharis palustris* (I), *Polygonum arenastrum* (I), *Spergularia* sp. (I).

Geographical distribution: The association is currently known in Sicily for Cozzo Fico e Cozzo Ogliastri, in Hyblaean plateau (Minissale et al., 2017).

Structure and ecology: This vegetation is localized in basaltic substrata, limitedly to pools covered by clayey-silty soils, flooded during the winter and early spring by freshwaters., within the thermomediterranean belt (350-400 m of altitude). It is a peculiar amphibious community characterized by the occurrence of *Pilularia minuta*, a rare species, whose presence in Sicily was recorded also by Troia & Lansdown (2016) from Anguillara wetland near Calatafimi. Its physiognomy is defined by some very specialized hygrophilous therophytes that grow together with *Pilularia minuta*, such as *Juncus pygmaeus*, *Lotus angustissimus*, *Lythrum hyssopifolia*, *L. borysthenicum*, *Ranunculus lateriflorus*, *Mentha pulegium*, *Bulliarda vaillantii*, *Solenopsis laurentia*, *Cicendia filiformis*, etc. According to Minissale et al. (2017), within this association, apart from the subass. *typicum*, also a subass. *tillaeetosum vaillantii* can be recognized, linked to more wet conditions.

Syndynamism: In the temporary ponds this community tends to occupy the area with shallow waters, which is already emerged at the end of winter, coming into contact in the more damp surfaces with the *Isoeto velatae-Crassuletum vaillantii* Poiron & Barbero 1965 (Minissale et al., 2017).

Habitat reference: See order.

10.2. Order: ***Nanocyperetalia*** Klika 1935

Annual meso-hygrophilous vegetation with summer-autumn development of surfaces that are submerged for a long period.

Synonyms: *Nanocypero-Polygonetalia* Koch 1926 (art. 2b); *Cyperetalia fusci* Müller-Stoll & Pietsch in Lohmeyer et al. 1962 (art. 2b); *Cyperetalia fusci* Müller-Stoll & Pietsch in T. Müller 1963 (art. 31); *Cyperetalia fusci* Pietsch 1963 (art. 29); *Elatino triandrae-Cyperetalia fusci* de Foucault 1988 (syntax. syn.); *Scirpetalia setacei* de Foucault 1988 (art. 30, mut. illeg.); *Isolepidetalia setacei* de Foucault 1988 nom. mut. propos. (mut. illeg.); *Cicendietalia filiformis* Gèhu 1992 (art. 2b); *Myosuro-Beckmannietalia eruciformis* Shapoval 2006 (art. 2b, 5).

Lectotypus: *Nanocyperion flavescentis* W. Koch ex Libbert 1932.

Characteristic and differential species: *Centaurium pulchellum* (Sw.) Druce, *Corrigiola littoralis* L., *Cyperus fuscus* L., *C. michelianus* (L.) Link, *Eryngium pusillum* L., *Gnaphalium luteo-album* L., *G. uliginosum* L., *Peplis portula* L., *Plantago intermedia* Gilib., *Sagina procumbens* L., *S. subulata* (Sw.) C. Presl, *Spergularia rubra* (L.) J. Presl & C. Presl.

Geographical distribution: This order is mainly represented in Central Europe and in the Atlantic area, but with penetrations in the Mediterranean countries (Brullo & Minissale, 1998).

Structure and ecology: The *Nanocyperetalia* order brings together the hygrophilous communities characterized by the dominance of therophytes with late summer-autumn development, which are linked to surfaces flooded for long periods, but dry during the summer. This vegetation colonizes eutrophic or hypertrophic soils with basic or sub-acid chemism, both in inland and coastal sites with surfaces extensively, often flooded by slightly brackish waters (Brullo & Minissale, 1998). Floristically, this syntaxon is differentiated by ephemeral species usually showing a prostrate and creeping habit.

Syndynamism: The communities of this order can be considered as a permanent vegetation, linked to silty-clay surfaces of wetlands submerged for long period with damp soils also in summer, usually covering wide stands.

Habitat reference: C3.5a Periodically exposed shore with stable, eutrophic sediments with pioneer or ephemeral vegetation; C3.5c Periodically exposed saline shore with pioneer or ephemeral vegetation.

10.2.1. Alliance: ***Nanocyperion flavescentis*** W. Koch 1926

Hygrophilous vegetation of very damp, sandy-clayey or organic soils, with the dominance of small or medium-sized annual hydrophytes with prostrate habit.

Synonyms: *Nanocyperion* Libbert 1932 p.p (art. 31); *Eu-Nanocyperion flavescentis* (W. Koch 1926) Rivas Goday in Rivas Goday & Borja 1961 p.p. (orig. form.) (art. 29a, 34b); *Peplidion portulae* Pietsch & Müller-Stoll 1974 (syntax. syn.); *Centaurio pulchelli-Blackstonion perfoliatae* de Foucault 1988 (art. 3g).

Lectotypus: *Juncus compressus-Parvocyperus* assoziation Br.-Bl. 1920.

Characteristic and differential species: *Blackstonia perfoliata* (L.) Huds., *B. acuminata* (W.D.J. Koch & Ziz) Domin, *Cyperus flavescens* L., *Digitaria ischaemum* (Schreb. ex Schweigg.) Schreb. ex Muhl.

Geographical distribution: This alliance presents an Atlantic, Central European and Mediterranean distribution (Brullo & Minissale, 1998).

Structure and ecology: The alliance gathers the communities dominated by small and dwarf hygrophytes, which colonize the surfaces flooded for long periods. It is an acidophilous vegetation that prefers sandy-clayey or organic soils located in the shores of rivers and lakes with oligo-mesotrophic waters (Brullo & Minissale, 1998; Bagella et al., 2007). For the nomenclatural question we refer to Koch (1926), Libbert (1932) and Mucina et al. (2016).

Syndynamism: See order.

Habitat reference: See order.

10.2.1.1. ***Plantago intermediae-Cyperetum fusci*** Sciandrello, D'Agostino & Minissale 2013

Ephemeral vegetation with waybread of acid soils submerged for long periods

Synonyms:-

Holotypus: rel. 1, tab. 7, Sciandrello et al. (2013).

Characteristic and differential species: *Cyperus fuscus* L., *Plantago intermedia* Gilib.

Phytosociological table: From Sciandrello et al. (2013), tab. 7, 8 rel.

Char. association: *Cyperus fuscus* (V), *Plantago intermedia* (IV).

Char. order and class: *Juncus bufonius* (V), *Mentha pulegium* (V), *Lythrum hyssopifolia* (IV), *Polypogon maritimus* (IV), *Juncus hybridus* (IV), *Lotus angustissimus* (II).

Other species: *Polypogon viridis* (V), *Juncus articulatus* (IV), *Trifolium resupinatum* (II), *Samolus valerandi* (II).

Geographical distribution: This association is known only for the surroundings of Taormina in the Peloritani range (Sciandrello et al., 2013).

Structure and ecology: The association colonizes hilly and mountain ponds (above 600 m a. s. l.), with acidic soils that rarely dry out in summer. It is a hygrophilous vegetation with summer to autumnal optimum, characterized by *Plantago major* subsp. *intermedia* and *Cyperus fuscus*, which are associated with several other acidophilous hygrophytes, such as *Juncus bufonius*, *Mentha pulegium*, *Juncus hybridus*, *Polypogon maritimus*, *Lythrum hyssopifolia*, etc.

Syndynamism: See class.

Habitat reference: See order.

10.2.2. Alliance: ***Verbenion supinae*** Slavnic 1951

Nitro and sub-halophilous vegetation of surfaces that are subject to long period of submersion.

Synonyms: *Heleochloion* Br.-Bl. in Br.-Bl. et al 1952; *Fimbristylion dichotomae* Horvatić 1954 (syntax. syn.); *Myosurion minimi* Oberd. 1956 (art. 2b); *Myosurion minimi* Oberd. 1957 (art. 2b, 3b); *Crypsio alopecuroidis-Cyperion fusci* Pietsch 1961 (art. 1); *Chlorocyperion glomerati* Müller-Stoll & Pietsch in T. Müller 1963 (art. 2b); *Chlorocyperion glomerati* Pietsch in Horvatić 1963 (art. 2b); *Dichostylion micheliani* Pietsch in Horvatić 1963 (art. 2b); *Fimbristylion dichotomae* Müller-Stoll & Pietsch in T. Müller 1963 (art. 2b); *Verbenion supinae* Müller-Stoll & Pietsch in T. Müller 1963 (art. 2b); *Heleochloo-Cyperion micheliani* Pietsch & Müller-Stoll 1968 (art. 2b); *Menthion pulegii* Lakusić et al. 1975 (phantom); *Menthion pulegii* Lakusić in Blecić & Lakusić 1976 (art. 2b).

Lectotypus: *Heliotropio supini-Verbenetum supinae* Slavnic 1951.

Characteristic and differential species: *Coronopus squamatus* (Forssk.) Asch., *Crypsis aculeata* (L.) Aiton, *Euphorbia chamaesyce* L., *Fimbristylis bisumbellata* (Forssk.) Bubani, *Glinus lotoides* L., *Heleochloa alopecuroides* (Piller & Mitterp.) Host, *H. schoenoides* (L.) Host, *Heliotropium supinum* L., *Hordeum geniculatum* All., *Lythrum tribracteatum* Salzm. ex Spreng, *Paspalum distichum* L., *Pulicaria sicula* (L.) Moris, *Ranunculus sardous* Crantz, *Schenkia spicata* (L.) G. Mans., *Teucrium campanulatum* L., *Verbena supina* L.

Geographical distribution: This alliance is spread in the Euro-mediterranean territories (Mucina et al., 2016).

Structure and ecology: This alliance groups the annual hygrophilous communities, well adapted to subhalo-nitrophilous edaphic conditions. They colonize the surfaces subject to a long period of submersion and with damp soils in the summer. This vegetation has its optimum in the late summer-autumn period and is characterized by the dominance of therophytes with prostrate-repting habit (Brullo & Minissale, 1998).

Syndynamism: See order.

Habitat reference: See order.

10.2.2.1. ***Heliotropio supini-Heleochloetum schoenoidis*** Rivas Goday 1956

Late hygro-subnitrophilous vegetation with hairy heliotrope and swamp prickle grass

Synonyms: *Glino-Heliotropietum supini* Brullo & Marcenò 1974 *heliotropietosum* Brullo & Marcenò 1974 (synt. syn.).

Lectotypus: rel. 3, tab. 14, Rivas Goday (1956).

Characteristic and differential species: *Heleochloa schoenoides* (L.) Host, *Heliotropium supinum* L.

Phytosociological table: From Brullo & Marcenò (1974), tab. 1, 21 rel.; 8 unpublished rel.

Char. association: *Heliotropium supinum* (V), *Heleochloa schoenoides* (III).

Char. alliance and order: *Euphorbia chamaesyce* (III), *Paspalum distichum* (III), *Plantago intermedia* (I), *Pulicaria sicula* (II), *Coronopus squamatus* (I), *Cyperus fuscus* (I), *Crypsis aculeata* (I), *Verbena supina* (I), *Schenkia spicata* (I).

Char. class: *Mentha pulegium* (IV), *Lythrum hyssopifolia* (II).

Other species: *Xanthium spinosum* (IV), *Convolvulus arvensis* (III), *Helminthotheca echioides* (III), *Xanthium italicum* (III), *Verbena officinalis* (III), *Symphyotrichum squamatum* (II), *Cynodon dactylon* (II), *Tamarix gallica* (II), *Solanum nigrum* (II), etc.

Geographical distribution: The association was described from Spain (Rivas Goday, 1956) and later surveyed also in Corsica (Grillas et al., 2004). In Sicily it occurs in several artificial

basins (Brullo & Marcenò, 1974; Marcenò & Raimondo, 1977; Pavone et al., 2007; Sciandrello, 2009).

Structure and ecology: The community at issue colonises the banks of artificial reservoirs with a sufficiently pronounced inclination to reduce the insolation and accumulation of muddy debris. This vegetation has sub-nitrophilous requirements and is characterized by the dominance of annual prostrate hygrophytes, such as *Heliotropium supinum* and *Heleochloa schoenoides*. Previously, Brullo & Marcenò (1974) attributed this community to subass. *heliotropietosum* of *Glino-Heliotropietum supini*, identifying various facies floristically dominated by a particular species linked to well defined edaphic conditions.

Syndynamism: This association shows a markedly pioneer character, localizing above all in the belt closer to the shore with more sloped surfaces, which dries up later. In the outermost stands that dries more precociously with less inclined soils and rich in the muddy and organic component, it is replaced by another more mature and evolved association, represented by the *Glino-Verbenetum supini* (Brullo & Marcenò, 1974).

Habitat reference: See order.

10.2.2.2. ***Glino-Verbenetum supini*** Rivas Goday 1964

Hygrophilous vegetation with lotus sweetjuice and trailing verbena of flat wet surfaces.

Synonyms: Ass. *Glinus lotoides* et *Verbena supina* Rivas Goday 1964; *Glino-Heliotropietum supini* Brullo & Marcenò 1974 *glinetosum* Brullo & Marcenò 1974 (syntax. syn.).

Lectotypus: Rel. 1, pg. 188, Rivas Goday (1964), here designated.

Characteristic and differential species: *Glinus lotoides* L., *Verbena supina* L.

Phytosociological table: From Brullo & Marcenò (1974), tab. 1, 27 rel.; 7 unpublished rel.

Char. association: *Glinus lotoides* (V), *Verbena supina* (V).

Char. alliance and order: *Heliotropium supinum* (V), *Paspalum distichum* (V), *Heleochloa schoenoides* (V), *Plantago major* (IV), *Euphorbia chamaesyce* (III), *Corrigiola littoralis* (III), *Gnaphalium uliginosum* (II), *Cyperus fuscus* (II), *Cyperus michelianus* (I), *Pulicaria sicula* (I), *Heleochloa alopecuroides* (I), *Eryngium pusillus* (I).

Char. class: *Mentha pulegium* (II), *Lythrum hyssopifolia* (II), *Juncus hybridus* (I), *Coronopus squamatus* (I), *Cyperus fuscus* (I), *Veronica anagalloides* (I).

Other species: *Persicaria lapathifolia* (IV), *Xanthium spinosum* (III), *Trifolium fragiferum* (III), *Amaranthus deflexus* (III), *Chenopodium rubrum* (II), *Xanthium italicum* (II), *Symphyotrichum squamatum* (II), *Helminthotheca echioides* (II), *Polygonum aviculare* (II), *Cyperus rotundus* (II), *Echinochloa crus-galli* (II), etc.

Geographical distribution: The association, originally described from Spain by Rivas-Goday (1964), was recorded by Brullo & Minissale (1998) also for Sicily and later by Sciandrello

(2009). Really, it was previously surveyed by Brullo & Marcenò (1974) and attributed to *Glino-Heliotropietum supini* subass. *glinetosum*.

Structure and ecology: This community colonizes the more external surfaces of artificial basins, which dry out early and are characterized by a greater accumulation of muddy soil rich in nutrients. It is a hygro-subnitrophilous vegetation, physiognomically dominated by prostrate hygrophytes, such as *Glinus lotoides*, *Verbena supina*, *Heleochloa schoenoides* and *Heliotropium supinum*. This vegetation finds its optimum during late summer and autumn, when the surfaces occupied by it have emerged for some time, but remain quite wet (Sciandrello, 2009).

Syndynamism: See *Heliotropio supini-Heleochloetum schoenoidis.*

Habitat reference: See order.

10.2.2.3. ***Verbeno supinae-Gnaphalietum luteo-albi*** Rivas Goday 1970

Amphibious vegetation with procumbent vervain of sandy soils submerged for long periods

Synonyms: comunidad prov. *Gnaphalio-Verbena supina* Rivas Goday 1955 (art. 3b, 3c).

Lectotypus: Rel. 10, cuadro n. 8, Rivas-Goday (1970), here designated.

Characteristic and differential species: *Gnaphalium luteo-album* L.; *Verbena supina* L.

Phytosociological table: From Sciandrello (2009), tab. 3, rel. 2.

Char. association: *Gnaphalium luteo-album* (2).

Char. alliance, order and class: *Verbena supina* (2), *Paspalum distichum* (2), *Centaurium spicatum* (2), *Juncus hybridus* (2), *Heleochloa schoenoides* (1).

Other species: *Xanthium italicum* (2), *Symphyotrichum squamatum* (2), *Sonchus oleraceus* (2), *Medicago intertexta* (2), *Medicago hispida* (1), *Rumex pulcher* (1), *Phragmites australis* (1).

Geographical distribution: This association, originally described from Iberian Peninsula (Rivas Goday, 1970), in Sicily was surveyed at Cimia lake, but probably it is more widespread in other artificial basins of island (Sciandrello, 2009).

Structure and ecology: The association colonizes the banks of artificial basins with soils rich in sandy component and which remain wet during the summer. From a structural point of view, this community is characterized by the dominance of nitrophilous terophytes with prostrate-ascending habitus, such as *Gnaphalium luteo-album*, Verbena *supina*, *Paspalum distichum*, *Centaurium spicatum*, *Juncus hybridus* and *Euphorbia chamaesyce* (Sciandrello, 2009).

Syndynamism: In the stands with silty-clay soils, this community is replaced by associations rich in reptant hygrophytes, such as the *Heliotropio-Heleochloetum schoenoidis* or *Glino-*

Verbenetum supini. On the outer shores, subject to a shorter submerging period, the communities of *Bidentetea tripartitae* class become dominant.

Habitat reference: See order.

10.2.2.4. ***Coronopo-Sisymbrelletum dentatae*** Minissale & Spampinato 1987

Hygrophilous vegetation with toothed watercress of depressions with shallow waters

Holotypus: rel. 6, tab. 8, Minissale & Spampinato (1987).

Characteristic and differential species: *Anthemis cotula* L., *Sisymbriella dentata* (L.) O.E. Schulz.

Phytosociological table: From Minissale & Spampinato (1987), tab. 8, 10 rel.; 6 unpublished rel.

Char. association: *Sisymbriella dentata* (V), *Anthemis cotula* (V).

Char. alliance and order: *Eryngium pusillum* (V), *Hordeum hystrix* (V), *Coronopus squamatus* (IV), *Ranunculus sardous* (II), *Teucrium campanulatum* (II).

Char. class: *Mentha pulegium* (V), *Gaudinia fragilis* (II), *Ranunculus trilobus* (II), *Lythrum hyssopifolia* (I), *Pulicaria vulgaris* (I), *Poa infirma* (I).

Other species: *Convolvulus arvensis* (V), *Plantago lanceolata* (III), *Potentilla reptans* (III), *Xanthium italicum* (II), *Elytrigia repens* (II), *Cichorium intybus* (II), *Polygonum aviculare* (II), etc.

Geographical distribution: The association is known exclusively for the northern side of Etna Mt., at Gurrida Lake and Castiglione (Minissale & Spampinato, 1987).

Structure and ecology: It is localized in volcanic depressions with silty-clay soils, submerged by freshwaters until late spring and dry in summer. The vegetation is characterized by the occurrence of *Sisymbriella dentata*, an endemic species of Sicily, previously recorded also in Calabria, but currently here disappeared for the destruction of its habitat. Several hygrophythes are frequent, as *Anthemis cotula*, *Eryngium pusillum*, *Coronopus squamatus*, *Teucrium campanulatum*, *Hordeum hystrix*, *Ranunculus sardous*, *Mentha pulegium*, *Gaudinia fragilis*, *Lythrum hyssopifolia*, etc.

Syndynamism: This community in the most raised and dry places is replaced by the sub-xerophilous meadows of the *Epilobio hirsuti-Agropyretum repentis*, with which it is sometimes mixed in the depressions. In the stands with higher humidity the *Eleocharido-Alismetum lanceolati* is installed instead. The *Coronopo-Sisymbrelletum dentatae* represents a very rare vegetation that has suffered from the strong human disturbance that have affected the humid environments in the last decades (Minissale & Spampinato, 1987).

Habitat reference: See order.

10.2.2.5. ***Damasonio bourgeai-Crypsietum aculeatae*** Rivas-Martínez & Costa in Rivas-Martínez et al. 1980 corr. Silva & Costa 2012

Hygrophilous vegetation with starfruit and pricklegrass of clayey soils submerged by brackish waters

Synonyms: *Damasonio alismatis-Crypsietum aculeatae* Rivas-Martínez & Costa in Rivas-Martínez et al. 1980; *Cresso creticae-Damasonietum bourgei* Sciandrello 2007 (syntax. syn.).

Holotypus: rel. 3, tab. 15, Rivas-Martinez et al. (1980).

Characteristic and differential species: *Cressa cretica* L., *Crypsis aculeata* (L.) Aiton; *Damasonium bourgaei* Coss.

Phytosociological table: From Sciandrello (2007), tab. 4 , 34 rel.

Char. association: *Damasonium bourgaei* (V), *Cressa cretica* (IV), *Pulicaria sicula* (IV), *Lythrum tribracteatum* (III), *Crypsis aculeata* (III).

Char. alliance and order: *Hordeum geniculatum* (III), *Centaurium spicatum* (III), *Heliotropium supinum* (III), *Paspalum distichum* (II), *Euphorbia chamaesyce* (I), *Coronopus squamatus* (I).

Char. class: *Mentha pulegium* (III), *Lythrum hyssopifolia* (II)*, Juncus hybridus* (I), *Juncus bufonius* (I).

Other species: *Polypogon monspeliensis* (IV), *Atriplex elongata* (III), *Ecballium elaterium* (III), *Symphyotrichum squamatus* (II)*, Suaeda spicata* (II), *Kickxia spuria* (I), etc.

Geographical distribution: The association was described from the Iberian Peninsula (Rivas-Martinez et al., 1980) and was subsequently reported in Tunisia (Barbagallo et al., 1990). In Sicily it is known for coastal stands near Gela (Sciandrello, 2007).

Structure and ecology: It is mainly localized in wide flat depressions with clay surfaces, occurring in coastal stands subjected to periodic flooding by brackish waters. This vegetation shows subhalophilous requirements and is also adapted to grazing pressure in the summer. Floristically, it is characterized by *Damasonium bourgaei*, *Cressa cretica*, *Crypsis aculeata* and *Pulicaria sicula*, which grow with several other hygrophythes with prostrate habit, such as *Heliotropium supinum*, *Coronopus squamatus*, *Euphorbia chamaesyce*, *Lythrum hyssopifolia*, *Lythrum tribracteatum*, etc. It was described by Sciandrello (2007) as *Cresso creticae-Damasonietum bourgei*, but for its ecology and floristic set it must be referred to *Damasonio bourgeai-Crypsietum aculeatae*, association firstly described as *Damasonio alismatis-Crypsietum aculeatae* by Rivas-Martínez & Costa (see Rivas-Martinez et al., 1980) and later corrected by Silva & Costa (2012).

Syndynamism: In the most marginal raised places, where the submerging period is shorter, the *Damasonio bourgeai-Crypsietum aculeatae* is replaced by the *Chamaemelo fuscati-Leontodontetum muelleri*, a more halophilous community with a more precocious cycle (Sciandrello, 2007).

Habitat reference: See order.

10.2.2.6. ***Heleochloo schoenidis-Chenopodietum botryoidis*** Brullo & Sciandrello 2006

Hygro-subnitrophilous vegetation with low goosefoot of lake shores subject to summer drying.

Holotypus: rel. 9, tab. 2, Brullo & Sciandrello (2006).

Characteristic and differential species: *Oxybasis chenopodioides* (L.) S. Fuentes, Uotila & Borsch. (=*Chenopodium botryoides* Sm.).

Phytosociological table: From Brullo & Sciandrello (2006), tab. 2 , 10 rel.

Char. association: *Oxybasis chenopodioides* (V).

Char. alliance, order and class: *Heleochloa schoenoides* (V), *Cyperus fuscus* (IV), *Crypsis aculeata* (II), *Juncus hybridus* (II).

Other species: *Atriplex prostrata* (V), *Tamarix africana* (V), *Symphyotrichum squamatus* (V), *Sonchus asper* (V), *Persicaria lapathifolia* (V), *Juncus maritimus* (IV), *Phragmites australis* (IV), *Chenopodium album* (IV), *Polypogon monspeliensis* (III), *Typha latifolia* (II), etc.

Geographical distribution: This association is currently known only for the shores of Biviere di Gela (Brullo & Sciandrello, 2006).

Structure and ecology: This vegetation is localized along the shores of Biviere di Gela, in the stands dried from summer to early autumn, with silty-sandy soils. It is characterized by the occurrence of *Oxybasis chenopodioides* and *Heleochloa schoenoides*, often growing with other prostrate hygrophythes, as *Crypsis aculeata* and *Cyperus fuscus*. It is a very peculiar community, linked to a certain edaphic nitrophily, limitedly to surfaces with humid lower layers during the summer period (Brullo & Sciandrello, 2006).

Syndynamism: On the shores subject to longer submersion periods, the *Heleochloo schoenidis-Chenopodietum botryoidis* is replaced by the hygrophilous vegetation of the *Schoenoplecto litoralis-Cyperetum distachyi*. On the contrary, in the most raised surfaces, submerged only for short periods, it is replaced by lianoid communities with *Dorycnium rectum* or by the thermo-hygrophilous woods of the *Tamaricetum africana-arboreae* (Brullo & Sciandrello, 2006). Recent inspections have shown that this vegetation has suffered a drastic reduction and in some years it has not even been observed due to changes in the water regime of the lake basin.

Habitat reference: See order.

10.2.2.7. ***Pulicario grecae-Damasonietum bourgei*** Minissale, Santo & Sciandrello 2011

Subhalo-nitrophilous vegetation with greek false fleabane of small coastal ponds, subject to summer drying.

Holotypus: rel. 2, tab. 3, Minissale et al. (2011).

Characteristic and differential species: *Pulicaria vulgaris* Gaertn. var. *graeca* (Sch.-Bip.) Fiori.

Phytosociological table: From Minissale et al. (2011), tab. 3, 6 rel.

Char. association: *Pulicaria vulgaris* var. *graeca* (V).

Char. alliance, order and class: *Damasonium bourgaei* (V), *Heliotropium supinum* (IV), *Polypogon subspathaceus* (IV), *Lythrum tribracteatum* (II), *Pulicaria sicula* (II), *Coronopus squamatus* (II), *Schenkia spicata* (I).

Other species: *Bolboschoenus maritimus* (V), *Limonium narbonense* (V), *Polypogon maritimus* (IV), *Trifolium resupinatum* (II), *Juncus subulatus* (I), *Hordeum marinum* (I), *Dittrichia viscosa* (I).

Geographical distribution: This association was described from a small pond near Capo Murro di Porco, Syracuse (Minissale et al., 2011).

Structure and ecology: The *Pulicario grecae-Damasonietum bourgei* colonizes the sandy-clayey surfaces of a shallow coastal pond (40-50 cm), which become completely dry since the spring. It is a sub-nitrophilous vegetation, whose physiognomy is given by the presence of small hygrophythes, such as *Pulicaria vulgaris* var. *graeca*, *Damasonium bourgaei*, *Heliotropium supinum*, *Polypogon subspathaceus*, *Lythrum tribracteatum*, *Coronopus squamatus*, etc. Previously, this vegetation was surveyed by Barbagallo et al. (1977).

Syndynamism: In the central parts of the pool, this community is replaced by the hygrophilous aspects of the *Scirpetum maritimi* with *Limonium narbonense*, while the low and raised outer shores are colonized respectively by *Juncus subulatus* community and *Caricetum divisae*. The *Pulicario grecae-Damasonietum bourgei* is replaced by monospecific populations of *Bulliardia vaillantii* (Minissale et al., 2011) in the smallest ponds affected by a shorter submerging period.

Habitat reference: See order.

10.2.2.8. ***Ranunculo trilobi-Lythretum tribracteati*** Sciandrello 2005

Halo-hygrophilous vegetation with threebract loosestrife and three lobed buttercup of sandy-loamy soils.

Holotypus: rel. 3, tab. 8, Sciandrello (2005).

Characteristic and differential species: *Lythrum tribracteatum* Spreng., *Ranunculus trilobus* Desf.

Phytosociological table: From Sciandrello (2005), tab. 8, 3 rel.

Char. association: *Ranunculus trilobus* (3), *Lythrum tribracteatum* (3).

Char. alliance, order and class: *Polypogon subspathaceus* (3), *Lythrum hyssopifolia* (3), *Mentha pulegium* (3), *Pulicaria sicula* (3), *Coronopus squamatus* (2), *Gaudinia fragilis* (2), *Damasonium bourgaei* (1), *Schenkia spicata* (1), *Juncus bufonius* (1).

Other species: *Trifolium resupinatum* (3), *Centaurium tenuiflorum* (3), *Juncus hybridus* (3), *Anagallis arvensis* (3), *Chamaemelum fuscatum* (3), *Bromus hordeaceus* (3), *Polygonum aviculare* (2), *Plantago coronopus* (2), *Hordeum marinum* (2), *Podospermum canum* (2), *Cressa cretica* (2), *Medicago intertexta* subsp*. ciliaris* (2), etc.

Geographical distribution: This syntaxon was described by Sciandrello (2005) for the salt marshes of Piana del Signore near Gela.

Structure and ecology: The sandy-loamy soils submerged during the winter by slightly salt water and humid also in summer, are colonized by a therophytic vegetation referred to *Ranunculo trilobi-Lythretum tribracteati*. The physiognomy of this community is given by species with erect habitus, such as *Lythrum tribracteatum*, *L. hyssopifolia*, *Ranunculus trilobus* and by prostrate plants, among them *Coronopus squamatus*, *Damasonium bourgei*, etc.

Syndynamism: This community occupies small surfaces within the helophytic vegetation of *Phragmito-Magnocaricetea*.

Habitat reference: See order.

11. Class: ***Scheuchzerio-Caricetea fuscae*** R.Tx 1937

Vegetation of peatlands.

Synonyms: *Sphagniherbosa* Rübel 1933 p.p. (art. 3d); *Caricetales uliginosae* Br.-Bl. & Vlieger in Vlieger 1937 p.p. (orig.form); *Scheuchzerio palustris-Caricetea nigrae* R. Tx. 1937 nom. mut. propos. (art. 45); *Sphagno-Caricetea fuscae* Duvigneaud 1949 (art. 29c); *Caricetea fuscae* Oberd. ex Kuhn 1954 (syntax. sin.); *Drepanocladetea* Du Rietz 1954 (29b); *Sphagno-Drepanocladetea* Du Rietz 1954 (art. 29b)*; Drepanocladetea* Traas 1963 (art. 2b)*; Trichophoretea* Traas 1963 (art. 2b); *Caricetea limosae* Malmer 1968 (syntax. syn.); *Scorpidietea* Malmer 1968 (art. 29b); *Tofieldietea* Malmer 1968 (syntax. sin.); *Parvocaricetea* Westhoff in Den Held & Westhoff in Westhoff & Den Held 1969 (orig.form) (syntax. syn.)*; Scheuchzerietea* Den Held et al. in Westhoff & Den Held 1969 (syntax.syn.); *Drepanocladetea* R. Tx. 1970 (art. 29b); *Trichophoretea* R. Tx. 1970 (syntax. syn.); *Carici-Drepanocladetea* Pałczyński 1975 (art. 3b); *Caricetea fuscae* (Den Held et al. in Westhoff & Den Held 1969) de Foucault 1984 (art. 29a); *Caricetea nigrae* (Den Held et al. in Westhoff & Den Held 1969) de Foucault 1984 nom. mut. propos. (mut. superfl.); *Minero-Sphagnioni* Tołpa 1985 (art. 3d).

Lectotypus: *Caricetalia fuscae* W. Koch 1926

Characteristic and differential species: *Aneura pinguis* (L.) Dumort., *Calypogeia fissa* (L.) Raddi., *Carex demissa* Hornem., *Deschampsia cespitosa* (L.) Beauv., *Polytrichum commune* Hedw., *Riccardia multifida* (L.) Gray, *Sphagnum contortum* Schultz, *S. subesecundum* Nees subsp. *inundatum* (Russow) Meyl.

Geographical distribution: This class has a wide distribution in the Euro-Siberian territories, while in the Mediterranean area it is limited to the wet mountain stands, where it can be considered a relict vegetation (Brullo et al., 2001).

Structure and ecology: The class gathers the hygrophilous communities of peatlands dominated by strongly acidophilous bryophytes, which are associated with sedges and ephemeral hygrophythes. This vegetation is linked to temperate-cold climates, preferring acidified soils, permanently saturated by freshwaters and poor in nitrogen and phosphorus. The syntaxonomic classification of this syntaxon reflects the pedological characteristics of the stands and in particular the pH and the mineral richness (Šumberová, 2011).

Syndynamism: The communities of this class represent a permanent vegetation, whose dynamism is linked to the natural burial and draining processes of the peatlands (Brullo et al., 2001).

Habitat reference: D1.1 Raised bog.

11.1. Order: ***Caricetalia fuscae*** W. Koch 1926

Communities of oligotrophic peats and mineral peaty soils.

Synonyms: *Caricetalia fuscae* W. Koch 1928 (phantom); *Caricetalia nigrae* W. Koch 1926 nom. mut. propos. (art. 45)*; Drepanocladetalia exannulati* Krajina 1933 (syntax.sin.); *Drepanocladetalia exannulati* Krajina 1934 (phantom)*; Scheuchzerio-Caricetalia nigrae* Nordhagen 1936 (phantom)*; Caricetalia goodenowii* Nordhagen 1937 nom. mut. propos. (art. 45); *Caricetalia nigrae* Nordhagen 1937 nom. mut. propos. (art. 45); *Molinio-Caricetalia fuscae* Duvigneaud 1949 (art. 29)*; Herbotrichophoretalia* Traas 1963 (art. 2b)*; Junco-Caricetalia nigrae* Doing 1963 (art. 2b); *Anagallido tenellae-Juncetalia bulbosi* Br.-Bl. 1967 (syntax. sin.); *Scheuchzerio-Caricetalia fuscae* (Koch 1926) Gòrs & T. Müller in Oberd. et al. 1967 (art. 2b)*; Narthecietalia Lakusić 1968 (phantom); Narthecietalia* Lakusić 1973 (syntax. sin.); *Sphagno-Caricetalia* Succow 1974 (syntax. sin.); *Junco acutiflori-Caricetalia nigrae* Julve 1983 (art. 1)*; Caricetalia intricatae* de Foucault 1984 (art. 1); *Caricetalia magellanicae* de Foucault ex Julve 1993 (2b, 3b).

Lectotypus: *Caricion nigrae* W. Koch em. Klika 1934.

Characteristic and differential species: *Aulacomnium palustre* (Hedw.) Schwaegr., *Carex punctata* Gaudin.

Geographical distribution: This order is distributed mainly in the central European area, with penetration into the Mediterranean mountain ranges (Brullo et al., 2001).

Structure and ecology: The syntaxon groups the hygrophilous communities linked to flat and markedly acid peatlands, with slowly flowing superficial oligo-mesotrophic waters.

Syndynamism: See class.

Habitat reference: See class.

11.1.1 Alliance: ***Caricion fuscae*** W. Koch 1926

Sedge-moss vegetation dominated by calcifuge brown-mosses.

Synonyms: *Caricion nigrae* W. Koch 1926; *Rhynchosporion albae* W. Koch 1926 (syntax. syn.); *Parvocaricion* Rübel 1933 p.p. (art. 2b); *Caricion canescenti-goodenowii* Nordhagen 1936 (phantom); *Caricion canescenti-goodenowii* Nordhagen 1937 (syntax. syn.); *Caricion canescenti-nigrae* Nordhagen 1937 (art. 30); *Caricion canescentis* Kalliola 1939 (art. 2b); *Parvocaricion canescentis-fuscae* Duvigneaud & Vanden Berghen 1945 (syntax. syn.); *Caricion lasiocarpae* sensu auct. p.p., non Vanden Berghen in Lebrun et al. 1949 (pseudonym); *Eriophorion gracilis* Oberd. 1956 (art. 2b); *Eriophorion gracilis* Preising ex Oberd. 1957 (syntax. syn.); *Acrocladion* Traas 1963 (art. 2b); *Mesotrichophorion* Traas 1963 p.p. (art. 2b); *Rhynchosporo-Sphagnion* (Koch 1926) Jasnowski 1968 (art. 29); *Caricion curto-nigrae* (Koch 1926) Westhoff & Den Held 1969 (art. 31); *Droserion intermediae* Succow 1974 (syntax. syn.); *Sphagnion teretis* Succow 1974 p.p. (art. 29b); *Calamagrostion neglectae* Pałczynski 1975 (art. 31); *Ranunculo-Caricion fuscae* Passarge 1978 (syntax. sin.); *Junco acutiflori-Caricion lasiocaropae* Julve 1993 (art. 2b, 5); *Carici-Nardion* V. Randelović 1998 (art. 2b).

Lectotypus: *Caricetum (goodenowii) niigrae* Br. Bl. 1915.

Characteristic and differential species: See order.

Geographical distribution: The syntaxon is widespread in the mountains of south-western Europe (Alps and Pyrenees), with scattered stands in the Apennine areas, which are characterized by an oceanic climate (Brullo et al., 2001).

Structure and ecology: The alliance groups the hygrophilous communities of flat lowland bogs and oligotrophic waters characterized mainly of Cyperaceae and small bryophytes.

Syndynamism: See class.

Habitat reference: See class.

11.1.1.1 ***Carici tumidicarpae-Solenopsietum bivonae*** ass. nov. provv.

Peatland vegetation with common yellow sedge and Bivona's laurentia.

Holotypus: Not designated.

Characteristic and differential species: *Carex paniculata* L., *Hypericum tetrapterum* Fr., *Isolepis setacea* (L.) R. Br., *Ranunculus fontanus* C. Presl, *Solenopsis bivonae* (Tineo) M.B. Crespo, Serra & Juan.

Phytosociological table: From Raimondo et al. (1980), tab. 2, 10 rel.; from Petronici et al. (1978), tab. pg. 22, 1 rel.

Char. association: *Solenopsis bivonae* (V), *Isolepis setacea* (V), *Hypericum tetrapterum* (V), *Ranunculus fontanus* (III), *Carex paniculata* (I).

Char. alliance and order: *Aulacomnium palustre* (V), *Carex punctata* (IV).

Char. class: *Sphagnum subsecundum* subsp. *inundatum* (V), *Carex demissa* (V), *Polytricum commune* (III), *Calypogeia fissa* (III), *Sphagnum contortum* (II), *Riccardia multifida* (I), *Deschampsia caespitosa* (II), *Aneura pinguis* (I).

Other species: *Juncus articulatus* (V), *Poa trivialis* (V), *Mentha aquatica* (V), *Bryum pseudotriquetrum* (V), *Dactylorhiza saccifera* (V), *Philonotis fontana* (V), *Bellis hybrida* (V), *Trifolium repens* (V), *Calligorniella cuspidata* (IV), *Juncus conglomeratus* (IV), *Epilobium parviflorum* (III), etc.

Geographical distribution: The association is known only in the eastern part of the Madonie massif with impermeable siliceous substrata, where the only peat bogs of Sicily occur

Structure and ecology: This association includes the vegetation of peatlands, which are very peculiar wet environments located between 1000 and 1500 m a.s.l.. This community occurs on soils characterized by slow flow of cold water with acidic soils, which inhibit the natural decomposition processes of organic matter, favoring its deposit. Most of the organic material that constitute the bog comes from the rich bryophyte flora of this vegetation, including *Sphagnum subsecundum*, *S. contortum*, *Aulacomnium palustre*, *Pholia sp*., *Polytrichum commune*, etc. The phanerogamic component, which grows on the dense briofitic surface is mainly represented by species belonging to Juncaceae and Cyperaceae families, such as *C. demissa*, *C. paniculata*, *C. punctata*, *Juncus articulatus*, which grows together with *Hypericum tetrapterum*, *Isolepis setacea, Lysimachia nemorum*, *Deschampsia caespitosa*, *Solenopsis bivonae* and *Ranunculus fontanus*.

Syndynamism: The peat bogs derive from the progressive burial of small mountain ponds and subsequently tend to naturally evolve in the pteridophytic communities of the *Carici remotae-Osmundetum regalis* and later in monophytic populations of *Ilex aquifolium*.

Habitat reference: See class.

12. Class: ***Phragmito-Magnocaricetea*** Klika in Klika & Novàk 1941

Perennial helophytic vegetation of lakes, marshes and watercourses.

Synonyms: *Phragmito-Magnocaricetea* Klika in Klika & Hadač 1944 (art. 31); *Phragmito-Magnocaricetales* Klika in Klika & Novàk 1941 orig. form (art. 41b); *Magnocarici-Phragmitetea* Klika in Klika & Novàk 1941 nom. invers. propos. (art. 42)*; Phragmitetea* R. Tx. & Preising 1942 (syntax. syn.); *Phragmitetea* Br.-Bl. in Br.-Bl. et al. 1947 (art. 2b)*; Bolboschoenetea maritimi* Bilyk 1963 (phantom); *Arctophiletea fulvae* Pestryakov & Gogoleva 1989 (art. 1); *Bolboschoenetea maritimi* R. Tx. & Vicherek in R. Tx. & Hülbusch 1971 (syntax. syn.);

Nasturtietea officinalis Zohary 1973 (art. 2b); *Glycerio-Nasturtietea officinalis* Gèhu & Gèhu-Franck 1987 (art. 8); *Phragmito-Caricetea elatae* Klika in Klika & Novàk 1941 corr. Trinajstić 2008 (art. 40a, corr. illeg.)*; Arctophiletea fulvae* Pestryakov & Gogoleva in Pestryakov & Okhlopkov 2013 (art. 2b, 5).

Holotypus: *Phragmitetalia communis* Koch 1926.

Characteristic and differential species: *Agrostis stolonifera* L.*, Alisma lanceolatum* With.*, A. plantago-aquatica* L.*, Carex acutiformis* Ehrh.*, C. leporina* L.*, Cladium mariscus* (L.) Pohl, *Cyperus laevigatus* L.*, Eleocharis palustris* (L.) Roem. & Schult., *Epilobium parviflorum* Schreb., *Galium debile* Desv.*, G. palustre* L.*, Glyceria fluitans* (L.) R. Br., *Iris pseudacorus* L.. *Lycopus europaeus* L.*, Lythrum salicaria* L.*, Mentha aquatica* L., *M. longifolia* (L.) L., *Phragmites australis* (Cav.) Trin. ex Steud., *Persicaria decipiens* (R. Br.) K.L. Wilson, *Rumex sanguineus* L., *Sparganium erectum* L., *Veronica anagallis-aquatica* L.

Geographical distribution: The class shows a wide distribution centered in the temperate areas of Eurasia and North America, with penetrations also in the subtropical and tropical territories (Šumberová, 2011). In Sicily, the communities belonging to this syntaxon are very common throughout the island, especially near lake, ponds, rivers and streams.

Structure and ecology: The Class *Phragmito-Magnocaricetea* groups all the hygrophilous communities dominated by medium-large sized helophytes growing in lake or river environments with stagnant or weakly flowing waters. In particular, this vegetation is linked to silty or clayey surfaces submerged throughout the year or dried up only for short periods, such as the shores of lakes, ponds and lagoons and in the low hydrodynamical sections of the waterways, where it is usually arranged in narrow belts (Brullo et al., 2001). From the floristic point of view, this vegetation is often characterized by a quite impoverished floristic set, since one or a few species tend to be dominant, sometimes constituting dense and more or less monophytic communities, resulting from an intense vegetative reproduction through rhizomes (Šumberová, 2011).

Syndynamism: These are permanent communities with an edaphic character, whose settlement is linked to the degree of water trophy and to the water gradient of the soil. Some natural phenomena, such as sedimentation and burial processes, can influence their dynamism and distribution in water bodies (Brullo et al., 2001). Generally, during the early stages of burial of a basin with deep waters, the bottom, which is poor in nutrients and rich in minerals, is colonized by the communities with large graminaceous plants. These ones, due to their remarkable biomass, contribute actively to the sedimentation process, favoring the following development of a lower vegetation with Cyperaceae, which prefers soils rich in organic matter and more shallow waters (Šumberová, 2011).

Habitat reference: C5.1a Tall-helophyte bed; C5.1b Small-helophyte bed; C5.2 Tall-sedge bed; C5.4 Inland saline or brackish helophyte bed.

12.1. Order: ***Phragmitetalia communis*** W. Koch 1926

Marsh vegetation with large rhizomatous helophytes.

Synonyms: *Phragmitetalia* Br.-Bl. 1931 (art. 2b); *Phragmitetalia eurosibirica* R. Tx. & Preising 1942 (art. 34a)*; Phragmito-Magnocaricetalia* Klika in Klika & Hadač 1944 (phantom)*; Eu-Phragmitetalia* (Koch 1926) Pignatti 1953 (phantom); *Hydro-Phragmitetalia* Succow 1974 (art. 29); *Oenanthetalia aquaticae* Hejný in Kopecký & Hejný 1965 nom. nud. (art. 2b, 8).

Holotypus: *Phragmition communis* W. Koch 1926.

Characteristic and differential species: *Bolboschoenus glaucus* (Lam.) Sm., *Cladium mariscus* (L.) Pohl., *Epilobium hirsutum* L., *Eupatorium cannabinum* L., *Oenanthe aquatica* (L.) Poir., *Schedonorus arundinaceus* (Schreb.) Dumort., *Schoenoplectus lacustris* (L.) Palla, *Sonchus maritimus* L., *Typha angustifolia* L., *T. domingensis* (Pers.) Steud., *T. latifolia* L.

Geographical distribution: This order has an almost cosmopolitan distribution (Costa et al., 2012).

Structure and ecology: The communities dominated by large rhizomatous helophytes, which colonize rivers, streams or canals with stagnant or slowly flowing waters and the shores of lakes and ponds with permanent or more rarely also temporary waters, are framed within this syntaxon. It is a vegetation characterized by one or a few graminaceous species tolerating also short periods of drying, which is linked to meso-eutrophic mineral soils, often with a muddy matrix (Brullo et al., 2001).

Syndynamism: See class.

Habitat reference: See class.

12.1.1. Alliance: ***Phragmition communis*** W. Koch 1926

Marsh vegetation with large rhizomatous helophytes of freshwater and brackish waters.

Synonyms: *Phragmition* Br.-Bl. 1931 (art. 2b); *Phragmition eurosibiricum* R. Tx. & Preising 1942 (art. 34a)*; Eco-Phragmition* Chapman 1959 (art. 3d); *Eu-Phragmition* (Koch 1926) Passarge 1964 (34b); *Phalarido-Glycerion maximae* Passarge 1964 p.p. (art. 2b); *Meso-Phragmition* Succow 1974 (syntax. syn.); *Stachyo palustris-Phragmition* Succow 1974 (syntax. syn.)*; Equisetion fluviatilis* V. Randelović 2007 (art. 8); *Scorpidio scorpioidis-Cladion marisci* (W. Braun 1968) Succow 1974 p.p.; *Phalaridion arundinaceae* Kopecký 1961.

Lectotypus: *Scirpo-Phragmitetum* W. Koch 1926.

Characteristic and differential species: See order.

Geographical distribution: See order.

Structure and ecology: This syntaxon groups the marsh vegetation constituted by large helophytes (such as *Phragmites australis*, *Typha angustifolia*, *T. latifolia*, *Schoenoplectus*

lacustris, etc.), which colonizes the shores of lakes, ponds, rivers and canals with freshwater or brackish waters, sometimes subject to extensive seasonal fluctuations. From a structural point of view, these coenoses are generally monolayer, but when the dominant species reaches high coverage values, it is possible to identify another layer consisting of elodeids (e.g. *Myriophyllum* sp. pl. or *Potamogeton pectinatus*) and pleustophytes (e.g. *Lemna* sp. pl., *Ceratophyllum demersum*) when the water level is sufficiently high, or hygrophilous species (e.g. *Lythrum salicaria*, *Mentha aquatica*, *Lycopus europaeus*, *Calystegia sepium*, *Juncus* sp. pl.) in shallow waters (Biondi & Blasi , 2015).

Syndynamism: These are permanent communities, generally not subject to dynamic processes. However, the disturbance caused by human activities, such as reclamation, changes in the hydraulic regime and frequent cuts in the vegetation of the shores, can determine the disappearance or the floristic impoverishment of these communities, favoring the development of more adaptable species such as *Phragmites australis* or also *Arundo donax* which tend to form dense monophytic reeds.

Habitat reference: C5.1a Tall-helophyte bed; C5.4 Inland saline or brackish helophyte bed.

12.1.1.1. ***Phragmitetum communis*** Savič 1926

Helophytic vegetation with common reed.

Synonyms: *Scirpo-Phragmitetum* Koch 1926 p. p. nom. amb. (art. 36), *Phragmitetum lacustre* Gams 1927, *Phragmitetum vulgaris* Soó 1927, *Phragmitetum communis* (Gams 1927) Schmale 1939, *Riccietum fluitantis* Slavnić 1956, *Calystegio-Phragmitetum* Golub & Mirkin 1986.

Lectotypus: Not designated.

Characteristic and differential species: *Phragmites australis* (Cav.) Trin. ex Steud.

Phytosociological table: From Brullo & Furnari (1976), pag. 34, 47 rel.

Char. association: *Phragmites australis* (V).

Char. alliance and order: *Typha latifolia* (III), *Schedonorus arundinaceus* (III), *Sonchus maritimus* (II), *Bolboschoenus maritimus* (I), *Schoenoplectus lacustris* (I), *Cladium mariscus* (I),

Char. class: *Veronica anagallis-aquatica* (I), *Cirsium creticum* subsp. *triumfetti* (I), *Agrostis stolonifera* (I), *Lythrum salicaria* (I), *Galium palustre* (I), *Iris pseudacorus* (I), *Lycopus europaeus* (I), *Euphorbia hirsuta* (I), *Carex hispida* (I), *Apium nodiflorum* (1), *Eleocharis palustris* (1).

Other species: *Equisetum ramosissimum* (II), *Arundo donax* (II), *Xanthium italicum* (I), *Polygonum maritimum* (I), *Samolus valerandi* (I), *Solanum dulcamara* (I), etc.

Geographical distribution: The association shows an almost cosmopolitan distribution, but is more frequent in the temperate zones of Europe, Asia and America (Meusel et al., 1965, Hultén & Fries 1986). The *Phragmitetum communis* is one of the most common helophytic

marsh communities in the waterways and coastal ponds of Sicily, especially in the central-southern part (Bartolo et al., 1982; Brullo & Spampinato, 1990; Brullo & Siracusa, 2000).

Structure and ecology: The association at issues colonizes the marshy areas of streams and rivers, preferring the places with calm or stagnant waters on silty-clayey or muddy soils (Bartolo et al., 1982). This vegetation is linked to eutrophic soils that are permanently flooded by freshwaters or weakly salty (Brullo & Furnari, 1976). The physiognomy of this community is defined by *Phragmites australis*, which often forms dense monophytic populations, while sometimes in the stands with permanent sweet waters (subass. *typicum*) it is associated with other hygrophilous species, such as *Schedonorus arundinaceus*, *Equisetum ramosissimum*, *Samolus valerandi*, etc. Some halophytic species, such as *Sarcocornia fruticosa*, *Limbarda crithmoides*, *Arthrocaulon meridionalis*, *Suaeda maritima*, etc., become frequent in the most dry stands with brackish waters (subass. *halophylum*).

Syndynamism: It is a permanent vegetation, whose presence can be favored by human disturbance on wet environments (Brullo et al., 2001). Generally, the *Phragmitetum australis* makes a more or less continuous belt along the marshy shores of the watercourses, being bordered externally by the *Caricetum hispidae* or sometimes directly by the riparian vegetation of the *Salicetum albo-pedicellatae* (Brullo & Spampinato, 1990). In recent decades, the creation of small artificial basins or the enlargement of existing ponds for the exploitation of water for irrigation, has led to a considerable expansion of the *Phragmitetum australis*. Infact, this vegetation has found its ideal habitat on the shores of these environments, due to the presence of permanently flooded surfaces with a high amount of organic matter. In these stands, the *Phragmitetum communis* sometimes comes into catenal contact with some communities that are linked to surfaces with a shorter submerging period, such as the *Eleochardo-Alismetum lanceolati* (Minissale & Spampinato, 1987).

Habitat reference: C5.1a Tall-helophyte bed; C5.4 Inland saline or brackish helophyte bed.

12.1.1.2. ***Bolboschoenetum glauci*** Grechushkina., Sorokin & Golub 2011

Helophytic vegetation with tuberous bulrush.

Synonyms: *Scirpetum maritimi* auct. sic. p.p. non Van Langendonck 1931; *Bolboschoenetum glauci* Julve 2010 nom. nud.

Holotypus: Rel. 4, tab. 3, Grechushkina et al. (2011).

Characteristic and differential species: *Bolboschoenus glaucus* (Lam.) Sm.

Phytosociological table: From Brullo & Ronsisvalle (1975), tab. 3, 16 rel.

Char. association and alliance: *Bolboschoenus glaucus* (V).

Char. order and class: *Phragmites australis* (V), *Sonchus maritimus* (V), *Iris pseudacorus* (II), *Cirsium creticum* subsp. *triumfetti* (II), *Apium nodiflorum* (I), *Senecio jacobea* (I), *Lythrum*

salicaria (I), *Carex vulpina* (I), *Epilobium parviflorum* (I), *Solanum dulcamara* (I), *Veronica anagallis-aquatica* (I), *Carex hispida* (I), *Carex distans* (I).

Other species: *Dittrichia viscosa* (V), *Symphyotrichum squamatum* (IV), *Polypogon monspeliensis* (III), *Juncus acutus* (II), *Juncus maritimus* (II), *Dorycnium rectum* (II), *Samolus valerandi* (II), *Plantago major* (I), *Atriplex hastata* (I), etc.

Geographical distribution: This association was decribed by Grechushkina et al. (2011) from the coasts of Azov sea (Southern Russia), was later recorded by Nowak et al. (2014) from Tajikistan. Besides, Julve (2010) reported this vegetation with the same name from Southern France. As concern Sicily, the communities dominated by *Bolboschoenus maritimus* (*Scirpus maritimus*) occurring mainly in fresh waters are partly should be attributed to this association, rather than to *Scirpetum maritimi* Van Langendonck 1931 (Brullo & Furnari, 1971, 1976; Brullo & Ronsisvalle, 1973, 1975; Bartolo et al., 1982; Marcenò & Raimondo, 1977; Brullo et al., 1988; Minissale & Spampinato, 1990; Brullo & Siracusa, 2000; Sciandrello, 2009; Minissale et al., 2011; Guglielmo et al., 2012).

Structure and ecology: The shores of lagoon and more rarely also along the artificial basins with freshwaters, are sometimes colonized by a thermophilous vegetation dominated by *Bolboschoenus glaucus*, which is linked to silty soils with a rich sandy component, usually subject to a short period of summer drying. Previously, this community, often monophytic, was referred to *Scirpetum maritimi* s.l., but this attribution is not always correct, since acccording to Hroudova et al. (2007) and Pignatti (2017), *Bolboschoenus maritimus* in Sicily is usually replaced in the wetlands with fresh waters by *B. glaucus*. Therefore, from the nomenclatural point of view this vegetation occurring in the last habitats must be referred to a different syntaxon, physiognomically characterized by the dominance of the aforesaid species. From the recent literature data, it was already described an association with *B. glaucus*, represented by *Bolboschoenetum glauci* Grechushkina., Sorokin & Golub 2011. Therefore, seems appropriate to ascribe the Sicilian vegetation dominated by *Bolboschoenus glaucus* to this association. Usually, it is represented by almost monophytic populations of *Bolboschoenus glaucus*, although sometimes it grows together with some helophytes of the *Phragmito-Magnocaricetea*, such as *Phragmites australis*, *Sonchus maritimus*, *Iris pseudacorus*, *Cirsium creticum*, etc. (Brullo & Ronsisvalle, 1975).

Syndynamism: Usually, the *Bolboschoenetum glauci* constitutes a more or less discontinuous belt in the inner stands of lagoons, taking contact outwards with other helophytic communities that grow in the surfaces with a more direct contact with the shores, such as the *Phragmitetum communis*.

Habitat reference: C5.1b Small-helophyte bed.

12.1.1.3. ***Schoenoplectetum lacustris*** Chouard 1924

Helophytic vegetation with lakeshore bulrush.

Synonyms: Association a *Scirpus lacustris* Chouard 1924; *Scirpo lacustris-Glycerietum aquaticae* Allorge 1921; *Scirpo-Phragmitetum* Koch 1926 p. p. (art. 36, 45 nom. amb.); *Schoenoplectetum lacustris* Eggler 1933*; Scirpetum lacustris* Schmale 1939.

Lectotypus: Not designated.

Characteristic and differential species: *Schoenoplectus lacustris* (L.) Palla.

Phytosociological table: From Brullo et al. (1994), tab. 14, 11 rel.

Char. association: *Schoenoplectus lacustris* (V).

Char. alliance and order: *Typha angustifolia* (IV), *Typha latifolia* (III), *Oenanthe aquatica* (II), *Epilobium hirsutum* (I), *Eupatorium cannabinum* (I).

Char. order and class: *Galium elongatum* (III), *Mentha aquatica* (IV), *Lycopus europaeus* (IV), *Eleocharis palustris* (II), *Sparganium erectum* (II), *Apium nodiflorum* (II), *Epilobium parviflorum* (I), *Alisma lanceolatum* (I), *Cirsium creticum* subsp. *triumfetti* (I), *Phragmites australis* (I).

Other species: *Juncus articulatus* (II), *Pulicaria dysenterica* (II), *Agrostis castellana* (I), *Carex* sp. (I), etc.

Geographical distribution: The association has a wide distribution in temperate Eurasia, including the Mediterranean (Hultén & Fries 1986; Šumberová, 2011). In Sicily the syntaxon is known only on the Nebrodi and in particular in the ponds of Serra della Testa, San Giorgio, in the small Campanito lake and at the Biviere di Cesarò (Brullo et al., 1994).

Structure and ecology: The shores of marsh or fluvial environments with freshwaters or slightly salt waters, deep at least 40-60 cm, are colonized by a peculiar community referred to the *Schoenoplectetum lacustris* (Brullo et al., 1988). This vegetation is localized in the calm or low hydrodynamical tracts that remain humid also during the summer and often tends to constitute a very narrow belt in direct contact with the shores (Brullo & Ronsisvalle, 1975). The physiognomy of this community is defined by *Schoenoplectus lacustris*, which is sometimes accompanied by some species of the *Phragmition communis* and the *Phragmitetea communis* with low indices of presence, such as *Phragmites australis*, *Typha angustifolia*, *T. latifolia*, *Eleocharis palustris* and *Sparganium erectum*, However, in the mountain ponds the association often shows a fairly impoverished floristic set and sometimes appears as a dense monophytic population of *Schoenoplectus lacustris* without anchorage on the bottom, so as to form real floating vegetation islands. Later, these ones can be occupied by dense populations of *Salix pedicellata* that substitute *Schoenoplectus lacustris* altogether, as can be seen in the Biviere di Cesarò (Brullo et al., 1994).

Syndynamism: The *Schoenoplectetum lacustris* often represents the innermost belt of marsh vegetation, coming into contact with other communities linked to shallow waters such as *Oenantho fistulosae-Glycerietum spicatae*, *Typhetum angustifoliae* and *Typhetum latifoliae* on the low muddy bottoms or even the *Cyperetum longi* in the most raised shores (Brullo et al., 1994). In the low-altitude places this vegetation is replaced by another community, richer

from the floristic point of view, represented by the *Typho angustifoliae-Phragmitetum australis*.

Habitat reference: C5.1a Tall-helophyte bed; C5.4 Inland saline or brackish helophyte bed.

12.1.1.4. ***Typhetum angustifoliae*** Pignatti 1953

Helophytic vegetation with narrowleaf cattail.

Synonyms: *Scirpo lacustris-Glycerietum aquaticae* Allorge 1921, faciès à *Typha angustifolia* Allorge 1921 (art. 3c); *Scirpo-Phragmitetum* Koch 1926 p. p. (art. 36, nom. amb.); *Typhetum angustifolio-latifoliae* Schmale 1939 p. p. (art. 36, nom. amb.).

Lectoypus: Not designated.

Characteristic and differential species: *Typha angustifolia* L.

Phytosociological table: From Brullo & Siracusa (2000), tab. 7, 5 rel.

Char. association and alliance: *Typha angustifolia* (V).

Char. order and class: *Rumex conglomeratus* (V), *Schedonorus arundinaceus* (V), *Agrostis stolonifera* subsp. *scabriglumis* (V), *Phragmites australis* (III).

Other species: *Paspalum paspaloides* (V), *Trifolium resupinatum* (III), *Juncus subulatus* (II).

Geographical distribution: This syntaxon shows a wide Euro-Mediterranean distribution (Allorge, 1921; Pignatti, 1953; Oberdorfer, 1977; Brullo et al., 2001). In Sicily the association is quite common, having been reported for various locations of the Nebrodi (Brullo et al., 2001), on the Hyblaean Mountains (Brullo et al., 1996), in the rivers of the central-southern part of the island (Brullo & Spampinato, 1990), the Biviere di Gela (Brullo & Sciandrello, 2006) and on the western side of Etna (Brullo & Siracusa, 2000).

Structure and ecology: The *Typhetum angustifoliae* prefers the banks of rivers, canals and lake with shallow waters and muddy bottoms, generally forming a belt that is quite discontinuous and limited to small surfaces. It is a vegetation related to the swampy areas with stagnant mesotrophic waters (Brullo et al., 1994). From a physiognomic point of view, this community is represented by a dense population of *Typha angustifolia*, which is associated with a few other species such as *Schoenoplectus palustris*, *Carex acutiformis*, *Galium elongatum*, *Apium nodiflorum*, *Mentha aquatica* and very rarely also with *Epipactis palustris*. Besides, the occurrence of *Phragmites australis* is rather sporadic and fragmentary in this association (Brullo & Spampinato, 1990).

Syndynamism: This community replaces the *Typho angustifoliae-Phragmitetum australis*, with which it is often in catenal contact, particularly in the dead sections of the watercourses and in the outer belt with shallow waters (Oberdorfer, 1977; Brullo & Spampinato, 1990).

Habitat reference: C5.1a Tall-helophyte bed.

12.1.1.5. ***Typhetum latifoliae*** Nowiński 1930

Helophytic vegetation with broadleaf cattail.

Synonyms: *Scirpo-Phragmitetum* Koch 1926 p. p. (art. 36, nomen ambiguum); *Typhetum latifoliae* Soó 1927 (art. 2b, nomen nudum); *Typhetum angustifolio-latifoliae* Schmale 1939 p. p.; *Typhetum latifoliae* Lang 1973.

Lectotypus: Not designated.

Characteristic and differential species: *Typha latifolia* L.

Phytosociological table: From Brullo et al. (1994), tab. 20, 3 rel.
Char. association and alliance: *Typha latifolia* (3)
Char. alliance and order: *Schoenoplectus lacustris* (1).
Char. order and class: *Galium elongatum* (3), *Epilobium parviflorum* (2), *Mentha aquatica* (2), *Alisma lanceolatum* (1), *Apium nodiflorum* (1), *Sparganium erectum* (1), *Cirsium creticum* subsp. *triumfetti* (1).
Other species: *Glyceria spicata* (1), *Holcus lanatus* (1), *Agrostis castellana* (1), *Juncus effusus* (1), *Juncus articulatus* (1), *Mentha longifolia* (1).

Geographical distribution: This community is known for most of Europe (Oberdorfer, 1977), including Sicily, where it was reported from Nebrodi, Hyblaean Plateau (Brullo et al., 1996) and Biviere di Gela (Brullo & Sciandrello, 2006), but probably is more widespread in the regional territory than currently known in literature (Brullo et al., 1994).

Structure and ecology: The lake shores with fairly superficial waters and subject to an intense grazing disturbance, are colonized by a dense vegetation dominated by *Typha latifolia*, referring to the *Typhetum latifoliae*. This association is characterized by a quite impoverished floristic set, despite various species belonging to *Phragmition* and syntaxa of higher rank are represented, such as *Galium elongatum*, *Mentha aquatica*, *Sparganium erectum*, *Schoenoplectus lacustris*, etc. (Brullo et al., 1994).

Syndynamism: This association prefers markedly eutrophic subtrata and therefore tends to replace the *Typhetum angustifoliae* in the waters that are richer in nutrients.

Habitat reference: C5.1a Tall-helophyte bed.

12.1.1.6. ***Typhetum domingensis*** Brullo, Minissale & Spampinato 1994

Helophytic vegetation with southern cattail.

Synonyms: *Typho angustifoliae-Schoenoplectetum tabernaemontani* Br.-Bl. & O. Bolòs 1957 var. *Typha domingensis* Biondi et al. 1997.

Holotypus: rel. 1, tab. 21, Brullo et al. (1994).

Characteristic and differential species: *Typha domingensis* (Pers.) Steud.

Phytosociological table: From Brullo et al. (1994), tab. 21, 5 rel.
Char. association: *Typha domingensis* (V).
Char. order and class: *Galium elongatum* (III), *Alisma lanceolatum* (III), *Mentha aquatica* (I), *Rumex conglomeratus* (I), *Cyperus papyrus* (I), *Apium nodiflorum* (I).
Other species: *Agrostis castellana* (II), *Juncus articulatus* (I), *Mentha pulegium* (I).

Geographical distribution: This association, described from the Nebrodi area (Brullo et al., 1994), was later found also in central Italy (Landucci et al., 2013) and in Sardinia (Biondi & Bagella, 2005).

Structure and ecology: The *Typhetum domingensis* can constitute more or less continuous belts, around ponds, small damp depressions and artificial basins that occur at low altitudes. It is a vegetation with a marked thermophilic character that prefers the banks with muddy-peaty soils, subject to summer drying. From the physiognomic point of view, the dominant species is *Typha domingensis*, to which few other plants belonging to the *Phragmito-Magnocaricetea* class are associated, such as *Galium elongatum*, *Cyperus longus*, *Alisma lanceolatum*, *Mentha aquatica*, etc. (Brullo et al., 1994).

Syndynamism: The community at issue represents a thermophilous vicariant of the *Typhetum angustifoliae*, which is normally linked to more mesic stands. The *Typhetum domingensis* can present catenal contacts outwards with other aspects of marshy vegetation, as the *Eleocharido-Alismetum lanceolati*, while inwards is replaced by the communities of the *Potametea* (Brullo et al., 1994).

Habitat reference: C5.1a Tall-helophyte bed.

12.1.1.7. ***Typho angustifoliae-Phragmitetum australis*** (Tx. & Preising 1942) Rivas Martinez et al. 1991

Helophytic vegetation with narrowleaf cattail and common reed

Synonyms: *Scirpo-Phragmitetum mediterraneum* R. Tx. & Preising 1942 (nom. illeg.); *Schoenoplecto-Phragmitetum* R. Tx. & Preising 1942 (nom. mut.); *Scirpo lacustris-Phragmitetum mediterraneum typicum* Br.-Bl. in Br.-Bl., Roussine & Nègre 1952 (corresp. name).

Holotypus: Not designated.

Characteristic and differential species: *Phragmites australis* (Cav.) Trin. ex Steud., *Typha angustifolia* L.

Phytosociological table: From Brullo & Ronsisvalle (1975), tab. 2, 5 rel.

Char. association, alliance and order: *Schoenoplectus lacustris* (V), *Typha angustifolia* (IV), *Typha latifolia* (III), *Bolboschoenus glaucus* (II), *Sonchus maritimus* (V).

Char. class: *Phragmites australis* (V), *Cirsium creticum* subsp. *triumfetti* (II), *Senecio jacobea* (II), *Lythrum salicaria* (I).

Other species: *Symphyotrichum squamatum* (III), *Dittrichia viscosa* (II), *Samolus valerandi* (II), *Arundo donax* (II), *Dorycnium rectum* (I), *Hypericum perfoliatum* (I).

Geographical distribution: This association, occurring in the western Mediterranean and in the Atlantic Europe (Rivas-Martinex et al., 1991, 2001; Molina & Moreno, 2003; Bacchetta et al., 2007; De Martis & Serri, 2009), is quite common in the coastal and hilly areas of Sicily. In fact, it is recorded from several localities near the sea, such as the mouths of some rivers, such as Simeto (Brullo & Spampinato, 1990), Salso (Bonanno, 2008) and Anapo, the coastal ponds of the south-eastern part (Brullo & Furnari, 1976; Bartolo et al., 1982), Gorghi Tondi and Lago Preola area (Brullo & Ronsisvalle, 1975). In the inner parts it is quite frequent in the Anapo valley on the Hyblaean Mountains (Minissale et al., 2007), in some artificial lakes of central Sicily (Marcenò & Raimondo, 1977, Marceno et al., 1978), Sicani range and Ficuzza (Gianguzzi, 2008).

Structure and ecology: The *Typho angustifoliae-Phragmitetum australis* occurs along the shores of the mesotrophic rivers and basins with deep and clear waters (Rivas Martinez et al., 1991; Bacchetta et al., 2007). It is a dense community of high helophytes (1-3 m) linked to silty-clayey soils subject to long periods of submersion by fresh water or weakly salt waters, particularly frequent at the mouths of the rivers (Bartolo et al., 1982). From the floristic point of view, it is a rather rich vegetation, in which *Schoenoplectus lacustris*, *Typha angustifolia* and *Phragmites australis* are dominant, being associated with several taxa typical of the *Phragmition australis* alliance, such as *Typha latifolia*, *Bolboschoenus glaucus*, *Sonchus maritimus*, *Iris pseudacorus* and *Schoenoplectus tabernaemontani*. Besides, the characteristic species of order and class are also very frequent, among them *Galium elongatum*, *Samolus valerandi*, *Alisma plantago-aquatica*, *Cirsium creticum* and *Lythrum salicaria*.

Syndynamism: This community usually constitutes a helophytic vegetation directly in contact with the shores of lakes and streams. Typically in the areas affected by greater seasonal variations in the water level, it tends to be replaced by other associations, such as the *Scirpetum maritimi* and also the *Phragmitetum australis,* which is linked to the shores with shallow water and with a greater content of nutrients (Brullo & Furnari, 1976). Conversely, it sometimes comes into catenal contact with the *Soncho-Cladietum marisci*, which can constitute the belt closest to the banks in the surfaces subject to long periods of submersion (Brullo & Ronsisvalle, 1975). Moreover, this community can form a continuous belt around the small artificial reservoirs, entering in contact with the vegetation of the *Potametea* (Gianguzzi, 2008).

Habitat reference: C5.1a Tall-helophyte bed.

12.1.1.8. ***Typho angustifoliae-Schoenoplectetum glauci*** Br.-Bl. & O.Bolòs 1958 corr. Molina & Moreno 2003

Helophytic vegetation with narrowleaf cattail and grey club-rush

Synonyms: *Typho-Schoenoplectetum tabernaemontani* Br.-Bl. & O. Bolòs 1958 (original form).

Lectotypus: Rel. 17, tab. 14, Braun Blanquet & Bolòs (1958), here designated.

Characteristic and differential species: *Schoenoplectus lacustris* subsp. *glaucus* (Sm.) Bech.

Phytosociological table: From Brullo & Siracusa (2000), tab. 8, 4 rel.
Char. association: *Schoenoplectus lacustris* subsp. *glaucus* (4).
Char. alliance, order and class: *Typha angustifolia* (4)**,** *Schedonorus arundinaceus* (4), *Rumex conglomeratus* (4), *Bolboschoenus maritimus* (3).
Other species: *Paspalum paspaloides* (4), *Agrostis scabriglumis* (4).

Geographical distribution: This association is mainly widespread in the western Mediterranean (Rivas-Martinez et al., 2001; Molina & Moreno, 2003), while in Sicily it is quite rare being known only for a few localities, such as the Platani river (Sortino et al., 1974), the western slope of Etna (Brullo & Siracusa, 2000) and the Biviere di Gela (Brullo & Sciandrello, 2006).

Structure and ecology: The *Typho angustifoliae-Schoenoplectetum glauci* is localized along the shores of watercourses or lake with silty-clayey soils and subject to periods of prolonged submersion by moderately salt waters,. If compared to other *Phragmition* communities, this association is characterized by its halophilous needs and for the preference of clayey substrata. It is also more closely linked to the raised banks of watercourses with sloping riverbeds, affected by short periods of drying during the summer. From the physiognomic point of view, this vegetation is generally dominated by *Schoenoplectus lacustris* subsp. *glaucus*, to which several species of the *Phragmitetea* are associated, including *Typha angustifolia*, *Rumex conglomeratus*, *Schedonorus arundinaceus*, *Bolboschoenus maritimus*, etc. (Brullo & Siracusa, 2000).

Syndynamism: This community tends to replace the *Typhetum angustifoliae* on the shores subject to a short period of emersion. From the catenal point of view, the *Typho angustifoliae-Schoenoplectetum glauci* can be into contact outwards with the *Juncetum maritimo-acuti* and inward with the *Typhetum angustifoliae* (Brullo & Sciandrello, 2006).

Habitat reference: C5.1a Tall-helophyte bed; C5.4 Inland saline or brackish helophyte bed.

12.1.1.9. ***Iridetum pseudacori*** Eggler ex Brzeg & Wojterska 2001

Helophytic vegetation with yellow flag.

Synonyms: *Iridetum pseudacori* Eggler 1933; *Iridetum pseudoacori* Krzywanski 1974.

Holotypus: Not designated.

Characteristic and differential species: *Iris pseudacorus* L.

Phytosociological table: From Brullo et al. (1994), tab. 18, 8 rel.

Char. association: *Iris pseudacorus* (V).

Char. order and class: *Galium elongatum* (V), *Cirsium creticum* subsp. *triumfetti* (IV), *Mentha aquatica* (IV), *Rumex sanguineus* (IV), *Schenodorus arundinaceus* (II), *Carex otrubae* (II), *Rumex conglomeratus* (II), *Epilobium parviflorum* (II), *Sparganium erectum* (I), *Lycopus europaeus* (I).

Other species: *Juncus effusus* (V), *Holcus lanatus* (V), *Oenanthe fistulosa* (II), *Agrostis castellana* (III), *Ranunculus neapolitanus* (III), *Juncus inflexus* (II), etc.

Geographical distribution: The syntaxon at issue was originally reported for central Europe (Krzywanski, 1974), while in Sicily it was surveyed by Barbagallo et al. (1979c) and Brullo et al. (1994) in the Nebrodi area.

Structure and ecology: The shores of the small ponds, sometimes buried, with muddy bottoms and subject to complete drying during the summer, are colonized by a vegetation physiognomically dominated by *Iris pseudacorus*. This mesophilous community is referred to the *Iridetum pseudoacori*, a syntaxon which is clearly attributable to the *Phragmitetea* class, due to the presence of several helophytes, such as *Galium elongatum*, *Mentha aquatica*, *Rumex sanguineus*, *Cirsium creticum*, etc. (Brullo et al., 1994).

Syndynamism: The *Iridetum pseudoacori* often is in catenal contact with the hygrophilous grasslands of the *Dactylorhizo-Juncetum effusi*, a vegetation linked to surfaces with little inclination and very shallow waters, subject to a shorter submerging periods (Barbagallo et al., 1979c).

Habitat reference: C5.1a Tall-helophyte bed.

12.1.1.10. ***Polygono salicifolii-Phragmitetum australis*** Barbagallo, Brullo & Furnari 1979

Helophytic vegetation with common reed and slender knotweed.

Holotypus: Rel. 2, tab. 1, Barbagallo et al. (1979).

Characteristic and differential species: *Phragmites australis* (Cav.) Trin. ex Steud., *Persicaria decipiens* (R.Br.) K.L.Wilson.(= *Polygonum salicifolium* Brouss. ex Willd.)

Phytosociological table: subass. *cyperetosum papyri*, from Barbagallo et al. (1979), tab. 1, 13 rel.

Char. association and subassociation: *Persicaria decipiens* (V), *Cyperus papyrus* subsp. *papyrus* (V).

Char. alliance and order: *Sonchus maritimus* (II).

Char. class: *Phragmites australis* (V). *Apium nodiflorum* (IV), *Galium elongatum* (I), *Cirsium creticum* subsp. *triumfetti* (I), *Agrostis stolonifera* (I), *Lythrum salicaria* (I), *Alisma plantago-aquatica* (I), *Glyceria spicata* (I).

Other species: *Calystegia sepium* (V), *Equisetum telmateja* (II), *Mentha longifolia* (I), *Solanum dulcamara* (I), *Pulicaria dysenterica* (I).

Geographical distribution: This association is widespread in several watercourses of eastern Sicily, such as Ciane and Fiumefreddo (Barbagallo et al., 1979a, Brullo & Spampinato, 1990), the Pantano Gurna (Minissale & Spampinato, 1990) and the Hyblaean rivers (Brullo et al., 1996). Recently, this syntaxon has also been found in Calabria (Maiorca et al., 2007).

Structure and ecology: The watercourses characterized by running and limpid waters, often near sources and groundwater, are colonized by a particular helophytic association represented by the *Polygono salicifolii-Phragmitetum australis*. It is dominated by *Phragmites australis*, which grows together with the rare *Persicaria decipiens*, and other species of the *Phragmitetea* class, such as *Apium nodiflorum*, *Sonchus maritimus*, *Iris pseudacorus*, *Carex otrubae*, *Lycopus europaeus*, *Schoenoplectus lacustris*, *Bolboschoenus maritimus*, etc. (Brullo & Spampinato, 1990). This vegetation tends to constitute a more or less continuous belt around the shores of watercourses, while more rarely occupies the wet depressions, but always in the presence of a continuous flow of cold and well oxygenate waters (Minissale & Spampinato, 1990). A particular aspect of this association is represented by the subass. *cyperetosum papyri* described by Barbagallo et al. (1979) for the muddy banks, which are flooded by the Ciane river, with stagnant or slowly flowing waters. This vegetation is differentiated by a dense population of *Cyperus papyrus* L. subsp. *papyrus*., which according to Chiovenda ( ) and Brullo et al. ( )is endemic from Sicily. This vegetation it is often subject to periodic cuts especially of the rhizomatous parts of *Phragmites australis.* in order to prevent it from suffocating the papyrus, which could be damaged, as well as to prevent the expansion of the barrel towards the adjacent agricultural lands (Barbagallo et al., 1979a).

Syndynamism: On the most external surfaces, this community comes into contact with the *Caricetum ripariae*, a more mature and evolved association. The *Polygono salicifolii-Phragmitetum australis* is also replaced by the *Phragmitetum australis* in the parts of watercourses with stagnant waters (Brullo & Spampinato, 1990).

Habitat reference: C5.1a Tall-helophyte bed.

12.1.1.11. ***Soncho maritimi-Cladietum marisci*** (Br.-Bl. & O. Bolòs 1958) Cirujano 1980

Helophytic vegetation with swamp sawgrass and sea sow thistle.

Synonyms: *Mariscetum oligohalinum* Br.-Bl. & Bolòs 1958.

Lectotypus: Rel. 2, tab. 15, Braun Blanquet & Bòlos (1958), here designated.

Characteristic and differential species: *Agrostis stolonifera* L. subsp. *maritima* (Lam.) Vasc., *Cladium mariscus* (L.) Pohl ; *Ipomoea sagittata* Poir., *Linum maritimum* L., *Sonchus maritimus* L.

Phytosociological table: From Brullo & Furnari (1976), pag. 36, 26 rel.

Char. association: *Cladium mariscus* (V), *Sonchus maritimus* (V), *Ipomoea sagittata* (I), *Linum maritimum* (I), *Agrostis stolonifera* subsp. *maritima* (I).

Char. alliance and order: *Typha latifolia* (III), *Schoenoplectus lacustris* (I).

Char. class: *Phragmites australis* (V), *Iris pseudacorus* (II), *Epilobium parviflorum* (II), *Cirsium creticum* subsp. *triumfetti* (I), *Lythrum salicaria* (I), *Veronica anagallis-aquatica* (I), *Alisma plantago-aquatica* (I), *Carex vulpine* (I), *Carex hispida* (I), *Cyperus levigatus* (I), *Teucrium scordioides* (I), *Mentha aquatica* (I).

Other species: *Samolus valerandi* (II), *Dorycnium rectum* (I), *Dittrichia viscosa* (I), *Lythrum junceum* (I), *Lotus preslii* (I), *Daucus carota* s.l. (I), *Erianthus ravennae* (I), *Convolvulus arvensis* (I), *Polypogon maritimus* (I), etc.

Geographical distribution: The association is mainly represented in the western Mediterranean (Braun-Blanquet & Bolòs, 1957; Bolòs, 1967; Rivas Martinez et al., 2001; Landucci et al., 2013) Italy including. In Sicily its distribution is rather localized, being reported for some coastal stations, such as the Gorghi Tondi and the Preola Lake (Brullo & Ronsisvalle, 1975), Capo Feto (Brullo, 1978), Arezzi marsh near Pozzallo (Brullo & Furnari, 1976; Bartolo et al., 1982) and also the Cassibile river in the Hyblaean (Brullo et al., 1993).

Structure and ecology: The *Soncho-Cladietum marisci* is a peculiar helophytic community linked to the coastal ponds with fresh or slightly brackish waters, where it grows in the silty-clayey shores, permanently submerged or dried up only for a short periods (Brullo & Ronsisvalle, 1975). The physiognomy of this association is defined by *Cladium mariscus*, a rare sedge, that forms large bushes up to 2 m tall, associated with some oligo-halophilous species of considerable phytogeographic interest, such as *Sonchus maritimus*, *Linum maritimum*, *Ipomoea saggittata* and *Agrostis stolonifera* subsp. *maritima* (Brullo & Furnari, 1976).

Syndynamism: This vegetation can constitute a belt with an intermediate position between the communities closest to the shore, such as the *Phragmitetum communis* or the *Typho angustifoliae-Phragmitetum australis*, and the vegetation related to the surfaces with a shorter period of flooding, such as the *Caricetum hispidae* (Brullo, 1978). The *Soncho-Cladietum marisci* can evolve in the *Schoeneto-Plantaginetum crassifoliae*, if there is a rapid increase in soil, or towards other communities of the *Phragmitetalia* (e. g. the vegetation with *Carex hispida*), if the elevation is slow and gradual (Brullo & Ronsisvalle, 1975). Moreover, some aspects of degradation of this vegetation, deriving from fires, mowing and agricultural activities, are known, such as the groupement with *Sonchus maritimus* reported in some watercourses of southern Sicily (Turrisi et al., 2001).

Habitat reference: C5.1a Tall-helophyte bed; C5.4 Inland saline or brackish helophyte bed.

12.1.2. Alliance: ***Agrostio scabriculmis-Elytrigion athericae*** Brullo &. Siracusa 2000

Hygrophilous sub-halophilous vegetation of inland stands subject to summer drying.

Holotypus: *Puccinellietum gussonei* Brullo & Siracusa 2000.

Characteristic and differential species: *Agropyron repens* (L.) Beauv.; *Agrostis stolonifera* subsp. *scabriglumis* (Boiss. & Reut.) Maire; *Carex distans* L.; *Elytrigia atherica* (Link) Kerguèlen; *Juncus subulatus* Forssk., *Schedonorus interruptus* (Desf.) Tzvelev.

Geographical distribution: This alliance is known only for the south-western side of Etna mountain (Brullo & Siracusa, 2000).

Structure and ecology: The alliance gathers some very specialized hygrophilous communities with a sub-halophilous character that colonize clayey substrata, limited to flat or slightly inclined surfaces of inland places, submerged by more or less brackish waters for a quite short period during autumn-spring period, but dried in summer (Brullo & Siracusa, 2000).

Syndynamism: See class.

Habitat reference: C5.4 Inland saline or brackish helophyte bed.

12.1.2.1. ***Elytrigio athericae-Puccinellietum fasciculatae*** Brullo & Siracusa 2000 corr.

Hygrophilous subhalophilous vegetation with saltmarsh alkaligrass.

Synonyms: *Puccinellietum gussonei* Brullo & Siracusa 2000 nom. illeg. (art. 48).

Holotypus: rel. 4, tab. 3, Brullo & Siracusa (2000).

Characteristic and differential species*: Puccinellia fasciculata* (Torr.) E.P. Bicknell (=*Puccinellia borreri* (Bab.) Hayek).

Phytosociological table: From Brullo & Siracusa (2000), tab. 3, 8 rel.

Char. association: *Puccinellia fasciculata* (V).
Char. alliance: *Elytrigia atherica* (V), *Elytrigia repens* (IV), *Carex distans* (II).
Char. order and class: *Schenodorus arundinaceus* (V), *Phragmites australis* (IV).
Other species: *Polypogon maritimus* (V), *Spergularia marina* (V), *Suaeda vera* (V), *Cynodon dactylon* (V)**,** *Moricandia arvensis* (V), *Bromus mollis (*V), *Phalaris minor* (V)**,** *Lactuca viminea* (IV)**,** *Sonchus oleraceus* (III)**,** *Lolium perenne* (III), etc.

Geographical distribution: The association is exclusive of the south-western side of Etna and in particular of Contrada Barcavecchia near Adrano (Brullo & Siracusa, 2000).

Structure and ecology: A peculiar hygrophilous vegetation with *Puccinellia fasciculata* (= *P. borreri*), a rare subhalophilous species with Atlantic-Mediterranean distribution in Sicily

recorded only for a few stands (Giardina et al., 2007), occurs in the clayey low sloped surfaces at the base of the badlands, These places are subject to a weak flow of water during the winter but totally dry during the spring-summer period. Previously, this species was wrongly attributed by Brullo & Siracusa (2000) to *P. gussonei* Parl., considering it as characteristic of a new association named *Puccinellietum gussonei*. According to Art. 43 and 48 of Phytosociological Code, the name of this syntaxon must be corrected in *Puccinellietum fasciculatae*. Unfortunately, this name was used by Beeftink (1965) to describe an association occurring in North Atlantic coasts very different from that one at issue. Therefore, the new name proposed for the *Puccinellietum gussonei* is *Elytrigio athericae-Puccinellietum fasciculatae* Brullo & Siracusa 2000 corr. Currently, others associations characterized by *Puccinellia fasciculata* are known in literature, such as *Astero tripolii-Puccinellietum fasciculatae* Gehu 1976 and *Aeluropo littoralis-Puccinellietum fasciculatae* (Rivas Goday 1955) Rivas Martinez & Costa 1976 em. Rivas Martinez 1984. As concerns its syntaxonomical arrangment, the *Elytrigio athericae-Puccinellietum fasciculatae* is well differentiated from the aforesaid associations, both for floristic and ecological viewpoint. In fact, the latter are not referable to *Phragmito-Magnocaricetea*, but to *Asteretea tripolii* or *Juncetea maritimae*.

Syndynamism: This vegetation replaces the *Festuco-Caricetum divisae* and the *Festuco-Juncetum subulati* in the places affected by greater edaphic salinity, while in the surfaces with greater inclination it tends to disappear in favor of the *Festuco-Elytrigietum athericae*. The community at issue is actually very rare and its complete disappearance is probably to be expected in the short term due to the conversion of its habitat into landfills.

Habitat reference: See alliance.

12.1.2.2. ***Schenodoro interrupti-Juncetum subulati*** Brullo & Siracusa 2000 corr.

Hygrophilous vegetation with somerset rush and tall fescue.

Synonyms: *Festuco-Juncetum subulati* Brullo & Siracusa 2000.

Holotypus: rel. 10, tab. 4, Brullo & Siracusa (2000).

Characteristic and differential species*: Schedonorus interruptus* (Desf.) Tzvelev (=*Festuca arundinacea* Schreb. subsp. *fenas* (Lag.)Arcang.), *Juncus subulatus* Forssk.

Phytosociological table: From Brullo & Siracusa (2000), tab. 4, 14 rel.

Char. association: *Juncus subulatus* (V),

Char. alliance: *Agrostis stolonifera* subsp. *scabriglumis* (V), *Elytrigia atherica* (V), *Schedonorus interruptus* (V), *Elytrigia repens* (IV), *Carex distans* (III).

Char. order and class: *Rumex conglomeratus* (IV), *Bolboschoenus maritimus* (III), *Phragmites australis* (III), *Carex otrubae* (II), *Typha angustifolia* (I), *Holoschoenus australis* (I), *Cyperus distachyos* (I), *Cyperus longus* (I).

Other species: *Bromus mollis* (V), *Polypogon maritimus* (IV), *Juncus acutus* (IV), *Gaudinia fragilis* (IV), *Centaurium pulchellum* (III), *Hordeum maritimum* (III), *Dittrichia viscosa* (III), *Suaeda vera* (III), etc.

Geographical distribution: The association is exclusive of the south-western side of Etna and in particular of Contrada Barcavecchia near Adrano (Brullo & Siracusa, 2000).

Structure and ecology: This hygrophilous community occurs in the stands affected by long periods of submersion, often located at the margins of large wetlands characterized by clay substrata. Physiognomically it is dominated by *Juncus subulatus,* which grows together with other helophytes, such as *Schedonorus interruptus*, *Elytrigia atherica*, *Carex distans* and *Agrostis stolonifera* subsp. *scabriglumis* (Brullo & Siracusa, 2000).

Syndynamism: The community at issue is replaced by the *Festuco-Caricetum divisae* in the areas affected only by a slight flow of water during the winter, while in the wettest stations the *Bolboschoenetum compacti* finds its optimum (Brullo & Siracusa, 2000).

Habitat reference: See alliance.

12.1.2.3. ***Schenodoro interrupti-Caricetum divisae*** Brullo & Siracusa 2000 corr.

Hygrophilous vegetation with divided sedge and tall fescue.

Synonyms: *Festuco-Caricetum divisae* Brullo & Siracusa 2000.

Holotypus: rel. 3, tab. 5, Brullo & Siracusa (2000).

Characteristic and differential species: *Schedonorus interruptus* (Desf.) Tzvelev, *Carex divisa* Huds.

Phytosociological table: From Brullo & Siracusa (2000), tab. 5, 8 rel.

Char. association: *Carex divisa* (V).

Char. alliance and order: *Agrostis stolonifera* subsp. *scabriglumis* (V), *Schenodorus interruptus* (V)**.** *Juncus subulatus* (V), *Elytrigia atherica* (I).

Char. class: *Bolboschoenus maritimus* (IV)**,** *Phragmites australis* (III), *Apium nodiflorum* (I).

Other species: *Oenanthe pimpinelloides* (V)**,** *Romulea ramiflora* (IV)**,** *Juncus acutus* (IV), *Poa trivialis* (IV)**,** *Polypogon maritimus* (IV), *Gaudinia fragilis* (III), *Daucus carota* (III), *Centaurium pulchellum* (III), etc.

Geographical distribution: The association is exclusive of the south-western side of Etna and in particular of Contrada Barcavecchia near Adrano (Brullo & Siracusa, 2000).

Structure and ecology: This association colonizes the surfaces localized at the margins of the wellands subject to a superficial swamping or affected by a slow water flowing. This vegetation is dominated by *Carex divisa* is characterized by a contingent of hygrophilous species belonging to *Phragmito-Magnocaricetea*, such as *Agrostis scabriglumis*, *Juncus*

subulatus, *Elytrigia atherica*, *Schedonorus interruptus*, *Bolboschoenus maritimus* and *Phragmties australis*. From the floristic and physiognomic viewpoint it is quite related with the *Caricetum divisae*, an association belonging to *Juncion maritimi*, linked to coastal marshes with brackish waters (Brullo & Siracusa, 2000).

Syndynamism: This vegetation outward in the more dry stands in in contact with *Hyparrhenia hirta* grasslands, while in the areas subject to a more prolonged submersion it is replaced by the *Festuco-Juncetum subulati* (Brullo & Siracusa, 2000).

Habitat reference: See alliance.

12.1.2.4. ***Schenodoro interrupti-Elytrigietum athericae*** Brullo in Brullo et al. 1988 corr.

Hygrophilous vegetation with sea couch grass and tall fescue.

Synonyms: *Festuco-Agropyretum pungentis* Brullo in Brullo et al. 1988 (orig. form.), *Festuco-Elytrigietum athericae* Brullo in Brullo & Siracusa 2000 and Brullo et al. 2000.

Holotypus: rel. 5, tab. 11, Brullo et al. (1988).

Characteristic and differential species: *Elytrigia atherica* (Link) Kerguèlen.

Phytosociological table: From Brullo & Siracusa (2000), tab. 5, 8 rel.
Char. association: *Elytrigia atherica* (V).
Char. alliance and order: *Schenodorus interruptus* (V), *Juncus subulatus* (III).
Char. class: *Phragmites australis* (V).
Other species: *Anisantha madritensis* (V), *Melilotus sulcata* (V), *Limonium narbonense* (V), *Suaeda vera* (IV), *Symphyotrichum squamatum* (IV), *Scolymus grandiflorus* (IV), *Medicago ciliaris* (IV), *Juncus acutus* (III), *Silene gallica* (III), *Parapholis filiformis* (III), *Limbarda crithmoides* subsp. *longifolia* (III), etc.

Geographical distribution: The association is currently recorded from the Simeto mouth (Brullo et al., 1988), Torre Manfria near Gela (Brullo et al., 2000) and Contrada Barcavecchia in the territory of Adrano (Brullo & Siracusa, 2000).

Structure and ecology: The stands with silty-clayey substrata subject to short periods of submersion during the winter, are colonized by a peculiar hygrophilous community dominated by *Elytrigia atherica*. This vegetation is referred to the *Festuco-Elytrigietum athericae*, an association originally attributed to the *Sarcocornetea* class (Brullo et al., 1988) for the occurrence of some halophytes. However, these species should be considered as transgressive because they come from other communities with which the association in question is in catenal contact (Brullo & Siracusa, 2000). From the physiognomic point of view, in addition to *Elytrigia atherica*, several species belonging to *Agrostio scabriculmis-Elytrigion athericae* and *Phragmito-Magnocaricetea* class play an important role, such as *Agrostis scabriglumis*, *Schedonorus interruptus* and *Phragmites australis*.

Syndynamism: This vegetation shows intermediate ecological requirements between the *Festuco-Caricetum divisae* and the *Festuco-Juncetum subulati*, but prefers a greater edaphic salinity, substituting the *Puccinellietum fasciculatae* in slightly inclined surfaces (Brullo & Siracusa, 2000). In the coastal marshes this association colonizes the most raised stands subject to short periods of flooding with slightly salty waters, taking contact with the halophilous vegetation of the *Arthocnemo-Juncetum subulati*, while more externally, in the surfaces that are not affected by submersion, with the *Atriplici halimi-Artemisietum arborescentis* (Brullo et al., 1988).

Habitat reference: See alliance.

12.2. Order: ***Nasturtio-Glycerietalia*** Pignatti 1953

Helophytic vegetation of well-oxygenated running waters.

Holotypus: *Glycerio fluitantis-Sparganion neglecti* Br.-Bl. & Sissingh in Boer 1942.

Characteristic and differential species: *Berula erecta* (Huds.) Coville, *Glyceria fluitans* (L.) Br., *G. notata* Chevall., *G. spicata* Guss., *Helosciadium nodiflorum* (L.) W.D.J. Koch; *Nasturtium officinale* R. Br., *Sparganium erectum* L., *Veronica anagallis-aquatica* L.

Geographical distribution: This syntaxon shows a wide distribution in the temperate and Mediterranean areas of Europe and North Africa, including Madeira (Mucina et al., 2016).

Structure and ecology: The order groups the amphibious communities dominated by rhizomatous and small-medium sized helophytes (belonging to genera such as *Berula*, *Glyceria*, *Helosciadium*, *Nasturtium* and *Veronica*), which grow on the banks of clear and well-oxygenated watercourses (Pignatti, 1953).

Syndynamism: See class.

Habitat reference: C5.1b Small-helophyte bed.

12.2.1. Alliance: ***Glycerio-Sparganion neglecti*** Br.-Bl. & Sissing in Boer 1942

Vegetation with amphibious species, more or less submerged, liked to stagnant or slightly flowing waters.

Synonyms: *Sparganio-Glycerion* Br.-Bl. & Sissingh in Boer 1942 nom. invers. propos. (art. 42); *Glycerion* Br.-Bl. & Tx. 1943 (art. 2b); *Phalarido-Glycerion maximae* Passarge 1964 p.p. (art. 2b); *Apion nodiflori* Segal in Westhoff & Den Held 1969 (syntax. syn.); *Glycerion fluitantis* Gèhu & Gèhu-Franck 1987 (art. 29); *Nasturtion officinalis* Gèhu & Gèhu-Franck 1987 (syntax. syn.); *Rorippion nasturtium-aquatici* Gèhu et Gèhu-Franck 1987 nom. mut. propos. (art. 45); *Nasturtio-Veronicion beccabungae* Borhidi 2001 (syntax. syn.).

Holotypus: *Glycerio fluitantis-Sparganietum neglecti* Koch 1926.

Characteristic and differential species: See order.

Geographical distribution: This alliance is widespread in the Temperate and Mediterranean areas of Europe and North Africa (Costa et al., 2012).

Structure and ecology: This alliance groups the amphibious communities colonizing the banks of streams and small wetlands with of fine-grained sediment on the bottom. It is a vegetation dominated by reptant helophytes, generally linked to eutrophic waters with low hydrodynamism (or stagnant) and subject to considerable seasonal fluctuations, sometime completely dried in summer (Costa et al., 2012).

Syndynamism: This vegetation assumes an intermediate position between the aquatic cenosis of the *Potametea* class and the helophytic ones of the *Phragmition*, growing in the lower shores (Brullo & Spampinato, 1990).

Habitat reference: See order.

12.2.1.1. ***Sparganietum erecti*** Philippi 1973

Amphibious vegetation with simplestem bur-reed.

Lectotypus: Rel. 4, tab. 3, Philippi (1973), here designated.

Characteristic and differential species: *Sparganium erectum* L.

Phytosociological table: From Brullo et al. (1994), tab. 16, 7 rel.

Char. association: *Sparganium erectum* (V).

Char. alliance and order: *Glyceria spicata* (V), *Helosciadium nodiflorum* (I).

Char. class: *Mentha aquatica* (IV), *Galium elongatum* (V), *Iris pseudacorus* (II), *Typha latifolia* (II), *Lycopus europaeus* (I), *Alisma lanceolatum* (I), *Cirsium creticum* subsp. *triumfetti* (I).

Other species: *Oenanthe fistulosa* (IV), *Juncus effusus* (II), *Holcus lanatus* (II), *Solanum dulcamara* (II), *Rumex sanguineus* (I).

Geographical distribution: The association occurs mainly in the temperate territories of central Europe, while it tends to become more rare in the Mediterranean ones (Philippi, 1973, Oberdorfer, 1977). In Sicily it is recorded from Fiumefreddo (Brullo & Spampinato, 1990), Nebrodi range (Brullo et al., 1994), Ficuzza woods (Gianguzzi, 2008) and Anapo valley (Minissale et al., 2007).

Structure and ecology: This amphibious vegetation, suveyed along the river banks with a persistent flow throughout the year, is represented by more or less dense populations of *Sparganium erectum*. This mesophilous vegetation is mainly occurs in rivers with cold and limpid waters, calm or slowly flowing and in particular in sunny loops with permanently

submerged but not asphyxiated substrata (Minissale et al., 2007). Sometimes this association grows also in the surfaces of the permanent wetlands with shallow waters (Brullo et al., 1994). Floristically, it is a rather poor community, in which *Helosciuadium nodiflorum*, *Mentha aquatica*, *Iris pseudacorus*, *Galium elongatum* and *Typha latifolia* are quite frequent (Brullo & Spampinato, 1990).

Syndynamism: The *Sparganietum erecti* is a permanent community, which under more thermophilous conditions is replaced by the *Helosciadietum nodiflori* along the low banks of watercourses, while in the higher and shaded shores it is in contact with the *Cyperetum longi* (Minissale et al., 2007). In marshy environments this association comes into contact with other hygrophilous communities linked to deeper waters, and in particular with the *Glycerio spicatae-Oenanthetum aquaticae* (Brullo et al., 1994).

Habitat reference: See order.

12.2.1.2. ***Eleocharido palustris-Alismetum lanceolati*** Minissale & Spampinato 1987

Hygrophilous vegetation with water plantain and common spike-rush

Holotypus: rel. 2, tab. 4, Minissale & Spampinato (1987).

Characteristic and differential species: *Alisma lanceolatum* With., *Eleocharis palustris* (L.) Roem. & Schult.

Phytosociological table: From Brullo et al. (1994), tab. 15,13 rel.

Char. association: *Alisma lanceolatum* (V), *Eleocharis palustris* (V).

Char. alliance and order: *Veronica anagallis-aquatica* (III), *Nasturtium officinale* (II), *Glyceria spicata* (II), *Helosciadium nodiflorum* (I).

Char. class: *Galium elongatum* (III), *Typha angustifolia* (II), *Bolboschoenus glaucus* (I), *Carex otrubae* (I), *Rumex conglomeratus* (I), *Schenodorus arundinaceus* (I).

Other species: *Agrostis stolonifera* (IV), *Oenanthe aquatica* (III), *Mentha pulegium* (II), *Juncus articulatus* (II), *Rumex sanguineus* (I), *Plantago major* (I), *Utricularia australis* (II), etc.

Geographical distribution: In Sicily this association is surveyed only in Etna territory at the Gurrida lake (Minissale & Spampinato, 1987) and in the Nebrodi range (Brullo et al., 1994).

Structure and ecology: The muddy shores of wetlands and small damp depressions permanently flooded or sometimes subject to a short period of summer drying, are colonized by a peculiar community belonging to *Eleocharido palustris-Alismetum lanceolati* (Brullo et al., 1994). It is a hygrophilous vegetation dominated by *Eleocharis palustris* and *Alisma lanceolatum*, associated with other species of the alliance and class, among them *Galium debile*, *Carex otrubae*, *Typha angustifolia*, *Nasturtium officinale* and *Bolboschoenus glaucus*. According to Minissale & Spampinato (1987), within this association can be distinguished two variant, such as the subass. *alismetosum lanceolati* representing the typical aspect, while the

subass. *bolboschoenetosum maritimis* characterized by the occurrence of *Bolboschoenus glaucus* is differentiated for its more marked hygrophily.

Syndynamism: In the surfaces subject to a shorter submersion period, the association at issue is replaced by the *Carici otrubae-Juncetum inflexi*, a slightly nitrophilous community (Minissale & Spampinato, 1987) or by the *Dactylorrhizo-Juncetum effusi* in less disturbed stands.. Towards the central part of the pond the *Eleocharido-Alismetum lanceolatum* can show catenal contacts with communities of the *Alopecuro-Glycerion spicatae* (Brullo et al., 1994).

Habitat reference: See order.

12.2.1.3. ***Eleocharido palustris-Sparganietum neglecti*** Brullo, Minissale & Spampinato 1994

Hygrophilous vegetation with common spike-rush and branched bur reed.

Holotypus: rel. 4, tab. 17, Brullo et al. (1994).

Characteristic and differential species: *Sparganium erectum* L. subsp. *neglectum* (Beeby) K. Richt., *Eleocharis palustris* (L.) Roem. & Schult.

Phytosociological table: From Brullo et al. (1994), tab. 17, 9 rel.

Char. association: *Sparganium erectum* subsp. *neglectum* (V), *Eleocharis palustris* (V).

Char. alliance, order and class: *Mentha aquatica* (V), *Alisma lanceolatum* (V), *Schoenoplectus lacustris* (IV), *Lycopus europaeus* (III), *Typha angustifolia* (II), *Rumex conglomeratus* (II), *Phragmites australis* (II), *Glyceria spicata* (I).

Other species: *Oenanthe fistulosa* (V), *Lythrum portula* (IV), *Persicaria amphibia* (III), *Juncus articulatus* (III), *Juncus effusus* (II), *Solanum dulcamara* (I).

Geographical distribution: This association was surveyed only at the Biviere di Cesarò, in the Nebrodi mountains (Brullo et al., 1994).

Structure and ecology: The community at issue colonizes the lake shores with muddy substrata, always submerged by shallow, clear and cold waters. It is a community with marked mesophilous requirements, which is exclusive to the supramediterranea belt, where the climatic vegetation is represented by beech woods. From the physiognomic point of view, the rare *Sparganium erectum* subsp. *neglectum* assumes a relevant ecological role, while *Eleocharis palustris* tends to be dominant, growing with other helophytes, such as *Schoenoplectus lacustris*, *Alisma lanceolatum* and *Mentha aquatica*. The *Eleocharido-Sparganietum neglecti* shows some ecological and floristic similarities with the *Glycerio-Sparganietum neglecti* W. Koch 1926, widespread in Central Europe, of which it can be considered a southern vicariant (Brullo et al., 1994).

Syndynamism: This community tends to constitute a more or less discontinuous belt near the north-eastern banks of the Biviere di Cesarò, where it replaced by the *Oenantho-Glycerietum spicatae* in the deeper waters (Brullo et al., 1994).

Habitat reference: See order.

12.2.1.4. ***Helosciadietum nodiflori*** Maire 1924

Amphibious vegetation with fool's-water-cress

Synonyms: *Helosciadietum nodiflori* Br.-Bl. 1931, nom. nud.; *Helosciadetum nodiflori* Br.-Bl. ex Boer 1942 (syn. sin.); *Glycerio declinatae-Helosciadetum nodiflori* J.A. Molina 1996, p. p.

Holotypus: Rel. pg. 96, Maire (1924).

Characteristic and differential species: *Helosciadium nodiflorum* (L.) W.D.J. Koch

Phytosociological table: From Sortino et al. (1974), tab. 12, 12 rel.; from Brullo & Spampinato (1990), tab. 24, 6 rel. (1,2,5,6,8,9).

Char. association: *Helosciadium nodiflorum* (V).

Char. alliance and order: *Nasturtium officinale* (V), *Veronica anagallis-aquatica* (IV), *Glyceria fluitans* (II), *Berula erecta* (I), *Sparganium erectum* (I), *Glyceria notata* (I).

Char. class: *Rumex conglomeratus* (IV), *Agrostis stolonifera* (III), *Schenodorus arundinaceus* (II), *Mentha aquatica* (II), *Typha latifolia* (II), *Bolboschoenus glaucus* (I), *Sonchus maritimus* (I), *Galium elongatum* (I), *Eupatorium cannabinum* (II), *Typha angustifolia* (I), *Schoenoplectus lacustris* (I), *Carex hispida* (I), *Phragmites australis* (I), *Alisma plantago-aquatica* (I), *Cirsium creticum* subsp. *triumfetti* (I), *Epilobium hirsutum* (I).

Other species: *Scrophularia auriculata* (IV), *Lythrum junceum* (III), *Plantago major* (III), *Juncus articulatus* (II), *Mentha suaveolens* (III), *Sonchus oleraceus* (III), *Juncus inflexus* (III), *Sonchus asper* (II), etc.

Geographical distribution: This association, widespread in large part of the Mediterranean area (Ninot et al., 2000), results quite frequent in the permanent watercourses of all Sicily, and in particular of the northern and eastern part (Sortino et al., 1974; Barbagallo et al., 1979a and 1979b; Minissale & Spampinato, 1990; Brullo & Spampinato, 1990; Brullo & Siracusa, 2000; Minissale et al., 2007; Gianguzzi, 2008).

Structure and ecology: The banks of the less disturbed rivers, with shallow, clear and well-oxygenated waters, are colonized by a peculiar vegetation with a summer development, dominated by *Helosciadium nodiflorum*. This community, which is referred to the *Helosciadietum nodiflori*, is linked to small surfaces of 5-10 m^2 with gravelly-sandy alluviums, in the stands with stagnant or weakly flowing waters of rivers with perennial flow (Brullo et al., 2001). The physiognomy of this community is defined by *Helosciadium nodiflorum*, as well as by other amphibious species, such as *Nasturtium officinale*, *Veronica anagallis-aquatica*,

Rumex conglomeratus, *Mentha suaveolens*, *Glyceria fluitans*, *Eleocharis palustris*, *Alisma plantago-aquatica*, *Galium elongatum*, *Iris pseudacorus* , *Sparganium erectum*, etc.

Syndynamism: The *Helosciadietum nodiflori* is a permanent community with an edaphic character, which colonizes the lowest banks of the rivers. In correspondence of the more raised shores, it can shows catenal contacts with the helophytic vegetation of the *Phragmition communis* or *Magnocaricion* and sometimes also with the hygrophilous shrubs of the *Salicetalia purpureae*. The *Apio-Glycerietum spicatae* shows a very similar ecology, but prefers the silty-clayey substrata and the slightly salt waters (Brullo & Spampinato, 1990).

Habitat reference: See order.

12.2.1.5. ***Nasturtietum officinalis*** Gilli 1971

Amphibious vegetation with watetcress.

Synonyms: Nast*urtietum officinalis* Seibert 1962 (phantom); *Nasturtietum officinalis* Philippi 1973.

Lectotypus: Rel. 57, tab. 6, Gilli (1971), here designated.

Characteristic and differential species: *Nasturtium officinale* R. Br.

Phytosociological table: From Brullo & Spampinato (1990), tab. 24, 5 rel. (3,4,7,10,11); from Sortino et al. (1974), tab. 12, 10 rel.

Char. association: *Nasturtium officinale* (V).

Char. alliance: *Helosciadium nodiflorum* (V), *Veronica anagallis-aquatica* (V), *Glyceria fluitans* (IV).

Char. order and class: *Agrostis stolonifera* (II), *Mentha aquatica* (II), *Bolboschoenus glaucus* (I), *Sonchus maritimus* (I), *Galium elongatum* (I), *Schenodorus arundinaceus* (I), *Typha angustifolia* (I), *Schoenoplectus lacustris* (I), *Carex hispida* (I), *Alisma plantago-aquatica* (I), *Cirsium creticum* subsp. *triumfetti* (I), *Cyperus longus* (I), *Lycopus europaeus* (I).

Other species: *Juncus articulatus* (IV), *Scrophularia auriculata* (III), *Lythrum junceum* (III), *Plantago major* (II), *Mentha suaveolens* (II), *Sonchus asper* (II), *Poa annua* (II), etc.

Geographical distribution: It is a syntaxon with a wide distribution in the Temperate and Mediterranean territories of Europe (Wattez, 1975). In Sicily it is quite frequent along rivers and streams (Sortino et al., 1974; Brullo & Spampinato, 1990).

Structure and ecology: This association replaces the *Helosciadietum nodiflori* in the waters with greater hydrodynamism, growing in a more advanced position (Corbetta et al., 1998). The *Nasturtietum officinalis*, a rather poor community from the floristic point of view, in which *Helosciadium nodiflorum* tends to disappear completely, being replaced by *Nasturtium officinale*, which often reaches high levels of coverage. Besides, some other species are frequent, such as *Veronica anagallis-aquatica*, *Persicaria lapathifolia*, *Mentha aquatica*,

Agrostis stolonifera, etc. (Angiolini et al., 2005). Previously, the relevés characterized by the dominance of *Nasturtium officinale* with low coverage values of *Helosciadium nodiflorum* were attributed by Sortino et al. (1974) and Brullo & Spampinato (1990) to *Helosciadietum nodiflori*, but basing on current literature they must be referred to *Nasturtietum officinalis* Gilli 1971 (Šumberová, 2011).

Syndynamism: This community represents a permanent vegetation, which often comes into contact with the *Helosciadietum nodiflori*, generally localized on the banks of the river, but it can also grows in waters with a greater amount of organic matter (Sortino et al., 1974).

Habitat reference: See order.

12.2.1.6. ***Apio nodiflorae-Glycerietum plicatae*** Brullo & Spampinato 1990

Hygrophilous vegetation with plicate sweet-grass

Holotypus: rel. 1, tab. 25, Brullo & Spampinato (1990).

Characteristic and differential species: *Glyceria notata* Chevall. (= *G, plicata* (Fr.) Fr.)

Phytosociological table: From Brullo & Spampinato (1990), tab. 25, 10 rel.

Char. association: *Glyceria notata* (V).

Char. alliance: *Helosciadium nodiflorum* (V), *Nasturtium officinale* (III), *Veronica anagallis-aquatica* (II).

Char. order and class: *Rumex sanguineus* (V), *Schenodorus arundinaceus* (IV), *Phragmites australis* (III), *Persicaria decipiens* (II), *Typha angustifolia* (I).

Other species: *Polypogon viridis* (V), *Polygonum aviculare* (V), *Rumex crispus* (V), *Xanthium italicum* (V), *Polypogon monspeliensis* (V), *Tamarix africana* (IV), *Tamarix gallica* (IV), *Ammi visnaga* (II), *Melilotus siculus* (I)*, Mentha pulegium* (I)*, Spergularia marina* (I)*, Plantago major* (I).

Geographical distribution: This association is quite frequent in the rivers of central Sicily (Brullo & Spampinato, 1990) and has also been reported for the Settefrati area near Cefalù (Fici & Gianguzzi, 2011). Outside of Sicily, the community is known only in Calabria, on the Aspromonte Massif (Brullo et al., 2001).

Structure and ecology: The silty- clayey shores of rivers with slightly salt waters are colonized by a amphibious vegetation dominated by prostrate helophytes, in which *Glyceria notata* assumes a relevant role from the physiognomic point of view (Brullo & Spampinato, 1990). This vegetation, described as *Apio-Glycerietum plicatae*, is characterized by other igrophytes as *Helosciadium nodiflorum*, *Nasturtium officinale*, *Veronica anagallis-aquatica* and by some species of the *Phragmito-Magnocaricetea*, such as *Phragmites australis*, *Rumex sanguineus*, *Schedonorus arundinaceus*, etc. .

Syndynamism: This community replaces the *Helosciadetum nodiflori* in the silty-clayey surfaces that are submerged by slightly salt waters (Brullo & Spampinato, 1990).

Habitat reference: See order.

12.3. Order: ***Magnocaricetalia*** Pignatti 1953

Marsh vegetation with large sedges (Cyperaceae) on the outer banks of the watercourses.

Synonyms: *Caricetalia elatae* (Pignatti 1953) Rivas-Martinez 1973 (art. 29); *Magnocarici-Phragmitetalia* (Pignatti 1953) Succow 1974 (orig. form) (art. 29); *Carici elatae-Phragmitetalia australis* (Pignatti 1953) Succow 1974 (phantom)*; Scrophulario umbrosae-Caricetalia paniculatae* Koska in Dengler et al. 2004 (syntax. sin.); *Caricetalia elatae* Trinajstić 2008 (art. 29).

Holotypus: *Magnocaricion elatae* W. Koch 1926

Characteristic and differential species: *Althaea officinalis* L.*, Carex cuprina* (Heuff.) A. Kern., *C. elata* All.*, C. hispida* Willd.*, C. riparia* Curtis*, Cirsium creticum* (L.) Scop. subsp. *triumfettii* (Lacaita) K. Werner, *Cyperus longus* L. subsp. *longus*, *Epilobium parviflorum* Schreb., *Euphorbia hirsuta* L.*, Galium elongatum* C. Presl*, Rumex conglomeratus* Murray, *Teucrium scordium* L. subsp. *scordioides* (Schreb.) Arcang.

Geographical distribution: The syntaxon is well represented in the temperate areas of Europe and Asia (Mucina et al., 2016). In Sicily it is quite frequent throughout the island (Brullo & Spampinato, 1990).

Structure and ecology: This order brings together the marsh communities dominated by large Cyperaceae (mainly belonging to the genera *Cyperus* and *Carex*), which constitute the most outer belt of vegetation on the banks of the rivers and lakes being linked to surfaces only seasonally flooded (Pignatti, 1953).

Syndynamism: The associations belonging to the *Magnocaricetalia* show a permanent character and often enter in contact with the vegetation of the *Phragmitetalia*, which is linked to the inner shores with a more direct contact with the water (Brullo & Spampinato, 1990).

Habitat reference: C5.2 Tall-sedge bed.

12.3.1. Alliance: ***Magnocaricion elatae*** Koch 1926

Vegetation with large sedges on organogenic water-saturated (sometimes peaty) soils.

Synonyms: *Magnocaricion* Br.-Bl. 1931 (phantom), *Caricion gracilis* Neuhäusl 1959 (syntax. syn.); *Caricion acutae* Neuhäusl 1959 nom. mut. propos. (art. 45); *Caricion rostratae* Neuhäusl 1959 (phantom)*; Caricion rostratae* Bal.-Tul. 1963 (syntax. syn.)*; Caricion elatae* (Koch 1926)

Rivas-Martinez 1973 (art. 29*); Acrocladio-Caricion* Succow 1974 (syntax. syn.)*; Scorpidio-Cladion marisci* Succow 1974 (syntax. syn.); *Scrophulario umbrosae-Caricion paniculatae* Koska in Dengler et al. 2004 (syntax. syn.); *Caricion elatae* (Koch 1926) Trinajstić 2008 (art. 29, 40).

Holotypus: *Caricetum elatae* W. Koch 1926.

Characteristic and differential species: See order.

Geographical distribution: Thi syntaxon is widespread in the temperate Eurasia, including the Mediterranean area (Costa et al., 2012). It is the only alliance of the *Magnocaricetalia* occurring in Sicily, where it shows a very scattered and fragmented distribution (Brullo & Spampinato, 1990; Gianguzzi et al., 1995).

Structure and ecology: The syntaxon at issue groups the associations linked to the banks of rivers and lake that remain very humid even during the summer, although they are subjected to short periods of emersion. In Sicily communities of this alliance are not very frequent, since it is not easy to establish ecological conditions that allow their establishment and therefore they are usually few represented and impoverished (Brullo & Spampinato, 1990). From the structural point of view, it is possible to identify two structural aspects in the communities belonging to the *Magnocaricion elatae*. The first one is defined by a dominant stoloniferous species (generally Cyperaceae) that constitute dense and compact populations in which few other species can grow, while in the second one, the dominant species constitute clumps that do not completely cover the surface, allowing the growth of some small species that colonize the spaces between the clumps, such as *Agrostis stolonifera*, *Lycopus europaeus*, *Lythtrum salicaria*, etc. (Biondi & Blasi, 2015).

Syndynamism: The anthropic disturbance, and in particular the enrichment of the soil in nitrogenous substances, leads to the replacement of the communities at issue with the associations of *Agroproro-Rumicion crispi*. Conversely, under optimal conditions it occupies the intermediate belt between the helophytic communities of the *Phragmitetalia* and the shrubby or arboreal vegetation of the *Salicetea purpureae* and the *Populetalia albae* (Brullo & Spampinato, 1990). Sometimes, it can also has contact with the vegetation of the *Molinio-Arrhenatheretea* (in stands characterized by a lower presence of water) or the *Bidentetea tripartitae* (in the more anthropized environments and with a high presence of nitrogenous substances in the soil) (Biondi & Blasi , 2015).

Habitat reference: See order.

12.3.1.1. ***Cyperetum longi*** Micevski 1963

Hygrophilous vegetation with galingale of surfaces that remain humid also during the summer period

Synonyms: *Cyperetum longi* Soó 1927 nom. nud.; *Cyperetum longi* Micev 1957 nom. nud.

Lectotypus: Rel. 1, tab., 9, Micevski (1963), here designated.

Characteristic and differential species: *Cyperus longus* L.

Phytosociological table: From Barbagallo et al. (1979), tab. 3, 13 rel.

Char. association: *Cyperus longus* (V).

Char. alliance and order: *Cirsium creticum* subsp. *triumfetti* (IV), *Epilobium parviflorum* (II), *Galium elongatum* (I), *Lycopus europaeus* (I).

Char. class: *Helosciadium nodiflorum* (III), *Iris pseudacorus* (I), *Typha angustifolia* (III), *Schoenoplectus lacustris* (III), *Schenodorus arundinaceus* (II), *Sparganium erectum* (II), *Phragmties australis* (II), *Eupatorium cannabinum* (II), *Rumex conglomeratus* (II), *Veronica angallis-aquatica* (I), *Alisma plantago-aquatica* (II), *Bolboschoenus glaucus* (I), *Lythrum salicaria* (I).

Other species: *Mentha longifolia* (IV), *Dorycnium rectum* (III), *Polypogon semiverticillatus* (III), *Lythrum junceum* (I), *Juncus articulatus* (I), *Paspalum vaginatum* (I).

Geographical distribution: This association, distributed mainly in Eastern Europe and in particular in the Balkan peninsula (Micevski, 1957; Horvatić, 1963; Horvat et al., 1974), is quite common in the Hyblaean rivers (Barbagallo et al., 1979a; Brullo & Spampinato, 1990, Minissale et al., 2007) and also in some mountain stands of the Nebrodi area (Brullo et al., 1994).

Structure and ecology: It is localized along the stretches of rivers characterized by calm waters and with a considerable deposit of silty material. This association prefers the most elevated shores, subject to periodic submersions, but always humid, often in correspondence of the river widenings in the shade of the riparian wood (Minissale et al., 2007). The floristic set of the *Cyperetum longi* includes numerous taxa of *Magnocaricion elatae* alliance, such as *Cirsium creticum* subsp. *triumfetti*, *Epilobium parviflorum*, *Galium elongatum* and *Lythrum salicaria*, and class, among them *Helosciadium nodiflorum*, *Iris pseudacorus*, *Typha angustifola*, *Phragmties australis*, *Schoenoplectus lacustris*, *Schedonorus arundinaceus* and *Sparganium erectum*. Barbagallo et al. (1979) distinguished two aspects within this association: the subass. *typicum* representing the typical community, linked to the quite sunny shores, while the subass. *caricetosum pendulae* replaces the previous one in the most shaded stands and is characterized by the high coverage of *Carex pendula*.

Syndynamism: Along the watercourses of the Hyblaean area, the *Cyperetum longi* frequently comes into contact with the riparian wood of the *Platano-Salicetum pedicellatae*, located more externally than the shore, while in a more advanced position on the lower banks it is replaced by the *Helosciadietum nodiflori*. Conversely, in the sunniest stands it is replaced by the *Sparganietum erecti* (Brullo & Spampinato, 1990). In the lake places this vegetation forms a discontinuous belt between the most strictly hygrophilous communities (*Eleocharido-Alismetum lanceolati*) linked to long submerged surfaces and the *Molinio-Arrhenatheretea* meadows, which grow in the most xeric surfaces (Brullo et al., 1994).

12.3.1.2. ***Cypero badii-Caricetum otrubae*** R.Tx. in R.Tx. & Oberd. 1958

Hygrophilous vegetation with galingale and false fox sedge of surfaces subject to summer drying.

Lectotypus: Rel. 160, tab., 33, Tüxen .& Oberdorfer (1958), here designated.

Characteristic and differential species: *Carex otrubae* Podp., *C. riparia* Curtis; *Cyperus badius* Desf.

Phytosociological table: From Barbagallo et al. (1979), tab. 2, 13 rel.

Char. association: *Carex riparia* (V), *Carex otrubae* (V), *Cyperus badius* (V).

Char. alliance and order: *Rumex conglomeratus* (III), *Lythrum salicaria* (III), *Epilobium parviflorum* (II), *Galium elongatum* (II), *Althaea officinalis* (II), *Cyperus longus* (II).

Char. class: *Phragmties australis* (V), *Schenodorus arundinaceus* (IV), *Alisma plantago-aquatica* (III), *Helosciadium nodiflorum* (II), *Iris pseudacorus* (II), *Sonchus maritimus* (II), *Agrostis stolonifera* (II), *Persicaria decipiens* (I).

Other species: *Pulicaria dysenterica* (IV), *Potentilla reptans* (III), *Cichorium intybus* (III), *Rubus ulmifolius* (II), *Arum italicum* (II), *Panicum repens* (II).

Geographical distribution: The association, described for Spain (Tuxen & Oberborfer, 1958; Bolòs, 1962), in Sicily was surveyed from Ciane river and Fiumefreddo river (Barbagallo et al., 1979a; Brullo & Spampinato, 1990).

Structure and ecology: The *Cypero badii-Caricetum otrubae* colonizes the stretches of canals and rivers with shallow stagnant waters dried during the summer. This association is differentiated from *Carex otrubae*, *C. riparia* and *Cyperus longus* subsp. *badius*, growing together with several taxa of higher rank syntaxa, among them *Rumex conglomeratus*, *Lyhtrum salicaria*, *Phragmties australis*, *Schedonorus arundinaceus*, *Althaea officinalis*, *Epilobium parviflorum*, etc. (Barbagallo et al., 1979a).

Syndynamism: This association replaces the *Caricetum ripariae* in wet channels and depressions (Brullo & Spampinato, 1990).

12.3.1.3. ***Caricetum ripariae*** Soó ex Máthé & Kovacs 1959

http://real-j.mtak.hu/id/eprint/8167

Hygrophilous vegetation with pond sedge.

Synonyms: *Caricetum ripariae* Soó 1928; *Galio palustris-Caricetum ripariae* Balátová-Tulácková et al. 1993.

Holotypus: Rel. 1, tab. 1, Máthé & Kovacs (1959).

Characteristic and differential species: *Carex riparia* Curtis.

Phytosociological table: From Barbagallo et al. (1979), tab. 3, 7 rel.

Char. association: *Carex riparia* (V).

Char. alliance and order: *Epilobium parviflorum* (III), *Althaea officinalis* (III), *Cyperus longus* (I), *Rumex conglomeratus* (I).

Char. class: *Lythrum salicaria* (V), *Phragmties australis* (V), *Sonchus maritimus* (IV), *Schenodorus arundinaceus* (II), *Mentha aquatica* (I).

Other species: *Pulicaria dysenterica* (V), *Potentilla reptans* (IV), *Rubus ulmifolius* (V), *Arum italicum* (IV), *Equisetum telmateja* (III), *Panicum repens* (III), *Agropyron repens* (III), *Cichorium intybus* (II), *Verbascum blattaria* (II), *Ranunculus neapolitanus* (II), *Torillis arvensis* (I), *Hordeum bulbosum* (I), *Rumex crispus* (I), *Helminthotheca echioides* (I), *Verbena officinalis* (I), *Phalaris paradoxa* (I), *Agrimonia eupatoria* (I), etc.

Geographical distribution: The association is mainly represented in Central Europe (Knapp & Stoffer, 1962), while in Sicily it is very rare, being known only from Ciane and Fiumefreddo rivers (Barbagallo et al., 1979a; Brullo & Spampinato, 1990).

Structure and ecology: The banks of some short streams with constant flow and medium-high hydrodynamism, which remain humid throughout the year (but generally not inundated), are colonized by a dense vegetation dominated by *Carex riparia*. This community, referred to the *Caricetum ripariae*, is rich in taxa belonging to the *Magnocaricion* and higher rank syntaxa, such as *Lythrum saicaria*, *Epilobium parviflorum*, *Althaea officinalis*, *Phragmites australis*, *Sonchus maritimus*, etc. (Barbagallo et al., 1979a).

Syndynamism: This association replaces the *Cyperetum longi*, typical of the Hyblaean rivers, in two peculiar watercourses of eastern Sicily characterized by a rather short course and with the same origin, since both originate by large groundwater that determine fresh and clear waters, constant throughout the year (Brullo & Spampinato, 1990). The *Caricetum ripariae* often shows catenal contacts with the *Polygono salicifolii-Phragmitetum*, with respect to which it grows more externally (Barbagallo et al., 1979a).

12.3.1.4. ***Caricetum hispidae*** Brullo & Ronsisvalle 1975

Hygrophilous vegetation with hispid sedge

Synonyms: *Leucoio-Caricetum ripariae* subass. *caricetosum hispidae* Br. Bl. & Bolòs 1957 (synt. syn,); *Cladio-Caricetum hispidae* O. Bolòs 1967 (p.p.).

Lectotypus: Rel. 4, tab. 4, Brullo & Ronsisvalle (1975), here designated.

Characteristic and differential species: *Carex hispida* Willd.

Phytosociological table: From Brullo & Ronsisvalle (1975), tab. 4, 10 rel.

Char. association: *Carex hispida* (V).

Char. alliance and order: *Cirsium creticum* subsp. *triumfetti* (IV)**,** *Althaea officinalis* (IV), *Rumex conglomeratus* (II)**,** *Epilobium parviflorum* (I).

Char. class: *Phragmties australis* (V), *Sonchus maritimus* (V), *Lythrum salicaria* (IV), *Iris pseudacorus* (III), *Bolboschoenus maritimus* (II), *Veronica anagallis-aquatica* (I), *Cladium mariscus* (I), *Alisma plantago-aquatica* (I).

Other species: *Dittrichia viscosa* (III), *Dorycnium rectum* (III), *Rubus ulmifolius* (II), *Scirpus holoschoenus* (I), *Calystegia sepium* (I), *Juncus acutus* (I), *Juncus maritimus* (I), *Daucus carota* s. l. (I), etc.

Geographical distribution: The association occuring in several territories of the central-western Mediterranean (Braun-Blanquet & Bolòs 1957; Bolòs 1967 Géhu & Biondi 1988), in Sicily it was recorded only from the western and southern part where it is localized near lakes and salt marshes (Sortino et al., 1974; Brullo & Ronsisvalle, 1975; Bartolo et al., 1982; Brullo & Spampinato, 1990).

Structure and ecology: This association is linked to marshes or lake stands with brackish waters, preferring wet but not flooded surfaces (Brullo & Ronsisvalle, 1975). It is a clearly thermophilous vegetation, typical of watercourses with considerable slope and reduced flow, where *Carex hispida* has a relevant role from the physiognomic point of view. It is associated with several species belonging to alliance and order, such as *Carex distans*, *C. vulpina*, *Lythrum salicaria*, *Cirsium creticum*, *Galium elongatum*, *Althaea officinalis*, *Teucrium scordium* subsp. *scordioides*, *Euphorbia pubescens*, etc. (Brullo & Spampinato, 1990).

Syndynamism: This association replaces the *Cyperetum longi* in the waterways of western and southern Sicily, where it occupies a belt placed between the *Phragmitetum communis* and the riparian woods of the *Salicetum albo-pedicellatae* (Brullo & Spampinato, 1990), verifica Brullo & Ronsisvalle 1975.

12.3.1.5. ***Carici distantis-Schoenetum nigricantis*** Brullo, Minissale, Scelsi & Spampinato 1993

Hygrophilous vegetation with distant sedge and black bog-rush.

Holotypus: rel. 1, tab. 9, Brullo et al. (1993).

Characteristic and differential species: *Schoenus nigricans* L., *Carex distans* L.

Phytosociological table: From Brullo et al. (1993), tab. 9, 6 rel.

Char. association: *Schoenus nigricans* (V), *Carex distans* (V).

Char. alliance, order and class: *Sonchus maritimus* (V), *Cirsium creticum* subsp. *triumfetti* (III), *Scrophularia* sp. (III), *Cladium mariscus* (III).

Other species: *Juncus articulatus* (V), *Dorycnium rectum* (IV), *Trifolium squarrosum* (IV), *Dittrichia viscosa* (III), *Samolus valerandi* (III).

Geographical distribution: The association has been described for the Cava Grande of Cassibile river, in the Hyblaean Plateau, where it is localized near sources (Brullo et al., 1993).

Structure and ecology: The *Carici distantis-Schoenetum nigricantis* is a rare plant community linked to the sources occurring along narrow fluvial gorges constitute by limestone rocks. In particular, this association prefers wet surfaces, encaved in the rock, with well oxygenated fresh waters of phreatic origin. Its physiognomy is defined by *Carex distans* and *Schoenus nigricans*, species the latter generally linked to coastal brackish marshes, associated with other taxa of alliance and class, such as *Sonchus maritimus*, *Cirsium creticum* and *Cladium mariscus* (Brullo et al., 1993).

Syndynamism: This association replaces the *Soncho-Cladietum marisci* in the stands with thinner ground and in direct contact with the bare rock (Brullo et al., 1993).

12.3.1.6. ***Caricetum pendulo-panormitanae*** Gianguzzi, Cusimano, Ilardi & Romano 2013

Hygrophilous vegetation with Palermo sedge and pendulous sedge.

Holotypus: rel. 13, tab. 7, Gianguzzi et al. (2013).

Characteristic and differential species: *Carex panormitana* Guss., *Carex pendula* Huds., *Bidens frondosa* L., *Scrophularia umbrosa* Dumort.

Phytosociological table: From Gianguzzi et al. (2013), tab. 7,15 rel.

Char. association: *Carex panormitana* (V), *Carex pendula* (V), *Bidens frondosa* (IV), *Scrophularia umbrosa* (III).

Char. alliance, order and class: *Helosciadium nodiflorum* (V), *Equisetum telmateja* (IV), *Cyperus longus* subsp. *badius* (IV), *Lythrum salicaria* (III), *Scirpoides holoschoenus* (III), *Eupatorium cannabinum* (II), *Scrophularia auriculata* (II), *Nasturtium officinale* (II), *Lycopus europaeus* (I), *Veronica anagallis-aquatica* (I).

Other species: *Persicaria maculata* (III), *Erigeron sumatrensis* (II), *Melissa officinalis* subsp. *altissima* (II), *Symphyotrichum squamatum* (II), *Parietaria judaicae* (II), *Carex divisae* (II), *Sonchus oleraceus* (II), *Picris echioides* (II), *Lycopersicon esculentum* (II), *Atriplex prostrata* (II), *Piptantherum miliaceum* (II), *Trachelium coeruleum* (I), etc.

Geographical distribution: The association has been described from the Oreto river, near Palermo (Gianguzzi et al., 2013).

Structure and ecology: The *Caricetum pendulo-panormitanae* is a helophytic community with spring-summer development, which grows in the stretches of watercourses inside more or less narrow gorges, preferring the less sloped stands with clear and persistent waters at the shade of riparian vegetation. Sometimes, it also grow inside the river bed, colonizing the larger boulders. From the physiognomic point of view, *Carex pendula* and *Carex panormitana*, the latter a rare species endemic of Sicily and Sardinia, have a dominant role, associated with *Bidens frondosa*, *Scrophularia umbrosa* and other species of the *Phragmito-Magnocaricetea*, including *Helosciadium nodiflorum*, *Cyperus longus* subsp. *badius*, *Lycopus europaeus*, *Nasturtium officinale*, etc. In addition, several species of *Salicetea purpureae*, *Galio-Urticetea*,

Molinio-Arrhenatheretea and *Chenopodietea* are frequent. In fact the high quantity of nutrients dissolved in the water, due to the proximity of the urban settlements, favors the presence of nitrophilous species (Gianguzzi et al., 2013).

Syndynamism: This community should be interpreted as an edaphic vegetation, which is linked to nemoral stations with calcareous substrata. It constitutes a more or less continuous belt between the *Helosciadietum nodiflori*, which is linked to surfaces submerged for long periods, and the riparian wood (*Platano-Salicetum pedicellatae* in the upstream stands and *Salicetum albo-pedicellatae* lower) or the reedbeds of the *Calystegio sylvaticae-Arundinetum donacis* (Gianguzzi et al., 2003).

12.4. Order: ***Bolboschoenetalia maritimi*** Hejny in Holub et al. 1967

Helophytic vegetation of meso-eutrophic and brackish waters.

Synonyms: *Bolboschoenetalia maritimi* Hejny in Gèhu 1969 (art. 2b); *Bolboschoenetalia compacti* Hejny in Holub et al. 1967 corr. Rivas Martinez et al. 1980 (phantom); *Scirpetalia compacti* Hejny in Holub et al. 1967 corr. Rivas-Martinez et al. 1980 (art. 31).

Holotypus: *Scirpion maritimi* Dahl & Hadac 1941.

Characteristic and differential species: *Bolboschoenus maritimus* (L.) Palla, *Cyperus laevigatus* L. subsp. *distachyos* (All.) Maire & Weiller, *Scirpoides holoschoenus* (L.) Soják, *Schoenoplectus tabernaemontani* (Gmelin) Palla*, S. litoralis* (Schrad.) Palla, *Sonchus maritimus* L.

Geographical distribution: This syntaxon has a wide distribution in central and southern Europe (Mucina et al., 2016). In Sicily it is widespread mainly in coastal areas, including small islands (Brullo et al., 1977; Brullo & Sciandrello, 2006).

Structure and ecology: The order, described by Holub et al. (1967), gathers subhalophilous helophytic communities linked to more or less brackish waters. As concerns its syntaxonomic position, this order is included by some authors (Tüxen & Hülbusch, 1971; Dubyna & Neuhauslova, 2000; Solomakha, 2008) in an autonomous class: *Bolboschoenetea maritimi* Vicherek & R. Tx. ex R. Tx. & Hiilbusch 1971.

Syndynamism: The communities belonging to this order replace the *Phragmitetalia* vegetation in the stands with more halophilous conditions.

Habitat reference: C5.4 Inland saline or brackish helophyte bed.

12.4.1. Alliance: ***Scirpion maritimi*** Dahl & Hadac in Saertr. 1941.

Helophytic vegetation of coastal brackish water.

Synonyms: *Bolboschoenion maritimi* Dahl & Hadac 1941 nom. mut. propos. (art. 45); *Caricion paleaceae* Dahl & Hadac 1941 (phantom)*; Magnocaricion paleaceae* Dahl & Hadac 1941 (syntax. sin.)*; Bolboschoenion maritimi* Soò 1947 (art. 31); *Eco-Phragmition* Chapman 1954 p.p. (art. 3d); *Eco-Magnocaricion paleaceae* Chapman 1954 (orig. form) (art. 3d)*; Eleocharition uniglumis* Tyler 1969 (phantom); *Bolboschoenion maritimi continentale* (Soò 1945) Borhidi 1970 (art. 34a); *Eleocharition uniglumis* Siira 1970*; Halo-Scirpion* (Dahl & Hadac 1941) Den Held et Westhoff in Westhoff et Den Held 1969 (art. 29); *Scirpion compacti* Dahl & Hadac 1941 corr. Rivas-Martinez et al. 1980 (art. 30, mut. illeg.)*; Bolboschoenion compacti* Dahl & Hadac 1941 corr. Rivas-Martinez et al. 1980 (art. 45); *Scirpion compacto-littoralis* Rivas-Martinez et al. 1980 (art. 22, 23); *Bolboschoeno maritimi-Schoenoplection litoralis* Rivas-Martinez, M.J.Costa, Castrov. & Valdés Berm. ex Delcoigne & Thébaud 2018.

Lectotypus: *Scirpetum maritimi* (W.F.Christ. 1934) Tüxen 1937.

Characteristic and differential species: See order.

Geographical distribution: This alliance presents an Euro-mediterranean distribution (Braun Blanquet, 1952; Bolòs, 1962; Rivas-Martinez et al., 1980, 2001, 2011), while in Sicily it is mainly known for the southern area (Bartolo et al 1982, Brullo & Sciandrello, 2006), in the island of Pantelleria (Brullo et al., 1977) and sporadically in the northern and eastern parts (Brullo & Siracusa, 2000; Licandro et al., 2011).

Structure and ecology: This alliance brings together the thermophilous communities dominated by helophytes that colonize coastal brackish stands, preferring the silty-clayey surfaces subject to summer drying, but which still maintain a certain degree of humidity. The physiognomy of this vegetation is defined by some halophilous and sub-halophilous species, among them *Schoenoplectus litoralis* and *Bolboschoenus maritimus* are the more represented.

Syndynamism: See order.

12.4.1.1. ***Scirpetum maritimi*** Van Langendonck 1931

Hygro-subhalophilous vegetation with sea club-rush of coastal salt-marshes.

Synonyms: *Scirpetum* Eggler 1933 (art. 22, 23); *Halo-Scirpetum maritimi* Dahl & Hadac 1941 (art. 22, 23); *Scirpetum compacti* Van Langendonck 1931 corr. Bueno & F. Prieto in Bueno 1997 (art. 45).

Lectotypus: Not designated.

Characteristic and differential species: *Bolboschoenus maritimus* (L.) Palla (=*Bolboschoenus maritimus* (L.) Palla subsp. *compactus* (Hoffm.) Hejný in Dostál.

Phytosociological table: From Brullo et al. (1988), tab. 18, 7 rel.
Char. association: *Bolboschoenus maritimus* (V).
Char. alliance: *Schoenoplectus lacustris* (II).

Char. class: *Phragmites australis* (V), *Typha angustifolia* (III), *Schedonorus arundinaceus* (III), *Carex otrubae* (I), *Rumex conglomeratus* (I).

Other species: *Polypogon monspeliensis* (III), *Juncus maritimus* (II), *Rumex crispus* (II), *Hordeum marinum* (II), etc.

Geographical distribution: This syntaxon presents a wide European distribution, where it is widespread mainly along the coasts, while in the eastern Europe occurs also in inner salty stands, as well as in the Mediterranean area (Bueno, 1997; Venanzoni & Gigante, 2000; Rivas-Martinez, 2001; Tomaselli et al., 2008). In Sicily it is quite frequent in the coastal areas and has been reported for the Simeto mouth (Brullo et al., 1988), the Maddalena peninsula near Syracuse (Minissale et al., 2011), the Pantano Gurna at Mascali (Minissale & Spampinato, 1990), the south-western slope of Etna (Brullo & Siracusa, 2000) and the Hyblaean salt-marshes (Brullo & Furnari, 1976; Guglielmo et al., 2012).

Structure and ecology: The *Scirpetum maritimi* is a sub-halophilous helophytic community, which colonize the shores of the coastal ponds with clayey-loamy soils, submerged for long periods by brackish water. It is a thermophilous vegetation, able to tolerate large fluctuations in the water level, since its stands are often dried in summer, even if maintaining a certain degree of humidity. Its physiognomy is defined by *Bolboschoenus maritimus*, species having according to Hroudova et al. (2007) mainly a wide Euromediterranean distribution, which often constitutes a monophytic population.

Syndynamism: This vegetation shows catenal contact with the communities of the *Juncetea maritimae*, such as the *Juncetum maritimo-acuti* and the *Juncetum subulati*, which colonize the surfaces affected by a shorter flooding period; often it is in contact with other sub-halophilous communities of the *Phragmito-Magnocaricetea*.

Habitat reference: See order.

12.4.1.2. ***Cypero laevigati-Schoenoplectetum thermalis*** Brullo, Di Martino & Marcenò 1977

Hygrophilous vegetation with smooth flatsedge and thermal club-rush of coastal lagoon.

Holotypus: rel. 8, tab. 8, Brullo et al. (1977).

Characteristic and differential species: *Cyperus laevigatus* L.; *Schoenoplectus litoralis* (Schard.) Palla subsp. *thermalis* (Trab.) S. S. Hooper (=*S. subulatus* (Vahl) Lye).

Phytosociological table: From Brullo et al. (1988), tab. 8, 10 rel.

Char. association and alliance: *Cyperus laevigatus* (V), *Schoenoplectus litoralis* subsp. *thermalis* (III).

Char. class: *Typha angustifolia* (IV).

Other species: *Limonium secundirameum* (I), *Sonchus oleraceus* (I).

Geographical distribution: It is an association known exclusively for Pantelleria, where it is restricted to Bagno di Venere, a coastal lake fed by thermal springs, but probably it has a wider distribution in similar environments of North African territories (Brullo et al., 1977).

Structure and ecology: The association at issue is limited to the south-eastern part of Bagno di Venere lake, in the surfaces that remain submerged for the whole year or in any case for long periods (Figure 49). This vegetation has a distinctly thermophilous character, as clearly evidenced by the occurrence of two rare helophytes distributed mainly in the warm areas of North Africa, such as *Cyperus laevigatus* and *Schoenoplectus litoralis* subsp. *thermalis*. The latter is referred by Towsend (1962) to *S. subulatus* (Vahl) Lye, spiecies having a tropical distribution. According to Brullo et al. (1977), within this association can be distinguished two subassociation: a) *typhetosum angustifoliae,* that represents the typical aspect linked to the stands near the thermal spring and is characterized by *Typha angustifolia* and *Schoenoplectus litoralis* subsp. *thermalis*; b) *cyperetosum laevigati* differentiated from the dominance of *Cyperus laevigatus* subsp. *laevigatus* which forms monophytic populations at a greater distance from the sources.

Syndynamism: The *Cypero-Schoenoplectetum thermalis* comes into contact with the *Limonietum secundiramei* on the most raised shores, which are submerged only for short periods (Brullo et al., 1977).

Habitat reference: See order.

12.4.1.3. ***Scirpetum maritimo-littoralis*** Br.-Bl. in Br.-Bl. et al. 1952

Hygrophilous subhalophilous vegetation with tuberous bulrush and coast club-rush of coastal salt-marshes.

Synonyms: *Scirpetum maritimo-littoralis* Br. Bl. 1931 nom. nud.; *Scirpetum maritimi* Br. Bl. in Br. Bl. et al. 1952; *Scirpetum maritimo-littoralis* Br.-Bl. ex O. Bolòs 1962; *Scirpetum compacto-littoralis* Br.-Bl. in Br.-Bl. et al. 1952 corr. Rivas-Martinez et al. 1980 (art. 43); *Bolboschoeno compacti-Schoenoplectetum littoralis* Br.-Bl. in Br.-Bl. et al. 1952 corr. Rivas-Martinez et al. 1980, nom. mut. propos. by Rivas-Martinez et al. 2011.

Lectotypus: Not designated.

Characteristic and differential species: *Bolboschoenus maritimus* (L.) Palla.; *Schoenoplectus litoralis* (Schrad.) Palla.

Phytosociological table: From Brullo & Sciandrello (2006), tab. 3, 9 rel.

Char. association and alliance: *Schoenoplectus litoralis* (V), *Bolboschoenus maritimus* (V).

Char. class: *Phragmites australis* (V), *Typha angustifolia* (V), *Schoenoplectus tabaernemontanus* (I).

Other species: *Samolus valerandi* (III), *Dorycnium rectum* (II), *Symphyotrichum squamatum* (V), *Atriplex prostrata* (V), *Tamarix africana* (IV), *Calystegia sylvatica* (IV), *Juncus maritimus* (III).

Geographical distribution: This association described from Southern France (Br.-Bl., 1931; Br.-Bl. et al. 1952), in Sicily is reported by Brullo & Furnari (1976) and Brullo & Sciandrello (2006) for the Biviere di Gela and some salt-marshes near Pozzallo.

Structure and ecology: This vegetation occurs along the shores of coastal marshes and rivers, on silty-clayey soils, rich in the sandy components, which are submerged by slightly brackish waters and sometimes dried only for short periods during the summer. It was described by Braun Blanquet (1931) as sub *Scirpetum maritimo-littoralis* nom. nud. and later by Braun Blanquet et al. (1952) as *Scirpetum maritimi*, pubblishing a synthetic table. Besides, Bolòs (1962) proposed for the *Scirpetum maritimi* sensu Braun Blanquet 1952, the old name given to it by Braun Blanquet (1931): *Scirpeto maritimo-littoralis*. Recently, Julve (2010) according to Hroudovà et al (2007), highlights that the populations from Southern France are referable to *Bolboschoenus glaucus*. Therefore, because Braun Blanquet (1931 and 1952) described the vegetation at issue for that territory the name *Scirpetum maritimo-littoralis* must be corrected in *Bolboschoeno glauci-Schoenoplectetum littoralis*. The latter can be also used for the relevés of the *Scirpetum maritimo-littoralis* recorded from Sicily.

Syndynamism: In marshes or rivers (limitedly to the stands with irrelevant hydrodynamism) usually with brackish waters, this community is localized in the submerged belt. Conversely, the more raised shores it is replaced by the communities that can tolerate a certain emersion period, such as the *Typho-Schoenoplectetum tabaernemontani* (Brullo & Sciandrello, 2006).

Habitat reference: See order.

12.4.1.4. ***Schoenoplecto litoralis-Cyperetum distachyi*** (Barbagallo, Brullo & Furnari 1990) Brullo & Sciandrello 2006

Hygrophilous community with coastal club-rush and Mediterranean galingale of coastal salt-marshes.

Synonyms: *Cyperetum distachyi* Barbagallo, Brullo & Furnari 1990 nom. illeg. (art. 10) non Bolòs & Molinier 1984.

Holotypus: rel. 1, tab. 29, Barbagallo et al. (1990).

Characteristic and differential species: *Cyperus laevigatus* subsp. *distachyos* (All.) Maire & Weiller*; Schoenoplectus litoralis* (Schrad.) Palla.

Phytosociological table: From Brullo & Sciandrello (2006), tab. 4, rel. 8.
Char. association: *Cyperus laevigatus* subsp. *distachyos* (V), *Schoenoplectus litoralis* (II).
Char. alliance: *Bolboschoenus maritimus* (II).

Char. order and class: *Typha angustifolia* (V), *Phragmites australis* (V), *Schoenoplectus tabernaemontani* (II), *Dorycnium rectum* (II), *Lythrum salicaria* (I).

Other species: *Juncus maritimus* (V), *Tamarix africana* (V), *Symphyotrichum squamatus* (IV), *Dittrichia viscosa* (IV), *Scirpoides holoschoenus* subsp. *australis* (IV), *Atriplex prostrata* (IV), *Lotus preslii* (IV), *Sonchus asper* (IV), *Persicaria lapathifolia* (IV), *Samolus valerandi* (IV), *Cyperus fuscus* (III), *Juncus subulatus* (II), *Lippia nodiflora* (I), *Carex extensa* (I), *Chenopodium botryoides* (I).

Geographical distribution: This association described from the coastal salt-marshes of southern Tunisia (Barbagallo et al., 1990), while in Sicily it was reported by Brullo & Sciandrello (2006) for the Biviere di Gela, but it is probably more widespread in the southern Mediterranean area.

Structure and ecology: The vegetation dominated by *Cyperus laevigatus* subsp. *distachyos*, a stoloniferous helophyte that colonizes the shores of brackish marshes with short periods of summer drying, must be referred to *Schoenoplecto litoralis-Cyperetum distachyi*. From the floristic point of view, in this community occurs some species of the *Scirpion maritimi* alliance, such as *Schoenoplectus litoralis* and *Bolboschoenus maritimus*, and also of *Phragmito-Magnocaricetea* class, such as *Typha angustifolia*, *Phragmites australis*, *Schoenoplectus tabernaemontani*, etc. It is a vegetation with clearly thermophilous requirements, showing a more or less sparse coverage.

Syndynamism: This helophytic community replaces the *Bolboschoeno glauci-Schoenoplectetum littoralis* in the outer surfaces of salt marshes, where a short period of drying occurs (Brullo & Sciandrello, 2006).

Habitat reference: See order.

12.4.1.5. ***Festuco arundinaceae-Cyperetum distachyi*** Brullo & Sciandrello 2006

Hygrophilous community with tall fescue and Mediterranean galingale of brackish wetlands.

Synonyms: *Cyperetum distachyi* Brullo & Siracusa 2000, non Barbagallo et al. 1990, nec Bolòs & Molinier 1984.

Holotypus: rel. 5, tab. 1, Brullo & Siracusa (2000).

Characteristic and differential species: *Cyperus laevigatus* subsp. *distachyos* (All.) Maire & Weiller*; Schedonorus arundinaceus* (Schreb.) Dumort.

Phytosociological table: From Brullo & Siracusa (1990), tab. 1, 7 rel.

Char. association: *Cyperus laevigatus* subsp. *distachyos* (V), *Schedonorus arundinaceus* (V).

Char. class: *Rumex conglomeratus* (V), *Typha angustifolia* (III), *Cirsium creticum* subsp. *triumfetti* (II).

Other species: *Polypogon maritimus* (V), *Juncus subulatus* (V), *Elytrigia atherica* (V), *Agrostis stolonifera* subsp. *scabriglumis* (IV), *Trifolium resupinatum* (IV), *Juncus acutus* (IV), *Juncus hybridus* (II), *Lotus preslii* (I).

Geographical distribution: This association is currently known only for a wetland near Adrano in the south-western slope of Etna Mountain (Brullo & Siracusa, 2000).

Structure and ecology: The edges of small depressions with slightly salt waters are sometimes colonized by a peculiar hygrophilous vegetation, where *Cyperus laevigatus* subsp. *distachyos* it is generally dominant. It grows together with several sub-halophilous plants, such as *Juncus subulatus*, *J. acutus*, *Lotus preslii*, etc. This vegetation was originally reported by Brullo & Siracusa (2000) as *Cyperetum distachyi* Barbagallo, Brullo & Furnari 1990, but later it was recognized as a different association by Brullo & Sciandrello 2006 for its peculiar floristic and ecological features. It is named *Festuco arundinaceae-Cyperetum distachyi*, which is linked to clay soils subject to a seasonal swamping by slowly flowing brackish waters in inland places. Compared to the *Schoenoplecto litoralis-Cyperetum distachyi*, it shows a less marked halophilous requirements and is differentiated by the occurrence of *Schedonorus arundinaceus*, *Rumex conglomeratus*, *Cirsium creticum* subsp. *triumfetti*, etc.

Syndynamism: It is a permanent vegetation, having catenal contacts with other hygrophilous communities, such as the *Bolboschoenetum glauci* in the stands with brackish stagnant water or the *Typho angustifoliae-Schoenoplectetum tabernaemontani* in the most raised places (Brullo & Siracusa, 2000).

Habitat reference: See order.

12.4.1.6. ***Scirpo maritimi-Cyperetum alopecuroidis*** Brullo & Sciandrello 2006

Hygrophilous community with tuberous bulrush and foxtail sedge of coastal lagoon.

Holotypus: Rel. 1, tab. 5, Brullo & Sciandrello (2006a).

Characteristic and differential species: *Cyperus alopecuroides* Rottb.

Phytosociological table: From Brullo & Sciandrello (2006), tab. 5, 2 rel.

Char. association: *Cyperus alopecuroides* (2).

Char. alliance and order: *Bolboschoenus maritimus* (2), *Cyperus laevigatus* subsp. *distachyos* (2).

Char. class: *Typha angustifolia* (2), *Phragmites australis* (2), *Schoenoplectus tabernaemontani* (2), *Dorycnium rectum* (1), *Lythrum salicaria* (1).

Other species: *Juncus maritimus* (2), *Tamarix africana* (2), *Symphyotrichum squamatus* (2), *Lotus preslii* (2), *Persicaria lapathifolia* (2), *Atriplex prostrata* (2), *Dittrichia viscosa* (1), *Sonchus asper* (1), *Cyperus fuscus* (1), *Samolus valerandi* (1), *Juncus subulatus* (1), *Lippia nodiflora* (1), *Leptochloa fusca* subsp. *uninervia* (1).

Geographical distribution: This syntaxon was described by Brullo & Sciandrello (2006a) for the north-eastern side of Biviere di Gela, which is actually the only stand reported for this association.

Structure and ecology: The *Scirpo maritimi-Cyperetum alopecuroidis* is a very peculiar plant community, differentiated by the occurrence of *Cyperus alopecuroides*, a tropical cosmopolitan species that outside Sicily it is known only in Egypt and Palestine for the Mediterranean area (Post & Dinsmore, 1932; Boulos, 2005, Brullo & Sciandrello 2006b). It is linked to peculi edaphich conditions, represented by silt-sandy soils of marshes, flooded by brackish waters during the whole year. From the physiognomic point of view, this vegetation is characterized by the presence of big helophytes, such as the above mentioned *C. alopecuroidis* and also *Typha angustifolia* and *Phragmites australis*. Besides, its floristic set is enriched by other species belonging to *Phragmito-Magnocaricetea* class, among them *Bolboschoenus maritimus*, *Schoenoplectus tabernaemontani*, *Dorycnium rectum* and *Lythrum salicaria* (Brullo & Sciandrello, 2006b).

Syndynamism: The presence of this vegetation is possible only in permanently flooded stands, resulting particularly sensitive to any activity that can change the basin water regime.

Habitat reference: See order.

12.5. Order: ***Oenanthetalia aquaticae*** Hejný ex Balátová-Tuláčková et al. 1993.

Pioneer vegetation that grows on disturbed edges of lentic or slow-flowing waters.

Synonyms: *Oenanthetalia aquaticae* Hejný in Kopecý & Hejný 1965 (art. 2b).

Holotypus: *Eleocharito palustris-Sagittarion sagittifoliae* Passarge 1964.

Characteristic and differential species: *Oenanthe aquatica* (L.) Poir., *Rorippa amphibia* (L.) Besser., *Sparganium emersum* Rehmann.

Geographical distribution: This syntaxon shows a wide distribution in boreal and temperate Europe (Mucina et al., 2016).

Structure and ecology: This order comprises the low amphibious herbaceous communities of stands subject to periodic flooding by stagnant or slow-flowing waters (Valachovic et al., 2002; Landucci et al., 2013).

Syndynamism: The communities belonging to this order represent a permanent vegetation, linked to large seasonal fluctuations in water level.

Habitat reference: C5.1b Small-helophyte bed.

12.5.1. Alliance: ***Alopecuro-Glycerion spicatae*** Brullo, Minissale, Spampinato 1994

Hygrophilous vegetation of shallow montane ponds with meso-eutrophic waters and muddy to peaty 1 m-deep backdrops, often dry during the summer.

Holotypus: *Oenantho fistulosae-Glycerietum spicatae* Brullo & Grillo 1978.

Characteristic and differential species: *Alopecurus aequalis* Sobol., *Glyceria spicata* Guss., *Peplis portula* L.

Geographical distribution: The alliance is actually reported only for Sicily and in particular for the Nebrodi Mountains (Brullo et al., 1994; Raimondo et al., 2011), Madonie and Ficuzza area (Caldarella, 2012; Caldarella et al., 2013).

Structure and ecology: The *Alopecuro-Glycerion spicatae* alliance groups the amphibious communities of rizophytes that colonize the muddy to peaty 1 m-deep backdrops of small mountain lakes and ponds with meso-oligotrophic waters, often subject to large variation in precipitation patterns, especially during the summer when they often result dryed (Brullo et al., 1994). These associations prefer the low-sloped stands and often represent the most marginal belt of the lacustrine surface. From the physiognomic point of view, this vegetation is characterized by the occurrence of prostrate rizhophytes, such as *Alopecurus aequalis*, *Glyceria spicata* and *Peplis portula*, mixed to submerged hydrophytes. Due to the significant presence of submerged rhyzophytes, this alliance was attributed by Brullo et al. (1994) to the *Potametea* class. However, Mucina et al. (2016) for its ecological peculiarities and occurrence of *Phragmito-Magnocaricetea* species, suggesting that the *Alopecuro-Glycerion spicatae* should be assigned to *Oenanthetalia aquaticae* order in *Phragmito-Magnocaricetea* class, where shows some similarities with *Eleocharito palustris-Sagittarion sagittifoliae* Passarge 1964 alliance.

Syndynamism: The communitiees of this syntaxon represent a permanent vegetation linked to flooded throughout the year stands, resulting particularly sensitive to any activity that can change the basin water regime.

Habitat reference: See order.

12.5.1.1. ***Oenantho fistulosae-Glycerietum spicatae*** Brullo & Grillo 1978

Hygrophilous vegetation with water lovage and spicate sweet grass

Holotypus: rel. 3, tab. 8, Brullo & Grillo (1978).

Characteristic and differential species: *Oenanthe fistulosa* L.

Phytosociological table: From Brullo & Grillo (1978), tab. 8, 12 rel.
Char. association: *Oenanthe fistulosa* (V).
Char. alliance: *Glyceria spicata* (V), *Lythrum portula* (V), *Alopecurus aequalis* (IV).
Char. order and class: *Eleocharis palustris* (II), *Galium debile* (III), *Carex leporina* (II).

Other species: *Apium inundatum* (IV), *Callitriche obtusangula* (IV), *Ranunculus aquatilis* (IV), *Ranunculus peltatus* (IV), *Callitriche stagnalis* (III), *Ranunculus omiophyllus* (III), *Myriophyllum alterniflorum* (III), *Potamogeton polygonifolius* (II), *Potamogeton natans* (IV), *Juncus articulatus* (IV), *Ranunculus flammula* (IV), *Myosotis sicula* (III), *Ranunculus muricatus* (II), *Carex distans* (II), *Potentilla reptans* (II).

Geographical distribution: This association was described by Brullo & Grillo (1978) for the Nebrodi range, where it is quite common in the mountain wetlands (Brullo et al., 1994), particularly in the Monte Soro surroundings.

Structure and ecology: The community is localized along the shores of small mountain wetlands and sometimes also of streams with low hydro-dynamism, within the beech bioclimatic belt. This hygrophilous vegetation is dominated by submerged and amphibious hydrophytes, as *Alopecurus aequalis*, *Oenanthe fistulosa*, *Glyceria spicata* and *Peplis portula,* which is linked to the muddy surfaces of lacustrine environments often subject to a partial or total drying during the summer (Brullo & Grillo, 1978). Furthermore, the floristic set of this association is constituted also by several rhyzophytes, such as *Callitriche obtusangula*, *Apium inundatum*, *Potamogeton natans*, *Myriophyllum alterniflorum*, etc. According to Brullo et al. (1994), within the *Oenantho fistulosae-Glycerietum spicatae,* two subassociations can be recognized: a) *glycerietosum spicatae,* that is characterized by the dominance of *Glyceria spicata* and represents the typical aspect occurring in mountain stands above 1200 m; b) *dreplanocladetosum*, which is a thermophilous aspect, linked to lower stands (900-1000 m), where *Glyceria spicata* is totally absent, while the very rare moss *Drepanocladus aduncus* occurs

Syndynamism: From the catenal point of view, this vegetation generally take contact directly with the submerged or floating vegetation of *Potametea* and *Lemnetea*, costituting a more or less continuous belt around the pond, being replaced outwards by other hydrophytic communities, such as *Eleocharido-Alismetum lanceolati* and *Sparganietum erecti*.

Habitat reference: See order.

12.5.1.2. ***Glycerio spicatae-Oenanthetum aquaticae*** Brullo, Minissale & Spampinato 1994

Hygrophilous vegetation with fineleaf water dropwort and spicate sweet grass.

Holotypus: Rel. 15, tab. 11, Brullo et al. (1994).

Characteristic and differential species: *Oenanthe aquatica* (L.) Poiret.

Phytosociological table: From Brullo et al. (1994), tab. 11, 11 rel.
Char. association: *Oenanthe aquatica* V.
Char. alliance: *Glyceria spicata* (IV), *Alopecurus aequalis* (IV), *Lythrum portula* (III).
Char. order and class: *Alisma lanceolatum* (III).
Other species: *Potamogeton natans* (III), *Callitriche hamulata* (I).

Geographical distribution: The association at issue occurs in the Nebrodi range, (Brullo et al., 1994) and in the Ficuzza area, at Gorgo Lungo (Gianguzzi & La Mantia, 2004).

Structure and ecology: At lower altitudes (900-1250 m) within the *Quercus cerris* belt, the *Oenantho fistulosae-Glycerietum spicatae* is replaced by a similar but more thermophilous vegetation, where *Oenanthe fistulosa* is totally lacking. This community, referred to *Glycerio spicatae-Oenanthetum aquaticae*, shows a high coverage of *Oenanthe aquatica*, together with *Glyceria spicata*, *Peplis portula* and also *Alopecurus aequalis* in the stands with deeper waters. This association, as well as the previous one, occupies the marshy surfaces subject to a partial summer drying, often forming the outer vegetation belt near the shores. Occasionally, the two associations can take catenal contact, as is the case of Contrada Pantana and Serra della Testa, where the *Glycerio spicatae-Oenanthetum aquaticae* colonizes the inner surfaces with deeper water, while the *Oenantho fistulosae-Glycerietum spicatae* prefers the outer stands near the shores (Brullo et al., 1994). In some stands this vegetation shows a a greater and more continuous extension, linked to the low sloping of the shores and also the tree shading, that prevents the development of a typical helophytic vegetation.

Syndynamism: See previous association.

Habitat reference: See order.

12.5.1.3. ***Glycerio spicatae-Callitrichetum obtusangulae*** Brullo, Minissale & Spampinato 1994

Hygrophilous vegetation with blunt fruited water starwort and spicate sweet grass.

Synoyms: Aggr. a *Glyceria spicata* Raimondo 1980.

Holotypus: Rel. 3, tab. 12, Brullo et al. (1994).

Characteristic and differential species: *Callitriche obtusangula* Le Gall.; *C. hamulata* Kuetz., *C. stagnalis* Scop.

Phytosociological table: From Brullo et al. (1994), tab. 12, 6 rel.

Char. association: *Callitriche obtusangula* (V)**,** *Callitriche hamulata* (II)**,** *Callitriche stagnalis* (I).

Char. alliance: *Glyceria spicata* (V)**,** *Lythrum portula* (IV), *Alopecurus aequalis* (III).

Char. order and class: *Alisma lanceolatum* (I), *Oenanthe aquatica* (IV), *Alisma lanceolatum* (I).

Other species: *Apium inundatum* (V), *Ranunculus omiophyllus* (III), *Myriophyllum alterniflorum* (III), *Callitriche truncata* subsp. *occidentalis* (III), *Callitriche lenisulca* (II), *Ranunculus flammula* (II), *Ranunculus peltatus* (I), *Myriophyllum verticillatum* (I), *Utricularia australis* (I), *Mentha aquatica* (I).

Geographical distribution: This association was described by Brullo et al. (1994) for some wetlands of Nebrodi range (Contrada Pantana, Mt. Soro, San Giorgio, Biviere di Cesarò, Contrada Scagliola, Serra della Testa). However, the same community occurs also in the Madonie Massif, where it was surveyed by Raimondo (1980) and indicated as aggr. a *Glyceria spicata*.

Structure and ecology: This hygrophilous vegetation occurs along the muddy and shallow (10-20 cm deep) shores of eutrophic ponds, often subjected to partial drying during the summer. Physiognomically it is defined by the following rhyzophytes: *Callitriche obtusangula*, *C. hamulata* and *C. stagnalis*. This community is spread in the mountain ponds, occurring at altitudes between 900 and 1800 m. The presence of *Glyceria spicata*, *Peplis portula* and *Alopecurus aequalis* allows to refer this association to the *Alopecuro-Glycerion spicatae* alliance, while it was originally attributed to *Potametea* class for the remarkable occurrence of species belonging to this class, such as *Ranunculus omiophyllus*, *R. peltatus*, *Myriophyllum alterniflorum*, *Apium inundatum*, etc. Within this syntaxon, Brullo et al. (1994) recognized the subass. *callitrichetosum stagnalis*, a peculiar aspect that differs from the typical one (subass. *callitrichetosum obtusangulae*) for its nemoral and less hygrophilous requirements.

Syndynamism: Usually, the *Glycerio spicatae-Callitrichetum obtusangulae* shows an intermediate position between the helophytic vegetation of *Phragmitetea* class and the other associations of the *Alopecuro-Glycerion spicatae*.

13. Class: ***Euphorbio paraliae-Ammophiletea australis*** Géhu & Rivas-Martinez in Rivas-Martinez et al. 2011

Tall-grass perennial swards on mobile coastal dunes of the seaboards.

Synonyms: *Ammophiletea* Br.-Bl. 1933 (phantom); *Ammophiletea* Br.-Bl. & R. Tx. 1943 (art. 2b); *Ammophiletea* R. Tx. in Knapp 1943 (art.1); *Ammophiletea* Br.-Bl. & R. Tx. in Br.-Bl. et al. 1952 (art. 31); *Elymetea arenarii* Géhu 1964; *Honckenyo-Elymetea arenarii* R. Tx. 1966 (syntax. syn.); *Euphorbio paraliae-Ammophiletea arundinaceae* Géhu & Géhu-Franck 1988 (art. 29); *Euphorbio paraliae-Ammophiletea australis* Géhu & Géhu-Franck 1988 corr. Géhu 1998 (art. 43); *Euphorbio paraliae-Ammophiletea australis* Géhu & Géhu Franck 1988 corr. Géhu in Bardat et al. 2004 (art. 43); *Helichryso-Crucianelletea* Gèhu, Rivas Martinez & R. Tx. in Géhu 1975 p.p.; *Retametea arenariae* (=Retametales arenariae) Eig 1939; *Retametea raetam* Eig ex Danin & Solomeshch in Danin & Orshan 1999.

Holotypus: *Ammophiletalia* Br.-Bl. 1933.

Characteristic and differential species: *Achillea maritima* (L.) Ehrend. & Y.P.Guo subsp. *maritima*, *Ammophila australis* (Mabille) Porta & Rigo, *Anthemis maritima* L., *Calystegia soldanella* (L.) R. Br., *Cyperus capitatus* Vand., *Echinophora spinosa* L., *Elytrigia juncea* (L.) Nevski, *Eryngium maritimum* L., *Euphorbia paralias* L., *E. terracina* L., *Launaea fragilis* (Asso) Pau, *Lotus creticus* L., *L. cytisoides* L., *Matthiola sinuata* (L.) R. Br.; *Medicago marina* L.,

Pancratium maritimum L., *Silene nicaeensis* All. var. *perennis* Maire, *Sporobolus virginicus* (L.) Kunth.

Geographical distribution: The *Euphorbio paraliae-Ammophiletea* class shows a wide distribution along the coasts of central and western Europe, Mediterranean and Black Sea (Mucina et al., 2016). In Sicily this class is quite widespread, mainly along the southern sandy beaches between Trapani and Catania (Frei, 1937; Pirola, 1959; Brullo & Furnari, 1970; Bartolo et al., 1982; Brullo et al., 1988, 1996, 1998; 2001; Minissale et al., 2010), while it is quite rare in the small islands (Ferro & Furnari, 1970; Bartolo et al., 1990a; Brullo & Siracusa, 1996) and in the northern coast (Marcenò & Romano, 2010).

Structure and ecology: According to Géhu & Géhu-Frank (1988) and Rivas Martinez (2011), the class *Euphorbio paraliae-Ammophiletea* gathers the perennial psammophilous vegetation colonizing the most part of European and Mediterranean sandy coasts. This syntaxon is replaced in North Europe, Greenland and North America by the *Honckenyo-Elymetea arenarii* R. Tx. 1966 (=*Ammophiletea arenariae* Br. Bl. & R. Tx in Westhoff et al. 1946 p.p.), while in the Macaronesian islands and the Western Saharian coasts is vicaried by *Polycarpaeo niveae-Traganetea moquinii* Rivas Martinez & Wildpret in Rivas Martinez et al. 2002. The communities of this syntaxon show a chain succession, definied by an ecological gradient linked to their distance from the sea shore, influence of wind and storm surges, and above all to the kind of substrate in terms of granulometry, dryness, mobility and stabilisation (Biondi, 2007). In particular, the sand stabilizations is closely linked to the action of the root systems of perennial psammophytes, that with their vegetative structure hold the grains of sand carried by the wind, causing the gradual raising of the dunes. In particular, *Sporobolus virginicus* and *Elytrigia juncea*, both species with well-developed rhizomatous hypogeal systems start the building of the first embryonic dunes closer to the sea. Then it goes into action *Ammophila australis*, that with its large tufts it retains much better the sand, allowing a more marked increase of the dunes. Finally the dune cordon, often even several tens of meters high, protects efficiently the sandy substrates of the interior, which are thus much more stable and colonized by a mainly shrubby vegetation (Braun Blanquet, 1933; Géhu, 1986, 1998; Géhu & Géhu-Franck, 1986, 1988; Géhu et al., 1990; Géhu & Biondi, 1994; Biondi, 1999; Biondi et al., 2001; Brullo et al., 2001; Rivas-Martínez et al., 2002, 2011; Biondi & Bagella, 2005; Biondi & Galdenzi, 2014). From the syntaxonomical point of view, Mucina et al. (2016) included in a distinct class, represented by *Ammophiletea* Br. BL. & R. Tx ex Weisthoff et al. 1946, only the pioneer vegetation of shifting dunes, while attributed the communities occurring in the stabilized hind dunes, which are characterized by dwarf scrub and grassland, in a separated class, corrisponding to *Helichryso-Crucianelletea maritimi* Géhu et al. in Sissingh 1974. This hypothesis is not justifiable from the floristic point of view (Rivas Martinez et al., 2011), since these communities, although structurally more mature than those of the embryonic dunes, have in common a rich contingent of perennial psammophytes, as well as being part of the same dynamic geopermaseries.

Syndynamism: The complete succession of dune communities is possible only in conditions of absence of anthropic pressure. Currently, the sandy complexes that were widespread in Sicily until a few decades ago, due to tourism, agricolture, coast erosion and urbanization, has

been mostly altered or completely disappeared, replaced by synanthropic habitats. Unfortunately, this trend is in continuous growth and being natural biocoenoses with high biodiversity linked to delicate environmental equilibria, their loss is an incalculable damage for the future of the Earth. These upheavals along the sandy coasts occur continuously as well as in Sicily, also in the rest of the Mediterranean countries (Bartolo et al., 1982; Bertacchi et al., 2009; Acosta et al., 2000; Çakan et al., 2011; Zimmiti et al., 2015). The deleting of mobile dunes represents a serious threat not only for the fauna and flora of these now rare natural habitats, but also, for the human activities, since they play a role in protection of the inland from sea winds and sands, water regulation, storm protection, etc. (Everard et al., 2010). However, dunes are subject also to natural erosion that can give origin to the formation of salt marshes.

Habitat reference: B1.3b Mediterranean and Black Sea shifting coastal dune; B1.4b Mediterranean and Macaronesian coastal dune grassland (grey dune).

13.1. Order: ***Ammophiletalia australis*** Br.-Bl. 1933

Tall-grass perennial swards on mobile white and embryonic coastal dunes of the Mediterranean.

Synonyms: *Ammophiletalia* Br.-Bl. 1931 (art. 2b); *Ammophiletalia* Br.-Bl. & Tx. 1943 (art. 2b); *Elymetalia arenarii* Br.-Bl. & Tx. 1943 (art. 2b); *Elymetalia arenarii* Br.-Bl. & Tx. in Br.-Bl. & Tx. 1952); *Elymo-Ammophiletalia arenariae* Géhu & J. Géhu 1969 (syntax. syn.); *Euphorbio-Ammophiletalia* Géhu & J. Géhu 1969 (syntax. syn.).

Lectotypus: *Ammophilion arundinaceae* Br.-Bl. 1921

Characteristic and differential species: *Ammophila australis* (Mabille) Porta & Rigo, *Elytrigia juncea* (L.) Nevski, *Euphorbia paralias* L., *Medicago marina* L., *Sporobolus virginicus* (L.) Kunth.

Geographical distribution: This order is widespread mainly along the coasts of the Western Mediterranean and south Atlantic Europe.

Structure and ecology: The *Ammophiletalia australis* order gathers together the psammophilous communities colonizing shifting dunes, linked to the warm-temperate climate spread in the Western Mediterranean countries, penetrating in the nearby Atlantic coasts. In particular, in this order are included the communities dominated by *Sporobolus virginicus* in the stands near the shoreline, those ones with *Elytrigia juncea* colonizing low embryonic dunes and also the vegetation with *Ammophila australis*, typical of more raised mobile dunes (white dunes).

Syndynamism: The herbaceous communities of this order take contact towards the sea with the halo-subnitrophilous therophytic communities of *Cakiletea maritimae*, while inward they are in contact with the more mature associations belonging to *Crucianelletalia maritimae*.

Sometimes, they are directly in contact with the coastal maquis, which in Sicily is mainly represented by *Ephedro fragilis-Juniperetum macrocarpae* and *Asparago horridi-Retametum gussonei*.

Habitat reference: B1.3b Mediterranean and Black Sea shifting coastal dune.

13.1.1. Alliance: ***Ammophilion australis*** Br.-Bl. 1921 corr. Rivas-Martínez et al. 1990

Tall-grass perennial swards on mobile white and embryonic coastal sand dunes of the Mediterranean.

Synonyms: *Ammophilion littori-arenariae* Br.-Bl. 1921 (art. 34a); *Ammophilion* Br.-Bl. 1933 (art. 2b); *Ammophilion borealis* R. Tx. in Br. Bl. & R. Tx 1952; *Agropyrion juncei* Pignatti 1953 (syntax. syn.); *Agropyrion mediterraneum* Géhu & Géhu-Franck 1969 (art. 2b); *Euphorbio-Ammophilion arenariae* Géhu & Géhu-Franck 1969 (art. 29).

Lectotypus: *Medicagini marinae-Ammophiletum arundinaceae* Br.-Bl. 1921.

Characteristic and differential species: See order.

Geographical distribution: The alliance occurs exclusively in the western Mediterranean area and in the near thermo-atlantic territories.

Structure and ecology: According to literature data (Brullo et al., 2001; Rivas-Martínez et al., 2002, 2011; Costa et al., 2012; Bioret et al., 2013; Biondi et al., 2014), within the *Ammophilion australis*, basing on floristic-structural characteristics and ecological requirements, some other syntaxa can be recognized. In particular, three suballiances result well defined as emphasized by Brullo et al. (2001), which are represented by *Sporobolenion arenarii* occurring on flat surfaces localized at the base of embryonic dunes and dominated by *Sporobolus virginicus*, *Elytrigenion junceae* colonizing the embryonic dunes and physiognomically characterized by *Elytrigia juncea* and finally *Ammophilenion australis*, exclusive of high dunes with *Ammophila australis*.

Syndynamism: See order.

Habitat reference: See order.

13.1.1..1. Suballiance: ***Sporobolenion arenarii*** Géhu & Géhu-Frank ex Géhu & Biondi 1994

Perennial reptant vegetation on flat sandy beaches with seashore dropseed.

Synonyms: *Sporobolion arenarii* (Géhu & Géhu-Frank ex Géhu & Biondi 1994) Rivas-Martinez & Cantò 2002.

Holotypus: *Eryngio maritimi-Sporoboletum arenarii* (Arènes ex Géhu & Biondi 1994) Rivas-Martinez & Cantò 2002.

Characteristic and differential species: *Sporobolus virginicus* (L.) Kunth.

Geographical distribution: See alliance.

Structure and ecology: This syntaxon includes the psammophilous communities featured by *Sporobolus virginicus*, a reptant species colonizing the sandy beaches in the stands near the shoreline. The surfaces are more or less flat with soils rich in salt and organic matter beached during the storm surges. This vegetation is linked to the thermo- and meso-mediterranean belt with dry ombrotype.

Syndynamism: The communities of this syntaxon are often in contact with the therophytic vegetation of *Cakiletea maritimae*, while inward are replaced by the *Elytrigia juncea* vegetation.

Habitat reference: See order.

13.1.1.1.1. ***Eryngio maritimi-Sporoboletum arenarii*** (Arènes ex Géhu & Biondi 1994) Rivas-Martínez & Cantò 2002

Pioneer coastal vegetation with seashore dropseed.

Synonyms: Group. à *Sporobolus arenarius* Arènes 1924 (art. 3c); *Sporoboletum arenarii* Arènes ex Br.-Bl., Roussine & Nègre, Group. 1952 (syntax. syn.); *Sporoboletum arenarii* Arènes ex Géhu & Biondi 1994 (syntax. syn.); *Sporobolo arenarii-Centaureetum maritimae* Rivas Goday & Rigual 1959 (art. 37); *Agropyretum mediterraneum* Br. Bl. 1933 subass. *sporoboletosum* Brullo & Furnari 1970.

Holotypus: rel. 7, tab. 3, Géhu & Biondi (1994).

Characteristic and differential species: *Sporobolus virginicus* (L.) Kunth (=*Sporobolus arenarius* (Gouan) Duval-Jouve).

Phytosociological table: From Bartolo et al. (1982), tab. 8, 8 rel.

Char. association: *Sporobolus virginicus* (V).

Char. alliance, order and class: *Elytrigia juncea* (V), *Echinophora spinosa* (IV), *Launaea fragilis* (IV), *Ammophila australis* (IV), *Eryngium maritimum* (IV), *Pancratium maritimum* (IV), *Achillea maritima* subsp. *maritima* (II), *Ononis ramosissima* (II), *Lotus creticus* (I), *Medicago marina* (I), *Seseli tortuosum* subsp. *maritimus* (I), *Euphorbia paralias* (I).

Other species: *Cakile maritima* (IV), *Salsola tragus* (IV), *Ononis variegata* (II), *Xanthium italicum* (II), etc.

Geographical distribution: The association is widespread mainly in the Western Mediterranean (Brullo et al., 2001). In Sicily it is quite common in the sandy coasts around the

island (Brullo & Furnari, 1970; Bartolo et al., 1982; Brullo et al., 1998; Marcenò & Romano. 2010; Minissale et al., 2010; Licandro et al., 2011).

Structure and ecology: The flat surfaces occurring at the base of the embryonic dunes are often colonized by populations of *Sporobolus virginicus,* a stoloniferous hemicryptophyte that is sporadically associated with few other psammophytes, such as *Cyperus capitatus*, *Medicago marina*, *Achillea maritima* subsp. *maritima*, *Euphorbia paralias*, *Eryngium maritimum*, etc. This vegetation, referable to *Eryngio maritimi-Sporoboletum arenarii*, previously indicated as a facies or subassociation of *Agropyretum mediterraneum* s.l., is localized usually in stands subject to submersion during the storm surges and characterized by coarser sands mixed to organic matter (Brullo & Furnari, 1970; Brullo et al., 2001).

Syndynamism: It is a vegetation with an unstable character due to the strong winds and sea swell, having catenal contact with *Elytrigia juncea* communities, as well as with annual associations of *Cakiletea maritimae*.

Habitat reference: See order.

13.1.1..2. Suballiance: ***Elytrigenion junceae*** Rivas-Martinez et al. 1980 nom. mut.

Perennial vegetation of the embryonic dunes with sand couch grass.

Synonyms: *Agropyrenion farcti* Rivas-Martinez et al. 1980.

Holotypus: *Cypero mucronati-Elytrigietum juncei* Kühnholtz-Lordat ex Br.-Bl. 1933.

Characteristic and differential species: *Elytrigia juncea* (L.) Nevski (= *Agropyron junceum* (L.) P. Beauv.).

Geographical distribution: See alliance.

Structure and ecology: The psammophilous communities dominated by *Elytrigia juncea*, colonizing the embryonic dunes, can be attributed to this syntaxon. This species favors through its well developed stoloniferous system with plagiogeotropic behavior the building of dunes, retaining the sand grains carried by the wind.

Syndynamism: This vegetation represents the first stage of colonization of dunal systems, that in the absence of disturbance constitute a quite continuous belt interposed between the *Sporoboletum arenarii* s.l. and the *Ammophiletum australis* s.l.

Habitat reference: See order.

13.1.1.2.1. ***Launeo fragilis-Elytrigietum junceae*** ass. nov. provv.

Psammophilous vegetation of embryonic dunes with sand couch grass and divided leaved sow thistle.

Synonyms: *Cypero mucronati-Elytrigietum junceae* auct. sic. non Kühnholtz-Lordat ex Br.-Bl. 1933; *Cypero capitati-Elymetum farcti* auct. Sic. non Br. Bl. 1933; *Agropyretum mediterraneum* auct. sic. non Br.-Bl. 1933; *Sporobolo-Agropyretum farcti* auct. sic. non Rivas-Martínez, Costa, Castroviejo & E. Valdés 1980; *Agropyretum mediterraneum* subass. *typicum* Brullo & Furnari 1970.

Holotypus: rel. 3, tab. 2, Brullo, Guarino & Ronsisvalle (2000).

Characteristic and differential species: *Launaea fragilis* (Asso) Pau., *Silene nicaeensis* All. var. *perennis* Maire.

Phytosociological table: From Brullo et al. (2000), tab. 2, 5 rel.

Char. association: *Silene nicaeensis* var. *perennis* (V)**,** *Launaea fragilis* (IV).

Char. alliance, order and class: *Elytrigia juncea* (V)**,** *Eryngium maritimum* (V)**,** *Sporobolus virginicus* (V), *Euphorbia terracina* (V), *Cyperus capitatus* (V)**,** *Medicago marina* (V)**,** *Echinophora spinosa* (V), *Pancratium maritimum* (V)**,** *Ammophila australis* (III), *Euphorbia paralias* (II)**,** *Achillea maritima* subsp. *maritima* (I).

Geographical distribution: This association occurs currently in Sicily, where is mainly represented along the south, western and eastern coasts, but impoverished aspects were reported also from the northern part and for the nearby islets (Frei, 1937; Pignatti, 1951; Pirola, 1959; Ferro & Furnari, 1970; Brullo & Furnari, 1970; Furnari & Ronsisvalle, 1971; Ronsisvalle, 1971, 1972; Brullo et al., 1974, 1988, 1998; Bartolo et al., 1982, 1988; Poli Marchese & Carfì, 1996; Turrisi, 2005; Giusso del Galdo et al., 2008; Marcenò & Romano. 2010; Minissale et al., 2010; Licandro et al., 2011; Zimmiti et al., 2015; Minissale & Sciandrello, 2017).

Structure and ecology: The low embryonic dunes are colonized by a pioneer and perennial vegetation dominated by *Elytrigia juncea*, a stoloniferous grass that with its stolons holds the sand moved by the wind, promoting the dune edification. This community has been named in different ways, mainly because of the various nomenclatural treatments of *Elytrigia juncea* (Brullo et al., 2001). As regards the Sicilian community dominated by *Elytrigia juncea*, they show some floristic peculiarities compared with the other ones occurring in the rest of Mediterranean territories, which allow to distinguish a new association proposed as *Launeo fragilis-Elytrigietum junceae.* It is characterized by *Launaea fragilis*, species with a South Mediterranean-Saharo-Sindian distribution (Pignatti, 2018), and *Silene nicaeensis* var. *perennis*, known from North-western Africa (Maire, 1963). This association can be considered a geographical vicariant of *Cypero mucronati-Elytrigietum junceae* Kühnholtz-Lordat ex Br.-Bl. 1933, occurring in other western Mediterranean territories.

Syndynamism: This community represents the first type of vegetation that colonizes the embryonic dunes near the shoreline and with the progressive development of the dune tends to evolve towards the *Launeo fragilis-Ammophiletum australis*. It is a permanent vegetation

belonging to a psammophilous geopermaseries, having catenal contacts with the *Eryngio maritimi-Sporoboletum arenarii*, while in the more higher dunes it is replaced by the *Launeo fragilis-Ammophiletum australis*.

Habitat reference: See order.

13.1.1.2.2. ***Pancratietum linosae*** Brullo & Siracusa 1996 corr.

Vegetation with Linosa sea daffodil on embryonic dunes.

Synonyms: *Pancratietum angustifolii* Brullo & Siracusa 1996; *Sporobolo-Agropyretum juncei* Bartolo et al. (1990) non Br. Bl. 1933.

Holotypus: rel. 5, tab. 15, Brullo & Siracusa (1996).

Characteristic and differential species: *Pancratium linosae* Soldano & F. Conti (=*Pancratium angustifolium* Lojac.).

Phytosociological table: From Brullo & Siracusa (1996), tab. 15, 7 rel.; Bartolo et al. (1990), tab. 8, 3 rel.

Char. association: *Pancratium linosae* (V).

Char. order and class: *Medicago marina* (III), *Elytrigia juncea* (III), *Euphorbia paralias* (I), *Eryngium maritimus* (I), *Scolymus hispanicus* (I).

Other species: *Polygonum maritimum* (IV), *Medicago littoralis* (IV)**,** *Glaucium flavum* (III)**,** *Vulpia fasciculata* (II), *Salsola tragus* (II)**,** *Cakile maritima* (II)**,** *Cutandia maritima* (II), etc.

Geographical distribution: The *Pancratietum linosae* is found only in Linosa and Lampedusa in the Pelagian Archipelago (Brullo et al., 2001).

Structure and ecology: This association described by Brullo & Siracusa (1996) from Linosa, occurs also in Lampedusa (Bartolo et al., 1990), where it is very rare and localized. It is linked to very arid bioclimatic conditions falling in the infra-mediterranean belt. Physiognomically, this vegetation is characterized by the dominance of *Pancratium linosae*, endemic of this archipelago, growing together with few other psammophytes, such as *Medicago marina*, *Elytrigia juncea*, *Achillea maritima* subsp. *maritima* and *Euphorbia paralias*.

Syndynamism: It is a pioneer community of edaphic character linked to volcanic stands, represented by steep sandy slopes or sometimes to small dunes with shifting sands. In both cases the ecological features of these habitats prevents the natural evolution of this vegetation towards more complex psammophilous communities.

Habitat reference: See order.

13.1.1.2.3. ***Calendulo maritimae-Elytrigietum junceae*** Brullo, Giusso, Siracusa & Spamp. 2002

Coastal vegetation with marine marigold on low dunes with a high degree of organic matter.

Synonyms: *Agropyretum mediterraneum* Brullo & Di Martino (1974) non Br. Bl. 1933 p.p.

Holotypus: rel. 5, tab. 16, Brullo & Di Martino (1974).

Characteristic and differential species: *Calendula maritima* Guss.

Phytosociological table: From Brullo & Di Martino (1974), tab. 16, 4 rel.

Char. association: *Calendula maritima* (4).

Char. order and class: *Elytrigia juncea* (4), *Sporobolus virginicus* (4), *Anthemis maritima* (3), *Euphorbia paralias* (3), *Lotus creticus* (1), *Achillea maritima* (1), *Euphorbia terracina* (1), *Pancratium maritimum* (1), *Scolymus hispanicus* (1).

Other species: *Spartina versicolor* (4)**,** *Matthiola tricuspidata* (2), *Echium sabulicola* (1)**,** *Cakile maritima* (1)**,** *Limonium virgatum* (1).

Geographical distribution: This community occurs only in Western Sicily, where there are several populations of *Calendula maritima* (Grammatico, 2011 and Troia, 2011). In particular, it seems to have a very scattered distribution between Trapani and Marsala.

Structure and ecology: The low embryonic dunes near the shoreline, subject to a significant accumulation of organic matter carried by the sea, are sometimes colonized by a peculiar psammophilous vegetation referred to *Calendulo maritimae-Elytrigietum junceae* by Brullo et al. (2001). This association, described from Isola Grande dello Stagnone, is differentiated by the occurence of *Calendula maritima*, a rare endemic species exclusive of Western Sicily. This species seems to be mainly linked to *Posidonia oceanica* banquettes, whose occurrence is favored by low sea bottoms with shorelines not subject to strong storm surges (Coupland & Mc Donald, 2008). It takes an important physiognomic role within a sparse vegetation with *Elytrigia juncea* that shows a marked floristic poverty and a nitrophilous character (Brullo et al., 2001).

Syndynamism: As previously highlighted this vegetation is closely linked to surfaces rich in nutrients, so the removal of wrack material and in particular of *Posidonia* banquettes can represent a serious threat to the subsistence of this community, while the mineralization of organic matter deriving from some anthropic activities can favor its establishment (Pasta et al., 2017). Because of the anthropic disturbance or the low extension of the sandy beaches, this vegetation generally does not tend to evolve towards the *Ammophiletum*, coming often in contact with various aspects of ruderal vegetation that occur in the surrounding areas.

Habitat reference: See order.

13.1.1.3. Suballiance: ***Ammophilenion australis*** (Br. Bl. 1921) Rivas-Martinez & Géhu in Rivas Martinez et al. 1990

Perennial vegetation of the dunes with european marram.

Synonyms: *Ammophilenion arundinaceae* Rivas Martinez, Costa, Castroviejo & E. Valdes 1980.

Holotypus: *Medicagini marinae-Ammophiletum australis* Br. Bl. 1921 corr. F. Prieto & T.E. Dielz 1991.

Characteristic and differential species: *Ammophila australis* (Mabille) Porta & Rigo.

Geographical distribution: See alliance.

Structure and ecology: This syntaxon groups the psammophilous communities characterized by *Ammophila australis* localized in the high shifting dunes. This species is a big-sized caespitose grass, which grows in height, allowing the grains of sand carried by the wind to accumulate at its base with the progressive and slow raising of the dunes.

Syndynamism: Usually, in the colonization processes of dunes this vegetation represents the next stage, more evolved than that one with *Elytrigia juncea* occurring in the embryonic dunes. The communities with *Ammophila australis* occupy the top of higher dunes and constitute a valid windbreak, that efficiently protects the sand deposits of the inner stands, stabilizing them.

Habitat reference: See order.

13.1.1.3.1. ***Launeo fragilis-Ammophiletum australis*** Brullo et al. ass. nov. provv.

Pioneer coastal vegetation of high shifting dunes with european marram and divided leaved sow thistle.

Synonyms: *Medicagini marinae-Ammophiletum australis* auct. sic. non Br.-Bl. 1921; *Ammophiletum arundinaceae* auct. sic. non Br. Bl. 1933.

Holotypus: rel. 2, tab. 3, Brullo, Guarino & Ronsisvalle (2000).

Characteristic and differential species: *Ammophila australis* (Mabille) Porta & Rigo, *Launaea fragilis* (Asso) Pau., *Silene niceensis* All. var. *perennis* Maire.

Phytosociological table: From Brullo et al. (2000), tab. 3, 5 rel.

Char. association: *Ammophila arenaria* subsp. *australis* (V), *Launaea fragilis* (V), *Silene nicaeensis* var. *perennis* (V).

Char. order and class: *Eryngium maritimum* (V), *Elytrigia juncea* (V), *Euphorbia terracina* (V), *Echinophora spinosa* (V), *Pancratium maritimum* (IV), *Medicago marina* (III), *Euphorbia paralias* (II), *Cyperus capitatus* (II).

Other species: *Daucus carota* (III).

Geographical distribution: This community is actually recorded only in Sicily, where is quite spread in the south, western and eastern coasts, while results very rare in the northern part and in the islets (Frei, 1937; Pignatti, 1951; Pirola, 1959; Brullo & Furnari, 1970; Ronsisvalle

1972; Brullo et al., 1974, 1988, 2000, 2001; Bartolo et al., 1982; Giusso del Galdo et al., 2008; Marcenò & Romano. 2010; Minissale et al., 2010).

Structure and ecology: The higher shifting dunes are colonized by a psammophilous vegetation dominated by *Ammophila australis*, which with its caespitose culms allows the progressive raising of dunes. This species in Sicily for its relevant physiognomic and structural role is proposed as characteristic species of the *Launeo fragilis-Ammophiletum australis*, which can be considered a geographical vicariant of the *Medicagini marinae-Ammophiletum australis* Br. Bl. 1921, association widely distributed in the western Mediterranean area. In particular, the Sicilian community is differentiated from the latter for the occurrence of *Launaea fragilis* and *Silene niceensis* var. *perennis*, which emphasize its marked thermo-xerophilous character. The floristic set is completed by other psammophytes, among them *Echinophora spinosa*, *Eryngium maritimum*, *Pancratium maritimum*, *Medicago marina* and *Euphorbia paralias*. According to Bartolo et al. (1982), within this vegetation can be distinguished three subassociations: the subass. *otanthetosum* is linked to the first inner dunes and shows a high coverage of *Achillea maritima*; the subass. *ammophiletosum* colonize the tops of the highest dunes and is characterized by the dominance of *Ammophila arenaria*; the subass. *medicaginetosum* represents the most mature stage of the association and prefers the quite stable internal dunes, where *Medicago marina* has high levels of presence.

Syndynamism: The *Launeo fragilis-Ammophiletum australis* is a permanent vegetation with an edaphic character, linked to shifting higher dunes not yet established. As concerns the catenal contacts, this vegetation is replaced by the *Launeo fragilis-Elytrigietum junceae* in the embryonic dunes, while in the inner stabilized dunes, it is usually in contact with the *Seselio maritimi-Crucianelletum maritimae* or the *Centaureo-Ononidietum ramosissimae*.

Habitat reference: See order.

13.2. Order: ***Crucianelletalia maritimae*** Sissingh 1974

Chamaephytic vegetation of inner stabilized dunes (grey dunes) in Mediterranean area.

Synonyms: *Helichryso-Crucianelletalia maritimae* Géhu et al. 1973 (art. 2b); *Helichryso-Crucianelletalia maritimae* (Sissingh 1974) Géhu et al. in Géhu 1975 (art. 29).

Holotypus: *Crucianellion maritimae* Rivas Goday & Rivas-Martinez 1963.

Characteristic and differential species: *Anthemis maritima* L., *Centaurea sphaerocephala* L., *Crucianella maritima* L., *Euphorbia terracina* L., *Lotus commutatus* Guss., *Ononis ramosissima* Desf., *Pycnocomon rutifolium* (Vahl) Hoffmanns. & Link, *Scabiosa maritima* L., *Scrophularia frutescens* L., *Scolymus hspanicus* L., *Seseli tortuosum* L. subsp. *maritimum* (Guss.) C. Brullo, Brullo, Giusso & Sciandrello, *Sonchus bulbosus* (L.) N. Kilian & Greuter.

Geographical distribution: The order shows a wide distribution through the coasts of Atlantic and western Mediterranean area (Brullo et al., 2001). In Sicily it is represented

mainly along the coast of southern, western and eastern Sicily (Frei, 1937; Brullo & Furnari, 1970; Brullo & Di Martino, 1974; Brullo et al., 1974; 1988. 1998; Bartolo et al., 1982; Poli & Carfì, 1996; Giusso et al., 2008; Marcenò & Romano. 2010; Minissale et al., 2010; Zimmitti et al., 2015; Minissale & Sciandrello, 2017).

Structure and ecology: The *Crucianelletalia maritimae* groups all the perennial communities linked to stabilized grey dunes, an ecotonal habitat interposed between shifting white dunes localized in the stands near the sea and psammophilous maquis of the inner dunes (Brullo et al., 2001; Rivas-Martinez et al., 2001, 2011; Marcenò et al.; 2018). Within the *Ammophiletea* class, the communities of this order are well differentiated from those ones belonging to *Ammophiletalia australis* for the occurrence of some dwarf shrubs, such as *Crucianella maritima*, *Euphorbia terracina*, *Pycnocomon rutifolium*, *Ononis ramosissima*, etc., generally mixed with several psammophilous hemicryptophytes belonging to *Ammophiletea* class. However, some authors (Géhu, 1975; Géhu & Biondi, 1994; Biondi, 2007; Biondi et al., 2014; Biondi & Blasi, 2015) prefer to include this vegetation into a separate class, named *Helichryso-Crucianelletea maritimae* Géhu et al. in Sissingh 1974, which gathers the shrubby communities occurring both in inner dunes and rocky coasts, separating them into two distinct orders. More recently, Mucina et al (2016) amended this class including into it only the psammophilous communities, while attributed those ones localized in the rocky coast to the class *Crithmo-Staticetea*. Really, due to their ecology and floristic set, these communities clearly fall in two well distinct class, represented by *Ammophiletea australis*, as concerns the psammophilous ones, and by *Crithmo-Limonietea* relatively to the rupestrian ones, as emphasized also by Rivas-Martinez et al. (2011). Therefore, the hypothesis to include the *Crucianelletalia maritimae* in the *Helichryso-Crucianelletea maritimae* class must be completely rejected, since it is a very heterogeneous and doubtful syntaxon.

Syndynamism: The communities belonging to *Crucianelletalia maritimae*, often representing the primary vegetation colonizing the grey dunes, can be interpreted as the most mature stage of geopermaseries. Furthermore, due to its ecotonal character, this vegetation shows an occurrence of species coming from the adjacent coastal maquis, while that one of nitrophilous species is linked to human pressure, that often modify the coverage values of natural vegetation.

Habitat reference: B1.4b Mediterranean and Macaronesian coastal dune grassland (grey dune).

13.2.1. Alliance: ***Ononidion ramosissimae*** Pignatti 1952

Western and Central Mediterranean dwarf scrub on stabilized coastal hind dunes.

Synonyms: *Crucianellion* Rivas-Goday & Rivas-Martinez 1959 (art. 2b); *Crucianellion maritimae* Rivas-Goday & Rivas-Martinez 1963.

Lectotypus: *Crucianelletum maritimae* Br.-Bl 1933.

Characteristic and differential species: See order.

Geographical distribution: This alliance shows a central-western Mediterranean distribution (Brullo et al., 2001; Mucina et al., 2016).

Structure and ecology: This alliance was validly described by Pignatti (1952b) and named *Ononidion ramosissimae*, including within it three associations: *Crucianelletum maritimae* Br.-Bl 1933, Ass. a *Centaurea sphaerocephala* e *Ononis ramosissima* Br. Bl. & Frei 1937 and *Ononido-Retametum bovei* Pignatti 1952. Later, Rivas Goday & Rivas Martinez (1959) proposed as *nomen nudum* an alliance named *Crucianellion* (grex *Crucianelletum*), which only after was correctly described by the same authors (Rivas Goday & Rivas Martinez, 1963). Therefore, for priority reasons, it must be used *Ononidion ramosissimae* Pignatti 1952 instead of *Crucianellion maritimae* Rivas Goday & Rivas Martinez 1958, unlike what is reported in the recent literature (Rivas et al., 2011; Biondi et al., 2014; Mucina et al., 2016; Marcenò et al., 2018). The alliance, grouping the dwarf shrub communities localized in the inland stabilized dunes, is vicaried in the atlantic coasts of Portugal by the *Helichrysion picardii* (Rivas-Martinez, Costa & Izco in Rivas-Martinez et al. 1990) Rivas-Martinez, Fernandez-Gonzalez & Loidi 1999.

Syndynamism: See order.

Habitat reference: See order.

13.2.1.1. ***Centaureo sphaerocephalae-Ononidietum ramosissimae*** Br.-Bl. & Frei in Frei 1937

Retrodunal vegetation with beach cornflower and shrubby rest-harrow.

Synonyms: Ass. di *Centaurea sphaerocephala* e *Ononis ramosissima* Br.-Bl. & Frei in Frei 1937.

Lectotypus: rel. 35, tab. 3, Frei (1937), here designated.

Characteristic and differential species: *Centaurea sphaerocephala* L., *Ononis natrix* subsp. *ramosissima* (Desf.) Batt.

Phytosociological table: From Bartolo et al. (1982), tab. 10, 26 rel.

Char. association: *Ononis ramosissima* (V), *Centaurea sphaerocephala* (IV).

Char. alliance and order: *Euphorbia terracina* (IV), *Seseli tortuosum* subsp. *maritimum* (III), *Scolymus hispanicus* (II), *Crucianella maritima* (I), *Scabiosa maritima* (I).

Char. class: *Lotus creticus* (V), *Elytrigia juncea* (IV), *Echinophora spinosa* (IV), *Launaea fragilis* (III), *Eryngium maritimum* (III), *Pancratium maritimum* (II), *Cyperus capitatus* (II), *Ammophila australis* (II), *Sporobolus virginicus* (II), *Medicago marina* (I), *Achillea maritima* subsp. *maritima* (I), *Calystegia soldanella* (I), *Euphorbia paralias* (I).

Other species: *Cutandia divaricata* (V), *Ononis variegata* (III), *Erodium laciniatum* (III), *Silene colorata* (II), *Plantago coronopus* (II), *Senecio coronopifolius* (II), *Cutandia maritima* (I), etc.

Geographical distribution: The association is represented along all the sandy coasts of Sicily and in particular in the southern and eastern stands, resulting very rare only on the northern part, where it was almost completely destroyed by agricultural and tourist activities (Frei, 1937; Brullo & Furnari, 1970; Ronsisvalle, 1971; Brullo et al., 1980, 1988. 1998; Bartolo et al., 1982; Raimondo et al., 1990; Poli Marchese & Carfì, 1996; Marcenò & Romano. 2010; Zimmitti et al., 2015).

Structure and ecology: This vegetation colonizes In the inner slopes of sand dunes with a more stable and compact sandy soils (Brullo et al., 2001). It is linked to stands relatively protected from the sea wind and aerosol, where the high plant coverage allows the formation of a thin layer of humus and a start to pedogenetic processes, which are a prelude to the more mature soils covered by the coastal maquis. Within this association several variants were described by (Frei (19379 as "facies" and by Bartolo et al. (1982) as "subassociations". In particular the last authors distinguished the subass. *ononidetosum ramosissimae*, which represents the more mature aspect of this community, the subass. *centauretosum sphaerocephalae* of the stands affected by a significant anthropic disturbance, the subass. *lotetosum cretici* markedly nitrophilous. Besides, by the same authors a subass. *crucianelletosum maritimae* is proposed, which is treated by Brullo et al. (1998) as a distinct association (*Seselio maritimi-Crucianelletum maritimae*), as well as a subass. *lygetosum*, dominated by *Retama raetam* subsp. *gussonei* and corrisponding to *Asparago stipularis-Retametum gussonei* (Brullo et al, 2000, 2001).

Syndynamism: This community often represents the most evolved vegetation of the inner sandy dunes, but is actually quite rare and fragmented due to urbanization, reforestation and cultivation of the surfaces potentially occupied by it. For this reason the secondary aspects results now more frequent, such as the *Centaurea sphaerocephala* and *Lotus creticus* communities, which show a marked nitrophilous and pioneer character in the colonization of uncultivated lands (particularly the abandoned vineyards) or surfaces constantly disturbed by bathers and/or vehicles.

Habitat reference: See order.

13.2.1.2. ***Seselio maritimi-Crucianelletum maritimae*** Brullo, Minissale & Siracusa 1998

Psammophilous vegetation with maritime crosswort on more or less stabilized sandy dunes.

Synonyms: Ass. di *Centaurea sphaerocephala* e *Ononis ramosissima* Br.-Bl. & Frei in Frei 1937 facies a *Crucianella maritima* Frei 1937; *Centaureo-Ononidetum ramosissimae* subass. *crucianelletosum* Bartolo, Brullo & Marcenò 1982.

Holotypus: Rel. 2, tab. 10, Bartolo et al. (1982).

Characteristic and differential species: *Crucianella maritima* L., *Seseli tortuosum* L. subsp. *maritimum* (Guss.) C. Brullo, Brullo, Giusso & Sciandrello.

Phytosociological table: From Brullo et al. (1974), tab. 4, 14 rel.

Char. association: *Seseli tortuosum* subsp. *maritimum* (V).

Char. alliance and order: *Crucianella maritima* (V), *Euphorbia terracina* (V), *Scolymus hispanicus* (V), *Scrophularia frutescens* (III), *Scabiosa maritima* (II), *Ononis natrix* subsp. *ramosissima* (I), *Pycnocomon rutifolium* (I).

Char. class: *Echinophora spinosa* (V), *Launaea fragilis* (V), *Lotus creticus* (V), *Ammophila australis* (III), *Elytrigia juncea* (III), *Medicago marina* (II), *Pancratium maritimum* (II), *Eryngium maritimum* (I), *Euphorbia paralias* (I), *Sporobolus virginicus* (I).

Other species: *Cutandia maritima* (V), *Rostraria cristata* (L.) Tzvelev. (IV), *Pseudorlaya pumila* (III), *Echium sabulicola* (III), *Salsola tragus* (III), *Rumex bucephalophorus* (III), *Silene colorata* (I).

Geographical distribution: The association is mainly distributed in southern and eastern Sicily, along the sandy coasts (Frei, 1937; Brullo & Furnari, 1970; Brullo et al., 1974, 1996, 1998, 2000, 2001; Bartolo et al., 1982; Giusso et al., 2008).

Structure and ecology: This vegetation occurring in the stabilized inner dunes is dominated by *Crucianella maritima* and *Seseli tortuosum* subsp. *maritimum*, liking the slopes more or less steep and very sunny Previously, it was attributed to *Centaureo-Ononidetum ramosissimae* facies a *Crucianella maritima* by several authors (Frei, 1937, Brullo & Furnari, 1970 and Brullo et al., 1974) or as subass. *crucianelletosum* of the same association (Bartolo et al., 1982). This association, described by Brullo et al. (1998), due to the occurrence of *Crucianella maritima* and its ecology, shows some relationships with *Crucianelletum maritimae* Br.-Bl. 1933, an association with a western Mediterranean distribution. The last syntaxon differs floristically from the *Seselio maritimi-Crucianelletum maritimae* mainly for the occurrence of *Teucrium dunense* subsp. *dunense*, *Helichrysum stoechas* var. *maritimum* and *Artemisia campestris* subsp. *glutinosa*.

Syndynamism: This community represents a quite mature aspect in which the considerable coverage given by some chamaephytes contributes to stabilization of the sandy surfaces, allowing the settlement of the *Centaureo-ononidetum ramosissimae* (Giusso et al., 2008). These two communities are subject to degradation processes by human activities, which can determine their replacement with a highly degraded vegetation dominated by *Centaurea sphaerocephala* in the more nitrophilous stands or *Lotus creticus* in abandoned and uncultivated lands (Bartolo et al., 1982). The *Seselio maritimi-Crucianelletum maritimae* comes into close contact with the *Ammophila australis* community with which it is sometimes mixed, while more internally it is generally followed by the *Centaureo-ononidetum ramosissimae* or sometimes directly by the *Ephedro fragilis-Juniperetum macrocarpae* coastal maquis.

Habitat reference: See order.

13.2.1.3. ***Centaureo sphaerocephalae-Anthemidetum maritimae*** Brullo, Giusso, Siracusa & Spampinato 2001

Vegetation with sea chamomille and beach cornflower of retrodunal habitats.

Lectotypus: Rel. 15, tab. 16, Brullo & Di Martino (1974).

Characteristic and differential species: *Anthemis maritima* L.

Phytosociological table: From Brullo & Di Martino (1974), tab. 16, 3 rel.
Char. association: *Anthemis maritima* (3).
Char. alliance and order: *Centaurea sphaerocephala* (3), *Euphorbia terracina* (3).
Char. class: *Pancratium maritimum* (3), *Lotus creticus* (3), *Ammophila australis* (1).
Other species: *Salsola tragus* (2), *Echium sabulicola* (2), *Euphorbia pinea* (1), *Cachrys sicula* (1), *Charybdis pancration* (1).

Geographical distribution: This syntaxon is endemic of western Sicily, where is quite rare (Brullo et al., 2001).

Structure and ecology: The *Centaureo sphaerocephalae-Anthemidetum maritimae* is a psammophilous community that prefers stabilized sands in retrodunal stands not very far from the sea (Brullo et al., 2001). Infact, the beached organic material gives a subnitrophilous character to this vegetation. Physiognomically, it is characterized by the dominance of *Centaurea sphaerocephala* and *Anthemis maritima*, associated with *Lotus creticus*, *Euphorbia terracina*, *Pancratium maritimum*, etc.

Syndynamism: This vegetation is threatened by human activities, mainly due to dunes leveling.

Habitat reference: See order.

14. Class: ***Cakiletea maritimae*** R. Tx. & Preising in R. Tx. 1950

Pioneer halo-nitrophilous short-lived vegetation in strandlines of sandy and shingle beaches.

Synonyms: *Cakileto-Therosalicornietea* Pignatti 1952 p.p. (art. 2b); *Cakileto-Therosalicornietea* Pignatti 1953 p.p.; *Cakiletea maritimae* R. Tx. & Preising ex Oberd. 1952 (art. 2b).

Lectotypus: *Euphorbietalia peplis* R. Tx. 1950

Characteristic and differential species: *Cakile maritima* Scop., *Salsola kali* L.

Geographical distribution: The class at issue is widespread in the coasts of North Atlantic, Arctic Oceans, Mediterranean and Black Sea (Mucina et al., 2016). In Sicily it is very common in all the coasts surrounding the island, including also most of the small neighboring islets (Brullo & Di Martino, 1974; Brullo et al., 1974, 1988, 1996, 1998; Bartolo et al., 1982, 1990; Brullo & Furnari, 1994; Turrisi, 2005; Giusso et al., 2008; Bonanno & Lo Giudice, 2009; Marcenò & Romano, 2010; Licandro et al., 2011; Zimmitti, 2015).

Structure and ecology: In the sandy beaches the aphytoic zone affected by waves takes contact with a belt colonized by a pioneer halo-nitrophilous communities linked to surfaces with an accumulation of organic debris. According to literature (Tüxen, 1950, Brullo et al., 2001; Rivas-Martinez et al., 2002; Costa et al., 2012; Biondi et al., 2014; Mucina et al., 2016), this vegetation falls within the *Cakiletea maritimae* class, a syntaxon that gathers several communities requiring a soil rich in chlorides and nitrates, which is floristically differentiated by annual species, often succulent with a summer-autumn cycle. The species more common in these stands are mainly *Cakile maritima*, *Salsola tragus*, *Euphorbia peplis*, etc. This class was validly described by Tüxen & Preising (Tüxen 1950), including three orders: a) *Euphorbietalia peplis* R. Tx. 1950, having a mainly Mediterranean distribution and represented by the only alliance *Euphorbion peplis* R. Tx. 1950 with several associations, of which some are nomenclaturally invalid, others provisional and only one valid, corrisponding to *Euphorbio-Glaucietum flavi* Horvatic 1934 (sub *Euphorbio-Glaucietum petrosum*), which must be considered the nomenclature type of the alliance; b) *Cakiletalia maritimae* R. Tx. 1950 from central and northern Europe; c) *Cakiletalia edentulae* R. Tx. 1950 ord. provv. from North America. Besides, Pignatti (1953) attributed these plant communities to the *Cakileto-Therosalicornietea* class, within which recognized three orders: a) *Thero-Salicornietalia* Pignatti 1953, grouping the annual halophilous communities of salt marshes, characterized mainly by *Salicornia herbacea*, *Suaeda maritima* and *Soda inermis*; b) *Thero-Atriplicetalia* Pignatti 1953 regarding the annual subhalo-nitrophilous communities of reclaimed muddy soils and dominated by some species of *Atriplex*; c) *Cakiletalia maritimae* Pignatti 1953 non R. Tx. 1950 occurring in the sandy beaches of Mediterranean territories, where precedes the *Agropyretum mediterraneum*, with two alliances, such as the southernmost *Salsolo-Polygonion maritimi* Pignatti 1953 and the northernmost *Cakilion littoralis* Pignatti 1953. Furthermore, it should be noted that the syntaxonomical arrangement proposed by Mucina et al. (2016) to consider *Euphorbietalia peplis* a nomen nudum (art. 2b) is not correct, least of all to include this order among the synoyms of *Thero-Atriplicetalia* Pignatti 1953, since as highlighted above according to Pignatti (1953) it not regards the vegetation of sandy coasts.

Syndynamism: This vegetation shows a seasonal character, since it dissapears every year after the winter storms and in the following summer it grows not always in the same stands (Leuschner & Ellenberg, 2017). As a result of this, the *Cakiletea maritimae* communities are not able to evolve towards more mature aspects, but often they are spatially connected to the dunes vegetation of the *Euphorbio paraliae-Ammophiletea australis* class, particularly with the *Elytrigia juncea* or *Sporobolus virginicus* associations. Sometimes, the human pressure on the sandy beaches with the destruction of the dunal systems can favor the spread of the *Cakiletea maritimae* communities in inner stands not strictly linked to the strandline, where the soil is similarly subject to a nutrient enrichment (Tomaselli & Sciandrello, 2017). Conversely, the mechanical cleaning of beaches and coastal erosion due to the alterations of the flow rates of rivers and to the touristic structures or ports, can cause its total disappearance.

Habitat reference: B1.1b Mediterranean and Black Sea sand beach; B2.1b Mediterranean and Black Sea coastal shingle beach.

14.1. Order: ***Euphorbietalia peplidis*** R. Tx. 1950

Pioneer annual halo-nitrophilous strandline vegetation of Mediterranean, Cantabro-Atlantic and Black Sea coasts.

Synonyms: *Cakiletalia maritimae* Pignatti 1953 non R. Tx. 1950; *Thero-Atriplicetalia* sensu Mucina et al. 2016 non Pignatti 1953.

Lectotypus: *Euphorbion peplidis* R. Tx. 1950.

Characteristic and differential species: *Atriplex prostrata* Boucher ex DC, *Beta vulgaris* L. subsp. *maritima* (L.) Arcang., *Euphorbia peplis* L., *Glaucium flavum* Crantz, *Polygonum maritimum* L., *Salsola tragus* L., *Xanthium italicum* Moretti.

Geographical distribution: This syntaxon is distributed in the Cantabro-Atlantic, Mediterranean and Black Sea coasts (Brullo et al., 2001; Mucina et al., 2016).

Structure and ecology: The southernmost communities belonging to *Cakiletea maritimae* class are grouped within this order, which is in turn represemted by two alliances: *Euphorbion peplidis* R. Tx. ex Oberd. 1952 comprises the syntaxa of the Mediterranean and Cantabro-Atlantic coasts; *Cakilion euxinae* Géhu et al. 1994 distributed in the Black Sea (Mucina et al., 2016).

Syndynamism: See class.

Habitat reference: See class.

14.1.1. Alliance: ***Euphorbion peplidis*** R. Tx. 1950

Pioneer halo-nitrophilous strandline vegetation of the Cantabro-Atlantic and the Mediterranean coasts.

Synonyms: *Salsolo-Polygonion maritimi* Pignatti 1952 (art. 2b); *Cakilion litoralis* Pignatti 1953; *Salsolo-Polygonion maritimi* Pignatti 1953; *Glaucio-Cakilion maritimae* O. Bolòs 1962; *Cakilion aegyptiacae* Rivas-Martinez & M. Costa in Rivas-Martinez et al. 1980.

Lectotypus: *Euphorbio paraliae-Glaucietum flavi* Horvatić 1934.

Characteristic and differential species: See order.

Geographical distribution: This alliance occurs in the Mediterranean and Cantabro-Atlantic coasts (Mucina et al., 2016).

Structure and ecology: See class.

Syndynamism: See class.

Habitat reference: See class.

14.1.1.1. ***Salsolo tragi-Cakiletum maritimae*** Costa & Mansanet 1981, corr.

Annual vegetation with prickly Russian thistle and Europaean searocket of sandy beaches.

Synonyms: *Salsolo kali-Cakiletum aegyptiacae* Costa & Mansanet 1981; *Salsolo kali-Cakiletum maritimae* Costa & Mansanet 1981, corr. Rivas-Martínez et al. 1992.

Holotypus: Rel. 1, tab. 1, Costa & Mansanet (1981).

Characteristic and differential species: *Cakile maritima* Scop., *Salsola tragus* L.

Phytosociological table: From Marcenò & Romano (2010), tab. 1, 4 rel.; Bartolo et al. (1990), tab. 19, 1 rel.

Char. association: *Cakile maritima* (V), *Salsola tragus* (V).

Char. alliance, order and class: *Euphorbia peplis* (II), *Polygonum maritimum* (I), *Beta vulgaris* subsp. *maritima* (I).

Other species: *Echium sabulicola* (I), *Eryngium maritimum* (I), *Cutandia maritima* (I).

Geographical distribution: This syntaxon is widespread in the Mediterranean and Atlantic coasts (Costa & Mansanet, 1981; Géhu & Biondi, 1994; Brullo et al., 2001). In Sicily it is very common in all the territory, including the small islands around (Bartolo et al., 1990a; Brullo & Furnari, 1994; Gianguzzi et al., 1996; Brullo et al., 1996; Gianguzzi, 1999b; Gianguzzi & La Mantia, 2008; Giusso et al., 2008; Bonanno, 2008, 2014; Bonanno & Lo Giudice, 2009; Marcenò & Romano, 2010; Licandro et al., 2011; Fici & Gianguzzi, 2011; Zimmitti et al., 2015).

Structure and ecology: This association colonizes the stands of sandy beaches with accumulation of organic material beached during storm surges. It is a halo-nitrophilous vegetation, physiognomically characterized by annual species with summer-autumn optimum, such as *Cakile maritima* and *Salsola tragus*. It was proposed by Costa & Mansanet (1981) as *Salsolo-Cakiletum aegyptiacae* and later corrected by Rivas-Martinez et al. (1992) in *Salsolo kali-Cakiletum maritimae*, since *C. aegyptica* a synomym of *C. maritima*. According Brullo et al. (2015), *Salsola kali* is an Atlantic species usually replaced in the Mediterranean by *S. tragus* consequently the name of the association must be corrected in *Salsolo tragi-Cakiletum maritimae*. This community, occurring in the surfaces richer in organic material, is localized in a belt parallel to the coast-line, between the aphitoic zone and the embryonic dunes. It is a species-poor community with low coverage values, appearing often patchy and fragmented, due to exposure to wave inundation, salt spray and wind stress. In fact, only few species fit to adapt to these harsh environmental conditions, since these stands are affected and strongly modified by numerous natural factors (wind, sea, aerosol, saltiness, etc.) which are re-colonized annually ex-novo (Seabloom & Wiedemann, 1994; Nordstrom et al., 2009).

Syndynamism: In natural environments this vegetation can not further evolve because of the peculiar environmental conditions of its habitat, represented by the of the strandline zone. In

the less disturbed stands and with a greater quantity of organic matter, this association is replaced by the *Atriplicetum hastato-tornabenii*. However, the *Salsolo kali-Cakiletum maritimae* can grow also in the degraded and disturbed dunes quite distant from the shoreline, representing the first stage of plant colonization. In fact, thanks to their marked pioneer character, the therophytes typical of this class can colonize sandy beaches strongly disturbed by anthropic activities (Gèhu et al., 1984a; Acosta et al., 2003).

Habitat reference: See class.

14.1.1.2. ***Salsolo tragi-Euphorbietum paraliae*** Pignatti 1952 corr.

Subnitrophilous vegetation with tumbleweed and sea spurge of sandy beaches.

Lectotypus: Rel. 3, tab. pg. 80, Pignatti (1952c), here designated.

Characteristic and differential species: *Euphorbia paralias* L.

Phytosociological table: From Brullo & Di Martino (1974), tab. 14, 8 rel.

Char. association: *Euphorbia paralias* (V).

Char. alliance, order and class: *Salsola tragus* (V), *Cakile maritima* (V), *Atriplex littoralis* (II), *Glaucium flavum* (I), *Beta vulgaris* subsp. *maritima* (I).

Other species: *Sporobolus virginicus* (V), *Pancratium maritimum* (III), *Limonium virgatum* (II), *Eryngium maritimum* (II), *Soda inermis* (II), *Elytrigia juncea* (I), *Crithmum maritimum* (I), *Anthemis maritima* (I), *Echium sabulicola* (I).

Geographical distribution: This syntaxon is spread in the Mediterranean area from Morocco to Lebanon (Pignatti, 1952c, 1953; Brullo et al., 2001). In Sicily, it is quite common along the sandy coasts (Pirola, 1959; Brullo & Di Martino, 1974; Brullo et al., 1974, 1977, 1988, 1996; Bartolo et al., 1982).

Structure and ecology: The *Salsolo-Euphorbietum paraliae*, described from Lebanon by Pignatti (1952c), is a pioneer vegetation that colonizes the strandlines of sandy coasts. This is a very peculiar enviroment, due to the high salinity and the accumulation of organic matter carried by the sea, suitable only for few subnitrophilous species with summer development, such as *Euphorbia paralias*, *Salsola tragus, Cakile maritima*, *Polygonum maritimum*, *Glaucium flavum*, etc.

Syndynamism: Generally, the *Salsolo-Euphorbietum paraliae* replaces the other communities belonging to *Cakiletea maritimae* class on disturbed ground or less nitrophilous soils, often on flat surfaces derived from the dunes destruction, representing in this case the first stage in the evolution of psammophilous vegetation (Bartolo et al., 1982). Sometimes, it is the first vegetation after the aphytoic belt in the sandy beaches, growing during the summer on the material washed by the winter storms and takes catenal contact with the *Launeo fragilis-Elytrigietum junceae*.

Habitat reference: See class.

14.1.1.3. ***Cakilo maritimae-Xanthietum italici*** Pignatti 1953

Halo-nitrophilous vegetation with Europaean searocket and italian cocklebur of wet sands.

Synonyms: *Salsolo-Cakiletum aegyptiacae* Costa & Mansanet 1981 subass. *xanthietosum* Géhu & Scoppola in Géhu et al. 1984; *Xanthio-Cakiletum* (Beg. 1941) Pignatti 1953; *Cakiletum maritimae* Gerdol & Piccoli 1984.

Neotypus: Rel. 13, tab. 1, Pignatti (1959), here designated.

Characteristic and differential species: *Xanthium italicum* Moretti.

Phytosociological table: From Marcenò & Romano (2010), tab. 2, 12 rel.

Char. association: *Xanthium. italicum* (V),

Char. alliance, order and class: *Cakile maritima* (V), *Salsola tragus* (V), *Euphorbia peplis* (IV), *Glaucium flavum* (III), *Beta vulgaris* subsp. *maritima* (II), *Polygonum maritimum* (I).

Other species: *Cynodon dactylon* (II), *Lotus creticus* (IV), *Medicago marina* (IV), *Eryngium maritimum* (III), *Dactyloctenium aegyptium* (II), *Crithmum maritimum* (II), *Tribulus terrestris* (II), *Reichardia picroides* (II), *Achillea maritima* (I), *Portulaca oleracea* (I), *Elytrigia juncea* (I), *Cyperus capitatus* (I), *Scolymus hispanicus* (I).

Geographical distribution: This association is widespread in the Western Mediterranean territories (Brullo et al., 2001). In Sicily it was surveyed in some localities by various authors (Brullo et al., 1996, 1998; Bonanno, 2008; Marcenò & Romano, 2010).

Structure and ecology: The *Cakilo maritimae-Xanthietum italici* is linked to quite humid sands, often near the mouth of rivers and streams. This vegetation shows a marked nitrophilous character, due to the accumulation of organic material carried by sea, resulting in a high presence of *Xanthium italicum*, together with few other therophytes, such as *Cakile maritima*, *Salsola tragus*, *Atriplex prostrata,* etc. (Pignatti, 1953, 1959; Brullo et al., 1998).

Syndynamism: This community occurs near the shoreline, in an environment that does not allow further evolution, but it can also grow in disturbed sandy surfaces deriving from the destruction of the dunes (Marcenò & Romano, 2010).

Habitat reference: See class.

14.1.1.4. ***Atriplicetum hastato-tornabenii*** O. Bolòs 1962

Hypernitrophilous vegetation with tartary orache saltbush and hastate saltplant of the strandlines.

Synonyms: *Cakilo aegyptiacae-Atriplicetum tornabeni* Géhu et al. 1984

Lectotypus: Rel. 1, tab. 66, O. Bolòs (1962), here designated.

Characteristic and differential species: *Atriplex prostrata* Boucher ex DC., *A. tornabeni* Tineo.

Phytosociological table: From Bartolo et al. (1982), tab. 7, 25 rel.

Char. association: *Atriplex tornabeni* (V), *Atriplex prostrata* (III).

Char. alliance, order and class: *Cakile maritima* (V), *Salsola tragus* (V), *Polygonum maritimum* (III), *Euphorbia peplis* (III), *Salsola tragus* (III), *Xanthium italicum* (I), *Beta vulgaris* subsp. *maritima* (I), *Glaucium flavum* (I).

Other species: *Sporobolus virginicus* (III), *Soda inermis* (III), *Elytrigia juncea* (II), *Halimione portulacoides* (I), *Plantago coronopus* (I), *Chenopodium album* (I), *Salicornia patula* (I), *Eryngium maritimum* (I), *Echinophora spinosa* (I), *Euphorbia paralias* (I), *Achillea maritima* subsp. *maritima* (I), *Suaeda spicata* (I), *Limbarda crithmoides* subsp. *longifolia* (I), *Calystegia soldanella* (I).

Geographical distribution: This association occurs in the Western Mediterranean area (Brullo et al., 2001). In Sicily it is quite rare, being reported mainly in the south-eastern coast (Brullo et al., 1980, 1996; Bartolo et al., 1982; Poli Marchese & Carfì. 1996; Bonanno, 2008).

Structure and ecology: The *Atriplicetum hastato-tornabenii* is a pioneer community that occurs in the strandline of the the less disturbed beaches with a high presence of organic matter beached by the sea. It is a vegetation with hypernitrophilous requirements, characterized by the dominance of ephemeral psammophytes with summer-autumn development, such as *Atriplex tornabeni* and *A. prostrata*, together with some species belonging to *Cakiletea* class, among them *Cakile maritima*, *Polygonum maritimum*, *Euphrbia peplis, Salsola tragus* and *Glaucium flavum.* Some species of the *Ammophiletea* class, as *Eryngium maritimum*, *Elytrigia juncea*, *Sporobolus virginicus*, *Echinophora spinosa*, are quite frequent, because of contact with *Launeo fragilis-Elytrigietum junceae*.

Syndynamism: This vegetation prefers the more natural stands, being replaced in the disturbed areas by the *Salsolo-Euphorbietun paraliae* or also by the *Salsolo kali-Cakiletum maritimae* (Bartolo et al., 1982; Bonanno 2008).

Habitat reference: See class.

14.1.1.5. ***Salsolo tragi-Euphorbietum peplis*** Géhu et al. 1984, corr.

Subnitrophilous vegetation with purple spurge of disturbed coarse sands.

Holotypus: Rel. 4, tab. 2, Géhu et al. (1984b).

Characteristic and differential species: *Euphorbia peplis* L.

Phytosociological table: From Marcenò & Romano (2010), tab. 3, 5 rel.

Char. association: *Euphorbia peplis* (V).

Char. alliance, order and class: *Salsola tragus* (V), *Cakile maritima* (III), *Polygonum maritimum* (II), *Xanthium italicum* (II), *Glaucium flavum* (II).

Other species: *Eryngium maritimum* (V), *Medicago marina* (IV), *Crithmum maritimum* (III), *Cynodon dactylon* (III), *Lotus creticus* (III).

Geographical distribution: This syntaxon, recorded by Géhu et al. (1984b, 1989, 1992) from the eastern Mediterranean area, in Sicily it is quoted only between Cefalù and Capo Tindari in the northern coasts (Marcenò Co. & Romano, 2010), but probably more widespread.

Structure and ecology: This association is linked to stands with coarse and mobile sands with a very low presence of organic debris. It is a therophytic community with a summer-autumn optimum, where *Euphorbia peplis* is dominant, associated with *Salsa tragus* while *Cakile maritima* and *Polygonum maritimum* are infrequent.

Syndynamism: The *Salsolo kali-Euphorbietum peplis* shows ecological requirements very similar to those ones of the *Salsolo kali-Cakiletum maritimae*, replacing this on the sands with coarser grain size (Marcenò & Romano, 2010). It rarely occurs in natural environments, preferring surfaces strongly disturbed by human activities.

Habitat reference: See class.

14.1.1.6. ***Glaucio flavi-Matthioletum tricuspidatae*** Blasi, Fascetti, Veri & Bruno 1983

Nitrophilous vegetation with horned-popp and Mediterranean stock of pebbly or gravelly beaches.

Holotypus: Rel. 6, tab. 2, Blasi et al. (1983).

Characteristic and differential species: *Glaucium flavum* Crantz, *Matthiola tricuspidata* (L.) R.Br.

Phytosociological table: From Marcenò & Romano (2010), tab. 4, 3 rel.

Char. association: *Matthiola tricuspidata* (3), *Glaucium flavum* (2).

Char. alliance, order and class: *Cakile maritima* (3), *Xanthium italicum* (3), *Salsola tragus* (3), *Ruphorbia peplis* (1).

Other species: *Eryngium maritimum* (3), *Cynodon dactylon* (3), *Catapodium rigidum* (2), *Achillea maritima* subsp. *maritima* (2), *Lotus creticus* (2), *Hordeum murinum* (1), *Dysphania ambrosioides* (1).

Geographical distribution: This association was described by Blasi et al. (1983) from the Tyrrhenian coasts of Calabria and after surveyed by Marcenò & Romano (2010) in North-Eastern Sicily near Milazzo and by Minissale & Sciandrello (2017) in the Vendicari islet (Noto).

Structure and ecology: The sandy beaches subject to accumulation of shingle and coarse gravel, which derives not only from the sea action but also from the fluvial deposit of watercourses, are colonized by a peculiar vegetation, referred to *Glaucio flavi-Matthioletum tricuspidatae.* Furthermore, the settlement of this community is favored by a significant presence of nitrates in the soil and also by the action of mechanical vehicles that smooth the dunes, determining the accumulation of coarser sediments in some parts of the beach. From the floristic point of view, *Glaucium flavum* shows high coverage values, together with *Matthiola tricuspidata* and few other psammophilous species belonging to *Cakiletea maritimae* class, such as *Cakile maritima*, *Salsola tragus, Xanthium italicum* and *Euphorbia peplis*.

Syndynamism: Generally, this vegetation replaces the other *Cakiletea* communities on the beaches where sand is mixed with shingle, while if the substrata is more compact a monospecific vegetation with *Crithmum maritimum* occurs (Marcenò Co. & Romano, 2010).

Habitat reference: See class.

15. Class: ***Crithmo maritimi-Limonietea*** Br.-Bl. in Br.-Bl., Roussine & Negre 1952 nom. mut.

Halo-chasmophilous vegetation of rocky coast.

Synonyms: *Crithmo-Staticetea* Br.-Bl. in Br.-Bl., Emberger & Molinier 1947 nom. inval. (art. 8)**;** *Crithmo-Staticetea* Br.-Bl. in Br.-Bl., Roussine & Négre 1952**;** *Crithmo-Limonietea pseudominuti* Br.-Bl. et al. 1947 corr. Julve 1993 (2b); *Astydamio-Limonietea* Voggenreiter 1995 (art. 2b, 5, 8); *Armerio maritimae-Festucetea pruinosae* Bioret et Géhu 2008 (syntax. syn.).

Lectotypus: *Crithmo maritimi-Limonietalia* Molinier 1934 nom. mut.

Characteristic and differential species: *Crithmum maritimum* L., *Dactylis marina* Borrill, *Daucus gingidium* L.

Geographical distribution: This class shows a wide distribution in the Atlantic and Mediterranean coasts of Europe, North Africa and Middle East (Mucina et al., 2016; Brullo et al., 2017).

Structure and ecology: The *Crithmo-Limonietea* class gathers the perennial communities linked to the rocky coast and sea cliffs constitutes by various geological substrata, directly affected by marine agents. Infact, this vegetation, as highlighted by many authors (Braun-Blanquet et al., 1952; Molinier, 1934, 1954; Rivas-Martínez et al., 1990, 2011; Géhu & Biondi, 1994; Costa et al., 2012; Biondi & Blasi, 2015; Brullo et al., 2017), shows clearly halophilous requirements, due to the permanent influence of sea winds, salt spray and strong edaphic dryness. Its physiognomy is given by halo-tolerant species, represented by nanophanerophytes, mainly pulvinate, chamaephytes and also hemicryptophytes, often succulent. In the belt closer to the sea, this vegetation is dominated by *Crithmum maritimum*

and *Limonium* sp. pl., often represented by local endemics, while in the inner stands it is characterized by many pulvinate dawrf shrubs. Basing on these ecological and floristic differences and on a biogeographical criterion, three orders were identified by Brullo et al. (2017) within this class: *Crithmo maritimi-Limonietalia* Molinier 1934, including the Mediterranean and South Europaean communities; *Crithmo-Armerietalia* Géhu & Géhu-Franck 1984, regarding the Atlantic seaboards vegetation *Frankenio-Astydametalia* Santos 1976, a syntaxon endemic of Macaronesian islands and Atlantic coast of Morocco. Moreover, Mucina et al. (2016) in addition to these three orders also include the *Helichrysetalia italici* Biondi & Géhu in Géhu & Biondi 1994, grouping the subhalophilous schrub communities, but it is a very doubtful syntaxon by Géhu & Biondi 1994 and Biondi et al. (2014) attributed to the *Helichryso-Crucianelletea* class. Besides, Biondi 2007 and Biondi et al. (2014) recognized within the *Crithmo-Limonietea* a further order indicated as *Senecionetalia cinerariae* Biondi 2007, including exclusively the alliance *Anthyllidion barbae-jovis* Brullo & De Marco 1989 related to sea cliffs, by Mucina et al. (2016) treated as a synonym of *Helichrysetalia italici*. In-depth syntaxonomic investigations of both nomenclatural, ecological-floristic, as well as structural, do not show any plausible motivation in recognizing these two orders (*Helichrysetalia italici* and *Senecionetalia cinerariae*) to add useful information apart from to those already highlighted at the alliance level. Ultimately, the recognizable orders within this class are only those that have a clear phytogeographic connotation. In the Mediterranean area this vegetation occurs between the infra and mesomediterranean belts. From the nomenclatural point of view, this syntaxon was originally described by Braun-Blanquet in Braun-Blanquet et al. (1952) as *Crithmo-Staticetea*, using the name of *Crithmum maritimum* and *Statice* s.l. Unfortunately, the latter represents a *nomen ambiguum*, since it included more genera of Plumbaginaceae (*Limonium*, *Armeria*, *Limoniastrum*, *Goniolimon*, *Acantholimon*, etc.) and is no loger recognized in taxonomy. Therefore, according to the art. 45 of the I.C.P.N., the generic name *Statice* can not be used to give the name of a syntaxon. As result, the new name *Crithmo maritimi-Limonietea* has been accepted by the Nomenclature Commission (Willner et al., 2011).

Syndynamism: The *Crithmo-Limonietea* communities represent a permanent vegetation with an edaphoclimatophilous role, sometimes subject to anthropic pressure, that can determine a floristic impoverishment. This vegetation often takes catenal contact with coastal maquis or garrigue or also with anthropogenic vegetation in degraded stands.

Habitat reference: B3.1b Mediterranean and Black Sea rocky sea cliff and shore; B3.1a Atlantic and Baltic rocky sea cliff and shore; B3.1c Macaronesian rocky sea cliff and shore .

15.1. Order: ***Crithmo maritimi-Limonietalia*** Molinier 1934, nom. mut.

Halophilous and sub-halophilous rupicolous vegetation of Mediterranean seaboards.

Synonyms: *Crithmo maritimi-Staticetalia* Molinier 1934; *Staticetalia* Chapman 1959, p.p. (art. 2b); *Astragaletalia glacialis* Lovrić 1971 (art. 2b); *Crithmo-Limonietalia pseudominuti* Molinier

1934 corr. Julve 1993 (art. 40a, corr. illeg.); *Helichrysetalia italici* Biondi & Géhu in Géhu & Biondi 1994 nom. ambig. (art. 36); *Senecionetalia cinereae* Biondi 2007 (syntax.syn.).

Holotypus: *Crithmo maritimi-Limonion* Molinier 1934.

Characteristic and differential species: *Allium commutatum* Guss., *Daucus carota* subsp. *hispanicus* (Gouan) Thell., subsp. *commutatus* (Paol.) Thell, subsp. *gummifer* (Syme) Hook. f. and subsp. *hispidus* (Arcang.) Heywood, *Frankenia hirsuta* L., *Helichrysum conglobatum* (Viv.) Steud., *Jacobaea maritima* (L.) Pelser & Meijden s.l., *Limbarda crithmoides* (L.) Dumort. subsp. *longifolia* (Arcang.) Greuter, *Limonium virgatum* (Willd.) Fourr., *Lotus cytisoides* L., *Pallenis maritima* (L.) Greuter, *Plantago macrorrhiza* Poir., *Reichardia crassifolia* (Willk.) Guarino & Pignatti, *Silene sedoides* Poir., *Sonchus glaucescens* Jord.

Geographical distribution: This order results widespread in the Atlantic and Mediterranean coast of southern Europe, North Africa and Middle East (Mucina et al., 2016; Brullo et al. 2017).

Structure and ecology: The halo-rupestrian communities grouped within this order show a thermophilous character and occur along the rocky coast in the infra-thermo-mesomediterannean bioclimatic belts, with semiarid to subhumid ombrotypes. The *Crithmo maritimi-Limonietalia* must be considered the only order belonging to *Crithmo-Limonietea* occurring in the Mediterranean area. As already highlighted in the treatment of the class, considering as completely unrealistic the inclusion of the orders *Helichrysetalia italici* and *Senecionetalia cinerariae* into it, since as this only causes nomenclatural confusion without providing any clarification. Therefore, it seems more reasonable to place in the *Crithmo maritimi-Limonietalia* both the more halophilous communities with *Crithmum maritimum* and *Limonium* sp. pl. and the inner sub-halophilous vegetation with dwarf shrubs, distinguishing them only at the alliance rank, as proposed by Brullo et al. (2017).

Syndynamism: See class.

Habitat reference: See class.

15.1.1. Alliance: ***Crithmo-Limonion*** Molinier 1934 nom. mut.

Western Mediterranean rupicolous vegetation linked to the sea spray coastal habitats.

Synonyms: *Crithmo-Staticion* Molinier 1934; *Crithmo-Limonion minuti* Molinier 1934 (art. 40a); *Crithmo-Limonion pseudominuti* Molinier 1934 corr. Julve 1993 (art. 40a).

Lectotypus: *Crithmo maritimi-Limonietum pseudominuti* Arènes ex Molinier 1934 nom. mut.

Characteristic and differential species: See order.

Geographical distribution: This alliance is distributed in the central and western part of the Mediterranean area (Mucina et al., 2016; Brullo et al., 2017).

Structure and ecology: Among the alliances recognized within the *Crithmo maritimi-Limonietalia* order, the *Crithmo-Limonion* includes the most halophilous communities of the rocky coasts of central and western Mediterranean area (Bartolo et al., 1989; Bartolo & Brullo, 1993; Biondi & Blasi, 2015). Infact, this halo-chasmophilous vegetation results well adapted to the sea spray, affected more or less sloped rocky surfaces of the shorelines. The physiognomy of these communities is given by small chamaephytes, mainly belonging to *Limonium* genus, which constitute a more or less continuous belt near the shoreline with a low coverage value. From the syntaxonomic point of view, also the original name of this syntaxon (*Crithmo-Staticion* Molinier 1934) must be correct because the *Statice* genus is a nomen ambiguum. As emphasized by Mucina et al. (2016), Molinier (1934) in the original diagnosis does not use a clearly identifiable *Limonium* species, therefore the correction of the name, as proposed by some authors (e.g. Julve 1993; Géhu & Franck, 1984), using several *Limonium* taxa (e.g. *L. articulatum, L. minutum, L. pseudominutum*) as eponymous, does not appear admissible.

Syndynamism: It is a pioneer, permanent and highly specialized vegetation, generally for edaphic factors not subject to dynamic processes. From the catenal point of view, these communities take contact inward with the shrubby subhalophilous communities, or directly with the maquis.

Habitat reference: See class.

15.1.1.1. ***Limonietum cosyrensis*** Brullo, Di Martino & Marcenò 1977

Halo-rupicolous vegetation with Pantelleria sea lavender of volcanic rocks.

Lectotypus: Rel. 7, tab. 5, Brullo et al. (1977).

Characteristic and differential species: *Limonium cosyrense* (Guss.) O. Kuntze.

Phytosociological table: From Brullo et al. (1977), tab. 5, 20 rel.

Char. association: *Limonium cosyrense* (V).

Char. alliance, order and class: *Silene sedoides* (V), *Lotus cytisoides* (IV), *Reichardia crassifolia* (IV), *Crithmum maritimum* (III), *Plantago macrorrhiza* (III), *Daucus gingidium* (III), *Limonium virgatum* (III), *Thymelaea hirsuta* (I), *Sonchus asper* subsp. *glaucescens* (I).

Other species: *Anthemis cosyrensis* (V), *Mesembryanthemum nodiflorum* (IV), *Frankenia hirsuta* (IV), *Euphorbia pinea* (III), *Parapholis incurva* (III), *Beta vulgaris* subsp. *maritima* (III), *Catapodium balearicum* (III), *Hypochaeris achyrophorus* (II), *Allium ampeloprasum* (II), *Limonium parvifolium* (I), *Senecio leucanthemifolius* (I).

Geographical distribution: This association occurs on the rocky coasts of Pantelleria island, where it is widespread in the all island, (Brullo et al., 1977; Bartolo & Brullo, 1993; Gianguzzi, 1999b).

Structure and ecology: The *Limonietum cosyrensis* represents the first type of vegetation that grow on the low reefs or at the base of coastal cliffs near the shoreline of Pantelleria island,

where it colonizes the bare basaltic rock subject to sea aerosol. From the floristic point of view, this vegetation is very well characterized because it is dominated by endemic *Limonium cosyrense*, while among the characteristicto the class, *Silene sedoides*, *Reichardia picroides* var. *maritima*, *Plantago macrorrhiza* and *Lotus cytosoides* result very frequent.

Syndynamism: The association on the more or less sloped reefs takes catenal contact with the chamaephytic vegetation of the *Matthiolo pulchellae-Helichrysetum errerae* Brullo, Di Martino & Marcenò 1977. Otherwise, it is replaced by the maquis of *Periploco angustifoliae-Juniperetum turbinatae* subass. *brassicetosum insularis* Gianguzzi 1999 on the higher part of coastal cliffs.

Habitat reference: See class.

15.1.1.2. ***Limonietum secundiramei*** Brullo, Di Martino & Marcenò 1977

Halophilous vegetation with venus lake sea lavender of volcanic alkaline rocks*.*

Holotypus: Rel. 4, tab. 7, Brullo et al. (1977).

Characteristic and differential species: *Limonium secundirameum* (Lojac.) Brullo

Phytosociological table: From Brullo et al. (1977), tab. 7, 9 rel.

Char. association: *Limonium secundirameum* (V).

Char. alliance, order and class: *Lotus cytisoides* (V), *Reichardia crassifolia* (IV), *Silene sedoides* (III), *Daucus carota* subsp. *hispanicus* (III), *Frankenia hirsuta* (III), *Plantago macrorrhiza* (II).

Other species: *Sonchus oleraceus* (V), *Parapholis incurva* (IV), *Sonchus bulbosus* (III), *Spergularia marina* (III), *Mesembryanthemum nodiflorum* (III), *Bellis annua* (II), *Cynodon dactylon* (II), *Beta vulgaris* subsp. *maritima* (II), *Senecio leucanthemifolius* (II), *Catapodium balearicum* (I).

Geographical distribution: This association was recorded only in Pantelleria island, where it is very rare and localized (Brullo et al., 1977; Bartolo & Brullo, 1993).

Structure and ecology: The rocky surfaces along the shores of the ”Bagno dell’Acqua” lake, characterized by alkaline deposit due to phenomena of secondary volcanism, are colonized by a specialized vegetation, which was referred by Brullo et al., 1977 to *Limonietum secundiramei*. The soil of these stands results relatively poor in chlorides but rich in silica, calcium carbonate, sodium and magnesium, leading to a marked floristic poverty, where the endemic *Limonium secundirameum* shows high coverage values. Although this community is not directly affected by marine agents, some species of *Crithmo maritimi-Limonietea* occur, such as *Reichardia picroides* var. *maritima*, *Silene sedoides*, *Lotus cytisoides* and *Daucus carota* subsp. *hispanicus*.

Syndynamism: See alliance.

Habitat reference: See class.

15.1.1.3. ***Limonietum bocconei*** Barbagallo, Brullo & Guglielmo 1979

Rupicolous vegetation with Boccone sea lavender of limestone rocks.

Holotypus: Rel. 7, tab. 1, Barbagallo et al. (1979).

Characteristic and differential species: *Limonium bocconei* (Lojac.) Litard., *L. dubium* (Andrews ex Guss.) Litard., *L. lojaconoi* Brullo, *L. ponzoi* (Fiori & Bég.) Brullo.

Phytosociological table: From Bartolo & Brullo (1993), tab. 3-4, 24 rel.

Char. association: *Limonium bocconei* (V), *Limonium ponzoi* (III), *Limonium lojaconoi* (II), *Limonium dubium* (II).

Char. alliance, order and class: *Frankenia hirsuta* (V), *Crithmum maritimum* (V), *Silene sedoides* (IV), *Daucus gingidium* (IV), *Limonium virgatum* (IV), *Lotus cytisoides* (IV), *Plantago macrorrhiza* (IV), *Reichardia crassifolia* (III), *Jacobaea maritima* subsp. *maritima* (III), *Limbarda crithmoides* subsp. *longifolia* (II), *Thymelaea hirsuta* (I).

Other species: *Catapodium balearicum* (IV), *Parapholis incurva* (III), *Anthemis secundiramea* (III), *Dactylis hispanica* (III), *Senecio leucanthemifolius* (III), etc.

Geographical distribution: This syntaxon occurs along the north-western coasts of Sicily, between Capo Zafferano (Bagheria) and Trapani, as well as in Favignana and Levanzo islands (Barbagallo et al., 1979e; Bartolo & Brullo, 1993; Gianguzzi & La Mantia, 2008).

Structure and ecology: The calcareous or dolomitic low reefs of North-western Sicily are colonized by a vegetation belonging to *Crithmo-Limonietea* class, where the endemic *Limonium bocconei* shows high values of coverage. This community, named *Limonietum bocconei*, is floristically quite rich, being well represented several species of higher rank, such as *Crithmum maritimus*, *Lotus cytisoides*, *Pallenis maritima*, *Plantago macrorrhiza*, *Silene sedoides*, etc. Other endemic *Limonium* characterizes this association, such as *L. dubium*, *L. ponzoi* and *L. lojaconoi* (Bartolo & Brullo, 1993).

Syndynamism: The *Limonietum bocconei* is generally in contact inward with the coastal maquis, which in this area is mainly represented by the *Pistacio lentisci-Chamaeropetum humilis* Brullo & Marcenò 1985. Only in the dry slopes of Monte Cofano, this vegetation takes catenal contact with a subhalophilous community dominated by *Helichrysum panormitanum* subsp*. brulloi* (Gianguzzi & La Mantia, 2000).

Habitat reference: See class.

15.1.1.4. ***Limonietum hyblaei*** Bartolo, Brullo & Marcenò 1982

Rupicolous vegetation with Hyblaean sea lavender of limestone rocks**.**

Holotypus: Rel. 9, tab. 20, Bartolo et al. (1982).

Characteristic and differential species: *Limonium hyblaeum* Brullo.

Phytosociological table: From Bartolo et al. (1982), tab. 20, 14 rel. (6-19).

Char. association: *Limonium hyblaeum* (V).

Char. alliance, order and class: *Limonium virgatum* (V), *Frankenia hirsuta* (V), *Plantago macrorrhiza* (V), *Crithmum maritimum* (IV), *Lotus cytisoides* (IV), *Reichardia crassifolia* (IV), *Daucus gingidium* (II), *Thymelaea hirsuta* (I).

Other species: *Parapholis incurva* (IV), *Desmazeria pignattii* (IV), *Catapodium balearicum* (III), *Arthrocaulon meridionalis* (III), *Plantago weldenii* (II), *Aeluropus lagopoides* (II), etc.

Geographical distribution: This vegetation results widespread in the south-eastern coasts of Sicily, between Capo Passero and Scoglitti (Bartolo et al., 1982; Bartolo & Brullo, 1993).

Structure and ecology: The *Limonietum hyblaei* is an halophilous vegetation that grows on coastal cliffs with miocenic limestone or rarely also calcareous marly substrata. This syntaxon is differentiatedted by the dominance of the endemic *Limonium hyblaeum*, which is associated with *Crithmum maritimum*, *Limonium virgatum*, *Plantago macrorrhiza*, *Lotus cytisoides*, *Frankenia hirsuta*, etc.

Syndynamism: This vegetation consitutes a discontinuous belt along the reefs in the stands near the sea, which is replaced inward by the *Thymelaeo hirsutae-Helichrysetum conglobati* (particularly on the miocenic limestones) or sometimes is directly in contact with the coastal maquis.

Habitat reference: See class.

15.1.1.5. ***Limonietum syracusani*** Bartolo, Brullo & Marcenò 1982

Rupicolous vegetation with Syracuse sea lavender of limestone rocks.

Holotypus: Rel. 16, tab. 21, Bartolo et al. (1982).

Characteristic and differential species: *Limonium syracusanum* Brullo.

Phytosociological table: From Bartolo et al. (1982), tab. 21, 18 rel.

Char. association: *Limonium syracusanum* (V).

Char. alliance, order and class: *Limonium virgatum* (V), *Crithmum maritimum* (V), *Lotus cytisoides* (IV), *Plantago macrorrhiza* (IV), *Frankenia hirsuta* (IV), *Silene sedoides* (III), *Daucus gingidium* (III), *Reichardia crassifolia* (III), *Cichorium spinosum* (III), *Thymelaea hirsuta* (I), *Limbarda crithmoides* subsp. *longifolia* (I).

Other species: *Arthrocaulon meridionalis* (V), *Catapodium balearicum* (IV), *Anthemis secundiramea* (IV), *Mesembryanthemum nodiflorum* (III), *Silene vulgaris* subsp. *tenoreana* (II), *Valantia muralis* (II), *Parapholis incurva* (II), *Trifolium scabrum* (II), *Parapholis filiformis* (II), *Capparis spinosa* (II), etc.

Geographical distribution: This vegetation occurs in the Ionian coast of South-East Sicily, between Capo Passero and Brucoli (Bartolo et al., 1982; Bartolo & Brullo, 1993; Minissale et al., 2011).

Structure and ecology: Along the Ionian coasts, the *Limonietum hyblaei* is vicaried by another community of *Crithmo-Limonion*, whose physiognomy is given by *Limonium syracusanum*, an endemic species strictly related to *Limonium bocconei*. This vegetation, described by Bartolo et al. (1982) as *Limonietum syracusani*, is linked to low cliffs of calcarenite and Miocenic limestone subject to sea agents, where *Cichorium spinosum*, *Limonium virgatum*, *Crithmum maritimum*, *Plantago macrorrhiza*, *Lotus cytisoides*, *Silene sedoides*, etc. are frequent.

Syndynamism: This community occupies a narrow belt near the shoreline and takes catenal contact inward with the costal garrigues of *Chamaeropo humilis-Sarcopoterietum spinosi* or sometimes also with the *Thymelaeo hirsutae-Helichrysetum conglobati*.

Habitat reference: See class.

15.1.1.6. ***Limonietum tenuiculi*** Brullo & Marcenò 1983

Rupicolous vegetation with Marettimo sea lavender of limestone rocks.

Holotypus: Rel. 5, tab. 1, Brullo & Marcenò (1983).

Characteristic and differential species: *Limonium tenuiculum* (Tineo) Pignatti.

Phytosociological table: From Brullo & Marcenò (1983), tab. 1, 13 rel.

Char. association: *Limonium tenuiculum* (V).

Char. alliance, order and class: *Silene sedoides* (V), *Lotus cytisoides* (V), *Daucus gingidium* (V), *Crithmum maritimum* (V), *Reichardia crassifolia* (IV), *Plantago macrorrhiza* (III), *Frankenia hirsuta* (III), *Jacobaea maritima* subsp. *sicula* (III), *Limbarda crithmoides* subsp. *longifolia* (II).

Other species: *Anthemis secundiramea* (IV), *Senecio aegadensis* (IV), *Catapodium balearicum* (IV), *Hyoseris radiata* (III), *Hymenolobus revelieri* subsp. *sommieri* (II), *Parapholis incurva* (II), *Euphorbia pinea* (II), *Bellis annua* (II), *Ranunculus paludosus* (II), *Sagina maritima* (II), *Plantago coronopus* (I), *Trifolium scabrum* (I), *Arthrocaulon meridionalis* (I).

Geographical distribution: This syntaxon is exclusive of Marettimo island in the Egadian Archipelago (Brullo & Marcenò, 1983b; Bartolo & Brullo, 1993).

Structure and ecology: The *Limonietum tenuiculi* is a geographical vicariant of *Limonietum bocconei* in calcareous rocky coasts and cliffs of Marettimo islands. This vegetation is characterized by the dominance of *Limonium tenuiculum*, endemic species similar to *Limonium bocconei*, which grows together with other species of *Crithmo-Limonietea,* such as

Crithmum maritimum, Daucus gingidium, Reichardia crassifolia, *Lotus cytisoides*, *Silene sedoides*, *Plantago macrorrhiza*, etc.

Syndynamism: This chasmophilous community constitutes a narrow belt between the aphytoic zone and the sub-halophilous shrubby vegetation represented by the *Senecioni siculae-Helichrysetum messerii*.

Habitat reference: See class.

15.1.1.7. ***Asparago stipularis-Limoniastretum monopetali*** Bartolo, Brullo & Marcenò 1982

Rupicolous vegetation with grey asparagus and bushy sea- lavender of calcarenitic rocks.

Holotypus: Rel. 4, tab. 22, Bartolo et al. (1982).

Characteristic and differential species: *Asparagus horridus* L.; *Limoniastrum monopetalum* (L.) Boiss., *Lycium intricatum* Boiss.

Phytosociological table: From Bartolo et al. (1982), tab. 22, 15 rel.

Char. association: *Limoniastrum monopetalum* (V), *Asparagus aphyllus* (V), *Lycium intricatum* (V).

Char. alliance, order and class: *Limonium virgatum* (III), *Plantago macrorrhiza* (III), *Crithmum maritimum* (II), *Reichardia crassifolia* (II), *Daucus gingidium* (I).

Other species: *Sporobolus virginicus* (V), *Parapholis incurva* (III), *Mesembryanthemum nodiflorum* (II), *Rostraria cristata* (II), *Catapodium balearicum* (I), *Salsola tragus* (I), *Cakile maritima* (I), *Plantago coronopus* (II), *Valantia muralis* (I).

Geographical distribution: This association is currently known only for Punta Braccetto near Scoglitti (South-Eastern Sicily), where it was described by Bartolo et al. (1982).

Structure and ecology: It occurs on calcarenitic substrata in stands near the sea, whose physiognomy is given by the large pulvinate shrubs of *Limoniastrum monopetalum*, which grows with other thermo-xerophilous shrubs, as *Asparagus horridus* and *Lycium intricatum*. Despite these plants usually occurs in other types of vegetation, this association can be referred to the *Crithmo-Limonietea* due to its ecology and the occurrence of several species belonging to this class, such as *Plantago macrorrhiza*, *Limonium virgatum*, *Reichardia crassifolia*, *Crithmum maritimum*, etc.

Syndynamism: As observed by Bartolo & Brullo (1993), moving inward on clay soils this vegetation becomes impoverished by the elements of the *Crithmo-Limonietea*, enriching at the same time of the *Pegano-Salsoletea* species, as *Salsola oppositifolia* and *Atriplex halimus*, which allow to identify another community, probably referable to the *Suaedo verae-Limoniastretum monopetali* Bartolo et al. 1988.

Habitat reference: See class.

15.1.1.8. ***Limonietum minutiflori*** Barbagallo, Brullo & Signorello 1983

Rupicolous vegetation with Aeolian sea lavender of volcanic or calcareous rocks.

Holotypus: rel. 22, tab. 3, Barbagallo et al. (1983).

Characteristic and differential species: *Limonium minutiflorum* (Guss.) Kuntze.

Lectotypus: Rel. 22, tab. 3, Barbagallo et al. (1983).

Characteristic and differential species: *Limonium minutiflorum* (Guss.) Kuntze.

Phytosociological table: From Barbagallo et al. (1983), tab. 3, 27 rel.

Char. association: *Limonium minutiflorum* (V).

Char. alliance, order and class: *Crithmum maritimum* (V), *Reichardia crassifolia* (IV), *Daucus gingidium* (IV)*, Limbarda crithmoides* subsp. *longifolia* (III), *Jacobaea maritima* subsp. *bicolor* (III), *Lotus cytisoides* (III), *Plantago macrorrhiza* (II), *Frankenia hirsuta* (II), *Sonchus asper* subsp. *glaucescens* (I), *Allium commutatum* (I).

Other species: *Catapodium balearicum* (V), *Mesembryanthemum nodiflorum* (IV), *Matthiola incana* subsp. *rupestris* (III), *Hyoseris radiata* (II), *Parapholis incurva* (II), *Capparis spinosa* (II), *Dactylis glomerata* subsp. *hispanica* (II), *Helichrysum litoreum* (II), *Hypochoeris achyrophorus* (I), *Senecio leucanthemifolius* (I).

Geographical distribution: This association occurs in the Aeolian Islands (Salina, Filicudi, Lipari and Panarea) as well as in the rocky coasts near Milazzo in North Eastern Sicily, where it represents the only *Crithmo-Limonietea* community in the coast from Cefalù to Messina (Barbagallo et al., 1983; Bartolo & Brullo, 1993).

Structure and ecology: It is a halo-rupicolous vegetation, localized in the belt directly affected by sea spray. It grows on various substrata, occurring on basaltic rocks in the Aeolian Archipelago and on metamorphic rocks or limestone in the stand of Capo Milazzo (North-eastern Sicily). From the floristic point of view, this vegetation is characterized by the dominance of the endemic *Limonium minutiflorum*, which is associated together with some species belonging to the *Crithmo-Limonietea* class, such as *Lotus cytisoides*, *Crithmum maritimum*, *Reichardia crassifolia*, *Limbarda crithmoides* subsp. *longifolia*, etc.

Syndynamism: In the inner belt, this community is replaced by the *Senecioni bicoloris-Helichrysetum litorei*, a shrubby vegetation with a less marked halophilous character (Barbagallo et al., 1983).

Habitat reference: See class.

15.1.1.9. ***Limonietum flagellaris*** Bartolo & Brullo 1993

Rupicolous vegetation with lissom sea lavender of calcarenitic rocks.

Holotypus: Rel. 9, tab. 5, Bartolo & Brullo (1993).

Characteristic and differential species: *Limonium flagellare* (Lojac.) Brullo.

Phytosociological table: From Bartolo & Brullo (1993), tab. 5, 14 rel.

Char. association: *Limonium flagellare* (V).

Char. alliance, order and class: *Crithmum maritimum* (V), *Reichardia crassifolia* (IV), *Silene sedoides* (IV), *Lotus cytisoides* (IV), *Plantago macrorrhiza* (IV), *Daucus gingidium* (IV).

Other species: *Mesembryanthemum nodiflorum* (IV), *Catapodium balearicum* (III), *Anthemis maritima* (III), *Plantago coronopus* (III), *Juniperus turbinata* (II), *Dactylis glomerata* subsp. *hispanica* (II), *Bituminaria bituminosa* (II), *Sporobolus virginicus* (II), *Capparis spinosa* (II), *Lolium rigidum* (II), *Asparagus acutifolius* (II), etc.

Geographical distribution: This syntaxon occurs only in the short coastal stretch of North-western Sicily between Castellamare del Golfo and Balestrate (Brullo & Bartolo, 1993).

Structure and ecology: This community represents an edaphic vicariant of the *Limonietum bocconei*, being linked to higher cliffs with quaternary calcarenitic substrata. Its physiognomy is defined by the endemic *Limonium flaggelaris*, which grows together with *Crithmum maritimum*, *Reichardia crassifolia*, *Plantago macrorrhiza*, *Lotus cytisoides*, *Daucus gingidium* and *Silene sedoides*. Furthermore, the sporadic occurrence of some species belonging to *Ammophiletea* class is explained by the proximity of extensive dunal systems.

Syndynamism: This vegetation inward takes contact with coastal maquis.

Habitat reference: See class.

15.1.1.10. ***Limonietum algusae*** Bartolo & Brullo 1993

Rupicolous vegetation with Linosa sea lavender of volcanic rocks.

Holotypus: rel. 4, tab. 13, Bartolo & Brullo (1993).

Characteristic and differential species: *Limonium algusae* (Brullo) Greuter.

Phytosociological table: From Brullo & Siracusa (1996), tab. 2, 15 rel.

Char. association: *Limonium algusae* (V).

Char. alliance, order and class: *Crithmum maritimum* (V), *Frankenia hirsuta* (V), *Silene sedoides* (V), *Jacobaea maritima* subsp, *sicula* (IV), *Lotus cytisoides* (IV), *Daucus gingidium* (III), *Reichardia crassifolia* (II).

Other species: *Mesembryanthemum nodiflorum* (IV), *Euphorbia pinea* (IV), *Catapodium balearicum* (III), *Rumex bucephalophorus* (III), *Medicago littoralis* (III), *Parapholis incurva* (III), *Mesembryanthemum crystallinum* (III), *Sedum litoreum* (II), *Lotus edulis* (II), *Silene neglecta* (II), *Senecio leucanthemifolius* (I), *Glaucium flavum* (I).

Geographical distribution: This association occurs along the coasts of Linosa island, in the Pelagian Archipelago (Brullo & Piccione, 1980; Bartolo & Brullo, 1993; Brullo & Siracusa, 1996).

Structure and ecology: The low reefs of Linosa island are colonizeb by an halo-casmophilous community dominated by *Limonium algusae*, which allows to identify an endemic community named *Limonietum algusae.* This vegetation represents a geographic vicariant of the *Limonietum cosyrensis*, being very similar under the ecological and floristic profile. In fact, both communities are linked to volcanic rocks near the shoreline, which are directly affected by sea agents, such as salt spray and wind. From the floristic point of view, several species of *Crithmo-Limonietea*, as *Crithmum maritimum*, *Frankenia hirsuta*, *Lotus cytisoides*, *Daucus gingidium*, *Jacobaea maritima* subsp. *sicula*, *Silene sedoides* and *Reichardia crassifolia*, result very frequent.

Syndynamism: This vegetation appears rather fragmented and relegated to the less disturbed rocky coasts. In the more flat and ventilated stands, the community can go inside for a few tens of meters, being then replaced by the *Senecioni siculae-Lycietum intricati* (Brullo & Siracusa, 1996).

Habitat reference: See class.

15.1.1.11. ***Limonietum pavoniani*** Bartolo & Brullo 1993

Rupicolous vegetation with Pavone sea lavender of calcarenitic rocks.

Holotypus: rel. 6, tab. 8, Bartolo & Brullo (1993).

Characteristic and differential species: *Limonium pavonianum* Brullo.

Phytosociological table: From Bartolo & Brullo (1993), tab. 8, 7 rel.

Char. association: *Limonium pavonianum* (V).

Char. alliance, order and class: *Crithmum maritimum* (V), *Lotus cytisoides* (V), *Limonium virgatum* (V), *Plantago macrorrhiza* (V), *Frankenia hirsuta* (IV), *Reichardia crassifolia* (IV), *Daucus gingidium* (III), *Thymelaea hirsuta* (I).

Other species: *Elytrigia juncea* (III), *Catapodium balearicum* (II), *Capparis spinosa* (II), *Asparagus aphyllus* (I).

Geographical distribution: This association occurs only in the short coastal stretch between Sampieri and Cava d'Aliga, in the south-eastern part of Sicily (Bartolo & Brullo, 1993).

Structure and ecology: It occurs in the calcarenitic and calcareous outcrops of the Hyblaean coast, where replaces the *Limonietum hyblaei* in stands characterized by a marked edaphic xericity. Physiognomically, it is differentiated by the dominance of *Limonium pavonianum*, usually associated with several other halophilous species, such as *Crithmum maritimum*,

Limonium virgatum, *Lotus cytisoides*, *Plantago macrorrhiza*, *Daucus gingidium*, *Reichardia crassifolia*, etc.

Syndynamism: Usually, it is in contact inward with the shrubby vegetation of *Thymelaeo hirsutae-Helichrysetum conglobati*.

Habitat reference: See class.

15.1.1.12. ***Limonietum jonici*** Bartolo & Brullo 1993

Rupicolous vegetation with Ionian sea lavender of calcareous rocks.

Holotypus: rel. 2, tab. 12, Bartolo & Brullo (1993).

Characteristic and differential species: *Limonium jonicum* Brullo.

Phytosociological table: From Bartolo & Brullo (1993), tab. 12, 5 rel.
Char. association: *Limonium jonicum* (V).
Char. alliance, order and class: *Crithmum maritimum* (V), *Lotus cytisoides* (V), *Limbarda crithmoides* subsp. *longifolia* (V), *Crithmum maritimum* (IV).
Other species: *Brassica incana* (IV), *Dianthus rupicola* (II), *Lomelosia cretica* (II).

Geographical distribution: This association is exclusive of the rocky coast near Taormina, including the nearby Isola Bella (Bartolo & Brullo, 1993; Minissale et al., 2005).

Structure and ecology: This vegetation grows in the calcareous reefs and at the base of high cliffs in the stands directly affected by salt-spray and other sea agents. Physyognomically, it is differentiated by the endemic *Limonium jonicum*, which shows close relations with *L. minutiflorum*. Some halophytes, such as *Crithmum maritimum*, *Lotus cytisoides* and *Limbarda crithmoides* subsp. *longifolia* are frequent in this community. Moreover, some rupicolous species of *Asplenitetea trichomanis* class, that colonize the highest part of the cliff, are well represented, among them *Brassica incana*, *Dianthus rupicola* and *Lomelosia cretica*, highlighting its peculiar chasmophilous character.

Syndynamism: This association is vicaried in the higher cliffs by a rupestrian community of *Asplenitetea trichomanis*.

Habitat reference: See class.

15.1.1.13. ***Limonietum tauromenitani*** Bartolo & Brullo 1993

Rupicolous vegetation with Taormina sea lavender of volcanic rocks.

Holotypus: rel. 1, tab. 11, Bartolo & Brullo (1993).

Characteristic and differential species: *Limonium tauromenitanum* Brullo.

Phytosociological table: From Bartolo & Brullo (1993), tab. 11, 9 rel.

Char. association: *Limonium tauromenitanum* (V).

Char. alliance, order and class: *Limbarda crithmoides* subsp. *longifolia* (V), *Lotus cytisoides* (V), *Crithmum maritimum* (IV), *Plantago macrorrhiza* (III), *Reichardia crassifolia* (II), *Daucus gingidium* (II), *Frankenia hirsuta* (II).

Other species: *Spergularia marina* (V), *Catapodium balearicum* (IV), *Parapholis incurva* (II), *Carex divisa* (II), *Juncus acutus* (II), *Rostraria cristata* (II), *Anagallis arvensis* (II), *Halimione portulacoides* (II), *Sonchus asper* subsp. *asper* (I).

Geographical distribution: This community is restricted to a short coastal stretch near Giardini Naxos (Bartolo & Brullo, 1993).

Structure and ecology: It is exclusive of the volcanic rocky coast, occurring in the southern part of Taormina, where it colonizes the rocky crevices. The *Limonietum tauromenitani*, a very rare vegetation dominated by *Limonium tauromenitanum*, is characterized by various elements of the *Crithmo-Limonietea*, such as *Limbarda crithmoides* subsp. *longifolia*, *Lotus cytisoides*, *Crithmum maritimum*, *Plantago macrorrhiza*, etc. (Bartolo & Brullo, 1993). This association can be considered an ecological vicariant of *Limonietum jonici*, which is linked to limestone.

Syndynamism: It is a very specialized community, not having any catenal contacts with other associations.

Habitat reference: See class.

15.1.1.14. ***Limonietum selinuntini*** Bartolo & Brullo 1993

Rupicolous vegetation with Selinunte sea lavender of calcarenitic rocks.

Holotypus: rel. 2, tab. 6, Bartolo & Brullo (1993).

Characteristic and differential species: *Limonium selinuntinum* Brullo.

Phytosociological table: From Bartolo & Brullo (1993), tab. 6, 5 rel.

Char. association: *Limonium selinuntinum* (V).

Char. alliance, order and class: *Crithmum maritimum* (V), *Lotus cytisoides* (II).

Other species: *Sporobolus virginicus* (III), *Plantago coronopus* (III).

Geographical distribution: This vegetation shows a very punctiform distribution, occurring only in the western part of Sicily and in particular in the rocky coast near Selinunte (Bartolo & Brullo, 1993).

Structure and ecology: The *Limonietum selinuntini* colonizes the calcarenitic outcrops near the shoreline. Under the floristic profile, it is a very poor vegetation, where the endemic *Limonium selinuntinum* grows together with few other species, such as *Crithmum maritimum*

and *Lotus cytisoides*. It should be noted that *Limonium selinuntinum* belongs to the cycle of *L. densiflorum*, which generally includes species linked to salt marshes, rather than rocky coasts (Brullo & Pavone, 1981).

Syndynamism: This vegetation does not seem to show catenal contacts with other associations.

Habitat reference: See class.

15.1.1.15. ***Crithmo-Limonietum melancholici*** Brullo, Marcenò & Romano 1996

Rupicolous vegetation with sad sea lavender of sandstones.

Holotypus: rel. 8, tab. 1, Brullo, Marcenò & Romano (1996).

Characteristic and differential species: *Limonium melancholicum* Brullo, Marcenò & Romano.

Phytosociological table: From Brullo et al. (1996), tab. 6, 8 rel.

Char. association: *Limonium melancholicum* (V).

Char. alliance, order and class: *Crithmum maritimum* (V), *Lotus cytisoides* (V), *Reichardia crassifolia* (V), *Plantago macrorrhiza* (V), *Daucus gingidium* (IV), *Limbarda crithmoides* subsp. *longifolia* (III), *Allium commutatum* (II), *Thymelaea hirsuta* (II).

Other species: *Hypochoeris laevigata* (IV), *Carlina sicula* (IV), *Plantago serraria* (IV), *Dactylis glomerata* subsp. *hispanica* (IV), *Asparagus acutifolius* (II), *Pallenis spinosa* (II), *Suaeda vera* (I).

Geographical distribution: This very rare community is restricted to the coast near Sciacca, in the southern-west part of Sicily (Brullo et al., 1996).

Structure and ecology: The *Crithmo-Limonietum melancholici* is an halophilous community, which is is linked to the sandstones near the sea. It is characterized by the dominance of *Limonium melancholicum,* a rare endemism belonging to *L. minutiflorum* group, that grows together with few other species, such as *Crithmum maritimum*, *Lotus cytisoides*, *Plantago macrorrhiza*, *Daucus gingidium*, *Reichardia crassifolia*, etc. Despite this vegetation shows some relations with *Limonietum minutiflori* and *Limonietum jonici*, it differs from them for more xerophilous requirements.

Syndynamism: This vegetation does not seem to show catenal contacts with other associations.

Habitat reference: See class.

15.1.1.16. ***Crithmo maritimi-Limonietum cophanensis*** ass. nov. provv.

Rupicolous vegetation with Cofano sea lavender of calcarenitic coasts.

Holotypus: Not designated.

Characteristic and differential species: *Limonium cophanense* C.Brullo, Brullo, Cambria, Giusso & Ilardi.

Phytosociological table: 6 unpublished releves from Monte Cofano.

Char. association: *Limonium cophanense* (V).

Char. alliance, order and class: *Crithmum maritimum* (V), *Lotus cytisoides* (V), *Plantago macrorrhiza* (V), *Silene sedoides* (V), *Pallenis maritima* (V), *Reichardia crassifolia* (IV), *Frankenia hirsuta* (III).

Other species: *Hyoseris radiata* (V), *Euphorbia pinea* (IV), *Dactylis glomerata* subsp. *hispanica* (II), *Sporobolus virginicus* (II).

Geographical distribution: This vegetation is localized in a small stand in the east part of Monte Cofano (North Western Sicily).

Structure and ecology: The association shows a very circumscribed distribution, occurring only on the calcarenitic outcrops of Plio-Pleistocene origin. It is differentiated by *Limonium cophanense*, a very peculiar species recently described by Brullo et al. (2016). This species grows together with *Crithmum maritimum*, *Pallenis maritima*, *Lotus cytisoides*, *Plantago macrorrhiza* and *Silene sedoides*. This vegetation can be considered an edaphic vicariant of the *Limonietum bocconei*, with which it is in direct catenal contact at the edges of its distribution area.

Syndynamism: Similarly to *Limonietum bocconei*, it is replaced inward by the coastal maquis.

Habitat reference: See class.

15.1.1.17. ***Crithmo maritimi-Limonietum virgati*** Pirone 1995

Rupicolous vegetation with violet sea lavender of various substrata.

Synonyms: Group. a *Crithmum maritimum* et *Limonium oleoifolium* Géhu et al. 1992.

Holotypus: Rel. 16., tab. 19, Pirone (1995).

Characteristic and differential species: *Limonium virgatum* (Willd.) Fourr.

Phytosociological table: From Brullo et al. (2000), tab. 6, 6 rel.

Char. association: *Limonium virgatum* (V).

Char. alliance, order and class: *Crithmum maritimum* (V), *Reichardia crassifolia* (V), *Limbarda crithmoides* subsp. *longifolia* (V), *Thymelaea hirsuta* (IV), *Plantago macrorrhiza* (IV), *Daucus gingidium* (IV), *Lotus cytisoides* (II), *Allium commutatum* (II).

Other species: *Coridothymus capitatus* (IV), *Capparis spinosa* (IV).

Geographical distribution: This vegetation, originally described by Pirone (1995) from the Adriatic coasts ofAbruzzo, is widespread in the Mediterranean area, including Sicily, where it was surveyed for the first time by Brullo et al. (2000) in the southern coast near Gela and attributed to *Crithmo-Limonietum virgati* sensu Géhu et al. 1992. Moreover, according to Minissale et al. (2010), it occurs also along the Agrigento coast.

Structure and ecology: The *Crithmo-Limonietum virgati* represents the basal phytocoenon of the Mediterranean *Crithmo-Limonietea* without endemic *Limonium* species, growing in recent substrata, as basalts, marls and calcarenites. It is a very poor community, where the widespread *Limonium virgatum* grows together with *Crithmum maritimum*, *Reichardia crassifolia*, *Lotus cytisoides*, *Daucus gingidium*, *Limbarda crithmoides* subsp. *longifolia*, *Plantago macrorrhiza*, etc. The Crithmo maritimi-Limonietum virgati shows some relations with the *Reichardio-Crithmetum maritimi*, association described by Bolos (1962) for Catalonia (South Spain), from which it differs for the ecology and floristic set.

Syndynamism: This community is an impoverished aspect that is generally linked to coastal stands subject to human activities or very recent substrata.

Habitat reference: See class.

15.1.1.18. ***Hyoseridetum taurinae*** Brullo et al. 1997

Rupicolous vegetation with succulent hyoseris of rocky coasts.

Holotypus: rel. 3, tab. 1, Brullo et al. (1997).

Characteristic and differential species: *Hyoseris taurina* (Pamp.) Martinoli.

Phytosociological table: From Brullo et al. (1997), tab. 1, 9 rel. (subass. *inuletosum crithmoides*).

Char. association: *Hyoseris taurina* (V).

Char. subassociation: *Limbarda crithmoides* subsp. *longifolia* (V), *Matthiola incana* subsp. *incana* (II).

Char. alliance, order and class: *Crithmum maritimum* (III), *Reichardia crassifolia* (V), *Daucus gingidium* (II), *Jacobaea maritima* subsp, *bicolor* (II), *Lotus cytisoides* (V), *Allium commutatum* (IV), *Limonium minutiflorum* (I).

Other species: *Silene vulgaris* subsp. *angustifolia* (IV), *Dittrichia viscosa* (III), *Euphorbia dendroides* (II).

From Brullo et al. (1997), tab. 1, 8 rel. (subass. *dianthetosum aeolici*).

Char. association: *Hyoseris taurina* (V).

Char. subassociation: *Dianthus rupicola* subsp. *aeolicus* (V), *Matthiola incana* subsp. *rupestris* (II), *Kochia saxicola* (II).

Char. alliance, order and class: *Daucus gingidium* (V), *Jacobaea maritima* subsp. *bicolor* (IV), *Crithmum maritimum* (II), *Reichardia crassifolia* (II).

Other species: *Dactylis glomerata* subsp. *hispanica* (V), *Silene vulgaris* subsp. *angustifolia* (II), *Euphorbia dendroides* (I).

Geographical distribution: The distribution of this community coincides with that one of *Hyoseris taurina*, its differential species, which occurs in south-western Sardinia, southern Calabria, north-eastern Sicily, Aeolian islands and northern Tunisia (Brullo et al., 1997).

Structure and ecology: The *Hyoseridetum taurinae* is a sub-halo chasmophilous community, which colonizes the north-facing sea cliffs exposed to salt spray, preferring stands with thermomediterranean subhumid climate. It can grow on various siliceous substrata, as granites, vulcanites, sandstones and gneiss. The structure of this vegetation is definied by *Hyoseris taurina*, a southern tyrrhenian endemism that is associated with several species of *Crithmo-Limonietea* class, such as *Lotus cytisoides*, *Crithmum maritimum*, *Daucus gingidium*, *Reichardia crassifolia* and *Jacobaea maritima*. Within this syntaxon, Brullo et al. (1997) distinguished four subassociations: a) subass. *inuletosum crithmoides* is spread in the north-eastern part of Sicily and in south-western Calabria and is characterized by the occurrence of *Limbarda crithmoides* subsp. *longifolia*, *Matthiola incana* subsp. *incana* and *Centaurea deusta* s.l.; b) subass. *dianthetosum aeolici* is restricted to Aeolian islands (mainly Stromboli and Strombolicchio) and is differentiated by *Dianthus rupicola* subsp. *aeolicus*, *Matthiola incana* subsp. *rupestris* and *Kochia saxicola*; c) subass. *seseletosum praecocis* occurs only in south-western Sardinia; d) subass. *telephietosum imperati* is only known in northern Tunisia.

Syndynamism: This vegetation replaces the *Limonietum minutiflori* in the shaded cliffs with more humid and cooler conditions.

Habitat reference: See class.

15.1.2. Alliance: ***Helichrysion litorei*** Biondi ex Biondi in Biondi et al. 2013

Sub-halophilous coastal scrub with pulvinate dwarf shrubs on salt sprayed cliffs.

Synonyms: *Plantaginenion* (*Plantaginion*) *subulatae* Molinier 1954 nom. nud. (art. 2b); *Plantaginenion* (*Plantaginion*) *subulatae* Rioux, Roux & Pignatti 1955 nom. nud. (art. 2b); *Plantagini-Thymelaeneion hirsutae* Bartolo, Brullo & Marcenò 1982; *Plantagini subulatae-Thymelaeion hirsutae* Bartolo & Brullo in Bartolo, Brullo & Signorello 1992 nom. nud. (art. 2b); *Helichrysion litorei* Biondi 2007 nom. inval. (art. 2b, 5, 17).

Holotypus: *Senecioni-Helichrysetum litorei* Barbagallo, Brullo & Signorello 1983.

Characteristic and differential species: *Helichrysum litoreum* Guss., *H. conglobatum* (Viv.) Steud., *Jacobaea maritima* (L.) Pelser & Meijden s.l., *Pallenis maritima* (L.) Greuter, *Thymelaea hirsuta* (L.) Endl., *T. tartonraira* All.

Geographical distribution: This alliance occurs in the Central and Western part of the Mediterranean area (Biondi, 2007; Biondi & Blasi, 2015), while in Sicily it is widespread in the southern and western coasts and also in the surrounding islands (Bartolo et al., 1982, 1992).

Structure and ecology: The alliance gathers the sub-halophilous communities dominated by dwarf shrubs, occurring in the rocky coast, usually in contact towards the sea with those of *Crithmo-Limonion*. Previously, this vegetation was referred to different suballiances of the *Crithmo-Limonion* by various authors (Molinier, 1954; Rioux et al., 1955; Bartolo et al., 1982). Later, Bartolo et al. (1992) and Biondi (2007) arranged these communities inside a new alliances, named respectively *Plantagini subulatae-Thymelaeion hirsutae* and *Helichrysion litorei*, both invalidly published. Finally, the *Helichrysion litorei* was validated by Biondi et al. (2013), while Mucina et al. (2016) preferred to include this syntaxon within the *Anthyllidion barbae-jovis* Brullo & De Marco 1989, although it comprises the phanerophytic chasmophilous vegetation colonizing the highest part of sea cliffs.

Syndynamism: The communities of *Helichrysion litorei* replaces the *Crithmo-Limonion* vegetation in the inner coastal belt. Besides, if compared to the communities belonging to the *Crithmo-Limonion*, it represents a more evolved vegetation under the structural profile. Inward, it is in contact with the coastal maquis, growing on more mature soils.

Habitat reference: See class.

15.1.2.1. ***Thymelaeo hirsutae-Helichrysetum conglobati*** Bartolo, Brullo & Marcenò 1982 corr.

Sub-halophilous coastal scrub with conglobate everlasting and spur flax on calcareous rocks.

Synonyms: *Thymelaeo-Helichrysetum siculi* Bartolo, Brullo & Marcenò 1982.

Holotypus: rel. 16, tab. 23, Bartolo et al. (1982).

Characteristic and differential species: *Helichrysum conglobatum* (Viv.) Steud., *Teucrium luteum* (Mill.) Degen., *Thymbra capitata* (L.) Cav.

Phytosociological table: From Bartolo et al. (1982), tab. 23, rel. 27.

Char. association: *Thymbra capitata* (V), *Helichrysum conglobatum* (III), *Teucrium luteum* (II).

Char. alliance: *Thymelaea hirsuta* (V).

Char. order and class: *Reichardia crassifolia* (V), *Lotus cytisoides* (IV), *Daucus gingidium* (IV), *Limonium virgatum* (III), *Plantago macrorrhiza* (III), *Sonchus asper* subsp. *glaucescens* (I), *Limonium hyblaeum* (I), *Crithmum maritimum* (I).

Other species: *Hedysarum spinosissimum* (IV), *Parapholis incurva* (IV), *Anthemis secundiramea* (III), *Catapodium balearicum* (III), *Dactylis glomerata* subsp. *hispanica* (III), *Moraea sisyrinchium* (III), *Trifolium scabrum* (III), *Valantia muralis* (III), *Sporobolus virginicus*

(II), *Limonium sinuatum* (II), *Hedypnois rhagadioloides* (II), *Medicago littoralis* (II), *Plantago coronopus* (II).

Geographical distribution: This vegetation is well represented in the south-eastern coasts, between Scoglitti and Capo Passero, with isolated stands near Syracuse (Barbagallo et al., 1977; Bartolo et al., 1982; Bartolo & Brullo, 1993; Minissale et al., 2011).

Structure and ecology: The halophilous vegetation with *Limonium hyblaeum* or *L. syracusanum* is followed inward by a low garrigue with prostrate chamaephytes or nanophanerophytes, among them *Helichrysum conglobatum* (previously identified as *Helichrysum siculum* (Spreng.) Boiss.), *Teucrium luteum*, *Thymbra capitata* and *Thymelaea hirsuta* have high coverage values. This community, named *Thymelaeo hirsutae-Helichrysetum conglobati*, is linked to open stands affected by strong sea winds, mainly on calcareous substrata. According to Bartolo et al. (1982), the syntaxon at issue must be attributed to the *Crithmo-Limonietea* for the presence of numerous species belonging to this class, such as *Lotus cytisoides*, *Reichardia crassifolia*, *Plantago macrorrhiza*, *Daucus gingidium*, *Limonium virgatum*, etc.

Syndynamism: From the dynamic point of view, this community occupies an intermediate position between the *Limonietum hyblaei* (or rarely the *Limonietum syracusani*) and the coastal maquis (Bartolo et al., 1982; Bartolo & Brullo, 1993).

Habitat reference: See class.

15.1.2.2. ***Matthiolo pulchellae-Helicrhysetum errerae*** Brullo, Di Martino & Marcenò 1977

Sub-halophilous coastal scrub with Pantelleria everlasting and *hoary stock* on volcanic rocks.

Holotypus: rel. 3, tab. 6, Brullo et al. (1977).

Characteristic and differential species: *Helichrysum errerae* Tineo; *Matthiola incana* (L.) R.Br. subsp. *pulchella* (Conti) Greuter & Burdet.

Phytosociological table: From Brullo et al. (1977), tab. 6, 16 rel.

Char. association: *Helichrysum errerae* (V), *Matthiola incana* subsp. *pulchella* (V).

Char. alliance: *Thymelaea hirsuta* (IV), *Jacobaea maritima* subsp. *bicolor* (IV).

Char. order and class: *Lotus cytisoides* (V), *Reichardia crassifolia* (V), *Daucus gingidium* (IV), *Limonium cosyrense* (II), *Silene sedoides* (II), *Plantago macrorrhiza* (II), *Sonchus asper* subsp. *glaucescens* (I), *Crithmum maritimum* (I).

Other species: *Mesembryanthemum nodiflorum* (IV), *Euphorbia pinea* (IV), *Hyparrhenia hirta* (III), *Capparis spinosa* (III), *Anthemis secundiramea* var. *cosyrensis* (III), *Asparagus acutifolius* (II), *Genista aspalathoides* (II), *Hypochaeris achyrophorus* (II), *Catapodium balearicum* (II), *Senecio leucanthemifolius* (I).

Geographical distribution: This community occurs only in Pantelleria island, where it is widespread (Brullo et al., 1977; Bartolo & Brullo, 1992; Gianguzzi, 1999b).

Structure and ecology: The quite wide belt lying between the *Limonietum cosyrensis* and the woody vegetation of *Genisto aspalathoidis-Pinetum hamiltonii*, is occupied by a low shrubby community, which is dominated by the endemic *Helichrysum errerae* and *Matthiola incana* subsp. *pulchella*. This association, described by Brullo et al. (1977) as *Matthiolo-Helicrhysetum errerae,* occurs on more or less flat basaltic surfaces near the sea, showing also a pioneer character colonizing uncultivated lands of the coastal area or disturbed rocky slopes in the inland. In its floristic set various species of the *Crithmo-Liomnietea* are well represented, such as *Lotus cytisoides*, *Daucus gingidium*, *Reichardia crassifolia*, *Silene sedoides*, etc. Brullo et al. (1977) recognized within it two subassociations: subass. *thymelaetosum* Brullo et al. 1977 representing the typical aspect and is differentiated by *Thymelaea hirsuta*; subass. *genistetosum* has a less marked halophilous character, being differentiated by *Genista asphalatoides*, *Erica multiflora*, *Pistacia lentiscus* and *Prasium majus*.

Syndynamism: This community occurs in the inner part of low reefs, while it is replaced by *Periploco angustifoliae-Juniperetum turbinatae* subass. *brassicetosum insularis* in the higher coastal cliffs (Gianguzzi, 1999b).

Habitat reference: See class.

15.1.2.3. ***Senecioni siculae-Helichrysetum messerii*** Brullo & Marcenò 1983

Sub-halophilous coastal scrub with Marettimo everlasting and sicilian silver ragwort on sloping calcareous surfaces.

Holotypus: rel. 5, tab. 2, Brullo & Marcenò (1983).

Characteristic and differential species: *Helichrysum panormitanum* Tineo ex Guss. subsp. *messeriae* (Pignatti) Brullo et al., *Jacobaea maritima* (L.) Pelser & Meijden subsp. *sicula* Passalacqua et al., *Polycarpon alsinifolium* (Biv.) DC.

Phytosociological table: From Brullo & Marcenò (1983), tab. 2, rel. 10.

Char. association: *Helichrysum panormitanum* subsp. *messeriae* (V), *Jacobaea maritima* subsp. *sicula* (V), *Polycarpon alsinifolium* (V).

Char. alliance: *Thymelaea hirsuta* (V).

Char. order and class: *Reichardia crassifolia* (V), *Lotus cytisoides* (V), *Daucus gingidium* (V), *Crithmum maritimum* (V), *Plantago macrorrhiza* (IV), *Limonium tenuiculum* (IV), *Silene sedoides* (III), *Thymelaea hirsuta* (II), *Sonchus asper* subsp. *glaucescens* (II), *Limbarda crithmoides* subsp. *longifolia* (I).

Other species: *Dactylis glomerata* subsp. *hispanica* (V), *Hyoseris radiata* (V), *Catapodium balearicum* (V), *Anthemis secundiramea* (IV), *Euphorbia pinea* (IV), *Trachynia distachya* (III), *Trifolium scabrum* (III), *Sideritis romana* (III), *Erica multiflora* (III), *Catapodium rigidum* (III), etc.

Geographical distribution: This community occurs only in the coasts of Marettimo islands in the Egadian Archipelago (Brullo & Marcenò, 1983b; Bartolo & Brullo, 1993).

Structure and ecology: The association grows on the steep calcareous surfaces in contact with the *Limonietum tenuiculi*. It is characterized by the endemic *Helichrysum panormitanum* subsp. *messeriae* and *Jacobaea maritima* subsp. *sicula*, growing together with *Polycarpon alsinifolium*. Besides, several species belonging to *Crithmo-Limonietea* class occur, such as *Plantago macrorhiza*, *Daucus gingidium*, *Crithmum maritimus*, *Lotus cytisoides*, *Reichardia crassifolia*, *Silene sedoides*, etc.

Syndynamism: This vegetation constitutes a discontinuous belt between the *Limonietum tenuiculi* and the dense garrigues of *Erico-Micromerietum fruticulosae* Brullo & Marceno 1983.

Habitat reference: See class.

15.1.2.4. ***Senecioni bicoloris-Helichrysetum litorei*** Barbagallo, Brullo & Signorello 1983

Sub-halophilous coastal scrub with coastal everlasting and silver ragwort on volcanic substrata.

Holotypus: rel. 5, tab. 4, Barbagallo et al. (1983).

Characteristic and differential species: *Helichrysum litoreum* Guss.

Phytosociological table: From Barbagallo et al. (1983), tab. 4, 10 rel.

Char. association: *Helichrysum litoreum* (V).

Char. alliance: *Jacobaea maritima* subsp. *bicolor* (V), *Thymelaea hirsuta* (IV).

Char. order and class: *Reichardia crassifolia* (V), *Daucus gingidium* (V), *Limbarda crithmoides* subsp. *longifolia* (V), *Lotus cytisoides* (IV), *Crithmum maritimum* (IV), *Plantago macrorrhiza* (IV), *Limonium minutiflorum* (III), *Sonchus asper* subsp. *glaucescens* (III).

Other species: *Dactylis glomerata* subsp. *hispanica* (V), *Mesembryanthemum nodiflorum* (V), *Catapodium balearicum* (V), *Lagurus ovatus* (V), *Senecio leucanthemifolius* (IV), *Hyparrhenia hirta* (IV), *Matthiola incana* subsp. *rupestris* (III), *Brachypodium retusum* (III), *Hyoseris radiata* (III), *Artemisia arborescens* (III), etc.

Geographical distribution: This association, apart from Aeolian island where it was described by Barbagallo et al. (1983), occurs also in the Sorrento peninsula, southern Latium and in some neighboring islands (Ischia, Capri and Pontine Islands).

Structure and ecology: The *Senecioni bicoloris-Helichrysetum litorei* occurs in the rocky coasts (basalts, limestones, etc.) in a more internal position than the communities of *Crithmo-Limonion*, limitedly to the stands subject to strong winds. This vegetation is characterized by small, often pulvinate, shrubs, such as *Helichrysum litoreum* (endemism of south Tyrrhenian area), *Jacobaea maritima* subsp. *bicolor* and *Thymelaea hirsuta*. Besides, several halophilous

species belonging to *Crithmo-Limonietea* occur, among them *Daucus gingidium*, *Reichardia crassifolia*, *Crithmum maritimum* and *Lotus cytisoides*.

Syndynamism: In Sicily this community is localized on volcanic rocks, replacing the *Limonietum minutiflori* in the inner stands slightly exposed to sea aerosol, while inwards it takes contact with the *Genistetum tyrrhenae* or the coastal maquis.

Habitat reference: See class.

15.1.2.5. ***Senecioni siculae-Lycietum intricati*** Brullo & Siracusa 1996 corr.

Sub-halophilous and xerophilous coastal scrub with sicilian silver ragwort and southern tea tree.

Synonyms: *Senecioni bicoloris- Lycietum intricati* Brullo & Siracusa 1996.

Holotypus: rel. 7, tab. 3, Brullo & Siracusa (1996).

Characteristic and differential species: *Lycium intricatum* Boiss.

Phytosociological table: From Brullo & Siracusa (1996), tab. 3, 12 rel.
Char. association: *Lycium intricatum* (V).
Char. alliance: *Jacobaea maritima* subsp. *sicula* (V).
Char. order and class: *Frankenia hirsuta* (V), *Daucus gingidium* (V), *Crithmum maritimum* (II), *Allium commutatum* (I), *Limonium algusae* (I), *Silene sedoides* (I).
Other species: *Euphorbia pinea* (V), *Rumex bucephalophorus* (IV), *Arisarum vulgare* (III), *Sedum litoreum* (III), *Parietaria judaica* (III), *Prasium majus* (I), *Sonchus bulbosus* (I), etc.

Geographical distribution: This association occurs only in Linosa, island of Pelagian Archipelago (Brullo & Siracusa, 1996).

Structure and ecology: The *Senecioni siculae-Lycietum intricati* grows on rough basalts and is in contact towards the sea with the *Limonietum algusae*. The physiognomy is given by *Jacobaea maritima* subsp. *sicula* and *Lycium intricatum*. For the occurrence of the last species, linked to the xeric territories of the South-western Mediterranean area, this vegetation shows some relations with the *Limonio-Lycietum intricati*, association described by Esteve Chueca (1973) from southern Spain. However, the two association differ very well both under the ecological and floristic viewpoint. In particular, the Spanish vegetation occurs on limestone and is differentiated by some Iberian endemism. In the *Senecioni-Lycietum intricati* several species belonging to *Crithmo-Limonietea* class are frequent, such as *Daucus gingidium*, *Crithmum maritimum* and *Silene sedoides*.

Syndynamism: This association has an intermediate position between the halophilous vegetation of *Limonietum algusae* and the maquis of *Periploco-Euphorbietum dendroidis*.

Habitat reference: See class.

15.1.2.6. ***Pallenio maritimi-Helichrysetum brulloi*** ass. nov. provv.

Sub-halophilous coastal scrub with Brullo everlasting of dry slopes near the sea.

Synonyms: *Limonietum bocconei* subass. *helichysetosum cophanensis* Gianguzzi & La Mantia 2008.

Holotypus: Rel. 6, tab. 10, Gianguzzi & La Mantia (2008).

Characteristic and differential species: *Helichrysum panormitanum* subsp*. brulloi* Iamonico & Pignatti.

Phytosociological table: From Gianguzzi & La Mantia (2008), tab. 6, 6 rel. (7-12).

Char. association: *Helichrysum panormitanum* subsp*. brulloi* (V).

Char. alliance: *Pallenis maritima* (V).

Char. order and class: *Plantago macrorrhiza* (V), *Reichardia crassifolia* (V), *Daucus gingidium* (V), *Limonium bocconei* (V), *Crithmum maritimum* (V)**,** *Lotus cytisoides* (V)**,** *Thymelaea hirsuta* (IV), *Frankenia hirsuta* (II).

Other species: *Seseli bocconei* (V), *Dactylis glomerata* subsp. *hispanica* (V), *Silene vulgaris* s.l. (V), *Hyoseris radiata* (IV), *Anthemis secundiramea* (IV), *Arthrocaulon meridionalis* (III), *Brachypodium retusum* (III), *Asparagus acutifolius* (III), etc..

Geographical distribution: This vegetation is currently known only from Monte Cofano in NW Sicily (Gianguzzi & La Mantia, 2008).

Structure and ecology: The association replaces the *Limonietum bocconei* in the steep slopes, often vertical, occurring in the coastal belt. This sub-halophilous vegetation is differentiated by the endemic *Helichrysum panormitanum* subsp*. brulloi.* It was previously treated by Gianguzzi & La Mantia (2008) as subass. *helichysetosum cophanensis* of the *Limonietum bocconei*, but for its structural and ecological peculiarities this community must be considered a distinct association, similarly to other ones differentiated by pulvinate *Helichrysum* species. According to Iamonico et al. (2016), *Helichrysum panormitanum* subsp. *cophanensis,* described by Brullo & Brullo (2013) is an invalid name and replaced by *Helichrysum panormitanum* subsp. *brulloi*. The association, linked to calcareous Mesozoic rocks, must be referred to *Crithmo-Limonietea* for its ecological requirements and occurrence of several halophilous chamaephytes of this class. Among them *Crithmum maritimum*, *Limonium bocconei*, *Pallenis maritima* and *Lotus cytisoides* show high coverage values.

Syndynamism: This vegetation replaces inward the *Limonietum bocconei* on more inclined surfaces and on the other side should be in contact with the coastal maquis of *Pistacio lentisci-Chamaeropetum humilis*.

15.1.3. Alliance: ***Crucianellion rupestris*** Brullo & Furnari 1988

Subaerohaline dwarf scrub of Central Mediterranean rocky coasts.

Synonyms: *Crucianellion rupestris* Brullo & Furnari 1981 (art. 2b, 5).

Holotypus: *Limonietum cyrenaici* Brullo & Furnari 1988.

Characteristic and differential species: *Crucianella rupestris* Guss., *Daucus rupestris* Guss., *Hypericum aegypticum* L. subsp. *webbii* (Spach) N. Robson, *Cichorium spinosum* L., *Frankenia revoluta* Forssk.

Geographical distribution: This alliance was firstly reported for the coasts of Cyrenaica by Brullo & Furnari (1981, 1988), but later it was surveyed also in the Pelagian and Maltese islands, as well as in the south-western coasts of Sicily near Mazara del Vallo (Bartolo et al., 1990a; Bartolo & Brullo, 1993; Biondi et al., 2014).

Structure and ecology: The *Crucianellion rupestris* replaces the *Crithmo-Limonion* in the more xeric places of the Central Mediterranean area. The communities of this alliance are dominated by small pulvinate chamephytes, which are usually linked to calcareous rocky stands more or less directly affected by sea factors, within the infra-thermo mediterranean belts (Brullo & Marcenò, 1973; Zahran & Willis, 1992).

Syndynamism: The communities belonging to this syntaxon colonize the coastal belt closer to the sea, but some of them grow also in inner stands, where take catenal contact with the coastal maquis.

Habitat reference: See class.

15.1.3.1. ***Limonietum lopadusani*** Bartolo, Brullo, Minissale & Spampinato 1990

Sub-halophilous and xerophilous coastal vegetation with Lampedusa sea lavender.

Holotypus: rel. 4, tab. 5, Bartolo et al. (1990).

Characteristic and differential species: *Allium hemisphaericum* (Sommier) Brullo, *Limonium lopadusanum* Brullo.

Phytosociological table: From Bartolo et al. (1990a), tab. 5, 24 rel.

Char. association: *Limonium lopadusanus* (V), *Allium hemisphaericum* (III).

Char. alliance: *Crucianella rupestris* (IV), *Hypericum aegypticum* subsp. *webbii* (III).

Char. order and class: *Reichardia crassifolia* (V), *Lotus cytisoides* (V), *Frankenia hirsuta* (IV), *Sonchus asper* subsp. *glaucescens* (III), *Crithmum maritimum* (II), *Silene sedoides* (II), *Thymelaea hirsuta* (I), *Allium commutatum* (I).

Other species: *Anthemis lopadusana* (IV), *Catapodium balearicum* (IV), *Senecio leucanthemifolius* (III), *Daucus lopadusanus* (III), *Limbarda crithmoides* subsp. *longifolia* (III), *Euphorbia pinea* (III), *Halimione portulacoides* (II), *Parapholis incurva* (II), *Cynodon dactylon*

(I), *Rumex bucephalophorus* subsp. *aegaeus* (I), *Chiliadenus lopadusanus* (I), *Mesembryanthemum nodiflorum* (I), *Arthrocaulon meridionalis* (I).

Geographical distribution: This vegetation is widespread along the rocky coasts of Lampedusa island (Bartolo et al., 1990a; Bartolo & Brullo, 1993).

Structure and ecology: The low reefs and the coastal cliffs of Lampedusa are colonized by a peculiar community, whose physiognomy is given by the low pulvinate shrubs of *Limonium lopadusanum*, an endemic species that is exclusive of this island. This vegetation, named *Limonietum lopadusani*, occupies the belt closest to the sea and is clearly referable to the *Crucianellion rupestris* for its xerophilous character and for the high coverage of the characteristic species of this alliance, such as *Crucianella rupestris* and *Hypericum aegypticum*. Besides, the endemic *Allium hemisphaericum* and other species belonging to the *Crithmo-Limonietea* are quite frequent, such as *Reichardia crassifolia*, *Lotus cytisoides*, *Frankenia hirsuta*, *Sonchus asper* subsp. *glaucescens*, etc. The most typical aspect of this association (subass. *limonietosum*) is linked to flat rocky surfaces, where constitutes a continuous belt along the coastline. Conversely, a different aspect (subass. *halimionetosum*) is localized in the less inclined coastal cliffs with northern exposure, where there is an intense shading and a considerable atmospheric humidity. From the floristic point of view, this aspect is differentiated by the dominance of *Halimione portulacoides* and *Arthrocaulon meridionalis*.

Syndynamism: It is a permanent vegetation, that in the inner stands not directly affected by the sea is followed by the *Chiliadenetum lopadusani*.

Habitat reference: See class.

15.1.3.2. ***Limonietum albidi*** Bartolo & Brullo 1993

Sub-halophilous and xerophilous coastal vegetation with Lampione sea lavender.

Holotypus: rel. 9, tab. 14, Bartolo & Brullo (1993).

Characteristic and differential species: *Limonium albidum* (Guss.) Pignatti.

Phytosociological table: From Bartolo & Brullo (1994), tab. 14, 9 rel.
Char. association: *Limonium albidum* (V).
Char. alliance: *Daucus rupestris* (III).
Char. order and class: *Frankenia hirsuta* (IV), *Allium commutatum* (III).
Other species: *Arthrocaulon meridionalis* (V), *Sarcocornia fruticosa* (V), *Mesembryanthemum nodiflorum* (V), *Atriplex halimus* (IV), *Capparis spinosa* (II), *Lavatera arborea* (II).

Geographical distribution: This vegetation is restricted to Lampione, a small islet near Lampedusa (Bartolo & Brullo, 1993).

Structure and ecology: In the Lampione islet, the *Limonietum lodapusani* is replaced by a similar community, named *Limonietum albidi*, which is characterized from the floristic point of view by the dominance of the strictly endemic *Limonium albidum*. Besides, this vegetation differs from the previous one also for its ecology, being linked to older Jurassic limestones, and for the absence of *Crucianella rupestris* and *Hypericum aegypticum* subsp. *webbi*, which are very frequent in the *Limonietum lodapusani.* Conversely, its floristic set is characterized by the occurrence of some halophytes, such as *Sarcocornia fruticosa* and *Arthrocaulon meridionalis*, denoting a marked edaphic salinity.

Syndynamism: This vegetation takes catenal contact with some halo-nitrophilous communities, such as the *Lavateretum cretico-arboreae,* whose expansion is favored by a colony of gulls settled on the islet. Recently, this association is almost disappeared from the island.

Habitat reference: See class.

15.1.3.3. ***Limonietum mazarae*** Bartolo & Brullo 1993

Sub-halophilous coastal vegetation with Mazara sea lavender.

Holotypus: rel. 4, tab. 7, Bartolo & Brullo (1993).

Characteristic and differential species: *Limonium mazarae* Pignatti, *Limonium furnarii* Brullo.

Phytosociological table: From Bartolo & Brullo (1993), tab. 7, 10 rel.

Char. association: *Limonium mazarae* (V), *Limonium furnarii* (V).

Char. alliance: *Crucianella rupestris* (III).

Char. order and class: *Pallenis maritima* (V), *Crithmum maritimum* (V), *Plantago macrorrhiza* (V), *Lotus cytisoides* (IV), *Reichardia crassifolia* (IV), *Frankenia hirsuta* (III), *Daucus gingidium* (II), *Helichrysum conglobatum* (II), *Limonium virgatum* (I).

Other species: *Dactylis glomerata* subsp. *hispanica* (III), *Parapholis incurva* (III), *Catapodium balearicum* (III), *Capparis spinosa* (II), *Convolvulus lineatus* (II), *Asparagus acutifolius* (II), *Euphorbia pinea* (II), *Thymbra capitata* (II), *Sporobolus arenarius* (II), *Anthemis maritima* (I), *Arthrocaulon meridionalis* (I), *Sarcocornia fruticosa* (I), *Halimione portulacoides* (I).

Geographical distribution: This vegetation is circumscribed to the western part of Sicily, between Mazara del Vallo and Capo Granitola (Bartolo & Brullo, 1993).

Structure and ecology: The *Limonietum mazarae* is a very peculiar community, occurring in a narrow coastal stretch, which is characterized by calcarenitic outcrops and quite xeric bioclimatic conditions. Its structure is defined by the occurrence of two rare endemism, such as *Limonium mazarae* and *L. furnarii*, which grow together with *Crucianella rupestris*, *Pallenis*

maritima, *Crithmum maritimum*, *Plantago macrorrhiza*, *Lotus cytisoides*, *Reichardia crassifolia*, etc.

Syndynamism: This community is replaced inwards by the coastal shrubby community of *Crucianello rupestris-Helichrysetum conglobati*.

Habitat reference: See class.

15.1.3.4. ***Chiliadenetum lopadusani*** Bartolo, Brullo, Minissale & Spampinato 1990

Sub-halophilous and xerophilous coastal shrub vegetation with Lampedusa fleabane.

Synonyms: *Triadenio-Chiliadenetum lopadusani* Bartolo & Brullo 1993 nom. inval.

Holotypus: rel. 13, tab. 6, Bartolo et al. (1990).

Characteristic and differential species: *Apteranthes europaea* (Guss.) Plowes, *Chiliadenus lopadusanus* Brullo, *Echinops spinosissimus* Turra subsp. *spinosus* Greuter, *Oncostema dimartinoi* (Brullo & Pavone) F. Conti & Soldano.

Phytosociological table: From Bartolo et al. (1990a), tab. 6, 19 rel. (subass. *typicum*)

Char. association: *Chiliadenus lopadusanus* (V), *Echinops spinosissimus* subsp. *spinosus* (III), *Apteranthes europaea* (II)*, Scilla dimartinoi* (I).

Char. alliance: *Hypericum aegypticum* subsp*. webbii* (V), *Crucianella rupestris* (V).

Char. order and class: *Lotus cytisoides* (V), *Limonium lopadusanum* (III)*, Reichardia crassifolia* (V)*, Allium commutatum* (I), *Thymelaea hirsuta* (III), *Frankenia hirsuta* (III), *Silene sedoides* (II), *Sonchus asper subsp. glaucescens* (I).

Other species: *Thymbra capitata* (V), *Euphorbia pinea* (IV), *Convolvulus lineatus* (IV), *Charybdis pancration* (IV)*, Daucus lopadusanus* (IV), *Anthemis lopadusana* (IV), *Catapodium balearicum* (IV), *Hypochoeris achyrophorus* (III), *Hyoseris radiata* (III), *Senecio leucanthemifolius* s.l. (III), *Carlina involucrata* (III), *Eryngium dichotomum* (III), *Trachynia distachya* (III), *Parapholis incurva* (III), *Prospero autumnale* (III), *Asteriscus aquaticus* (II), *Plantago coronopus* (II), etc.

From Bartolo et al. (1990a), tab. 6, rel. 11 (subass. *dianthetosum*).

Char. association: *Chiliadenus lopadusanus* (V), *Echinops spinosissimus subsp. spinosus* (I).

Char. subassociation: *Dianthus rupicola* subsp. *lopadusanus* (V), *Sedum dasyphyllum* (V), *Melica minuta* (IV).

Char. alliance: *Hypericum aegypticum* subsp*. webbii* (V), *Crucianella rupestris* (V), *Daucus rupestris* (I).

Char. order and class: *Lotus cytisoides* (IV), *Limonium lopadusanum* (IV), *Reichardia crassifolia* (I), *Allium commutatum* (I).

Other species: *Asparagus acutifolius* (IV), *Sedum sediforme* (IV), *Roccellia* sp. (II), *Parietaria judaica* (II), etc.

Geographical distribution: This association is exclusive of Lampedusa island, where it is quite common (Bartolo et al., 1990a; Bartolo & Brullo, 1993).

Structure and ecology: Along the rocky coasts of Lampedusa, this vegetation replaces the *Limonietum lopadusani* in the inner calcareous surfaces not directly affected by sea aereosol, showing a sub-halophilous and markedly xerophilous character. Its physiognomy is given by the endemic *Chiliadenus lopadusanus*, which grow together with some species belonging to the *Crucianellion rupestris* alliance, such as *Hypericum aegypticum* subsp*. webbii* and *Crucianella rupestris*, as well as to the *Crithmo-Limonietea* class, among them *Reichardia crassifolia*, *Lotus cytisoides*, *Silene sedoides* and *Thymelaea hirsuta*. Besides, some very peculiar taxa occur in this vegetation, such as *Echinops spinosissimus* subsp. *spinosus*, *Apteranthes europaea* and *Oncostema dimartinoi*, which are considered characteristics of the *Chiliadenetum lopadusani*. According to Bartolo et al. (1990a), within this association can be recognized two subass: *typicum* linked to low rocky coast in the less inclined stands; *dianthetosum rupicolae* on the vertical sea cliffs with northern exposure, where some casmophilous species belonging to *Dianthion rupicolae* alliance (*Asplenietea trichomanis* class) occur, such as *Dianthus rupicola* subsp. *lopadusanus*, *Melica minuta* and *Sedum dasyphyllum*, despite the clear dominance of several *Crithmo-Limonietea* species.

Syndynamism: This community shows catenal contact with the *Limonietum lopadusani*, growing in the coastal belt directly affected by sea aereosol, while inwards it is followed by the *Coridothymus capitatus* coastal garrigue or the *Periploco-Euphorbietum dendroidis* maquis. In the steep south-facing marly outcrops, the subass. *dianthetosum rupicolae* is replaced by the *Salsolo oppositifoliae-Suaedetum pelagicae*, a community belonging to the *Pegano harmalae-Salsoletea vermiculatae* class (Brullo et al., 2012).

Habitat reference: See class.

15.1.3.5. ***Crucianello rupestris-Helichrysetum conglobati*** ass. nov. provv.

Sub-halophilous scrub vegetation with rocky crossworts and conglobate everlasting.

Synonyms: *Thymelaeo-Helichrysetum siculae* Bartolo & Brullo 1993 p.p.

Holotypus: rel. 7, tab. 15, Bartolo & Brullo (1993).

Characteristic and differential species: *Helichrysum conglobatum* (Viv.) Steudel.

Phytosociological table: From Bartolo & Brullo (1993), tab. 15, 7 rel.

Char. association: *Helichrysum conglobatum* (V).

Char. alliance: *Crucianella rupestris* (V).

Char. order and class: *Plantago macrorrhiza* (V), *Pallenis maritima* (V), *Reichardia crassifolia* (V), *Lotus cytisoides* (V), *Daucus gingidium* (V), *Thymelaea hirsuta* (IV), *Crithmum maritimum* (II).

Other species: *Thymbra capitata* (V), *Asperula aristata* (V), *Asparagus acutifolius* (V), *Dactylis hispanica* (V), *Teucrium luteum* (III), *Convolvulus lineatus* (III), *Schoenus nigricans* (III), *Sixalix atropurpurea* subsp. *maritima* (III), *Smilax aspera* (III), *Fumana thymifolia* (III), *Odontites rigidifolia* (III).

Geographical distribution: This community is actually known only from the rocky coast near Capo Granitola (Mazara del Vallo).

Structure and ecology: The *Limonietum mazarae* is restricted to the belt more affected by the sea, while in the inner stands is replaced by the association at issue. It was attributed by Bartolo & Brullo (1993) to *Thymelaeo hirsutae-Helichrysetum conglobati*, both dominated by *Helichrysum conglobatum*. In particular, the *Crucianello rupestris-Helichrysetum conglobati* differs from the latter for the occurrence of *Crucianella rupestris*, which allows to referred it to *Crucianellion rupestris* alliance. The floristic set of this association is enriched by the occurrence of several characteristic species of *Crithmo-Limonietea* class, such as *Pallenis maritima*, *Reichardia crassifolia*, *Lotus cytisoides*, etc.

Syndynamism: This community occupies an intermediate position between the halophylous vegetation of *Limonietum mazarae* and the inner maquis of *Chamaeropo-Quercetum calliprini*.

15.1.4. Alliance: ***Anthyllidion barbae-jovis*** Brullo & De Marco 1989

Subaerohaline casmophilous vegetation of high sea cliffs.

Holotypus: *Anthyllido-Helichrysetum litorei* Brullo & De Marco 1989.

Characteristic and differential species: *Anthyllis barba-jovis* L., *Matthiola incana* (L.) R. Br. subsp. *incana*.

Geographical distribution: This syntaxon has a central-western Mediterranean distribution, where it includes various associations, often with punctiform distribution (Brullo & De Marco, 1989; Biondi et al., 2014). In Sicily, only one community belonging to this alliance is currently known (Brullo & Minissale, 1997).

Structure and ecology: The casmophilous communities of high coastal reefs or also cliffs near the sea, in the vertical or sub-vertical uppermost sectors not directly affected by salt-spray, are classified within the *Anthyllidion barbae-jovis* alliance. It is a sub-halophilous, nanophanerophytic and chamaephytic vegetation, where several halo-tolerant species, such as *Anthyllis barba-jovis* and *Matthiola incana* subsp. *incana* find their optimum. Besides, several species belonging to *Crithmo-Limonietea* class are quite frequent in the communities of this alliance, among them *Crithmum maritimum*, *Daucus gingidium*, *Lotus cytisoides*, *Reichardia picroides* var. *maritima*, *Allium commutatum* and *Thymelaea hirsuta*. The floristic set of these communities shows a certain variability on the basis of the ecological features and geographical location, usually enriching with an endemic contingent. Previously, Biondi (2007) referred this alliance to a distinct order, proposed as *Senecetalia cinerariae*, while

Mucina et al. (2016) included it into the *Helichrysetalia italici* Biondi & Géhu in Géhu & Biondi 1994, considering the *Senecetalia cinerariae* its synonym.

Syndynamism: The communities belonging to this syntaxon represent a permanent vegetation, showing an intermediate position between *Crithmo-Limonion* associations and the coastal maquis. Conversely, the *Anthyllidion barbae-jovis* communities are replaced by the rupicolous vegetation of the *Asplenietea trichomanis* in the inner or less exposed cliffs.

Habitat reference: See class.

15.1.4.1. ***Anthyllido barbae-jovis -Erucastretum virgati*** Brullo & Minissale 1997

Subaerohaline casmophilous vegetation with jupiter's beard and twiggy dogmustard.

Holotypus: rel. 1, tab. 5, Brullo & Minissale (1997).

Characteristic and differential species: *Erucastrum virgatum* C. Presl.

Phytosociological table: From Brullo & Minissale (1997), tab. 5, 3 rel.

Char. association: *Erucastrum virgatum* (3).

Char. alliance: *Anthyllis barba-jovis* (3).

Char. order and class: *Lotus cytisoides* (3), *Limbarda crithmoides* subsp. *longifolia* (3), *Reichardia crassifolia* (1).

Other species: *Brachypodium retusum* (3), *Ampelodesmos mauritanicus* (3), *Bupleurum fruticosum* (2), *Silene vulgaris* subsp. *angustifolia* (2), *Dactylis glomerata* subsp. *hispanica* (1), *Ficus carica* (1), *Calicotome infesta* (1), *Reseda alba* (1), *Phagnalon saxatile* (1).

Geographical distribution: This vegetation occurs exclusively in a small stand near Castel di Tusa, in the North-East Sicily (Brullo & Minissale, 1997).

Structure and ecology: The only Sicilian stand of *Anthyllis barba-jovis* is located in a small vertical schistous cliff near the sea, where it characterizes a relict community attributed by Brullo & Minissale (1997) to *Anthyllido-Erucastretum virgati*. It is a poor and very disturbed vegetation, which is clearly affected by sea agents and is linked to a sub-humid thermomediterranean climate. From the floristic point of view, the class *Crithmo-Limonietea* is represented only by *Lotus cytisoides, Reichardia crassifolia* and *Limbarda crithmoides subsp. longifolia*, while *Erucastrum virgatum*, a typically rupicolous species, is very frequent.

Syndynamism: Although potentially the *Anthyllido barbae-jovis-Erucastretum virgati* is a permanent rupestrian vegetation, due to the proximity of a very busy coastal road it is affected by human pressure that determines a certain floristic impoverishment.

Habitat reference: See class.

16. Class: ***Juncetea maritimi*** Br.-Bl. in Br.-Bl., Roussine & Nègre 1952

Perennial grasslands of coastal and inland salt-marshes.

Synonyms: *Juncetea maritimi* Br.-Bl. 1931 (phantom); *Astero-Salicornietea* Westhoff et al. 1942 (art. 3b); *Juncetea maritimi* Br.-Bl. ex R. Tx. & Oberd. 1958 (art. 31); *Asteretea tripolii* Westhoff & Beeftink in Beeftink 1962.

Lectotypus: *Juncetalia maritimi* Br.-Bl. ex Horvatić 1934

Characteristic and differential species: *Carex distachya* Desf., *Carex extensa* Gooden, *Juncus acutus* L., *Juncus maritimus* Lam., *Juncus subulatus* Forssk., *Limonium narbonense* Miller, *Lotus preslii* Ten., *Puccinellia festuciformis* (Host) Parl., *Scirpoides holoschoenus* (L.) Soják, *Spartina pumila* Roth, *Tripolium pannonicum* (Jacq.) Dobrocz.

Geographical distribution: The syntaxon at issue has a wide distribution in the Euro.Atlantic and Mediterranean area (Mucina et al.,2016). In Sicily it results quite frequent in the coastal areas throughout the island and in some islets (Ferro & Furnari, 1970; Brullo & Furnari, 1971, 1976; Brullo & Di Martino, 1974; Brullo et al., 1988, 1996; Brullo & Sciandrello, 2006; Bonanno & Lo Giudice, 2009; Licandro et al., 2011).

Structure and ecology: According to Braun & Blanquet et al. (1952), the perennial communities of salt-marshes, mainly dominated by grasses and rushes, must be attributed to *Juncetea maritimi* class. It gathers the halophilous communities colonizing the surfaces with silty or sandy soils, long inundated by salty or brackish waters, occurring in coastal marshes, retrodunal wetlands, estuaries and also continental depressions. From the structural point of view, this vegetation is represented by more or less dense grasslands, dominated by one or few hemicryptophytes of big size, mainly Juncaceae (Géhu, 1987; Minissale et al., 2010; Costa et al., 2012; Biondi & Blasi 2015, Mucina et al., 2016).

Syndynamism: The communities of *Juncetea maritimi* represent a permanent vegetation, usually having catenal contacts with the psammophilous vegetation of sandy coasts or with the halophilous shrub communities of *Salicornietea fruticosae* linked to more salt waters. Moreover, they can be mixed with the annual vegetation of *Saginetea maritimae*.

Habitat reference: A2.5d Mediterranean and Black Sea coastal salt marsh; B1.8b Mediterranean and Black Sea moist and wet dune slack; C5.4 Inland saline or brackish helophyte bed.

16.1. Order: ***Juncetalia maritimi*** Br.Bl. ex Horvatić 1934

Mediterranean and thermo-atlantic tall-rush saline wetland vegetation.

Synonyms: *Juncetalia maritimi* Br.-Bl. 1931 p.p. (art. 2b); *Juncetalia maritimi* Br.-Bl. in Br.-Bl. et al. 1952; *Caricetalia extensae* Pignatti 1953; *Coeno-Halojuncetalia* Chapman 1954 (art. 2b);

Juncetalia maritimi Br.-Bl. ex R. Tx & Oberd. 1958; *Coeno-Juncetalia* Chapman 1959 (art. 2b); *Carici-Juncetalia gerradi* (Pignatti 1953) Passarge 1978 (art. 29).

Lectotypus: *Juncion maritimi* Br.-Bl. ex Horvatić 1934.

Characteristic and differential species: See class.

Geographical distribution: See class.

Structure and ecology: See class.

Syndynamism: See class.

Habitat reference: See class.

16.1.1. Alliance: ***Juncion maritimi*** Br.-Bl. ex Horvatić 1934

Mediterranean and thermo-atlantic vegetation of clayey-loamy soils under a prolonged flooding regime of brackish waters.

Synonyms: *Juncion maritimi* Br.-Bl. 1931 (art. 2b); *Juncion maritimi* Br.-Bl. in Br.-Bl. et al. 1952; *Tetragonolobion siliquosi* Pignatti 1953; *Eco-Juncion maritimi* Chapman 1954 (art. 2b); *Juncion maritimi* Chapman 1959 (art. 2b); *Apio-Juncion maritimi* Pop 1962; *Apio-Juncion maritimi* Rivas Goday & Rivas-Martinez 1963; *Glauco maritimae-Juncion maritimi* Géhu & Géhu-Franck 1984 (art. 2b); *Puccinellion festuciformis* Géhu & Scoppola in Géhu et al. 1984 (art. 31); *Limonio gmelinii-Juncion maritimi* Golub & V. Solomakha 1988; *Glauco maritimae-Juncion maritimi* Géhu 2007 (syntax. syn.).

Lectotypus: *Juncetum maritimo-acuti* Horvatić 1934.

Characteristic and differential species: See class.

Geographical distribution: The alliance at issue has a wide distribution in the Mediterranean and Euro-Atlantic territories (Costa et al., 2012; Mucina et al., 2016).

Structure and ecology: This syntaxon groups the hygrophilous communities with sub-halophilous requirements colonizing the coastal and inner environments, represented by salt marshes, river mouths and wetlands. This vegetation is linked to clayey-loamy soils, generally flooded for long periods by brackish waters, which is physiognomically dominated by some species of the genus *Juncus*, such as *J. maritimus*, *J. acutus* and *J. subulatus*, as well as by various sedges and grasses (Géhu et al., 1984a; Blasi et al., 2010).

Syndynamism: The communities belonging to the *Juncion maritimi* represent a permanent edapho-hygrophilous vegetation, occurring in stands subject to long periods of flooding. From the catenal point of view, they are in contact with the perennial halophilous communities of *Salicornietea fruticosi* and less frequently also with more or less halophilous reeds of the *Phragmito-Magnocaricetea* (Biondi et al., 2014).

Habitat reference: See class.

16.1.1.1. ***Inulo longifoliae-Juncetum maritimi*** Brullo in Brullo et al. 1988 corr.

Hygrophilous vegetation with sea rush and Mediterranean golden samphire of surfaces with a long flooding period by weakly salt waters.

Synonyms: *Inulo crithmoidis-Juncetum maritimi* Brullo in Brullo et al. 1988; *Puccinellio festuciformis-Juncetum maritimi* subass. *inuletosum crithmoidis* (Pignatti 1954) Géhu in Géhu et al. 1984; *Juncetum maritimi* auct. sic. non Rubel ex Pignatti 1953.

Holotypus: rel. 3, tab. 14, Brullo et al. (1988).

Characteristic and differential species: *Limbarda crithmoides* (L.) Dumort. subsp. *longifolia* (Arcang.) Greuter.

Phytosociological table: From Brullo et al. (1988), tab. 14, 6 rel.

Char. association: *Limbarda crithmoides* subsp. *longifolia* (V).

Char. alliance, order and class: *Juncus maritimus* (V), *Limonium narbonense* (V), *Carex extensa* (V), *Tripolium pannonicum* (V), *Juncus acutus* (III),.

Other species: *Sarcocornia fruticosa* (V), *Phragmites australis* (V), *Centaurium tenuiflorum* (V), *Melilotus sulcata* (V), *Polypogon monspeliensis* (V), *Halimione portulacoides* (IV), *Sonchus oleraceus* (IV), *Hordeum maritimum* (IV), *Parapholis incurva* (III), *Sarcocornia perennis* (II), *Plantago coronopus* (II), *Symphyotrichum squamatum* (II), *Phalaris paradoxa* (I), *Sarcocornia alpini* (I).

Geographical distribution: This association, described from the mouth of the Simeto River near Catania by Brullo et al. (1988), is widespread in the salt marshes of West and South-East Sicily (Brullo & Furnari 1971, 1976, Brullo & Ronsisvalle, 1973; Brullo, 1978; Calvo et al., 1995; Guglielmo et al. 2012) and also in other Mediterranean territories where it is a vicariant of the *Juncetum maritimi* s.l. (De Martis & Serri, 2009; Tomaselli et al., 2010a).

Structure and ecology: This vegetation colonizes the clay shores of salt marshes, which are subject to a long period of submersion by brackish waters. This vegetation, named *Inulo longifoliae-Juncetum maritimi,* can be considered a thermophilous vicariant of the *Puccinellio festuciformis-Juncetum maritimi* (Pignatti 1954) Géhu in Géhu et al. 1984, a syntaxon spread in the northern Mediterranean territories with a more humid and mesic climate. This association was previously attributed to *Juncentum maritimi* Rubel ex Pignatti 1953, distributed in European Atlantic coasts (Brullo & Furnari, 1976; Géhu et al., 1984; Brullo et al., 1988) In this vegetation several species of *Juncetea maritimi* class are frequent, such as *Limonium narbonense*, *Carex extensa*, *Juncus acutus*, *Tripolium pannonicum*, etc., as well as some transgressive taxa of *Salicornietea*, as *Sarcocornia fruticosa*, *S. alpini*, *Halimione portulacoides*, etc.

Syndynamism: The *Inulo longifoliae-Juncetum maritimi* is replaced in the stands with less humid and salter soils by shrubby communities of the *Salicornietea fruticosae*.

Habitat reference: See class.

16.1.1.2. ***Caricetum divisae*** Br.Bl. in Br.-Bl., Roussine & Nègre 1952

Hygrophilous vegetation with divided sedge of slightly salt environment.

Synonyms: ass. à *Carex divisa* et *Lotus decumbens* Br.Bl. 1931 (art. 2b, 7).

Lectotypus: Not designated.

Characteristic and differential species: *Carex divisa* Huds.

Phytosociological table: From Brullo et al. (1988), pag. 179, 1 rel.

Char. association: *Carex divisa* (1).

Char. alliance, order and class: *Juncus maritimus* (1), *Tripolium pannonicum* (1), *Limonium narbonense* (1).

Other species: *Centaurium tenuiflorum* (1), *Limbarda crithmoides* subsp. *longifolia* (1), *Parapholis filiformis* (1), *Polypogon maritimus* (1), *Hordeum maritimum* (1), *Elytrigia elongata* (1), *Sonchus oleraceus* (1), *Halimione portulacoides* (1), *Silene colorata* (1), *Trifolium squarrosum* (1), *Juncus bufonius* (1), *Anagallis arvensis* (1), *Bromus racemosus* (1).

Geographical distribution: This vegetation, having a Mediterranean distribution (Rivas-Martínez et al., 2001), in Sicily shows a scattered distribution, being known only in some salt marshes of the Hyblaean area (Brullo et al., 1996), mouth of Simeto river (Brullo et al., 1988) and also near Syracuse (Minissale et al., 2011).

Structure and ecology: The *Caricetum divisae* is an almost monophytic community, which is dominated by *Carex divisa*, growing together with few other species belonging to *Juncetea maritimi*, such as *Juncus maritimus*, *Limonium narbonense* and *Tripolium pannonicum*. This association grows in the banks of slightly salt ponds, that remain wet for long time, constituting a dense and compact vegetation (Braun-Blanquet et al., 1952).

Syndynamism: In the stands submerged for longer periods, this community is replaced by the *Inulo longifoliae-Juncetum maritimi* or *Juncetum maritimo-subulati*.

Habitat reference: See class.

16.1.1.3. ***Juncetum maritimo-acuti*** Horvatić 1934

Hygro-psammophilous vegetation with sharp rush of retrodunal stands.

Lectotypus: rel. 1, tab. 16, Horvatić (1934). here designated.

Characteristic and differential species: *Juncus acutus* L., *Tripolium pannonicum* (Jacq.) Dobrocz.

Phytosociological table: From Brullo & Sciandrello (2006), tab. 10, 6 rel.

Char. association: *Juncus acutus* (V).

Char. alliance, order and class: *Juncus maritimus* (V), *Carex extensa* (IV), *Lotus preslii* (V), *Scirpoides holoschoenus* (V).

Other species: *Phragmites australis* (V), *Symphyotrichum squamatum* (V), *Juncus subulatus* (V), *Lippia nodiflora* (V), *Atriplex prostrata* (V), *Tamarix gallica* (V), *Typha angustifolia* (V), *Cyperus laevigatus* subsp. *distachyos* (V), *Sonchus asper* (IV), *Samolus valerandi* (IV), *Polypogon monspeliensis* (IV), *Persicaria lapathifolia* (II), *Dorycnium rectum* (II), *Schoenoplectus tabernaemontani* (II), *Calystegia sylvatica* (II), *Persicaria maculosa* (I), *Carex otrubae* (I).

Geographical distribution: This community, described from the Dalmatian coasts (Horvatić, 1964, 1963), was later recorded from several localities of northern Mediterranean area (Biondi, 1986; Sarika, 2012; Fanelli et al., 2015). In Sicily, it occurs in the coastal marshes of southern and eastern part, such as mouth of Simeto river (Brullo et al., 1988), Marinello lakes (Licandro et al., 2011), Biviere di Gela (Brullo & Sciandrello, 2006) and Hyblaean marshes (Guglielmo et al., 2012). Besides, it was surveyed also in the Aeolian islands (Brullo & Furnari, 1990).

Structure and ecology: The association, colonizing the sandy and humid surfaces of retrodunal stands, is dominated by *Juncus acutus*, wich grows together with several other taxa of the *Juncetea maritimi*, such as *Tripolium pannonicum*, *Juncus maritimus*, *Carex extensa*, *Lotus preslii*, *Scirpoides holoschoenus*, etc. These hemicryptophytes, having usually a large size, characterizes a vegetation linked to soils subject to short flooding periods and with slight halophilous requirements. For its ecology, the *Juncetum maritimo-acuti* can be considered a transitional aspect between the *Plantaginion crassifoliae* associations, which are linked to sandy soils but in conditions of greater edaphic xericity, and the more hygrophilous vegetation of *Juncion maritimi*.

Syndynamism: This association takes an intermediate position between the psammophilous communities of *Euphorbio paraliae-Ammophiletea* and the markedly halophilous vegetation of *Salicornietea fruticosae*, or sometimes with the *Phragmito-Magnocaricetea* communities (e.g. *Typho-Schoenoplectetum glauci)* in less halophilous stands.

Habitat reference: See class.

16.1.1.4. ***Limonio virgati-Juncetum acuti*** Brullo & Di Martino ex Brullo & Furnari 1976

Halo-psamophilous vegetation with violet sea-lavender and sharp rush.

Synonyms: *Limonio virgati-Juncetum acuti* Brullo & Di Martino 1974, (art. 3b).

Holotypus: rel. 3, tab. 11, Brullo & Di Martino (1974).

Characteristic and differential species: *Juncus acutus* L., *Limonium virgatum* (Willd.) Fourr.

Phytosociological table: From Brullo & Di Martino (1974), tab. 11, 6 rel.

Char. association: *Juncus acutus* (V), *Limonium virgatum* (V).

Char. alliance, order and class: *Juncus maritimus* (V), *Schoenus nigricans* (III), *Limonium narbonense* (I).

Other species: *Limbarda crithmoides* subsp. *longifolia* (V), *Blackstonia perfoliata* (V), *Sporobolus virginicus* (V), *Anagallis arvensis* (III), *Phragmites australis* (III), *Halimione portulacoides* (II), *Sarcocornia fruticosa* (II), *Asparagus acutifolius* (II), *Oglifa gallica* (II), *Thapsia garganica* (II), *Silene colorata* (II), *Panicum repens* (II), etc.

Geographical distribution: Currently, this vegetation is known only for western and southern Sicily, where is strictly linked to coastal salt marshes (Brullo & Di Martino, 1974; Brullo & Furnari, 1976).

Structure and ecology: The association replaces the *Juncetum maritimo-acuti* in sandy stands with a more marked edaphic xericity. It is differentiated by *Juncus acutus*, dominant species, which grows together with *Limonium virgatum,* an halophilous species favored by quite dryed sands. This vegetation was provisionally described by Brullo & Di Martino (1974) as *Limonieto-Juncetum acuti* and later validly described in Brullo & Furnari (1976). It occurs in the retrodunal depressions or in the banks of salt-marshes, preferring surfaces with a short flooding period. From the floristic point of view, some species typical of *Juncetea maritimi* class occur, such as *Juncus maritimus*, *Carex extensa*, *Schoenus nigricans*, *Scirpoides holoschoenus*, etc., as well as some transgressive plants belonging to *Salicornietea* communities, which grow nearby.

Syndynamism: Usually, the *Limonio virgati-Juncetum acuti* grows between the psammophilous communities of *Ammophiletea* and the more halo-hygrophilous ones of *Salicornietea*, which colonizes the surfaces with a longer flooding period.

Habitat reference: See class.

16.1.1.5. ***Spartino versicoloris-Juncetum maritimi*** O. Bolòs 1962

Hygro-psammophilous vegetation with Mediterranean cordgrass of retrodunal stands.

Lectotypus: rel. 2, tab. 54, O. Bolòs (1962). here designated.

Characteristic and differential species: *Spartina pumila* Roth (=*Spartina versicolor* Fabre).

Phytosociological table: From Brullo & Di Martino (1974), tab. 10, 12 rel.

Char. association: *Spartina pumila* (V).

Char. alliance, order and class: *Juncus maritimus* (V), *Juncus acutus* (V), *Schoenus nigricans* (V), *Scirpoides holoschoenus* subsp. *australis* (I),

Other species: *Limbarda crithmoides* subsp. *longifolia* (V), *Asparagus acutifolius* (V), *Arthrocaulon meridionalis* (V), *Elytrigia elongata* (IV), *Limonium virgatum* (III), *Sporobolus virginicus* (II), *Lotus creticus* (II), *Lygeum spartum* (II), *Blakstonia serotina* (II), *Cakile maritima* (II), *Cynodon dactylon* (I), *Limoniastrum monopetalum* (I), *Suaeda vera* (I), *Gladiolus italicus* (I).

Geographical distribution: This syntaxon, described by Bolòs (1962) from Iberian Peninsula, in Sicily was recorded from the Isola Grande dello Stagnone near Marsala (Brullo & Di Martino, 1974), Capo Feto near Mazara del Vallo (Brullo et al., 1978) and Hyblaean salt marshes (Brullo & Furnari, 1976; Guglielmo et al., 2012).

Structure and ecology: The *Spartino versicoloris-Juncetum maritimi* is a quite rare vegetation, which is closely linked to the sandy soils of salt marshes, never flooded or only exceptionally for a very short period. The physiognomy to this community (subass. *spartinetosum*) is given by *Spartina pumila*, which constitutes dense grasslands usually mixed with some species of *Juncetea maritimi*, such as *Juncus maritimus*, *Carex extensa*, *Scirpoides holoschoenus* subsp. *australis*, etc. Besides, Brullo & Furnari (1976) identified a transitional aspect (subass. *schoenetosum*) towards the *Schoeno nigricantis-Plantaginetum crassifoliae*, characterized by the occurrence of *Schoenus nigricans* and *Plantago crassifolia*.

Syndynamism: The community at issue finds its optimum in the retrodunal stands, where it is in catenal contact towards thee dunes with the communities of *Plantaginion crassifoliae*, such as the *Schoeno nigricantis-Plantaginetum crassifolia,* and those ones more wet of the *Juncion maritimi* near the salt marshes (Brullo & Furnari, 1976).

Habitat reference: See class.

16.1.1.6. ***Juncetum subulati*** Caniglia et al. ass. nov.

Hygro-halophilous vegetation with somerset rush of surfaces flooding by slightly salt waters.

Synonyms: *Juncetum subulati* Caniglia et al. 1984, nom. inval. (art. 5).

Holotypus: rel. 5, tab. 8, Caniglia et al. (1984).

Characteristic and differential species: *Juncus subulatus* Forssk.

Phytosociological table: From Guglielmo et al. (2012), 5 rel.

Char. association: *Juncus subulatus* (V).

Char. alliance, order and class: *Limonium narbonense* (II), *Juncus acutus* (III), *Juncus maritimus* (I), *Carex extensa* (I).

Other species: *Sarcocornia alpini* (IV), *Limbarda crithmoides* subsp*. longifolia* (III), *Arthrocaulon meridionalis* (II), *Elytrigia scirpea* (II), *Polypogon monspeliensis* (I), *Halimione portulacoides* (I).

Geographical distribution: This association described by Caniglia et al. (1984) from southern Apulia, but it was not validly published since the nomenclatural type is not indicated. It was later quoted also from South-eastern Sicily (Guglielmo et al. 2012; Minissale et al., 2011; Sciandrello et al., 2014).

Structure and ecology: This vegetation replaces the *Scirpetum maritimi* in the less depressed stands, where the flooding period by slightly salt waters is shorter. It is characterized by the dominance of *Juncus subulatus*, which grows together with few other species of order and class, such as *Limonium narbonense*, *J. maritimus*, *J. acutus*, *Carex extensa* and *C. divisa* (Minissale et al., 2011; Guglielmo et al., 2012).

Syndynamism: It shows an intermediate position between the hygrophilous communities of *Phragmition australis* and those ones of *Salicornietea fruticosae*.

Habitat reference: See class.

16.1.2. Alliance: ***Plantaginion crassifoliae*** Br.-Bl. in Br.-Bl., Roussine & Negre 1952

Mediterranean halo-psamophilous vegetation of outer margins of salt marshes.

Synonyms: *Plantaginion crassifoliae* Br.-Bl. 1931 (art. 2b); *Schoenion ferruginei* Rivas Goday 1945 (art. 2b).

Lectotypus: *Schoeno nigricantis-Plantaginetum crassifoliae* Br.-Bl. in Br.-Bl., Roussine & Negre 1952.

Characteristic and differential species: *Daucus carota* L. subsp. *maritimus* (Lam.) Batt., *Juncus littoralis*, *Imperata cylindrica* (L.) P.Beauv., *Plantago crassifolia* Forssk., *Schoenus nigricans* L., *Tripidium ravennae* (L.) H. Scholz.

Geographical distribution: This syntaxon is widely distributed in the Mediterranean area from the Iberian Peninsula to the Balkans (Biondi et al., 2014; Mucina et al., 2016).

Structure and ecology: The perennial communities of this alliance grow in the retrodunal stands in contact with the salt marshes on sandy soils, often mixed with pebbly. This vegetation has a intermediate position between the dunal systems and the halophilous communities of salt-marshes, constituting subhalophilous grasslands on surfaces briefly flooded during the winter and dry in summer (Gèhu et al., 1984a; Minissale et al., 2010; Biondi et al., 2014). Under the structural profile, cespitose or rosulate hemicryptophytes, such as *Juncus littoralis*, *Schoenus nigricans, Tripidium ravennae* and *Plantago crassifolia*, as well as rhizomatous geophytes, determine the physiognomy of this vegetation.

Syndynamism: The *Plantaginion crassifoliae* communities must be considered a permanent edaphic vegetation, having a transitional position between the psammophilous vegetation of the *Euphorbio-Ammophiletea australis* and that one of the *Juncion maritimi* of the salt marshes (Biondi et al., 2014).

Habitat reference: See class.

16.1.2.1. ***Schoeno nigricantis-Plantaginetum crassifoliae*** Br.-Bl. in Br.-Bl., Roussine & Negre 1952

Halophilous vegetation with black bog-rush and sea plantain of retrodunal stands.

Synonyms: *Schoeno nigricantis - Plantaginetum crassifoliae* Braun-Blanquet 1931 (art. 2b).

Lectotypus: Not designated.

Characteristic and differential species: *Anacamptis coriophora* (L.) R. M. Bateman, Pridgeon & M. W. Chase, *Plantago crassifolia* Forssk., *Schoenus nigricans* L., *Thymelaea passerina* (L.) Coss. & Germ.

Phytosociological table: From Brullo & Furnari (1976), pag. 29, 21 rel.

Char. association: *Schoenus nigricans* (V), *Anacamptis coriophora* (I), *Thymelaea passerina* (I).

Char. alliance: *Plantago crassifolia* (V), *Daucus carota* subsp. *maritima* (II), *Tripidium ravennae* (I).

Char. order and class: *Juncus maritimus* (IV), *Juncus acutus* (III), *Limonium narbonense* (III), *Carex extensa* (III), *Blackstonia acuminata* (III), *Scirpoides holoschoenus* subsp. *australis* (I), *Lotus preslii* (I), *Juncus littoralis* (I).

Other species: *Parapholis filiformis* (IV), *Limonium virgatum* (IV), *Limbarda crithmoides* subsp. *longifolia* (IV), *Centaurium tenuiflorum* (III), *Aeluropus lagopoides* (II), *Briza minor* (II), *Polypogon maritimus* (II), *Halimione portulacoides* (I), *Phragmites australis* (I), *Centaurium spicatum* (I), *Elytrigia elongatum* (I), *Triglochin bulbosa* (I), *Plantago coronopus* (I), *Bellardia trixago* (I), *Ononis ramosissima* (I), *Sporobolus virginicus* (I), *Trifolium campestre* (I), *Juncus bufonius* (I), *Silene colorata* (I), *Asparagus acutifolius* (I), *Centaurium pulchellum* (I), *Spartina pumila* (I), *Sarcocornia fruticosa* (I), *Sarcocornia alpini* (I), *Juncus subulatus* (I), *Orchis palustris* (I), *Suaeda spicata* (I), *Anagallis arvensis* (I), *Linum bienne* (I), *Lotus creticus* (I).

Geographical distribution: This association results widespread in the western Mediterranean area and in the Balkans (Braun-Blanquet et al., 1952; Ruci et al., 2001; Tomaselli et al., 2011; Loidi, 2017). In Sicily it occurs in the Hyblaean area and Capo Feto near Mazara (Brullo & Furnari, 1971, 1976; Sciandrello et al., 2014).

Structure and ecology: The *Schoeno nigricantis-Plantaginetum crassifoliae* finds its optimum in the retrodunal stands, which are flooded only exceptionally, preferring slightly raised sandy surfaces. From the floristic point of view, *Plantago crassifolia* and *Schoenus nigricans* are associated with the local characteristics *Anacamptis coriophora* and *Thymelaea passerina*, as well as to some higher rank taxa, such as *Imperata cylindrica*, *Tripidium ravennae*, *Juncus acutus*, *Scirpoides holoschoenus* subsp. *australis,* etc. Brullo & Furnari (1976) have identified two aspects: the first one is characterized by the dominance of *Schoenus nigricans* and occurs

in the wetter surfaces, while in more xerophilous conditions *Plantago crassifolia* become dominant and *Schoenus nigricans* is almost absent.

Syndynamism: See alliance.

Habitat reference: See class.

16.1.2.2. ***Holoschoenetum globiferi*** Pirola 1959

Halophilous vegetation with Round-headed club-rush of wet depressions with long flooding period.

Lectotypus: rel. 6, tab. 3, Pirola (1959), here designated.

Characteristic and differential species: *Scirpoides holoschoenus* (L.) Soják subsp*. globifera* (L.f.) Soják

Phytosociological table: From Pirola (1959), tab. 3, 10 rel.; Brullo et al. (1988), tab. 16, 4 rel.
Char. association: *Scirpoides holoschoenus* subsp*. globifera* (IV).
Char. alliance: *Tripidium ravennae* (IV), *Schoenus nigricans* (II), *Plantago crassifolia* (I).
Char. order and class: *Juncus acutus* (V), *Carex extensa* (II), *Juncus maritimus* (II), *Tripolium pannonicum* (II), *Juncus littoralis* (II).
Other species: *Paspalum distichum* (V), *Dittrichia viscosa* (IV), *Lotus creticus* (III), *Pulicaria sicula* (III), *Lippia nodiflora* (III), *Tamarix gallica* (III), *Vicia villosa* subsp. *pseudocracca* (III), *Lathyrus aphaca* (III), *Bolboschoenus maritimus* (II), *Pulicaria dysenterica* (II), etc.

Geographical distribution: The association was surveyed only in the sandy coasts near Catania (Pirola, 1959; Brullo et al., 1988).

Structure and ecology: The wet and deep depressions occurring inside the inner part of coastal dunes, where the flooding period is sufficiently long, are colonized by a hygrophilous vegetation named *Holoschoenetum globiferi*. This association is characterized by the occurrence of *Scirpoides holoschoenus* subsp. *globifera*, which grow together with some species of *Plantaginion crassifoliae*, such as *Tripidium ravennae*, *Schoenus nigricans, Juncus littoralis* and *Plantago crassifolia*, as well as with various taxa of order and class, among them *Juncus maritimus*, *J. acutus*, *Tripolium pannonicum* and *Carex extensa* (Brullo et al., 1988).

Syndynamism: Usually, the *Holoschoenetum globiferi* occurs inside the belt colonized by the *Centaureo-Ononidietum ramosissimae* and replaces the *Juncetum maritimo-acuti* in the more humid surfaces quite distant from the sea.

Habitat reference: See class.

16.1.2.3. ***Imperato cylindricae-Juncetum littoralis*** Brullo & Furnari 1976 corr.

Halophilous vegetation with cogongrass of sandy depressions, only exceptionally subject to flooding.

Synonyms: *Imperato-Juncetum tommasinii* Brullo & Furnari 1976.

Holotypus: rel. pag. 32, Brullo & Furnari (1976).

Characteristic and differential species: *Imperata cylindrica* (L.) P.Beauv., *Juncus littoralis* C.A.Mey.

Phytosociological table: From Brullo & Furnari (1976), tab. pag. 31, 28 rel.

Char. association: *Imperata cylindrica* (V), *Juncus littoralis* (V).

Char. alliance: *Daucus carota* subsp. *maritima* (IV), *Tripidium ravennae* (IV), *Scirpoides holoschoenus* subsp. *australis* (III), *Schoenus nigricans* (II), *Plantago crassifolia* (II),

Char. order and class: *Juncus acutus* (III), *Carex extensa* (III), *Lotus preslii* (II).

Other species: *Saccharum aegyptiacum* (IV), *Parapholis filiformis* (III), *Dittrichia viscosa* (III), *Centaurium spicatum* (II), *Samolus valerandi* (II), *Blackstonia acuminata* (II), *Limbarda crithmoides* subsp. *longifolia* (II), *Briza minor* (II), *Polypogon maritimus* (II), *Panicum repens* (II), *Lippia nodiflora* (I), *Launaea resedifolia* (I), etc.

Geographical distribution: This vegetation occurs in South-Eastern Sicily (Brullo & Furnari, 1976; Bartolo et al., 1982; Brullo & Sciandrello, 2006). More recently, it has been reported also for Central Italy (Pirone et al., 2009).

Structure and ecology: The *Imperato cylindricae-Juncetum littoralis* represents a thermophilous and slightly halo-hygrophilous vegetation, linked to retrodunal stands normally not subject to flooding, colonizing also the the outermost sandy margins of the salt marshes (Brullo & Furnari, 1976). The physiognomy of this vegetation is given by *Imperata cylindrica*, a stoloniferous hemicryptophyte which tends to form extensive perennial grasslands together with others hemicriptophytes of *Juncetea maritimi*, as *Juncus littoralis*, *Scirpoides holoschoenus* subsp. *australis*, *Lotus preslii*, *Daucus carota* subsp. *maritimus*, etc. (Brullo & Sciandrello, 2006).

Syndynamism: This association can be considered a transitional community between the psammophilous vegetation of *Euphorbio paraliae-Ammophiletea australis* class and the halo-hygrophilous aspects of *Juncion maritimi*, and in particular it replaces the *Juncetum maritimo-acuti* in the external and raised surfaces, where the flooding period is almost or totally absent. Moreover, as the level of nitrophily in the soil increases, it can be replaced by the *Lippio-Panicetum repentis* (Brullo & Sciandrello, 2006).

Habitat reference: See class.

17. Class: ***Salicornietea fruticosae*** Br.-Bl. & R. Tx. ex A. Bolòs y Vayreda & O. Bolòs in A. Bolòs y Vayreda 1950

Halo-succulent perennial woody vegetation of the salt marshes.

Synonyms: *Puccinellio-Salicornietea* Topa 1939 p.p. (art. 3f); *Salicornietea* Br.-Bl. & R. Tx. 1943 (art. 2b); *Sarcocornietea futicosae* Br.-Bl. & R. Tx. ex A. Bolòs y Vayreda 1950 *nom. mut. propos.; Puccinellio-Salicornietea* Topa ex Pignatti 1953; *Salicornietea* Br.-Bl. & R. Tx. in Br.-Bl. et al. 1952; *Salicornietea fruticosae* Br.-Bl. in R. Tx. & Oberd. 1958 (art. 31); *Arthrocnemetea fruticosi* Br.-Bl. & R. Tx. 1943 corr. O. Bolòs 1967.

Lectotypus: *Salicornietalia fruticosae* Br.-Bl. 1933.

Characteristic and differential species: *Halimione portulacoides* L., *Limbarda crithmoides* (L) Dumort., *Limonium virgatum* (Willd.)Fourr:, *L. narbonense* Mill., *L. bellidifolium* (Gouan) Dumort., *Puccinellia festuciformis* (Host) Parl. s.l.*.*, *Sarcocornia fruticosa* (L.) A.J. Scott., *S. alpini* (Lag.) Rivas-Martinez., *Trigochin barrelieri* Loisel.

Geographical distribution: This syntaxon results widely distributed in the Mediterranean and Thermo-Atlantic territories (Rivas-Martınez et al., 2011).

Structure and ecology: The *Salicornietea fruticosae* class includes the perennial plant communities of coastal salt marshes, lagoons, estuaries and also inland areas, in the arid to dry bioclimatic range from infra- to supra-mediterranean belts (Biondi & Blasi 2015). It is a low woody vegetation, whose physiognomy is given by succulent Chenopodiaceae with a chamaephytic or nanophanerophytic habitus, which are linked to halomorphic soils periodically flooding by salt waters. Floristically, this vegetation is quite impoverished, sometimes monotypic, since high salinity and low soil oxygen represent very important stress factors for many species, reducing species richness in the salt marsh so that only few salt tolerant plants can cover large surfaces in inner salt deserts (Gèhu et al., 1984a; Adam, 1990; Tomaselli & Sciandrello, 2017). However, they colonizes only small coastal surfaces in Sicily, constituting several concentric belts around the salt-marshes, which depend by a gradient of salinity and soil moisture and in particular by the flooding period (Minissale et al., 2010). In fact, the diminishing influence of the sea moving landwards determines the occurrence of different zones parallel to the coast, which are themselves affected by micro-relief and flooding periodicity, resulting in a variety of specialised communities (Deil 2000; Cutini et al., 2010). As regards the nomenclatural aspects, Rivas-Martinez et al. (2002) suggested the name change for this class in *Sarcocornietea futicosae*. According to Mucina et al. (2016), this proposal can not be accepted, since the genus *Sarcocornia* is paraphyletic to *Salicornia* (Kadereit et al. 2007).

Syndynamism: The shrubby vegetation of *Salicornietea fruticosae* represents a permanent vegetation, usually not subjected to dynamic-successional phenomena, often forming distinct mosaics with various kinds of halophilous communities, including the annual vegetation of *Saginetea maritimae* and *Thero-Salicornietea*, as well as the hemicryptophytic vegetation of

Juncetea maritimi, etc. Besides, in the deeper lagoon and marshes it should be in catenal contact with the *Ruppietea* and *Phragmito-Magnocaricetea* vegetation.

Habitat reference: A2.5d Mediterranean and Black Sea coastal salt marsh.

17.1. Order: ***Salicornietalia fruticosae*** Br.-Bl. 1933

Halo-succulent perennial woody vegetation of coastal and inland salt marshes periodically flooded.

Synonyms: *Salicornietalia fruticosae* Br.-Bl. 1931 (art. 2b); *Sarcocornietalia fruticosae* Br.-Bl. 1933 nom. mut. propos.*; Limonieto-Salicornietalia* Pignatti 1952; *Limonio-Salicornietalia* Pignatti 1953; *Coeno-Salicornietalia* Chapman 1959 p.p. (art. 3d); *Arthrocnemetalia fruticosi* Br.-Bl. 1931 corr. O. Bolòs 1967 (art. 2b).

Lectotypus: *Salicornion fruticosae* Br.-Bl. 1933.

Characteristic and differential species: See class.

Geographical distribution: See class.

Structure and ecology: The *Salicornietalia fruticosae* is the more differentiated and structured order of *Salicornietea fruticosae* occurring in Sicily and gathers the halophilous or hyper-halophilous vegetation with succulent woody Chenopodiaceae of temporarily flooded surfaces. It includes various alliances, whose communities differs, apart from floristically, mainly for their ecological requirements and in particular for duration of flooding period and degree of salinity (Minissale et al., 2010).

Syndynamism: See class.

Habitat reference: See class.

17.1.1. Alliance: ***Salicornion fruticosae*** Br.-Bl. 1933

Halo-succulent perennial vegetation dominated by shrubby glasswort of salt marshes.

Synonyms: *Salicornion fruticosae* Br.-Bl. 1931 (art. 2b); *Sarcocornion fruticosae* Br.-Bl. 1933 nom. mut. propos.; *Salicornion fruticosae* Br.-Bl. in Br.-Bl. et al. 1952*; Halo-Puccinellion* Pignatti 1952*; Halo-Puccinellion* Pignatti 1953*; Eco-Fruti-Salicornion* Chapman 1954 (art. 3d); *Arthrocnemion fruticosi* Br.-Bl. 1931 corr. O. de Bolòs 1967 (art. 2b)*; Halimionion portulacoidis* Gèhu 1976; *Puccinellio maritimae-Halimionion portulacoidis* Géhu & Biondi 1995.

Lectotypus: *Limonio bellidifoliae-Salicornietum fruticosae* Br.-Bl. 1933.

Characteristic and differential species: *Sarcocornia fruticosa* (L.) A.J. Scott.

Geographical distribution: See class

Structure and ecology: This alliance includes the halophilous scrub communities of loamy-clayey soils, scarcely draining, flooded usually for long periods by salt waters. Physiognomically, it is dominated by *Sarcocornia fruticosa* (Biondi et al., 2014).

Syndynamism: See class.

Habitat reference: See class.

17.1.1.1. ***Junco subulati-Sarcocornietum fruticosae*** Brullo & Furnari 1990

Halo-succulent shrub vegetation with shrubby glasswort and somerset rush of salt marshes with loamy-clayey soils.

Synonyms: *Salicornietum fruticosae* Brullo & Ronsisvalle 1973 non Br.-Bl. 1933; *Arthocnemo-Juncetum subulati* Brullo & Furnari 1976 subass. *salicornietosum* Brullo & Furnari 1976.

Holotypus : rel. pag. 15 subass. c, Brullo & Furnari (1976).

Characteristic and differential species: *Juncus subulatus* Forssk.

Phytosociological table: From Brullo & Furnari (1976), tab. pag. 13 subass. c, 144 rel.
Char. association: *Juncus subulatus* (IV).
Char. alliance: *Sarcocornia fruticosa* (V),
Char. order and class: *Arthrocaulon meridionalis* (IV), *Limonium narbonense* (IV), *Halimione portulacoides* (III), *Sarcocornia alpini* (III), *Triglochin barrelieri* (II), *Limbarda crithmoides* subsp. *longifolia* (II), *Limonium virgatum* (I), *Limonium pachynense* (I), *Aeluropus repens* (I), *Spergularia marina* (I), *Elytrigia scirpea* (I).
Other species: *Phragmites australis* (III), *Parapholis filiformis* (III), *Polypogon monspeliensis* (II), *Juncus maritimus* (II).

Geographical distribution: This vegetation occurs in the central and southern Mediterranean area (Brullo & Furnari, 1990). In Sicily it was surveyed in the south-eastern salt-marshes (Brullo et al., 1996; Guglielmo et al., 2012), near Gela (Brullo et al., 1998; Guarino et al., 2008) and at the mouth of the Salso river near Licata (Bonanno, 2008).

Structure and ecology: This association colonizes the temporarily flooded shores of coastal salt marshes with loamy-clayey surfaces. It is dominated by *Sarcocornia fruticosa*, wich grows together with *Juncus subulatus*. This community is usually replaced in the northern Mediterranean by the *Puccinellio festuciformis-Sarcocornietum fruticosae* (Br.-Bl. 1933) Géhu 1976.

Syndynamism: It is a permanent vegetation linched to halomorphic soils submerged for long periods, sometimes relegated to the margins of artificial channels (Guarino et al., 2008). From the catenal point of view, this vegetation takes contact in the longest flooded stands with

communities dominated by *Sarcocornia alpini*, while in the surfaces not or rarely subject to submersion by the *Agropyro scirpei-Inuletum crithmoidis* (Brullo et al., 1998).

Habitat reference: See class.

17.1.2. Alliance: ***Sarcocornion alpini*** (Rivas-Martínez et al. 1990) Brullo, Giusso, Minissale, Siracusa & Spampinato 2002

Perennial halophylous shrub vegetation with perennial glasswort of salt marshes with a very long flooding period .

Synonyms: *Sarcocornienion alpini* Rivas-Martínez, Lousa, T.E. Diaz, Fernández-González & J.C. Costa 1990; *Sarcocornienion deflexae* Rivas-Martínez, Lousã, T.E. Díaz, Fernández-González & J.C. Costa 1990 corr. Géhu & Biondi 1995 (art. 29);

Holotypus: *Halimiono portulacoidis-Sarcocornietum alpini* Rivas-Martínez & Costa 1984.

Characteristic and differential species: *Sarcocornia alpini* (Lag.) Rivas Martinez (= *Salicornia perennis* auct. fl. medit. non Miller)

Geographical distribution: This alliance is widespread in the Mediterranean territories (Rivas Martinez et al 2011).

Structure and ecology: Compared to *Salicornion fruticosae*, the *Sarcocornion alpini* gathers the communities linked to surfaces submerged for very longer period. From the physiognomical point of view, it is characterized by the occurrence of *Sarcocornia alpini*, species closely related to *S. perennis* distributed in the European-Atlantic coasts, both characterized by a reptant habit, with woody branches rooting at the nodes. This vegetation, colonizing halomorphic soils, constitutes dense populations, sometimes almost monophytic (Brullo et al., 2002; Biondi et al., 2014).

Syndynamism: The association of this alliance are permanent community belonging to halophilous geosigmeta of coastal salt marshes, which are localizzed in the central part of the depressions, between the annual vegetation of the *Thero-Salicornietea* and that one with *Sarcocornia fruticosa* or *Arthrocaulon meridionalis*.

Habitat reference: See class.

17.1.2.1. ***Aeluropo lagopoidis-Sarcocornietum alpini*** Brullo in Brullo et al. 1988 corr. Barbagallo et al. 1990

Hyper-halophilous vegetation with perennial glasswort and mangrove grass of salt marshes.

Synonyms: *Aeluropo-Sarcocornietum perennis* Brullo in Brullo et al. 1988.

Holotypus: Rel. 5, tab. 7, Brullo et al. (1988).

Characteristic and differential species: *Aeluropus lagopoides* (L.) Thwaites

Phytosociological table: From Brullo et al. (1988), tab. 7, 5 rel.
Char. association: *Aeluropus lagopoides* (V).
Char. alliance: *Sarcocornia alpini* (V).
Char. order and class: *Halimione portulacoides* (V), *Limonium narbonense* (III), *Limbarda crithmoides* subsp. *longifolia* (II), *Triglochin barrelieri* (I), *Arthrocaulon meridionalis* (I), *Juncus subulatus* (I).
Other species: *Parapholis filiformis* (III), *Phragmites australis* (III), *Hordeum marinum* (II), *Polypogon monspeliensis* (II), *Melilotus sulcata* (II), *Suaeda vera* (I), *Plantago coronopus* (I), *Spergularia marina* (I), *Salicornia emerici* (I), *Suaeda spicata* (I), *Juncus acutus* (I), *Centaurium spicatum* (I).

Geographical distribution: This vegetation occurring in Tunisia and Cyrenaica (Brullo & Furnari, 1988; Barbagallo et al., 1990), in Sicily is recorded from the salt marshes of the Hyblaean area, mouth of the Simeto river and Gela (Brullo & Furnari, 1976; Brullo et al., 1988, 1998; Guarino et al., 2008).

Structure and ecology: The association occurs along the innermost belt of the coastal salt marshes, which are flooded for a long time. It is dominated by *Sarcocornia alpini* and is differentiated by *Aeluropus lagopoides*, a xerophytic grass that emphasized the thermophilous requirements of this vegetation (Brullo et al., 1988).

Syndynamism: In the surfaces with a longer flooding period this association is replaced by the *Arthrocnemo-Salicornietum emerici* (O.Bolòs 1962) J.-M. & J.Géhu 1978, while the raised places are colonized by the *Junco subulati-Sarcocornietum fruticosae*, which prefers a shorter flooding period (Brullo et al., 1988).

Habitat reference: See class.

17.1.2.2 ***Junco subulati-Sarcocornietum alpini*** Brullo & Sciandrello in Giusso et al. 2008

Halophilous vegetation with perennial glasswort and somerset rush of silty-clay soils.

Holotypus: rel. 6, tab. 6, Giusso et al. (2008).

Characteristic and differential species: *Juncus subulatus* Forssk.

Phytosociological table: From Guglielmo et al. (2012), 15 rel.
Char. association: *Juncus subulatus* (V).
Char. alliance: *Sarcocornia perennis* subsp. *alpini* (V).

Char. order and class: *Arthrocaulon meridionalis* (III), *Limbarda crithmoides* subsp. *longifolia* (III), *Halimione portulacoides* (II), *Elytrigia scirpea* (II), *Limonium narbonense* (I), *Limonium virgatum* (I).

Other species: *Bolboschoenus maritimus* (II), *Phragmites australis* (I), *Polypogon monspeliensis* (I), *Cressa cretica* (I), *Medicago ciliaris* (I), *Parapholis filiformis* (I), *Salicornia emerici* (I), *Suaeda spicata* (I), *Soda inermis* (I).

Geographical distribution: The community, firstly surveyed at the mouth of the Salso river by Giusso et al. (2008), occurs also in the salt-marshes of South-Eastern Sicily (Guglielmo et al., 2012).

Structure and ecology: In more mesic conditions the *Aeluropo lagopoidis-Sarcocornietum alpini* is replaced by another communty with *Sarcocornia alpini*, which is clearly differentiated for the absence of *Aeluropus lagopoides*. The latter, indicated as *Junco subulati-Sarcocornietum alpini*, is differentiated by the occurrence of *Juncus subulatus*, which grows inside the dense populations of *Sarcocornia alpini.* This vegetation is linked to silty-clay soils, subject to a long winter flooding and which remains wet also during the summer season (Giusso et al., 2008).

Syndynamysm: In the outer surfaces with a shorter flooding period, this community is replaced by the *Junco subulati-Sarcocornietum fruticosae .*

Habitat reference: See class.

17.1.3. Alliance: ***Suaedion verae*** Brullo & Furnari 1990

Halo-subnitrophilous vegetation of soils only exceptionally submerged.

Synonyms: *Suaedenion verae* Peinado, Martínez-Parras, Bartolomé & Alcaraz 1989; *Suaedenion verae* Rivas-Martínez, Lousã, T.E. Díaz, Fernández-González & J.C. Costa 1990; *Suaedion verae* (Rivas-Martínez, Lousã, T.E. Díaz, Fernández-González & J.C. Costa 1990) Rivas-Martínez, Fernández-González & Loidi 1999 (art. 40b).

Holotypus: *Halimiono portulacoidis-Suaedetum verae* Molinier & Tallon 1970 corr. Géhu in Géhu & al. 1984.

Characteristic and differential species: *Suaeda vera* J.F. Gmel.

Geographical distribution: This alliance occurs in the Mediterranean and Atlantic coastal areas (Biondi et al., 2014).

Structure and ecology: The associations belonging to this syntaxon are localized in the highest position of the salt marshes, which are only exceptionally inundated. It is a vegetation with subnitrophilous requirements, linked to stands with a high presence of nitrates. Sometimes, its occurs also in cliffs splashed by salt water, walls of salt pans and disturbed salty soils (Costa et al., 2012). From the floristic point of view, these communities are

dominated by *Suaeda vera*, often associated with various taxa of order and class, such as *Halimione portulacoides*, *Limbarda crithmoides* subsp. *longifolia* and *Elytrigia scirpea* (Brullo & Furnari, 1988).

Syndynamism: See class.

Habitat reference: See class.

17.1.3.1. ***Halimiono portulacoidis-Suaedetum verae*** Molinier & Tallon 1970 corr. Géhu in Géhu & al. 1984

Halophilous vegetation with alkali seepweed and sea purslane of raised stands with accumulation of organic debris.

Synonyms: *Suaedetum fruticosae* Br.-Bl. 1952 (nom. inval.); *Obioneto-Suadetum fruticosae* Molinier & Tallon 1970.

Lectotypus: Not designated.

Characteristic and differential species: *Halimione portulacoides* (L.) Aellen.

Phytosociological table: From Brullo et al. (1988), tab. 10, 3 rel.
Char. association: *Halimione portulacoides* (3).
Char. alliance: *Suaeda vera* (3).
Char. order and class: *Limbarda crithmoides* subsp. *longifolia* (3), *Limonium narbonense* (2).
Other species: *Hordeum leporinum* (3), *Trachynia distachya* (3), *Moricandia arvensis* (3), *Carlina lanata* (2), *Anisantha sterilis* (2), *Centaurea napifolia* (2), *Sonchus oleraceus* (2), *Medicago polymorpha* (2), *Carduus pycnocephalus* (2), etc.

Geographical distribution: This vegetation has a wide Mediterranean and Atlantic distribution (Braun Blanquet et al., 1952; Poittier-Alapetite, 1954; Bolòs & Molinier, 1958; Bòlos, 1967; Géhu et al., 1984a). In Sicily it was surveyed near Augusta (Brullo & Ronsisvalle, 1973), in the marshes of the Hyblaean area (Bartolo et al., 1982; Guglielmo et al., 2012), at the mouth of Simeto river (Brullo et al., 1988), near Gela (Brullo et al., 1998) and Vendicari islet (Minissale & Sciandrello, 2017).

Structure and ecology: The higher stands placed on the edges of salt environments and generally not subject to inundation are colonized by a shrubby vegetation dominated by *Suaeda vera*, growing together with *Halimione portulacoides*, *Limonium narbonense*, *Limbarda crithmoides* subsp. *longifolia, Elytrigia scirpea*, etc. (Brullo et al., 1998). This community, named *Halimiono portulacoidis-Suaedetum verae*, shows a subnitrophilous character, occurring in silty-clay soils with an high amount of organic debris near coastal salt marshes, but sometimes also along the edges of paths, in the organic accumulations near the sea and embankments (Bartolo et al., 1982; Brullo et al., 1988).

Syndynamism: The *Halimiono portulacoidis-Suaedetum verae* represents the most nitrophilous community of *Salicornietea* class, often replacing the other kinds of halophilous vegetation in the more degraded and anthropized places. Besides, it can be in catenal contact with some associations of *Pegano-Salsoletea* class, which are linked to more sloped stands with a less marked halo-nitrophilous character (Bartolo et al., 1982).

Habitat reference: See class.

17.1.4. Alliance: ***Arthrocnemion glauci*** Rivas-Martínez & Costa 1984

Hyperhaline succulent chenopod scrub of salt marshes from Medierranean territories.

Synonyms: *Staticion orientale* Oberd. 1952 (art. 34a); *Arthrocnemion macrostachyi* Rivas-Mart. et M. Costa 1984 nom. mut. propos.; *Halocnemion strobilacei* Korzhenevskii & Kliukin 1990 (art. 1); *Halocnemion strobilacei* Korzhenevskii & Kliukin in Korzhenevskii 2000.

Holotypus: *Sphenopo divaricati-Arthrocnemetum macrostachyi* Br.-Bl. 1933 em. Gèhu 1984.

Characteristic and differential species: *Arthrocaulon meridionalis* Ramirez et al. (=*Arthrocnemum glaucum* auct. non (Delile) Ung.-Stern.), *Arthrocaulon macrostachyum* (Moric.) Piirainen & G.Kadereit (=*Artrocnemum macrostachyum* (Moric.)K. Koch).

Geographical distribution: This syntaxon shows a wide Mediterranean distribution (Mucina et al., 2016).

Structure and ecology: This alliance gathers the halophilous communities with *Arthrocaulon meridionalis* and *A. macrostachyum*, which are linked to halomorphic soils of salt marshes and saline. This vegetation prefers the surfaces that are submerged for much of the year, but often dry during the summer. Sometimes, these communities can colonize also the small ponds with salt water of coastal reefs (Biondi et al., 2014).

Syndynamism: The communities of this syntaxon colonize a belt interposed between the therophytic associations of *Thero-Salicornitea* and the more mature ones of the *Inulion longifoliae*.

Habitat reference: See class.

17.1.4.1. ***Arthrocauletum meridionalis-Juncetum subulati*** Brullo & Furnari 1976 corr.

Halophilous vegetation with southern glasswort and somerset rush of salt marshes.

Synonyms: *Arthrocnemo-Juncetum subulati* Brullo & Furnari 1976; *Junco subulati-Arthrocnemetum glauci* Brullo & Furnari 1976 nom. invers. propos. Tomaselli, Di Pietro & Sciandrello 2011.

Holotypus: rel. pag. 14, Brullo & Furnari (1976).

Characteristic and differential species: *Arthrocaulon meridionalis* Ramirez et al., *Juncus subulatus* Forssk., *Limonium pachinense* Brullo.

Phytosociological table: From Brullo & Furnari (1976), tab. pag. 14 subass. a, 61 rel.

Char. association: *Juncus subulatus* (IV).

Char. alliance: *Arthrocaulon meridionalis* (V).

Char. order and class: *Sarcocornia alpini* (III), *Limonium narbonense* (I), *Sarcocornia fruticosa* (I), *Triglochin barrelieri* (I), *Limbarda crithmoides* subsp. *longifolia* (I), *Spergularia marina* (I), *Elytrigia scirpea* (I).

Other species: *Parapholis filiformis* (II), *Polypogon monspeliensis* (II), etc.

Geographical distribution: This vegetation is known for Sardinia (Biondi & Bagella, 2005; De Martis & Serri, 2009), central and southern Italy (Frondoni & Iberite, 2002; Tomaselli et al., 2011), Tunisia (Barbagallo et al., 1990) and Sicily, where it is quite frequent in the salt-marshes of the south-eastern coast (Brullo & Furnari, 1976; Guglielmo et al., 2012), as well as in Capo Feto (Brullo, 1978) and at mouth of Simeto river (Brullo et al., 1988).

Structure and ecology: The *Arthrocauletum meridionalis-Juncetum subulati* colonizes the inner surfaces of salt marshes with sandy-loamy soils, subject to a more or less long flooding period. This vegetation appears quite heterogenous, according to different ecological conditions. In fact, Brullo & Furnari (1976) distinguished four subassociations: the subass. *arthrocnemetosum* is represented by almost monophytic populations of *Arthrocaulon meridionalis*, which prefers sandy surfaces with a long flooding period; the subass. *parapholidetosum* is represented by dense meadows with *Parapholis filiformis* and is linked to sandy soils, flooded only exceptionally or for short time; the subass. *salicornietosum* prefers the clay surfaces with a less halophilous character, favoring an high presence of *Sarcocornia fruticosa*; the subass. *juncetosum maritimi* is linked to clay surfaces with a low salt content and wet during the summer, where some *Juncetalia* species have their optimum. Besides, Brullo et al. (1988) identified also the subass. *suaedetosum verae*, a further aspect with a subnitrophilous character, where *Suaeda vera* shows an high coverage. This association was described by Brullo & Furnari (1976) as *Arthrocnemo-Juncetum subulati*, but according to Ramirez et al. (2019) the populations of *Arthrocnemum glaucum* occurring in Sicily and other territories of southern Mediterranean territories must be attributed to a new species proposed as *Arthrocaulon meridionalis*, basing in particular on the taxonomic revision of Piiraien et al. (2017). Besides, the relevés of the Iberian peninsula by Rivas-Martinez et al. (1980) and Costa et al. (1996) referred to *Artrocnemo-Juncetum subulati* Brullo & Furnari 1976, must be attributed according to the aforesaid taxonomic data to a different association, for which it is proposed the new name *Junco subulati-Arthrocauletum macrostachii*.

Syndynamism: Usually, this associations replaces the *Aeluropo lagopoidis-Sarcocornietum alpini* in the more raised surfaces with a shorter flooding period, while the more dry environments are occupied by the *Agropyro scirpei-Inuletum longifoliae*. In the flatter clay

surfaces it can have catenal contact with the *Schenodoro interrupti-Elytrigietum athericae*, which prefers the less humid and salty places (Brullo et al., 1988).

Habitat reference: See class.

17.1.4.2. ***Sphenopo divaricati-Arthrocauletum meridionalis*** ass. nov. provv.

Halophilous vegetation with southern glasswort of dry clay soils of salt marshes.

Synonyms: *Arthrocnemetum* Brullo & Furnari 1976 non Br.-Bl. in Br.-Bl. et al. 1952.

Holotypus: Not designated.

Characteristic and differential species: *Arthrocaulon meridionalis* Ramirez et al., *Sphenopus divaricatus* (Gouan) Rchb.

Phytosociological table: From Brullo & Furnari (1976), tab. pag. 19, 28 rel.

Char. association: *Sphenopus divaricatus* (V).

Char. alliance: *Arthrocaulon meridionalis* (V).

Char. order and class: *Halimione portulacoides* (IV), *Sarcocornia fruticosa* (III), *Sarcocornia alpini* (II), *Triglochin barrelieri* (II), *Suaeda vera* (II), *Spergularia marina* (II), *Juncus subulatus* (I), *Limonium narbonense* (I), *Limonium virgatum* (I), *Cynomorium coccineum* (I), *Limbarda crithmoides* subsp. *longifolia* (I).

Other species: *Parapholis incurva* (V), *Parapholis filiformis* (IV), *Plantago coronopus* (IV), *Frankenia pulverulenta* (IV), *Hordeum maritimum* (III), *Mesembryanthemum nodiflorum* (II), *Bupleurum glaucum* (II), etc.

Geographical distribution: In Sicily this community occurs in the Hyblaean salt marshes (Brullo & Furnari 1976; Brullo et al. 1996).

Structure and ecology: This association replaces in more xerophilous conditions the *Arthrocauletum meridionalis-Juncetum subulati*, where *Arthrocaulon meridionalis* does not grow together with *Juncus subulatus* but with some halophilous therophytes, such as *Sphenopus divaricatus* and *Frankenia pulverulenta*. Previously, this vegetation was attributed by Brullo & Furnari (1976) to the *Arthrocnemetum* Braun-Blanquet 1928 (= *Sphenopo divaricati-Arthrocnemetum glauci* Br.-Bl. 1933), syntaxon described by Braun-Blanquet (1933) from suthern France, where is localized on salty surfaces with loamy-clayey soil, which are almost dry during the summer and recorded in several localities of the western Mediterranean (Braun Blanquet, 1952; Rivas-Martinez et al., 2001; Costa et al., 2012).

Syndynamism: This community replaces the *Arthrocauletum meridionalis-Juncetum subulati* in the surfaces with a shorter flooding period.

Habitat reference: See class.

17.1.4.3. ***Aeluropo lagopoidis-Limonietum intermedi*** Bartolo, Brullo, Miniss. & Spamp. 1990

Halophilous vegetation with intermediate sea lavender of short flooding salty soils.

Holotype: rel. 2, tab. 9, Bartolo et al. (1990).

Characteristic and differential species: *Limonium intermedium* (Guss.) Brullo.

Phytosociological table: From Bartolo et al. (1990), tab. 9, 10 rel.

Char. association: *Limonium intermedium* (V).

Char. alliance, order and class: *Aeluropus lagopoides* (V), *Spergularia marina* (V), *Triglochin barrelieri* (III), *Arthrocaulon meridionalis* (II).

Other species: *Suaeda spicata* (V), *Parapholis incurva* (IV), *Sphenopus divaricatus* (IV), *Heliotropium curassavicum* (I), *Frankenia hirsuta* (I), *Atriplex latifolia* (I), *Suaeda vera* (I).

Geographical distribution: This association was reported by Bartolo et al. (1996) for Lampedusa island, where it was restricted to a small salt marsh near the port. However, due to the intense anthropization of the area during the last decades, this community is disappeared for over forty years.

Structure and ecology: The *Aeluropo lagopoidis-Limonietum intermedi* was a very peculiar community, linked to a small salty depression with a short flooding period. It is characterized by the occurrence of the endemic species *Limonium intermedium*, growing together with some species of higher rank, such as *Aeluropus lagopoides*, *Spergularia marina*, *Triglochin barrelieri* and *Arthrocaulon meridionalis*.

Syndynamism: This association in its natural habitat did not appear to have catenal contacts with other halophile communities.

Habitat reference: See class.

17.1.4.4. ***Limonio densiflori-Arthocauletum meridionalis*** ass. nov. provv.

Halophilous vegetation with dense flowered sea lavender and southern glasswort of salty marshes.

Holotypus: Not designated.

Characteristic and differential species: *Arthrocaulon meridionalis* Fuentes et al., *Limonium densiflorum* (Guss.) Kuntze

Phytosociological table: 4 rel. ined., Ronciglio near Trapani (2008).

Char. association: *Limonium densiflorum* (4).

Char. class: *Arthrocaulon meridionalis* (4), *Cynomorium coccineum* (4), *Suaeda vera* (2).

Other species: *Parapholis filiformis* (4), *Melilotus siculus* (2), *Juncus hybridus* (2), *Lotus cytisoides* (2), *Heliotropium curassavicum* (2), *Phragmites australis* (1).

Geographical distribution: This vegetation was surveyed only in the salines near Trapani.

Structure and ecology: The salty-clay surfaces of the saline walkways and surrounding areas are colonized by an halophilous community dominated by *Arthrocaulon meridionalis*, which grows together with *Limonium densiflorum*, an rare endemic species. This vegetation, proposed as *Limonio densiflori-Artrocaulonetum meridionalis*, shows marked xerophilous requirements, being linked to a very dry thermomediterranean bioclimate. Its floristic set is enriched by the rare *Cynomorium coccineum*, a halophilous parasitic plant.

Syndynamism: It is a very rare and localized community occurring at the edges of the salines, in highly salty edaphic conditions.

Habitat reference: See class.

17.1.5. Alliance: ***Inulion longifoliae*** Brullo & Furnari 1990 corr.

Communities with golden samphireof of halomorphic soils not subjected to submersion.

Synonyms: *Inulion crithmoidis* Brullo & Furnari 1990.

Holotype: *Agropyro elongati-Inuletum crithmoidis* Br.-Bl. 1952.

Characteristic and differential species: *Limbarda crithmoides* (L.) Dumort subsp. *longifolia* (Arcang.) Greuter, *Elytrigia elongata* (Host) Nevsky*, E. scirpea* (C. Presl) Holub.

Geographical distribution: This alliance has a wide Mediterranean distribution (Brullo & Furnari, 1988).

Structure and ecology: This syntaxon groups the vegetation of halomorphic soils that are not subjected to submersion, located in the outer belt of coastal salt marshes. From the floristic viewpoint, in these communities the characteristic species of order and class are quite frequent (Brullo & Furnari, 1988).

Syndynamism: The associations of this alliance usually are localized in the outer belt of the salt marshes.

Habitat reference: See class.

17.1.5.1. ***Agropyro scirpei-Inuletum longifoliae*** Brullo in Brullo et al. 1988 corr.

Vegetation with golden samphireof and flaccid leaf couch grass of salt marshes with not submerged soils.

Synonyms: *Agropyro scirpei-Inuletum crithmoidis* Brullo in Brullo et al. 1988.

Holotype: rel. 2, tab. 9, Brullo et al. (1988).

Characteristic and differential species: *Elytrigia scirpea* (C. Presl) Holub, *Limbarda crithmoides* (L.) Dumort. subsp. *longifolia* (Arcang.) Greuter.

Phytosociological table: From Brullo et al. (1988), tab. 9, 9 rel.

Char. association: *Elytrigia scirpea* (V).

Char. alliance: *Limbarda crithmoides* subsp*. longifolia* (V).

Char. order and class: *Halimione portulacoides* (IV), *Sarcocornia fruticosa* (IV), *Limonium virgatum* (IV), *Suaeda vera* (II), *Sarcocornia alpini* (I).

Other species: *Phragmites australis* (III), *Symphyotrichum squamatus* (III), *Melilotus siculus* (III), *Suaeda spicata* (III), *Juncus maritimus* (II), *Triglochin barrelieri* (II), *Oxalis pes-caprae* (II), etc.

Geographical distribution: This association is distributed in the Central Mediterranea area (Brullo et al., 1998) and in particular in southern Italy (Tomaselli et al., 2011; Medagli et al., 2013) and Sicily, where it was surveyed in several coastal localities, as Stagnone lagoon (Brullo & Di Martino, 1974), salt marshes of Hyblaean area (Brullo & Furnari, 1976; Brullo et al., 1980; Guglielmo et al., 2012), Piana del Signore and Torre Manfria near Gela (Brullo et al., 1998; Sciandrello, 2007), Torre Salsa (Giusso et al., 2008) and the mouth of Simeto river near Catania (Brullo et al., 1988).

Structure and ecology: This association occurs in the outer belt of salt-marshes and artificial channel, which are never submerged or only for short time, but still slightly humid in summer. It is a peculiar halophilous vegetation with xeric requirement. dominated by *Limbarda crithmoides* subsp. *longifolia* and *Elytrigia scirpea* (Brullo et al., 1988). This association is clearly referable to *Salicornietalia fruticosae* for the occurrence of several shrubs belonging to this order, such as *Halimione portulacoides*, *Sarcocornia fruticosa*, *S. alpini*, *Suaeda vera*, etc. Besides, Brullo & Furnari (1976) distinguished within it, apart from a typical aspect, also a subass. *juncetosum maritimi*, which is linked to eroded soils and tends towards the communities of the *Juncetalia maritimi*. From the nomenclatural point of view, this vegetation was firstly reported fron Sicily by Brullo & Di Martino (1974) as *Agropyro elongati-Inuletum crithmoidis*, but *Elytrigia elongata*, the characteristic species of this syntaxon, lacks in the island, where it is replaced by the allied *Elytrigia scirpea*, while *Limbarda crithomides*, sub *Inula crithmoides*, is represented by the subsp. *longifolia*.

Syndynamism: Usually, this community represents a quite mature halophilous vegetation of *Salicornietea* class, which tends towards the evergreen maquis of *Oleo-Ceratonion*. In the less halophilous stands with a slight nitrophilous character, it is replaced by the *Schenodoro interrupti-Elytrigietum athericae* (Brullo et al., 1988).

Habitat reference: See class.

17. 2. Order: ***Limoniastrietalia guyoniani*** Guinochet 1951

Halophilous and hiper-halophilous perennial vegetation usually rich in sea-lavender of salt marshes, salines and rarely flooded retrodunal depressions linked to dry thermo-mediterranean climate.

Synonyms: *Limonietalia* Br.-Bl. & O. Bolòs 1958; *Halocnemetalia cruciati* Biondi, Casavecchia, Estrelles & Soriano 2013.

Holotypus: *Limoniastrion guyoniani* Guinochet 1951.

Characteristic and differential species: *Halocnemum cruciatum* (Forssk.) Tod., *Limonium* sp. pl., *Limoniastrum monopetalum* (L.) Boiss., *L. guyonianum* Dur., *Lygeum spartum* L.

Geographical distribution: This order is widespread in the Mediterranean territories in coastal salt marshes, salines and inland brackish depressions. In Sicily is represented along the north-western coast between Trapani and Mazara del Vallo.

Structure and ecology: This syntaxon groups shrub communities and grassland linked to halomorphic soils of salt depressions, occurring along the coast and inland stands. This vegetation usually colonizes habitats with markedly salty soils of territories affected by dray climatic condition. Usually, the communities of this order are dominated by thermo-xerophilous shrubs, such as *Halocnemum cruciatum*, *Limoniastrum monopetalum*, *L. guyonianum* and also by *Lygeum spartum*, usually growing with several species of *Limonium.* They occur on extremely arid surfaces, especially during the summertime, within the dry-thermo-inframediterranean bioclimatic belt. Basing on literature data, the *Limoniastrietalia guyoniani* shows close relationships with the *Limonietalia* Br.-Bl. & O. Bolòs 1958, order grouping the halophilous shrubby communities and grasslands distributed in very arid Mediterranean territories. In fact, both orders include associations that share, a part from the ecology, also numerous shrub species belonging to the genera *Halocnemum*, *Limonium* and *Limoniastrum* and caespitose hemicryptophytes such as *Lygeum spartum*. Among the synonyms of the *Limoniastrietalia guyoniani* must be also included *Halocnemetalia cruciati*, a syntaxon recently described by Biondi et al. (2013), showing close ecological and floristic similarities with the order at issue. According to literature data (Rivas-Martinez et al., 2011; Biondi et al., 2014; Mucina et al., 2016), within the *Limoniastrietalia guyoniani* several alliances can be included, among them *Limonion confusi* (Br.-Bl. 1933) Rivas-Martinez & Costa 1984 (= *Staticion galloprovincialis* Br.-Bl. 1933), which is the nomenclatural type of *Limonietalia*, *Limonion catalaunico-viciosoi* Rivas-Martinez & Costa 1984, *Lygeo sparti-Limonion furfuracei* Rigual 1968, *Lygeo sparti-Lepidion cardaminis* Rivas Goday & Rivas-Martinez in Rivas-Martinez & Costa 1984, *Limonion algarvensi-lanceolati* J.C. Costa et al. 2012, *Triglochino barrelieri-Limonion glomerati* Biondi et al. 2001, *Halocnemion cruciati* Biondi et al. 2013, *Limonion pruinosi* Brullo & Furnari 1988, *Frankenion thymifoliae* Barbagallo et al. 1990, *Limonion ferulacei* (Pignatti 1953) Beefting 1968 and *Limoniastrion guyoniani* Guinochet 1951.

Syndynamism: The associations of this order represent permanent communities, often in catenal contact with therophytic ones of the *Thero-Salicornietea* or *Saginetea maritimae*.

Habitat reference: See class.

17.2.1. Alliance: ***Limonion ferulacei*** (Pignatti 1952) Beefting 1968

Thermo-Mediterranean communities with fennel sea lavender of rarely inundated and markedly arid salt marshes.

Synonyms: *Limonienion ferulacei* Pignatti 1952; *Limoniastrion monopetali* Pignatti 1952; *Limoniastrion monopetali* Pignatti 1953, p.p.

Holotype: *Sarcocornio fruticosae-Limonietum ferulacei* Pignatti 1952.

Characteristic and differential species: *Myriolepis ferulacea* (L.) Lledó, Erben & M.B. Crespo (= *Limonium ferulaceum* (L.) Chaz.).

Geographical distribution: This syntaxon is distributed in North-western Africa, Iberian Peninsula, Southern France and Sicily (Barbagallo et al., 1990).

Structure and ecology: This alliance includes marked thermophilous communities of salt marshes linked to soils only rarely submerged or for short time. Originally, it was described by Pignatti (1952) as suballiance of the *Limoniastrion monopetali*, but the latter is a very heterogeneous syntaxon including also communities of *Pegano-Salsoletea*, which was later recognized by Beefting (1968) at alliance rank.

Syndynamism: It gathers very peculiar associations with marked thermo-xeric requirements, occurring on iper-halomorphic soil of very arid territories. They are represented by permanent communities distributed in a well definited belt along the salt marshes or salines.

Habitat reference: See class.

17.2.1.1. ***Salicornio fruticosae-Limonietum ferulacei*** Pignatti 1952

Halophilous vegetation with shrubby glasswort and fennel sea lavender on dry halomorphic soils of salt marshes.

Lectotypus: rel. 11., pag. 82, Pignatti (1952), here designated.

Characteristic and differential species: *Myriolepis ferulacea* (L.) Lledó, Erben & M.B. Crespo, *Sarcocornia fruticosa* (L.) A. J. Scott.

Phytosociological table: From Brullo & Di Martino (1974), tab. 7. 20 rel.

Char. association: *Sarcocornia fruticosa* (V).

Char. alliance: *Myriolepis ferulacea* (V).

Char. order: *Halocnemum cruciatum* (I), *Limonium densiflorum* (I), *Limoniastrum monopetalum* (I).

Char. class: *Arthrocaulon meridionalis* (V), *Halimione portulacoides* (V), *Limonium narbonense* (V), *Juncus subulatus* (IV), *Limbarda crithmoides* subsp. *longifolia* (IV), *Sarcocornia alpini* (IV), *Aeluropus lagopoides* (III), *Elytrigia scirpea* (II), *Spergularia marina* (II), *Limonium virgatum* (I).

Other species: *Parapholis filiformis* (II), *Polypogon maritimus* (II), *Triglochin bulbosa* (I), *Parapholis incurva* (I), *Juncus bufonius* (I), etc.

Geographical distribution: This association was described by Pignatti (1952) for the salt-marshes of Tunisia and later reported by Brullo & Di Martino (1974) and Brullo & Furnari (1976) also for western Sicily and in particular for the salty environments near Trapani and Marsala.

Structure and ecology: The *Salicornio fruticosae-Limonietum ferulacei* is a thermophilous vegetation linked to halomorphic soils with a more or less short flooding period. In particular, Brullo & Di Martino (1974) within this association distinguished two aspects: the first one is characterized by the occurrence of *Juncus subulatus*, denoting a longer period of submersion; the second one is differentiated by the high coverage of *Myriolepis ferulacea*, which finds its optimum in the surfaces with a very short flooding period.

Syndynamism: This community occupies an intermediate position in the series related to clay soils that remains quite humid also in summer, between the *Aeluropo lagopoidis-Sarcocornietum alpini*, which is linked to wetter surfaces, and the *Agropyro scirpei-Inuletum crithmoidis*, which colonizes the more dry marginal surfaces (Brullo & Di Martino, 1974).

Habitat reference: See class.

17.2.3.2. ***Limonio dubii-Lygetum spartii*** Brullo & Di Martino 1974 corr. Brullo & Furnari 1988

Grasslands with cord grass and dubious sea lavender of salt marshes with never submerged salty soils.

Synonyms: *Limonieto-Lygetum* Brullo & Di Martino 1974.

Holotype: Rel. 4, tab 8, Brullo & Di Martino (1974).

Characteristic and differential species: *Limonium dubium* (Guss.) Litard., *Lygeum spartum* L.

Phytosociological table: From Brullo & Di Martino (1974), tab. 8, 13 rel.

Char. association: *Lygeum spartum* (V), *Limonium dubium* (V).

Char. alliance: *Myriolepis ferulacea* (III).

Char. order: *Limonium lilybaeum* (III), *Limoniastrum monopetalum* (II).

Char. class: *Limonium narbonense* (IV), *Elytrigia scirpea* (IV), *Arthrocaulon meridionalis* (III), *Sarcocornia fruticosa* (III), *Halimione portulacoides* (II), *Limonium virgatum* (II), *Limbarda crithmoides* subsp. *longifolia* (I), *Spergularia marina* (I), *Sarcocornia alpini* (I).

Other species: *Parapholis strigosa* (II), *Limonium avei* (II), *Triglochin bulbosa* (II), *Polypogon maritimus* (I), *Bupleurum semicompositum* subsp. *glaucum* (I), *Parapholis incurva* (I), etc.

Geographical distribution: This association occurs only in the Isola Grande dello Stagnone near Marsala (Brullo & Di Martino, 1974).

Structure and ecology: The surfaces never submerged at the margins of coastal salt-marshes are colonized by dense meadows with *Lygeum spartum*, *Limoniastrum monopetalum*, *Myriolepis ferulacea* and some *Limonium* species, such as *L. dubium* and *L. lilybaeum*. This community, named *Limonio dubii-Lygetum spartii*, represents a very mature stage of halophilous vegetation in xerophilous conditions (Brullo & Di Martino, 1974).

Syndynamism: This community follows the *Limoniastro-Limonietum lilybei* in the outer raised places, being replaced outwards by the coastal maquis (Brullo & Furnari, 1976).

Habitat reference: See class.

17.2.3.3. ***Limoniastro monopetali-Limonietum lilybei*** Brullo & Di Martino 1974 corr. Brullo & Furnari 1988

Halophilous vegetation with bushy sea-lavender and Marsala sea-lavender of dry soils of salt marshes.

Synonyms: Ass. a L*imoniastrum* e *Statice lychnidifolia* Frei 1937; *Limonastrieto-Limonietum siculi* Brullo & Di Martino 1974.

Holotypus: Rel. 8, tab. 9, Brullo & Di Martino (1974), here designated.

Characteristic and differential species: *Limonium lilybaeum* Brullo, *Limoniastrum monopetalum* (L:) Boiss.

Phytosociological table: From Brullo & Di Martino (1974), tab. 9, 14 rel.

Char. association: *Limonium lilybaeum* (V).

Char. alliance and order: *Limoniastrum monopetalum* (V), *Limonium densiflorum* (III), *Halocnemum cruciatum* (II).

Char. class: *Halimione portulacoides* (V), *Limbarda crithmoides* subsp. *longifolia* (V), *Arthrocaulon meridionalis* (V), *Sarcocornia alpini* (IV), *Limonium virgatum* (IV), *Sarcocornia fruticosa* (III), *Limonium narbonense* (II).

Other species: *Parapholis incurva* (V), *Parapholis incurva* (V), *Limonium avei* (III), *Polypogon maritimus* (III), *Bupleurum semicompositum* subsp*. glaucum* (II), *Sphenopus divaricatus* (II), *Spergularia media* (II), F*rankenia pulverulenta* (I), *Hymenolobus procumbens* (I), *Parapholis strigosa* (I), etc.

Geographical distribution: This association was surveyed only in the Isola Grande dello Stagnone near Marsala (Brullo & Di Martino, 1974).

Structure and ecology: The *Limoniastro monopetali-Limonietum lilybei* is linked to compact clayey soils of salt marshes, subject to a short flooding period during the winter. The rare endemic *Limonium lilybaeum* finds its optimum in this vegetation, together with *Limoniastrum monopetalum* and *Limonium densiflorum* (Brullo & Di Martino, 1974; Brullo & Furnari, 1976).

Syndynamism: This vegetation constitutes a narrow belt between the *Arthrocaulo meridionalis–Halocnemetum cruciati* and the *Limonio dubii-Lygetum spartii* (Brullo & Di Martino, 1974).

Habitat reference: See class.

17.2.1. Alliance: ***Halocnemion cruciati*** Biondi, Casavecchia, Estrelles & Soriano 2013

Hyperalophilous vegetation with clasping leaved sea purslane of dry and salty soils.

Synonyms: *Halocnemion occidentale* Br.-Bl- 1949 nom illeg. (art. 34)*, Halocnemenion strobilacei* Géhu & Costa in Géhu et al. 1984; *Zygophyllo-Arthrocnemion macrostrachyae* Géhu, Arnold, Géhu-Franck & Apostolides 1992 nom. nud. (art. 2b, 8).

Holotype: *Zygophyllo albi-Halocnemetum cruciati* Géhu et al. ex Biondi et al. 2013.

Characteristic and differential species: *Halocnemum cruciatum* (Forssk.) Tod.

Geographical distribution: This alliance occurs in southern Mediterranean area, including South Spain, Sardinia, Sicily, North Africa, South Anatolia, Cyprus, Middle East and Sinai peninsula (Biondi et al., 2013).

Structure and ecology: According to Bacchetta et al. (2012) and Biondi et al. (2013), the most populations of *Halocnemum strobilaceum* occurring in the southern Mediterranean must be attributed to *Halocnemum cruciatum*. As concerns the typical ones of *H. strobilaceum*, they are widespread in the North-East Mediterranean territories, East Europe and nortern Asia. From the phytosociological viewpoint, the Mediterranean communities characterized by *Halocnemum cruciatum* can be arranged within the *Halocnemion cruciati*, alliance described by Biondi et al (2013)*,* which is well represented along the coastal and inland salt marshes of areas with an arid to hyperarid thermo-inframediterranean bioclimate. It gathers hyperhalophilous communities dominated by nanophanerophytic shrubs, showing a marked floristic poverty. This alliance was referred by Biondi et al. (2013) to a distinct order, named *Halocnemetalia cruciati*, which was considered by Mucina et al. (2016) a synonym of *Limoniastrietalia guyoniani*. Currently, the associations referable to this alliance are the following: *Zygophyllo albi-Halocnemetum cruciati* Géhu et al. ex Biondi et al. 2013, *Arhrocaulo meridionalis-Halocnemetum cruciati* Biondi et al. 2013 corr*., Frankenio corymbosae-Halocnemetum cruciati* Rivas-Martìnez et al 1984 corr. Biondi et al 2013, *Halocnemo cruciati-Sarcocornietum fruticosae* Géhu et al 1992 corr. Biondi et al 2013.

Syndynamism: This vegetation replaces the *Arthrocnemion glauci* communities in more xerophilous environmental conditions.

Habitat reference: See class.

17.2.1.1. ***Arthrocaulo meridionalis–Halocnemetum cruciati*** Biondi, Casavecchia, Estrelles & Soriano 2013 corr.

Hyperalophilous vegetation with clasping leaved sea purslane and southern glasswort of salt marshes.

Synonyms: *Halocnemetum* Pignatti, 1952 non Topa 1939; *Halocnemetum-Parapholidetum incurvae* Brullo & Di Martino 1974; *Halocnemo-Parapholidetum filiformis* De Marco, Dinelli & Mossa, 1980; *Arthrocnemo glauci–Halocnemetum strobilacei* auct. non Oberd. 1952; *Salicornio emerici-Halocnemetum strobilacei* Brullo & Di Martino 1974 non Wolff 1968.

Holotype: rel. 5, tab. 8, Gèhu et al. (1984).

Characteristic and differential species: *Arthrocaulon meridionalis* Ramírez et al., *Halocnemum cruciatum* (Forssk.) Tod.

Phytosociological table: From Brullo & Di Martino (1974), tab. 6, 21 rel.

Char. association: *Arthrocaulon meridionalis* (V).

Char. alliance: *Halocnemum cruciatum* (V).

Char. order and class: *Sarcocornia alpini* (III), *Sarcocornia fruticosa* (III), *Limbarda crithmoides* subsp. *longifolia* (III), *Halimione portulacoides* (II), *Limonium narbonense* (II), *Limonium halophilum* (II), *Limonium virgatum* (II), *Limonium ferulaceum* (I), *Cynomorium coccineum* (I), *Aeluropus lagopoides* (I), *Elytrigia scirpea* (I).

Other species: *Spergularia marina* (V), *Sphenopus divaricatus* (IV), *Parapholis filiformis* (III), *Frankenia pulverulenta* (III), *Limonium avei* (III), *Centaurium erythraea* (III), *Juncus bufonius* (II), *Blackstonia perfoliata* (II), *Bupleurum semicompositum* subsp. *glaucum* (II), *Hymenolobus procumbens* (II), *Sagina maritima* (II), *Mesembryanthemum nodiflorum* (I), *Polypogon maritimus* (I), *Hordeum maritimum* (I), *Spergularia media* (I), etc.

Geographical distribution: This association is distributed in the southern Mediterranean area and in particular in Sardinia, Sicily, Cyprus, Turkey and North Africa (Biondi et al., 2013). In Sicily it occurs only in the western part near Trapani and Stagnone islands (Brullo & Di Martino, 1974; Brullo & Furnari, 1976).

Structure and ecology: This association represents a thermo-xeric vicariant of the *Arthrocnemo glauci–Halocnemetum strobilacei* Oberd. 1952, which is spread in the North-eastern Mediterranean territories from Greece to Black Sea (Biondi et al., 2013). In fact, in the southern Mediterranean area *Halocnemum strobilaceum* is replaced by *H. cruciatum*, well distinct from the first one for its nanophanerophytic habitus and other relevant morphological characters (Bacchetta et al., 2012, Biondi et al. 2013). The *Arthrocaulo meridionalis–Halocnemetum cruciati* is linked to compact clayey and salty soils, subject to flooding during the winter and spring period, but dry during the summer. In addition to

Halocnemum cruciatum, *Arthrocaulon meridionalis* plays an important physiognomic role, growing together with various species of order and class, such as *Sarcocornia alpini*, *Sarcocornia fruticosa*, *Limbarda crithmoides* subsp. *longifolia*, *Halimione portulacoides*, *Limonium narbonense*, etc. (Brullo & Di Martino, 1974). Within this assocciation, it is possible recognized in Sicily a variant rich in *Salicornia emerici*, previously attributed by Brullo & Di Martino (1974) to *Salicornio emerici-Halocnemetum strobilacei* Wolff 1968, originally described from Greece. It differs from the typical *Arthrocaulo meridionalis–Halocnemetum cruciati* in the absence or low coverage values of *Arthocaulon meridionalis,* while *Halocnemum cruciatum* and *Salicornia emerici* are dominant. Ecologically, it seems liked to marked soil salinity, since le surfaces are sprinkled with chloride crystals.

Syndynamism: This community belongs to a xeric series of halophilous geosygmeta, which is linked to the progressive raising of salty surfaces and dry in summer. In particular, the *Arthrocaulo meridionalis–Halocnemetum cruciati* replaces the *Halopeplideum amplexicauli* in the raised stands, leading to the *Limoniastro-Limonietum lilybei* in more evolved soils (Brullo & Di Martino, 1974).

Habitat reference: See class.

18. Class: ***Thero-Salicornietea*** (Pignatti 1953) stat. nov.

Pioneer annual vegetation dominated by therophytic glassworts of brackish marshes that are temporarily inundated and salt pans.

Synonyms: *Therosalicornienea* Pignatti 1953; *Salicornietea* Br.-Bl. & R. Tx. 1943 (art. 2b); *Cakileto-Therosalicornietea* Pignatti 1952 p.p. (art. 2b); *Cakileto-Therosalicornietea* Pignatti 1953 p.p.; *Salicornietea strictae* R. Tx. 1954 (phantom); *Thero-Salicornietea* R. Tx. 1955 (art. 2b); *Thero-Salicornietea strictae* R. Tx. in R. Tx. & Oberd. 1958 nom. inval. (art. 3f); *Thero-Suaedetea* Rivas Martinez 1972 nom. nud. (art. 2b); *Thero-Suaedetea* Vicherek 1973 (art. 31); *Thero-Salicornietea* R. Tx. ex Géhu & Géhu-Franck 1984 (art. 31); *Salicornietea europaeae* (R. Tx. in R. Tx. & Oberd. 1958) Julve 1993 (art. 29); *Thero-Suaedetea splendentis* Rivas-Martinez 1972 in Biondi et al. 2014.

Lectotypus: *Thero-Salicornietalia* Pignatti 1953.

Characteristic and differential species: *Atriplex prostrata* Boucher ex DC subsp. *latifolia* (Wahlenb) Rauschert*, Cressa cretica* L. *Salicornia* sp. pl., *Soda inermis* Fourr., *Suaeda spicata* (Willd.) Moq.

Geographical distribution: This class is widely distributed in the Eurasian territories, both in coastal and inland salt marshes (Mucina et al., 2016).

Structure and ecology: Originally, Braun Blanquet & Tùxen (1943) classified all the succulent vegetation both of annual an perennial types occurring in the salt-marshes in one class named *Salicornietea*, while Pignatti (1953) proposed to separate the annual

communities from the perennial ones. Later, this arrangment was followed by several other authors (Tüxen, 1955; Tüxen & Oberdorfer, 1958; Rivas-Martinez, 1972, 1990; Géhu & Géhu-Franck 1984; Julve, 1993; Loidi et al., 1999; Rivas-Martinez et al., 2002; Biondi et al., 2014; Mucina et al., 2016), which included this vegetation within syntaxonomical schemes, in most cases discordant with each other, listing syntaxa often represented by invalid or illegitimate names. Nomenclatural investigations have shown a remarkable confusion in the syntaxa quoted by the aforesaid authors. Basing on the literature data regarding these plant communities, it resulted that the first author who validly described syntaxa of higher order referable to it was Pignatti (1953). Indeed, this author included the vegetation at issue in a separate subclass of the *Cakileto-Therosalicornietea*, named *Therosalicornienea* (sub *Therosalicornietea*), including a new order *Therosalicornietalia* and only the alliance *Therosalicornion* Br.-Bl. 1933. As concerns the *Thero-Salicornion*, it was validly described by Braun-Blanquet (1933), who included within it three associations, of which two are new (*Suaedo maritimae-Kochietum hirsutae* and *Suaedo splendentis-Salsoletum sodae)* and one described by Burollet (1927) as *Halopeplidetum amplexicaulis*. Afterwards, Braun-Blanquet et al. (1952) changed the name of this alliance in *Thero-Suaedion*, a syntaxon already proposed by Br.-Bl. 1931 as nomen nudum. Therefore, it is considered appropriate to raise the subclass *Thero-Sarcocornienea* to the rank of class (art. 27), proposing it as *Thero-Salicornietea* stat. nov. This class is represented by only one order, *Thero-Salicornietalia*, including several alliances, which will be treated later when the order will be examined. From the floristic and structural point of view, this class gathers pioneer annual vegetation, having their optimum in summer-autumn period, which colonize the innermost surfaces of salt-marshes subject to a long flooding. This vegetation is usually quite poor, often monophytic, and dominated by annual succulent Chenopodiaceae with articulated stems, mostly belonging to the genera *Salicornia*, *Salsola*, *Suaeda*, *Soda* and *Halopeplis* (Loidi et al., 1995, 1999). The communities belonging to this class are differentiated, a part from floristic set, also for their ecological requirements. In fact, they are closely linked to the soil salinity, as well as to the submersion period, geomorphology, lithology and organic matter deposited on the surfaces.

Syndynamism: This vegetation has a pioneer character and usually occupies the first belt of halophilous vegetation in marshes, channel, drainage systems or salt pans, where the flooding period is longer. Sometimes, it represents also the first stage of the secondary successions that is estabilished after the degradation of natural vegetation, giving way to a mosaic patterns with other aspects of halophilous vegetation, such as those ones of *Juncetea maritimi* and *Salicornietea fruticosae* (Loidi et al., 1999).

Habitat reference: A2.5d Mediterranean and Black Sea coastal salt marsh.

18.1. Order: ***Thero-Salicornietalia*** Pignatti 1953

Halophylous annual coastal and continental vegetation dominated by glassworts.

Synonyms: *Salicornietalia* Br.-Bl. & R. Tx. 1943 (art. 2b); *Therosalicornietalia* Pignatti 1953 (art. 31); *Thero-Salicornietalia strictae* R. Tx. 1954 (phantom); *Thero-Salicornietalia strictae* R.

Tx. in R. Tx. & Oberd. 1958 (art. 3f); *Thero-Suaedetalia* Br.-Bl. & O. Bolos 1958; *Coeno-Salicornietalia* Chapman 1959 p.p. (art. 3d); *Salicornietalia strictae* R. Tx. 1974 (phantom); *Thero-Salicornietalia* R. Tx. ex Géhu & Géhu-Franck 1984 (art. 31); *Salicornietalia europaeae* (Pignatti 1953) Marchiori & Medagli 2008 (art. 29).

Holotypus: *Thero-Salicornion* Br.-Bl. 1933.

Characteristic and differential species: See class.

Geographical distribution: This vegetation is distributed in the Mediterranean, temperate, boreal and subarctic Europe (Mucina et al., 2016).

Structure and ecology: This order gathers the succulent therophytic communities of irregularly flooded salty surfaces in coastal and continental areas (see class). This order is represented by various alliances, such as *Thero-Salicornion* Br.-Bl. 1933 (=*Thero-Suaedion* Br.-Bl. in Br.-Bl., Roussine & Nègre 1952), lectotypified by *Suaedo maritimae-Kochietum hirsutae* Br.-Bl. 1933, *Salicornion dolichostachyo-fragilis* Géhu & Rivas-Martinez ex Géhu & Gèhu-Franck 1984, typified by *Salicornietum fragilis* Géhu & Gèhu-Franck 1982, *Salicornion europaeo-ramosissimae* Géhu & Gèhu-Franck 1984, typified by *Salicornietum pusillo-ramosissimae* Géhu 1976, *Salicornion emerici* Géhu & Gèhu-Franck 1984, typified by *Salicornietum emerici* O. Bolòs ex Brullo & Furnari 1976, *Salicornion patulae* Géhu & Géhu-Franck 1984, typified by *Suaedo-Salicornietum patulae* Brullo & Furnari ex Géhu & Géhu-Franck 1984 and *Microcnemion coralloidis* Rivas-Martinez 1984, typified by *Microcnemetum coralloidis* Rivas-Martínez in Rivas-Martínez & Costa 1976.

Syndynamism: See class.

Habitat reference: See class.

18.1.1. Alliance: ***Salicornion patulae*** Géhu & Géhu-Franck 1984

Annual communities with diploid glassworts of arid and strongly salty soils.

Synonyms: *Salicornion patulae* Géhu & Géhu-Franck ex Rivas-Martínez 1990.

Holotypus: *Suaedo spicatae-Salicornietum patulae* (Brullo & Furnari 1976) Géhu & Géhu-Franck 1984 corr.

Characteristic and differential species: *Salicornia patula* Duval-Jouve.

Geographical distribution: It is a Mediterranean vegetation, which in Italy is localized only in the coastal salt marshes (Biondi et al., 2014).

Structure and ecology: This alliance groups the communities of annual *Salicornia*, which grow on humid or inundated surfaces with strong salt concentrations. Generally, it is

characterized by diploid *Salicornia* species linked to surfaces that are almost dry in the summer.

Sindynamism: It is a permanent vegetation, which has catenal contacts with the perennial communities of *Salicornietea fruticosae*, growing in the clearings between the chenopod shrubs. Sometimes, the *Salicornion patulae* vegetation can take contact also with the *Juncetalia maritimi*.

Habitat reference: See class.

18.1.1.1. ***Suaedo spicatae-Salicornietum patulae*** Brullo ass. nov., hoc loco

Annual vegetation with samphire of salty soil dry in summer.

Synonyms: *Salicornietum patulae* Brullo & Di Martino 1974 non Christiansen 1955; *Suaedo-Salicornietum patulae* Brullo & Furnari ex Géhu in Géhu & Géhu-Franck 1984 nom. inval. (art. 5); *Suaedo vulgaris-Salicornietum patulae* Brullo & Furnari ex Géhu in Géhu & Géhu-Franck 1984 nom. inval. (art. 5); *Suaedo maritimae-Salicornietum patulae* Brullo & Furnari ex Géhu in Géhu & Géhu-Franck 1984 corr. Rivas-Martinez 1990 nom. inval. (art. 5); *Arthrocnemo glauci-Salicornietum ramosissimae* (Brullo & Furnari 1976) Géhu, Géhu Frank & Caron 1978 nom. inval. (art. 5, 44).

Suaedo spicatae-Salicornietum patulae Brullo & Furnari ex Géhu & Géhu-Franck 1984 corr. Alcaraz, Ríos, De la Torre, Delgado & Inocencio 1998

Holotypus: rel. 7, tab. 1, Brullo & Di Martino (1974), hoc loco.

Characteristic and differential species: *Salicornia patula* Duval-Jouve.

Phytosociological table: From Brullo & Furnari (1976), tab. pag. 6, 35 rel.

Char. association and alliance: *Salicornia patula* (V).

Char. order and class: *Suaeda spicata* (III), *Salicornia emerici* (II), *Soda inermis* (II), *Cressa cretica* (I).

Other species: *Arthrocaulon meridionalis* (IV), *Sarcocornia alpini* (I), *Sarcocornia fruticosa* (I), etc.

Geographical distribution: This vegetation occurs in the Mediterranean area (Géhu et al., 1984a; Barbagallo et al., 1990). In Sicily it is quite frequent in all the coastal salt marshes (Brullo & Di Martino, 1974; Brullo & Furnari, 1976).

Structure and ecology: According to literature data (Brullo & Di Martino, 1974; Brullo & Furnari, 1976; Géhu et al., 1984a; Rivas-Martinez, 1990; Barbagallo et al., 1990; Loidi et al., 1999), the Mediterranean communities physiognomically dominated by *Salicornia patula*, diploid species showing relationships with *S. ramosissima* J. Woods and *S. europaea* L., both distributed in the atlantic European coasts, are attributed to *Suaedo-Salicornietum patulae*.

This vegetation was referred by Brullo & Di Martino (1974) and after by Brullo & Furnari (1976) to *Salicornietum patulae* (Schultz 1939) Christiansen 1955, but this attribution is not correct, since according to Westhoff (1987) the association described by Christiansen (1955) was based on a mistaken identification of the *Salicornia* Atlantic population with *S. patula*, a mediterranean species, which is replaced in the Atlantic stands by *S. brachystachya* A.H.L. Huiskes. Therefore, the name *Salicornietum patulae* (Schultz 1939) Christiansen 1955 must be corrected in *Salicornietum brachystachyae* (Schultz 1939) Christiansen 1955 corr. Westhoff 1987. As concerns the Mediterranean association dominated by *S. patula* s. str., Géhu (see Gèhu & Géhu Franck, 1984) proposed mistakenly the new name *Suaedo-Salicornietum patulae* Brullo & Furnari ex Géhu in Géhu & Géhu Franck 1984, since Brullo & Furnari (1976) and even before Brullo & Di Martino (1974) don't described a new association as required the art. 44 of the Code in the case in which it is proposed a new name. Therefore, this treatment represents an invalid name, besides the typification is missing (art. 5). For the same reason, the new name *Arthrocnemo glauci-Salicornietum ramosissimae* proposed by Géhu et al. (1978-1979), basing on *Salicornietum patulae* sensu Brullo & Di Furnari 1976 non Christiansen 1955, represents an invalid name (art. 44). Later, the name proposed by Géhu & Géhu-Franck (1984) was corrected by Rivas-Martinez (1990) in *Suaedo maritimae-Salicornietum patulae*. Unfortunately, this correction is wrong, because *Suaeda maritima* in the Mediterranean territories is vicaried by *S. spicata*. Finally, this association must be considered a new association, for which the name *Suaedo spicatae-Salicornietum patulae* is here proposed. This association is linked to the inner part of saline and salt marshes, colonizing the surfaces longely submerged until late spring and dried in summer. It is localized mainly in the stands with sandy-silty soils, often covered by dried hydrophyte residues. This vegetation, often almost monophytic, shows its optimum during the summer, when the surfaces are covered by a dense population of *Salicornia patula*, usually characterized by a red color.

Syndynamism: It is a pioneer vegetation that replaces the *Ruppietea* vegetation during the summer, when the upper part of the soil is almost dry and covered by organic rests of *Ruppia* and salt crystals, but still humid in the lower part (Brullo & Di Martino, 1974).

Habitat reference: See class.

18.1.2. Alliance: ***Salicornion emerici*** Géhu & Géhu-Franck 1984

Annual communities with tetraploid glassworts of damp and strongly salty soils.

Holotypus: *Salicornietum emerici* O. Bolòs ex Brullo & Furnari 1976.

Characteristic and differential species: *Salicornia emerici* Duval-Jouve.

Geographical distribution: It is a Mediterranean and Thermo-Atlantic vegetation, in Sicily occurs in the western and south-eastern salt marshes (Brullo & Furnari, 1976).

Structure and ecology: This alliance groups the communities of annual tetraploid *Salicornia*, colonizing the long submerged stands of salt-marshes with silty-clay soils. The surfaces

remain quite wet even during the summer period and are covered by a vegetation dominated by *Salicornia emerici*.

Sindynamism: See class.

Habitat reference: See class.

18.1.2.1. ***Salicornietum emerici*** O. Bolòs ex Brullo & Furnari 1976

Annual vegetation with shiny glasswort of inundated salty soils damp in summer.

Synonyms: *Salicornietum emerici* O. Bolòs 1962 nom. provv. (art. 3b)*; Arthrocnemo glauci-Salicornietum emerici* Géhu, Géhu-Franck & Caron 1978 nom. illeg. (art. 3a, 5).

Lectotypus: rel. 3, tab. 57, Bolòs (1962), here designated.

Characteristic and differential species: *Salicornia emerici* Duval-Jouve.

Phytosociological table: From Brullo & Furnari (1976), pag. 7, 56 rel.
Char. association: *Salicornia emerici* (V).
Char. alliance: *Salicornia patula* (II).
Char. order and class: *Suaeda spicata* (II), *Soda inermis* (I), *Cressa cretica* (I), *Atriplex hastata* (I), *Atriplex littoralis* (I), *Halopeplis amplexicaulis* (I).
Other species: *Arthrocaulon meridionalis* (III), *Sarcocornia alpini* (III), *Parapholis filiformis* (I), *Polypogon maritimus* (I), *Limonium narbonense* (I), *Halimione portulacoides* (I), *Spergularia marina* (I), *Juncus subulatus* (I), *Limonium virgatum* (I), *Aeluropus lagopoides* (I), *Triglochin bulbosa* (I).

Geographical distribution: This community occurs in the central and western Mediterranean area (Bolos, 1962, 1967, 1996; Géhu et al., 1978; Géhu & Géhu-Franck, 1984). In Sicily it was surveyed in various coastal localities, including the salt-marshes of Hyblaean area, Agrigento, Augusta, Marsala, Trapani, Gela and the mouth of Simeto river (Brullo & Furnari, 1976; Brullo et al., 1988; Sciandrello, 2007).

Structure and ecology: The clay surfaces of the innermost part of coastal salt-marshes, which are subject to a long flooding period during the winter but completely dry in summer, are colonized by an halophilous vegetation with *Salicornia emerici*, an annual species with a characteristic dark green color tinged with yellow-orange. It finds the optimum during the summer season, growing together with *Arthrocaulon meridionalis*, *Sarcocornia alpini* and few other species (Brullo et al., 1988). This community was provisionally described by Bolòs (1962) as *Salicornietum emerici* and later named *Arthrocnemo-Salicornietum emerici* by Géhu & Géhu-Franck (1978).

Syndynamism: This community replaces the *Suaedo spicatae-Salicornietum patulae* in the more compact and strongly desiccated surfaces, preferring natural environments, as coastal marshes, avoiding the artificial ones, as saline and reclaimed places (Brullo & Furnari, 1976).

Habitat reference: See class.

18.1.3. Alliance: ***Thero-Salicornion*** Br.-Bl. 1933

Halo-nitrophilous and pioneer vegetation growing in surfaces rich in organic debris of lagoons and salt marshes.

Synonyms: *Thero-Suaedion* Br.-Bl. 1931 nom. nud. (art. 2b); *Thero-Suaedion* Br.-Bl. in Br.-Bl. et al. 1952; *Thero-Suaedion splendentis* Br.-Bl. in Br.-Bl et al. 1952 corr. Biondi et al. 2014.

Lectotypus: *Salsolo sodae-Suaedetum splendentis* Br.-Bl. 1933.

Characteristic and differential species: *Soda inermis* L.*, Suaeda spicata* (Willd.) Moq.

Geographical distribution: This alliance is mainly distributed in the Mediterranean area (Biondi et al., 2014). In Sicily it is widespread in many coastal salt marshes (Brullo & Di Martino, 1974; Brullo & Furnari, 1976; Sciandrello, 2007).

Structure and ecology: This alliance groups the annual halo-nitrophilous communities, which colonizes the loamy-sandy soils with an high content of nitrates and flooded by brackish waters for most of the year. In particular, this vegetation grows on deposits of organic debris in the central part of lagoons and salt marshes, sometimes also in the coastal depressions that are dry during the summer season. Under the floristic profile, it is a very poor vegetation, whose structure is given by few annual species with summer optimum, such as *Suaeda spicata*, *Soda inermis* and *Cressa cretica*.

Syndynamism: See class.

Habitat reference: See class.

18.1.3.1. ***Suaedetum spicatae*** Pignatti 1953 corr.

Summer vegetation with annual sea blite of nutrient-rich sandy or clayey soils of salt marshes.

Synonyms: *Suaedetum maritimae* Pignatti 1953.

Lectotypus: Not designated.

Characteristic and differential species: *Suaeda spicata* (Willd.) Moq. (= *Suaeda maritima* auct. fl. medit. non (L.) Dumort.).

Phytosociological table: From Brullo & Di Martino (1974), tab. 12, 6 rel.

Char. association: *Suaeda spicata* (V).

Char. order and class: *Cressa cretica* (III), *Salicornia patula* (II), *Salicornia emerici* (II), *Soda inermis* (II), *Atriplex hastata* (II).

Other species: *Spergularia marina* (V), *Arthrocaulon meridionalis* (IV), *Limbarda crithmoides subsp. longifolia* (III), *Sarcocornia fruticosa* (II), *Halocnemum cruciatum* (II).

Geographical distribution: This association occurs only in the Mediterranean area, where it replaces the *Suaedetum maritimae* Géhu & Géhu-Franck 1984 corr. (=*Suaedetum vulgaris* Géhu & Géhu-Franck 1969 nom. inval. art. 5) from the Atlantic coasts. In Sicily it was surveyed by Frei (1937), Brullo & Ronsisvalle (1973), Brullo & Di Martino (1974), Brullo & Furnari (1976) for the south-eastern and western salt-marshes. It occurs also in the Aeolian islands (Brullo & Furnari, 1990).

Structure and ecology: It occurs in the wet silty soils of salt marshes with deposits of organic matter. Physiognomically, it is characterized by the dominance of *Suaeda spicata*, a succulent halo-nitrophilous species, which constitutes an annual pioneer vegetation well adapted to slightly humid stands with salty soils rich in nitrates (Brullo & Di Martino, 1974; Brullo & Furnari, 1976).

Sindynamism: Usually, this vegetation shows catenal contacts with the perennial communities of *Salicornietea fruticosae*.

Habitat reference: See class.

18.1.3.2. ***Salsoletum sodae*** Pignatti 1953

Annual vegetation with oppositeleaf russian thistle of organic debris deposits.

Lectotypus: Not designated.

Characteristic and differential species: *Soda inermis* L. (= *Salsola soda* L.).

Phytosociological table: From Brullo & Di Martino (1974), tab. 13, 6 rel.

Char. association: *Soda inermis* (V).

Char. order and class: *Suaeda spicata* (V), *Atriplex hastata* (III).

Other species: *Spergularia marina* (IV), *Cakile maritima* (III), *Limbarda crithmoides* subsp. *longifolia* (III), *Juncus acutus* (II), *Limonium densiflorum* (I), *Polypogon maritimum* (I).

Geographical distribution: This association was surveyed in several localities of Mediterranean area (Pignatti, 1952, Corbetta & Lorenzoni 1973). In Sicily it is known for coastal places near Augusta, Trapani, Marsala, Gela and Hyblaean area (Brullo & Ronsisvalle, 1973; Brullo & Di Martino, 1974; Brullo & Furnari, 1976; Sciandrello, 2007).

Structure and ecology: The *Salsoletum sodae* is linked to salty surfaces with sandy soils, often mixed with coarse debris, rich in organic matter (*Posidonia oceanica* and seaweeds). It is

an annual, paucispecific vegetation dominated by *Soda inermis* (Brullo & Di Martino, 1974; Brullo & Furnari, 1976). Usually, it is vicaried in heavy clay-loamy soils, quite humid during the summer, by the *Suaedetum spicatae*.

Sindynamism: Compared to *Suaedetum spicatae*, the *Salsoletum sodae* shows more nitrophilous and xeric requirements, replacing it in more dry and drained soils (Brullo & Furnari, 1976).

Habitat reference: See class.

18.1.3.3. ***Cressetum creticae*** Brullo & Furnari 1976

Annual vegetation with Mediterranean bindweed of long flooded clayey-loamy soils.

Holotypus: rel. pag. 11, Brullo & Furnari (1976).

Characteristic and differential species: *Cressa cretica* L.

Phytosociological table: From Brullo & Furnari (1976), pag. 11, 11 rel.
Char. association: *Cressa cretica* (V).
Char. alliance: *Suaeda spicata* (IV), *Soda inermis* (II).
Char. order and class: *Salicornia patula* (I), *Salicornia emerici* (I).
Other species: *Sarcocornia fruticosa* (IV)*, Aeluropus lagopoides* (III)*, Limbarda crithmoides* subsp. *longifolia* (I), *Arthrocaulon meridionalis* (I), *Phragmites australis* I, *Juncus maritimus* I, *Bolboschoenus maritimus* (I)*, Chenopodium album* (I).

Geographical distribution: This association was described by Brullo & Furnari (1976) for Capo Feto and the coastal salt-marshes of south-eastern Sicily, but was surveyed also near Gela by Sciandrello (2007). Outside Sicily, it occurs in Tunisia, Corsica, Sardinia, South Italy, Spain and Croatia (Barbagallo et al., 1990; Géhu & Biondi, 1994; Galán de Mera et al., 1997; Biondi et al., 2001; Tomaselli et al., 2010b, 2011; Jasprica et al., 2015).

Structure and ecology: The *Cressetum creticae* shows its optimum in the summertime and occurs in the inner part of coastal salt-marshes, subject to a long flooding period until late spring. This vegetation is characterized by a dense population of *Cressa cretica*. It is an annual species, growing in clayey-loamy soils with organic debris, which usually is associated with other succulent halophytes, such as *Suaeda spicata*, *Soda inermis*, *Salicornia patula* and *S. emerici* (Brullo & Furnari, 1976).

Sindynamism: This community replaces the *Suaedetum spicatae* in the wetter surfaces with a lower occurrence of organic matter (Brullo & Furnari, 1976).

Habitat reference: See class.

18.1.4. Alliance: ***Microcnemion coralloidis*** Rivas-Martinez 1984

Ephemeral hyperhalophilous vegetation of temporarily wet salt-marshes in markedly xeric habitats.

Holotypus: *Microcnemetum coralloidis* Rivas-Martínez in Rivas-Martínez & Costa 1976.

Characteristic and differential species: *Halopeplis amplexicaulis* (Vahl) Ung.-Sternb., *Microcnemum coralloides* (Loscos & J.Pardo) Font Quer.

Geographical distribution: This alliance is mainly represented in the inner salt marshes of Iberian peninsula (Rivas-Martinez, 1984; Rivas-Martinez et al., 2002; Mucina et al., 2016), but occurs also in Sicily, Sardinia, Southern Italy and North Africa (Brullo & Di Martino, 1974; Brullo & Furnari, 1976, 1988; Barbagallo et al., 1990; De Martis & Serri, 2009; Minissale et al., 2010; Siletti, 2012).

Structure and ecology: The *Microcnemion coralloidis* gathers the hyperhalophilous communities of annual succulent halophytes that grow on halomorphic soils dried in the summer. This alliance was described by Rivas-Martinez (1984) from the continental salt-marshes of Spain with the only association *Microcnemetum coralloidis* Rivas-Martínez in Rivas-Martínez & Costa 1976, while later other authors included within it also the *Halopeplidetum amplexicaulis* Burollet 1927 occurring in the coastal salt-marshes with a dry infra-thermomediterranean bioclimate (Rivas-Martinez et al., 2002).

Sindynamism: In Sicily the communities of this alliance take catenal contacts with the thermo-xeric ones dominated by *Halocnemum cruciatum* or *Arthrocaulon meridionalis*.

Habitat reference: See class.

18.1.4.1. ***Halopeplidetum amplexicaulis*** Burollet 1927

Ephemeral vegetation with amplexicaul glasswort of very salty soils of salt-marshes.

Lectotypus: Not designated.

Characteristic and differential species: *Halopeplis amplexicaulis* (Vahl) Ung.-Sternb.

Phytosociological table: From Brullo & Furnari (1976), pag. 8, 18 rel.

Char. association: *Halopeplis amplexicaulis* (V).

Char. order and class: *Suaeda spicata* (III), *Salicornia patula* (III), *Salicornia emerici* (II), *Soda inermis* (I).

Other species: *Arthrocaulon meridionalis* (IV), *Halocnemum cruciatum* (II), *Spergularia marina* (II), *Parapholis incurva* (I), *Frankenia pulverulenta* (I), *Triglochin bulbosa* (I), *Polypogon maritimus* (I), *Sphenopus divaricatus* (I), *Mesembryanthemum nodiflorum* (I), *Juncus acutus* (I), *Frankenia hirsuta* (I).

Geographical distribution: This association occurs in Spain (Rivas-Martinez et al., 2002), Cyrenaica (Brullo & Furnari, 1988), Tunisia (Burollet, 1927; Barbagallo et al., 1990), Sardinia

(De Martis & Serri, 2009), Apulia (Silletti, 2012) and Sicily, where it is represented mainly in the western part, while it is rarer in the south-eastern salt marshes (Frei, 1937; Brullo & Di Martino, 1974; Brullo & Furnari, 1976; Minissale et al., 2010).

Structure and ecology: The *Halopeplidetum amplexicaulis* is localized on compact clayey soils with a high salt concentration of salt-marshes and salines. It is an annual vegetation dominated by *Halopeplis amplexicaulis*, which grows together with few other species, such as *Suaeda spicata*, *Salicornia patula*, *S. emerici* and *Soda inermis*. It shows a marked xerophilous character, colonizing the surfaces that are dry and fissured during the summer (Brullo & Furnari, 1976).

Sindynamism: The association constitutes the first stage of a xeric halophilous succession occurring in the stands with the surface covered by a layer of chloride crystals and markedly dried in summer. In fact, it colonizes the long flooded surfaces, but dry in summer, taking contact in the raised stands with the *Arthrocaulo meridionalis–Halocnemetum cruciati* or *Sphenopo divaricati-Arthrocauletum meridionalis* (Brullo & Di Martino, 1974; Brullo & Furnari, 1976).

Habitat reference: See class.

19. Class: ***Saginetea maritimae*** Westhoff, Van Leeuwen & Adriani 1962

Halo-ephemeral vegetation on clayey, loamy or rocky substrates, seasonally wet with Atlantic-Mediterranean distribution. .

Synonyms: *Saginetea maritimae* Westhoff et al. in Beeftink 1962 (art. 31); *Frankenietea pulverulentae* Rivas-Mart. in Rivas-Mart. & M. Costa 1976 (art. 2b); *Frankenietea pulverulentae* Rivas-Mart. ex Castroviejo et Porta 1976.

Holotypus: *Saginetalia maritimae* Westhoff, Van Leeuwen & Adriani 1962.

Characteristic and differential species: *Bupleurum tenuissimum* L., *Centaurium tenuiflorum* (Hoffmanns. & Link) Fritsch, *Galium verrucosum* Huds. var. *halophilum* (Ponzo) Natali & Jeanm., *Hordeum marinum* Huds., *Hornungia procumbens* (L.) Hayek, *Parapholis incurva* (L.) C.E.Hubb., *Plantago coronopus* L., *Sagina maritima* G. Don, *Spergularia marina* (L.) Besser.

Geographical distribution: This vegetation results widespread in the Mediterranean and Atlantic area (Westhoff et al. 1962; Tüxen & Westhoff, 1963; Castroviejo & Porta, 1976; Brullo, 1988; Brullo & Giusso, 2003; De Foucault & Bioret, 2010; Costa et al., 2012).

Structure and ecology: This class gathers the halophilous ephemeral communities with a short spring development, colonizing the seasonally wet clayey, loamy or rocky surfaces near the sea and also the inland badlands. On the whole, it is a pioneer vegetation characterized by small therophytic, xerophilous, halophilous and sub-halophilous, occasionally sub-nitrophilous species, occurring on sandy-loamy or rocky substrates of coastal and inland stands. The communities of this syntaxon vegetation usually grow inside the halo-

hygrophilous communities of salt marshes, as those ones belonging to *Juncetea maritimi* and *Salicornietea fruticosae*, as well as along the rocky coast inside the *Crithmo maritimi-Limonietea* ones- Previously, Some authors (Braun-Blanquet et al., 1952; Dierßen & Dierßen, 1996; Polte, 2001, 2004) prefer to treat the syntaxa of *Saginetea maritimae* inside the above mentioned class, focusing on the co-occurrence of several species. However, as emphasized by Mucina et al. (2016), the spatial juxtaposition and sampling scale must be considered, since the plot size of *Juncetea maritimi* communities is usually very large if compared to that one of *Saginetea maritimae*, determining the presence of *Saginetea* species inside the *Juncetea* releves. Furthermore, the vegetation at issue shows a well defined structural and ecologic character, being linked to very peculiar micro-habitats of the ecotone area between coastal dunes and coastal salt marshes or also of rocky coasts, whose dynamic processes select an unique floristic set with short-lived herbs.

Syndynamism: Usually, the communities of *Saginetea* show a pioneer character and their occurrence is linked to several natural or anthropic dynamic processes that affect these habitats. From the catenal point of view, this vegetation colonizes the disturbed stands within the perennial communities of *Juncetea maritimi*, *Crithmo maritimi-Limonietea*, *Salicornietea fruticosae* and *Lygeo-Stipetea* constituting a mosaic with them (Brullo & Giusso, 2003).

Habitat reference: B3.1b Mediterranean and Black Sea rocky sea cliff and shore.

19.1. Order: ***Frankenietalia pulverulentae*** Rivas-Martínez ex Castroviejo & Porta 1976

Ephemeral inconspicuous vegetation of salty soils with short spring cycle linked to the Mediterranean macrobioclimate.

Synonyms: *Frankenietalia pulverulentae* Rivas-Martinez in Rivas-Martinez & M. Costa 1976 (art. 2b).

Holotypus: *Frankenion pulverulentae* Rivas-Martínez ex Castroviejo & Porta 1976.

Characteristic and differential species: *Bellis annua* L., *Bupleurum semicompositum* L. var. *glaucum* (Robill. & Castagne ex DC.) H. Wolff, *Schenkia spicata* (L.) G: Mans., *Frankenia pulverulenta* L., *Juncus hybridus* Brot., *Monerma cylindrica* (Willd.) Greuter, *P. subspathaceus* Req., *Senecio leucanthemifolius* Poir., *Sphenopus divaricatus* (Gouan) Rchb.

Geographical distribution: This order is widespread in the Mediterranean and Macaronesian territories (Castroviejo & Porta, 1976; Brullo & Giusso, 2003; De Foucault & Bioret, 2010).

Structure and ecology: This order, previously included by Castroviejo & Porta 1976 in the distint Mediterranean class *Frankenietea pulverulente*, must be arranged for its floristic and ecological peculiarity within the *Saginetea maritimae* as emphasized by recent literature (Brullo & Giusso, 2003; De Foucault & Bioret, 2010; Biondi et al., 2014; Mucina et al., 2016). It

groups the ephemeral halophilous vegetation occurring in the Mediterranean territories, and is vicaried in the Atlantic coasts by the *Saginetalia maritimae* Weshtoff et al. 1962.

Syndynamism: The communities of this order are represented by permanent micro-associations showing catenal contacts with the perennial halophilous vegetation of the *Juncetea maritimi*, *Salicornietea fruticosae* or *Crithmo maritimi-Limonietea*. Usually they are localizzed on very small surfaces, where due to the micro-topography of these habitats, edaphic conditions of lesser salinity are established than those of the surrounding perennial communities.

Habitat reference: See class.

19.1.1. Alliance: ***Frankenion pulverulentae*** Rivas-Martínez ex Castroviejo & Porta 1976

Ephemeral halophilous vegetation on sandy-loamy surfaces of temporarily inundated depressions near the sea.

Synonyms: *Frankenion pulverulentae* Rivas-Martinez in Rivas-Martinez & Costa 1976 (art. 2b); *Hordeion marini* Ladero et al. 1984; *Saginion mediterraneum* Wolff 1968 nom. illeg. (art. 34); *Polypogonion subspathacei* Gamisans 1992.

Holotypus: *Parapholido incurvae-Frankenietum pulverulentae* Rivas-Martínez ex Castroviejo & Porta 1976 (art. 8).

Characteristic and differential species: *Parapholis filiformis* (Roth) C.E. Hubbard, *Polypogon maritimus* Willd., *P. monspeliensis* (L.) Desf.

Geographical distribution: The alliance at issue results well distributed mainly in the northern Mediterranean area (Brullo, 1988; Brullo & Giusso, 2003; Biondi et al.; 2014). In Europe this vegetation occurs along the Mediterranean coasts, while in Italy is mainly spread in Sicily, Sardinia and in the southern part of the Peninsula.

Structure and ecology: This syntaxon gathers the microphytic halo-subnitrophilous communities of sandy-loamy or silty-clayey soils, occurring in the salt marshes near the sea within the thermo-mediterranean belt with arid and dry ombrotypes (Brullo & Giusso, 2003). It is a vegetation characterized by pioneer terophytes, having its optimum in the springtime, which is linked to salty surfaces flooded during the winter.

Syndynamism: The communities of this alliance are usually permanent and show catenal contacts with suffruticose or helophytic ones of the *Salicornietea fruticosae* or *Juncetea maritimi* classes.

Habitat reference: See class.

19.1.1.1. ***Isolepido cernuae-Saginetum maritimae*** Brullo 1988

Ephemeral vegetation with sea pearlwort and low bulrush of wet sandy surfaces.

Holotypus: rel. 2, tab. 2, Brullo (1988).

Characteristic and differential species: *Isolepis cernua* (Vahl) Roem. & Schult.

Phytosociological table: From Brullo (1988), tab. 2, 5 rel.

Char. association: *Isolepis cernua* (V).

Char. alliance: *Parapholis filiformis* (V), *Polypogon monspeliensis* (IV).

Char. order: *Juncus hybridus* (V), *Schenkia spicata* (V), *Bellis annua* (V), *Frankenia pulverulenta* (II).

Char. class: *Sagina maritima* (V), *Centaurium tenuiflorum* (V), *Juncus hybridus* (V), *Parapholis incurva* (V).

Other species: *Cerastium glomeratum* (V), *Anagallis arvensis* (V), *Plantago crassifolia* (V), *Rumex bucephalophorus* (IV), *Triglochin barrelieri* (III), *Centranthus calcitrapa* (III), *Arenaria leptoclados* (III), *Medicago minima* (II).

Geographical distribution: This vegetation occurs in Apulia (Porto Cesareo), southern Sardinia and Sicily, where it was surveyed in the Hyblaean area (Brullo, 1988a; Bartolo et al., 1992; Brullo & Giusso, 2003; Tomaselli et al., 2008).

Structure and ecology: The *Isolepido cernuae-Saginetum maritimae* covers small sandy surfaces of salt-marshes near the sea, which are subject to winter flooding. The floristic set of this community is characterized by the occurrence of *Isolepis cernua*, which grows together with *Sagina maritima*, *Juncus hybridus*, *Bellis annua*, *Parapholis incurva*, *P. filiformis* and *Frankenia pulverulenta* (Brullo, 1988a).

Syndynamism: This association is mixed with the perennial vegetation of *Juncetea maritimi* and in particular find its optimum within the *Schoeno-Plantaginetum crassifoliae* (Brullo, 1988a).

Habitat reference: See class.

19.1.1.2. ***Parapholidetum filiformis*** Brullo, Scelsi & Siracusa 1994

Ephemeral vegetation with slender sea hard-grass of salt and dry surfaces.

Synonyms: *Parapholido-Frankenietum pulverulentae* Brullo 1988, non Rivas-Martínez ex Castroviejo & Porta 1976

Holotypus: rel. 3, tab. 9, Brullo et al. (1994).

Characteristic and differential species: *Parapholis filiformis* (Roth) C.E.Hubb.

Phytosociological table: From Brullo et al. (1994), tab. 9, 9 rel.

Char. association: *Parapholis filiformis* (V).

Char. alliance and order: *Sphenophus divaricatus* (V), *Polypogon monspeliensis* (V), *Juncus hybridus* (V), *Bellis annua* (V), *Frankenia pulverulenta* (IV), *Bupleurum semicompositum* var. *glaucum* (III).

Char, class: *Parapholis incurva* (V), *Sagina maritima* (V), *Spergularia marina* (V).

Other species: *Anagallis arvensis* (IV), *Blackstonia perfoliata* (III), *Mesembryanthemum nodiflorum* (III), *Centaurium pulchellum* (III), etc.

Geographical distribution: This vegetation results quite common in the marshy areas of western and south-eastern Sicily (Brullo, 1988; Brullo et al., 1994; Brullo & Scelsi, 1998; Guglielmo et al., 2012; Minissale & Sciandrello, 2017). Outside Sicily it is known from Sardinia (Brullo & Giusso, 2003; Biondi & Bagella, 2005) and Apulia (Tomaselli et al., 2010a, 2010b, 2011; Tomaselli & Sciandrello, 2016).

Structure and ecology: The *Parapholidetum filiformis* is an ephemeral vegetation linked to the salty surfaces of coastal marshes not subject to flooding, which are very wet only during the winter. This vegetation is localized in the higher part of salt marshes, where it grows on quite dry halomorphic soil, constituting more or less dense annual meadows dominated by *Parapholis filiformis* (Brullo & Giusso, 2003). Besides, the floristic set of this community includes several species of *Saginetea maritimae* and *Frankenion pulverulentae*, among them *Sphenophus divaricatus*, *Parapholis incurva*, *Sagina maritima*, *Frankenia pulverulenta*, *Polypogon monspeliensis*, *Bellis annua*, *Spergularia marina* and *Bupleurum semicompositum* (Brullo 1988a). As concerns its taxonomical arrangment, the Sicilian community was firstly referred by Brullo (1988) to the *Parapholido-Frankenietum pulverulentae* Rivas-Martínez ex Castroviejo & Porta 1976, an association that is actually known only from the Iberian Peninsula, which results well distinct under the floristic profile from the *Parapholidetum filiformis* (Rivas Martinez & Costa, 1976). From the literature, other associations characterized by *Parapholis filiformis* are the *Junco minutuli-Parapholidetum filiformis* described by Perdigo & Papio (1983) from Southern Spain, where it grows within the *Sarcocornia fruticosa* communities, and the *Polypogono subspathacei-Parapholidetum filiformis* described from North Sardinia by Biondi & Bagella (2005)

Syndynamism: The vegetation at issue occurs within the perennial communities of *Sarcornietalia fruticosae* and particularly in those of the *Sphenopo divaricati-Arthrocauletum meridionalis* and *Agropyro scirpei-Inuletum longifoliae.*

Habitat reference: See class.

19.1.1.3. ***Sphaenopo divaricati-Spergularietum maritimae*** Sciandrello 2007

Ephemeral vegetation with coastal grass and media sandspurry of salt marshes.

Holotypus: rel. 11, tab. 12, Sciandrello (2007).

Characteristic and differential species: *Spergularia media* (L.) C. Presl (=*S. maritima* (All.) Chiov.), *Sphenopus divaricatus* (Gouan) Rchb.

Phytosociological table: From Sciandrello (2007), tab. 12, 12 rel.

Char. association: *Spergularia maritima* (V).

Char. alliance and order: *Sphenophus divaricatus* (V), *Juncus hybridus* (V), *Polypogon maritimus* (V), *Frankenia pulverulenta* (III), *Monerma cylindrica* (II), *Bupleurum semicompositum* var. *glaucum* (I), *Parapholis filiformis* (I).

Char. class: *Plantago coronopus* (V), *Parapholis incurva* (V), *Hordeum marinum* (IV), *Spergularia marina* (II).

Other species: *Medicago ciliaris* (II), *Cladanthus mixtus* (II), *Podospermum canum* (II), *Melilotus siculus* (II), *Gynandryris sysyrinchium* (I), *Phalaris minor* (I), *Trifolium resupinatum* (I), *Centaurium pulchellum* (I).

Geographical distribution: This association occurs in Sicily, where it was described from Piana del Signore marshland, near Gela (Sciandrello, 2007).

Structure and ecology: It is localized in the clearings of the shrubby halophilous vegetation of *Salicornietea fruticosae*. The surfaces, manly sandy, are characterized by salty and feebly nitrified soils, which are flooded only for short periods. These peculiar ephemeral meadows, exclusive of coastal salt marshes, are dominated by *Spergularia media* and *Sphenopus divaricatus*. The floristic set is represented by several species of *Frankenion pulverulentae* and *Saginetea maritimae*, such as *Spergularia marina*, *Frankenia pulverulenta*, *Polypogon maritimus*, *Plantago coronopus*, *Parapholis incurva*, *Hordeum marinum* and *Juncus hybridus* (Sciandrello, 2007).

Syndynamism: This vegetation occupies small surfaces in contact with the *Salicornietalia fruticosae* communities (Sciandrello, 2007).

Habitat reference: See class.

19.1.1.4. ***Spergulario salinae-Hordeetum marini*** Biondi, Filigheddu & Farris 2001

Ephemeral vegetation with salt sandspurry and sea barley of salty surfaces.

Synonyms: *Hordeo marini-Spergularietum marinae* Guarino, Minissale & Sciandrello 2008 (syntax. syn.).

Holotypus: rel. 2, tab. 11, Biondi et al. (2001).

Characteristic and differential species: *Hordeum marinum* Huds., *Spergularia marina* (L) Besser.

Phytosociological table: From Guarino et al. (2008), tab. 1, 8 rel.

Char. association: *Hordeum marinum* (V).

Char. alliance and order: *Polypogon monspeliensis* (V), *Frankenia pulverulenta* (V), *Juncus hybridus* (IV), *Sphenopus divaricatus* (IV), *Monerma cylindrica* (II), *Bupleurum semicompositum* var. *glaucum* (II).

Char. class: *Spergularia marina* (V), *Plantago coronopus* (V), *Parapholis incurva* (V), *Spergularia marina* (I).

Other species: *Pulicaria sicula* (II), *Atriplex elongata* (II), *Salicornia emerici* (II), *Cressa cretica* (II), *Medicago ciliaris* (I).

Geographical distribution: This association was firstly reported by Biondi et al. (2001) from Sardinia, but occurs also in France (de Foucault & Bioret, 2010) and Apulia (Tomaselli & Sciandrello, 2017). In Sicily it is known for the coastal area near Gela (Guarino et al., 2008, Branca et al. 2010) and at the mouth of Salso river (Bonanno, 2008).

Structure and ecology: The *Spergulario salinae-Hordeetum marini* is a halo-nitrophilous vegetation, which is linked to wet sandy or clayey surfaces with a a significative organic component. It occurs in the stands subject to frequent trampling, which are still humid during the spring, when this vegetation has its optimum. Its physiognomy is given by some annual species belonging to *Saginetea maritimae* class, such as *Hordeum marinum*, *Spergularia marina*, *Frankenia pulverulenta*, *Polypogon monspeliensis*, *Parapholis incurva*, etc. (Guarino et al., 2008). From the syntaxonomical point of view, this Sicilian community was reported as a new association, named *Hordeo marini-Spergularietum marinae* Guarino, Minissale & Sciandrello 2008, which must be considered a synonym of the Sardinian vegetation described by Biondi et al. (2001).

Syndynamism: It is a pioneer community, which grows within the perennial vegetation of *Saliconietalia fruticosae* (Tomaselli & Sciandrello, 2017).

Habitat reference: See class.

19.1.1.5. ***Rumicetum palustris*** Bonanno 2008

Ephemeral vegetation with marsh dock of clayey-sandy surfaces with a high content of organic matter.

Holotypus: rel. 2, tab. 7, Bonanno (2008).

Characteristic and differential species: *Rumex palustris* Sm.

Phytosociological table: From Bonanno (2008), tab. 7, 6 rel.

Char. association: *Rumex palustris* (V).

Char. alliance, order: *Polypogon maritimus* (V), *Polypogon monspeliensis* (III).

Char. class: *Spergularia marina* (IV), *Spergularia media* (II), *Parapholis incurva* (II), *Plantago coronopus* (I).

Other species: *Phalaris minor* (V), *Mesembryanthemum nodiflorum* (IV), *Sarcocornia fruticosa* (III), *Beta vulgaris* subsp. *maritima* (III)**,** *Melilotus siculus* (II), *Symphyotrichum squamatum* (II), *Cuscuta campestris* (II), *Elymus elongatus* (II), *Xanthium orientale* subsp. *italicum* (II), *Atriplex prostrata* (II), *Salsola tragus* (II), *Cakile maritima* (II)**,** *Lolium perenne* (I), *Juncus maritimus* (I).

Geographical distribution: The syntaxon at issue was described by Bonanno (2008) for the mouth of Salso river (Southern Sicily).

Structure and ecology: The *Rumicetum palustris* is a peculiar halo-nitrophilous community, occurring in the clayey-sandy surfaces subject to a long flooding period from winter to spring. It is characterized by the dominance of *Rumex palustris*, a specie quite rare in Sicily, which grows together with *Polypogon maritimus, P. monspeliensis*, *Spergularia marina*, *S. media*, *Parapholis incurva*, etc. (Bonanno, 2008).

Syndynamism: This vegetation has a pioneer character in the anthropized stands of the surfaces which should be occupied by the perennial communities of *Sarcocornietea fruticosae* (Bonanno, 2008).

Habitat reference: See class.

19.1.2 Alliance.: ***Sileno sedoidis-Catapodion balearici*** de Foucault & Bioret 2010 corr.

Thermophilous therophytic vegetation of Mediterranean territories linked to rocky coasts.

Synonyms: *Sileno sedoidis-Catapodion loliacei* de Foucault & Bioret 2010 (art. 43).

Holotypus: *Parapholido incurvae-Silenetum sedoidis* Géhu et al. 1990.

Characteristic and differential species: *Catapodium balearicum* (Willk.) H. Scholz, C. *pauciflorum* (Merino) Brullo et al., *Hornungia revelierei* (Jord.) Soldano et al., *Limonium echioides* (L.) Mill., *Plantago weldenii* Reichb., *Silene sedoides* Poir., *Triplachne nitens* (Guss.) Link.

Geographical distribution: The communities of this alliance are spread in the Mediterranean territories, usually along the rocky coasts. In Italy they are frequent in the southern penisula and islands.

Structure and ecology: This vegetation is characterized by annual microphytes occurring in small depressions of the rocky coast, covered by a thin layer of salty soil still wet in early spring. In this micro-habitas, several subhalophilous therophytes are quite frequent, such as *Catapodium balearicum, C. pauciflorum, Silene sedoides, Frankenia pulverulenta, Parapholis incurva, Spergularia marina, Sagina maritima, Plantago coronopus,* etc. These communnities initially included by Brullo & Scelsi (1998) and Brullo & Giusso (2003) in the *Frankenion pulverulentae*, were attributed by de Foucault & Bioret (2010) to a distinct alliance, named *Sileno sedoidis-Catapodion loliacei.* Unfortunately, this syntaxon according to art. 43 of the Code must be corrected in *Sileno sedoidis-Catapodion balearici,* since *Catapodium loliaceum,* synonym of *C. maritimum*, used for give the name to the alliance is an Atlantic species vicariate in the Mediterranean by *C. balearicum* (Brullo et al., 2003).

Syndynamism: These communities are usually in catenal contact with the perennial halophilous associations belonging to *Crithmo maritimi-Limonietea*.

Habitat reference: See class.

19.1.2.1. ***Frankenio pulverulentae-Anthemidetum secundirameae*** Brullo & Scelsi 1998

Ephemeral subhalophilous vegetation with prostrate chamomile and annual sea heath of the limestone rocky coasts.

Holotypus: rel. 4, tab. 4, Brullo & Scelsi (1998).

Characteristic and differential species: *Anthemis secundiramea* Biv.

Phytosociological table: From Brullo & Scelsi (1998), tab. 4, 13 rel.
Char. association: *Anthemis secundiramea* (V).
Char. alliance: *Catapodium balearicum* (IV), *Silene sedoides* (IV).
Char. order: *Frankenia pulverulenta* (V).
Char. class: *Parapholis incurva* (V), *Plantago coronopus* (V), *Sagina maritima* (IV), *Spergularia marina* (I).
Other species: *Gynandryris sysyrinchium* (II).

Geographical distribution: This association occurs only in Sicily along the Hyblaean coasts (Brullo & Scelsi, 1998).

Structure and ecology: The *Frankenio pulverulentae-Anthemidetum secundirameae* is localized in the calcareous rocks near the sea, where it colonizes the depressions covered by sand soils full of minute debris. This vegetaion, well adapted to sea spray, is differenciated by the occurrence of *Anthemis secundiramea* and some prostrate-reptant subhalophillous therophytes belonging to *Saginetea maritimae*, such as *Frankenia pulverulenta*, *Plantago coronopus*, *Parapholis incurva*, *Sagina maritima*, *Catapodium balearicum*, etc. (Brullo & Scelsi, 1998).

Syndynamism: It represents a permanent vegetation growing within the *Crithmo-Limonietea* communities and in particular those of *Limonietum hyblaei* and *Limonietum syracusani* (Brullo & Scelsi, 1998).

Habitat reference: See class.

19.1.2.2. ***Frankenio pulverulentae-Spergularietum bocconei*** Brullo & Scelsi 1998

Ephemeral subhalophilous vegetation with Boccone's sandspurry and annual sea heath of disturbed rochy surfaces near the sea.

Holotypus: rel. 7, tab. 5, Brullo & Scelsi (1998).

Characteristic and differential species: *Spergularia bocconei* (Scheele) Asch. & Graeb.

Phytosociological table: From Brullo & Scelsi (1998), tab. 5, 8 rel.
Char. association: *Spergularia bocconei* (V).
Char. alliance and order: *Frankenia pulverulenta* (V), *Catapodium balearicum* (II).
Char. class: *Parapholis incurva* (V), *Plantago coronopus* (V), *Sagina maritima* (IV).
Other species: *Medicago littoralis* (IV), *Allium arvense* (IV).

Geographical distribution: This vegetation is known only for South-Eastern Sicily, where it was described (Brullo & Scelsi, 1998).

Structure and ecology: The *Frankenio pulverulentae-Spergularietum bocconei*, is localized along the calcareous rocky stands near the sea, usually subject to pounding. It is a microphytic prostate vegetation showing halo-subnitrophilous requirements, which is dominated by *Spergularia bocconei*. Several annual species of *Saginetea maritimae* are frequent, such as *Frankenia pulverulenta*, *Parapholis incurva*, *Plantago coronopus*, *Sagina maritima* and *Catapodium balearicum* (Brullo & Scelsi, 1998).

Syndynamism: This community occurs in coastal stands inside the belt occupied by the *Thymelaeo hirsutae-Helichrysetum conglobati* (Brullo & Scelsi, 1998).

Habitat reference: See class.

19.1.2.3. ***Desmazerio pignattii-Senecionetum pygmaei*** Brullo & Scelsi 1998

Ephemeral subhalophilous vegetation with pygmy ragwort and Pignatti's fern grass of the calcareous rocky coast.

Holotypus: rel. 2, tab. 6, Brullo & Scelsi (1998).

Characteristic and differential species: *Desmazeria pignattii* Brullo & Pavone, *Senecio pygmaeus* DC.

Phytosociological table: From Brullo & Scelsi (1998), tab. 6, 11 rel.
Char. association: *Desmazeria pignattii* (V), *Senecio pygmaeus* (V).
Char. alliance and order: *Catapodium balearicum* (V), *Frankenia pulverulenta* (IV), *Bellis annua* (II).
Char. class: *Parapholis incurva* (V), *Plantago coronopus* (V), *Sagina maritima* (III), *Spergularia marina* (III).

Geographical distribution: This association occurs only in the southern coast of the Hyblaean Plateau and Maltese islands, where it is quite rare (Brullo & Scelsi, 1998; Brullo & Giusso, 2003; Brullo et al., 2020).

Structure and ecology: It is a peculiar vegetation localized along the rocky calcareous coast in stands very close to the sea, linked to a dry thermo-mediterranean bioclimate belt. The surfaces occupied by this microphytic community are very small and covered by a thin layer of soil, represented by «terra rossa» rich in chlorides. Floristically, it is diffenrentiated by the occurrence of *Desmazeria pignattii* and *Senecio pygmaeus*, two rare endemic species having a Hyplaean-Maltese distribution. These two species grow together with several microphytes of *Saginetea maritimae*, such as *Catapodium balearicum*, *Parapholis incurva*, *Plantago coronopus*, *Sagina maritima*, *Frankenia pulverulenta*, etc. (Brullo & Scelsi, 1998; Brullo et a., l 2020).

Syndynamism: In Sicily this vegetation occurs in a very narrow belt near the sea, which is usually occupied by the *Limonietum hyblaei* (Brullo & Scelsi, 1998).

Habitat reference: See class.

19.1.2.4. ***Frankenio pulverulentae-Catapodietum balearici*** Brullo & Siracusa ass. nov. provv.

Ephemeral subhalophilous vegetation with Mediterranean sea fern grass and annual sea heath of volcanic rocky coast.

Holotypus: Not designated.

Characteristic and differential species: *Catapodium balearicum* (Willk.) H. Scholz.

Phytosociological table: 12 rel. ined., by Brullo & Siracusa from Catania.

Char. association: *Catapodium balearicum* (V).

Char. alliance, order and class: *Spergularia marina* (V), *Parapholis incurva* (V), *Frankenia pulverulenta* (V), *Plantago weldenii* (IV), *Silene sedoides* (IV).

Other species: *Lotus cytisoides* (III), *Anthemis secundiramea* (II), *Plantago lagopus* (I), *Hordeum leporinum* (I), *Arenaria leptoclados* (I).

Geographical distribution: This community was surveyed along the Catania coasts, but it is probably spread also in other localities of Sicily.

Structure and ecology: The small hollows of basaltic surfaces near the sea, where only a thin layer of sandy soil occur, are covered by a peculiar halophilous meadows with *Catapodium balearicum*. This new association, proposed as *Frankenio pulverulentae-Catapodietum balearici*, is clearly referable to *Saginetea maritimae* class for the occurrence of *Parapholis incurva*, *Spergularia marina, Silene sedoides*, *Plantago weldenii* and *Frankenia pulverulenta*.

Syndynamism: This vegetation grows within the belt occupied by halo-chasmophilous communities of *Crithmo-Limonietea*.

Habitat reference: See class.

19.1.2.5. ***Polypogonetum subspathacei*** Gamisans 1992

Ephemeral subhalophilous vegetation with greater annual beard-grass of rocky coasts.

Holotypus: rel. 3, tab. 3, Gamisans (1992).

Characteristic and differential species: *Polypogon subspathaceus* Req. ex Raspail.

Phytosociological table: From Brullo et al. (1994), tab. 10, 13 rel.

Char. association: *Polypogon subspathaceus* (V).

Char. alliance and order: *Frankenia pulverulenta* (V), *Catapodium balearicum* (V), *Bellis annua* (V), *Bupleurum semicompositum* var. *glaucum* (IV), *Sphenophus divaricatus* (IV), *Senecio leucanthemifolius* (III), , *Polypogon monspeliensis* (II).

Char. class: *Parapholis incurva* (V), *Sagina maritima* (V), *Spergularia marina* (IV), *Plantago coronopus* (III), *Centaurium tenuiflorum* (II).

Other species: *Anagallis arvensis* (IV), *Blackstonia acuminata* (V), *Centaurium pulchellum* (V), *Catapodium rigidum* (IV), *Valantia muralis* (IV), *Delphinium halteratum* (II), *Convolvulus lineatus* (II), *Euhporbia exigua* (II), *Erodium cicutarium* (II), etc.

Geographical distribution: This syntaxon was described by Gamisans (1992) from southern Corsica and later surveyed in Sicily (Brullo & Giusso, 2003), where it occurs in Linosa (Brullo & Siracusa 1996), Isola Grande dello Stagnone (Brullo et al. 1994) and Hyblaean coasts (Brullo & Scelsi 1998).

Structure and ecology: The small hollows covered by sandy-loamy soil occurring in the rocky places near the sea, flooding during the winter period, are colonized by a peculiar ephemeral community with a subnitrophilous character. This vegetation, described by Gamisans (1992) as *Polypogonetum subspathacei*, is floristically dominated by *Polypogon subspathaceus*, hygrophilous species usually frequent in the communities of *Isoeto-Nanojuncetea* class, which here has the role of differential. In fact, for the presence of *Plantago coronopus*, *Parapholis incurva*, *Catapodium balearicum*, *Frankenia pulverulenta* and *Sagina maritima*, this association must be referred to *Saginetea maritimae* class (Brullo & Giusso, 2003).

Syndynamism: This community usually shows catenal contact with the perennial communities of the *Crithmo-Limoniete* occurring in the coastal belt or more rarely with those of *Juncetea maritimi* and *Sarcocornietea fruticosae* (Brullo & Giusso, 2003).

Habitat reference: See class.

19.1.3. Alliance: ***Pholiuro-Spergularion*** Pignatti 1952

Ephemeral halophilous vegetation of periodically flooded stands of southern arid Mediterranean territories.

Synonyms: *Puccinellion distantis* Pignatti 1953, p. p.; *Limonion avei* Barbagallo et al. 1984 (art. 2b); *Limonion avei* Brullo 1988; *Limonion echioidis* S. Brullo 1988 corr. Bergmeier in Bergmeier & Dimopoulos 2003.

Lectotypus: *Spergulario bocconei-Limonietum avei* Pignatti 1952 corr. art. 43 (= ass. a *Limonium echioides* e *Spergularia atheniensis* Pignatti 1952), here designated.

Characteristic and differential species: *Limonium avei* (De Not.) Brullo & Erben, *Parapholis marginata* Runemark.

Geographical distribution: This alliance occurs in the Southern Mediterranean (Pignatti, 1952; Brullo & Di Martino, 1974; Brullo et al., 1994; Brullo & Giusso, 2003), particularly in North Africa, Sicily, Sardinia and Middle East. In Sicily the communities of this syntaxon are recorded from the Trapani territory (Brullo & Di Martino, 1974; Brullo et al., 1994).

Structure and ecology: The ephemeral communities of this alliance are localized in the salt marshes of territories characterized by very arid thermo-inframediterranean bioclimatic conditions. These halophilous communities are dominated by small thermo-xerophilous therophites, grows on clayey or loamy-sandy surfaces subject to seasonal flooding (Brullo, 1988). From the ecological point of view, this alliance replaces the *Frankenion pulverulentae* in the driest areas mainly of eastern and central Meditteranean basin (Brullo, 1988). This alliance was described by Pignatti (1952) from Tunisia attributing to it two associations represented by ass. a *Limonium echioides* e *Spergularia atheniensis* and ass. a *Limonium virgatum* e *Pholiurus incurvus*. In particular, only the first association, whose correct name is *Spergulario bocconei-Limonietum avei*, can be clearly attributed to this alliance, which includes only ephemeral communities, while the second association cannot be referred to it, since it is very heterogeneous, being rich in perennial species of *Salicornietea fruticosae* and therefore must be considered a nomen dubium (art. 37). Later, Pignatti (1953) not mentioned this alliance, including the ass. a *Limonium echioides* e *Spergularia atheniensis* within the *Puccinellion distantis*. More recently, Brullo (1988) arranged the association from South Mediterranean (Sicily, Tunisia and Cyrenaica), characterized by *Limonium avei* and other species thermo-xerophilous, in a new alliance named *Limoniun avei*, which represents therefore a nomenclatural synonym of the *Pholiuro-Spergularion*.

Syndynamism: In Sicily this vegetation shows catenal contacts mainly with the more thermophilous associations of *Salicornietea fruticosae* and especially with those of the *Limonion ferulacei.*

Habitat reference: See class.

19.1.3.1. ***Spergulario rubrae-Limonietum avei*** Brullo & Di Martino 1974 corr. Brullo 1988

Ephemeral vegetation with red sandspurry and annual sea lavender of salt marshes.

Synonyms: *Spegulario-Limonietum echioidis* Brullo & Di Martino 1974 (art. 43).

Holotype: rel. 5, tab. 15, Brullo & Di Martino (1974).

Characteristic and differential species: *Romulea columnae* Sebast. & Mauri, *Spergularia rubra* (L.) J. Presl & C. Presl.

Phytosociological table: From Brullo & Di Martino (1974), tab. 15, 7 rel.

Char. association: *Spergularia rubra* (V), *Romulea columnae* (III) .

Char. alliance: *Limonium avei* (V).

Char. order and class: *Spergularia marina* (V), *Parapholis incurva* (V), *Polypogon maritimus* (V), *Schenkia spicata* (IV), *Parapholis filiformis* (III), *Bellis annua* (III), *Sagina maritima* (III), *Frankenia pulverulenta* (II).

Other species: *Anagallis arvensis* (V), *Arthrocaulon meridionalis* (V), *Blackstonia perfoliata* (IV), *Mesembryanthemum nodiflorum* (IV), *Sarcocornia alpini* (III), *Salicornia patula* (III), *Suaeda spicata* (III), *Frankenia hirsuta* (III), *Silene colorata* (II).

Geographical distribution: This vegetation was surveyed only in Western Sicily, where occurs in the Isola Grande dello Stagnone, near Marsala (Brullo & Di Martino, 1974; Brullo, 1988; Brullo & Giusso, 2003).

Structure and ecology: The *Spergulario rubrae-Limonietum avei* appears as a sparse ephemeral community, covering the small sandy-loamy surfaces of salt marshes. The soils, flooded during the winter, are already dry from the beginning of spring and results very rich in chlorides (Brullo, 1988). Under the floristic profile, this community is characterized by the occurrence of *Limonium avei*, often having high coverage values, *Spergularia rubra* and *Romulea columnae*, growing together with several species of *Saginetea maritimae*, such as *Bellis annua*, *Spergularia marina*, *Sagina maritima*, *Parapholis incurva*, *Frankenia pulverulenta*, etc. (Brullo & Di Martino, 1974).

Syndynamism: This vegetation grows among the more xerophilous communities of *Sarcocrnietea fruticosae* and in particular of the *Halocnemion cruciati*.

Habitat reference: See class.

19.1.3.2. ***Limonio avei-Hymenolobetum procumbentis*** Brullo, Scelsi & Siracusa 1994

Ephemeral halophilous vegetation with annual sea lavender and slenderweed of walkways among salines.

Holotype: rel. 7, tab. 6, Brullo, Scelsi & Siracusa (1994).

Characteristic and differential species: *Hymenolobus procumbens* (L.) Schinz & Thell., *Limonium avei* (De Not.) Brullo & Erben.

Phytosociological table: From Brullo et al. (1994), tab. 6, 7 rel.

Char. association: *Hymenolobus procumbens* (V).

Char. alliance: *Limonium avei* (V), *Parapholis marginata* (II).

Char. order: *Frankenia pulverulenta* (V), *Polypogon monspeliensis* (V), *Sphenopus divaricatus* (III), *Senecio leucanthemifolius* (III).

Char. order and class:), *Parapholis incurva* (V), *Spergularia marina* (IV), *Sagina maritima* (IV).

Other species: *Valantia muralis* (IV), *Anagallis arvensis* (III), *Mesembryanthemum nodiflorum* (III), *Sonchus bulbosus* (II), *Hedypnois cretica* (I), *Beta vulgaris* subsp. *maritima* (I).

Geographical distribution: This vegetation occurs in the saline of Western Sicily (Brullo et al., 1994; Brullo & Giusso, 2003).

Structure and ecology: The association having marked halo-subnitrophilous requirement grows in the walkways among the salines, where loamy-clayey soils with high levels of chlorides occur. It is characterized by small therophytes well adapted to a moderate trampling, as *Hymenolobus procumbens*, *Frankenia pulverulenta*, *Parapholis incurva*, *Spergularia marina*, *Sagina maritima*, *Sphenopus divaricatus*, *Polypogon monspeliensis*, etc. Due to its thermo-xerophilous peculiarity and high coverage values of *Limonium avei*, this syntaxon must be included witihn the *Pholiuro-Spergularion* alliance (Brullo et al., 1994).

Syndynamism: This vegetation is linked to anthropogenic stands of salines with moderate disturbance, where can be in contact with some marked halophilous community of *Salicornietea fruticosae* class.

Habitat reference: See class.

19.1.3.3. ***Limonio avei-Parapholidetum marginatae*** Brullo, Scelsi & Siracusa 1994

Ephemeral halophilous vegetation with marginated hard-grass and annual sea lavender of salt marshes.

Holotype: rel. 9, tab. 7, Brullo, Scelsi & Siracusa (1994).

Characteristic and differential species: *Parapholis marginata* Runemark, *Limonium avei* (De Not.) Brullo & Erben.

Phytosociological table: From Brullo et al. (1994), tab. 6, 7 rel.

Char. association: *Parapholis marginata* (V).

Char. alliance: *Limonium avei* (V).

Char. order: *Polypogon monspeliensis* (V), *Sphenopus divaricatus* (V), *Bellis annua* (V), *Bupleurum semicompositum* var. *glaucum* (IV), *Senecio leucanthemifolius* (IV), *Frankenia pulverulenta* (III), *Juncus hybridus* (II).

Char. class: *Parapholis incurva* (V), *Sagina maritima* (V), *Plantago coronopus* (IV), *Spergularia marina* (IV).

Other species: *Anagallis arvensis* (V), *Blackstonia perfoliata* (III), *Polypogon subspathaceus* (II), *Sonchus oleraceus* (II), *Centaurium pulchellum* (I).

Geographical distribution: This community was surveyed by Brullo et al. (1994) in the salt marshes of Western Sicily.

Structure and ecology: The *Limonio avei-Parapholidetum marginatae* replaces the previous association in natural stands of salt marshes, while compared to *Spergulario rubrae-Limonietum avei* it prefers the more raised surfaces, where the flooding period is very shorter (Brullo & Giusso, 2003). From the floristic point of view, this community is characterized by the occurrence and often dominance of *Parapholis marginata*, growing together with *Limonium avei* and various other microphytes of *Saginetea maritimae*, such as *Bellis annua*, *Sphenopus divaricatus*, *Sagina maritima*, *Polypogon monspeliensis*, *Parapholis incurva*, *Plantago coronopus*, etc.

Syndynamism: This community constitutes ephemeral meadows localized among the perennial vegetation of *Limonion ferulacei*, as in particular *Sarcocornio fruticosae-Limonietum ferulacei* and *Limoniastro monopetali-Limonietum lilybaei*.

Habitat reference: See class.

19.1.4. Alliance: ***Gaudinio fragilis-Podospermion cani*** Brullo & Siracusa 2000

Ephemeral subhalophilous vegetation on clayey soils of inland badlands.

Holotypus: *Chamaemelo praecocis-Leontodentetum muelleri* Brullo & Siracusa 2000.

Characteristic and differential species: *Chamaemelum fuscatum* (Brot.) Vasc., *Gaudinia fragilis* (L.) Beauv., *Parapholis pycnantha* (Hack.) C. E. Hubb., *Podospermum canum* C. A. Mey., *Romulea ramiflora* Ten.

Geographical distribution: This alliance, distributed in the Central Mediterranean area, is quite spread in Sicily (Brullo & Siracusa, 2000; Brullo & Giusso, 2003).

Structure and ecology: The flat and more or less sloped clayey surfaces of inland badlands are often covered by ephemeral meadows with a subhalo-nitrohpilous character. According to Brullo & Siracusa (2000), this vegetation must be referred to *Gaudinio fragilis-Podospermion cani* alliance, which belongs to *Frankenietalia pulverulentae* order of *Saginetea maritimae* for the occurrence of *Polypogon monspeliensis*, *Parapholis incurva*, *Hordeum marinum*, *Plantago coronopus*, *Spergularia marina*, *Juncus hybridus*, etc. However, this syntaxon shows also a proper floristic set, represented by *Chamaemelum fuscatum*, *Gaudinia fragilis*, *Parapholis pycnantha*, *Podospermum canum* and *Romulea ramiflora*.

Syndynamism: The communities of this alliance show close catenal contacts with shrubby ones of *Pegano-Salsoletea* or with the meadows of *Lygeum spartum*.

Habitat reference: See class.

19.1.4.1. ***Podospermo cani-Parapholidetum pycnanthae*** Brullo & Siracusa 2000

Ephemeral vegetation with dense sickle grass and clay salsify of badlands.

Holotypus: Rel, 6, tab,11, Brullo & Siracusa (2000).

Characteristic and differential species: *Parapholis pycnantha* (Hack.) C.E. Hubb., *Podospermum canum* C. A. Mey.

Phytosociological table: From Brullo & Siracusa (2000), tab. 11, 10 rel.

Char. association: *Parapholis pycnantha* (V).

Char. alliance: *Podospermum canum* (V), *Gaudinia fragilis* (V), *Chamaemelum fuscatum* (V), *Romulea ramiflora* (III).

Char. order and class: *Polypogon monspeliensis* (V)**,** *Parapholis incurva* (V), *Hordeum marinum* (V), *Plantago coronopus* (V), *Spergularia marina* (V), *Juncus hybridus* (IV).

Other species: *Melilotus sulcatus* (V)**,** *Medicago polymorpha* (II)**,** *Anisantha fasciculata* (I), *Gynandriris sisyrinchium* (I), *Anacyclus clavatus* (I).

Geographical distribution: This vegetation, in the Italian Peninsula surveyed in the badlands of southern Calabria (Brullo et al., 2001) and Basilicata (Biondi et al., 1992), in Sicily occurs in the south-western slope of Etna (Brullo & Siracusa, 2000), but it is probably spread in other localities of the island.

Structure and ecology: The *Podospermo cani-Parapholidetum pycnanthae* is an ephemeral and pioneer community, which is linked to slightly inclined clayey surfaces of inland badlands. Although a period of flooding is generally absent, this vegetation is dominated by *Parapholis pycnantha* and others halo-hygrophilous species that require a certain edaphic humidity, among them *Podospermum canum*, *Gaudinia fragilis*, *Chamaemelum fuscatum*, *Romulea ramiflora*, *Polypogon monspeliensis* and *Parapholis incurva* (Brullo & Siracusa, 2000).

Syndynamism: This vegetation takes catenal contacts with *Lygeum spartum* grasslands (Brullo & Giusso, 2003).

Habitat reference: See class.

19.1.4.2. ***Chamaemelo praecocis-Leontodentetum muelleri*** Brullo & Siracusa 2000

Ephemeral vegetation with Mueller's hawkbit of flooded flat surfaces.

Holotypus: rel. 1, tab. 12, Brullo & Siracusa (2000).

Characteristic and differential species: *Scorzoneroides muelleri* (Sch. Bip.) Greuter & Talavera (= *Leontodon muelleri* (Sch. Bip.) Fiori).

Phytosociological table: From Brullo & Siracusa (2000), tab. 12, 10 rel. (subass. *trisetarietosum aureae*).

Char. association: *Scorzoneroides muelleri* (V).

Char. subassociation: *Trisetaria aurea* (V), *Matricaria chamomilla* (V).

Char. alliance: *Chamaemelum fuscatum* (V), *Romulea ramiflora* (V), *Podospermum canum* (V), *Gaudinia fragilis* (IV).

Char. order and class: *Juncus hybridus* (V), *Plantago coronopus* (V), *Parapholis incurva* (IV), *Hordeum marinum* (II), *Spergularia marina* (III), *Bellis annua* (IV).

Other species: *Carex divisa* (V), *Gynandriris sisyrinchium* (V)**,** *Rostraria cristata* (IV)**,** *Linum strictum* (III), *Melilotus sulcatus* (III), *Anisantha fasciculata* (II), *Euphorbia helioscopia* (II)**,** *Hypochoeris achyrophorus* (II), *Anacyclus clavatus* (II), *Catapodium rigidum* (II), *Beta vulgaris* subsp. *maritima* (II)**,** *Trifolium resupinatum* (II).

From Brullo & Siracusa (2000), tab. 12, 7 rel. (subass. *lythretosum hyssopifoliae*).

Char. association: *Scorzoneroides muelleri* (V).

Char. subassociation: *Lythrum hyssopifolia* (V), *Ranunculus trilobus* (V).

Char. alliance: *Chamaemelum fuscatum* (V)**,** *Romulea ramiflora* (V)**,** *Gaudinia fragilis* (V).

Char. order and class: *Juncus hybridus* (V)**,** *Plantago coronopus* (V)**,** *Parapholis incurva* (V), *Hordeum marinum* (V), *Polypogon monspeliensis* (V)*, Spergularia marina* (I), *Sagina maritima* (I).

Other species: *Rostraria cristata* (V)**,** *Beta vulgaris* subsp. *maritima* (V), *Bromus hordeaceus* (V), *Melilotus siculus* (V), *Trifolium resupinatum* (IV), *Geranium purpureum* (III), *Carlina lanata* (III), *Vulpia ciliata* (I).

Geographical distribution: This association is restricted to Adrano badlands, Piana del Signore near Gela and Pantano Gelsari near Lentini (Brullo & Siracusa, 2000; Brullo & Giusso, 2003; Sciandrello, 2007; De Pietro & De Pietro, 2012).

Structure and ecology: The *Chamaemelo praecocis-Leontodentetum muelleri* is linked to flat clayey surfaces subject to flooding during the winter and represents a precocious association with marked hygrophilous requirements (Brullo & Siracusa, 2000). Floristically, this vegetation is well differentiated for the presence and often dominance of *Scorzoneroides muelleri,* a north-african species very rare in Sicily (Brullo et al., 1994), growing together with *Chamaemelum fuscatum*, *Juncus hybridus*, *Plantago coronopus*, *Parapholis incurva*, *Bellis annua*, *Spergularia marina*, *Hordeum marinum*, etc. Besides, Brullo & Siracusa (2000) distinguished two subassociations, which are characterized by a quite different ecology and floristic set. The subass. *trisetarietosum aureae* represents the more xerophilous aspect, occurring in drier surfaces with a more steppic appearance for the high coverage of *Trisetaria aurea* and *Matricaria chamomilla*. Instead, the subass. *lythretosum hyssopifoliae* is a more hygrophilous community, as highlighted by the presence of *Ranunculus trilobus* and *Lythrum hyssopifolia*. This association is replaced in Apulia by another quite related vegetation described by Sciandrello et al. (2015) as *Sphenopo divaricati-Scorzoneroidetum muelleri*, always belonging to *Gaudinio fragilis-Podospermion cani* alliance.

Syndynamism: Usually, the community at issue has catenal contact with the perennial sub-halo-hygrophilous communities of *Phragmitetea* or *Juncetea maritimae* (Brullo & Giusso, 2003). In the more depressed stands, it should be in contact also with the ephemeral and hygrophilous vegetation of *Damasonio alismatis-Crypsietum aculeatae* (Sciandrello, 2007).

Habitat reference: See class.

19.1.4.3. ***Brassico amplexicaulis-Astragaletum raphaelis*** Brullo et al. ass. nov. provv.

Ephemeral vegetation with Raphael milkvetch and Soulié cabbage of dry clayey surfaces.

Holotypus: Not designated.

Characteristic and differential species: *Astragalus raphaelis* Ferro; *Brassica amplexicaulis* subsp. *souliei* (Batt.) Maire & Weiller.

Phytosociological table: 5 rel. ined., Brullo et al., Diga Comunelli.

Char. association: *Astragalus raphaelis* (V), *Brassica amplexicaulis* subsp. *souliei* (V), *Anthemis muricata* (IV).

Char. alliance: *Podospermum canum* (V), *Parapholis pycnantha* (V), *Chamaemelum fuscatum* (III).

Char. order and class: *Centaurium tenuiflorum* (V), *Spergularia marina* (III), *Plantago coronopus* (III), *Hordeum marinum* (II).

Other species: *Hypocheris achyrophorus* (V), *Melilotus sulcata* (V), *Aegilops geniculata* (V), *Trachynia distachya* (V), *Linum decumbens* (V), *Reichardia intermedia* (V), *Lolium rigidum* (V), *Vicia tenuifolia* (V), *Aegilops neglecta* (IV), *Ononis biflora* (IV), *Beta vulgaris* subsp. *maritima* (IV), *Anisantha fasciculata* (IV), *Filago pyramidata* (III), *Sulla coronaria* (III), *Anagallis arvensis* (III), *Avena barbata* (III), etc.

Geographical distribution: This vegetation results quite rare in the badlands of Central-Southern Sicily.

Structure and ecology: The *Brassico amplexicaulis-Astragaletum raphaelis* is a peculiar therophytic vegetation, which is characterized by the occurrence of *Astragalus raphaelis*, a very rare endemic species (Romano et al., 1994; C. Brullo et al., 2011). It grows in the small dry surfaces of badlands, often quite inclined, and is linked to a dry thermo-mediterranean bioclimate (80-230 m a.s.l.). Its floristic set is represented by some endemic or rare species, such as *Anthemis muricata* and *Brassica amplexicaulis* subsp. *souliei*, as well as various taxa belonging to *Gaudinio fragilis-Podospermion cani*, among them *Podospermum canum*, *Chamaemelum fuscatum* and *Parapholis pycnantha*.

Syndynamism: This vegetation prefers the clearings among the xerophilous grasslands dominated by *Lygeum spartum*.

Habitat reference: See class.

19.1.4.4 ***Senecioni pectinati-Scabiosetum parviflorae*** Brullo et al. ass. nov. provv.

Ephemeral vegetation with small flower pincushion of dry clayey surfaces.

Holotypus: Not designated.

Phytosociological table: 4 rel. ined., Brullo et al., Serradifalco (Caltanissetta).

Char. association: *Scabiosa parviflora* (4)**,** *Senecio leucanthemiflius* subsp. *pectinatus* (4)**,** *Allium agrigentinum* (4)**,** *Nigella arvensis* subsp. *glaucescens* (2).

Char. alliance: *Podospermum canum* (4)**,** *Parapholis pycnantha* (4), *Chamaemelum fuscatum* (1), *Gaudinia fragilis* (1).

Char. order and class: *Plantago coronopus* (4)**,** *Centaurium tenuiflorum* (4)**,** *Bellis annua* (3)**,** *Hordeum marinum* (1).

Other species: *Diplotaxis erucoides* (4), *Sulla coronaria* (4), *Catananche lutea* (4), *Aegilops geniculata* (4)**,** *Lolium rigidum* (3), *Filago pyramidata* (3), *Euphorbia pycnophylla* (3), *Anisantha rubens* (3), *Centaurea schouwii* (3), *Avellinia michelii* (3), *Bromus intermedius* (3), *Poa bulbosa* (3), etc.

Geographical distribution: Basing on field investigations, this community at issue results spread in the badlands of Central-Western Sicily and in particular in Agrigento and Caltanissetta areas.

Structure and ecology: The flat clayey surfaces of badlands, generally dry since the beginning of spring, are colonized by a peculiar xerophilous community, which is characterized by the occurrence of some rare or endemic species, such as *Scabiosa parviflora*, *Allium agrigentinum*, *Senecio leuncathemifolius* subsp. *pectinatus*, *Nigella arvensis* subsp. *glaucescens*. This vegetation, named *Senecioni pectinati-Scabiosetum parviflorae*, must be attributed to *Gaudinio fragilis-Podospermion cani* mainly for the occurrence of *Podospermum canum* and *Parapholis pycnantha*. From the ecological point of view, this association prefers the thermo-mesomediterranean belt with dry-subhumid ombrotype.

Syndynamism: This vegetation colonizes the sunny clearings of xerophilous grasslands dominated by *Lygeum spartum*.

Habitat reference: See class.

19.1.4.5. ***Chamaemelo fuscati-Rostrarietum hispidae*** Brullo et al. ass. nov. provv.

Ephemeral vegetation with hairy hairgrass of salty surfaces.

Holotypus: Not designated.

Characteristic and differential species: *Rostraria hispida* (Savi) Dogan

Phytosociological table: 6 rel. ined., Brullo et al., Saline di Trapani.

Char. association: *Rostraria hispida* (V).

Char. alliance: *Chamaemelum fuscatum* (V), *Podospermum canum* (V), *Gaudinia fragilis* (V).

Char. order and class: *Plantago coronopus* (V)**,** *Hordeum marinum* (V), *Monerma cylindrica* (V), *Juncus hybridus* (IV), *Bupleurum tenuissimum* (III).

Other species: *Melilotus sulcata* (V), *Sulla coronaria* (V), *Medicago ciliaris* (V), *Centaurium pulchellum* (V), *Melilotus siculus* (V), *Soda inermis* (V)**,** *Blackstonia perfoliata* (V)**,** *Bromus hordeaceus* (V), *Trifolium resupitanum* (IV), *Lythrum hyssopifolia* (IV), *Triglochin barrelieri* (III), *Ammi visnaga* (II), *Ranunculus trilobus* (II).

Geographical distribution: This community was surveyed in some coastal salt marshes near Trapani (West Sicily).

Structure and ecology: The *Chamaemelo fuscati-Rostrarietum hispidae* grows in the small salty surfaces with a very short flooding period, occurring among the perennial vegetation of salt marshes and saline. Its physiognomy is given by *Chamaemelum fuscatum* and *Rostraria hispida*, which must be considered differential species of this syntaxon. Besides, some taxa of *Gaudinio fragilis-Podospermion cani* are quite frequent, among them *Podospermum canum* and *Gaudinia fragilis*, as well as those ones belonging to *Saginetea maritimae*, as *Plantago coronopus*, *Hordeum marinum*, *Monerma cylindrica*, *Juncus hybridus* and *Bupleurum tenuissimum*.

Syndynamism: Usually, this community is found mixed with the halo-hygrophilous vegetation of *Sarcocornietea fruticosae*.

Habitat reference: See class.

19.1.4.6. ***Sphaenopo divaricati-Spergularietum diandrae*** Brullo & Siracusa 2000

Ephemeral vegetation with southern sea-spurrey and coastal grass of shady badlands.

Holotypus: rel. 3, tab. 13, Brullo & Siracusa (2000).

Characteristic and differential species: *Spergularia diandra* (Gussone) Heldreich.

Phytosociological table: From Brullo & Siracusa (2000), tab. 13, 7 rel.

Char. association: *Spergularia diandra* (V).

Char. alliance: *Chamaemelum fuscatum* (V), *Podospermum canum* (V), *Romulea ramiflora* (V), *Gaudinia fragilis* (II).

Char. order and class: *Plantago coronopus* (V), *Parapholis incurva* (V), *Sphenopus divaricatus* (V), *Hymenolobus procumbens* (IV), *Hordeum marinum* (III), *Spergularia marina* (III), *Juncus hybridus* (II), *Bellis annua* (II), *Polypogon monspeliensis* (I), *Sagina maritima* (I).

Other species: *Gynandriris sisyrinchium* (V), *Filago pyramidata* (IV), *Poa bulbosa* (IV), *Catapodium rigidum* (IV), *Vulpia ciliata* (III), *Bromus hordeaceus* (III), etc.

Geographical distribution: It is a rare Sicilian vegetation, occurring only in the badlands near Adrano (Brullo & Siracusa, 2000).

Structure and ecology: The halo-nitrophilous meadows growing under the big shrubs of *Salsola oppositifolia* and *Suaeda vera* are represented by a very peculiar community named *Sphaenopo divaricati-Spergularietum diandrae.* According to Brullo & Siracusa (2000), it is a vegetation with sciaphilous requirements, which prefers the clayey soils with a shallow accumulation of organic matter. From the floristic point of view, it is characterized by the occurrence of *Spergularia diandra*, a rare Saharo-Arabian species, which grows with several species belonging to the *Gaudinio fragilis-Podospermion cani* and higher rank, such as *Sphenopus divaricatus*, *Parapholis incurva*, *Sphenopus divaricatus, Hymenolobus procumbens*, *Chamaemelum fuscatum*, *Podospermum canum* and *Romulea ramiflora*.

Syndynamism: This association is localized under the shrubs of communities of *Pegano-Salsoletea* class, as the *Lycio intricati-Salsoletum oppositifoliae* (Brullo & Siracusa, 2000).

Habitat reference: See class.

20. Class: ***Adiantetea capilli-veneris*** Br.-Bl. in Br.-Bl., Roussine & Negre 1952

Chasmo-chomophytic vegetation of shaded and water-splashed habitats rich in bryophytes and pteridophytes.

Synonyms: *Adiantetea* Br.-Bl. & R. Tx. 1943 (art. 2b); *Adiantetea* Br.-Bl. in Br.-Bl. et al. 1947 (art. 2b); *Adiantetea* Br.-Bl. 1948 (art. 2b).

Holotypus: *Adiantetalia capilli-veneris* Br.-Bl. ex Horvatic 1934.

Characteristic and differential species: *Adiantum capillus-veneris* L.*, Conocephalum conicum* (L.) Underw.*, E. verticillatum* (Brid.) B., S. & G.*, P. endiviifolia* (Dicks.) Dum.*, Pholia wahlenbergii* (Web. & Mohr.) Andr.*, Samolus valerandi* L.

Geographical distribution: This class has a wide Mediterranean distribution, including Atlantic islands, North Africa and Middle East (Deil, 1998; Mucina et al., 2016).

Structure and ecology: The shaded cliffs with dripping or running water are colonized by very peculiar communities characterized mainly *Adiantum capillus-veneris*, which grows often together with other vascular plants and several bryophytes. This vegetation, classified within the *Adiantetea capilli-veneris* class, grows on wet halvcaves, natural cliffs, man-made walls overflown by fresh water and near waterfalls, where the climatic conditions are quite constant, making these communities independent from the precipitation regime and from the climatic changes, despite they are more common in the areas with humid-subhumid thermo-mesomediterranean bioclimate. For this reason, the *Adiantetea* vegetation hosts several paleoendemic and relict species, including some tropical ferns (Brullo et al., 1989; Deil, 1996, 1998).

Syndynamism: This vegetation has a permanent character and is not subject to dynamic phaenomena. It can takes catenal contact with the *Asplenietea trichomanis* vegetation in the

more dry stands with a xerophilous character and sometimes also with the *Montio-Cardaminetea* communities in the riparian environments near springs, streams and waterfalls.

Habitat reference: H3.4 Wet inland cliff.

20.1. Order: ***Adiantetalia capilli-veneris*** Br.-Bl. ex Horvatic 1934

Chasmo-chomophytic vegetation rich in bryophytes and pteridophytes of humid cliffs.

Synonyms: *Adiantetalia* Br.-Bl. 1931 (art. 2b); *Adiantetalia* Br.-Bl. in Br.-Bl. et al. 1947 (art. 2b); *Adiantetalia* Br.-Bl. 1948 (art. 2b); *Adiantetalia* Br.-Bl. in Br.-Bl. et al. 1952 (art. 31); *Pinguiculetalia longifoliae* Fernàndez Casas 1970.

Lectotypus: *Adiantion capilli-veneris* Br.-Bl. ex Horvatic 1934

Characteristic and differential species: See class.

Geographical distribution: See class.

Structure and ecology: According to Mucina et al. (2016), the *Adiantetalia capilli-veneris* represents the only order of *Adiantetea* class in Europe.

Syndynamism: See class.

Habitat reference: See class.

20.1.1. Alliance: ***Adiantion*** Br.-Bl. ex Horvatič 1934

Chasmo-chomophytic vegetation rich in bryophytes and pteridophytes of wet cliffs that are subject to dripping of calcareous waters.

Synonyms: *Adiantion* Br.-Bl. 1931 (art. 2b); *Adiantion* Br.-Bl. in Br.-Bl. et al. 1947 (art. 2b); *Adiantion* Br.-Bl. in Br.-Bl. et al. 1952; *Polysticho setiferi-Phyllitidion scolopendri* Ubaldi ex Ubaldi & Biondi in Biondi et al. 2014 nom. inval. (art. 3f).

Lectotypus: *Eucladio-Adiantetum capilli-veneris* Br.-Bl. ex Horvatic 1934.

Characteristic and differential species: See class.

Geographical distribution: The alliance, widely distributed in the Mediterranean territories, in Sicily was recorded by several authors (Raimondo & Dia, 1980; Raimondo et al., 1981; Brullo et al., 1989, 1993c; Puglisi, 1994).

Structure and ecology: The communities of *Adiantion* alliance are linked to wet walls and cliffs, subject to dripping of waters with a strong carbonates content, which for the continuous deposition on the leaves of ferns and bryophytes determining the tufaceous and travertine rock formations. Recently, Biondi et al. (2014b) described a new alliance within the

Adiantetea capilli-veneris, named *Polysticho setiferi-Phyllitidion scolopendri*, but unfortunately this syntaxon is invalid (art. 3f), since in the *Conocephalo conici-Woodwardietum radicantis* Brullo et al. 1989, association designated as holotypus, both species giving the name to this alliance not occur in any releves regarding its original table.

Syndynamism: See class.

Habitat reference: See class.

20.1.1.1. ***Eucladio verticillati-Adiantetum capilli-veneris*** Br.-Bl. ex Horvatic 1934

Chasmo-chomophytic vegetation with venus hair fern of wet cliffs.

Synonyms: Ass. à *Adiantum capillus veneris* et *Eucladium* Br.-Bl. 1931 (2b); *Eucladieto-Adiantetum* Br.-Bl, Roussine et Negre 1952.

Holotypus: rel. pag. 199, Horvatic (1934).

Characteristic and differential species: *Adiantum capillus-veneris* L.

Phytosociological table: From Brullo et al. (1989), tab. 1, 12 rel.

Char. association: *Adiantum capillus-veneris* (V).

Char. alliance, order and class: *Eucladium verticillatum* (V), *Pellia endiviifolia* (IV), *Pohlia wahlenbergii* (III), *Samolus valerandi* (II), *Conocephalum conicum* (I).

Other species: *Rhynchostegiella tenella* (III), *Bryum capillare* (II), *Cephalozia bicuspidata* (II), *Southbya tophacea* (II), *Scorpiurum circinatum* (II), etc.

Geographical distribution: This vegetation has a wide distribution in the Mediterranean area (Baun-Blanquet et al. 1952; Gradstein & Smittenberg, 1977; Deil, 1998; Bardat et al., 2004), including France, Spain, Balkans, Greece, Crete and Italy. In Sicily it was surveyed by Raimondo et al. (1981) and Brullo et al. (1989) mainly for the northern part of the island and also for the Hyblaean area (Brullo et al., 1993a, b) and Lampedusa island (Bartolo et al., 1990a).

Structure and ecology: The wet limestone cliffs, or sometimes also schists, volcanic rocks and sandstones always subject to the dripping of calcareous waters, are colonized by the *Eucladio-Adiantetum capilli-veneris*, a basiphilous vegetation of the thermomediterranean belt. This association shows a typical two-stratified structure, being costituted by a basal layer represented by a bryophytic carpet dominated mainly by *Eucladium verticillatum* and *Pellia endiviifolia* and by a higher layer with *Adiantum capillus-veneris* (Brullo et al., 1989).

Syndynamism: See class.

Habitat reference: See class.

20.1.1.2. ***Eucladio verticillati-Didymodonetum tophacei*** Hébrard 1973

Bryophytic vegetation with didymodon moss of very humid anthropogenic walls.

Synonyms: *Eucladio-Adiantetum* subass. *didymodetosum* Raimondo et al. 1981. nom. inval. (art. 5).

Lectotypus: Not designated.

Characteristic and differential species: *Didymodon tophaceus* (Brid.) Lisa

Phytosociological table: From Brullo et al. (1989), tab. 2, 13 rel.

Char. association: *Didymodon tophaceus* (V).

Char. alliance, order and class: *Pellia endiviifolia* (III), *Eucladium verticillatum* (III), *Adiantum capillus veneris* (III), *Samolus valerandi* (III).

Other species: *Cratoneuron filicinum* (II), *Rhynchostegium riparioides* (I), *Pohlia wahlenbergii* (I).

Geographical distribution: This vegetation occurs in France (Hébrard, 1973), Iberian peninsula (Sanchez & Gil, 1982) and Sicily. In the last territory it was surveyed by Raimondo et al. (1981), Privitera & Lo Giudice (1986) and Brullo et al. (1989) in various localities of the island.

Structure and ecology: The *Eucladio-Didymodonetum tophaccei* replaces the *Eucladio-Adiantetum* in more hygrophilous conditions and shows a less marked thermophilous character. It is a basiphilous vegetation, growing in the stands subject to water dripping with a short period of dryness. This community prefers sunny exposure, colonizing walls with anthropogenic origin, as water-splashed walls, wet road embankments, fountains, etc. Physiognomically, it is characterized by the dominance of a well developed bryophytic layer, like a pulvinate tufts and often incrusted with carbonates. From the floristic point of view, *Didymodon tophaceus* shows a high coverage, growing together with *Eucladium verticillatum* and *Pellia endiviifolia*. Besides, *Adiantum capillus veneris* and *Samolus valerandi* are frequent too (Raimondo et al., 1981, Brullo et al., 1989).

Syndynamism: See class.

Habitat reference: See class.

20.1.1.3. ***Adianto capilli-veneris-Cratoneuretum filicini*** Brullo, Lo Giudice & Privitera 1989

Chasmo-chomophytic vegetation with venus hair fern and fern-leaved hookmoss of humid cliffs.

Synonyms: aggr. a *Cratoneuron filicinum* e *Cratoneuron filicinum* var. *fallax* Privitera & Lo Giudice 1986; *Eucladio-Adiantetum* subass. *cratoneuretosum filicini* Deil 1996.

Holotypus: rel. 3, tab. 3, Brullo et al. (1989).

Characteristic and differential species: *Cratoneuron filicinum* (Hedw.) Spruce.

Phytosociological table: From Brullo et al. (1989), tab. 3, 6 rel.

Char. association: *Cratoneuron filicinum* (V).

Char. alliance, order and class: *Adiantum capillus veneris* (V), *Eucladium verticillatum* (V), *Pellia endiviifolia* (IV), *Didymodon tophaceus* (III), *Samolus valerandi* (III).

Other species: *Hypericum hircinum* (III), *Plangiumnium undulatum* (I), *Sothybya tophacea* (I), *Eurhynchium speciosum* (I), *Lophozia turbinata* (I).

Geographical distribution: This community was described by Brullo et al. (1989) from central and north-eastern Sicily.

Structure and ecology: The association shows more hygrophilous requiremens compared to the previous ones, occurring mainly on limestone substrata (sometimes also schists) in the stands with a humid-subhumid mesomediterranean bioclimate. It is indifferent to exposure, but needs markedly humid conditions. Usually, it is two-stratified with an uppper layer dominated by *Adiantum capillus-veneris* and a lower one represented by a moss carpet with *Cratoneuron filicinum*, which is associated with *Eucladium verticillatum*, *Pellia endiviifolia*, etc. (Brullo et al., 1989).

Syndynamism: See class.

Habitat reference: See class.

20.1.1.4. ***Adianto capilli-veneris-Cratoneuretum commutati*** Privitera & Lo Giudice 1986

Chasmo-chomophytic vegetation with venus hair fern and curled hookmoss of very humid tufaceous cliffs.

Lectotypus: rel. 19, tab. 2, Privitera & Lo Giudice (1986), here designated.

Characteristic and differential species: *Cratoneuron commutatum* (Hedw.) G. Roth.

Phytosociological table: From Brullo et al. (1989), tab. 4, 12 rel.

Char. association: *Cratoneuron commutatum* (V).

Char. alliance, order and class: *Adiantum capillus veneris* (IV), *Pellia endiviifolia* (IV), *Eucladium verticillatum* (III), *Samolus valerandi* (III), *Conocephalum conicum* (II), *Pohlia wahlenbergii* (I).

Other species: *Hypericum hircinum* (II), *Eurhynchium speciosum* (II), *Cladophora* sp. (II), *Philonotis marchica* (II), *Rhynchostegium riparioides* (I), etc.

Geographical distribution: This community occurs only in southern Italy (Brullo et al., 2001; Cancellieri, 2008) and in Sicily, where it is quite frequent (Privitera & Lo Giudice, 1986; Brullo et al., 1989, 1993a).

Structure and ecology: The tufaceous stands of vertical or subvertical cliffs, subject to dripping or running waters, are colonized by a dense carpet with *Cratoneuron commutatum*, which determines the formation of calcareous precipitates. This community, named *Adianto-Cratoneuretum commutati*, shows a basiphilous and a meso-hygrophilous character, being restricted to the mesomediterranean belt. Under the floristic profile, the coverage of *Adiantum capillus-veneris*, *Pellia endiviifolia*, *Eucladium verticillatum* and *Samolus valerandi* is quite relevant (Brullo et al., 1989). In the spring and stream stands of mountain belt, this association is replaced by the *Cratoneureton commutati*, vegetation of *Montio-Cardaminetea*.

Syndynamism: See class.

Habitat reference: See class.

20.1.1.5. ***Conocephalo conici-Woodwardietum radicantis*** Brullo, Lo Giudice & Privitera 1989

Chasmo-chomophytic vegetation with chain fern of wet cliffs near waterfalls.

Holotypus: rel. 3, tab. 6, Brullo et al. (1989).

Characteristic and differential species: *Conocephalum conicum* (L.) Dumort., *Woodwardia radicans* (L.) Sm.

Phytosociological table: From Brullo et al. (1989), tab. 6, 7 rel.

Char. association: *Woodwardia radicans* (V), *Conocephalum conicum* (V).

Char. alliance, order and class: *Adiantum capillus veneris* (V), *Pellia endiviifolia* (V), *Pohlia wahlenbergii* (IV), *Eucladium verticillatum* (III), *Samolus valerandi* (II), *Eucladium verticillatum* (I).

Other species: *Hypericum hircinum* (IV), *Eurhynchium speciosum* (IV), *Aneura pinguis* (IV), *Philonotis marchica* (III), *Bryum* sp. (I).

Geographical distribution: This association in Sicily occurs only in few places of Peloritani Mountains, in the north-eastern part of the island (Brullo et al., 1989). It was surveyed also in southern Italy (Calabria and Campania), where it is localized near waterfalls too (Brullo et al., 2001; Spampinato et al., 2008; Cancellieri, 2008). Besides, very similar communities dominated by Woodwardia radicans have been recorded from Crete by Cambria & Puglisi (2018).

Structure and ecology: The *Conocephalo-Woodwardietum radicantis* represents a markedly mesophilous vegetation with neutrophilous or slightly basophilous requirements, colonizing the schistous cliffs near waterfalls with a strong edaphic humidity. It prefers the shaded stands with a mesomediterranean bioclimate, where the relict fern *Wooddwardia radicans* finds its optimum, growing together with *Conocephalum conicum* and also other bryophytes, such as *Pellia endiviifolia*, *Pohlia wahlenbergii*, *Eucladium verticillatum*, etc. (Brullo et al., 1989).

Syndynamism: See class.

Habitat reference: See class.

20.1.1.6. ***Adianto capilli-veneris-Pteridetum vittatae*** Brullo, Lo Giudice & Privitera 1989

Chasmo-chomophytic vegetation with ladder brake and venus hair fern of shaded humid cliffs.

Synonyms: *Eucladio-Adiantetum* subass**.** *pteridietosum vittatae* Deil 1996

Holotypus: rel. 4, tab. 5, Brullo et al. (1989).

Characteristic and differential species: *Barbula ehrenbergii* (Lorentz) M. Fleisch., *Pteris vittata* L.

Phytosociological table: From Brullo et al. (1989), tab. 5, 5 rel.

Char. association: *Pteris vittata* (V), *Barbula ehrenbergii* (V).

Char. alliance, order and class: *Adiantum capillus veneris* (V), *Eucladium verticillatum* (V), *Pellia endiviifolia* (V), *Samolus valerandi* (II), *Pohlia wahlenbergii* (II).

Other species: *Eurhynchium speciosum* (III), *Hymenostylium recurvirostrum* (I), *Marchantia paleacea* (I), *Bryum gemmiparum* (I), *Hypericum hircinum* (I), etc.

Geographical distribution: This community was surveyed in the Peloritani and Hyblaean mountains (Brullo et al., 1989, 1993a) and also in southern Italy (Cancellieri, 2008).

Structure and ecology: The highly humid schistous or limestone cliffs of shaded stands, subject to the dripping of calcareous waters, are colonized by the *Adianto-Pteridetum vittatae*. It is a hyper-hygrophilous and thermophilous vegetation, which is restricted to the thermo-mediterranean belt, where the subtropical fern *Pteris vittata* finds its optimum. This species grows with *Adiantum capillus-veneris*, constituting a well developed chormophytic layer, while the bryophytic component is represented by *Barbula ehrenbergii*, a caespitose bryo-chamaephyte, and also by *Eucladium verticillatum*, *Pellia endiviifolia*, *Pohlia wahlenbergii*, etc. (Brullo et al., 1989).

Syndynamism: See class.

Habitat reference: See class.

20.1.1.7. ***Adianto capilli-veneris-Osmundetum regalis*** Brullo, Lo Giudice & Privitera 1989

Chasmo-chomophytic vegetation with royal fern and venus hair fern of schistous cliffs subject to dripping or running acid waters.

Synonyms: *Eucladio-Adiantetum* subass**.** *osmundetosum regalis* Deil 1996.

Holotypus: rel. 1, tab. 7, Brullo et al. (1989).

Characteristic and differential species: *Calypogeia fissa* (L.) Raddi, *Osmunda regalis* L.

Phytosociological table: From Brullo et al. (1989), tab. 7, 9 rel.

Char. association: *Osmunda regalis* (V), *Calypogeia fissa* (V).

Char. alliance, order and class: *Adiantum capillus veneris* (V), *Pellia epiphylla* (V), *Pohlia wahlenbergii* (IV), *Eucladium verticillatum* (III), *Conocephalum conicum* (I), *Samolus valerandi* (I).

Other species: *Riccardia multifida* (IV), *Cephalozia bicuspidata* (IV), *Jungermannia hyalina* (III), *Fossombronia* cfr. *caespitiformis* (III), *Rhynchostegium confertum* (II), *Trichostomum brachydontium* (II), *Bryum* sp. (II), etc.

Geographical distribution: This community occurs in the Peloritani mountains and in the Aspromonte massif (Brullo et al., 1989; 2001). It is also recorded from Crete by Cambria & Puglisi (2018).

Structure and ecology: The *Adianto-Osmundetum regalis* is a sciaphilous and hygrophilous vegetation, which grows on the schistous cliffs subject to dripping or running of acid waters. It is linked to the humid mesomediterranean belt, showing oceanic requirements. From the floristic viewpoint, this community is characterized by the mesophilous fern *Osmunda regalis*, growing together with *Adiantum capillus veneris* and several bryophytes, such as *Calypogeia fissa*, *Pellia epiphylla*, *Pohlia wahlenbergii*, *Eucladium verticillatum*, *Conocephalum conicum*, etc. (Brullo et al., 1989).

Syndynamism: See class.

Habitat reference: See class.

20.1.1.8 ***Thamnobryo alopecuri-Phyllitidetum scolopendrium*** Brullo, Privitera & Puglisi 1993

Chasmo-chomophytic vegetation with hart's-tongue fern and fox-tail feathermoss of shady and humid cliffs.

Holotypus: rel. 7, tab. 1, Brullo et al. (1993c).

Characteristic and differential species: *Phyllitis scolopendrium* (L.) Newman, *Thamnobryum alopecurum* (Hedw.) Gangulee.

Phytosociological table: From Brullo et al. (1993c), tab. 1, 28 rel.

Char. association: *Phyllitis scolopendrium* (V), *Thamnobryum alopecurum* (V).

Char. alliance, order and class: *Adiantum capillus veneris* (V), *Conocephalum conicum* (IV), *Pellia endiviifolia* (IV), *Samolus valerandi* (I), *Phyllitis sagittata* (I), *Eucladium verticillatum* (I).

Other species: *Plagiomnium undulatum* (V), *Fissidens taxifolius* (III), *Polystichum setiferum* (III), *Eurhynchium praelongum* (II), *Rhyncostegium confertum* (II), *Didymodon insulanus* (II), *Asplenium trichomanes* (II), etc.

Geographical distribution: This community is distributed in southern Italy and Sicily, where occurs small spots with oceanic conditions (Brullo et al., 1989; 2001). In Sicily it is known for few localities, where shows a relict character.

Structure and ecology: The association is localized in strongly shaded cliffs, more or less inclined and covered by a shallow layer of soil. This vegetation occurs in humid places from 200 to 1000 m a.s.l., on various kinds of substrata, including limestones, volcanites and schist, but is strictly linked to scarcely luminous stands, where it can cover quite wide surfaces. Floristically, it is characterized by scattered individuals of *Phyllitis scolopendrium*, which grows usually together with *Thamnobryum alopecurum*. The bryophytes component is represented by *Conocephalum conicum*, *Pellia endiviifolia*, *Eucladium verticillatum*, *Plagiomnium undulatum*, *Fissidens taxifolius*, etc. As concerns the vascular species, *Phyllitis sagittata*, *Adiantum capillus veneris*, *Samolus valerandi* and *Polystichum setiferum* result quite frequent (Brullo et al., 1993c).

Syndynamism: See class.

Habitat reference: See class.

20.1.1.9. ***Homalio lusitanicae-Adiantetum capilli-veneris*** Puglisi 1994

Chasmo-chomophytic vegetation with homalia moss and venus hair fern of slightly humid cliffs.

Holotypus: Rel. 1, tab. 1, Puglisi (1994).

Characteristic and differential species: *Homalia lusitanica* Schimp.

Phytosociological table: From Puglisi (1994), tab. 1, 7 rel.

Char. association: *Homalia lusitanica* (V).

Char. alliance, order and class: *Adiantum capillus-veneris* (V), *Pellia endiviifolia* (V), *Eucladium verticillatum* (III), *Conocephalum conicum* (III), *Samolus valerandi* (III).

Other species: *Rhynchostegium confertum* (IV), *Eurynchium speciosum* (III), *Cymbalaria pubescens* (III), *Brachytecium rutabulum* (III), etc.

Geographical distribution: This vegetation occurs only in the Hyblaean and Peloritani mountains (Puglisi, 1994; Minissale et al., 2007).

Structure and ecology: The *Homalio lusitanicae-Adianthetum capilli-veneris* colonizes the humid and very shaded vertical cliffs near springs and dripping rocks. This community is characterized by the occurrence of *Homalia lusitanica*, a rare atlantic-mediterranean species that is very rare in Sicily (Puglisi, 1991, 1994). This hepatic constitutes a dense carpet covering the calcareous rocks and is usually associated with *Adiantum capillus-veneris*.

Syndynamism: See class.

Habitat reference: See class.

20.1.1.10. ***Adianto capillis veneris-Solenopsietum bivonae*** ass. nov. provv.

Chasmophilous vegetation with venus hair fern and Bivona's laurentia of wet calcareous rocks.

Holotypus: Not designated.

Characteristic and differential species: *Solenopsis bivonae* (Tineo) M.B.Crespo, Serra & Juan.

Phytosociological table: 8 rel. ined., Cambria, Fiume Sosio near Chiusa Sclafani (2018).

Char. association: *Solenopsis bivonae* (V).

Char. alliance, order and class: *Adiantum capillus-veneris* (V), *Pellia endiviifolia* (V), *Samolus valerandi* (IV), *Eucladium verticillatum* (III).

Other species: *Rhynchostegiella tenella* (IV), *Scorpiurum circinatum* (III), *Lotus tenuis* (II), *Mentha pulegium* (II), *Hypericum hircinum* subsp. *majus* (II), *Eupatorium cannabinum* (II), *Crepis leontodontoides* (II), etc.

Geographical distribution: The association is exclusive of Sicily, where it was surveyed in few stands along some watercourses, such as Sosio and Oreto rivers.

Structure and ecology: It is a very rare association usually occurring on wet calcareous rocks along the river banks, in correspondence of crevices where a little bit of soil is deposited. This vegetation is characterized by the rare *Solenopsis bivonae*, which grows together with *Adiantum capillus veneris* and some hygrophilous bryophytes. It is a thermophilous community, localized in stands with an altitude of 50-500 m, within the thermomediterranean belt.

Syndynamism: See class.

Habitat reference: See class

21. Class: ***Asplenietea trichomanis*** (Br.-Bl. in Meier & Br.-Bl. 1934) Oberd. 1977

Perennial chasmophilous vegetation growing in the crevices of rocks, cliffs and walls.

Synonyms: *Asplenietales rupestres* Br.-Bl. in Meier & Br.-Bl. 1934; *Rupicapro-Cheilanthetea maderensis* Lacourt in Géhu 1992 (art. 2b); *Petrocoptido pyrenaicae-Sarcocapnetea enneaphyllae* Rivas Mart. et al. 2002 (syntax. syn.).

Lectotypus: *Potentilletalia caulescentis* Br.-Bl. in Br.-Bl. & Jenny 1926.

Characteristic and differential species: *Arabis collina* Ten., *Asplenium trichomanes* L., *Athamanta sicula* L., *Ballota hispanica* (L.) Benth., *Ceterach officinarum* Willd., *Cheilanthes acrostica* (Balb.) Tod.,, *Cystopteris fragilis* (L.) Bernh., *Ficusa carica* L., *Sedum dasyphyllum* L., *Umbilicus horizontalis* (Guss.) DC., *Umbilicus rupestris* (Salisb.) Dandy.

Geographical distribution: This class is distributed in Europe, North Africa, Middle East, Greenland and Artic islands (Brullo et al., 2004; Biondi et al., 2014; Mucina et al., 2016).

Structure and ecology: The *Asplenietea trichomanis* class gathers the chasmophytic communities colonizing crevices, rocky ledges and faces of rocky cliffs and walls. It is a very specialized vegetation, whose communities are quite variable for floristic composition, ecology and structure, occurring from the sea level up to over 2000 m a.s.l. on various kinds of substrata (limestones, dolomites, schists, sandstones, granites, volcanites, etc.). Besides, the occurrence of regional and local endemics allows to distinguish several geographical vicariant syntaxa well differentiated for their floristic set. From the structural point of view, this vegetation is constituted by chasmophytes with various life-forms, as hemicryptophytes, nanophanerophytes, chamaephytes and phanerophytes. These plants are linked to crevices of rocks, where the competition among species is low or absent. Therefore, several relict and isolated paleo-endemics have found refuge in the cliff habitats, which are also less affected by climatic change and human activities, as grazing and agricolture (Brullo & Spampinato, 2003).

Syndynamism: This vegetation with azonal meaning is linked to peculiar environments not subject to dynamic processes, but sometimes affected by human disturbance, such as quarries, climbing, road construction and spread of exotic species, which can determine a strong floristic impoverishment.

Habitat reference: H3.2d Mediterranean base-rich inland cliff; H3.1d Mediterranean siliceous inland cliff.

21.1. Order: ***Asplenietalia glandulosi*** Br.-Bl. & Meier in Meier & Br.-Bl. 1934

Perennial chasmophilous vegetation withthermo-mesophilous requirements occurring on basic or neutral cliffs and walls of West Mediterranean.

Synonyms: *Asplenietalia petrarchae* Br.-Bl. & Meier in Meier & Br.-Bl. 1934 nom. mut. illeg. (proposed by Rivas-Martinez et al. 2002); *Tinguarretalia siculae* Rigual et al. 1963 (art. 29); *Arenario bertolonii-Phagnaletalia sordidae* Arrigoni & Di Tommaso 1991.

Lectotypus: *Asplenion glandulosi* Br.-Bl. & Meier in Meier & Br.-Bl. 1934.

Characteristic and differential species: *Hypochaeris laevigata* (L.) Ces., P. & G., *Lomelosia cretica* (L.) Greuter & Burdet, *Melica minuta* L., *Teucrium flavum* L.

Geographical distribution: This order is widespread in the territories of western Mediterranean area, where it is represented by several alliances (Meier & Braun-Blanquet, 1934; Braun-Blanquet et al., 1952; Rivas-Martinez et al., 2002, 2011; Brullo & Spampinato, 2003; Brullo et al., 2004; Biondi et al., 2014).

Structure and ecology: It is a thermo-mesophilous vegetation, localized in the rocky crevices from sea level to 1500 m of altitude on various substrata, mainly of carbonatic type, but occurs sometimes also on metamorphic, granites and volcanic rocks (Brullo et al., 2004). Usually the communities of this syntaxon are distributed within the thermo- and meso-mediterranean belts with dry to humid ombrotypes.

Syndynamism: This order groups permanent communities having an edapho-climatic role.

Habitat reference: H3.2d Mediterranean base-rich inland cliff.

21.1.1. Alliance: ***Dianthion rupicolae*** Brullo & Marcenò 1979

Chasmophilous vegetation with thermo-mesophilous requirements occurring in southern Italy and Sicily.

Holotypus: *Scabioso-Centauretum ucriae* Brullo & Marcenò 1979.

Characteristic and differential species: *Anthemis cupaniana* Tod. ex Nyman, *Antirrhinum siculum* Mill., *Asperula rupestris* Tineo, *Brassica incana* Ten., *B. macrocarpa* Guss., *B. rupestris* Raf., *Cymbalaria pubescens* (C. Presl) Cufod., *Dianthus rupicola* Biv. subsp. *rupicola*, *Erucastrum virgatum* (J. & C. Presl) C. Presl, *Glandora rosmarinifolia* (Ten.) D. C. Thomas, *Iberis semperflorens* L., *Matthiola incana* (L.) W.T.Aiton subsp. *rupestris* (Raf.) Nyman, *Odontites bocconei* (Guss.) Walp. subsp. *bocconei*, *Pimpinella anisoides* V. Brig., *Pseudoscabiosa limonifolia* (Vahl) Devesa, *Seseli bocconei* Guss. subsp. *bocconei*, *Silene fruticosa* L.

Geographical distribution: This alliance is circumscribed to the Tyrrhenian coast from Latium to Calabria, southern-ionian Calabria, Sicily and Malta (Brullo & Marcenò, 1979; Brullo et al., 2001; 2004; Brullo & Spampinato, 2003).

Structure and ecology: This alliance groups the thermophilous and mesophilous communities of cliffs that grows from the sea level to 1500 m a.s.l., mainly on carbonatic rocks or more rarely on siliceous substrata. This vegetation is much rich of endemic species, often with punctiform distribution, represented by shrubs having a relict Tertiary origin (Brullo & Marcenò, 1979). As concerns the syntaxonomical arrangement of this alliance, it is followed the scheme proposed by Brullo & Marcenò (1979), Brullo & Spampinato (2003), Brullo et al. (2004) and Biondi et al. (2014), while the proposal of Mucina et al. (2016), as emphasized also by Guarino et al. (2017), to include the *Dianthion rupicolae* alliance within the acidophilous order *Asplenietalia lanceolato-obovati* must be rejected, because it is senseless.

Syndynamism: The associations of *Dianthion rupicolae* must be considered as edapho-climatic communities, since are linked to stands where the normal soil evolution is prevented. Under the synphytosociological profile, they can be attributed to the southern Tyrrhenian geosigmetum of chasmophytic type, represented by *Dianthion rupicolae* and *Oleo-Ceratonion*.

Habitat reference: See order.

21.1.1.1. ***Scabioso creticae-Centauretum ucriae*** Brullo & Marcenò 1979

Chasmophilous vegetation with Cretan scabious and Palermo centaury of dry limestone cliffs.

Synonyms: ass. à *Scabiosa cretica* R. & R. Molinier 1955, nom. inval. (art. 3b).

Holotypus: rel. 1a, pag. 139. Brullo & Marcenò (1979).

Characteristic and differential species: *Brassica villosa* Biv. subsp. *villosa*, *Centaurea panormitana* Lojac. subsp. *ucriae* (Lacaita) Greuter, *Centaurea panormitana* Lojac. subsp. *umbrosa* (Fiori) Greuter, *Convolvulus cneorum* L., *Euphorbia bivonae* Steud., *Helichrysum panormitanum* Tineo ex Guss. s.l.

Phytosociological table: From Brullo et al. (2004), tab. 1, 32 rel. (subass. *typicum*).

Char. association: *Centaurea panormitana* subsp. *ucriae* (IV), *Helichryum panormitanum* s.l. (IV), *Centaurea panormitana* subsp. *umbrosa* (II), *Euphorbia bivonae* (II), *Brassica villosa* subsp. *villosa* (I), *Convolvulus cneorum* (I).

Char. alliance: *Dianthus rupicola* subsp. *rupicola* (V), *Iberis semperflorens* (V), *Silene fruticosa* (IV), *Seseli bocconei* subsp. *bocconei* (IV), *Matthiola incana* subsp. *rupestris* (III), *Antirrhinum siculum* (III), *Glandora rosmarinifolia* (III), *Brassica rupestris* (III), *Asperula rupestris* (II), *Cymbalaria pubescens* (II), *Anthemis cupaniana* (II), *Brassica villosa* subsp. *bivoniana* (I).

Char. order: *Lomelosia cretica* (V), *Athamanta sicula* (IV), *Melica minuta* (III), *Teucrium flavum* (II), *Ballota rupestris* (II).

Char. class: *Sedum dasyphyllum* (IV), *Hyphochoeris laevigata* (IV), *Umbilicus rupestris* (II), *Ceterach officinarum* (II), *Ficus carica* (I).

Other species: *Hyoseris radiata* (IV), *Micromeria fruticulosa* (III), *Euphorbia dendroides* (III), *Parietaria lusitanica* (II), *Polypodium cambricum* (I), etc.

From Brullo et al. (2004), tab. 2, 16 rel. (subass. *helichrysetosum straminei*).

Char. association: *Centaurea panormitana* subsp. *umbrosa* (V), *Centaurea panormitana* subsp. *ucriae* (IV), *Euphorbia bivonae* (III), *Convolvulus cneorum* (I).

Char. subassociation: *Helichryum panormitanum* subsp. *stramineum* (V), *Anthemis ismelia* (V), *Hieracium lucidum* (III), *Genista gasparrinii* (III), *Limonium panormitanum* (I).

Char. alliance: *Pseudoscabiosa limonifolia* (V), *Glandora rosmarinifolia* (V), *Asperula rupestris* (V), *Seseli bocconei* subsp. *bocconei* (V), *Dianthus rupicola* subsp. *rupicola* (V), *Iberis semperflorens* (IV), *Matthiola incana* subsp. *rupestris* (II), *Antirrhinum siculum* (II), *Brassica rupestris* (II), *Cymbalaria pubescens* (II), *Silene fruticosa* (I).

Char. order: *Lomelosia cretica* (V), *Melica minuta* (III), *Teucrium flavum* (I), *Asplenium petrarchae* (I), *Athamanta sicula* (I), *Ballota rupestris* (I).

Char. class: *Hyphochoeris laevigata* (V), *Umbilicus rupestris* (II), *Sedum dasyphyllum* (II), *Asplenium trichomanes* (I), *Ficus carica* (I).

Other species: *Hyoseris radiata* (V), *Erica multiflora* (IV), *Ampelodesmos mauritanicus* (II), *Polypodium cambricum* (I), etc.

From Brullo et al. (2004), tab. 2, 11 rel. (subass. *centauretosum todari*).

Char. association: *Convolvulus cneorum* (V), *Helichryum panormitanum* s.l. (IV), *Euphorbia bivonae* (IV), *Centaurea panormitana* subsp. *umbrosa* (I).

Char. subassociation: *Centaurea panormitana* subsp. *todaroi* (V).

Char. alliance: *Glandora rosmarinifolia* (V), *Asperula rupestris* (V), *Dianthus rupicola* subsp. *rupicola* (V), *Seseli bocconei* subsp. *bocconei* (IV), *Iberis semperflorens* (IV), *Matthiola incana* subsp. *rupestris* (III).

Char. order: *Lomelosia cretica* (V), *Melica minuta* (III), *Teucrium flavum* (I), *Asplenium petrarchae* (I), *Athamanta sicula* (I), *Ballota rupestris* (I).

Char. class: *Hyphochoeris laevigata* (II), *Umbilicus rupestris* (II), *Sedum dasyphyllum* (I), *Asplenium trichomanes* (I), *Ficus carica* (I).

Other species: *Lotus cytisoides* (V), *Micromeria fruticolosa* (V), *Erica multiflora* (IV), *Ampelodesmos mauritanicus* (III), *Chamaerops humilis* (III), *Hyoseris radiata* (III), *Polypodium cambricum* (I), etc.

From Brullo et al. (2004), tab. 3, 24 rel. (subass. *ericetosum siculae*).

Char. association: *Centaurea panormitana* subsp*. ucriae* (V), *Convolvulus cneorum* (IV), *Centaurea panormitana* subsp. *umbrosa* (I).

Char. subassociation: *Erica sicula* subsp. *sicula* (V), *Helichryum panormitanum* subsp. *brulloi* (IV), *Hieracium cophanense* (III), *Phagnalon metlesicsii* (III), *Limonium todaroanum* (I).

Char. alliance: *Glandora rosmarinifolia* (IV), *Asperula rupestris* (IV), *Dianthus rupicola* subsp. *rupicola* (III), *Seseli bocconei* subsp. *bocconei* (IV), *Iberis semperflorens* (IV), *Brassica villosa* subsp. *bivoniana* (III), *Silene fruticosa* (II), *Anthemis cupaniana* (II), *Pseudoscabiosa limonifolia* (II), *Odontites bocconei* subsp. *bocconei* (I), *Matthiola incana* subsp. *rupestris* (I), *Cymbalaria pubescens* (I), *Brassica villosa* subsp. *drepanensis* (I).

Char. order: *Lomelosia cretica* (V), *Melica minuta* (IV), *Teucrium flavum* (III), *Athamanta sicula* (II).

Char. class: *Hyphochoeris laevigata* (IV), *Sedum dasyphyllum* (IV), *Ceterach officinarum* (III), *Asplenium trichomanes* (I), *Cheilanthes acrostica* (I), *Ranunculus rupestris* (I), *Ballota hispanica* (I), *Ficus carica* (I).

Other species: *Galium pallidum* (V), *Lotus cytisoides* (III), *Micromeria fruticulosa* (III), etc.

From Brullo et al. (2004), tab. 4, 20 rel. (subass. *brassicetosum macrocarpae*).

Char. association: *Helichryum panormitanum* s.l. (IV).

Char. subassociation: *Euphorbia papillaris* (V), *Centaurea aegusae* (IV), *Brassica macrocarpa* (III).

Char. alliance: *Dianthus rupicola* subsp. *rupicola* (V), *Seseli bocconei* subsp. *bocconei* (V), *Silene fruticosa* (V), *Iberis semperflorens* (IV), *Matthiola incana* subsp. *rupestris* (I).

Char. order: *Lomelosia cretica* (V), *Melica minuta* (III), *Athamanta sicula* (III), *Teucrium flavum* (II).

Char. class: *Sedum dasyphyllum* (V), *Umbilicus rupestris* (III), *Ceterach officinarum* (II), *Hyphochoeris laevigata* (I).

Other species: *Micromeria fruticulosa* (V), *Jacobaea cineraria* subsp. *sicula* (V), *Hyoseris radiata* (V), *Valantia muralis* (III), *Polypodium cambricum* (II), etc.

From Brullo et al. (2004), tab. 4, 8 rel. (subass. *brassicetosum drepanensis*).

Char. association and subassociation: *Brassica drepanensis* (V), *Centaurea erycina* (IV).

Char. alliance: *Dianthus rupicola* subsp. *rupicola* (V), *Silene fruticosa* (V), *Cymbalaria pubescens* (IV), *Asperula rupestris* (I).

Char. order: *Athamanta sicula* (V), *Melica minuta* (IV), *Lomelosia cretica* (I).

Char. class: *Hyphochoeris laevigata* (V), *Umbilicus rupestris* (V), *Sedum dasyphyllum* (III), *Ballota rupestris* (III), *Asplenium trichomanes* (II), *Ceterach officinarum* (I).

Other species: *Hyoseris radiata* (IV), *Allium subhirsutum* (V), *Parietaria judaica* (V), *Polypodium cambricum* (III), etc.

Geographical distribution: This vegetation is mainly distributed in the north-western part of Sicily, between Cefalù and Sciacca, Egadi islands with some isolated stands in the Nebrodi mountains (Rocche del Crasto). The association is represented by several subassociations, such as : a) subass. *typicum* is the most widespread; b) subass. *helichrysetosum straminei* is restricted to the northern slopes of Capo Gallo, near Palermo; c) subass. *centauretosum todari* occurs only in Monte Catalfano, near Bagheria; d) subass. *ericetosum siculae* is known only from Monte Passo del Lupo and Monte Cofano, near Trapani; e) subass. *brassicetosum macrocarpae* from Egadi islands (Favignana and Levanzo); f) *brassicetosum drepanensis* from Monte Erice (Brullo et al., 2004).

Structure and ecology: The association grows on calcareous cliffs with northern exposure of the thermomediterranean belt (from sea level to 900 m). This peculiar rupestrian community is characterized by the occurrence of several endemic and relict species, as *Centaurea panormitana* subsp. *ucriae*, *Lomelosia cretica*, *Helichryum panormitanum* s.l., *Euphorbia bivonae*, *Brassica villosa*, *Convolvulus cneorum*, *Dianthus rupicola* subsp. *rupicola*, *Iberis semperflorens*, *Silene fruticosa*, *Seseli bocconei* subsp. *bocconei*, *Glandora rosmarinifolia*, *Brassica rupestris*, *B. bivoniana*, *B. villosa*, *Asperula rupestris*, *Anthemis cupaniana*, etc. It is widespread on coastal and inland cliffs, constituted mainly by Mesozoic limestones and dolomites. This association can be considered the most floristically rich of the all island. Brullo & Marcenò (1979) and later Brullo et al. (2004) distinguished six subassociations, which are well differentiated under the floristic and chorological profiles: a) subass. *typicum* (holotypus: rel. 1a, pag. 139) is the more common aspect and lacks of proper characteristic taxa, but all the typical species of association are well represented; b) subass. *helichrysetosum straminei* (syn: *Scabioso-Centauretum ucriae* subass. *anthemidetosum ismeliae* Brullo et al. 2004, holotypus: rel. 1b, pag. 140) is characterized by some narrow endemic, as *Anthemis ismelia*,

Hieracium lucidum, *Genista gasparrinii* and *Limonium panormitanum*, which are restricted to limestone cliffs near the sea with northern exposure; c) subass. *centauretosum todari* (holotypus: rel. 1c, pag. 140) is differentiated by the occurence of *Centaurea panormitana* subsp. *todaroi*, whose presence is linked to more xerophilous conditions; d) subass. *ericetosum siculae* (holotypus: rel. 1d, pag. 140) is a particularly rich community with *Erica sicula* subsp. *sicula*, *Hieracium cophanense*, *Phagnalon metlesicsii* and *Limonium todaroanum*, which grows on coastal dolomitic cliffs with different exposure; e) subass. *brassicetosum macrocarpae* (holotypus: rel. 1f, pag. 141) represents a geographic insular vicariant, being characterized by the occurrence of some endemic species of Egadi islands as *Brassica macrocarpa*, *Centaurea aegusae* and *Euphorbia papillaris*; f) subass. *brassicetosum drepanensis* (holotypus: rel. 1e, pag. 140) is a more mesophilous aspect, since it is linked to limestone cliffs subject to frequent presence of fogs and clouds, where *Brassica drepanensis* and *Centaurea erycina* finds its optimum.

Syndynamism: This vegetation colonizes the more or less developed vertical cliffs that usually are very inaccessible habitat, despite the spreading of some exotic species, as *Opuntia ficus-indica*, can represent a threat to this community. As concern the catenal contact, it occurs above *Quercus ilex* woodlands, here represented by *Rhamno alaterni-Quercetum ilicis*, which is often replaced by secondary communities, such as garrigues and *Ampelodesmos mauritanicus* grasslands. Besides, it is to be highlighted that in the rocky ledges this association is in catenal contact with *Oleo-Ceratonion* shrublands.

Habitat reference: See order.

21.1.1.2. ***Bupleuro dianthifolii-Scabiosetum limonifoliae*** Brullo & Marcenò 1979

Chasmophilous vegetation with Marettimo hare's-ear and Trapani widow of dolomitic cliffs.

Holotypus: rel. 2, pag. 141, Brullo & Marcenò (1979).

Characteristic and differential species: *Allium franciniae* Brullo & Pavone, *Bupleurum dianthifolium* Guss., *Helichrysum panormitanum* Tineo ex Guss. subsp*. messeriae* (Pignatti) C. Brullo & Brullo, *Oncostema hughii* (Tineo ex Guss.) Speta, *Thymus nitidus* Guss.

Phytosociological table: From Brullo et al. (2004), tab. 5, 18 rel.

Char. association: *Bupleurum dianthifolium* (V), *Helichrysum panormitanum* subsp*. messeriae* (V), *Oncostema hughii* (IV), *Thymus nitidus* (II), *Allium franciniae* (I).

Char. alliance: *Pseudoscabiosa limonifolia* (V), *Asperula rupestris* (V), *Seseli bocconei* subsp. *bocconei* (V), *Iberis semperflorens* (V), *Glandora rosmarinifolia* (IV)*, Dianthus rupicola* subsp. *rupicola* (IV), *Brassica macrocarpa* (I).

Char. order and class: *Hyphochoeris laevigata* (IV), *Melica minuta* (II), *Ceterach officinarum* (II), *Athamanta sicula* (I), *Umbilicus rupestris* (I), *Ranunculus rupestris* (I), *Sedum dasyphyllum* (I).

Other species: *Erica multiflora* (V), *Jacobaea cineraria* subsp. *sicula* (IV), *Micromeria fruticulosa* (IV), *Rosmarinus officinalis* (II), *Polypodium cambricum* (II), etc.

Geographical distribution: This community is exclusive of Marettimo in the Egadi islands (Brullo & Marcenò, 1979, 1983b; Brullo et al., 2004).

Structure and ecology: This association, replacing the *Scabioso creticae-Centauretum ucriae* on Marettimo island, is well characterized by some narrow endemisms, as *Bupleurum dianthifolium*, *Oncostema hughii*, *Helichrysum panormitanum* subsp. *messeriae*, *Thymus nitidus* and *Allium franciniae*. The vegetation colonizes the dolomitic cliffs with various exposure and at an altitude between 200 and 600 m (Brullo et al., 2004).

Syndynamism: See alliance.

Habitat reference: See order.

21.1.1.3. ***Brassico rupestris-Centauretum saccensis*** Bazan, Ilardi & Raimondo 2006

Chasmophilous vegetation with Sciacca centaury and kohl rabi of very dry limestone cliffs.

Holotypus: rel. 4, tab. 4, Bazan et al. (2006).

Characteristic and differential species: *Centaurea saccensis* Raimondo, Bancheva & Ilardi, *Matthiola fruticulosa* (L.) Maire.

Phytosociological table: From Bazan et al. (2006), tab. 4, 6 rel.

Char. association: *Centaurea saccensis* (V), *Matthiola fruticulosa* (IV).

Char. alliance: *Dianthus rupicola* subsp. *rupicola* (V), *Silene fruticosa* (V), *Euphorbia bivonae* (V), *Antirrhinum siculum* (III), *Brassica rupestris* (III), *Seseli bocconei* subsp. *bocconei* (I).

Char. order: *Lomelosia cretica* (V), *Teucrium flavum* (III), *Ballota rupestris* (III), *Athamanta sicula* (I).

Char. class: *Sedum dasyphyllum* (II), *Hyphochoeris laevigata* (II).

Other species: *Sedum sediforme* (V), *Galium lucidum* (V), *Capparis spinosa* (V), *Coronilla valentina* (V), *Micromeria graeca* (V), *Rhamnus lycioides* subsp. *oleoides* (V), *Chamaerops humilis* (IV), *Phagnalon rupestre* (IV), *Sedum album* (IV), etc.

Geographical distribution: This community was surveyed only in the Tardara gorge, near Sciacca (Bazan et al., 2006).

Structure and ecology: The limestone cliffs of south-western Sicily are colonized by a chasmophilous vegetation with a xeric character. It is the *Brassico rupestris-Centauretum saccensis*, which is differentiated by the occurrence of the endemic *Centaurea saccensis*. The species of alliance are well represented, among them occur *Dianthus rupicola* subsp. *rupicola*, *Silene fruticosa*, *Euphorbia bivonae*, *Brassica rupestris, Seseli bocconei* subsp. *bocconei*, and also *Lomelosia cretica*, *Teucrium flavum*, *Athamanta sicula*, *Sedum dasyphyllum*, *Hypochoeris laevigata* belongs to order and class (Bazan et al., 2006).

Syndynamism: See alliance.

Habitat reference: See order.

21.1.1.4. ***Anthemido cupanianae-Centauretum busambarensis*** Brullo & Marcenò 1979

Chasmophilous vegetation with Sicilian chamomile and Busambra centaury of mountain cliffs.

Holotypus: rel. 3a, pag. 141, Brullo & Marcenò (1979).

Characteristic and differential species: *Anthemis cupaniana* Tod. ex Nyman, *Armeria gussonei* Boiss., *Bupleurum elatum* Guss., *Campanula marcenoi* Brullo, *Centaurea busambarensis* Guss., *Dianthus busambrae* Soldano & F. Conti, *Helichrysum pendulum* C. Presl., *Viola tineorum* Erben & Raimondo.

Phytosociological table: From Brullo et al. (2004), tab.6, 28 rel. (subass. *scabiosetosum creticae*).

Char. association: *Anthemis cupaniana* (V), *Centaurea busambarensis* (V), *Helichrysum pendulum* (IV).

Char. subassociation: *Lomelosia cretica* (V), *Euphorbia dendroides* (IV), *Sedum sediforme* (III), *Helictotrichon convolutum* (III), *Coronilla valentina* (III), *Genista demarcoi* (II), *Erica multiflora* (II).

Char. alliance: *Silene fruticosa* (IV), *Brassica rupestris* (IV), *Iberis semperflorens* (IV), *Seseli bocconei* subsp. *bocconei* (II), *Odontites bocconei* subsp. *bocconei* (II), *Cymbalaria pubescens* (II), *Antirrhinum siculum* (I).

Char. order: *Athamanta sicula* (IV), *Melica minuta* (III), *Teucrium flavum* (III), *Asplenium petrarchae* (I).

Char. class: *Sedum dasyphyllum* (V), *Ceterach officinarum* (IV), *Hyphochoeris laevigata* (IV), *Umbilicus rupestris* (II), *Ranunculus rupestris* (I), *Asplenium trichomanes* (I).

Other species: *Galium lucidum* (IV), *Hyoseris radiata* (IV), *Dianthus arrostii* (IV), *Micromeria juliana* (IV), *Ampelodesmos mauritanicus* (II), *Polypodium cambricum* (II), etc.

From Brullo et al. (2004), tab. 7, 23 rel. (subass. *poetosum bivonae*).

Char. association: *Anthemis cupaniana* (V), *Centaurea busambarensis* (V), *Helichrysum pendulum* (III), *Viola tineorum* (II), *Dianthus busambrae* (II), *Campanula marcenoi* (I), *Armeria gussonei* (I), *Bupleurum elatum* (I).

Char. subassociation: *Poa bivonae* (V), *Edraianthus graminifolius* susbp. *siculus* (IV), *Cerastium tomentosum* (III), *Laserpitium siculum* (II), *Arabis alpina* (II), *Hieracium symphytIfolium* (II), *Lomelosia crenata* (II), *Sesleria nitida* subsp. *sicula* (II), *Saxifraga callosa* (I), *Silene saxifraga* subsp. *rupicola* (I), *Draba turgida* (I), *Aubretia deltoidesa* subsp. *sicula* (I), *Potentilla caulescens* subsp. *nebrodensis* (I).

Char. alliance: *Silene fruticosa* (V), *Iberis semperflorens* (V), *Brassica rupestris* (IV), *Cymbalaria pubescens* (II), *Odontites bocconei* subsp. *bocconei* (I), *Antirrhinum siculum* (I).

Char. order: *Athamanta sicula* (III), *Teucrium flavum* (III).

Char. class: *Sedum dasyphyllum* (V), *Hypochoeris laevigata* (V), *Ceterach officinarum* (III), *Asplenium trichomanes* (II).

Other species: *Dianthus arrostii* (V), *Galium lucidum* (V), *Hyoseris radiata* (III), *Festuca circummediteranea* (III), *Polypodium cambricum* (II), etc.

Geographical distribution: This association is spread in the mountains of north-western Sicily and in particular mountains near Palermo, Rocca Busambra and Madonie range (Brullo & Marcenò, 1979; Brullo et al., 2004).

Structure and ecology: The *Anthemido cupanianae-Centauretum busambarensis* is a mesophilous community of limestone cliffs, occurring in the mountain and sub-mountain belts between 500 and 1500 m. From the floristic point of view, it is differentiated by some rare endemic species that are restricted to mountain stands, as *Anthemis cupaniana*, *Centaurea busambarensis*, *Helichrysum pendulum*, *Viola tineorum*, *Armeria gussonei*, *Bupleurum elatum*, *Dianthus busambrae*, *Campanula marcenoi*, etc. Brullo & Marcenò (1979) and Brullo et al. (2004), recognized two subassociations: a) subass. *scabiosetusum creticae*, which is the more thermophilous aspect, being linked to quite xeric conditions being distributed under 1000-1200 m of altitude, and is differentiated by the occurrence of *Lomelosia cretica*, *Sedum sediforme*, *Euphorbia dendroides*, *Coronilla valentina*, *Helictotrichon convolutum*, *Erica multiflora* and *Genista demarcoi;* b) subass. *poetosum bivonae* is localized in mountain stands above 1000 m, on cliffs with northern exposure, where some mesophilous and orophilous taxa find their optimum, as *Poa bivonae*, *Edraianthus gramniifolius* subsp. *siculus*, *Cerastium tomentosum*, *Arabis caucasica*, *Laserpitium siculum*, *Sesleria nitida* subsp. *sicula*, *Hieracium symphytifolium*, *Draba olympicoides*, *Saxifraga callosa*, etc.

Syndynamism: See class.

Habitat reference: See order.

21.1.1.5. ***Putorio calabricae-Micromerietum microphyllae*** Brullo & Marcenò 1979

Chasmophilous vegetation with stinking madder and small-leaved Micromeria of dry limestone cliffs.

Holotypus: rel. 4a, pag. 142, Brullo & Marcenò (1979).

Characteristic and differential species: *Asperula aristata* L. f. subsp. *scabra* Nyman, *Helichrysum scandens* Guss., *Micromeria microphylla* (D'Urv.) Benth., *Odontites bocconei* subsp. *angustifolius* (Lojac.) Giardina & Raimondo, *Putoria calabrica* (L. f.) DC., *Trachelium lanceolatum* Guss.

Phytosociological table: From Brullo et al. (2004), tab. 8, 52 rel.

Char. association: *Putoria calabrica* (V), *Micromeria microphylla* (V), *Asperula aristata* subsp. *scabra* (IV), *Trachelium lanceolatum* (II), *Helichrysum scandens* (I), *Odontites bocconei* subsp. *angustifolius* (I).

Char. alliance: *Dianthus rupicola* subsp. *rupicola* (V), *Antirrhinum siculum* (V), *Silene fruticosa* (III), *Cymbalaria pubescens* (I), *Brassica incana* (I).

Char. order: *Melica minuta* (V), *Ficus carica* (IV), *Teucrium flavum* (IV), *Lomelosia cretica* (II), *Ballota rupestris* (I).

Char. class: *Sedum dasyphyllum* (IV), *Ceterach officinarum* (III), *Umbilicus rupestris* (III), *Arabis collina* (I), *Asplenium trichomanes* (I).

Other species: *Centranthus ruber* (V)*, Parietaria judaica* (IV), *Capparis spinosa* (IV), *Hyoseris radiata* (IV), *Euphorbia dendroides* (III), *Polypodium cambricum* (II), etc.

Geographical distribution: This association occurs in south-eastern Sicily and Maltese Archipelago (Brullo & Marcenò, 1979).

Structure and ecology: The Miocenic limestone cliffs of deep fluvial valleys, locally known as «cave», are colonized by a peculiar chasmophilous vegetation with some endemisms or species that in Sicily are exclusive of Hyblaean montains, as *Putoria calabrica*, *Micromeria microphylla*, *Helichrysum stoechas*, *Anthemis pignattiorum* and *Trachelium lanceolatum*. It is a quite termophilous vegetation, which occurs between the sea level and 600 m a.s.l. The Sicilian aspect was described by Brullo & Marcenò (1979) as subass. *dianthetosum rupicolae*, while the similar community occurring in the Maltese islands was described as subass. *chiliadenetosum bocconei*.

Syndynamism: See class.

Habitat reference: See order.

21.1.1.6. ***Brassico tinei-Diplotaxietum crassifoliae*** Brullo & Marcenò 1979

Chasmophilous vegetation with thick leaved wallrocket and Tineo cabbage of arid cliffs.

Holotypus: rel. 6, pag.143, Brullo & Marcenò (1979).

Characteristic and differential species: *Brassica tinei* Lojac., *Diplotaxis crassifolia* (Raf.) DC., *Erysimum metlesicsii* Polatschek, *Sedum gypsicola* Boiss. & Reuter subsp. *trinacriae* Afferni.

Phytosociological table: From Brullo et al. (2004), tab. 9, 22 rel.

Char. association: *Diplotaxis crassifolia* (V), *Sedum gypsicola* subsp. *trinacriae* (IV), *Erysimum metlesicsii* (III), *Brassica tinei* (III).

Char. alliance: *Silene fruticosa* (IV), *Antirrhinum siculum* (III), *Anthemis cupaniana* (II).

Char. order: *Athamanta sicula* (IV), *Teucrium flavum* (III), *Melica minuta* (II).

Char. class: *Sedum dasyphyllum* (V), *Ceterach officinarum* (III), *Umbilicus rupestris* (III), *Hypochoeris laevigata* (III), *Ficus carica* (II), *Cheilanthes acrostica* (I).

Other species: *Sedum sediforme* (IV), *Micromeria graeca* (IV), *Campanula erinus* (III), *Sonchus tenerrimus* (III), etc.

Geographical distribution: This community is distributed in central and central-western Sicily (Brullo & Marcenò, 1979).

Structure and ecology: The *Brassico tinei-Diplotaxietum crassifolia* colonizes the rocky cliffs with substrata belonging to Gypsum-Sulfur series occurring in the central Sicily, represented mainly by sandstones, marls and gypsum. This community having a marked xeric character is localized in stands under 800 m of altitude, within the dry thermo-mediterranean bioclimatic belt. Floristically, this vegetation is characterized by the occurrence of some endemism, such as *Erysimum metlesicsii*, *Brassica tinei*, *Sedum gypsicola* subsp. *trinacriae* and *Diplotaxis crassifolia* (Brullo et al., 2004).

Syndynamism: See class.

Habitat reference: See order.

21.1.1.7. ***Erucastretum virgati*** Brullo & Marcenò 1979

Chasmophilous vegetation with Peloritani rocket of the Complesso Calabride cliffs

Holotypus: rel. 7a, pag. 143, Brullo & Marcenò (1979).

Characteristic and differential species: *Erucastrum virgatum* C. Presl.

Phytosociological table: From Brullo et al. (2004), tab. 10, 9 rel. (subass. *typicum*).

Char. association: *Erucastrum virgatum* (V).

Char. alliance: *Dianthus rupicola* subsp. *rupicola* (IV), *Silene fruticosa* (III), *Matthiola incana* subsp. *rupestris* (III), *Antirrhinum siculum* (I), *Brassica incana* (I), *Seseli bocconei* subsp. *bocconei* (I), *Iberis semperflorens* (I).

Char. order: *Lomelosia cretica* (IV), *Teucrium flavum* (IV), *Melica minuta* (III), *Athamanta sicula* (I).

Char. class: *Sedum dasyphyllum* (IV), *Ficus carica* (III), *Ceterach officinarum* (II), *Hypochoeris laevigata* (I), *Umbilicus rupestris* (I).

Other species: *Euphorbia dendroides* (IV), *Capparis spinosa* (IV), *Micromeria graeca* (III), *Galium aetnensis* (II), *Hyparrhenia hirta* (II), etc.

From Brullo et al. (2004), tab. 10, 4 rel. (subass. *limonietosum sibthorpiani*).

Char. association: *Erucastrum virgatum* (4).

Char. subassociation: *Limonium sibthorpianum* (4).

Char. alliance: *Dianthus rupicola* subsp. *rupicola* (3), *Brassica incana* (1), *Seseli bocconei* subsp. *bocconei* (1).

Char. order: *Lomelosia cretica* (2), *Teucrium flavum* (2), *Melica minuta* (1), *Ballota rupestris* (1).

Char. class: *Sedum dasyphyllum* (2), *Umbilicus rupestris* (1).

Other species: *Limbarda crithmoides* subsp. *longifolia* (4), *Capparis* spinosa (3), *Galium aetnensis* (3), etc.

From Brullo et al. (2004), tab. 10, 13 rel. (subass. *centauretosum tauromenitani*).

Char. association: *Erucastrum virgatum* (V).

Char. subassociation: *Colymbada tauromenitana* (V).

Char. alliance: *Dianthus rupicola* subsp. *rupicola* (IV), *Silene fruticosa* (II), *Matthiola incana* subsp. *rupestris* (I), *Brassica incana* (I), *Seseli bocconei* subsp. *bocconei* (I).

Char. order: *Lomelosia cretica* (V), *Teucrium flavum* (II), *Athamanta sicula* (II), *Melica minuta* (II), *Ballota rupestris* (I).

Char. class: *Sedum dasyphyllum* (IV), *Hypochoeris laevigata* (II), *Umbilicus rupestris* (I), *Cheilanthes vellea* (I), *Ficus carica* (I), *Ceterach officinarum* (I).

Other species: *Micromeria graeca* (V), *Euphorbia dendroides* (V), *Galium aetnensis* (III), etc.

From Brullo et al. (2004), tab. 10, 8 rel. (subass. *centauretosum sequenzae*).

Char. association: *Erucastrum virgatum* (V).

Char. subassociation: *Centaurea seguenzae* (V).

Char. alliance: *Dianthus rupicola* subsp. *rupicola* (V), *Matthiola incana* subsp. *rupestris* (I), *Brassica incana* (I).

Char. order: *Lomelosia cretica* (V), *Teucrium flavum* (III), *Athamanta sicula* (I), *Ballota rupestris* (I).

Char. class: *Sedum dasyphyllum* (V), *Ceterach officinarum* (V), *Hypochoeris laevigata* (I).

Other species: *Euphorbia dendroides* (V), *Galium aetnensis* (V), *Capparis spinosa* (III), *Micromeria graeca* (III), etc.

From Brullo et al. (2004), tab. 10, 3 rel. (subass. *edraianthetosum siculi*).

Char. association: *Erucastrum virgatum* (3).

Char. subassociation: *Edraianthus graminifolius* subsp. *siculus* (3), *Lomelosia crenata* (2).

Char. alliance: *Odontitetes bocconei* subsp. *bocconei* (2).

Char. order: *Athamanta sicula* (3), *Teucrium flavum* (2).

Char. class: *Sedum dasyphyllum* (3), *Ceterach officinarum* (3), *Hypochoeris laevigata* (2), *Arabis collina* (1).

Other species: *Euphorbia rigida* (3), *Pimpinella tragium* (3), *Dianthus arrostii* (3), *Cerastium tomentosum* (2), *Poa bivonae* (2), etc.

Geographical distribution: This community is localized in southern Calabria and Peloritani range in north-eastern Sicily, (Brullo & Marcenò, 1979; Brullo et al., 2001; Brullo & Spampinato, 2003), where it is represented by various subassociations. In particular, the subass. *typicum* is the most widespread, while the subass. *limonietosum sibthorpiani* and subass. *centauretosum seguenzae* are restricted respectively to Capo D'Alì and Capo Tindari, while the subass. *centauretosum tauromenitanae* is circumscribed to a narrow coastal belt near Taormina an, finally, the subass. *edraianthetosum siculi* is known only for Monte Scuderi (Brullo et al., 2004).

Structure and ecology: The *Erucastretum virgati* is exclusive of the substrata belonging to the «Calabrian Arc subduction complex», including schists, gneiss and granites, but sometimes

occurs also on Mesozoic limestones and volcanic rocks. It is spread from the sea level until 1100 m of altitude, colonizing often also small surfaces. This community is well differentiated from the other syntaxa of the *Dianthion rupicolae* alliance for the occurrence of *Erucastrum virgatum*, an endemic species of Calabria and north-estern Sicily (Brullo & Marcenò, 1979; Brullo et al., 2004). Within this association were distinguished five different subassociations: a) subass. *typicum* is linked to various substrata and lacks of differential species; b)subass. *limonietum sibthorpiani* is differentiated by the very rare endemic *Limonium sibthorpianum*, which grows on siliceous cliffs directly affected by sea agents; c) subass. *centauretosum tauromenitanae* (syn: *Scabiosetum creticae* subass. *centauretosum tauromenitanae* Pirola 1961 nom. inval. (art. 4)) occurs mainly in the limestone cliffs from the sea level to 600 m of altitude, where the endemic *Colymbada tauromenitana* finds its optimum; d) subass. *centauretosum seguenzae* grows on calcareous or siliceous cliffs near the sea (until 300 m a.s.l.) and is characterized by the occurrence of the endemic *Centaurea seguenzae*; e) subass. *edraianthetosum siculi* is a mesophilous aspect, which is restricted to mountain stands above 1000 m, where *Edraianthus graminifolius* subsp. *siculus* and *Lomelosia crenata* have high values of coverage, also the rare endemic *Hieracium montis- scuderii* must be included between the differential species. Other subassociations of the *Erucastretum virgati* were described from Calabria by Brullo et al. (2001) and Brullo & Spampinato (2003).

Syndynamism: See alliance.

Habitat reference: See order.

21.1.1.8. ***Diantho aeolici-Centauretum aeolicae*** Barbagallo, Brullo & Signorello 1983 corr.

Chasmophilous vegetation with Aeolian pink and Aeolian centaury of volcanic rocks.

Holotypeus: rel. 17, tab. 1, Barbagallo et al. (1983).

Characteristic and differential species: *Centaurea aeolica* Guss. ex Lojac., *Daucus foliosus* Guss., . *Dianthus rupicola* Biv., subsp. *aeolicus* (V), *Silene hicesiae* Brullo & Signorello.

Phytosociological table: From Brullo et al. (2004), tab. 11, 21 rel.

Char. association: *Centaurea aeolica* (V), *Dianthus rupicola* subsp. *aeolicus* (V), *Daucus foliosus* (IV), *Silene hicesiae* (I).

Char. alliance: *Silene fruticosa* (III), *Matthiola incana* subsp*. rupestris* (V), *Seseli bocconei* subsp. *bocconei* (I), *Iberis semperflorens* (I).

Char. order and class: *Umbilicus rupestris* (V)*, Lomelosia cretica* (II), *Ceterach officinarum* (II), *Teucrium flavum* (I), *Ficus carica* (I), *Oeosporangium pteridiodes* (I), *Asplenium obovatum* (I).

Other species: *Jacobaea cineraria* (III), *Genista tyrrhena* (III), *Helichrysum litoreum* (III), *Hyoseris radiata* (III), *Limbarda crithmoides* subsp. *longifolia* (III),), *Polypodium cambricum* (II), etc.

Geographical distribution: This community is restricted to Aolian islands and in particular to Lipari, Salina, Panarea and Alicudi (Barbagallo et al., 1983;Brullo et al., 2004).

Structure and ecology: The association occurs on the volcanic cliffs and walls of Aeolian Islands from the sea level to 300 m of altitude. It is a chasmophilous community characterized by some local endemisms, as *Centaurea aeolica*, *Silene hicesiae*, *Daucus foliosus* and *Dianthus rupicola* subsp. *aeolica*. The *Diantho rupicolae-Centauretum aeolicae* can be considered a geographic vicariant of *Erucastretum virgati*, which grows on the nearby coasts of North Sicily (Barbagallo et al., 1983).

Syndynamism: See alliance.

Habitat reference: See order.

21.2 Order: ***Potentilletalia caulescentis*** Br.-Bl. in Br.-Bl. & Jenny 1926

Orophilous communities of limestone cliffs from Europaean territories.

Synonyms: *Potentilletalia* Br.-Bl. 1931 (art. 2b); *Asplenietalia rutae-murariae* (Br.-Bl. & Meier in Meier & Br.-Bl. 1934) Oberd. et al. 1967 (art. 2d, 3a, 29); *Artemisietalia petrosae* Sanda et al. 2001 (art. 5).

Lectotypus: *Potentillion caulescentis* Br.-Bl. in Br.-Bl. & Jenny 1926.

Characteristic and differential species: *Asplenium ruta-muraria* L., *Campanula tanfanii* Podlech, *Cystopteris fragilis* (L.) Bernh., *Erigeron glabratus* Bluff & Fingerh., *Potentilla caulescens* L. subsp. *caulescens*, *Saxifraga moschata* Wulfen, *Silene parnassica* Boiss, & Spruner, *Silene saxifraga* L., etc.

Geographical distribution: This order has a wide distribution in the mountain ranges of central and southern Europe (Biondi et al., 1997; Biondi & Blasi, 2014; Mucina et al., 2016).

Structure and ecology: The mesophilous and orophilous communities of Europaean rocky cliffs are classified within the *Potentilletalia caulescentis* order. It is a basophilous or neutrophilous vegetation, which prefers carbonates, dolomites, sandstones or rarely also volcanic rocks (Brullo et al., 2004). This order is represented by several alliance distributed in the all temperate Europaean and oro-Medieterranean territories (Biondi et al.. 2014; Mucina et al., 2016)

Syndynamism: The communities of this order, linked to carbonatic cliffs, show a pioneer and azonal role of edapho-climatophilous kind. They can be referred to the geosigmetum basifilous of rocks and screes within the climotophilos belt of *Quercetea pubescentis-petraeae* and *Querco-Fagetea sylvaticae* and also of the orophilous primary vegetation.

Habitat reference: H3.2d Mediterranean base-rich inland cliff.

21.2.1. Alliance: ***Saxifragion australis*** Biondi & Ballelli ex Brullo 1984

Orophilous chasmophilous vegetation of carbonatic mountain cliffs from central-southern Italy and Sicily.

Synonyms: *Saxifragion australis* Pedrotti in Pedrotti et Sanesi 1969 (art. 2b); *Saxifragion australis* Biondi et Ballelli 1982 (art. 5).

Holotypus: *Saxifrago australis-Trisetetum bertolonii* Biondi & Ballelli 1982.

Characteristic and differential species: *Edraianthus graminifolius* (L.) A. DC. subsp. *siculus* (Strobl) Lakusič, *Minuartia graminifolia* (Ard.) Jav. subsp. *rosani* (Ten.) Mattf., *Potentilla caulescens* L. subsp. *nebrodensis* (Strobl ex Zimmeter) Arrigoni, *Saxifraga australis* Moric.

Geographical distribution: This alliance is restricted to central-southern Appennines and Sicily (Brullo, 1984; Brullo & Spampinato, 2003; Biondi & Blasi, 2014; Mucina et al., 2016).

Structure and ecology: In Sicily the orophilous communities of the mountain cliffs occurring between 1000 and 3000 m of altitude can be refered to the *Saxifragion australis* alliance. Sometimes, this vegetation can be found also in hilly stands with particularly mesic conditions (Brullo et al., 2004).

Syndynamism: See order.

Habitat reference: See order.

21.2.1.1. ***Asperuletum gussonei*** Brullo 1984

Chasmophilous vegetation of dolomitic high peaks.

Synonyms: *Asperulo-Potentilletum nebrodensis* Raimondo 1984, nom. illeg. (art. 22).

Holotypus: rel. 18, tab. 4, Brullo (1984).

Characteristic and differential species: *Asperula gussonei* Boiss., *Aubretia deltoidea* (L.) DC. subsp. *sicula* (Strobl) Phitos, *Draba turgida* É. & A Huet ex Ces., Pass. & Gibelli, *Helichrysum nebrodense* Heldr., *Hieracium symphytifolium* Froel., *Silene saxifraga* L. subsp*. rupicola* (É. Huet ex Nyman) C. Brullo & Brullo.

Phytosociological table: From Brullo et al. (2004), tab. 12, 19 rel.

Char. association: *Asperula gussonei* (V), *Silene saxifraga* subsp*. rupicola* (IV), *Helichrysum nebrodense* (III), *Draba turgida* (III), *Hieracium symphytifolium* (III), *Aubretia deltoidea* subsp. *sicula* (III).

Char. alliance and order: *Edraianthus graminifolius subsp. siculus* (IV), *Saxifraga callosa* (IV), *Potentilla caulescens* subsp*. nebrodensis* (III), *Asplenium ruta-muraria* (II), *Minuartia graminifolia* subsp*. rosani* (I).

Char. class: *Hypochoeris laevigata* (IV), *Sedum dasyphyllum* (IV), *Anthemis cupaniana* (III), *Iberis semperflorens* (II), *Arabis collina* (II), *Odontites bocconei* subsp. *bocconei* (I), *Ceterach officinarum* (I), *Athamanta sicula* (I).

Other species: *Galium lucidum* (IV), *Minuartia verna* subsp. *grandiflora* (III), *Arenaria grandiflora* (III), *Dianthus arrostii* (III), *Laserpitium siculum* (III), *Sesleria nitida* subsp. *sicula* (II), etc.

Geographical distribution: According to literature data (Brullo et al., 2004), this vegetation was surveyed only in the Madonie Massif, where the association has its best development.

Structure and ecology: The highest carbonatic cliffs of Madonie Massif are colonized by the *Asperuletum gussonei*, a very peculiar rupestrian vegetation occurring between 1500 and 1800 m a.s.l. From the floristic point of view, it is characterized by some orophilous endesmism, as *Asperula gussonei*, *Helichrysum nebrodense*, *Draba turgida*, *Hieracium symphytifolium*, *Silene saxifraga* subsp. *rupicola*, and *Aubretia deltoidea* subsp. *sicula*. The alliance and higher rank are represented by *Edraianthus graminifolius* subsp. *siculus*, *Saxifraga callosa*, *Silene saxifraga* subsp. *lojaconoi*, *Potentilla caulescens* subsp. *nebrodensis*, *Asplenium ruta-muraria* and *Minuartia graminifolia* subsp. *rosani* (Brullo, 1984).

Syndynamism: See order.

Habitat reference: See order.

21.3. Order: ***Cheilanthetalia maranto-maderensis*** Saenz de Rivas & Rivas-Martínez 1979

Thermo-xerophilous rupicolous Mediterranean vegetation dominated by small fern of siliceous and basic rocks.

Lectotypus: *Phagnalo saxatilis-Cheilanthion maderensis* Loisel 1970 corr. Perez & al. 1989**.**

Characteristic and differential species: *Oeosporangium pteridiodes* (Reichard) Fraser-Jenk. & Pariyar (=*Cheilanthes maderensis* Lowe)*, Cosentinia vellea* (Aiton) Tod., *Asplenium obovatum* Viv. subsp. *obovatum*.

Geographical distribution: The order is distributed in the Mediterranean and Macaronesian territories (Saenz de Rivas & Rivas-Martínez, 1979; Mucina et al. 2016)

Structure and ecology: This syntaxon groups the more xerophilous aspects of chasmophilous vegetation that grow on ultramafic rocks and sometimes also limestones from the sea level to the sub-mountain belt. Its xeric character is due to the scarce depth of rocky crevices, which together with the low permeability of the substrata, allow the accumulation of a little layer of soil. They are xerophilous rupestrian communities dominated by small fern belonging to the *Cheilanthes* and *Cosentinia* genera, which are localized mainly in the thermomediterran bioclimatic belt (Brullo et al., 2004).

Sindynamism: The communities of this syntaxon replace those ones of the *Asplenietalia glandulosi* in habitats particularly xeric from the edaphic viewpoint. They, being strictly pioneer since linked to rocky stands, have potentially no chance for a eventual evolution.

Habitat reference: H3.2d Mediterranean base-rich inland cliff; H3.1d Mediterranean siliceous inland cliff.

21.3.1. Alliance: ***Phagnalo saxatilis-Cheilanthion maderensis*** Loisel 1970 corr. Perez & al. 1989

Thermophilous, silicicolous or basophilous, chasmophytic communities rich in ferns of Mediterranean dry cliffs.

Synonyms: *Asplenion cuneifolii mediterraneum* P. da Silva 1970 (art. 3b); *Phagnalo saxatilis-Cheilanthion fragrantis* Loisel 1970 (art. 43); *Asplenion serpentini mediterraneum* Silva 1970; *Asplenio obovati-Cheilanthion maderensis* (Loisel 1970) Saenz & Rivas.-Mart. 1979 (art. 29a, 40).

Holotypus: *Cheilantho maderensis-Notholaenetum maranthe* O. Bolòs 1956 corr. Pérez, Díaz, Fernández & Salvo 1989.

Characteristic and differential species: *Phagnalon saxatile* (L.) Cass.

Geographical distribution: This alliance occurs in the more dry Mediterranean territories (Loisel, 1970; Perez Carro et al., 1989). In Sicily is quite rare and very localized (Brullo et al., 2004).

Structure and ecology: The communities belonging to *Phagnalo saxatilis-Cheilanthion maderensis* show a thermophilous character and are characterized by a marked floristic poverty. This chasmophilous vegetation is linked compact and not very permeable naked substrata, colonizing the crevices of small rocky surfaces which do not allow an adequate soil accumulation with sufficient water retention. The substrata are usually represented by metamorphites, vulcanites, granites and dolomitized limestones. This vegetation is distributed mainly in the thermomediterranean bioclimatic belt, penetrating marginally in the mesomediterranean one. The alliance gathers plant communities developping mainly on rocks rich in basic silicates and heavy metals, which determine very unfavorable conditions for the settlement of vascular plants. Only the communities characterized by the dominance of small ferns belonging to the genera *Oeosporangium* (= *Cheilanthes*) and *Cosentinia* can develop, showing however low coverage values (Brullo et al., 2004; Biondi & Blasi, 2014).

Syndynamism: See order.

Habitat reference: see order.

21.3.1.1. ***Phagnalo saxatilis-Cheilanthetum maderensis*** Loisel 1970 corr. Perez et al. 1989

Chasmophilous vegetation with Mediterranean phagnalon and ressurection fern of small crevices of the volcanic rocks.

Synonyms: *Andropogono distachyi-Phagnaletum saxatilis* Molinier 1954 p.p.; *Andropogono distachyi-Phagnaletum saxatilis* Molinier 1956 non Molinier 1954; *Phagnalo-Cheilanthetum fragrantis* Loisel 1970 (art. 43, 48).

Lectotypus: rel. 2, tab. pag. 16, Molinier (1956), here designated.

Characteristic and differential species: *Oeosporangium pteridiodes* (Reichard) Fraser-Jenk. & Pariyar (=*Cheilanthes maderensis* Lowe).

Phytosociological table: From Brullo et al. (2004), tab. 25, 16 rel.

Char. association: *Oeosporangium pteridiodes* (V).

Char. alliance and order: *Phagnalon saxatile* (IV).

Char. class: *Ceterach officinarum* (V), *Asplenium trichomanes* (V), *Umbilicus horizontalis* (IV), *Umbilicus rupestris* (II), *Sedum dasyphyllum* (I).

Other species: *Poa bulbosa* (IV), *Parietaria lusitanica* (III), *Sedum rubens* (III), *Geranium robertianum* (II), etc.

Geographical distribution: This association occurs in the Iberian Peninsula and southern France (Molinier, 1956; Loisel, 1970; Saenz & Rivas Martinez, 1979), while in Sicily it is restricted to the southern and western sides of Etna (Brullo et al., 2004).

Structure and ecology: The *Phagnalo saxatilis-Cheilanthetum maderensis* is a very xeric community, which colonizes the small crevices of volcanic rocks, between 300 and 1000 m. It is characterized by the dominance of *Oeosporangium pteridiodes*, growing together with *Phagnalon saxatile* and some species of class, as *Ceterach officinarum*, *Asplenium trichomanes* and *Umbilicus horizontalis* (Brullo et al., 2004).

Syndynamism: See order.

Habitat reference: See order.

21.3.1.2. ***Cosentinietum bivalentis*** Brullo in Brullo et al. 2004

Chasmophytic xeric vegetation with velvety fern of very dry limestone cliffs.

Synonyms: *Cheilantho maderensis-Cosentinietum velleae* Licandro et al. 2011 non Ladero ex Pérez, Diaz, Fernandez & Salvo 1989.

Holotypus: rel. 4, tab. 26, Brullo et al. (2004).

Characteristic and differential species: *Cosentinia vellea* (Ait.) Tod. subsp. *bivalens* (Reichst.) Rivas Mart. & Salvo.

Phytosociological table: From Brullo et al. (2004), tab. 26, 8 rel.

Char. association: *Cosentinia vellea* subsp*. bivalens* (V).

Char. alliance and order: *Phagnalon saxatile* (II), *Asplenium obovatum* (II).

Char. class: *Sedum dasyphyllum* (V), *Ceterach officinarum* (IV), Other species: *Valantia muralis* (V), *Micromeria graeca* (IV), *Festuca circummediteranea* (V), etc.

Geographical distribution: This community in Sicily is known only from Capo Tindari in the Peloritani range (Brullo et al., 2004; Licandro et al., 2011).

Structure and ecology: The association occurs in the small crevices of siliceous and calcareous rocky surfaces between 0 and 200 m. It is a xerophilous community, floristically differentiated by *Cosentinia vellea* subsp. *bivalens*, which is replaced by the *Erucastretum virgati* in the superficial crevices of cliffs (Brullo et al., 2004).

Syndynamism: See order.

Habitat reference: See order.

21.3.1.3. ***Sedo dasyphilli-Cheilanthetum maderensis*** Sciandrello, D'Agostino & Minissale 2013

Chasmophilous vegetation ressurection fern and thick-leaved stonecrop of shallow crevices of exposed limestone cliffs.

Holotypus: rel. 21, tab. 5, Sciandrello et al. (2013).

Characteristic and differential species: *Oeosporangium pteridioides* (Reichard) Fraser-Jenk. & Pariyar (=*Cheilanthes maderensis* Lowe).

Phytosociological table: From Sciandrello et al. (2013), tab. 5, 8 rel.

Char. association and alliance: *Oeosporangium pteridiodes* (V), *Cosentinia vellea* subsp. *vellea* (V).

Char. alliance, order and class: *Sedum dasyphyllum* (V), *Ceterach officinarum* (V).

Other species: *Campanula erinus* (V), *Valantia muralis* (V), *Prospero autumnale* (I), *Selaginella denticulata* (I), *Parietaria lusitanica* (I).

Geographical distribution: This community occurs only near Taormina in the Peloritani range (Sciandrello et al., 2013).

Structure and ecology: The *Sedo dasyphilli-Cheilanthetum maderensis* is a chasmophilous community, occurring between 200 and 800 m. It is linked to shallow and exposed fissures of limestone rocks with southern exposure. The physiognomy is given by the occurrence of *Oeosporangium pteridiodes* which grows together with *Ceterach officinarum*, *Sedum dasyphyllum*, etc. (Sciandrello et al. 2013).

Syndynamism: See order.

Habitat reference: See order.

21.3.1.4. ***Sedo albi-Cosentinietum velleae*** Sciandrello, D'Agostino & Minissale 2013

Chasmophilous vegetation with velvety fern and white stonecrop of dry limestone cliffs.

Holotypus: rel. 25, tab. 5, Sciandrello et al. (2013).

Characteristic and differential species: *Cosentinia vellea* (Ait.) Tod. subsp. *vellea*, *Dianthus siculus* C. Presl and *Sedum album* L. subsp. *album.*

Phytosociological table: From Sciandrello et al. (2013), tab. 5, 8 rel.

Char. association: *Cosentinia vellea* subsp. *vellea* (V), *Sedum album* subsp. *album* (V), *Dianthus siculus* (IV).

Char. alliance, order and class: *Sedum dasyphyllum* (V), *Lomelosia cretica* (V), *Ceterach officinarum* (IV), *Hypochoeris laevigata* (II), *Phagnalon saxatile* (II).

Other species: *Campanula erinus* (V), *Valantia muralis* (V), *Bupleurum fruticosum* (V), *Sedum sediforme* (IV), *Micromeria graeca* (III), *Euphorbia dendroides* (II), *Charybdis pancration* (II), etc.

Geographical distribution: This community is restricted to the coastal area near Taormina (Sciandrello et al., 2013).

Structure and ecology: This association replaces the *Sedo dasyphilli-Cheilanthetum maderensis* in more thermophilous conditions. It is a very xeric chasmophilous vegetation occurring on calcareos rocky habitats, which is characterized by the occurrence of *Cosentinia vellea* and some species of *Sedum*, as *S. album* subsp. *album*, *S. dasyphyllum*, *S. sediforme* and some others species of higher rank, among them *Ceterach officinarum*, *Lomelosia cretica, Phagnalon saxatile*, etc.

Syndynamism: See order.

Habitat reference: See order.

22. Class: ***Polypodietea vulgaris*** Jurko & Peciar ex Boscaiu, Gergely & Codoreanu in Ratiu et al. 1966

Chomophytic and epiphytic vegetation of fern- and moss-rich communities of rocky surfaces from Mediterranean and temperate European territory.

Synonyms: *Polypodietea* Jurko et Peciar 1963 (art. 2b); *Anogrammo-Polypodietea* Rivas-Mart. 1975 (art. 3f); *Anomodonto-Polypodietea cambrici* Rivas-Martinez 1975 nom. mut. propos. by Rivas Martinez et al. 2001; *Anomodonto-Polypodietea serrati* Rivas-Martinez 1978 (art. 2b); *Anomodonto-Polypodietea serrati* Rivas-Martinez in Rivas-Martinez et al. 1993.

Holotypus: *Ctenidio-Polypodietalia vulgaris* Jurko & Peciar ex Boscaiu, Gergely et Codoreanu in Ratiu et al. 1966.

Characteristic and differential species: *Bartramia pomiformis* Hedwig, *Brachythecium rutabulum* (Hedwig) Bruch et al., *Hypnum cupressiforme* Hedwig, *Polypodium vulgare* L., *Rhyncostegium confertum* (Dicks.) Bruch et al., *Saxifraga rotundifolia* L., *Tortella tortuosa* (Hedwig) Limpricht.

Geographical distribution: This syntaxon is widespread in the holarctic territories (Rivas-Martinez et al., 2011). In Sicily it is well represented in the inland stands (Brullo et al., 2004).

Structure and ecology: The class groups the chomophytic and epiphytic communities linked to very shady stands represented by rocks, walls and old trees. This vegetation is dominated by bryophytes and pteridophytes, usually of small size with its rhizomes implanted on moss carpet, while the spermatophytes are quite rare. It is localized mainly within woodlands on surfaces covered by a thin layer of soil or organic matter, characterized by infra-supramediterranean bioclimate with subhumid to hyperhumid ombrotype and also in the infra-supratemperate with humid-hyperhumid ombrotype (Rivas Martinez et al., 2002, 2011). This class was proposed by Jurko & Paicer (1963) from Carpathian mountains, including within it two new orders: *Ctinidio-Polypodietalia* (calcicolous) and *Hypno-Polypodietalia* (silicicolous), bryo-pteridophytic syntaxa characterized by *Polypodium vulgare* and numerous mesophilous bryophytes. Unfortunately, all this syntaxa are invalid names from the nomenclatural point of view (art. 2b), since no alliance was described, but only two association, one for each order, were validly proposed. Later, Mucina et al. (2016) emphasized that the *Polypodietea* Jurko & Peciar 1963 class was validated by Ratiu et al. (1966). In fact, the latter provided a syntaxonomical scheme, in which are quoted the class *Polypodietea* with a single order *Ctinidio-Polypodietalia* and one alliance *Moehringion muscosae* Horvat & Horvatic in Horvat 1962, including three associations previously described by other authors. It should be noted that the *Moehringion muscosae* is an invalid name (art. 2b), which must be validated by one of three associations. In particular, the only association that can be used for its typification is the *Asplenio-Poetum nemoralis* Soò 1944, since the name giving taxa are all indicated in its original diagnosis. As concerns the *Anogrammo-Polypodietea,* class described by Rivas-Martinez (1975c), according to Mucina et al. (2016) the syntaxon is an invalid name (art. 3f), since *Anogramma leptophylla* is absent in the under association. In fact, as indicated by Rivas-Martinez (1975c), the holotype of this class is *Anomodonto-Polypodietalia* O. Bolòs & Vives in O. Bolòs 1957, which includes two alliances: the *Polypodion serrati* Br.-Bl. in Br. Bl. et al. 1952 (sub *Polypodion serrati* Br.-Bl. (1931) 1947), which is typified by *Polypodietum serrati* Br.-Bl. in Br.-Bl. et al. 1952, and the *Bartramio-Polypodion serrati* O. Bolòs & Vives in O. Bolòs 1957, which has as holotype the *Sedeto-Polypodietum serrati* O. Bolòs & Vives in O. Bolòs 1957. In particular, the *Polypodion serrati* is designated by Rivas-Martinez et al. (2011) as lectotype of *Anomodonto-Polypodietalia*, but as can be deduced from the original diagnosis of the *Polypodietum serrati*, validly pubblicated by Braun-Blanquet et al. (1952) in its synthetic table *Anogramma leptophylla* is absent. The same author in other later works (Rivas-Martinez, 1978c; Rivas-Martinez et al., 1993, 2001, 2002, 2011) modified the name of the syntaxon in *Anomodonto-Polypodietea*, but this new name must be considered as illegitimate (art. 29c).

Syndynamism: The communities of this class represent a permanent vegetation of edaphophilous type, since the habitats where they grow not allow its evolution.

Habitat reference: H3.2d Mediterranean base-rich inland cliff; H3.1d Mediterranean siliceous inland cliff.

22.1. Order: ***Anomodonto-Polypodietalia serrati*** O.Bolòs & Vives in O.Bolòs 1957

Chomophytic and epiphytic vegetation dominated by bryophytes and pteridophytes, growing on shaded rocks or trees.

Synonyms: *Anomodonto-Polypodietalia cambrici* O. Bolòs & Vives in O. Bolòs 1957 nom. mut. propos. by Rivas Martinez et al. 2002 (art. 45).

Holotypus: *Polypodion serrati* Br.-Bl. in Br.-Bl., Roussine & Nègre 1952 nom. mut.

Characteristic and differential species: *Anogramma leptophylla* (L.) Link, *Arabis alpina* L. subsp. *caucasica* (Willd.) Briq., *Asplenium obovatum* Viv., *Ctenidium molluscum* (Hedwig) Mitten, *Encalypta streptocarpa* Hedwig, *Homalothecium sericeum* (Hedwig) Bruch & al., *Hypnum cupressiforme* Hedwig, *Leucodon sciuroides* (Hedwig) Schwägr., *Neckera complanata* (Hedwig) Huebener, *Neckera crispa* Hedwig, *Polypodium cambricum* L., *Polypodium interjectum* Shivas, *Pterogonium gracile* (Hedw.) Sm., *Saxifraga adscendens* L., *Saxifraga bulbifera* L., *Schistidium apocarpum* (Hedwig) Bruch & Schimper, *Selaginella denticulata* (L,) Spring.

Geographical distribution: This order is distributed in the Mediterranean area, with penetrations in the Atlantic and Central Europe (Brullo et al., 2004; Rivas Martinez et Coautores, 2011, Biondi & Blasi, 2014; Mucina et al., 2016). In Sicily it is quite spread from the sea level to the mountain belt (Brullo et al., 2004).

Structure and ecology: This syntaxon gathers thermophilous communities usually dominated by *Polypodium cambricum*, which grow from sea level to mountain belt, showing their optimum mainly in oceanic microclimatic condition. It represents a chomophytic and epilithic vegetation with a rich bryo-pteridophytic component, which colonizes the shaded and wet rocky surface and often the old branches of trees, showing an epiphytic character. It is usually bi-layered with a dense moss carpet on which the rhizomes of ferns adhere. According to Brullo et al. (2001), this syntaxon is replaced in territories falling in the temperate bioclimate by a different order represented by *Hypno-Polypodietalia vulgaris* Jurko & Peciar ex Brullo et al. 2001, floristically differentiated by *Polypodium vulgare* and several bryophytes, not occurring in the *Anomodonto-Polypodietalia serrati*. In particular, within the *Hypno-Polypodietalia vulgaris* can be included two alliances, such as *Hypno-Polypodion vulgaris* Mucina 1993, which gathers silicicolous communities and *Ctenidio-Polypodion vulgaris* Brullo et al. 2001, regarding the calcicolous ones. Recently, Biondi et al. (2014) and Biondi & Blasi (2015) attributed the *Hypno-Polypodietalia vulgaris* to *Asplenietea trichomanis*,

while the *Anomodonto-Polypodietalia serrati* to the *Anomodonto-Polypodietea cambrici* Rivas-Martınez 1975. However, this treatment is not shared by Mucina et al. (2016), with which one agrees, who arranged both the orders, as well as the *Ctinidio-Polypodietalia* Jurko & Peciar ex Boscaiu, Gergely & Codoreanu in Ratiu et al. 1966, in the *Polypodietea* Jurko & Peciar ex Boscaiu, Gergely & Codoreanu in Ratiu et al. 1966.

Syndynamism: The communities belonging to this order occur within the climatophilous belt dominated by thermophilous and mesophilous woorlands of the *Quercetea ilicis*. They can be considered for their marked pioneer character as an azonal vegetation, having no evolutionary potentiality.

Habitat reference: See class.

22.1.1. Alliance: ***Polypodion serrati*** Br.-Bl. in Br.-Bl., Roussine & Négre 1952

Basophilous and thermophilous communities rich in bryophytes and dominated by southern polypody, linked to shaded rocks and old trees.

Synonyms: *Polypodion* Br.-Bl. 1931 (2b); *Polypodion* Br.-Bl. in Br.-Bl., Emberger & Molinier 1947 (art. 2); *Polypodion cambrici* Br.-Bl. in Br.-Bl. et al. 1952 nom. mut. propos. by Rivas Martinez et al. 2002 (art. 45); *Homalothecio-Polypodion serrati* (Br.-Bl. in Br.-Bl., Roussine & Nègre 1952) Mateo 1983 (art. 29); *Asplenio-Sedion* Br.-Bl. 1966 (2b); *Anogramnion leptophyllae* Bellot & Casaseca in Bellot 1966; *Anomodontion europaeum* O.Bolòs & Masalles 1983 (34a); *Selaginello denticulatae-Anogramnion leptophyllae* Rivas-Martinez et al. 1999. .

Holotypus: *Polypodietum serrati* Br.-Bl. in Br.-Bl., Roussine & Négre 1952.

Characteristic and differential species: See order.

Geographical distribution: See order.

Structure and ecology: The alliance at issue groups the basophilous bryophytic communities rich in ferns occurring in shady rock faces and old trees, within the thermo- to supramediterranean belt.

Syndynamism: See order.

Habitat reference: See order.

22.1.1.1. ***Polypodietum serrati*** Br.-Bl. in Br.-Bl., Roussine & Négre 1952

Chomophilous vegetation dominated by southern polypody and bryophytes of shaded rocks and old trees.

Synonyms: Ass. à *Polypodium* et *Anomodon viticulosus* Br.-Bl. 1931 (art. 2b, 46E).

Lectotypus: Not designated.

Characteristic and differential species: *Polypodium cambricum* L.

Phytosociological table: From Brullo et al. (2004), tab. 13, 14 rel.

Char. association: *Polypodium cambricum* (V).

Char. alliance and order: *Homalothecium sericeum* (IV), *Leucodon sciuroides* (IV), *Asplenium obovatum* (II), *Arabis alpina* subsp. *caucasica* (I).

Char. class: *Hypnum cupressiforme* (III).

Transgr. *Asplenietea trichomanis*: *Umbilicus rupestris* (V), *Sedum dasyphyllum* (V), *Ceterach officinarum* (V), *Asplenium trichomanes* (I), *Hypochoeris laevigata* (II), *Cymbalaria pubescens* (II), *Athamanta sicula* (I), *Melica minuta* (I), *Antirrhinum siculum* (I).

Other species: *Hyoseris radiata* (III), *Parietaria judaica* (III), *Campanula erinus* (III), *Theligonum cynocrambe* (II), *Sedum rubens* (II), etc.

Geographical distribution: This association is widely distributed in the Mediterranean territories. In Sicily is widespread both in coastal and inland areas (Brullo et al., 2004).

Structure and ecology: The *Polypodietum serrati* is a basophilous community that grows on shaded cliffs, walls and old tree from the sea level to 1000 m a.s.l. It can tolerate more or less long period of dryness during the summer. Its structure is given by a dense bryophytic component with *Homalothecium sericeum*, *Leucodon sciuroides* and *Hypnum cupressiforme*, which constitutes a carpet, where various ferns, as *Polypodium cambricum*, *Asplenium obovatum* and *A. trichomanes*, grow (Brullo et al., 2004).

Syndynamism: See order.

Habitat reference: See class.

22.1.1.2. ***Polypodio-Ranunculetum rupestris*** Barbagallo, Brullo & Signorello 1983

Chasmophilous vegetation with southern polypody and rupestrian buttercup of limestone and volcanic cliffs.

Holotypus: rel. 3, tab. 2, Barbagallo et al. (1983).

Characteristic and differential species: *Ranunculus rupestris* Guss.

Phytosociological table: From Brullo et al. (2004), tab. 14, 16 rel.

Char. association: *Ranunculus rupestris* (V).

Char. alliance and order: *Homalothecium sericeum* (V), *Polypodium cambricum* (V), *Selaginella denticulata* (IV), *Leucodon sciuroides* (IV), *Saxifraga bulbifera* (III), *Asplenium obovatum* (II), *Pterigonium gracile* (II), *Arabis alpina* subsp. *caucasica* (II), *Anogramma leptophylla* (II).

Char. class: *Hypnum cupressiforme* (V).

Transgr. *Asplenietea trichomanis*: *Sedum dasyphyllum* (V), *Umbilicus rupestris* (V), *Cymbalaria pubescens* (III), *Ceterach officinarum* (III), *Hypochoeris laevigata* (III), *Asplenium trichomanes* (II), *Umbilicus horizontalis* (I).

Other species: *Tortula ruralis* (III), *Minuartia verna* subsp. *grandiflora* (II), *Sedum tenuifolium* (II), *Allium flavum* (II), *Brachypodium retusum* (II), etc.

Geographical distribution: This community occurs in the north-western part of Sicily and in the Aeolian Islands as Filcudi and Alicudi (Barbagallo et al., 1983; Brullo et al., 2004).

Structure and ecology: The limestone or volcanic shaded cliffs, which are subject to a period of dryness during the summer, are colonized by the *Polypodio-Ranunculetum rupestris.* If compared to the *Polypodietum serrati,* the community at issue shows a more mesophilous character, occurring until 1400 m a.s.l. Its physyognomy is characterized by a bryophytic component with *Homalothecium sericeum*, *Leucodon sciuroides*, *Hypnum cupressiforme*, *Pterigonium gracile*, on which some ferns are estabilished, as *Polypodium cambricum*, *Asplenium obovatum*, *Anogramma leptophylla* and *Selaginella denticulata*. Moreover, this vegetation is differentiated by the occurrence of *Ranunculus rupestris*, a south-western Mediterranean geophyte, quite rare in Sicily (Barbagallo et al., 1983).

Syndynamism: See order.

Habitat reference: See class.

22.1.1.3. ***Homalothecio sericei-Poetum bivonae*** Brullo, Marcenò & Siracusa 2004

Chomophilous basophilous vegetation Bivona's bluegrass and silky wall feather moss of shaded mountain cliffs.

Holotype: rel. 5, tab. 16, Brullo et al. (2004).

Characteristic and differential species: *Hornungia petraea* (L.) Rchb., *Poa bivonae* Guss., *Sedum album* L.

Phytosociological table: From Brullo et al. (2004), tab. 16, 20 rel.

Char. association: *Poa bivonae* (V), *Sedum album* (V), *Hornungia petraea* (III).

Char. alliance and order: *Homalothecium sericeum* (V), *Leucodon sciuroides* (IV), *Saxifraga bulbifera* (IV), *Pterogonium gracile* (IV), *Anomodon viticulosus* (III), *Neckera complanata* (III), *Polypodium cambricum* (II), *Asplenium obovatum* (I).

Char. class: *Hypnum cupressiforme* (V).

Transgr. *Asplenietea trichomanis*: *Sedum dasyphyllum* (V), *Ceterach officinarum* (IV), *Umbilicus rupestris* (III), *Athamanta sicula* (III), *Hypochoeris laevigata* (II), *Cymbalaria pubescens* (II), *Arabis collina* (II), *Anthemis cupaniana* (II), *Asplenium trichomanes* (I).

Other species: *Sedum tenuifolium* (IV), *Minuartia verna* subsp, *grandiflora* (IV), *Arenaria grandiflora* (IV), *Festuca circummediterranea* (IV), *Grimmia pulvinata* (III), *Sedum hispanicum* (III), etc.

Geographical distribution: This community occurs in the mountains near Palermo and also in the Madonie Massif (Brullo et al., 2004).

Structure and ecology: The association colonized the shaded dolomitic or carbonatic rocks above 1000 m and is differentiated by the Sicilian endemic *Poa bivonae*, which grows with *Sedum album* and *Hornungia petraea*. It is an orophilous vegetation, which is linked to less sloped rocky surfaces with northern exposure, which are covered by a dense moss carpet, characterized by *Pterogonium gracile*, *Anomodon viticulosus*, *Homalothecium sericeum*, *Hypnum cupressiforme* and *Leucodon sciuroides*. Besides, the vascular plants component is represented also by *Saxifraga bulbifera, Polypodium cambricum*, *Asplenium obovatum*, *Sedum dasyphyllum*, *Ceterach officinarum*, *Umbilicus rupestris*, *Athamanta sicula*, *Hypochoeris laevigata*, etc. (Brullo et al., 2004).

Syndynamism: See order.

Habitat reference: See class.

22.1.1.4. ***Polypodio serrulati-Cheilanthetum acrosticae*** Brullo, Marcenò & Siracusa 2004 corr.

Chomophilous vegetation with southern polypody and fragrant lip fern of shady calcareous rocks.

Synonyms: *Polypodio serrulati-Cheilanthetum preridioidis* Brullo, Marcenò & Siracusa 2004 (art. 43).

Holotypus: rel. 2, tab. 17, Brullo et al. (2004).

Characteristic and differential species: *Oeosporangium acrosticum* (Balb.) L. Sáez & Aymerich (=*Cheilanthes acrostica* (Balb.) Tod.; *Cheilanthes pteridioides* auct. non (Reichard) C. Chr.).

Phytosociological table: From Brullo et al. (2004), tab. 17, 6 rel.

Char. association: *Oeosporangium acrosticum* (V).

Char. alliance and order: *Selaginella denticulata* (V), *Homalothecium sericeum* (V), *Polypodium cambricum* (V), *Leucodon sciuroides* (IV), *Saxifraga bulbifera* (III), *Asplenium obovatum* (II).

Char. class: *Hypnum cupressiforme* (V).

Transgr. *Asplenietea trichomanis*: *Sedum dasyphyllum* (V), *Ceterach officinarum* (V), *Umbilicus rupestris* (V), *Asplenium trichomanes* (IV).

Other species: *Tortula ruralis* (V), *Campanula erinus* (III), *Parietaria judaica* (III), *Allium subhirsutum* (III), *Sedum sediforme* (II), *Poa bulbosa* (II), etc.

Geographical distribution: This community occurs in the coastal stands of North-western Sicily (Brullo et al., 2004).

Structure and ecology: It is a chomophylous association linked to shady limestone rocks of coastal stands with northern exposure, where particularly humid and cool microclimatic conditions occur. In these stands it replaces the *Scabioso-Centauretum ucriae*, occurring in the cliff crevices. The *Polypodio serrulati-Cheilanthetum acrosticae* shows a rich bryo-pteridophytic component, including *Oeosporangium acrosticum*, *Selaginella denticulata*, *Homalothecium sericeum*, *Polypodium cambricum*, *Hypnum cupressiforme*, *Asplenium obovatum*, etc. (Brullo et al., 2004).

Syndynamism: See order.

Habitat reference: See class.

22.1.1.5. ***Selaginello denticulatae-Cymbalarietum pubescentis*** Brullo, Marcenò & Siracusa 2004

Chomophilous vegetation with Mediterranean clubmoss and Sicilian pennywort of very shaded calcareous rocks.

Holotypus: rel. 5, tab. 15, Brullo et al. (2004).

Characteristic and differential species: *Cymbalaria pubescens* (C. Presl) Cufod.

Phytosociological table: From Brullo et al. (2004), tab. 15, 6 rel.

Char. association: *Cymbalaria pubescens* (V).

Char. alliance and order: *Selaginella denticulata* (V), *Homalothecium sericeum* (V), *Polypodium cambricum* (V), *Arabis alpina* subsp. *caucasica* (V), *Anogramma leptophylla* (V), *Leucodon sciuroides* (IV), *Asplenium obovatum* (III).

Char. class: *Hypnum cupressiforme* (V).

Transgr. *Asplenietea trichomanis*: *Umbilicus rupestris* (V), *Hypochoeris laevigata* (IV), *Ceterach officinarum* (IV), *Asplenium trichomanes* (III), *Sedum dasyphyllum* (II), *Athamanta sicula* (I).

Other species: *Tortula ruralis* (V), *Allium subhirsutum* (V), *Dryopteris pallida* (IV), *Parietaria judaica* (IV), *Campanula erinus* (I), etc.

Geographical distribution: This vegetation occurs only in the deep valleys of Hyblaean plateau (Brullo et al., 2004).

Structure and ecology: The very shaded rocky surfaces, usually located in the undergrowth of forestal vegetation, are colonized by a hyper-sciaphilous community with *Cymbalaria pubescens*. It is the *Selaginello-Cymbalarietum pubescentis*, whose floristic set includes also several bryophytes and pteridophytes, as *Selaginella denticulata*, *Homalothecium sericeum*,

Polypodium cambricum, *Arabis alpina* subsp. *caucasica*, *Anogramma leptophylla*, *Hypnum cupressiforme*, *Leucodon sciuroides* and *Asplenium obovatum* (Brullo et al., 2004).

Syndynamism: See order.

Habitat reference: See class.

22.1.2. Alliance: ***Bartramio strictae-Polypodion cambrici*** O. Bolòs & Vives in O. Bolòs 1957

Silicicolous and thermophilous chomophytic vegetation dominated by bryophytes and pteridophytes.

Synonyms: *Anogrammion leptophyllae* Bellot & Casaseca in Bellot 1968.

Holotypus: *Sedo cepaeae-Polypodietum serrati* O. Bolòs & Vives in O. Bolòs 1957.

Characteristic and differential species: *Bartramia stricta* Brid., *Reboulia hemisphaerica* (L.) Raddi, *Targionia hypophylla* L., *Radula complanata* (L.) Dum., *Schistidium apocarpum* (Hedw.) Bruch, & Schimp.

Geographical distribution: This alliance occurs in the western Mediterranean area (Mucina et al., 2016). In Sicily it is widespread in the siliceous mountains (Brullo et al., 2004).

Structure and ecology: It groups the bryo-pteridophytic vegetation occurring in the siliceous cliffs, represented by schists, gneiss, granites and volcanic rocks. Its communities are distributed from the sea level to 1450 m of altitude within the climatophilous belt of the woodlands belonging to *Quercetea ilicis* class (Brullo et al., 2004).

Syndynamism: See order.

Habitat reference: See class.

22.1.2.1. ***Bartramio strictae-Polypodietum serrulati*** Brullo & Siracusa in Brullo & al. 2004

Chomophytic vegetation with southern polypody and rigid apple moss of cool and shady siliceous cliffs.

Holotypus: rel. 4, tab. 18, Brullo et al. (2004).

Characteristic and differential species: *Polypodium cambricum* L.

Phytosociological table: From Brullo et al. (2004), tab. 18, 13 rel.
Char. association: *Polypodium cambricum* (V).
Char. alliance: *Bartramia stricta* (V), *Targionia hypophylla* (IV), *Reboulia hemisphaerica* (II).
Char. order: *Homalothecium sericeum* (V), *Anogramma leptophylla* (IV), *Selaginella denticulata* (II), *Asplenium obovatum* (I).

Char. class: *Hypnum cupressiforme* (V).

Transgr. *Asplenietea trichomanis*: *Umbilicus rupestris* (V), *Ceterach officinarum* (III), *Asplenium trichomanes* (II), *Sedum dasyphyllum* (I).

Other species: *Bryum bicolor* (III), *Grimmia trichophylla* (III), *Parietaria lusitanica* (III), *Tortula ruralis* (III), *Pleurochaete squarrosa* (II), etc.

Geographical distribution: This vegetation was surveyed in eastern Sicily and in particular in the Peloritani mountains, Etna and Hyblaean area (Brullo et al., 2004).

Structure and ecology: The *Bartramio strictae-Polypodietum serrulati* is a meso-schiaphilous vegetation of siliceous cliffs, which finds it optimum in the cool and shaded stands of the sub-mountain belt. Floristically, it is characterized by some bryophytes, among them *Bartramia stricta*, *Targionia hypophylla* and *Reboulia hemisphaerica*, which are associated with various ferns, including *Polypodium cambricum*, *Anogramma leptophylla*, *Selaginella denticulata* and *Asplenium obovatum* (Brullo et al., 2004).

Syndynamism: See order.

Habitat reference: See class.

22.1.2..2. ***Scorpiuro circinnati-Anogrammetum leptophyllae*** Brullo & Siracusa in Brullo & al. 2004

Chomophytic vegetation with curving feather-moss and jersey fern of humid basaltic rocks.

Holotypus: rel. 5, tab. 20, Brullo et al. (2004).

Characteristic and differential species: *Scorpiurium circinatum* (Brid.) M.Fleisch. & Loeske.

Phytosociological table: From Brullo et al. (2004), tab. 20, 10 rel.

Char. association: *Scorpiurium circinatum* (V).

Char. alliance: *Bartramia stricta* (V), *Reboulia hemisphaerica* (V), *Targionia hypophylla* (III), *Radula complanata* (II), *Schistidium apocarpum* (I).

Char. order: *Anogramma leptophylla* (V), *Homalothecium sericeum* (III), *Pterogonium gracile* (II), *Polypodium cambricum* (I).

Char. class: *Hypnum cupressiforme* (II).

Transgr. *Asplenietea trichomanis*: *Umbilicus rupestris* (III).

Other species: *Parietaria lusitanica* (III), *Grimmia trichophylla* (III), *Funaria hygrometrica* (II), etc.

Geographical distribution: This vegetation is restricted to the hilly belt of the south-eastern side of Etna (Brullo et al., 2004).

Structure and ecology: It is a chomophytic vegetation having hygro-sciaphilous requirements, which is linked to more or less inclined basaltic rocks. This thermophilous

community has a winter-spring development, when the humus layer of rocks keeps a lot of humidity, which allows the growth of *Scorpiurium circinatum*, a hygrophilous moss. Besides, the bryophytic component is enriched by *Bartramia stricta*, *Reboulia hemisphaerica*, *Targionia hypophylla*, *Pterogonium gracile*, *Radula complanata*, *Schistidium apocarpum*, etc. (Brullo et al., 2004).

Syndynamism: See order.

Habitat reference: See class.

22.1.2.3. ***Bartramio strictae-Dryopteridetum pallidae*** Brullo & Siracusa in Brullo & al. 2004

Chomophytic and orophilous vegetation with rigid apple moss and pale buskler-fern of basaltic rocks.

Holotypus: rel. 9, tab. 21, Brullo et al. (2004).

Characteristic and differential species: *Dryopteris pallida* (Bory) Maire & Petitm.

Phytosociological table: From Brullo et al. (2004), tab. 21, 11 rel.
Char. association: *Dryopteris pallida* (V).
Char. alliance: *Bartramia stricta* (V), *Reboulia hemisphaerica* (I), *Pterogonium gracile* (I).
Char. order: *Leucodon sciuroides* (V), *Polypodium cambricum* (III), *Homalothecium sericeum* (III).
Char. class: *Hypnum cupressiforme* (IV).
Transgr. *Asplenietea trichomanis*: *Asplenium trichomanes* (V), *Ceterach officinarum* (V), *Umbilicus rupestris* (IV), *Oeosporangium pteridioides* (III), *Sedum dasyphyllum* (III).
Other species: *Parietaria judaica* (V), *Geranium purpureum* (V), *Pleurochaete squarrosa* (III), *Tortula ruralis* (III), etc.

Geographical distribution: This vegetation occcurs in all mountain sides of Etna (Brullo et al., 2004).

Structure and ecology: The *Bartramio strictae-Dryopteridetum pallidae* grows in the narrow hollows among the basaltic rocks of old lava flows. It is an orophilous community, occurring between 1000 and 1500 m in a quite humid and cool habitat. From the floristic point of view, it is characterized by the occurrence of *Dryopteris pallida*, which grows together with *Bartramia stricta*, *Reboulia hemisphaerica*, *Pterogonium gracile*, *Leucodon sciuroides*, *Hypnum cupressiforme*, etc. (Brullo et al., 2004).

Syndynamism: See order.

Habitat reference: See class.

22.1.2.4. ***Anogrammo leptophyllae-Selaginelletum denticulatae*** Molinier 1937

Chomophytic vegetation with jersey fern and Mediterranean clubmoss of cool and humid siliceous rocks.

Synonyms: Ass. à *Selaginella denticulata* et *Grammitis leptophylla* Molinier 1937.

Holotype: rel. pag. 122, Molinier (1937).

Characteristic and differential species: *Selaginella denticulata* (L.) Spring.

Phytosociological table: From Brullo et al. (2004), tab. 19, 9 rel.
Char. association: *Selaginella denticulata* (V).
Char. alliance: *Bartramia stricta* (V), *Targionia hypophylla* (V).
Char. order: *Anogramma leptophylla* (V), *Homalothecium sericeum* (V), *Polypodium cambricum* (IV), *Asplenium obovatum* (IV).
Char. class: *Hypnum cupressiforme* (V).
Transgr. *Asplenietea trichomanis*: *Ceterach officinarum* (IV), *Umbilicus rupestris* (I), *Asplenium trichomanes* (I).
Other species: *Grimmia tricophylla* (IV), *Bryum bicolor* (IV), *Crepis leontodontoides* (II), etc.

Geographical distribution: This vegetation occcurs in the western Mediterranean area. In Sicily is widely distributed in the eastern sector, from the Peloritani mountains to the Hyblaean area (Brullo et al., 2004).

Structure and ecology: The association occurs in the small siliceous rocky outcrops, in territories with a very cool and humid microclimate. Usually, it is localized inside shaded forest stands, where it constitutes a peculiar community dominated by *Selaginella denticulata*. The *Anogrammo leptophyllae-Selaginelletum denticulatae* can be considered an edaphic vicariant of the *Selaginello denticulatae-Cymbalarietum pubescentis*, occurring in the calcareous places (Brullo et al., 2004).

Syndynamism: See order.

Habitat reference: See class.

22.1.3. Alliance: ***Pohlio crudae-Asplenion septentrionalis*** Brullo & Siracusa in Brullo et al. 2004

Orophilous and calcifuge communities dominated by bryophytes and pteridophytes growing on shaded rocks.

Synonyms: *Pohlio crudae-Asplenion septentrionalis* Brullo & Siracusa in Brullo et al. 2001 (art. 5).

Holotypus: *Pohlio crudae-Cystopteridetum dichkeianae* Brullo & Siracusa in Brullo et al. 2004.

Characteristic and differential species: *Amphidium maugeotii* (Bruch. & Schimp.) Schimp., *Asplenium septentrionale* (L.) Hoffm., *Brachytecium velutinum* (Hedwig) Bruch et al., *Pohlia annotina* (Hedwig) Lindb., *Pohlia cruda* (Hedwig) Lindb., *Tortula subulata* Hedwig.

Geographical distribution: This alliance is currently known for Etna and Aspromonte massif (Brullo et al., 2001, 2004).

Structure and ecology: The *Pohlio crudae-Asplenion septentrionalis* gathers together the bryo-pteridophytic communities of shaded siliceous rocky surfaces, which occur in the high mountain belt between 1400 and 2100 m. This vegetation replaces the *Bartramio-Polypodion serrati* at higher altitude (Brullo et al., 2004). Previously, some bryophytic communities characterized by several species of *Pohlia* were described from Etna by Privitera & Puglisi (1996) and attributed to a peculiar alliance, proposed as *Pohlion crudae*, within the *Cladonio-Lepidozietea reptantis* Jezek & Vondracek 1962 class.

Syndynamism: See order.

Habitat reference: See class.

22.1.3.1. ***Pohlio crudae-Cystopteridetum dickieanae*** Brullo & Siracusa in Brullo & al. 2004

Chomophilous and orophilous vegetation with opal thread-moss and Dickie's bladder-fern of cool and humid volcanic rocks.

Holotypus: rel. 19, tab. 22, Brullo et al. (2004).

Characteristic and differential species: *Cystopteris dickieana* R. Sim.

Phytosociological table: From Brullo et al. (2004), tab. 22, 19 rel..

Char. association: *Cystopteris dickieana* (V).

Char. alliance: *Pohlia cruda* (V), *Amphidium maugeotii* (III), *Pohlia annotina* (III), *Asplenium septentrionale* (III), *Tortula subulata* (III), *Brachythecium velutinum* (III).

Char. order: *Homalothecium sericeum* (II), *Anogramma leptophylla* (I), *Reboulia hemisphaerica* (I), *Targionia hypophylla* (I).

Char. class: *Bartramia pomiformis* (III), *Hypnum cupressiforme* (I).

Transgr. *Asplenietea trichomanis*: *Umbilicus rupestris* (II), *Asplenium trichomanes* (I), *Sedum dasyphyllum* (I), *Hypochoeris laevigata* (I).

Other species: *Polytrichum juniperinum* (II), *Cerastium semidecandrum* (II), *Festuca circummediteranea* (II), etc.

Geographical distribution: This association was surveyed only in the Etna mountain (Brullo et al., 2004).

Structure and ecology: This vegetation occurs in shaded stands particularly cool and humid of the mountain belt between 1400 and 2200 m, as the opening of lavic cave or the deep

crevices of basaltic rocks. Floristically, this peculiar bryo-pteridophytic community is characterized by *Cystopteris dickieana* and *Asplenium septentrionale*, very rare ferns in the Etna territory, which grow together with several mosses, such as *Pohlia cruda, P. annotina, Amphidium maugeotii, Bartramia pomiformis*, etc. (Brullo et al., 2004).

Syndynamism: See order.

Habitat reference: See class.

22.1.3.2. ***Brachytecio velutini-Asplenietum trichomanis*** Brullo & Siracusa in Brullo & al. 2004

Orophilous and chomophylous vegetation with velvet feather-moss and maidenhair spleenwort of slightly shaded rocks.

Holotypus: rel. 4, tab. 23, Brullo et al. (2004).

Characteristic and differential species: *Brachythecium velutinum* (Hedw.) Schimp.

Phytosociological table: From Brullo et al. (2004), tab. 23, 8 rel.

Char. association: *Asplenium trichomanes* (V), *Brachythecium velutinum* (V).

Char. alliance: *Tortula subulata* (V), *Asplenium septentrionale* (IV), *Tortula subulata* (III), *Brachythecium velutinum* (III), *Amphidium mougeotii* (III), *Pohlia cruda* (II),

Char. order: *Homalothecium sericeum* (V), *Leucodon sciuroides* (I), *Reboulia hemisphaerica* (I).

Char. class: *Bartramia pomiformis* (I).

Transgr. *Asplenietea trichomanis*: *Ceterach officinarum* (V), *Umbilicus rupestris* (III), *Sedum dasyphyllum* (I).

Other species: *Polytrichum juniperinum* (II), *Asplenium onopteris* (I), *Tortula ruralis* (I), etc.

Geographical distribution: This association occurs only in the lower mountain belt of Etna (Brullo et al., 2004).

Structure and ecology: The *Brachytecio velutini-Asplenietum trichomanis* replaces the *Pohlio crudae-Cystopteridetum dickieanae* in less sciaphilous stands. It is a community with more thermophilous requirements, which occurs between 1000 and 1500 m in the underwood rocky outcrops. It is characterized by the occurrence of some less sciaphilous mosses, as *Brachythecium velutinum*, *Tortula subulata* and *Homalothecium sericeum*, while the pteridophytic component is mainly represented by *Asplenium trichomanes* and *A. septentrionale* (Brullo et al., 2004).

Syndynamism: See order.

Habitat reference: See class.

22.1.3.3. ***Asplenio septentrionalis-Dryopteridetum villarii*** Brullo & Siracusa in Brullo & al. 2004

Comophilous and orophilous vegetation with Villar's wood ferns and northern spleenwort of very shaded rocks.

Holotypus: rel. 4, tab. 24, Brullo et al. (2004).

Characteristic and differential species: *Dryopteris villarii* (Bellardi) Schinz & Thell.

Phytosociological table: From Brullo et al. (2004), tab. 24, 5 rel.
Char. association: *Dryopteris villarii* (V).
Char. alliance: *Pohlia cruda* (V), *Asplenium septentrionale* (V), *Cystopteris dickieana* (I).
Char. order: *Targionia hypophylla* (III), *Homalothecium sericeum* (I).
Char. class: *Bartramia pomiformis* (V).
Transgr. *Asplenietea trichomanis*: *Asplenium trichomanes* (V), *Umbilicus horizontalis* (V), *Hypochoeris laevigata* (V).
Other species: *Sedum tenuifolium* (V), *Festuca circummediteranea* (V), *Galium aetnicum* (IV), *Silene sicula* (IV), etc.

Geographical distribution: This association is restricted to the northern slope of Etna (Brullo et al., 2004).

Structure and ecology: The *Asplenio septentrionalis-Dryopteridetum villarii* is an hyper-sciaphilous and orophilous vegetation, which colonizes the walls of lavic caves, where the bright is just sufficient for plant life. It occurs between 1600 and 1900 m and is characterized by the occurrence of the rare *Dryopteris villarii*, growing together with *Asplenium septentrionale* and some bryophytes, as *Pohlia cruda* and *Bartramia pomiformis* (Brullo et al., 2004). This association is vicaried in Aspromonte (South Calabria) by the *Asplenio septentrionalis-Hieracietum aspromontani*, described by Brullo et al. (2001) from Montalto at 1700 m of altitude.

Syndynamism: See order.

Habitat reference: See class.

23. Class: ***Parietarietea judaicae*** Oberd. 1977

Chasmophilous and nitrophilous perennial vegetation growing in urban cliffs and walls crevices with Euro-atlantic and Mediterranean distribution.

Synonyms: *Parietarienea rupestris* Rivas-Martínez in Rivas Goday et al. 1956 (art. 2b, 3b, 8, 34); *Parietarietea* Rivas-Martinez in Rivas Goday 1964 nom. inval. (art. 8); *Cymbalario-Parietarietea* Oberd. in Oberd. et al. 1967 nom. nud. (art. 8); *Cymbalario-Parietarietea diffusae* Oberd. 1969 nom. inval. (art. 8); *Cymbalario-Parietarietea diffusae* Oberd. ex Oberd. 1977 (art.

3a); *Parietarietea muralia* Rivas-Martinez ex Izco, Ohba & R. Tx. in R.Tx. 1977 nom. inval. (art. 34).

Holotypus: *Parietarietalia judaicae* Rivas-Martínez 1969 corr. Oberd. 1977.

Characteristic and differential species: *Antirrhinum majus* L.*, Cymbalaria muralis* G. Gaertn., B. Mey. & Scherb*, Erigeron karvinskianus* DC.*, Erysimum cheiri* (L.) Crantz, *Parietaria judaica* L., *Sonchus tenerrimus* L., *Umbilicus rupestris* (Salisb.) Dandy.

Geographical distribution: This class is distributed in the Mediterranean, Macaronesian, Central and Atlantic Europe (Braun-Blanquet, 1952; Pignatti, 1953; Oberdorfer, 1977; Rivas-Martinez et al., 2002, 2011).

Structure and ecology: The *Parietarietea judaicae* gathers together the nitro-chasmophilous communities of masonry walls and urban cliffs. It is a synanthropic perennial vegetation characterized by hemicryptophytes, nanophanerophytes and chamephytes, which are ecologically well adapted to these peculiar disturbed habitats. Similarly to the natural cliffs, also these synanthropic habitats are not very suitable for plant colonization, since only small rocky crevices or surfaces where a slight layer of soil can accumulate can be used for the settlement of chasmophytes. Their ecological peculiarities have been extensively examined by Brullo & Guarino (1998), who pointed out that they are markedly mineralized with a scarcity of soil and high inclination (usually 90°), subject to rapid variations of temperature and humidity, totally exposed to wind and sun, incomplete cycle of organic matter released by the same plants, as well as directly affected by air pollution. Besides, these habitats are strongly subject to human disturbance, as periodical cleaning, restoration and renovation, which tend to modify in the time their physiognomy from the floristic point of view. This vegetation is usually characterized by several nitrophilous and well specialized species, such as *Parietaria judaica*, *Hyoscyamus albus*, *Sonchus tenerrimus*, *Centranthus ruber*, *Antirrhinum majus*, *Cymbalaria muralis, Capparis spinosa*, *Ficus carica* and also some alien species, such as *Erigeron karvinskianus, Erysimum cheiri*, etc. Sometimes, some chasmophytes of *Asplenietea trichomanis* occurr in the communities of *Parietarietea judaicae* (Bartolo & Brullo, 1986; Brullo & Guarino, 2002). From the syntaxonomical point of view, this class was examined by several authors (Rivas Goday et al., 1956; Rivas-Martinez, 1960, 1969, 2003; Rivas Goday, 1964; Oberdorfer et al., 1967; Oberdorfer, 1969, 1977; Izco et al., 1977; Bartolo & Brullo, 1986; Brullo & Guarino, 1998, 2002; Biondi et al., 2014, Bondi & Blasi, 2015; Mucina et al., 2016), who provide different arrangements, including syntaxa often invalid under the nomenclatural profile, which have led to a complex and tangled series of synonymies not easy to extricate. According to art. 34, several of this syntaxa are invalid and must be rejected, since they contain an ecological property, as indicated in the case of *Parietarienea rupestris* Rivas-Martínez in Rivas Goday et al. 1956, *Parietarietea muralia* Rivas-Martinez ex Izco, Ohba & R. Tx. in R.Tx. 1977, *Parietarietalia muralis* Rivas Martinez 1960, *Parietarietalia murale* Rivas-Martinez ex Br. Bl. 1966, *Parietarietalia muralis* Rivas-Martinez 1969, *Parietarietalia muralis* Rivas-Martínez ex Oberdorfer 1969 and *Galio-Parietarion muralis* Vigo & Terrada 1969. Besides, some of the aforesaid syntaxa are invalid also according to art. 2b, 3b and 8. As concerns the class, it was validly described for the first time by Oberdorfer (1977) as

Parietarietea judaicae, that in the original diagnosis this author refers to the citation of this class in his previously paper (Oberdorfer, 1969), where it is quoted as *Cymbalario-Parietarietea diffusae/judaicae*. In particular, Oberdorfer (1977) within this class included a single order (*Parietarietalia judaicae*) and alliance (*Centrantho-Paretarion*), syntaxa that validly proposed, correcting the invalid names (art. 8) pubblished by Rivas-Martinez (1960). All these syntaxa are validly typified by the *Parietarietum judaicae*, an association originally proposed by Arènes (1929) as *Parietarietum murale* nom. inval. (art. 34), of which Oberdorfer (1977) corrected the name.

Syndynamism: The synanthropic vegetation belonging to this class is characterized by a certain instability during the time due to the age of masonry walls, which are progressively colonized by more mature and differentiated communities. Besides, if they are no longer disturbated, they can evolve towards typical casmophilous vegetation of *Asplenietea trichomanis*.

Habitat reference: H3.1d Mediterranean siliceous inland cliff; H3.2d Mediterranean base-rich inland cliff.

23.1. Order: ***Tortulo-Cymbalarietalia*** Segal 1969

Nitro-casmophilous communities of walls or cliffs in anthropic areas.

Synonyms: *Parietarietalia* Rivas-Martinez in Rivas Goday et al. 1956 nom. inval. (art. 2b); *Parietarietalia muralis* Rivas Martinez 1960 nom. inval. (art. 8); *Parietarietalia* Rivas Goday 1964 nom. inval. (art. 8); *Parietarietalia diffusae* Br. Bl. 1964 nom. inval. (art. 2b); *Parietarietalia murale* Rivas-Martinez ex Br. Bl. 1966 nom. inval. (art. 8, 34); *Parietarietalia* Bolòs 1967, nom. inval. (art. 3a); *Parietarietalia muralis* Rivas-Martinez 1969 nom. inval. (art. 34); *Parietarietalia muralis* Rivas-Martínez ex Oberdorfer 1969 nom. inval. (art. 8, 34); *Parietarietalia judaicae* Rivas-Martinez 1969 corr. Oberdorfer 1977 (art. 22, 23); *Capparidetalia spinosae* Biondi, Blasi & Galdenzi in Biondi et al. 2014 (art. 22, 23).

Lectotypus: *Cymbalario-Asplenion* Segal 1969.

Geographical distribution: See class.

Characteristic and differential species: See class

Structure and ecology: From the literature data (Rivas-Goday et al., 1956; Rivas-Martinez, 1960, 1969; Rivas Goday, 1964; Br.-Bl., 1964, 1966; Segal, 1969; Oberdorfer 1969, 1977), within this class is recognized only one order, which similarly to the class presents a complex nomenclatural situation. The first syntaxon validly pubblished was proposed by Segal (1969) as *Tortulo-Cymbalarietalia*, which included only one alliance (*Parietarion judaicae*) with several associations, all in turn validly described. Previously, several invalid names were reported in literature (art. 2b, 3a, 8, 34), such as *Parietarietalia* Rivas-Martinez in Rivas Goday et al. 1956, *Parietarietalia muralis* Rivas Martinez 1960, *Parietarietalia* Rivas Goday 1964,

Parietarietalia diffusae Br. Bl. 1964, *Parietarietalia murale* Rivas-Martinez ex Br. Bl. 1966. Besides, two syntaxa were validly described by Oberdorfer (1977) as *Parietarietalia judaicae* and by Biondi et al. (2014b) as *Capparidetalia spinosae* (cf. Mucina et al., 2016).

Syndynamism: See class.

Habitat reference: See class.

23.1.1. Alliance: ***Parietarion judaicae*** Segal 1969

Nitrophilous and thermophilous communities of cliffs and walls.

Synonyms: *Parietario-Galion murale* Rivas-Martinez 1955 (phantom); *Parietario-Centranthion rubri* Rivas-Martinez 1960 (art. 8); *Parietario-Galion muralis* Rivas-Martinez 1960 (art. 8, 37); *Linarion cymbalariae* Segal 1961 (art. 2b); *Linario-Parietarion diffusae* Br.-Bl. 1964 (art. 2b); *Parietario mauritanicae-Galion murale* Rivas-Martinez ex Rivas-Goday 1964 nom. dubium (art. 37, 38); *Parietario-Galion muralis* Rivas-Martinez ex Br. Bl. 1966 nom. inval. (art. 3f); *Galio-Parietarion* Rivas-Martinez ex Oberd. 1969 nom. inval. (art. 3f); *Galio-Parietarion mauritanicae* Rivas-Martinez 1969 nom. dubium (art. 37); *Parietario-Centranthion rubri* Rivas-Martinez 1969 (art. 22, 23); *Centrantho-Parietarion judaicae* Rivas-Martinez 1975 (art. 29); *Centrantho-Parietarion* Rivas-Martinez ex Oberd. 1977 (art. 22, 23); *Crithmo-Parietarion judaicae* Caneva et al., 1989 (art. 3b).

Lectotypus: *Bromo madritensis-Parietarietum judaicae* Segal 1969, here designated.

Characteristic and differential species: *Antirrhinum siculum* Mill., *Capparis spinosa* L., *Centranthus ruber* (L.) DC., *Hyoseris radiata* L., *Trachelium caeruleum* L.

Geographical distribution: This alliance occurs mainly in the western Mediterranean, with penetrations in central and western Europe (Mucina et al., 2016).

Structure and ecology: This alliance groups the thermophilous chamaephytic and hemicryptophytic communities of walls with a poor bryo-pteridophytic component, occurring in the territories with a thermo- and mesomediterraean bioclimate. From the nomenclatural point of view, this alliance was validly described first by Segal (1969) as *Parietarion judaicae*, which is lectotypified by *Bromo madritensis-Parietarietum judaicae* Segal 1969, nomenclatural synonym of *Oxalido corniculatae-Parietarietum ramiflorae* Br.-Bl. 1966. Several authors published various alliances, most of which representing invalid or ambiguous names (art. 2b, 3b, 3f, 8, 34, 37, 38), among them can be quoted: *Parietario-Centranthion rubri* Rivas-Martinez 1960, *Linarion cymbalariae* Segal 1961, *Linario-Parietarion diffusae* Br.-Bl. 1964 and *Crithmo-Parietarion judaicae* Caneva et al., 1989. Besides, is to be highlighted that within this order was described a peculiar alliance represented by *Parietario mauritanicae-Galion murale* Rivas-Martinez ex Rivas-Goday 1964 (=*Parietario-Galion muralis* Rivas-Martinez 1960; *Galio-Parietarion* Rivas-Martinez ex Oberd. 1969; *Galio-Parietarion mauritanicae* Rivas-Martinez 1969), which must be considered according to Brullo et al. (2007) a *nomen dubium* (art. 38).

In fact, this alliance, validly described by Rivas Goday (1964), includes two associations: the *Parietarietum mauritanicae-bethuricum* and *Oryzopsis miliacea-Antirrhinum australis* ass., of these the first must be obligatorily chosen as lectotype for this alliance, since it is the only one having a *Parietaria* species in the relevés. From the floristic viewpoint, these two associations are very rich and often dominated by annual species, most of which belong to *Gerano-Cardaminetalia hirsutae* Brullo in Brullo & Marcenò 1985, order of *Chenopodietea* class. On that basis, Brullo et al. (2007) considered the *Parietarietum mauritanicae-bethuricum* partly a synonym of the *Torili nodosae-Parietarietum mauritanicae* Rivas-Martinez 1978, while the *Parietario mauritanicae-Galion murale* alliance partly a synonym of *Geranio pusilli-Anthriscion caucalidis* Rivas-Martinez 1978. It is noteworthy that also Rivas-Martinez (1978) agrees with this standpoint. Later, the same author (Rivas-Martinez, 2003) completely changes opinion, considering the *Parietarion-Galion muralis* as an order of *Parietarietalia* Rivas-Martinez in Rivas Goday 1964, while the *Parietario-Centranthion rubri* Rivas-Martinez 1969 is treated as a syntaxonomic synonym of the aforesaid alliance. Recently, Biondi et al. (2014b) described a new alliance markedly thermophilous, named *Artemisio arborescentis-Capparidion spinosae*, which is represented by the *Artemisio arborescentis-Capparidetum inermis* Biondi et al. 2014, association not surveyed in Sicily.

Syndynamism: See class.

Habitat reference: See class.

23.1.1.1. ***Oxalido corniculatae-Parietarietum ramiflorae*** Br.-Bl. 1966

Chasmo-nitrophilous vegetation dominated by spreading pellitory of shaded cliffs.

Synonyms: *Parietarietum murale* Arénes 1929 nom. inval. (art. 8); *Parietaria ramiflora-Oxalis corniculata* ass. Br.-Bl. 1931 (art. 2b); *Parietarietum murale* Br. BL. 1952 (art. 34); *Bromo madritense-Parietarietum judaicae* Segal 1969 (art. 22, 23); *Parietario lusitanicae-Antirrhinetum siculi parietarietosum diffusae* Oberd. 1975 p.p.; *Parietarietum judaicae* Arènes ex Oberd. 1977 (art. 22, 23); *Parietarietum judaicae* Diaz Gonzalez 1989 non *Parietaria ramiflora* ass. Buchwald 1952; *Suaedo verae-Parietarietum judaicae* Caneva et al. 1989 (art. 2b).

Lectotypus: tab.3, rel. 8, Braun-Blanquet (1966), here designated.

Characteristic and differential species: *Parietaria judaica* L.

Phytosociological table: From Bartolo & Brullo (1986), tab. 1, 20 rel. (subass. *typicum*).

Char. association: *Parietaria judaica* (V).

Char. alliance, order and class: *Sonchus tenerrimus* (V), *Centranthus ruber* (IV), *Hyoseris radiata* (III), *Umbilicus rupestris* (III), *Antirrhinum majus* (III), *Ceterach officinarum* (II), *Ficus carica* (II), *Cymbalaria muralis* (I), *Erigeron karviskianus* (I), *Polypodium cambricum* (I), *Erysimum cheiri* (I).

Other species: *Sedum dasyphyllum* (II), *Parietaria lusitanica* (II), *Antirrhinum siculum* (II), *Anogramma leptophylla* (II), *Theligonum cynocrambe* (II), *Piptantherum miliaceum* (II), *Mercurialis annua* (II), etc.

Phytosociological table: From Bartolo & Brullo (1986), tab. 6, 9 rel. (subass. *cymbalarietosum muralis*).

Char. association: *Parietaria judaica* (V).

Char. subass.: *Cymbalaria muralis* (V).

Char. alliance, order and class: *Sonchus tenerrimus* (IV), *Hyoseris radiata* (II), *Centranthus ruber* (I), *Ficus carica* (I), *Antirrhinum majus* (I), *Erigeron karviskianus* (I), *Umbilicus rupestris* (I).

Other species: *Mercurialis annua* (III), *Theligonum cynocrambe* (III), *Catapodium rigidum* (II), *Polypodium cambricum* (I), etc.

Geographical distribution: This vegetation, widely distributed in the Mediterranean area, in Sicily is widespread in all the territory (Bartolo & Brullo, 1986; Brullo & Guarino, 2002).

Structure and ecology: The walls with northern exposure, usually in urban and suburban areas, are colonized by a peculiar sciaphilous and nitrophilous vegetation, which is dominated by *Parietaria judaica*. This community is represented by the *Oxalido corniculatae-Parietarietum judaicae*, which occurs on masonry works with different geological origin (limestones, sandstones, volcanic rocks, schists, etc.) from the sea level to 800 m a.s.l. It is localized mainly on the faces of old buildings, bridges, road embankments, etc., where it occurs in the more shady stands. It is differentiated by the dominance of *Parietaria judaica*, which grows together with other chasmo-nitrophilous species, as *Sonchus tenerrimus*, *Hyoseris radiata*, *Centranthus ruber*, *Ficus carica*, *Antirrhinum majus*, *Erigeron karviskianus* and *Umbilicus rupestris*. In particular, *Oxalis corniculata* which give the name to this syntaxon, is a sporadic and occasional in this vegetation, to be considered an accidental species. Within this association Brullo & Guarino (1998), apart from a subass. *typicum*, distinguished also the subass. *cymbalarietosum muralis* (syn.: *Linario cymbalariae-Parietarietum ramiflorae* Bartolo & Brullo 1986, non Pignatti 1952), which is linked to more mesic conditions. In fact, it occurs in the mesomediterranean belt, colonizing the shaded surfaces that are moderately humid. According to literature data, this association was described for the first time by Arénes (1929) sub *Parietarietum murale* nom. inval. (art. 8) and also by Braun-Blanquet (1931), who quoted it as nomen nudum, sub *Parietaria ramiflora-Oxalis corniculata* ass.. Later, Braun-Blanquet (1952) pubblished a syntethic table of this association, naming it as *Paretarietum murale*, an invalid name (art. 34), while it was validly described by the same author (Braun-Blanquet, 1966) as *Oxalido corniculatae-Parietarietum ramiflorae*. Other valid names were proposed by other authors, among them *Bromo madritense-Parietarietum judaicae* by Segal (1969), *Parietarietum judaicae* by Arènes ex Oberd. 1977 and *Parietarietum judaicae* by Diaz Gonzalez (1989), which are therefore all illegitimate names (art. 22, 23).

Syndynamism: Generally, this vegetation takes catenal contact towards the base of the wall with the nitrophilous communities of *Chenopodietea*, while in the more sunny and exposed

stands it is replaced by more thermophilous chasmo-nitrophilous association of the *Parietarion judaicae*.

Habitat reference: See class.

23.1.1.2. ***Capparidetum rupestris*** O.Bolòs & Molinier 1958

Chasmo-nitrophilous vegetation with caper bush of disturbed dry walls and cliffs.

Synonyms: *Capparidetum inermis* Bolòs 1962 (art. 29); *Capparidi-Parietarietum judaicae* Segal 1969 (art. 22, 23); *Centaureo-Capparidetum rupestris* Caneva et al. 1989 (art. 2b).

Lectotypus: tab. 18, rel. 1, Bolòs & Molinier (1958).

Characteristic and differential species: *Capparis spinosa* L. (= *Capparis rupestris* Sm.).

Phytosociological table: From Bartolo & Brullo (1986), tab. 5, 10 rel.

Char. association: *Capparis spinosa* (V).

Char. alliance, order and class: *Parietaria judaica* (V), *Sonchus tenerrimus* (V), *Hyoseris radiata* (V), *Centranthus ruber* (IV), *Ficus carica* (IV), *Umbilicus rupestris* (II), *Antirrhinum majus* (I).

Other species: *Parietaria lusitanica* (III), *Mercurialis annua* (III), *Urtica membranacea* (III), *Lobularia maritima* (III), *Dittrichia viscosa* (II), etc.

Geographical distribution: This association occurs in the Mediterranean area, including Sicily, where it is frequent in the thermomediterranean belt (Bartolo & Brullo, 1986; Brullo & Guarino, 2002).

Structure and ecology: The *Capparidetum rupestris* grows on the south facing side of old walls, preferring the sunny places desturbed by human activities. Sometimes, it colonizes also the cliffs in urban areas, where replaces the chasmophilous vegetation of *Asplenietea trichomanis*. Under the floristic profile, it is dominated by *Capparis spinosa*, which is associated with some species of order and class, as *Parietaria judaica*, *Sonchus tenerrimus*, *Hyoseris radiata*, *Centranthus ruber*, *Ficus carica*, *Umbilicus rupestris* and *Antirrhinum majus* (Bartolo & Brullo, 1986).

Syndynamism: This vegetation is of permanent type, if the conditions of anthropic disturbance persist, as in urban and suburban environments. It is linked to xeric conditions, while it is replaced in more mesic habitats by others communities more exigent with regards to edaphic moisture.

Habitat reference: See class.

23.1.1.3. ***Centranthetum rubri*** Oberd. 1969

Nitro-chasmophilous vegetation with red valerian of old and sunny walls.

Synonyms: *Centaureo-Centranthetum rubri* Caneva et al. 1989 (art. 2b).

Lectotypus: rel. 16, tab. 1, Oberdofer (1969).

Characteristic and differential species: *Centranthus ruber* (L.) DC.

Phytosociological table: From Bartolo & Brullo (1986), tab. 2, 10 rel.

Char. association: *Centranthus ruber* (V).

Char. alliance, order and class: *Parietaria judaica* (V), *Sonchus tenerrimus* (V), *Hyoseris radiata* (IV), *Antirrhinum siculum* (IV), *Capparis spinosa* (IV), *Ficus carica* (III), *Umbilicus rupestris* (II), *Antirrhinum majus* (I).

Other species: *Veronica cymbalaria* (IV), *Reseda alba* (III), *Piptantherum miliaceum* (II), *Phagnalon rupestre* (II), *Campanula erinus* (II), *Ceterach officinarum* (I), etc.

Geographical distribution: This vegetation, common in the Mediterranean area, in Sicily is widespread in the all island (Bartolo & Brullo, 1986; Brullo & Guarino, 1998, 2002).

Structure and ecology: This association occurs in the old walls with sunny exposure, representing a thermophilous and mature vegetation. In particular, it is frequent in southern facing of masonry works of urban and extraurban areas, where it prefers the high part of these stands, where the narrow fissures doesn't allow the deposit of much organic matter (Bartolo & Brullo, 1986). This community is dominated by *Centranthus ruber*, which with its showy pink flowering makes a beatiful coloured spot on the walls. Among the species of higher rank *Parietaria judaica*, *Sonchus tenerrimus*, *Hyoseris radiata* and *Capparis spinosa* are quite frequent. Among the two subassociations of this association recognized by Brullo & Guarino (1998), in Sicily only that one *typicum* was surveyed.

Syndynamism: This association represents a more mature stage in the colonization processes of masonry walls, limetdly to xeric environmental conditions.

Habitat reference: See class.

23.1.1.4. ***Centrantho rubri-Hypericetum majoris*** Rivas-Martínez 1969 corr. Brullo & Guarino 1998

Chasmo-nitrophilous vegetation with red valerian and stinking tutsan of fresh and shaded walls.

Synonyms: *Kentrantho-Hypericetum hircini* Rivas-Martinez 1969 (art. 41, 43); *Hypericetum hircini* Rivas-Martinez 1969 nom. alternative (art. 3a).

Holotypus: rel. 3, tab. 2, Rivas-Martinez (1969).

Characteristic and differential species: *Hypericum hircinum* L. subsp. *majus* (Aiton) N. Robson.

Phytosociological table: From Brullo & Guarino (1998), tab. 2, 4 rel.

Char. association: *Hypericum hircinum* subsp. *majus* (4).

Char. alliance, order and class: *Hyoseris radiata* (4), *Centranthus ruber* (4), *Umbilicus rupestris* (4), *Parietaria judaica* (3).

Other species: *Cicerbita tenerrima* (2), *Ceterach officinarum* (2), *Asplenium trichomanes* (2).

Geographical distribution: This vegetation occurs in the Atlantic Iberian territories and on the north-eastern side of Etna (Brullo & Guarino, 1998).

Structure and ecology: The *Centrantho-Hypericetum majoris* colonizes the fresh and shaded walls within the mountain belt with a very damp climate. This community is dominated by *Hypericum hircinum* subsp. *majus* and *Centranthus ruber*, growing together with some species of higher rank, as *Hyoseris radiata*, *Umbilicus rupestris*, *Parietaria judaica*, etc. (Brullo & Guarino, 1998).

Syndynamism: In Sicily this vegetation represents one of the most mesophilous associations of this alliance, localizing exclusively in mountain stands, where it is very rare.

Habitat reference: See class.

23.1.1.5. ***Cymbalario muralis-Trachelietum caerulei*** Rivas-Martínez 1969

Chasmo-nitrophilous vegetation with ivy-leaved toadflax and blue throatwort of shaded and humid walls.

Holotypus: rel. 1, tab. 3, Rivas-Martinez (1969).

Characteristic and differential species: *Trachelium caeruleum* L. subsp. *caeruleum*.

Phytosociological table: From Bartolo & Brullo (1986), tab. 7, 4 rel.

Char. association: *Trachelium caeruleum* (4).

Char. alliance, order and class: *Parietaria judaica* (4), *Antirrhinum siculus* (4), *Centranthus ruber* (4), *Sonchus tenerrimus* (2), *Hyoseris radiata* (1).

Other species: *Micromeria graeca* (4), *Anthyllis vulneraria* (4), *Blackstonia perfoliata* (3), *Anogramma leptophylla* (2), etc.

Geographical distribution: This vegetation occurs in the Iberian Peninsula (Rivas Martinez 1969), along the Italian tyrrhenian coasts and Sicily (Bartolo & Brullo, 1986; Brullo & Guarino 1998).

Structure and ecology: The rocks and walls of urban and road artifacts with shaded and humid conditions are colonized by a peculiar vegetation that is differentiated by *Trachelium caeruleum*. Despite the low coverage or the abesence of *Cymbalaria muralis*, the Sicilian community can be ascribed to *Cymbalario muralis-Trachelietum caerulei*, an association of wet

marly-clayey stands. The syntaxa of higher rank are represented by *Parietaria judaica*, *Centranthus ruber*, *Sonchus tenerrimus* and *Hyoseris radiata* (Bartolo & Brullo, 1986).

Syndynamism: This vegetation can take contact in very wet stands with dripping waters with the *Adiantetea capilli-veneris* communities.

Habitat reference: See class.

23.1.1.6. ***Hyoscyamo albi-Parietarietum judaicae*** Segal 1969

Chasmo-nitrophilous vegetation with white henbane and spreading pellitory of old walls near the sea.

Synonyms: *Par**i**etario-Hyoscyametum albi* Bartolo & Brullo 1986 nom. illeg. (art. 22, 23).

Holotypus: rel. 2, tab. 12, Segal (1969).

Characteristic and differential species: *Hyoscyamus albus* L.

Phytosociological table: From Bartolo & Brullo (1986), tab. 8, 6 rel.

Char. association: *Hyoscyamus albus* (V).

Char. alliance, order and class: *Parietaria judaic* (V), *Sonchus tenerrimus* (IV), *Hyoseris radiata* (III), *Capparis spinosa* (III), *Umbilicus rupestris* (II).

Other species: *Mercurialis annua* (IV), *Sonchus oleraceus* (III), *Artemisia arborescens* (II), *Galium murale* (II), *Oxalis pes-caprae* (II), *Silene vulgaris* subsp. *tenoreana* (I), etc.

Geographical distribution: This community occurs in the Mediterranean area, mainly in the coastal places. In Sicily is quite frequent in the stands near the sea (Bartolo & Brullo, 1986; Brullo & Guarino, 1998, 2002).

Structure and ecology: The walls and faces of old buildings along the coastal belt, often dunged by sea-birds, are colonized by a chasmo-nitrophilous community named *Hyosciamo albi-Parietarietum judaicae*. This vegetation has a halo-xerophilous character, which is clearly highlighted by the occurrence of *Hyoscyamus albus*. The *Parietarietea judaicae* species are represented by *Parietaria judaica*, *Sonchus tenerrimus*, *Hyoseris radiata*, *Capparis spinosa*, etc. (Bartolo & Brullo, 1986).

Syndynamism: This association can be considered a markedly pioneer vegetation linked to a more or less constant arrival of organic matter.

Habitat reference: See class.

23.1.1.7. ***Antirrhinetum siculi*** Bartolo & Brullo 1986

Chasmo-nitrophilous vegetation with Sicilian snapdragon of sunny walls.

Synonyms: *Parietario-Antirrhinetum siculi* Brandes 1991 non Oberd. 1975; *Parietario-Antirrhinetum siculi* Oberd. 1975 nom. dubium (art. 37).

Holotypus: rel. 2, tab. 3, Bartolo & Brullo (1986).

Characteristic and differential species: *Antirrhinum siculum* Mill.

Phytosociological table: From Bartolo & Brullo (1986), tab. 3, 7 rel. (subass. *typicum*).

Char. association: *Antirrhinum siculum* (V).

Char. alliance, order and class: *Parietaria judaica* (V), *Capparis spinosa* (IV), *Centranthus ruber* (III), *Sonchus tenerrimus* (III), *Hyoseris radiata* (II), *Ficus carica* (II), *Umbilicus rupestris* (I).

Other species: *Parietaria lusitanica* (IV), *Valantia muralis* (III), *Mercurialis annua* (II), *Sonchus oleraceus* (II), etc.

From Bartolo & Brullo (1986), tab. 4, 11 rel. (subass. *majoretosum onitae*).

Char. association: *Antirrhinum siculum* (V).

Char. subass: *Origanum onites* (V).

Char. alliance, order and class: *Capparis spinosa* (V), *Ficus carica* (V), *Sonchus tenerrimus* (V), *Parietaria judaica* (IV), *Hyoseris radiata* (IV), *Centranthus ruber* (III), *Umbilicus rupestris* (II).

Other species: *Teucrium fruticans* (V), *Hyparrhenia hirta* (V), *Teucrium flavum* (IV), *Reichardia picroides* (IV), *Lotus cytisoides* (IV), *Dittrichia viscosa* (III), *Mercurialis annua* (III), *Asparagus acutifolius* (III), etc.

Geographical distribution: This community was surveyed in southern Italy and Sicily, where it is quite frequent (Bartolo & Brullo, 1986; Brullo & Guarino, 1998, 2002; Brullo et al., 2001). It occurs also in Malta, where it was recorded by Brandes (1991).

Structure and ecology: The association, colonizing the crevices of sunny or slighty shaded walls, represents a perennial chasmo-nitrophilous vegetation, which is dominated by *Antirrhinum siculum* with high coverage values. This vegetation is linked to dry and exposed stands with a scarse occurrence of humus, replacing the *Centranthetum rubri* in more xeric conditions. Generally, *Antirrhinum siculum* occurs in the rupestrian communities of *Asplenietea trichomanis*, while shows a piooner character in the above mentioned disturbed stands, where it grows together with *Parietaria judaica*, *Capparis spinosa*, *Centranthus ruber*, *Sonchus tenerrimus*, *Hyoseris radiata*, etc. (Bartolo & Brullo, 1986). Apart from the subass. *typicum*, Brullo & Guarino (1998) recognized a subass. *majoretosum onitae*, previously described by Bartolo & Brullo (1986) as *Majoranetum onitis*, which replaces the typical aspect in the calcareous walls with a marked sunny exposure. As concerns this vegetation, Oberdorfer (1975) described from Sicily an association named *Parietario-Antirrhinetum siculi*, but as can be seen from the relevés published by this author they are very heterogenous from floristic and acological point of view. Infact, according to Bartolo & Brullo (1986), the relevés can be attributed partly to *Parietarietum judaicae* and partly to *Parietario lusitanicae-*

Veronicetum cymbalariae, the latter belonging to *Geranio-Cardaminetalia hirsutae*. Therefore, the association proposed by Oberdorfer (1975) is clearly a nomen dubium (art. 37).

Syndynamism: It is a markedly xerophilous pioneer vegetation, which can evolve in more mature edaphic conditions towards the *Centranthetum rubri*.

Habitat reference: See class.

23.1.1.8. ***Antirrhinetum tortuosi*** Caneva & al. 1995

Chasmo-nitrophilous vegetation with greater snapdragon of sunny walls.

Holotypus: rel. 14, tab. 9, Caneva et al. (1995).

Characteristic and differential species: *Antirrhinum majus* L. subsp. *tortuosum* (Bosc ex Lam.) Rouy.

Phytosociological table: From Minissale et al. (2005), tab. 15, 3 rel.
Char. association: *Antirrhinum majus* subsp. *tortuosum* (3).
Char. alliance, order and class: *Parietaria judaica* (3), *Erysimum cheiri* (1), *Ceterach officinarum* (1), *Umbilicus rupestris* (1).
Other species: *Prasium majus* (3), *Polypodium cambricum* (2), *Sedum dasyphyllum* (2), etc.

Geographical distribution: This community was described from Latium by Caneva et al. (1995), but occurs also in Sicily, where it was surveyed in the Taormina area (Minissale et al., 2005).

Structure and ecology: The *Antirrhinetum tortuosi* is linked to the top of exposed walls, showing heliophilous requirements. This community is differentiated by the dominance of *Antirrhinum majus* subsp. *tortuosum*, growing together with *Parietaria judaica*, *Erysimum cheiri*, *Ceterach officinarum* and *Umbilicus rupestris* (Minissale et al., 2005). Usually, it replaces the *Antirrhinetum siculi* in the more mesic edaphic conditions, as emphasized by the occurrence of *Erysimum cheiri* and *Ceterach officinarum*.

Syndynamism: This vegetation is localized in the urban stands in situations of marked anthropic disturbance, showing always a pioneer character.

Habitat reference: See class.

23.1.1.9. ***Fico caricae-Erigeronetum mucronati*** Segal 1969

Chasmo-nitrophilous vegetation with ivy-leaved toadflax and Mexican fleabane of humid and less humified walls.

Synonyms: *Linario-Erigeronetum mucronati ficetosum caricae* Segal 1969 (art. 3a); *Cymbalario muralis-Erigeronetum karwinskiani* Segal 1969 nom. mut. prop. Brullo & Guarino 2002 (art. 45); *Erigeronetum karwinskiani* Oberd. 1969 nom. illeg. (art. 22-23); *Polygonum capitatum* community Ortiz & Rodriguez Oubiňac 1993 (art. 3c).

Holotypus: rel. 3, tab. 19, Segal (1969).

Characteristic and differential species: *Erigeron karvinskianus* DC. (=*Erigeron mucronatus* DC.).

Phytosociological table: From Brullo (1986), tab. 1, 3 rel. (8-10).

Char. association: *Erigeron karvinskianus* (3).

Char. alliance, order and class: *Parietaria judaica* (3), *Sonchus tenerrimus* (3), *Hyoseris radiata* (2), *Antirrhinum majus* (2), *Ficus carica* (2), *Centranthus ruber* (2), *Umbilicus rupestris* (2), *Antirrhinum siculum* (2), *Hyoscyamus albus* (1).

Other species: *Oryzopsis miliaceum* (2), *Campanula erinus* (1), *Veronica cymbalaria* (I), etc.

Geographical distribution: This vegetation is distributed in the Atlantic and Central-southern Europe, while in Sicily is restricted to the north-eastern sector (Brullo & Guarino, 2002).

Structure and ecology: The association is localized in small and few humified crevices of plastered and cemented old walls, in stands characterized by a marked atmospheric humidity. This vegetation is characterized by *Erigeron karvinskianus*, an American neophyte, usually growing together with *Parietaria judaica*, *Sonchus tenerrimus, Ficus carica, Antirrhinum majus, Centranthus ruber*, etc. (Brullo & Guarino, 2002). It was described firstly by Segal (1969) as *Fico caricae-Erigeronetum mucronati*, including among the synonyms the *Linario-Erigeronetum mucronati*, while Brullo & Guarino (2002) proposed as nomen mutatum *Cymbalario muralis-Erigeronetum karwinskiani* (art. 45). Besides, Oberdofer (1969) proposed for this association the name *Erigeronetum karwinskiani*.

Syndynamism: It is a very peculiar pioneer vegetation, linked to old walls affected by humid microclimatic conditions of oceanic kind.

Habitat reference: See class.

23.1.2. Alliance: ***Cymbalario-Asplenion quadrivalentis*** Segal 1969

Bryo-pteridophytic chasmo-nitrophilous vegetation of mesic and mountain habitats.

Synonyms: *Asplenion ruta-murariae* Gams 1936 (art. 2b); *Tortulo-Linarion cymbalariae* Westhoff 1966 (art. 2b).

Lectotypus: *Asplenietum rutae murariae-trichomanis* Kuhn 1937.

Characteristic and differential species: *Asplenium trichomanes* L. subsp. *quadrivalens* D.E. Mey., *Barbula unguiculata* Hedw., *Bryum caespiticium* Hedw., *Ceratodon purpureus* (Hedw.) Brid., *Didymodon rigidulus* Hedw., *D. vinealis* (Bridel) R. H. Zander, *Grimmia pulvinata* (Hedw.) Sm., *Homalothecium sericeum* (Hedw.) Schimp., *Hypnum cupressiforme* Hedw., *Scorpiurum circinatum* (Brid.) Fleisch., *Tortula muralis* Hedw.

Geographical distribution: This alliance occurs in the Central and Atlantic Europe, with some penetrations in the mountain Mediterranean area (Brullo & Guarino, 2002). In Sicily this vegetation is quite localized and was surveyed in the mountains, limitedly to urban habitats.

Structure and ecology: The *Cymbalario-Asplenion quadrivalentis* groups the chasmo-nitrophilous communities rich in the bryo-pteridophytic component, occurring in the territories characterized by temperate bioclimate, while in the Mediterranean area are localized in the mountain belt. Infact, the communities belonging to this alliance shows mesophilous requirements and in the Mediterranean area are restricted to the humid-hyperhumid meso-supramediterranean belts. Usually, they show a two-layered structure with a basal layer constituted by a moss carpet and an upper layer with cormophytes (Brullo & Guarino, 2002).

Syndynamism: From the dynamic point of view, the first stage in the colonization processes of walls is represented exclusively by a moss carpet, on which the cormophytes later install.

Habitat reference: See class.

23.1.2.1. ***Asplenio trichomanis-Parietarietum judaicae*** Segal 1969

Chasmo-nitrophilous vegetation with maidenhair spleenwort and spreading pellitory of shady walls.

Synonyms: *Anogrammo-Parietarietum judaicae* Segal 1969.

Lectotypus: rel. 5, tab. 21, Segal (1969).

Characteristic and differential species: *Parietaria judaica* L.

Phytosociological table: 4 unpublished relevés, Etna, Brullo & Siracusa.

Char. association: *Parietaria judaica* (4).

Char. alliance: *Asplenium trichomanes* subsp. *quadrivalens* (4), *Barbula unguiculata* (4), *Homalothecium sericeum* (3), *Bryum caespiticium* (3), *Grimmia pulvinata* (2).

Char. order and class: *Ceterach officinarum* (4), *Centranthus ruber* (3), *Umbilicus horizontalis* (3), *Umbilicus rupestris* (3), *Hyoseris radiata* (2), *Sonchus tenerrimus* (2).

Other species: *Polypodium cambricum* (3), *Reichardia picroides* (3), *Geranium molle* (3), *Oeosporangium pteridioides* (2), *Anogramma leptophylla* (1), etc.

Geographical distribution: This vegetation is mainly distributed in central and western Europe, while it is restricted to mountain stands in the Mediterranean area. In Sicily it was surveyed only in the Etna volcano (Brullo & Guarino, 1998).

Structure and ecology: The *Asplenio trichomanis-Parietarietum judaicae* is a chasmo-nitrophilous vegetation, occurring on the old walls of urban habitats with southern exposure within the mountain belt. This vegetation is dominated by *Parietaria judaica*, occurring with a rich bryo-pteridophytic component constituted by *Asplenium trichomanes* subsp. *quadrivalens*, *Homalothecium sericeum*, *Bryum caespiticium*, *Barbula unguiculata*, *Ceterach officinarum*, etc. (Brullo & Guarino, 1998).

Syndynamism: See alliance.

Habitat reference: See class.

23.1.2.2. ***Sedo dasyphylli-Ceterachetum officinarum*** Hruska ex Brullo & Guarino 1998

Mesophilous chasmo-nitrophilous vegetation with thick-leaved stonecrop and rustyback of crumbling walls.

Synonyms: *Parietaria ramiflora* ass. Buchwald 1952 p.p.; *Sedum dasyphyllum-Ceterach officinarum* ges. Oberd. 1975 (art. 3c); *Sedo dasyphylli-Ceterachetum officinalis* Hruska 1985 nom. inval. (art. 5).

Lectotypus: rel. 2, tab. 1, Segal (1969).

Characteristic and differential species: *Sedum dasyphyllum* L.

Phytosociological table: From Brullo & Guarino (2002), tab. 11, 7 rel. (14-20).

Char. association: *Sedum dasyphyllum* s.l. (V).

Char. alliance: *Asplenium trichomanes* subsp. *quadrivalens* (V), *Tortula muralis* (I), *Hypnum cupressiforme* (I).

Char. order and class: *Parietaria judaica* (V), *Ceterach officinarum* (V), *Hyoseris radiata* (IV), *Anogramma leptophylla* (IV), *Centranthus ruber* (III), *Umbilicus rupestris* (III), *Umbilicus horizontalis* (II), *Ficus carica* (II), *Cymbalaria muralis* (I), *Antirrhinum majus* (I).

Other species: *Polypodium cambricum* (V), *Arabidopsis thaliana* (IV), *Asplenium onopteris* (IV), *Geranium purpureum* (III), *Campanula erinus* (III), *Veronica cymbalaria* (III), *Sedum album* (II), etc.

Geographical distribution: This association is known for Liguria, central-southern Appennines and Sicily, where it was surveyed in Madonie and Peloritani mountains (Brullo & Guarino, 2002).

Structure and ecology: The *Sedo dasyphylli-Ceterachetum officinarum* is a mesic vegetation of crumbling walls with a consistent humic soil component. This community, occurring in the

hilly urban stands at 500-600 m of altitude, is characterized by the dominance of *Sedum dasyphyllum* and *Ceterach officinarum*, growing together with *Asplenium trichomanes*, subsp. *quadrivalens*, *Parietaria judaica*, *Hyoseris radiata*, etc. (Brullo & Guarino, 1998).

Syndynamism: See alliance.

Habitat reference: See class.

23.1.2.3. ***Asplenio trichomanis-Umbilicetum horizontalis*** Brullo & Guarino 2002

Chasmo-nitrophilous vegetation with maidenhair spleenwort and horizontal navelwort of slightly humid walls in mesic stands.

Holotypus: rel. 11, tab. 11, Brullo & Guarino (2002).

Characteristic and differential species: *Umbilicus horizontalis* (Guss.) DC.

Phytosociological table: From Brullo & Guarino (2002), tab. 11, 9 rel. (5-13).
Char. association: *Umbilicus horizontalis* (V).
Char. alliance: *Asplenium trichomanes* subsp. *quadrivalens* (IV), *Homalothecium sericeum* (IV), *Tortula muralis* (IV), *Barbula vinealis* (IV), *Hypnum cupressiforme* (III).
Char. order and class: *Parietaria judaica* (III), *Ceterach officinarum* (II), *Umbilicus rupestris* (I).
Other species: *Polypodium cambricum* (IV), *Arabidopsis thaliana* (III), *Geranium purpureum* (III), *Sedum tenuifolium* (III), *Achillea ligustica* (II), etc.

Geographical distribution: This association is known from Sicily, where was surveyd in Etna and Peloritani, occurring probably also in southern Italy (Brullo & Guarino, 2002).

Structure and ecology: The *Asplenio trichomanis-Umbilicetum horizontalis* is localized on quite humid walls at 500-1100 m of altitude, within the meso- supramediterranean belts with humid ombrotype. This vegetation is linked to surfaces with scarcely humified soils and is characterized by the dominance of *Umbilicus horizontalis*. It grows together with some species of alliance, among them *Asplenium trichomanes*, *Homalothecium sericeum*, *Polypodium cambricum*, *Tortula muralis* and *Barbula vinealis*, as well as with those ones of order and class, as *Parietaria judaica*, *Ceterach officinarum* and *Umbilicus rupestris* (Brullo & Guarino, 2002).

Syndynamism: See alliance.

Habitat reference: See class.

23.1.2.4. ***Cheirantho cheiri-Parietarietum judaicae*** Oberd. 1957

Nitro-chasmophilous vegetation with wallflower and spreading pellitory of wall fissures rich in fine-grained sediments.

Synonyms: *Cheiranthus cheiri* aggr. Jouanne 1929 nom. inval. (art. 3c); *Cheirantho-Parietarietum judaicae* Oberd. 1949 (art. 2b); *Cheirantho-Parietarietum ramiflorae* Oberd. 1954 (art. 3b); *Cheiranthetum cheiri* Segal 1961 (art. 2b); *Cheiranthetum cheiri* Segal 1962 (art. 29); *Cheiranthetum cheiri* Westhoff 1966 (art. 2b); *Asplenio-Cheiranthetum cheiri* Segal 1969 (art. 29); *Sedo-Cheiranthetum cheiri* Segal 1969 (art. 29); *Cheiranthus cheiri* Ges. Oberd. 1977 (art. 3c).

Lectotypus: rel. 1, tab. 15, Oberdorfer (1954).

Characteristic and differential species: *Erysimum cheiri* (L.) Crantz (=*Cheiranthus cheiri* L.).

Geographical distribution: This association occurs in Central and Atlantic Europe, while it is quite rare in the Mediterranean area, where is localized in the mountain territories (Brullo & Guarino, 2002). In Sicily it is very rare and observed only in some urban stands of the mountain belt.

Structure and ecology: The *Cheirantho-Parietarietum judaicae* is a quite mature chasmo-nitrophilous vegetation, which occurs on old walls, colonizing the fissures rich in humus. In Sicily it prefers the shady and cool surfaces of mountain habitats. It is characterized by the high coverage of *Erysimum cheiri*, a cultivated species probably having a hybrid origin, growing together with various species belonging to higher rank syntaxa, as *Tortula muralis*, *Sedum album*, *Homalothecium sericeum*, etc. (Brullo & Guarino, 2002).

Syndynamism: See alliance.

Habitat reference: See class.

24. Class: ***Scrophulario-Helichrysetea italici*** Brullo, Scelsi & Spampinato 1998

Perennial pioneer vegetation of screes, loose debris substrata, alluvial gravels, moraines and stream terraces from Tyrrhenian territories.

Synonyms: *Thlaspietea rotundifolii* sensu Brullo 1984, non Br. Bl. 1948; *Thlaspietea rotundifolii* sensu Brullo & Spampinato 1990, non Br. Bl. 1948.

Holotypus: *Scrophulario-Helichrysetalia siculi* Brullo 1984.

Characteristic and differential species: *Helichrysum italicum* (Roth) G. Don. s.l., *Scrophularia bicolor* Sibth. & Sm., *Centranthus ruber* (L.) DC., *Artemisia variabilis* Ten., *Lactuca viminea* (L.) J. & C. Presl, *Rumex scutatus* L. subsp. *glaucescens* (Guss.) Brullo, Scelsi & Spamp.

Geographical distribution: This class occurs in Sicily, Sardinia, Corsica and southern Italy (Brullo et al., 1998b).

Structure and ecology: According to Brullo et al. (1998b), the perennial pioneer vegetation of incoherent substrata occurring in the central Mediterranean area must be classified in a an indipendent class, named *Scrophulario-Helichrysetea italici*. Its physiognomy is given by

chamaephytes and hemicryptophytes, which are linked to scree with various kinds of soil, as clasts, gravels, pirocaslastites and sands, from the sea level until 1800 m a.s.l. Previously, Brullo (1984) and Brullo & Spampinato (1990) attributed the communities of this class within the *Thlaspietea rotundifolii* Br.-Bl. 1948, mainly for their structural and ecological peculiarities, treatment followed more recently by Biondi et al, (2014). However in spite of these relations, they differs significantly for their floristic set, since the typical meso- and orophilous species featuring the aforesaid class are absent or very rare in the central Mediterranean. Some authors (Belonovska et al., 2014; Mucina et al., 2016) prefers to classify the central mediterranean communities within the *Drypidetea spinosae* Quézel 1964, a class that includes the submediterranean and supra-oromediterranean vegetation of screes in the eastern Mediterranean area and Black Sea, but also in this case the affinities are essentially of ecological-structural kind, while the floristic ones are missing altogether. Besides, it is also noteworthy that several alliances, as Est Mediterranean ones by Mucina et al. (2016) arranged in the *Drypidetea spinosae* clearly belong to *Thlaspietea rotundifolii*, while only the Black Sea communities must be kept in a separate class, represented by the *Onosmo polyphyllae-Ptilostemonetea* Korzhenevskii 1990

Syndynamism: This vegetation shows a marked pioneer character, being linked to highly unstable environments, that usually do not allow an evolution according to the natural dynamic processes. However, in particular environmental conditions this vegetation can sometimes be subject to phenomena of debris stabilization, favoring the accumulation of a layer of soil and the consequent establishment of more mature communities. It shows usually catenal contacts with oro-chasmophilous communities, as well as with meadows and woodlands.

Habitat reference: H2.6b Western Mediterranean base-rich scree; H6.1 Mediterranean and temperate volcanic field.

24.1. Order: ***Scrophulario-Helichrysetalia siculi*** Brullo 1984

Perennial pioneer vegetation dominated by chamaephytes and hemicryptophytes growing on incoherent substrata.

Holotypus: *Linarion purpureae* Brullo 1984.

Characteristic and differential species: See class

Geographical distribution: See class.

Structure and ecology: Currently this order is represented by the following alliances: a) *Linarion purpureae* Brullo 1984, from South Italy an Sicily linked mainly to montain screes; *Euphorbion rigidae* Brullo 1984, from South Italy an Sicily distributed in alluvial gravels and stream terraces; *Ptilostemono casabonae-Euphorbion cupanii* Angiolini, et al. 2005, from Sardinia and Corsica linked to incoherent substrata.

Syndynamism: See class.

Habitat reference: See class.

24.1.1. Alliance: ***Linarion purpureae*** Brullo 1984

Pioneer perennial vegetation of calcareous, dolomite and pyroclastic screes in the montane belt of South Italy and Sicily.

Holotypus: *Senecioni-Ptilostemetum nivei* Brullo & Marcenò in Brullo 1984.

Characteristic and differential species: *Aethionema saxatile* (L.) R. Br., *Arrhenatherum nebrodense* Brullo, Miniss. & Spamp., *A. sardoum*, (Em. Schmid) Brullo & al., *Linaria purpurea* (L.) Mill., *Rumex scutatus* L. subsp. *scutatus, Ptilostemon niveus* (C. Presl) Greuter, *Secale strictum* (C. Presl) C. Presl.

Geographical distribution: This alliance occurs in South italy from Vesuvio to Aspromonte and in the mountains of Sicily (Brullo et al., 1998b).

Structure and ecology: The *Linarion purpureae* gathers the pioneer perennial communities of mountain screes from South Italy and Sicily, occurring on calcareous and volcanic clasts. Usually, this vegetation grows within the meso- or supra-Mediterranean bioclimatic belts, but sometimes it can be observed also in more thermophilous conditions, such as on the Aetnean pyroclastic scories where it occurs up to 200 m of altitude (Brullo, 1984a; Brullo et al, 1998b). These communities are differentiated by obligate glareophytes, represented mainly by chamaephytes and hemicryptophytes, which have developed physiological and structural adaptations, that allow them to colonize the mobile debris and clasts.

Syndynamism: The communities of this alliance can be considered of edaphoclimatic type, indifferent to the substratum, linked to habitats where the pedogenesis is blocked by environmental factors.

Habitat reference: See class.

24.1.1.1. ***Arenario grandiflorae-Rumicetum scutati*** Raimondo 1980

Pioneer and orophilous vegetation with large flowered sandwort and buckler sorrel of carbonatic screes.

Synonyms: *Senecioni-Ptilostemetum nivei* Brullo & Marcenò in Brullo 1984.

Holotypus: rel. 1, tab. 7, Raimondo (1980).

Characteristic and differential species: *Arenaria grandiflora* L., *Iberis pruitii* Tineo, *Jacobaea candida* (C. Presl) B. Nord. & Greuter, *Ptilostemon niveus* (C. Presl) Greuter.

Phytosociological table: From Brullo (1984), tab. 6, 18 rel.

Char. association: *Ptilostemon niveus* (V), *Arenaria grandiflora* (V), *Jacobaea candida* (IV), *Iberis pruitii* (II).

Char. alliance: *Arrhenatherum sardoum* (V), *Linaria purpurea* (IV), *Linaria simplex* (IV), *Secale strictum* (I).

Char. order and class: *Rumex scutatus* subsp*. scutatus* (V), *Scrophularia bicolor* (IV), *Lactuca viminea* (IV), *Helichrysum italicum* subsp. *siculum* (III), *Aethionema saxatile* (II).

Other species: *Sedum album* (V), *Catapodium rigidum* (V), *Hypochoeris laevigata* (IV), *Sideritis sicula* (IV), *Galium album* subsp. *venustum* (IV), *Asperula scabra* (III), *Carlina nebrodensis* (III), *Polycarpon polycarpoides* (III), *Pimpinella tragium* subsp. *glauca* (III), *Saponaria sicula* (II), etc.

Geographical distribution: This vegetation occurs only in the Madonie mountains (Raimondo, 1980; Brullo et al., 1998b).

Structure and ecology: The association colonizes the mountain screes resulting from the disintegration of the overlying carbonatic rocks. It is a very peculiar pioneer vegetation, which is characterized by the occurrence of some endemic or rare species, such as *Arenaria grandiflora*, *Ptilostemon niveus*, *Jacobaea candida* and *Iberis pruitii*. The characteristics of higher rank are quite frequent, such as *Arrhenatherum sardoum*, *Linaria purpurea*, *Secale strictum*, *Rumex scutatus* subsp. *scutatus*, *Scrophularia bicolor*, *Lactuca viminea*, *Helichrysum italicum* subsp. *siculum.* This community is restricted to the supra-mediterranean belt above 1400 m, where the climatophilous vegetation is mainly represented by beech forests (Brullo et al., 1998b).

Syndynamism: This is a climatophilous vegetation dynamically linked to the processes of stabilization of the carbonatic screes. In the stabilized rocky places it is replaced by pulvinate vegetation of the *Cerastio-Astragalion* (Raimondo, 1980; Brullo 1984).

Habitat reference: See class.

24.1.1.2. ***Senecionetum rupestris*** Brullo & Marcenò in Brullo 1984 corr. hoc loco

Pioneer vegetation of carbonatic unstable screes with rock ragwort in the low mountain belt.

Synonyms: *Senecionetum siculi* Brullo & Marcenò in Brullo 1984 (art. 43).

Holotype: rel. 7, tab. 7, Brullo (1984).

Characteristic and differential species: *Senecio rupestris* Waldst. & Kit.

Phytosociological table: From Brullo (1984), tab. 7, 10 rel.

Char. association: *Senecio rupestris* (V).

Char. alliance: *Arrhenatherum nebrodense* (V), *Linaria purpurea* (IV).

Char. order and class: *Scrophularia bicolor* (V), *Centranthus ruber* (II), *Rumex scutatus* subsp*. scutatus* (I)*, Lactuca viminea* (I).

Other species: *Bunium petraeum* (IV), *Sinapis pubescens* (III), *Anthemis cupaniana* (IV), *Galium lucidum* subsp. *venustum* (II), *Festuca circummediterranea* (II), etc.

Geographical distribution: This vegetation is restricted to Sicani mountains in western Sicily (Brullo, 1984; Brullo et al., 1998b).

Structure and ecology: The *Senecionetum rupestris* is a pioneer vegetation of unstable screes, which grows in the belt between 1100 and 1400 m. This community is dominated by *Senecio rupestris,* growing together with *Arrhenatherum nebrodense*, *Linaria purpurea* and some species of class, as *Scrophularia bicolor*, *Centranthus ruber*, *Rumex scutatus* subsp. *scutatus* and *Lactuca viminea* (Brullo et al., 1998b). This association was originally described by Brullo & Marcenò (see Brullo, 1984) as *Senecionetum siculi*, proposing as characteristic species *Senecio siculus*, but it is a misidentification, since the correct name is *Senecio rupestris*, as recently verified. Therefore, according to art. 43, the name of this association must be corrected in *Senecionetum rupestris*.

Syndynamism: It is a permanent vegetation, since its habitat is subject to a constant erosion, which don't allows its natural evolution.

Habitat reference: See class.

24.1.1.3. ***Centrantho rubri-Senecionetum ambigui*** Brullo 1984

Pioneer vegetation with red valerian and ambiguous ragwort of volcanic scories.

Holotypus: rel. 8, tab. 8, Brullo (1984).

Characteristic and differential species: *Jacobaea ambigua* (Biv.) Pelser & Veldkamp, *Senecio squalidus* L. subsp. *squalidus*.

Phytosociological table: From Brullo (1984), tab. 8, 12 rel.

Char. association: *Jacobaea ambigua* (V), *Senecio squalidus* subsp*. squalidus* (IV).

Char. alliance: *Linaria purpurea* (IV), *Linaria simplex* (III), *Secale strictum* (III).

Char. order and class: *Helichrysum italicum* subsp. *siculum* (V), *Rumex scutatus* subsp. *glaucescens* (V), *Scrophularia bicolor* (V), *Centranthus ruber* (V), *Lactuca viminea* (III).

Other species: *Rumex multifidus* (V), *Vulpia ciliata* (V), *Aira caryophyllea* (V), *Isatis tinctoria* (V), *Filago arvensis* (V), *Anisantha tectorum* (V), *Genista aetnensis* (V), etc.

Geographical distribution: This community occurs exclusively on the slopes of Etna mountain (Brullo et al., 1998b).

Structure and ecology: The *Centrantho rubri-Senecionetum ambigui* occurs on pyroclastites and lava scories between 200 and 1600 m. This pioneer community is dominated by *Jacobaea ambigua* and *Centranthus ruber*, occurring together with *Senecio squalidus* subsp. *squalidus* and some species of higher rank, as *Linaria purpurea*, *Secale strictum*, *Helichrysum italicum* subsp. *siculum*, *Rumex scutatus* subsp. *glaucescens, Scrophularia bicolor* and *Lactuca viminea* (Brullo et al., 1998b). Usually, the association colonizes lava flows covered by pyroclastic scories periodically issued by the volcano, showing itself in different stages of maturity.

Syndynamism: This vegetation due to the peculiarities of volcanic environment is not stable over time, showing a continuous evolution, which can only be interrupted by a new lava flow. Therefore, apart from being represented by various evolutionary stages, it naturally evolves towards more mature plant communities represented by *Genista aetnensis* shrublands and *Quercetea ilicis* forests.

Habitat reference: See class.

24.1.1.4. ***Rumici scutati-Cardaminetum graecae*** Brullo, Scelsi & Spampinato 1998

Pioneer vegetation with buckler sorrel and southern bitter cress of carbonatic screes in the mountain belt.

Holotypu: rel. 4, tab. 2, Brullo et al. (1998).

Characteristic and differential species: *Cardamine graeca* L., *Hesperis cupaniana* Guss.

Phytosociological table: From Brullo et al. (1998), tab. 2, 8 rel.

Char. association: *Cardamine graeca* (V), *Hesperis cupaniana* (I).

Char. alliance: *Rumex scutatus* subsp. *scutatus* (V), *Arrhenatherum nebrodens*e (V), *Secale strictum* (V), *Linaria purpurea* (IV).

Char. order and class: *Scrophularia bicolor* (V), *Helichrysum italicum* subsp. *siculum* (II), *Lactuca viminea* (I).

Other species: *Cerastium tomentosum* (V), *Clematis vitalba* (III), *Thalictrum calabricum* (II), *Sideritis sicula* (I), etc.

Geographical distribution: This vegetation occurs only in the Madonie massif (Brullo et al., 1998b).

Structure and ecology: The *Rumici scutati-Cardaminetum graecae* replaces the *Arenario-Rumicetum scutati* between 1000 and 1200 (Brullo et al., 1998b). It is linked to carbonatic unstable screes of markedly inclined slopes, where it shows low values of coverage. Floristically, this vegetation is characterized by *Cardamine graeca* and *Rumex scutatus* subsp. *scutatus*, growing together with some species of higher rank, as *Arrhenatherum nebrodense*, *Secale strictum*, *Linaria purpurea*, *Scrophularia bicolor*, *Helichrysum italicum* subsp. *siculum* and *Lactuca viminea*. Besides, in this habitat the very rare endemic *Hesperis cupaniana* occurs.

Syndynamism: It is a permanent vegetation localized within the climatophilous belt of the *Aceri campestris-Quercetum ilicis* (Brullo et al., 1998b).

Habitat reference: See class.

24.1.1.5. ***Scutellario rubicunda-Melicetum cupanii*** Brullo, Scelsi & Spampinato 1998

Pioneer vegetation with Sicilian skullcaps and Cupani's melic grass of stable calcareous screes.

Holotypus: rel. 5, tab. 5, Brullo et al. (1998).

Characteristic and differential species: *Bromus lanceolatus* Roth., *Melica cupanii* Guss., *Scutellaria rubicunda* Hornem.

Phytosociological table: From Brullo et al. (1998), tab. 5, 8 rel.
Char. association: *Scutellaria rubicunda* (V), *Melica cupanii* (V), *Bromus lanceolatus* (V).
Char. alliance: *Arrhenatherum nebrodense* (V), *Linaria purpurea* (II).
Char. order and class: *Lactuca viminea* (V), *Senecio rupestris* (I).
Other species: *Galium lucidum* (V), *Allium subhirsutum* (IV), *Allium arvense* (IV), *Isatis tinctoria* (IV), *Sedum album* (IV), *Vicia tenuifolia* (IV), *Reichardia picroides* (III), etc.

Geographical distribution: This vegetation is restricted to the Sicani mountains (Brullo et al., 1998b).

Structure and ecology: The *Scutellario-Melicetum cupanii* occurs on more or less stabilized screes constituted by calcareous debris. It is a quite mature vegetation, characterized by *Scutellaria rubicunda*, *Melica cupanii* and *Bromus lanceolatus*, growing together with some species of higher rank, as *Arrhenatherum nebrodense*, *Linaria purpurea* and *Lactuca viminea*, while the more pioneer plants are generally lacking (Brullo et al., 1998b). This association is replaced in the more mobile screes by the *Senecionetum rupestris.*

Syndynamism: It is a permanent vegetation distributed between 1000 and 1400 m of altitude, within the climatophilous belt of *Sorbo torminalis-Quercetum ilicis* Gianguzzi et al. 2016.

Habitat reference: See class.

24.1.1.6. ***Arrhenathero nebrodensis-Euphorbietum rigidae*** Brullo & Siracusa ass. nov. provv.

Perennial vegetation with Nebrodi oat-grass and gopher spurge of stabilized volcanic stones.

Holotypus: Not designated.

Characteristic and differential species: *Euphorbia rigida* M. Bieb., *Linaria multicaulis* (L.) Mill. subsp. *aetnensis* Giardina & Zizza.

Phytosociological table: 12 rel. ined., by Brullo & Siracusa, Etna, Ciapparazzo di Dragofora.

Char. association: *Euphorbia rigida* (V), *Linaria multicaulis* subsp. *aetnensis* (V).

Char. alliance: *Arrhenatherum nebrodense* (V), *Secale strictum* (IV), *Linaria purpurea* (III).

Char. order and class: *Rumex scutatus* subsp. *glaucescens* (IV), *Lactuca viminea* (III), *Centranthus ruber* (II).

Other species: *Festuca rubra* (V), *Erysimum etnense* (V), *Teucrium chamaedrys* (V), *Micromeria graeca* (V), *Petrorhagea saxifraga* subsp. *gasparrinii* (V), *Silene sicula* (V), *Calamintha nepeta* (V), *Orchis papilionacea* (V), *Pteridium aquilinum* (V), *Centaurea giardinae* (V), *Calicotome infesta* (V), etc.

Geographical distribution: This vegetation occurs in the western slopes of Etna.

Structure and ecology: The association colonizes stands characterized by volcanic stones, quite stabilized of slightly inclined slopes at an altitude of about 1000 m, within the mesomediterranean bioclimatic belt. Floristically, it is characterized by *Euphorbia rigida* and *Linaria multicaulis* subsp. *aetnensis*, which grows together with *Arrhenatherum nebrodense*, *Secale strictum*, *Linaria purpurea*, *Rumex scutatus* subsp. *glaucescens*, *Lactuca viminea*, *Centranthus ruber,* etc. Previously, this vegetation was surveyed by Grillo (1975) and indicated as aggr. *Euphorbia rigida*.

Syndynamism: It is a pioneer vegetation, colonizing the fissures among big basaltic stones of old lava flows. Following evolutionary processes this vegetation is progressively replaced by shrublands with *Genista aetnensis*.

Habitat reference: See class.

24.1.2. Alliance: ***Euphorbion rigidae*** Brullo & Spampinato 1990

Pioneer glareicolous communities of riverine gravel banks and landslide slopes of thermo-mesomediterranean belts.

Synonyms: *Artemision variabilis* Biondi et al. 1994 (syntax. syn.).

Holotypus: *Loto-Helichrysetum italici* Brullo & Spampinato 1990.

Characteristic and differential species: *Dittrichia viscosa* (L.) Greuter, *Euphorbia rigida* M. Bieb, *Micromeria graeca* (L.) Benth. ex Rchb.

Geographical distribution: This alliance is spread in Calabria and Sicily (Brullo & Spampinato, 1990; Brullo et al., 1998b).

Structure and ecology: This syntaxon groups the glareicolous pioneer communities colonizing riverine gravel banks, stream terraces, landslide slopes, sandy alluvial deposit and on other gravelly incoherent substrata, distributed within the thermo- and mesomediterranean bioclimatic belts. These communities results quite specialized, being characterized by glareophytes well adapted to mobile gravel surfaces sometimes more or less compacted. In Sicily this vegetation occurs mainly on the wide pebbly banks of the rivers, locally called "fiumare". (Brullo & Spampinato, 1990).

Syndynamism: This pioneer vegetation is usually permanent, being linked to seasonal overflowing of rivers, which always bring new sand-pebble material on the banks. Therefore, it shows a typical edaphophilous character, having catenal contacts with the shrublands of *Nerio-Tamaricetea* in the more raised surfaces with more mature soils, or with the *Bidentetea* communities on the more humid stands (Brullo & Spampinato, 1990).

Habitat reference: See class.

24.1.2.1. ***Loto commutati-Helichrysetum siculi*** Brullo & Spampinato 1990 corr. hoc loco

Pioneer vegetation with glareicolous bird's-foot trefoil and Sicilian curry plant of pebbly river-beds.

Synonyms: *Loto commutati-Helichrysetum italici* Brullo & Spampinato 1990 (art. 43).

Holotypus: rel. 3, tab. 8, Brullo & Spampinato (1990).

Characteristic and differential species: *Chamaenerion dodonaei* (Vill.) Schur ex Fuss, *Lotus commutatus* Guss., *Verbascum macrurum* Ten.

Phytosociological table: From Brullo & Spampinato (1990), tab. 8, 26 rel.

Char. association: *Lotus commutatus* (V), *Chamaenerion dodonaei* (II), *Verbascum macrurum* (II).

Char. alliance: *Micromeria graeca* (V), *Dittrichia viscosa* (V), *Euphorbia rigida* (III).

Char. order and class: *Helichrysum italicum* subsp. *siculum* (V), *Scrophularia bicolor* (V), *Centranthus ruber* (I), *Rumex scutatus* subsp. *glaucescens* (I).

Other species: *Spartium junceum* (V), *Catapodium rigidum* (V), *Bellardia trixago* (V), *Daucus carota* (IV), *Bituminaria bituminosa* (IV), *Foeniculum vulgaris* subsp. *piperitum* (IV), *Reichardia picroides* (IV), *Calicotome infesta* (IV), etc.

Geographical distribution: This vegetation is restricted to north-eastern Sicily, where it is linked to river-beds, locally named «fiumara» (Brullo & Spampinato, 1990; Brullo et al., 1998).

Structure and ecology: In the middle and final part, the rivers of Peloritani and partly of Nebrodi mountains flow into large riverine banks constituted by a mixture of sands and gravels mainly coming from the erosion of metamorphic rocks. This peculiar habitat is

colonized by the *Loto commutati-Helichrysetum italici*, a community with quite mesophilous requirements, occurring in the humid or sub-humid thermo- and meso-mediterranean bioclimatic belts, at an altitude of 100-800 m. Physiognomically, this association is dominated by *Helichrysum italicum* subsp. *siculum*, which with its showy yellowish flowering at the beggining of summer determines a rather typical landscape. This vegetation hosts some peculiar species, as *Lotus commutatus*, *Chamaenerion dodonaei* and *Verbascum macrurum,* as well as several species of higher rank, among them *Scrophularia bicolor*, *Centranthus ruber*, *Micromeria graeca*, *Dittrichia viscosa* and *Euphorbia rigida* (Brullo & Spampinato, 1990). According to Galbany-Casals et al. (2006), the populations of *Helichrysum italicum* from Sicily must be attributed to the subsp. *siculum* (Jordan & Fourr.) Galbany, L. Saez & Benedì. Therefore, the name of this syntaxon must be corrected in *Loto commutati-Helichrysetum siculi*.

Syndynamism: This community shows catenal contact with the nitrophilos vegetation of *Polygono-Xanthietum italici* and with the riparian forest of *Salicetum albo-purpureae*, which occurs in the lower terraces with a long flooding period, and is followed by the *Spartio-Nerietum oleandri* in the upper terraces with a shorter flooding (Brullo & Spampinato, 1990).

Habitat reference: See class.

24.1.2.2 ***Ononido ramosissimae-Helichrysetum siculi*** Brullo & Spampinato 1990 corr. hoc loco

Thermo-xerophilous vegetation with yellow restharrow and Sicilian curry plant of pebbly substrata.

Synonyms: *Ononido ramosissimae-Helichrysetum italici* Brullo & Spampinato 1990 (art. 43).

Holotypus: rel. 4, tab. 9, Brullo & Spampinato (1990).

Characteristic and differential species: *Ononis natrix* L. subsp. *ramosissima* (Desf.) Batt.

Phytosociological table: From Brullo & Spampinato (1990), tab. 9, 4 rel.
Char. association: *Ononis natrix* subsp. *ramosissima* (4).
Char. alliance: *Micromeria graeca* (4), *Dittrichia viscosa* (4), *Euphorbia rigida* (1).
Char. order and class: *Helichrysum italicum* subsp. *siculum* (4), *Scrophularia bicolor* (2).
Other species: *Foeniculum vulgare* subsp, *piperitum* (4), *Tamarix africana* (4), *Bellardia trixago* (4), *Melilotus sulcata* (2), *Onobrychis caput-galli* (2), *Catapodium rigidum* (2), etc.

Geographical distribution: This association occurs in the rivers of central Sicily (Brullo & Spampinato, 1990; Brullo et al., 1998).

Structure and ecology: The *Ononido ramosissimae-Helichrysetum siculi* replaces the previous community in more xerophilous conditions, differentiating for the occurrence of *Ononido natrix* subsp. *ramosissima*. This vegetation is linked to calcareous or siliceous substrata of

territories with annual rainfall between 500 and 700 mm. The more mesic species are totally lacking or sporadic, while *Helichrysum italicum* subsp. *siculum*, *Scrophularia bicolor*, *Dittrichia viscosa* and *Micromeria graeca* show high coverage values (Brullo & Spampinato, 1990).

Syndynamism: See previous association.

Habitat reference: See class.

24.1.2.3. ***Calendulo fulgidae-Helichrysetum siculi*** Brullo & Spampinato 1990 corr. hoc loco

Glareicolous vegetation with woody marigold and Sicilian curry plant of pebbly metamorphic substrata.

Synonyms: *Calendulo fulgidae-Helichrysetum italici* Brullo & Spampinato 1990 (art. 43).

Holotypus: rel. 1, tab. 10, Brullo & Spampinato (1990).

Characteristic and differential species: *Calendula suffruticosa* Vahl subsp. *fulgida* (Raf.) Guadagno, *Moricandia arvensis* (L.) DC.

Phytosociological table: From Brullo & Spampinato (1990), tab. 10, 5 rel.
Char. association: *Calendula suffruticosa* subsp. *fulgida* (V), *Moricandia arvensis* (III).
Char. alliance: *Dittrichia viscosa* (V), *Euphorbia rigida* (V), *Micromeria graeca* (V).
Char. order and class: *Helichrysum italicum* subsp. *siculum* (V), *Scrophularia bicolor* (V).
Other species: *Foeniculum vulgare* subsp, *piperitum* (V), *Reichardia picroides* (V), *Daucus carota* (V), *Pallenis spinosa* (V)*, Urospermum dalechampii* (V), *Sixalix atropurpurea* (IV), *Sulla coronaria* (IV), *Onobrychis caput-galli* (IV), etc.

Geographical distribution: This association occurs in the south-western side of Nebrodi mountains (Brullo & Spampinato, 1990; Brullo et al., 1998).

Structure and ecology: The *Calendulo fulgidae-Helichrysetum italici* colonizes the alluvial soils with a rich silty-clay component that originate from erosion of metamorphic rocks. It is a glareicolous vegetation of territories with a subhumid mesomediterranean bioclimate (Brullo & Spampinato, 1990). Its structure is given by *Helichrysum italicum* subsp. *siculum*, *Calendula suffruticosa* subsp. *fulgida* and *Moricandia arvensis*, which are characteristic of clayey soils. The alliance is represented by *Dittrichia viscosa*, *Euphorbia rigida* and *Micromeria graeca* (Brullo & Spampinato, 1990).

Syndynamism: See alliance.

Habitat reference: See class.

24.1.2.4. ***Senecioni gibbosi-Helichrysetum siculi*** Brullo & Spampinato 1990 corr. hoc loco

Glareicolous vegetation with silver ragwort and Sicilian curry plant of pebbly river-beds with metamorphic substrata.

Synonyms: *Senecioni gibbosi-Helichrysetum italici* Brullo & Spampinato 1990 (art. 43).

Holotypus: rel. 1, tab. 11, Brullo & Spampinato (1990).

Characteristic and differential species: *Jacobaea gibbosa* (Guss.) B. Nord. & Greuter

Phytosociological table: From Brullo & Spampinato (1990), tab. 11, 3 rel.

Char. association: *Jacobaea gibbosa* (3).

Char. alliance: *Dittrichia viscosa* (3), *Micromeria graeca* (3), *Euphorbia rigida* (I).

Char. order and class: *Helichrysum italicum* subsp. *siculum* (3) *Scrophularia bicolor* (3), *Centranthus ruber* (1).

Other species: *Oryzopsis miliaceum* (3), *Hyparrhenia hirta* (3), *Foeniculum vulgare* subsp. *piperitum* (3), *Verbascum sinuatum* (3), *Anisantha madritensis* (3), *Hypochoeris achyrophorus* (3), etc.

Geographical distribution: This association was surveyed only in Sicily in the neighborhood of Messina (Brullo & Spampinato, 1990).

Structure and ecology: The *Senecioni gibbosi-Helichrysetum siculi* is linked to the higher part of short rivers with narrow banks, which are characterized by large gravels coming from metamorphic rocks. It is a mesophilous vegetation dominated by *Helichrysum italicum* subsp. *siculum*, growing together with the endemic *Jacobaea gibbosa* and various taxa of higher rank, as *Dittrichia viscosa*, M*icromeria graeca*, *Euphorbia rigida*, *Scrophularia bicolor* and *Centranthus ruber* (Brullo & Spampinato, 1990).

Syndynamism: See alliance.

Habitat reference: See class.

24.1.2.5. ***Echinopo spinosissimi-Helichrysetum siculi*** Brullo, Scelsi & Spampinato 1998 corr. hoc loco

Perennial vegetation with thorny-headed globe thistle and Sicilian curry plant of sandy-pebbly stands near the sea.

Synonyms: *Echinopo spinosissimi-Helichrysetum italici* Brullo, Scelsi & Spampinato 1998 (art. 43).

Holotypus: rel. 8, tab. 7, Brullo et al. (1998).

Characteristic and differential species: *Echinops spinosissimus* Turra subsp. *spinosissimus.*

Phytosociological table: From Brullo et al. (1998b), tab. 7, 10 rel.

Char. association: *Echinops spinosissimus* subsp. *spinosissimus* (V).

Char. alliance: *Dittrichia viscosa* (V), *Micromeria graeca* (V).

Char. order and class: *Helichrysum italicum* subsp. *siculum* (V), *Scrophularia bicolor* (V).

Other species: *Asphodelus fistulosus* (V), *Hyparrhenia hirta* (V), *Verbascum sinuatum* (V), *Carlina corymbosa* (V), *Chondrilla juncea* (IV), *Andropogon distachyus* (II), *Medicago marina* (II), etc.

Geographical distribution: This association is currently recorded from Sicily, where occurs only in the Tindari beach (Brullo et al., 1998b).

Structure and ecology: The *Echinopo spinosissimi-Helichrysetum siculi* colonizes the soils with a mixture of sands and small gravels, which occur in the stands more distant from the sea. It is differentiated by the occurrence of *Echinops spinosissimus* subsp. *spinosissimus*, an eastern Mediterranean species very rare in Sicily, growing together with some species of higher rank, such as *Dittrichia viscosa*, *Micromeria graeca*, *Helichrysum italicum* subsp. *siculum* and *Scrophularia bicolor* (Brullo et al., 1998b).

Syndynamism: This community takes contact with the psammophilous communities of *Euphorbio paraliae-Ammophiletea australis*.

Habitat reference: See class.

24.1.2.6. ***Schrophulario bicoloris-Senecionetum bicoloris*** Brullo, Scelsi & Spampinato 1998

Pioneer vegetation with French figwort and bicolored silver ragwort of pyroclastitic screes.

Holotypus: rel. 4, tab. 8, Brullo et al. (1998).

Characteristic and differential species: *Centaurea aeolica* Guss. ex Lojac., *Jacobaea maritima* (L.) Pelser & Meijden subsp. *bicolor* (Willd.) B. Nord. & Greuter.

Phytosociological table: From Brullo et al. (1998b), tab. 8, 11 rel.

Char. association: *Jacobaea maritima* subsp. *bicolor* (V), *Centaurea aeolica* (II).

Char. alliance: *Dittrichia viscosa* (III), *Micromeria graeca* (I).

Char. order and class: *Scrophularia bicolor* (IV).

Other species: *Dactylis hispanica* (III), *Silene vulgaris* subsp. *tenorei* (III), *Ficus carica* (III), *Spartium junceum* (III), *Daucus carota* I, etc.

Geographical distribution: This association was observed in the Aeolian Archipelago, where occurs exclusively in Stromboli island (Brullo et al., 1998b).

Structure and ecology: The sloped surfaces periodically covered by pyroclastic material, due to volcanic activity, are colonized by this association. It is a permanent pioneer vegetation characterized by *Jacobaea maritima* subsp. *bicolor*, which grows together with the endemic *Centaurea aeolica* and other species of higher rank, as *Dittichia viscosa*, *Micromeria graeca* and *Scrophularia bicolor* (Brullo et al., 1998b).

Syndynamism: See alliance.

Habitat reference: See class.

24.1.2.7. ***Sedo sediformis-Centranthetum rubri*** Gianguzzi & La Mantia 2008

Pioneer vegetation with pale stonecrop and red valerian of calcareous coastal screes.

Holotypus: rel. 2, tab. 18, Gianguzzi & La Mantia (2008).

Characteristic and differential species: *Sedum sediforme* (Jacq.) Pau., *Teucrium flavum* L.

Phytosociological table: From Gianguzzi & La Mantia (2008), tab. 18, 6 rel.

Char. association: *Sedum sediforme* (V), *Teucrium flavum* (V).

Char. alliance, order and class: *Scrophularia bicolor* (V), *Centranthus ruber* (V), *Lactuca viminea* (III), *Senecio rupestris* (II).

Other species: *Smilax aspera* (V), *Allium subhirsutum* (V), *Polypodium cambricum* (V), *Pisum sativum* (V), *Umbilicus horizontalis* (IV), *Asparagus hederifolius* (III), *Hedera helix* (III), *Prasium majus* (III), etc.

Geographical distribution: This vegetation occurs in the north-western Sicily, in the mountain slopes between Cefalù and Trapani (Gianguzzi & La Mantia, 2008).

Structure and ecology: The xeric screes at the foot of limestone cliffs near the sea are colonized by a thermophilous and pioneer community, which was described by Gianguzzi & La Mantia (2008) as *Sedo sediformis-Centranthetum rubri.* This vegetation is differentiated by the occurrence of *Sedum sediforme* and *Teucrium flavum*, which are typical of dry rocky surfaces with a thin layer of soil. The alliance and the class are represented by *Centranthus ruber*, *Scrophularia bicolor*, *Lactuca viminea* and *Senecio rupestris*.

Syndynamism: See alliance.

Habitat reference: See class.

25. Class: ***Artemisietea vulgaris*** Lohm., Preising & R.Tx. ex von Rochow 1951

Perennial pioneer synanthropic ruderal and nitrophilous herbaceous vegetation that grows on soils rich in organic matter.

Synonyms: *Ruderali-Secalietea* Br.-Bl. et al. 1936 p.p. (art. 3f); *Artemisietea vulgaris* Lohmeyer et al. in R. Tx. 1950 (art. 2b); *Agropyretea repentis* Oberd.,T. Müller & Görs in Oberd. et al. 1967 (art.2b); *Agropyretea intermedio-repentis* T. Müller & Görs 1969 (syntax. syn.); *Meliloto-Artemisietea absinthii* Eliàš 1981 (syntax.syn.); *Polygono-Artemisietea austriacae* Mirkin,

Sakhapov & Solomeshch in A. Ishbirdin et al. 1988 (syntax. syn.); *Onopordetea* Br.-Bl. 1964 (art. 8); *Onopordetea* Br.-Bl. 1967 (syntax. syn.), *Onopordetea acantho-nervosi* Rivas-Martınez 1975 (syntax. syn.).

Lectotypus: *Artemisietalia vulgaris* Lohmeyer in Tüxen 1947

Characteristic and differential species: *Carduus nutans* L. subsp. *nutans*, *Cerinthe minor* L. subsp. *auriculata* (Ten.) Domac., *Chaerophyllum temulentum* L., *Conium maculatum* L., *Lapsana communis* L., *Malva moschata* L., *Rumex obtusifolius* L., *Sinapis pubescens* L., *Urtica dioica* L.

Geographical distribution: This class is widely distributed in the Mediterranean and Eurosiberian territories (Mucina et al., 2016).

Structure and ecology: The *Artemisietea vulgaris* groups together the perennial ruderal communities of low-altitudes and mountain places with an edaphoxeric character. It is linked to shallow soils with an high amount of organic matter, such as over-exploited pastures, disturbed sites near huts, grazing glades, etc. Its structure is given by large size geophytes and hemicryptophytes, such as *Arctium minus*, *Rumex obtusifolium*, *Lapsana communis*, *Urtica dioica, Chaerophyllum temulentum*, *Sambucus ebulus*, etc. (Brullo & Marcenò, 1985; Biondi et al., 2014). According to several authors (see Rivas-Martinez et al., 2002, 2011; Dengler et al., 2007; Biondi et al., 2014; Mucina et al., 2016), the *Onoportedea acanthii* class should be included within the *Artemisietea vulgaris*.

Syndynamism: It is secondary vegetation that colonizes the disturbed surfaces, but if the disturbance is progressively reduced this vegetation can be replaced by more mature communities.

Habitat reference: E1.3a Mediterranean closely grazed dry grassland.

25.1. Order: ***Arctio lappae-Artemisietalia vulgaris*** Dengler 2002

Ruderal mesophilous perennial vegetation from Central Europe and Mediterranean territories.

Synonyms: *Artemisietalia vulgaris* Tüxen 1947 nom. ambig. propos. p.p. Dengler 2002.

Lectotypus: *Arction lappae* Tüxen 1937.

Characteristic and differential species: See class.

Structure and ecology: This order groups the mesophilous communities, occurring only in mountain stands above 1000 m a.s.l.

Syndynamism: See class.

Geographical distribution: See class.

Habitat reference: See class.

25.1.1. Alliance: ***Arction lappae*** R. Tx. 1937

Ruderal perennial communities of lowland and mountainous areas.

Synonyms: *Rumicion obtusifolii* Gutte 1972; *Cirsio-Elytrigion* Doing 1974 (art. 2b); *Eu-Arction* Sissingh in Westhoff et al. 1946.

Lectotypus: *Urtico urentis-Chenopodietum boni-henrici* Tüxen 1937.

Characteristic and differential species: *Arctium minus* (Hill) Bernh., *Chenopodium bonus-henricus* L.*,* *Geranium pyrenaicum* Burm. f.*,*, *Verbascum rotundifolium* Ten.

Geographical distribution: This alliance occurs in the Mediterranean area, as well as in the Atlantic and Central Europe (Brullo & Marcenò, 1985; Pott, 1995). In Sicily it is spread in the mountain belt.

Structure and ecology: In the Mediterranean area, the communities belonging to *Arction lappae* alliance are restricted to orophilous stands, which are characterized by drained loamy soils, both in calcareous and siliceous substrata. The physiognomy of this nitrophilous vegetation is given by mesic short-lived perennials, as *Arctium minus*, *Chenopodium bonus-henricus*, *Geranium pyrenaicum*, etc. (Tuxen, 1950; Brullo & Marcenò, 1985).

Syndynamism: See class.

Habitat reference: See class.

25.1.1.1. ***Urtico dioicae-Arrhenatheretum elatioris*** Raimondo 1980 em. Brullo & Marcenò 1985

Nitrophilous vegetation with common nettle and false oat-grass of depressed surfaces with loamy soils.

Holotypus: rel. 3, tab. 10, Raimondo (1980).

Characteristic and differential species: *Arrhenatherum elatius* (L.) P. Beauv. ex J. Presl & C. Presl subsp. *elatius*.

Phytosociological table: From Brullo & Marcenò (1985), tab. 48, 5 rel.

Char. association: *Arrhenatherum elatius* subsp*. elatius* (V).

Char. alliance: *Arctium minus* (II), *Geranium pyrenaicum* (II).

Char. order and class: *Urtica dioica* (V), *Rumex obtusifolius* (III), *Sinapis pubescens* (III), *Carduus nutans* subsp. *nutans* (III), *Chaerophyllum temulentum* (I).

Other species: *Stellaria media* (III), *Capsella rubella* (II), *Geranium molle* (I)*, Anisantha tectorum* (I), etc.

Geographical distribution: This vegetation was surveyed only in the Madonie mountains (Raimondo, 1980; Brullo & Marcenò, 1985).

Structure and ecology: The depressed surfaces above 1400 m a.s.l. with loamy soils and abundant organic matter are colonized by a nitrophilous community named *Urtico-Arrhenatheretum elatioris*. It appeas as a dense and showy vegetation with *Urtica dioica* and *Arrhenatherum elatius* subsp. *elatius*, occurring together with some species of alliance, as *Arctium minus* and *Geranium pyrenaicum*, as well as of order and class, as *Urtica dioica*, *Rumex obtusifolius*, *Sinapis pubescens*, *Carduus nutans* subsp. *nutans* and *Chaerophyllum temulentum* (Brullo & Marcenò, 1985).

Syndynamism: This vegetation grows mainly on Numidic flysch, where occupies quite wide areas between the low meadows of *Plantaginion cupanii* and the shrubby vegetation of *Cerastio-Astragalion nebrodensis*.

Habitat reference: See class.

25.1.1.2. ***Cerintho minoris-Chenopodietum boni-henrici*** Brullo & Marcenò 1985

Orophilous and nitrophilous vegetation with lesser honeywort and good-king-Henry of dolines.

Holotypus: rel. 4, tab. 49, Brullo & Marcenò (1985).

Characteristic and differential species: *Cerinthe minor* L. subsp. *auriculata* (Ten.) Domac., *Chenopodium bonus-henricus* L.

Phytosociological table: From Brullo & Marcenò (1985), tab. 49, 5 rel.

Char. association: *Chenopodium bonus-henricus* (V), *Cerinthe minor* subsp. *auriculata* (V).

Char. alliance: *Geranium pyrenaicum* (V), *Arctium minus* (III).

Char. order and class: *Urtica dioica* (V), *Sinapis pubescens* (V), *Rumex obtusifolius* (V), *Chaerophyllum temulentum* (III), *Malva moschata* (III), *Carduus nutans* subsp. *nutans* (II).

Other species: *Viola nebrodensis* (V), *Capsella rubella* (V), *Scrophularia scopolii* (IV), *Rumex nebroides* (III), *Polygonum aviculare* (III), *Geranium molle* (III), *Lamium flexuosum* (II), etc.

Geographical distribution: This vegetation was surveyed only in the Madonie mountains and in particular near Pizzo Carbonara (Brullo & Marcenò, 1985).

Structure and ecology: The *Cerintho minoris-Chenopodietum boni-henrici* grows on the bottom of dolines between 1700 and 1900 m, where animals stay during the summer. It is a peculiar vegetation characterized by the very rare *Chenopodium bonus-henricus*. In Sicily this species finds its only stands in the basic soils with an high amount of organic matter, growing together with *Cerinthe minor* subsp. *auriculata* and with some species of order and class, as *Geranium pyrenaicum*, *Arctium minus*, *Urtica dioica*, *Sinapis pubescens*, etc. (Brullo & Marcenò, 1985).

Syndynamism: The maintenance of this community is guaranteed by a moderate grazing, while the overgrazing of these surfaces that occurs in the last years has led to the progressive disappearance of this vegetation.

Habitat reference: See class.

25.1.1.3. ***Verbasco rotundifoli-Sambucetum ebuli*** Brullo & Marcenò 1985

Nitrophilous vegetation with round leaved mullein and danewort of sunny roadsides and path in the mountain belt.

Holotypus: rel. 3, tab. 50, Brullo & Marcenò (1985).

Characteristic and differential species: *Cynoglossum nebrodense* Guss. subsp. *nebrodense*, *Verbascum rotundifolium* Ten.

Phytosociological table: From Brullo & Marcenò (1985), tab. 50, 5 rel.

Char. association: *Verbascum rotundifolium* (V), *Cynoglossum nebrodense* subsp. *nebrodense* (IV).

Char. alliance: *Geranium pyrenaicum* (IV), *Arctium minus* (II).

Char. order and class: *Sambuculus ebulus* (V), *Sinapis pubescens* (V), *Urtica dioica* (V), *Carduus nutans* subsp. *nutans* (V), *Chaerophyllum temulentum* (III), *Cerinthe minor* subsp. *auriculata* (II).

Other species: *Anisantha tectorum* (V), *Cerastium tomentosum* (IV), *Silene vulgaris* (III), *Centaurea solstitialis* subsp. *schouwii* (III), *Polygonum aviculare* (III), etc.

Geographical distribution: This vegetation is restricted to the Madonie mountains (Brullo & Marcenò, 1985).

Structure and ecology: The sunny roadsides and the path above 1500 m with calcareous or dolomitic substrata are colonized by a peculiar edapho-xerophilous community dominated by *Sambucus ebulus* and *Sinapis pubescens*. It is linked to superficial soils with a thin layer of humus and abundant coarse matter. This association, named *Verbasco-Sambucetum ebuli*, is differentiated by the occurrence of the endemic *Cynoglossum nebrodense* subsp. *nebrodense* and *Verbascum rotundifolium*. The floristic set is enriched by some species of alliance and class, as *Geranium pyrenaicum*, *Arctium minus*, *Urtica dioica*, *Carduus nutans* subsp. *nutans*, etc. (Brullo & Marcenò, 1985).

Syndynamism: See alliance.

Habitat reference: See class.

25.1.1.4. ***Urtico dioicae-Cirsietum italici*** Brullo & Marcenò 1985

Nitrophilous vegetation with common nettle and Italian thistle of sunny places within beech forests on metamorphic soils.

Holotypus: rel. 2, tab. 51, Brullo & Marcenò (1985).

Characteristic and differential species: *Cirsium italicum* DC., *Verbascum phlomoides* L.

Phytosociological table: From Brullo & Marcenò (1985), tab. 51, 7 rel.
Char. association: *Cirsium italicum* (V), *Verbascum phlomoides* (IV).
Char. alliance: *Arctium minus* (V), *Geranium pyrenaicum* (III).
Char. order and class: *Urtica dioica* (V), *Rumex obtusifolius* (V), *Chaerophyllum temulentum* (V), *Sinapis pubescens* (V), *Lapsana communis* (IV), *Sambucus ebulus* (IV).
Other species: *Clinopodium nepeta* (V), *Rubus hirtus* (V), *Pteridium aquilinum* (V), *Scrophularia scopolii* (IV), *Cynoglossum columnae* (IV), *Trifolium pratense* (IV), *Euphorbia meuselii* (IV), *Origanum vulgare* (IV), *Festuca circummediteranea* (IV), *Anthemis arvensis* subsp. *sphacelata* (IV), etc.

Geographical distribution: This vegetation occurs in the Nebrodi and Peloritani mountains (Brullo & Marcenò, 1985).

Structure and ecology: The *Urtico dioicae-Cirsietum italici* replaces the *Verbasco-Sambucetum ebuli* on metamorphic substrata in the beech forest belt. It is linked to sunny places with an high amount of organic matter, as roadsides or sheepfold, preferring rocky surfaces or soils with an abundant coarse compenent. The physiognomy of this community is given by *Cirsium italicum* and *Verbascum phlomoides*. The alliance and the class are represented by *Urtica dioica*, *Rumex obtusifolius*, *Chaerophyllum temulentum*, *Sinapis pubescens*, *Lapsana communis* and *Sambucus ebulus* (Brullo & Marcenò, 1985).

Syndynamism: See alliance.

Habitat reference: See class.

25.2. Order: ***Carthametalia lanati*** Brullo in Brullo & Marcenò 1985

Nitrophilous ruderal communities composed by perennial to biennial plants in abandoned farmland soils very altered by human activities.

Synonyms: *Onopordetalia acantho-nervosi* Rivas-Martínez 1975 (art. 25).

Holotypus: *Onopordion illyrici* Oberdorfer 1954.

Characteristic and differential species: *Carthamus lanatus* L., *Centaurea calcitrapa* L., *Cichorium intybus* L., *Cirsium vulgare* (Savi) Ten., *Cynoglossum cheirifolium* L., *Dipasacus fullonum* L., *Echium pustulatum* S. & S., *Eryngium campestre* L., *Lactuca serriola* L., *Marrubium vulgare* L., *Notobasis syriaca* (L.) Cass., *Onopordum illyricum* L., *Picnomon acarna* (L.) Cass.,

Picris hieracioides L.*, Scolymus hispanicus* L., *Scolymus maculatus* L., *Silybum marianum* (L.) Gaertn., *Verbascum thapsus* L.*, Verbascum pulverulentum* Vill.

Geographical distribution: This class is mainly distributed in the Mediterranean area, replacing the *Arctio lappae-Artemisietalia vulgaris* vegetation at lower altitudes (Nimis & Crovello, 1991).

Structure and ecology: The *Carthametalia lanati* groups together the hyper-nitrophilous communities with a xerophilous character. In fact, this vegetation occurs in dry environments from the sea-level until 1000(1300) m, growing indifferently on clayey, marly, metamorphic, volcanic and calcareous soils. Its structure is given by tall herbs, mainly thorny hemicryptophytes, as *Centaurea calcitrapa*, *Cirsium vulgare*, *Dipasacus fullonum*, *Eryngium campestre*, *Onopordum illyricum*, etc., as well as *Lactuca serriola*, *Marrubium vulgare*, *Verbascum thapsus*, *V. pulverulentum*, etc. This vegetation has a late spring-summer life cycle and is favored by extreme grazing (Brullo & Marcenò, 1985).

Syndynamism: This vegetation results very frequent in correspondence of disturbed stands, as uncultivated fields, cowsheds, farms, overgrazing grasslands and pastures, where the strong disturbance causes the progressive shift of *Lygeo-Stipetea* communities towards those ones belonging to the syntaxon at issue (Guarino, 2006).

Habitat reference: See class.

25.2.1. Alliance: ***Onopordion illyrici*** Oberd. 1954

Nitrophilous communities of thorny, large thermo-xerophilous hemicryptophytes of grazing lands.

Synonyms: *Brachypodion phoenicoidis* Br.-Bl. 1931 p.p.; *Scolymo-Carthamion lanati* Rivas Goday in Rivas Goday & Borja 1961; *Scolymo-Kentrophyllenion* Rivas-Goday 1964.

Lectotypus: *Onopordetum illyrici* Oberd. 1954.

Characteristic and differential species: *Carlina gummifera* (L.) Less., *Carthamus caeruleus* L., *Cynara cardunculus* L., *Phlomis herba-venti* L., *Scolymus grandiflorus* Desf.

Geographical distribution: This vegetation occurs in the Italian peninsula and eastern Mediterranean area (Biondi et al., 2014).

Structure and ecology: The thistle-dominated ruderal vegetation, which grows in the thermo- and meso-mediterranean belts, is classified within the *Onopordion illyrici*. This alliance includes nitrophilous communities with a marked xerophilous character, which are characterized by the occurrence of several thorny hemicryptophytes, as *Carlina gummifera*, *Carthamus caeuleus*, *Cynara cardunculus*, *Onopordium illyricum*, *Scolymus grandiflorus*, etc. (Brullo & Marcenò, 1985).

Syndynamism: See class.

Habitat reference: See class.

25.2.1.1. ***Scolymetum maculato-grandiflori*** Brullo & Marcenò 1985

Nitrophilous vegetation with spotted golden thistle and large-flowered golden thistle of roadsides and paths with siliceous substrata.

Holotypus: rel. 1, tab. 53, Brullo & Marcenò (1985).

Characteristic and differential species: *Scolymus maculatus* L.

Phytosociological table: From Brullo & Marcenò (1985), tab. 53, 4 rel.

Char. association: *Scolymus maculatus* (4).

Char. alliance: *Scolymus grandiflorus* (4), *Cynara cardunculus* (4), *Onopordum illyricum* (3), *Phlomis herba-venti* (3).

Char. order: *Carthamus lanatus* (3), *Notobasis syriaca* (3), *Echium vulgaris* subsp. *pustulatum* (I).

Char. class: *Verbascum thapsus* (4), *Eryngium campestre* (3), *Cichorium intybus* (2), *Picris hieracioides* (2), *Verbascum pulverulentum* (2), *Lactuca serriola* (2).

Other species: *Anisantha sterilis* (4), *Daucus carota* (4), *Rubus ulmifolius* (4), *Dittrichia viscosa* (4), *Sinapis pubescens* (4), *Origanum vulgare* (4), *Sixalix atropurpurea* (4), *Achillea ligustica* (3), etc.

Geographical distribution: This community was surveyed in Calabria and Sicily, where occurs in the Hyblaean mountains and in particular in the Monte Lauro area between 500 and 700 m (Brullo & Marcenò, 1985; Brullo et al., 2001; Passalacqua et al., 2007).

Structure and ecology: The nitrified surfaces with an abundant presence of coarse material and rocky outcrops are colonized by a peculiar vegetation dominated by *Scolymus maculatus* and *S. grandiflorus*. This vegetation, named *Scolymetum maculato-grandiflori*, is linked to the thermo- and meso-mediterranean belt, colonizing stands near roads and paths with acid soils. The *Onopordion illyrici* alliance is represented by *Scolymus grandiflorus*, *Cynara cardunculus*, *Onopordum illyricum* and *Phlomis herba-venti*, while order and class include *Carthamus lanatus*, *Notobasis syriaca*, *Verbascum thapsus*, *Eryngium campestre*, *Cichorium intybus*, etc. (Brullo & Marcenò, 1985).

Syndynamism: See alliance.

Habitat reference: See class.

25.2.1.2. ***Onopordo illyrici-Cirsietum scabri*** Brullo & Marcenò 1985

Nitrophilous vegetation with Illyrian thistle and giant thistle of clayey and marly soils within the sub-mountain belt.

Holotypus: rel. 2, tab. 54, Brullo & Marcenò (1985).

Characteristic and differential species: *Cirsium scabrum* (Poir.) Bonnet & Barratte.

Phytosociological table: From Brullo & Marcenò (1985), tab. 54, 6 rel.

Char. association: *Cirsium scabrum* (V).

Char. alliance: *Onopordum illyricum* (V), *Cynara cardunculus* (V), *Scolymus grandiflorus* (V), *Phlomis herba-venti* (III), *Carthamus caeruleus* (III), *Carlina gummifera* (III).

Char. order: *Carthamus lanatus* (V), *Notobasis syriaca* (IV), *Echium vulgaris* subsp. *pustulatum* (III).

Char. class: *Verbascum thapsus* (V), *Eryngium campestre* (V), *Picris hieracioides* (V), *Verbascum pulverulentum* (IV), *Cichorium intybus* (IV), *Marrubium vulgare* (III), *Dipsacus fullonum* (II), *Lactuca serriola* (II).

Other species: *Echium italicum* subsp. *siculum* (V), *Daucus carota* (V), *Avena barbata* (V), *Vicia villosa* (V), *Anisantha sterilis* (V), *Carduus pycnocephalus* (V), *Lathyrus articulatus* (V), etc.

Geographical distribution: This community is quite frequent in Sicily and in particular in the inner areas (Brullo & Marcenò, 1985; Marino et al., 2005).

Structure and ecology: The *Onopordo-Cirsietum scabri* is linked to nutrient-rich soils of sub-mountain stands between 600 and 1000 m a.s.l., growing mainly on clayey and marly substrata, but sometimes also on volcanic rocks and schists with a clayey component. It occurs in places very disturbed by the stationing of animals, as near sheepfolds, stables and farms. This vegetation is rather showy, for the dominance of *Cirsium scabrum* and *Onopordum illyricum*, two large-size thistles. They grow together with some species belonging to alliance, among them *Cynara cardunculus*, *Scolymus grandiflorus*, *Phlomis herba-venti*, *Carthamus caeruleus* and *Carlina gummifera*. The order and the class are represented by *Carthamus lanatus*, *Notobasis syriaca*, *Echium vulgaris* subsp. *pustulatum*, *Verbascum thapsus*, *Eryngium campestre*, *Picris hieracioides* , *Verbascum pulverulentum*, etc.

Syndynamism: See alliance.

Habitat reference: See class.

25.2.1.3. ***Pteridio aquilini-Tanacetum siculi*** Brullo & Marcenò 1985

Subnitrophilous vegetation with eagle fern and Sicilian tansy of disturbed stands.

Holotypus: rel. 3, tab. 55, Brullo & Marcenò (1985).

Characteristic and differential species: *Pteridium aquilinum* (L.) Kuhn, *Tanacetum siculum* (Guss.) Strobl

Phytosociological table: From Brullo & Marcenò (1985), tab. 55, 8 rel.

Char. association: *Tanacetum siculum* (V), *Pteridium aquilinum* (V).

Char. alliance: *Onopordum illyricum* (III), *Cynara cardunculus* (III), *Scolymus grandiflorus* (III), *Carthamus caeruleus* (II).

Char. order: *Carthamus lanatus* (V), *Notobasis syriaca* (III), *Silybum marianum* (II).

Char. class: *Eryngium campestre* (V), *Picris hieracioides* (IV), *Cichorium intybus* (III), *Marrubium vulgare* (III), *Dipsacus fullonum* (III), *Verbascum thapsus* (III), *Verbascum pulverulentum* (I).

Other species: *Urtica dioica (*V), *Echium italicum* subsp. *siculum* (V), *Anisantha sterilis* (V), *Origanum vulgare* (V), *Rubus ulmifolius* (V), *Carduus pycnocephalus* (IV), etc.

Geographical distribution: This association occurs in north-eastern Sicily, being quite frequent in the mountain area of Etna, Peloritani and Nebrodi (Brullo & Marcenò, 1985).

Structure and ecology: The disturbed soils with an abundant rocky component, as roadsides, paths, pastures and artificial escarpments, are colonized by a subnitrophilous community named *Pteridio-Tanacetum siculi*. This vegetation is linked to siliceous substrata, including schists, gneiss, quarzarenites and volcanic rocks, above 900 m and until 1500-1600 m, often covering very large surfaces in correspondence of sunny stands. Sometimes, it occurs also near huts, farms and water troughs. Under the floristic profile, *Tanacetum siculum* should be considered the differential species, growing together with *Pteridium aquilinum* and some species of alliance, order and class, as *Onopordum illyricum*, *Cynara cardunculus*, *Scolymus grandiflorus*, *Carthamus lanatus*, *Notobasis syriaca*, *Silybum marianum*, *Eryngium campestre*, *Picris hieracioides*, etc. (Brullo & Marcenò, 1985).

Syndynamism: This vegetation occurs in secondary stands, representing an early stage of a dynamic series leading to forest communities belonging to *Querco-Fagetea* and *Quercetea ilicis*.

Habitat reference: E5.3 Pteridium aquilinum stand.

25.2.1.4. ***Bonannietum graecae*** Brullo & Marcenò 1985

Subnitrophilous vegetation with greek bonannia of paths and roadsides with carbonatic substrata.

Holotypus: rel. 1, tab. 56, Brullo & Marcenò (1985).

Characteristic and differential species: *Bonannia graeca* (L.) Halácsy

Phytosociological table: From Brullo & Marcenò (1985), tab. 56, 6 rel.

Char. association: *Bonannia graeca* (V).

Char. alliance: *Cynara cardunculus* (V), *Scolymus grandiflorus* (V), *Carthamus caeruleus* (II), *Onopordum illyricum* (I), *Cirsium echinatum* (I), *Phlomis herba-venti* (I).

Char. order: *Carthamus lanatus* (V).

Char. class: *Eryngium campestre* (V), *Cichorium intybus* (V), *Marrubium vulgare* (I).

Other species: *Centaurea solstitialis* subsp. *schouwii* (V), *Dactylis glomerata* (V), *Poa sylvicola* (IV)*, Trifolium pratense* (IV), *Sixalix atropurpurea* (IV), *Helminthotheca echioides* (IV), etc.

Geographical distribution: This association is restricted to the north-western part of Sicily, being quite common in Madonie, Sicani and Palermo mountains (Brullo & Marcenò, 1985; Gianguzzi & La Mantia, 2004; Marino et al., 2005).

Structure and ecology: The sunny roadsides and paths with calcareous or dolomitic substrata, usually above 900 m, are colonized by a peculiar subnitrophilous vegetation with *Bonannia graeca*. This community, named *Bonannietum graecae*, must be attributed to the *Onopordion illyrici* alliance for the occurrence of *Cynara cardunculus*, *Scolymus grandiflorus*, *Carthamus caeruleus*, *Onopordum illyricum*, etc. Besides, the order and the class are represented by *Carthamus lanatus*, *Eryngium campestre*, *Cichorium intybus* and *Marrubium vulgare* (Brullo & Marcenò, 1985).

Syndynamism: See alliance.

Habitat reference: See class.

25.2.1.5. ***Phlomido herba-venti-Salvietum sclareae*** Brullo & Marcenò 1985

Subnitrophilous vegetation with pink Jerusalem sage and clary sage of rocky surfaces near farms and sheepfolds.

Holotypus: rel. 3, tab. 58, Brullo & Marcenò (1985).

Characteristic and differential species: *Salvia sclarea* L.

Phytosociological table: From Brullo & Marcenò (1985), tab. 58, 3 rel.

Char. association: *Salvia sclarea* (3).

Char. alliance: *Phlomis herba-venti* (3), *Cynara cardunculus* (3), *Carlina gummifera* (2), *Carthamus caeruleus* (1), *Scolymus grandiflorus* (1), *Cirsium echinatum* (I).

Char. order: *Carthamus lanatus* (3), *Notobasis syriaca* (3), *Silybum marianum* (2).

Char. class: *Marrubium vulgare* (3), *Cichorium intybus* (2), *Eryngium campestre* (2).

Other species: *Rubus ulmifolius* (3), *Geranium molle* (3), *Anisantha madritensis* (3), *Galium lucidum* (2), *Anisantha sterilis* (2), etc.

Geographical distribution: This association occurs in Madonie, Nebrodi and Hyblaean mountains (Brullo & Marcenò, 1985).

Structure and ecology: The *Phlomido-Salvietum sclareae* is a rare vegetation, which is linked to rocky stands with limestone substrata near farms and sheepfolds. It occurs in the belt between 500 and 800 m, where a sufficient amount of rainfall occurs. From the floristic point of view, this vegetation is characterized by the occurrence of *Salvia sclarea*, which together

with *Phlomis herba-venti* and *Cynara cardunculus* gives physiognomy to it. The alliance is well represented by *Phlomis herba-venti*, *Cynara cardunculus*, *Carlina gummifera*, *Carthamus caeruleus*, *Scolymus grandiflorus* and *Cirsium echinatum*. As concerns the order and class, *Carthamus lanatus*, *Notobasis syriaca*, *Marrubium vulgare* and *Cichorium intybus* are quite frequent (Brullo & Marcenò, 1985).

Syndynamism: See alliance.

Habitat reference: See class.

25.2.1.6. ***Phlomido herba-venti-Nepetetum apuleii*** Brullo & Marcenò 1985

Subnitrophilous and mesophilous vegetation with with pink Jerusalem sage and Apuleio catswort of rocky surfaces near farms and sheepfolds.

Holotypus: rel. 2, tab. 57, Brullo & Marcenò (1985).

Characteristic and differential species: *Nepeta apulei* Ucria

Phytosociological table: From Brullo & Marcenò (1985), tab. 57, 3 rel.

Char. association: *Nepeta apulei* (3).

Char. alliance: *Phlomis herba-venti* (3), *Carlina gummifera* (2), *Carthamus caeruleus* (2), *Scolymus grandiflorus* (1).

Char. order: *Silybum marianum* (1).

Char. class: *Eryngium campestre* (3), *Cichorium intybus* (2), *Picris hieracioides* (1).

Other species: *Dactylis glomerata* (3), *Pallenis spinosa* (3), *Centaurea nicaeensis* (3), *Avena barbata* (3), *Kundmannia sicula* (3), *Carlina sicula* (2), *Bituminaria bituminosa* (2), etc.

Geographical distribution: This association is restricted to Palermo and Sicani mountains (Brullo & Marcenò, 1985).

Structure and ecology: The *Phlomido-Nepetetum apuleii* replaces the *Phlomido-Salvietum sclareae* on distubed rocky stands above 700 m, usually near farms and sheepfolds, as well as along the roadsides. It is characterized by the occurrence of the rare *Nepeta apulei*, growing together with some species belonging to alliance, as *Phlomis herba-venti*, *Carlina gummifera*, *Carthamus caeruleus*, etc. The order and the class are represented by *Silybum marianum*, *Eryngium campestre*, *Cichorium intybus* and *Picris hieracioides* (Brullo & Marcenò, 1985).

Syndynamism: See alliance.

Habitat reference: See class.

25.2.1.7. ***Glaucio flavi-Onopordetum horridi*** Brullo & Marcenò 1985

Ruderal vegetation with yellow hornpoppy and horrid illyrian thistle of rodasides and rubbles.

Holotypus: rel. 5, tab. 59, Brullo & Marcenò (1985).

Characteristic and differential species: *Glaucium flavum* Crantz, *Onopordum illyricum* L. subsp. *horridum* (Viv.) Franco.

Phytosociological table: From Brullo & Marcenò (1985), tab. 59, 5 rel.
Char. association: *Onopordum illyricum* subsp*. horridum* (V), *Glaucium flavum* (IV).
Char. alliance: *Scolymus grandiflorus* (V), *Scolymus hispanicus* (II).
Char. order: *Carthamus lanatus* (V), *Notobasis syriaca* (IV).
Char. class: *Marrubium vulgare* (V), *Centaurea calcitrapa* (V), *Eryngium campestre* (II).
Other species: *Verbascum sinuatum* (V), *Smyrnium olusatrum* (V), *Carlina lanata* (IV), *Parietaria judaica* (IV), *Beta maritima* (IV), *Galactites tomentosa* (IV), etc.

Geographical distribution: This association was surveyed by Brullo & Marcenò (1985) in the Egadi islands, but results quite spread in the coastal stands of Sicily.

Structure and ecology: The *Glaucio-Onopordetum horridi* is a very xerophilous vegetation, which colonizes more or less disturbed rocky stands, as roadsides and rubbles*.* It occurs mainly in the coastal stands, as highligthed by the high coverage of the subhalophilous *Glacium flavum*, which together with the larg-size specimens of *Onopordum illyricum* subsp. *horridum* give the typical structure to this vegetation. The higher order syntaxa are represented by *Scolymus grandiflorus, Scolymus hispanicus, Carthamus lanatus, Notobasis syriaca, Marrubium vulgare, Centaurea calcitrapa*, etc. (Brullo & Marcenò, 1985).

Syndynamism: See alliance.

Habitat reference: See class.

25.2.1.8. ***Glaucio flavi-Scolymetum hispanici*** Bartolo, Brullo, Minissale & Spampinato 1990

Ruderal vegetation with yellow hornpoppy and common golden thistle of very dry places near the sea.

Holotypus: rel. 6, tab. 46, Bartolo et al. (1990).

Characteristic and differential species: *Beta* vulgaris L. subsp. *maritima* (L.) Arcang., *Glaucium flavum* Crantz, *Onopordum illyricum* L. subsp. *horridum* (Viv.) Franco.

Phytosociological table: From Brullo & Marcenò (1985), tab. 46, 6 rel.
Char. association: *Glaucium flavum* (V), *Beta vulgaris* subsp. *maritima* (V).
Char. alliance and order: *Scolymus hispanicus* (V), *Carthamus lanatus* (V), *Scolymus maculatus* (V), *Cynara cardunculus* (III), *Silybum marianum* (I).
Char. class: *Centaurea calcitrapa* (IV), *Cichorium intybus* (IV).

Other species: *Foeniculum vulgaris* subsp. *piperitum* (V), *Euphorbia pinea* (V), *Carduus pycnocephalus* (V), *Sonchus oleraceus* (V), *Lavatera cretica* (IV), *Nicotiana glauca* (I), etc.

Geographical distribution: This association occurs only in Lampedusa island (Bartolo et al., 1990a).

Structure and ecology: The ruderal vegetation of very dry coastal areas with an inframediterranean bioclimate is represented by the *Glaucio-Scolymetum hispanici*. This vegetation has a markedly nitrophilous character, occurring in places with accumulation of rubbish or organic matter. Its structure is determined by thorny Asteraceae, as *Scolymus hispanicus*, *S. maculatus*, *Cynara cardunculus*, *Carthamus lanatus* and *Silybum marianum*. *Glaucium flavum* and *Beta vulgaris* subsp. *maritima* represent the differential species of this community, highlighting the sub-halophilous requirements of this community (Bartolo et al., 1990a).

Syndynamism: See alliance.

Habitat reference: See class.

25.2.1.9. ***Carlino siculae-Feruletum communis*** Gianguzzi, Ilardi & Raimondo 1996

Perennial vegetation with Sicilian carline thistles and giant fennel of over-grazed pastures.

Holotypus: rel. 7, tab. 15, Gianguzzi et al. (1996).

Characteristic and differential species: *Asphodelus ramosus* L., *Carlina sicula* Ten., *Cynoglossum creticum* Mill., *Ferula communis* L., *Iris planifolia* (Mill.) Fiori, *Mandragora autumnalis* Bertol., *Rumex thyrsoides* Desf.

Phytosociological table: From Gianguzzi et al. (1996), table 15, 10 rel.

Char. association: *Ferula communis* (V), *Asphodelus ramosus* (V), *Carlina sicula* (V), *Rumex thyrsoides* (V), *Cynoglossum creticum* (IV), *Mandragora autumnalis* (III), *Iris planifolia* (II).

Char. alliance: *Scolymus grandiflorus* (V), *Cynara cardunculus* (V), *Carlina gummifera* (IV).

Char. order and class: *Eryngium campestre* (V), *Carthamus lanatus* (V), *Onopordum illyricum* (III), *Notobasis syriaca* (III), *Cichorium intybus* (III), *Silybum marianum* (III), *Centaurea calcitrapa* (III), *Pallenis spinosa* (II), *Thapsia garganica* (I), *Scolymus hispanicus* (I).

Other species: *Lolium perenne* (V), *Hyoseris radiata* (V), *Dactylis glomerata subsp. hispanica* (IV), *Vicia villosa* subsp. *varia* (IV), *Brachypodium retusum* (IV), *Daucus carota* (IV), *Gynandriris sisyrinchium* (IV), *Clinopodium nepeta* (IV).

Geographical distribution: This association is reported for North-Western and Central Sicily (Gianguzzi et al., 1996; Gianguzzi & La Mantia, 2008; Marcenò et al., 2011).

Structure and ecology: The shallow calcareous soils, usually mixed with rocky outcrops and subject to an intense grazing, are colonized by a subnitrophilous vegetation characterized by the high coverage of *Carlina sicula*, *Asphodelus ramosus* and *Ferula communis*. It is the *Carlino siculae-Feruletum communis*, whose floristic set includes also *Iris planifolia*, *Mandragora autumnalis* and *Rumex thyrsoides*, as well as some species of alliance and order, among them *Scolymus grandiflorus*, *Cynara cardunculus*, *Carlina gummifera*, *Eryngium campestre*, *Carthamus lanatus*, *Onopordum illyricum*, *Notobasis syriaca* and *Cichorium intybus*. This community is found within the thermomediterranean bioclimatic belt, with some occurrence also in the mesomediterranean one (Gianguzzi et al., 1996).

Syndynamism: This community represents a very early stage of *Pistacio-Quercetum ilicis*, which without disturbance tends to evolve towards the garrigue of *Erico multiflorae-Micromerietum fruticulosae*.

Habitat reference: See class.

25.2.2. Alliance: ***Silybo mariani-Urticion piluliferae*** Sissing ex Br.-Bl. & O. Bolòs 1958

Highly nitrophilous communities of deep, cool to humid soils.

Synonyms: *Silybo-Urticion* Sissingh 1950 nom. inval. (art. 2d, 3b); *Sylibion mariani* Rivas-Martínez in Rivas-Martínez, Costa & Loidi 1992 (syntax. syn.).

Lectotypus: *Silybo mariani-Urticetum piluliferae* Braun-Blanq.in Braun-Blanq., Gajewski, Wraber & Walas 1936.

Characteristic and differential species: *Carduus acicularis* Bertol., *Carduus argyroa* Biv., *Cirsium vulgare* (Savi) Ten., *Silybum marianum* (L.) Gaertn., *Urtica pilulifera* L.

Geographical distribution: This vegetation is widely distributed in the Mediterranean area (Mucina et al., 2016).

Structure and ecology: The highly nitrophilous vegetation of deep, cool to humid soils is classified within the *Silybo mariani-Urticion piluliferae*. This alliance includes the communities dominated by *Silybum marianum*, which grows on manure heaps and sheepfold, as well as in correspondence of uncultivated lands, roadsides and overgrazing pastures. As concerns its bioclimatic requirements, it is linked to the thermo- and meso-mediterranean belts (Biondi & Blasi, 2015).

Syndynamism: See alliance.

Habitat reference: See class.

25.2.2.1. ***Silybo mariani-Urticetum piluliferae*** Br.-Bl. in Br.-Bl. et al. 1936

Thermo-nitrophilous vegetation with milk thistle and roman nettle of manure heaps and sheepfold.

Lectotypus: Not designated.

Characteristic and differential species: *Urtica pilulifera* L.

Phytosociological table: From Brullo et al. (1993), table 14, 6 rel.
Char. association: *Urtica pilulifera* (V).
Char. alliance and order: *Silybum marianum* (V), *Notobasis syriaca* (V), *Scolymus hispanicus* (V), *Carthamus lanatus* (IV), *Cynoglossum creticum* (III), *Onopordon illyricum* (II).
Char. class: *Marrubium vulgare* (V), *Cichorium intybus* (III), *Eryngium campestre* (III).
Other species: *Glebionis coronaria* (IV), *Anisantha sterilis* (IV), *Hordeum leporinum* (IV), *Rumex pulcher* (IV), *Conium maculatum* (III), etc.

Geographical distribution: This vegetation is distributed in the central and western Mediterranean area. In Sicily it was surveyed in the Hyblaean area and Madonie mountains, bui is more widespread throughout the island (Brullo et al., 1993; Raimondo et al., 2004).

Structure and ecology: The *Silybo-Urticetum piluliferae* is a thermo-nitrophilous vegetation, which grows on manure heaps and near sheepfold. It prefers quite humid loamy-clayey soils. Its structure is given by large-sice thistles, as *Silybum marianum*, *Notobasis syriaca*, *Scolymus hispanicus* and *Onopordum illyricum*. From the floristic point of view, the occurrence of *Urtica pilulifera*, an hypernitrophilous species, characterizes this community (Brullo et al., 1993).

Syndynamism: See alliance.

Habitat reference: See class.

26. Class: ***Epilobietea angustifoliii*** R.Tx & Preising ex von Rochow 1951

Subnitrophilous perennial herbaceous vegetation with large macrophytes that grow in forest edges or clearings.

Synonyms: *Epilobietea angustifolii* R.Tx. & Preising in R. Tx. 1950 (art. 2b); *Epilobietea angustifolii* R. Tx. & Preising in Br-Bl. et al. 1952 (art. 31); *Urtico-Cirsietea* Doing 1963 (art. 2b); *Galio-Urticetea* Passarge 1967 (art. 3b); *Galio-Urticetea* Passarge ex Kopecky 1969 (syntax.syn.); *Galio aparines-Urticetea maioris* Passarge ex Kopecky 1969 (orig.form) (sensu Rivas-Martınez et al. 2011: 250) (phantom); *Chamaenerietea* Mititelu & Barabas 1972 (syntax.syn.)*; Galeopsio-Senecionetea sylvatici* Passarge 1981 (art. 3b); *Filipendulo ulmariae-Convolvuletea sepium* Géhu & Géhu-Franck 1987 (art. 2b); *Convolvulo sepium-Filipenduletea* Géhu & Géhu-Franck 1987 nom. invers. propos. (art. 2b, invers. superfl.); *Filipendulo ulmariae-Calystegietea sepium* Géhu & Géhu-Franck 1987 nom. mut. propos. (orig. form) (in Julve 1993)

(art. 2b, mut.superfl.); *Lythro salicariae-Calystegietea sepium* Klauck 1992 (syntax. syn.); *Circaeo-Stachyetea* Ubaldi 2011 (art. 2b).

Lectotypus: *Atropetalia belladonae* Vlieger 1937.

Characteristic and differential species: *Anthriscus nemorosa* (M. Bieb.) Spreng., *Epilobium angustifolium* L., *Galium aparine* L., *Geranium robertianum* L., *Heracleum sphondylium* L. *subsp. elegans* (Crantz) Schübl. & G. Martens, *Lamium flexuosum* Ten., *Poa trivialis* L., *Sambucus ebulus* L.

Geographical distribution: This class is mainly distributed in the temperate Eurosiberian territories, while is less represented in the Mediterranean area (Mucina et al., 1993, 2016).

Structure and ecology: The sciaphilous and/or edapho-hygrophilous communities of nutrient-rich and well moistened soils are grouped within the *Epilobietea angustifolii* class. This vegetation is characterized by the occurrence of some large-size hemicryptophytes and geophytes, which colonize nemoral and wet habitats, quite humid also during the summer, such as disturbed forest edges, nutrient rich riparian fringes and forest clearings (Mucina et al., 1993; Gianguzzi & La Mantia, 2004b). Several authors (see Mucina et al., 2016; Berg et al., 2004; Chytry, 2009) treats the *Galio-Urticetea* as part of *Epilobietea angustifolii*, recognizing the ecological and floristic similarity of their communities. Moreover, Dengler et al. (2007) treat the *Epilobietea angustifolii* as a subclass (the *Senecioni sylvatici-Epilobienea angustifolii*) within a wider concept of *Artemisietea vulgaris*, but excluded the communities of *Convolvuletalia sepium*.

Syndynamism: This syntaxon includes permanent semi-natural or natural aspects, which are linked to quite specialized habitats of forest edges, as well as anthropogenic communities of disturbed places, which often derive from the abandonment of irrigated crops. Considering the great variety of ecological conditions, they can have catenal contact with a wide range of communities belonging to different phytosociological classes.

Habitat reference: E5.2a Thermophile woodland fringe of base-rich soils; E5.2b Thermophile woodland fringe of acidic soils.

26.1. Order: ***Galeopsio-Senecionetalia sylvatici*** Passarge 1981

Tall-herb vegetation of forest edges and clearings with acidic soils.

Synonyms: *Atropetalia* Vlieger 1937 (art. 2b); *Atropetalia* R. Tx. 1947 nom. ambig. rejic. propos. (art. 36); *Epilobietalia angustifolii* (Vlieger 1937) Tx. 1950 (art. 2b); *Chamaenerietalia angustifolii* (Vlieger 1937) Tx. 1950 nom. mut. propos. (art. 2b, mut.superfl.); *Chamaenerietalia* Mititelu & Barabas 1972 (syntax.syn.).

Holotypus: *Epilobion angustifolii* (Rübel 1933) Soó 1933.

Characteristic and differential species: *Atropa belladonna* L., *Epilobium angustifolium* L., *Fragraria vesca* L., *Rubus idaeus* L.

Geographical distribution: This order occurs mainly in the Eurosiberian territories, with some penetrations in the Mediterranean area (Mucina et al., 2016).

Structure and ecology: The tall-herb semi-natural vegetation of clearings and edges of deciduous woodlands with acidic soils is classified within the *Atropetalia* R. Tx. 1947. According to Dengler et al. (2007) and Mucina et al. (2016), this syntaxon would be rejected as a *nomen ambiguum*, since its Holotypus *Atropion* R. Tx 1947 has the same name of *Atropion bellae-donnae* Aichinger 1933 and both have been widely used for forest-clearing communities on both nutrient-rich and nutrient-poor substrates. Therefore, the *Galeopsio-Senecionetalia sylvatici* was proposed as *nomen conservandum* to replace *Atropetalia* R. Tx. 1947.

Syndynamism: See class.

Habitat reference: E5.2b Thermophile woodland fringe of acidic soils.

26.1.1. Alliance: ***Epilobion angustifolii*** (Rübel 1933) Soó 1933

Communities of megaforbs on acidic well-nitrified soils that grow on the edges or in clearings of deciduous or coniferous forests.

Synonyms: *Epilobion angustifolii* Rubel 1933 (2b); *Epilobion angustifolii* Soò 1933 (art. 2b); *Chamaenerion angustifolii* Soò 1933 nom. mut. propos. (2b, mut. superfl.); *Atropion* R. Tx. 1937 nom. ambig. rejic. propos. (art. 36); *Carici piluliferae-Epilobion angustifolii* R. Tx. 1950 (art- 2b); *Epilobion angustifolii* R. Tx. ex von Rochow 1951 (art. 31); *Epilobion angustifolii* Eggler 1952 (art. 2b); *Galeopsio-Senecionion sylvatici* Passarge 1981 (art. 29); *Mycelido-Senecionion sylvatici* Passarge 1981 (syntax.syn.); *Rumici-Avenellion flexuosae* Passarge 1984*; Pteridion aquilini* Fukarek 1969 (art. 2b, 3b); *Prenanthion purpureae* Julve 1993 (art. 2b); *Holco mollis-Pteridion aquilini Passarge* (1994) 2002 (syntax.syn.).

Lectotypus: *Epilobio angustifolii-Senecionetum sylvatici* Tuxen 1950.

Characteristic and differential species: See order.

Geographical distribution: This vegetation is represented in the temperate areas of Europe, while it is quite rare in the Mediterranean region (Mucina et al., 2016).

Structure and ecology: The *Epilobion angustifolii* groups the perennial semi-natural communities of forest margins and in forest clearings with acidic soils.

Syndynamism: See class.

Habitat reference: See order.

26.1.1.1. ***Epilobio angustifoliae-Atropetum belladonae*** Br.-Bl. ex R.Tx. 1950

Sub-nitrophilous vegetation of forest clearings with clayey or silty soils.

Synonyms: *Atropetum belladonae* Br.-Bl. 1931.

Characteristic and differential species: *Atropa belladonna* L.

Geographical distribution: This community of Atlantic and Central Europe is very rare in Sicily, occurring only in very impoverished aspects on the upper belt of Nebrodi and Madonie mountains.

Structure and ecology: The forest clearings with clayey or silty soils, quite deep and humified, are colonized by a peculiar mesophilous vegetation, named *Epilobio angustifoliae-Atropetum belladonae*. In Sicily this community is restricted to shaded places with a supra-mediterranean belt and in particular to the beech forest belt above 1400 m, where is linked to slightly acidic or neutral substrata that are quite rich in organic matter. Its structure is given by some tall-herbs, as *Atropa belladonna* and *Epilobium angustifolium*, growing together with *Rubus hirtus*, *Rubus idaeus* and *Urtica dioica* (Oberdorfer, 1977; Brullo et al., 2001).

Syndynamism: See class.

26.2. Order: ***Circaeo-Stachyetalia sylvaticae*** Passarge 1967

Hygro-mesophilous nemoral vegetation of slightly nitrified soils near springs and shaded streams.

Synonyms: *Glechometalia hederaceae* R. Tx. in R. Tx. & Brun-Hool 1975 (syntax.syn.); *Agropyro-Glechometalia* Passarge 1978 (art. 29); *Impatienti noli-tangere-Stachyetalia sylvaticae* Boullet et al. in Bardat et al. 2004 (syntax. syn.).

Lectotypus: *Mycelido-Stachyion sylvaticae* Passarge 1967.

Characteristic and differential species: *Athyrium filix-femina* (L.) Roth, *Carex remota* L., *Circaea lutetiana* L., *Galium odoratum* (L.) Scop., *Lysimachia nemorum* L., *Mycelis muralis* (L.) Dumort., *Petasites hybridus* (L.) P. Gaertn., *Rhynchocorys elephas* (L.) Griseb., *Stachys sylvatica* L.

Geographical distribution: This class is mainly distributed in the cool-temperate and submediterranean Europe.

Structure and ecology: The hygro-mesophilous nemoral vegetation, natural or semi-natural, which grows in nutrient-poor or slightly nitrified soils near springs and shaded streams, is classified within the *Circaeo-Stachyetalia sylvaticae* order. The communities belonging to this order are characterized by the occurrence of several rare species that are restricted to these

habitats, such as *Athyrium filix-femina*, *Circaea lutetiana*, *Lysimachia nemorum*, *Petasites hybridus*, *Rhynchocorys elephas*, *Stachys sylvatica*, etc. (Gianguzzi & La Mantia, 2004).

Syndynamism: This permanent vegetation takes catenal contacts with the forest communities of *Fagetalia* and *Populetalia albae*.

Habitat reference: See order.

26.2.1. Alliance: ***Mycelido-Stachyion sylvaticae*** Passarge 1967

Subnitrophilous communities of wet and shaded stands.

Lectotypus: Not designated.

Characteristic and differential species: See order.

Geographical distribution: This alliance has its main distribution in Western and Central Europe, occurring also in the mountains of the Mediterranean area (Brullo et al., 2001; Gianguzzi & La Mantia, 2004).

Structure and ecology: See order.

Syndynamism: See order.

Habitat reference: See order.

26.2.1.1. ***Petagnietum saniculifoliae*** Brullo & Grillo 1978

Mesophilous vegetation with false sanicle of humid and wet stands.

Synonyms: *Petagniaeetum gussonei* Brullo & Grillo 1978 corr. illeg. Gianguzzi & La Mantia 2004.

Holotypus: rel. 2, tab. 6, Brullo & Grillo (1978).

Characteristic and differential species: *Petagnaea gussonei* (Spreng.) Rauschert (= *Petagnia saniculifolia* Guss.).

Phytosociological table: From Gianguzzi & La Mantia (2004), table 4, 24 rel.

Char. association: *Petagnaea gussonei* (V).

Char. alliance and order: *Mycelis muralis* (IV), *Lysimachia nemorum* (IV), *Rhynchocorys elephas* (IV), *Carex remota* (III), *Galium odoratum* (II), *Circaea lutetiana* (I), *Stachys sylvatica* (I), *Athyrium filix-foemina* (I).

Char. class: *Geranium robertianum* (III), *Poa trivialis* (III), *Chaerophyllum temulentum* (III), *Heracleum sphondylium* subsp. *elegans* (III), *Urtica dioica* (II), *Rumex conglomeratus* (II),

Lamium flexuosum (II), *Mentha suaveolens* (II), *Galium aparine* (I), *Sambucus ebulus* (I), *Anthriscus nemorosa* (I), *Petasites hybridus* (I).

Other species: *Geranium versicolor* (V), *Brachypodium sylvaticum* (IV), *Viola reichenbachiana* (III), *Carex pendula* (III), *Equisetum telmateja* (III), *Fragraria vesca* (II), *Trifolium pratense* subsp. *semipurpureum* (II), etc.

Geographical distribution: This vegetation occurs only in the Nebrodi mountains, North-East Sicily (Brullo & Grillo, 1978; Gianguzzi & La Mantia, 2004).

Structure and ecology: The *Petagnietum saniculifoliae* is a mesophilous community with nemoral and sub-hygrophilous requirements, occurring in the humid and shaded undergrowth of various forestal communities, usually near streams or springs. It is linked to slightly acidic soils, deep and well humified, deriving from Numidic Flysch formation and sandstones. From the bioclimatic point of view, this community prefers the meso- and supra-mediterranean belts, being more frequent between 800 and 1400 m a.s.l., despite it occurs also at lower altitudes in narrow and humid gorges. Its structure is definied by some geophytes and hemicryptophytes with spring optimum, among them *Petagnaea gussonei*, a very rare paleoendemism belonging to a monotypic genus, is dominant. This species is associated with some taxa of alliance and order, as *Mycelis muralis*, *Lysimachia nemorum*, *Rhynchocorys elephas*, *Carex remota*, *Galium odoratum*, *Circaea lutetiana*, *Stachys sylvatica* and *Athyrium filix-foemina*. Moreover, the class is represented by *Geranium robertianum*, *Poa trivialis*, *Chaerophyllum temulentum*, *Heracleum sphondylium* subsp. *elegans*, etc. This association was firstly attributed by Brullo & Grillo (1978) to *Dactylorhizo-Juncion striati* alliance (*Holoschoenetalia*) for the occurrence of helophytes and in particular of sedges and rushes, which according to Gianguzzi & La Mantia 2004 should be considered as transgressive of the nearby communities of *Molinio-Arrhenatheretea*.

Syndynamism: The streams colonized by the *Petagnietum saniculifoliae* usually fall in the *Arrhenathero-Quercetum cerridis* or *Anemono-Fagetum sylvaticae* belts, but at lower altitudes it occurs also in the thermophilous woodland of *Ostryo-Quercetum ilicis*. This vegetation is often in catenal contact with the *Helosciadietum nodiflori*, which occurs particularly in the inner part of the streams with slightly running waters. Along the banks, it takes contact with the riparian woodlands of *Ulmo canescentis-Salicetum pedicellatae* or *Salicetum albo-pedicellatae*. Besides, in the shaded lacustrine habitats it can be in contact with the *Dactylorhizo-Juncion striati* (Gianguzzi & La Mantia, 2004).

Habitat reference: See order.

26.2.1.2 ***Rhynchocoryetum elephantis*** ass. nov. provv.

Meso-hygrophilous vegetation with yellow elephantine of humid stands.

Holotypus: Not designated.

Characteristic and differential species: *Rhynchocorys elephas* (L.) Griseb

Phytosociological table: 2 unpublished rel., Alcantara river.

Char. association: *Rhynchocorys elephas* (2).

Char. alliance, order and class: *Lysimachia nemorum* (2), *Chaerophyllum temulentum* (2), *Carex remota* (2), *Mycelis muralis* (1).

Other species: *Samolus valerandi* (2), *Symphytum gussonei* (2), *Taraxacum siculum* (2), *Cerastium fontanum* (2), *Sanicula europaea* (1), *Aquilegia sicula* (1), *Veronica serpyllifolia* (1), *Veronica beccabunga* (1), *Orchis laxiflora* (1), *Ranunculus lateriflorus* (1), *Equisetum telmateja* (1).

Geographical distribution: This association was surveyed in northern Sicily, from Peloritani to Madonie mountains.

Structure and ecology: The nemoral stands, within the riparian forest of the meso- and supramediterranean belts, are sometimes colonized by a community characterized by the dominance of *Rhynchocorys elephas* (fig 30), a rare species spread from Sicily and Algeria to Western Asia (Pignatti, 1982; Giardina et al., 2007). This vegetation, referred to *Rhynchocoryetum elephantis*, is linked to rivular stations near mountain springs and waterfalls with cold and well-oxygenated waters. The floristic cortege of this association is enriched by the occurrence of numerous hygrophilous and nemoral hemicryptophytes, such as *Lysimachia nemorum*, *Veronica beccabunga*, *Chaerophyllum hirsutum*, *Aquilegia sicula*, *Listera ovata*, *Symphytum gussonei*, etc.

Syndynamism: This community is located in the streams within the riparian mountain forests of the *Salicetea porpureae* and makes contact with the hygrophilous sub-nitrophilous associations of the *Anthriscion nemorosae*.

Habitat reference: See order.

26.3. Order: ***Convolvuletalia sepium*** R. Tx. ex Moor 1958

Vegetation of perennial nitrophilous hygrophilous megaforbs, often rich in neophytes, that develops on alluvium, periodically inundated soils.

Synonyms: *Convolvuletalia sepium* R. Tx. 1950 (art. 2b); *Calystegietalia sepium* R.Tx. ex Moor 1958 nom. mut. propos. (art. 45); *Filipendulo-Calystegietalia sepium* Doing 1963 (art. 2b); *Galio-Convolvuletalia* (Tx. 1950) Oberd. et al. 1967 (art. 2b); *Calystegietalia sepium* R. Tx. 1950 corr. Julve 1993 (art. 2b, corr. superfl.); *Convolvuletalia sepium* R. Tx. ex Mucina 1993 (art. 31); *Calystegietalia sepium* R. Tx. ex Mucina 1993 nom. mut. propos. (art. 45); *Convolvuletalia sepium* R. Tx. em. Mucina 1993 (orig.form) (sensu Rivas-Martinez et al. 2011) (phantom).

Lectotypus: *Calystegion sepium* R. Tx. ex Oberdorfer 1957.

Characteristic and differential species: *Anthoxanthum odoratum* L., *Calystegia sepium* (L.) R. Br., *Pastinaca sativa* L. subsp. *urens* (Req.) Čelak.

Geographical distribution: See class.

Structure and ecology: The *Convolvuletalia sepium* order gathers together the nitro-hygrophilous communities of river banks with an high amount of organic matter. It is a quite sciaphilous vegetation, which colonize the deep and well humified soils (Brullo & Marcenò, 1985).

Syndynamism: See class.

Habitat reference: See class..

26.3.1. Alliance: ***Cynancho-Convolvulion sepium*** Rivas Goday & Rivas-Martinez ex Rivas-Martinez 1977

Subnitrophilous communities of wet banks at low altitudes.

Synonyms: *Cynancho-Convolvulion sepium* Rivas Goday et Rivas-Martinez 1963 (art. 3b); *Cynancho-Calystegion sepium* Rivas Goday & Rivas-Martinez ex Rivas-Martinez 1977 nom. mut. propos. (art. 45); *Bromo ramosi-Eupatorion cannabini* O. de Bolòs & Masalles in O. de Bolòs 1983 (syntax.syn.); *Cynancho acuti-Calystegion sepium* Rivas Goday & Rivas Mart. ex de Foucault 2011 (art. 31).

Neotypus: *Petasitetum hybridi* Oberd. 1949 emend. Kopecks' 1969.

Characteristic and differential species: *Arundo donax* L., *Cynanchum acutum* L.

Geographical distribution: This alliance occurs in the Western Mediterranean area (Mucina et al., 2016).

Structure and ecology: The slightly nitrophilous vegetation of wet banks at low altitudes is classified within the *Cynancho-Convolvulion sepium* alliance.

Syndynamism: See class.

Habitat reference: See class.

26.3.1.1. ***Calystegio silvaticae-Arundinetum donacis*** Brullo, Scelsi & Spampinato 2001

Sub-nitrophilous vegetation with false bindweed and giant cane of disturbed river banks.

Synonyms: *Arundini-Convolvuletum sepium* R. Tx. & Oberd. ex O. Bòlos sensu Brullo & Marcenò 1985.

Holotypus: rel. 1, tab. 168a , Brullo et al. (2001).

Characteristic and differential species: *Calystegia sylvatica* (Kit.) Griseb.

Phytosociological table: From Brullo & Marcenò (1985), table 46, 5 rel.

Char. association: *Calystegia sylvatica* (V).

Char. alliance, order and class: *Arundo donax* (V), *Galium aparine* (III), *Cynanchum acutum* (II).

Other species: *Symphyotrichum squamatus* (III), *Erigeron canadensis* (III), *Rubus ulmifolius* (III), *Parietaria judaica* (III), *Torillis arvensis* (II), *Picris hieracioides* (II)*, Urtica dioica* (II).

Geographical distribution: This vegetation occurs in southern Calabria and Sicily, where it is widespread (Brullo & Marcenò, 1985; Brullo et al., 2001; Brullo & Sciandrello, 2006; Giusso et al., 2008).

Structure and ecology: The disturbed banks of rivers and sometimes also the lacustrine habitat are colonized by dense, almost monophytic reeds with *Arundo donax*, growing together with some climbing species, as *Calystegium sylvatica* and *Cynanchum acutum*. This vegetation, named *Calystegio silvaticae-Arundinetum donacis*, has a slightly nitrophilous character and prefers the stretches with slowly running waters, where a certain accumulation of organic matter occurs (Brullo & Marcenò, 1985).

Syndynamism: See class.

Habitat reference: See class.

26.4. Order: ***Galio aparine-Alliarietalia petiolatae*** Oberd. in Görs & Müller 1969

Subnitrophilous communities with short-lives species of slightly humid stands.

Synonyms: *Glechometalia hederaceae* R.Tx. in R.Tx. & Brun-Hool 1975.

Lectotypus: *Geo-Alliarion* Lohmeyer & Oberdorfer ex Görs & Müller 1969.

Characteristic and differential species: *Alliaria petiolata* (M. Bieb.) Cavara & Grande; *Bryonia cretica* L. subsp. *dioica* (Jacq.) Tutin*, Cruciata laevipes* Opiz*,, Glechoma hirsuta* Waldst. & Kit.

Geographical distribution: This order occurs in the submediterranean and mediterranean territories (Mucina et al., 2016).

Structure and ecology: The *Galio aparine-Alliarietalia petiolatae* gathers together the ruderal and semi-natural communities of shaded stands with more or less humid and nutrient-rich soils. This vegetation is dominated by short-lived herbs, as *Alliaria petiolata*, *Bryonia cretica*, *Cruciata laevipes*, *Galium aparine*, etc.

Syndynamism: See class.

Habitat reference: See class.

26.4.1. Alliance: ***Anthriscion nemorosae*** Brullo in Brullo & Marcenò 1985

Sciaphilous and nitrophilous megaforb communities of nemoral places.

Synonyms: *Parietario judaicae-Arion italici* Biondi, Casavecchia & Gasparri in Biondi et al. 2014 (syntax.syn.).

Holotypus: *Lepidio-Smyrnietum perfoliati* Brullo & Marcerò 1985.

Characteristic and differential species: *Allium ursinum* L.*, Anthriscus nemorosa* (M.Bieb.) Spreng., *Lamium bifidum* Cirillo subsp*. bifidum, Ranunculus lanuginosus* L. var. *umbrosus* (Ten. & Guss.) P.Fourn., *Solenanthus apenninus* (L.) Fisch. & CA Mey, *Symphytum bulbosum* K.F.Schimp., *Thlaspi alliaceum* L.

Geographical distribution: This alliance occurs in Central-southern Italy and Sicily (Brullo & Marcenò, 1985; Biondi et al., 2014).

Structure and ecology: This alliance gathers together the sciaphilous communities of nemoral stands, as the undergrowth of decidous oaks and beech forest, colonizing the roadsides and the path with cool and nitrified soils. As concerns the floristic set, this vegetation is differentiated by the occurrence of some mediterranean orophilous species, as *Allium ursinum*, *Anthriscus nemorosa*, *Lamium bifidum*, *Ranunculus lanuginosus* var. *umbrosus*, *Solenanthus apenninus*, *Symphytum bulbosum* and *Thalspi alliaceum* (Brullo & Marcenò, 1985).

Syndynamism: See class.

Habitat reference: See order.

26.4.1.1. ***Anthrisco nemorosae-Chaerophylletum temuli*** Brullo, Scelsi & Spampinato 2001

Nitrophilous vegetation with southern beaked parsley and rough chervil of disturbed nemoral stands.

Synonyms: *Anthriscetum nemorosae* Hruska 1981 sensu Brullo & Marcenò 1985.

Holotypus: rel. 1, tab. 168b , Brullo et al. (2001).

Characteristic and differential species: *Chaerophyllum temulentum* L.

Phytosociological table: From Brullo & Marcenò (1985), table 40, 5 rel.

Char. association: *Chaerophyllum temulentum* (V).

Char. alliance: *Anthriscus nemorosa* (V), *Symphytum bulbosum* (III), *Allium ursinum* (III), *Ranunculus lanuginosus* var. *umbrosus* (II).

Char. order and class: *Urtica dioica* (V), *Galium aparine* (IV), *Alliaria petiolata* (IV), *Rumex obtusifolius* (IV), *Sinapis pubescens* (III), *Arctium minus* (I).

Other species: *Ranunculus ficaria* (II), *Stellaria media* (II), *Capsella rubella* (II), *Chenopodium vulvaria* (II), *Polygonum aviculare* (II).

Geographical distribution: This community is distributed in southern Appennines and Sicily, where it is quite scattered in the Nebrodi and Madonie mountains (Brullo et al., 2001).

Structure and ecology: The markedly disturbed nemoral stands with deep and nutrient rich soils are colonized by the *Anthrisco nemorosae-Chaerophylletum temuli*. Generally, this vegetation occurs near farms, huts and sheepfold, preferring siliceous substrata, as quartzarenites, schists, gneiss and flysch, while is very rare on limestone. The structure of this community is determined by *Anthriscus nemorosa*, growing together with *Chaerophyllum temulentum* and some species of alliance and class, as *Anthriscus nemorosa*, *Symphytum bulbosum*, *Allium ursinum*, *Ranunculus lanuginosus* var. *umbrosus*, *Urtica dioica*, *Galium aparine*, etc. (Brullo & Marcenò, 1985).

Syndynamism: See class.

Habitat reference: See order.

26.4.1.2. ***Lepidio nebrodensis-Smyrnietum perfoliati*** Brullo & Marcenò 1985

Nitrophilous vegetation with Nebrodi hairy pepperwort and perfoliate alexanders of disturbed dry stands.

Holotypus: rel. 2, tab. 41 , Brullo & Marcenò (1985).

Characteristic and differential species: *Lepidium nebrodense* Raf., *Smyrnium perfoliatum* L.

Phytosociological table: From Brullo & Marcenò (1985), table 41, 9 rel.

Char. association: *Smyrnium perfoliatum* (V), *Lepidium nebrodense* (V).

Char. alliance: *Anthriscus nemorosa* (V), *Symphytum bulbosum* (IV), *Thalspi alliaceum* (IV), *Ranunculus lanuginosus* var. *umbrosus* (IV), *Solenanthus appeninus* (IV), *Allium ursinum* (III), *Lamium bifidum* (III).

Char. order and class: *Galium aparine* (V), *Urtica dioica* (V), *Rumex obtusifolius* (V), *Sambucus ebulus* (V), *Alliaria petiolata* (III), *Arctium minus* (III), *Lapsana communis* (III), *Barbarea bracteosa* (III), *Taraxacum gasparrinii* (I).

Other species: *Lamium flexuosum* (V), *Bellis perennis* (V), *Rubus hirtus* (V), *Trifolium pratense* (IV), *Cirsium vallis-demonis* (IV), *Stellaria media* (III), etc.

Geographical distribution: This community is restricted to Nebrodi mountains (Brullo & Marcenò, 1985).

Structure and ecology: In more xerophilous and less disturbed stands, the previous association is replaced by another community, which is dominated by *Smyrnium perfoliatum* and *Lepidium nebrodense*. This vegetation, named *Lepidio nebrodensis-Smyrnietum perfoliari*,

is linked to metamorphic substrata in the beech forest belt, growing in shaded forest edges, roadsides and path. The alliance, order and class are well represented by *Anthriscus nemorosa*, *Symphytum bulbosum*, *Thalspi alliaceum*, *Ranunculus lanuginosus* var. *umbrosus*, *Solenanthus appeninus*, *Allium ursinum*, *Galium aparine*, *Urtica dioica*, *Rumex obtusifolius*, *Sambucus ebulus*, etc. (Brullo & Marcenò, 1985).

Syndynamism: See class.

Habitat reference: See order.

26.4.1.3. ***Anthrisco nemorosae-Heracletum cordati*** Brullo & Marcenò 1985

Nitrophilous and hygrophilous vegetation with southern beaked parsley and common hogweed of wet stands within beech forest.

Holotypus: rel. 3, Tab. 42 , Brullo & Marcenò (1985).

Characteristic and differential species: *Heracleum sphondylium* L. subsp. *elegans* (Jacq.) Schübl. & G. Martens

Phytosociological table: From Brullo & Marcenò (1985), table 42, 5 rel.

Char. association: *Heracleum sphondylium* subsp. *elegans* (V).

Char. alliance: *Anthriscus nemorosa* (V), *Symphytum bulbosum* (IV), *Ranunculus lanuginosus* var. *umbrosus* (IV), *Allium ursinum* (III), *Thalspi alliaceum* (III), *Lamium bifidum* (III), *Solenanthus appeninus* (II).

Char. order and class: *Galium aparine* (V), *Urtica dioica* (V), *Rumex obtusifolius* (IV), *Sambucus ebulus* (IV), *Alliaria petiolata* (III), *Arctium minus* (III), *Sinapis pubescens* (III), *Lapsana communis* (II).

Other species: *Stellaria media* (V), *Bellis perennis* (IV), *Dactylis glomerata* (IV), *Lolium perenne* (IV), *Poa sylvicola* (IV), *Viola reichembachiana* (III), etc.

Geographical distribution: The vegetation at issue occurs in the Nebrodi and Madonie mountains (Brullo & Marcenò, 1985).

Structure and ecology: If compared to the *Anthrisco nemorosae-Chaerophylletum temuli*, the *Anthrisco-Heracletum cordati* shows more hygrophilous requirements, being linked to quite wet stands in the underwood of beech forests, where the nappe is superficial or near small streams. This community is well differentiated by the showy specimens of *Heracleum sphondylium* subsp. *elegans*, growing together with some species belonging to alliance, among them *Anthriscus nemorosa*, *Symphytum bulbosum* and *Ranunculus lanuginosus* var. *umbrosus*. Besides, the order and the class are represented by *Galium aparine*, *Urtica dioica. Rumex obtusifolius*, *Sambucus ebulus*, *Alliaria petiolata*, *Arctium minus*, etc. (Brullo & Marcenò, 1985).

Syndynamism: See class.

Habitat reference: See order.

26.4.2. Alliance: ***Balloto foetidae-Conion maculati*** Brullo in Brullo & Marcenò 1985

Thermophilous and hypernitrophilous vegetation of wet soils.

Synonyms: *Sambucion ebuli* (O. de Bolòs & Vigo ex Rivas-Martinez et al. 1991) Rivas-Martinez & M. Costa 1998 (art. 2b); *Conio maculati-Sambucion ebuli* Rivas-Martínez et al. 2001 (syntax.syn.).

Holotypus: *Urtico-Sambucetum ebuli* Br.-Bl. (1936) 1952.

Characteristic and differential species: *Artemisia verlotiorum* Lamotte, *Ballota nigra* L. subsp. *uncinata* (Bég in Fiori & Paoletti) Patzak, *B. nigra* subsp. *meridionalis* (Bég.) Bég., *Chelidonium majus* L., *Conium maculatum* L., *Melissa officinalis* L. subsp. *altissima* (Sm.) Arcang., *Silene latifolia* Poir..

Geographical distribution: This alliance occurs in Central and Atlantic Europe, as well as in the (sub)Mediterranean area (Brullo & Marcenò, 1985; Biondi et al., 2014).

Structure and ecology: According to Brullo & Marcenò (1985), the thermophilous and hypernitrophilous vegetation of wet soils falls within the *Balloto-Conion maculati* alliance. This syntaxon is characterized by the occurrence of some nitro-subhygrophilous species, as *Artemisia verlotiorum*, *Ballota nigra* subsp. *uncinata*, *Chelidonium majus*, *Conium maculatum*, etc. (Brullo & Marcenò, 1985).

Syndynamism: See class.

Habitat reference: See class.

26.4.2.1. ***Urtico dioicae-Sambucetum ebuli*** Br.-Bl. in Br.-Bl., Roussine & Négre 1952

Hypernitrophilous vegetation with common nettle and danewort of shaded banks.

Lectotypus: Not designated.

Characteristic and differential species: *Sambucus ebulus* L.

Phytosociological table: From Brullo & Marcenò (1985), table 45, 5 rel.

Char. association: *Sambucus ebulus* (V).

Char. alliance: *Conium maculatum* (IV), *Silene latifolia* (IV), *Ballota nigra* subsp. *uncinata* (IV).

Char. order and class: *Galium aparine* (V), *Calystegia sepium* (IV), *Chelidonium majus* (II), *Alliaria petiolata* (II).

Other species: *Mentha longifolia* (V), *Dittrichia viscosa* (III), *Plantago major* (III), *Sylibum marianum* (III), *Rumex crispus* (III), *Geranium purpureum* (III), etc.

Geographical distribution: Its general distribution includes the Atlantic, Central and Mediterranean Europe. In Sicily it is scattered throughout the territory (Brullo & Marcenò, 1985; Minissale & Spampinato, 1990).

Structure and ecology: The shaded banks of permanent streams, where a sufficient accumulation of organic matter occurs, are colonized by the *Urtico dioiceae-Sambucetum ebuli*. In particular, this community grows near huts, sheepfolds, paths, roadsides, etc. Its structure is given by *Sambucus ebulus*, which is associated with *Urtica dioica* and several species belonging to alliance, such as *Galium aparine*, *Calystegia sepium*, *Silene latifolia*, *Chelidonium majus*, *Conium maculatum*, *Ballota nigra* subsp. *uncinata*, etc. (Brullo & Marcenò, 1985).

Syndynamism: See class.

Habitat reference: See class.

26.4.2.2. ***Galio aparines-Conietum maculati*** Rivas-Martínez ex Lopez 1978

Hypernitrophilous vegetation with poison hemlock of wet places near urban centers.

Lectotypus: Not designated.

Characteristic and differential species: *Conium maculatum* L.

Phytosociological table: From Brullo & Marcenò (1985), table 44, 5 rel.

Char. association and alliance: *Conium maculatum* (V), *Ballota nigra* subsp. *uncinata* (III), *Silene latifolia* (III).

Char. order and class: *Galium aparine* (V), *Calystegia sepium* (V), *Urtica dioica* (V).

Other species: *Carduus pycnocephalus* (V), *Malva nicaeensis* (IV), *Sinapis alba* (IV), *Sylibum marianum* (IV), *Symphyotrichum squamatus* (IV), etc.

Geographical distribution: This vegetation occurs in the Iberian peninsula (Ladero et al., 1981), central-southern Italy and Sicily, where it is widespread (Brullo & Marcenò, 1985).

Structure and ecology: The hypernitrophilous and humid stands near urban centers, as streams and channel that are affected by rubbish accumulation and sewer dumping, are colonized by a peculiar nitrophilous community dominated by *Conium maculatum*. It is the *Galio aparines-Conietum maculati*, a thermophilous vegetation of the coastal and hilly belts. The alliance and the order are represented by *Ballota nigra* subsp. *uncinata*, *Silene latifolia*, *Galium aparine*, *Calystegia sepium* and *Urtica dioica* (Brullo & Marcenò, 1985).

Syndynamism: This community replaces the hygrophilous vegetation of *Phragmitetea* in very disturbed stands (Brullo & Marcenò, 1985).

Habitat reference: See class.

26.4.2.3. ***Balloto uncinatae-Melissetum romanae*** Brullo, Minissale, Scelsi & Spampinato 1993

Nitrophilous vegetation with horehound and wild melissa of wet and well nitrified bottoms of narrow valleys.

Holotypus: rel. 1, tab. 15 , Brullo et al. (1993).

Characteristic and differential species: *Melissa officinalis* L. subsp. *altissima* (Sm.) Arcang. (= *Melissa romana* Mill.).

Phytosociological table: From Brullo et al. (1993), table 15, 8 rel.

Char. association: *Melissa officinalis* subsp. *altissima* (V).

Char. alliance: *Ballota nigra* subsp. *uncinata* (III), *Silene latifolia* (III), *Chelidonium majus* (III).

Char. order and class: *Galium aparine* (IV), *Calystegia sepium* (IV), *Urtica dioica* (IV), *Alliaria petiolata* (III), *Lamium bifidum* (III), *Chaerophyllum temulentum* (II), *Rumex obtusifolius* (II), *Sinapis pubescens* (I), *Sambucus ebulus* (I).

Other species: *Parietaria judaica* (V), *Geranium purpureum* (IV), *Anisantha sterilis* (III), *Acanthus mollis* (III), *Sonchus oleraceus* (III), etc.

Geographical distribution: This vegetation is restricted to the Hyblaean plateau (Brullo & Marcenò, 1985).

Structure and ecology: The wet and well nitrified bottoms of the narrow valleys commonly known as «cave» are colonized by a peculiar nitro-hygrophilous community named *Balloto uncinatae-Melissetum romanae*. It is characterized by the occurrence of *Melissa officinalis* subsp. *altissima* (=*Melissa romana*), growing together with some species of higher rank syntaxa, among them *Galium aparine*, *Ballota nigra* subsp. *uncinata*, *Silene latifolia*, *Calystegia sepium*, *Alliaria petiolata* and *Chelidonium majus* (Brullo et al., 1993).

Syndynamism: See class.

Habitat reference: See class.

26.4.2.4. ***Angelico sylvestris-Urticetum dioicae*** Minissale & Spampinato 1990

Nitrophilous vegetation with wild angelica and common nettle of artificial channels and disturbed rivers with cold waters.

Holotypus: rel. 4, tab. 8, Minissale & Spampinato (1990).

Characteristic and differential species: *Angelica sylvestris* L.

Phytosociological table: From Minissale & Spampinato (1990), table 8, 11 rel.

Char. association: *Angelica sylvestris* (V).

Char. alliance, order and class: *Urtica dioica* (V), *Calystegia sepium* (V), *Ballota nigra* subsp. *uncinata* (IV), *Galium aparine* (II), *Artemisia verlotorum* (I).

Other species: *Eupatorium cannabinum* (IV), *Parietaria judaica* (IV), *Persicaria decipiens* (III), *Solanum dulcamara* (III), *Agrostis castellana* (II), etc.

Geographical distribution: This vegetation was surveyed in north-eastern Sicily, along the Fiumefreddo river and near Mascali (Minissale & Spampinato, 1990).

Structure and ecology: On the banks of artificial channels and disturbed rivers with cold waters a peculiar nitrophilous community occurs. It is the *Angelico sylvestris-Urticetum dioicae*, a synanthropic vegetation that is dominated by some tall-herbs as *Angelica sylvestris*, *Urtica dioica* and *Calystegia sepium*. Besides, the alliance and the class are represented by *Ballota nigra* subsp. *uncinata*, *Galium aparine* and *Artemisia verlotorum* (Minissale & Spampinato, 1990).

Syndynamism: The maintenance of this community is permitted from the periodic mowing of the natural vegetation that prevents a further evolution towards the *Phragmito australis-Magnocaricetea elatae* (Minissale & Spampinato, 1990).

Habitat reference: See class.

27. Class: ***Pegano harmalae-Salsoletea vermiculatae*** Br.-Bl. & O. Bolos 1958

Mediterranean and Macaronesian semi-desertic halo-nitrophilous scrub in hyperarid coastal habitats.

Holotypus: *Salsolo vermiculatae-Peganetalia harmalae* Br.-Bl. & O. Bolòs 1954.

Characteristic and differential species: *Asparagus horridus* L., *Atriplex halimus* L., *Capparis sicula* Veill., *Lycium intricatum* Boiss., *Moricandia arvensis* (L.) DC.

Geographical distribution: This class occurs in the Mediterranean area (Géhu & Biondi 1986; Biondi et al., 1994; Brullo et al., 2001, 2012; Rivas-Martinez et al., 2002), as well as in the Saharan-Atlantic and Macaronesic territories (Sunding, 1972; Brullo & Furnari, 1996; Capelo et al., 2000).

Structure and ecology: The class at issue brings together the halo-nitrophilous scrub communities, colonizing marly to clayey substrata and evaporitic surfaces under thermo-xeric climatic conditions in the infra- and thermomediterranean belts or marginally up to the meso-

mediterranean one (Rivas-Martinez et al., 2002). This vegetation is characterized by the dominance of succulent chamaephytes and nanophanerophytes, often belonging to Chenopodiaceae family, such as *Atriplex halimus*, *Salsola oppositifolia*, *S. vermiculata*, *Suaeda vera*, *S. pruinosa*, etc. Besides, the nitrophilous component is represented also by *Artemisia arborescens*, *A. campestris*, *Lycium intricatum* and *Limonium* sp.pl. (Brullo et al., 2012).

Syndynamism: Usually, the *Pegano-Salsoletea* communities can be considered as secondary aspects within the *Oleo-Ceratonion* vegetation. However, they represent a permanent vegetation in badlands or dry environments near the sea, where can have catenal contacts with *Sarcocornetea fruticosae* in the depressed surfaces and also with the salty steppes of *Lygeo-Stipetea* in very arid places.

Habitat reference: F6.8 Mediterranean halo-nitrophilous scrub.

27.1. Order: ***Salsolo vermiculatae-Peganetalia harmalae*** Br.-Bl. & O. Bolòs 1954

Mediterranean halo-nitrophilous scrub of semi-desertic inland regions and hyperarid seaboards.

Synonyms: *Atriplicetalia glaucae* Rivas Goday et Rivas-Martinez 1963; *Onopordo-Salsoletalia vermiculatae* Rivas Goday et Rivas-Martinez 1963; *Ipomoeetalia purpureae* O. de Bolòs 1988 (art. 2b).

Holotypus: *Salsolo vermiculatae-Peganion harmalae* Br.-Bl. & O. Bolòs 1954.

Characteristic and differential species: *Artemisia arborescens* (Vaill.) L., *Lavatera arborea* (Mill.) Soldano, Banfi & Galasso, *Plumbago europaea* L., *Salsola vermiculata* L. subsp. *vermiculata*, *Solanum linnaeanum* Hepper & P.-M.L. Jaeger.

Geographical distribution: See class.

Structure and ecology: See class.

Syndynamism: See class.

Habitat reference: See class.

27.1.1. Alliance: ***Salsolo oppositifoliae-Suaedion verae*** Rigual 1972 corr. Rivas-Martinez et al. 2002

Halo-nitrophilous scrub occurring on clayey soils of arid regions of western and central Mediterranean.

Synonyms: *Salsolo-Fagonion creticae* Rivas Goday & Rigual 1958 (art. 3b); *Salsolo-Suaedion* Rigual 1972; *Salsolo oppositifoliae-Suaedion mollis* Rigual 1972 corr. Rivas-Martinez et al. 2011 (art. 43).

Lectotypus: *Atriplici glaucae-Suaedetum pruinosae* Rigual 1972, designated by Rivas-Martinez et al. (2012).

Characteristic and differential species: *Salsola oppositifolia* Desf.*, Suaeda pruinosa* Lange*, S. vera* J.F. Gmel.

Geographical distribution: This syntaxon occurs in the western and central Mediterranean territories (Mucina et al., 2016).

Structure and ecology: This alliance groups the nitrophilous shrubby communities of clayey surfaces with a sufficient degree of salinity within the infra- and thermomediterranean belts with dry ombrotype. This vegetation is linked to very xeric conditions, which allow the occurrence and often the dominance of some thermo-xerophilous species, such as *Salsola oppositifolia*, *Suaeda vera* and *S. pruinosa*, growing together with few other highly specialized species of the *Pegano harmalae-Salsoletea vermiculatae*.

Syndynamism: The communities of *Salsolo oppositifoliae-Suaedion verae* occur in natural habitats, despite their development is sometimes favoured by human activities. However, they represent a primary and permanent edapho-xerophilous vegetation only in clayey badlands, coastal slopes and along the borders of salt marshes and coastal lagoons (Brullo et al., 2012).

Habitat reference: See class.

27.1.1.1. ***Asparago albi-Salsoletum oppositifoliae*** Brullo, Giusso, Guarino, Miniss., Sciandr. & Spamp. 2012

Halo-nitrophilous scrub with white asparagus and opposite leaved saltwort of steep marly slopes.

Holotypus: rel. 4, Tab. 4 , Brullo et al. (2012).

Characteristic and differential species: *Asparagus albus* L.

Phytosociological table: From Brullo et al. (2012), table 4, 5 rel.

Char. association: *Asparagus albus* (V).

Char. alliance, order and class: *Salsola oppositifolia* (V), *Moricandia arvensis* (IV).

Other species: *Trachynia distachya* (V), *Lygeum spartum* (III), *Anisantha madritensis* (III), *Reichardia picroides* (II), *Catananche lutea* (I), *Charybdis pancration* (I), *Convolvulus althaeoides* (I).

Geographical distribution: This association was surveyed in Southern Sicily (near Agrigento) and also in Calabria at Capo dell'Armi (Brullo et al., 2012).

Structure and ecology: The marly surfaces of coastal stands, or rarely inner stand, are colonized by a nano-phanaerophytic vegetation, which is named *Asparago albi-Salsoletum oppositifoliae*. This community is linked to steep slopes, as cliffs and rocky outcrops, with a lower dry thermo-Mediterranean bioclimate. Under the floristic profile, *Salsola oppositifolia* shows high values of coverage, while the occurrence of *Asparagus albus* characterizes this association within the *Salsolo oppositifoliae-Suaedion fruticosae* alliance (Brullo et al., 2012).

Syndynamism: According to Brullo et al. (2012), this community must be considered a permanent edaphophilous community in the *Oleo-Ceratonion* belt.

Habitat reference: See class.

27.1.1.2. ***Atriplici halimi-Halimionietum portulacoidis*** Brullo, Giusso, Guarino, Miniss., Sciandr. & Spamp. 2012

Halo-nitrophilous scrub with sea purslane and mediterranean saltbush of volcanic outcrops near the sea.

Holotypus: rel. 13, tab. 3 , Brullo et al. (2012).

Characteristic and differential species: *Halimione portulacoides* (L.) Aellen.

Phytosociological table: From Brullo et al. (2012), table 4, 8 rel.

Char. association: *Halimione portulacoides* (V).

Char. alliance, order and class: *Suaeda vera* (V), *Capparis sicula* (IV), *Atriplex halimus* (IV).

Other species: *Lotus cytisoides* (V), *Crithmum maritimum* (V), *Spergularia salina* (V), *Mesembryanthemum nodiflorum* (IV), *Sonchus tenerrimus* (IV).

Geographical distribution: This association occurs in the rocky coast near Catania (Brullo et al., 2012).

Structure and ecology: The community at issue occurs in the flat or slightly sloping volcanic surfaces near the sea, where it is affected by the sea aerosol and by beached organic matter. It is linked to the thermo-Mediterranean subhumid bioclimatic belt. Its structure is given by *Halimione portulacoides*, growing together with few other species of higher rank, as *Suaeda vera*, *Capparis sicula* and *Atriplex halimus* (Brullo et al., 2012).

Syndynamism: This vegetation shows catenal contact with the *Crithmo-Limonietea* communities, which occur in the belt closest to the sea.

Habitat reference: See class.

27.1.1.3. ***Capparido siculae-Salsoletum oppositifoliae*** Brullo, Giusso, Guarino, Miniss., Sciandr. & Spamp. 2012

Halo-nitrophilous scrub with sicilian caper and opposite leaved saltwort of eroded clayey badlands.

Holotypus: rel. 10, tab. 4 , Brullo et al. (2012).

Characteristic and differential species: *Capparis sicula* Veill.

Phytosociological table: From Brullo et al. (2012), table 4, 4 rel.
Char. association: *Capparis sicula* (4).
Char. alliance, order and class: *Salsola oppositifolia* (4), *Suaeda vera* (4), *Asparagus stipularis* (3).
Other species: *Tamarix gallica* (4), *Lygeum spartum* (2), *Sonchus oleraceus* (3), *Mesembryanthemum nodiflorum* (3), *Vicia sativa* (2).

Geographical distribution: This association was surveyd near Adrano, in the western side of Mt. Etna, and in southern Sicily, from Porto Empedocle (Agrigento) to Capo Passero (Brullo et al., 2012).

Structure and ecology: The strongly eroded clayey badlands, localized both in inland and coastal places with a lower dry thermo-Mediterranean bioclimate, are colonized by a peculiar nano-phanaerophytic vegetation. This community, named *Capparido siculae-Salsoletum oppositifoliae*, grows in soils with a very high concentration of chlorides, so much that during the summer a layer of salt crystals can be observed on the ground surface. Its physiognomy is given by *Salsola oppositifolia* and *Capparis sicula*, which represents the differential species of this association (Brullo et al., 2012).

Syndynamism: This community is a permanent edaphophilous vegetation within the climatic belt of the *Oleo-Ceratonion*.

Habitat reference: See class.

27.1.1.4. ***Halimiono portulacoidis-Salsoletum oppositifoliae*** Brullo, Guarino & Ronsisvalle 1998

Halo-nitrophilous scrub with sea purslane and opposite leaved saltwort of coastal limestone and carbonatic sandstones.

Holotypus: rel. 5, tab. 9 , Brullo et al. (2000).

Characteristic and differential species: *Halimione portulacoides* (L.) Aellen.

Phytosociological table: From Brullo et al. (1998), table 9, 5 rel.
Char. association: *Halimione portulacoides* (V).

Char. alliance, order and class: *Salsola oppositifolia* (V), *Suaeda vera* (V), *Lycium intricatum* (V).

Other species: *Thymelaea hirsuta* (V), *Crithmum maritimum* (IV), *Reichardia picroides* var. *maritima* (IV), *Dactylis hispanica* (III).

Geographical distribution: This association was described for Torre Manfria, near Gela (Brullo et al., 1998; Guarino et al., 2008) and later also surveyed near Ribera (Brullo et al., 2012).

Structure and ecology: The *Halimiono portulacoidis-Salsoletum oppositifoliae* grows in the hollow of limestone and carbonatic sandstones near the sea, where the action of sea-storms and wind determine the deposit of loamy sediments and organic matter. The nitrophilous character of this community is emphasized by the dominance of *Halimione portulacoides*, growing together with some species of order and class, such as *Salsola oppositifolia*, *Suaeda vera* and *Lycium intricatum* (Brullo et al., 2012).

Syndynamism: This community is a permanent edaphophilous vegetation of the dry thermo-Mediterranean belt.

Habitat reference: See class.

27.1.1.5. ***Limonio calcarae-Suaedetum verae*** Brullo, Giusso, Guarino, Miniss., Sciandr. & Spamp. 2012

Halo-nitrophilous scrub with Calcara's sea-lavender and shrubby sea-blite of clayish badlands.

Holotypus: rel. 10, tab. 2 , Brullo et al. (2012).

Characteristic and differential species: *Limonium calcarae* (Tod.) Pign.

Phytosociological table: From Brullo et al. (2012), table 2, 6 rel.

Char. association: *Limonium calcarae* (V).

Char. alliance, order and class: *Suaeda vera* (V), *Moricandia arvensis* (IV).

Other species: *Beta vulgaris* subsp. *maritima* (V), *Allium agrigentinum* (V), *Daucus muricatus* (V), *Phalaris paradoxa* (V), *Parapholis pycnantha* (V), *Lolium rigidum* (IV), *Plantago coronopus* (IV), *Hordeum maritimum* (III), *Scorzonera cana* (III).

Geographical distribution: This association is restricted to Central Sicily, in Agrigento and Caltanissetta provinces (Brullo et al., 2012).

Structure and ecology: The clayish soils belonging to the evaporitic series of inner Sicily are covered by a very peculiar halo-nitrophilous vegetation. It is the *Limonio calcarae-Suaedetum verae*, which grows mainly on strongly eroded badlands and steep slopes. This association is well differentiated by the dominance of the narrow endemic *Limonium calcarae*, which is

associated with scattered individuals of *Suaeda vera* and *Moricandia arvensis* (Brullo et al., 2012).

Syndynamism: This vegetation represents a permanent edaphophilous vegetation of the dry thermo-Mediterranean bioclimatic belt.

Habitat reference: See class.

27.1.1.6. ***Salsoletum agrigentinae*** Brullo, Guglielmo & Pavone 1985

Halo-nitrophilous scrub with Agrigento saltwort of heavily eroded clayish badlands.

Holotypus: rel. 4, tab. 2 , Brullo et al. (1985).

Characteristic and differential species: *Salsola agrigentina* Guss.

Phytosociological table: From Brullo et al. (2012), table 2, 7 rel.
Char. association: *Salsola agrigentina* (V).
Char. alliance, order and class: *Suaeda vera* (V), *Salsola oppositifolia* (III), *Atriplex halimus* (III), *Moricandia arvensis* (I), *Asparagus stipularis* (I).
Other species: *Lygeum spartum* (V), *Gynandriris sisyrinchium* (I), *Plantago serraria* (I), *Hordeum maritimum* (I).

Geographical distribution: This association is distributed in Central and Southern Sicily (Brullo et al., 1985, 2012).

Structure and ecology: The *Salsoletum agrigentinae* is a nanophanerophytic community, which colonizes the steep and strongly eroded badlands, often covered by salt crystals during the summer period. In fact, this vegetation results well adapted to high concentrations of chlorides in the soil, appearing as a more or less dense scrub dominated by the endemic halotolerant *Salsola agrigentina*. The syntaxa of higher rank are represented by *Salsola oppositifolia*, *Suaeda vera* and *Atriplex halimus* (Brullo et al., 1985).

Syndynamism: This community is a permanent edaphophilous vegetation of the dry thermo-Mediterranean bioclimatic belt. On less sloping sites, it can be into contact with the perennial dry grasslands of *Lavatero agrigentinae-Lygeetum sparti* Brullo 1985.

Habitat reference: See class.

27.1.1.7. ***Limonio catanzaroi-Salsoletum oppositifoliae*** Brullo, Guglielmo & Pavone 1985, nom. inver. propos. Brullo et al. 2012

Halo-nitrophilous scrub with Catanzaro sea lavender and opposite leaved saltwort of salt marly surfaces.

Synonyms: *Salsolo oppositifoliae-Limonietum catanzaroi* Brullo, Guglielmo & Pavone 1985 (art. 42).

Holotypus: rel. 8, tab. 1, Brullo et al. (1985).

Characteristic and differential species: *Helminthotheca aculeata* (Vahl) Lack., *Limonium catanzaroi* Brullo

Phytosociological table: From Brullo et al. (2012), table 2, 9 rel.
Char. association: *Limonium catanzaroi* (V), *Helminthotheca aculeata* (V).
Char. alliance, order and class: *Salsola oppositifolia* (V), *Atriplex halimus* (V), *Suaeda vera* (II), *Capparis sicula* (II).
Other species: *Lygeum spartum* (V), *Phagnalon rupestre* (V), *Ampelodesmos mauritanicus* (III), *Lotus cytisoides* (III), *Thymelaea hirsuta* (II), *Matthiola fruticulosa* (II).

Geographical distribution: This association occurs only in South-western Sicily near Agrigento (Brullo et al., 1985, 2012).

Structure and ecology: In the salty lithosoils, which are originated by marls or marly clays interposed to sandstone layers, *Salsola oppositifolia* is associated with the very rare endemic *Limonium catanzaroi*. This vegetation, named *Limonio catanzaroi-Salsoletum oppositifoliae*, is linked to the dry thermomediterranean belt. Its floristic set includes some species belonging to class and alliance, as *Salsola oppositifolia*, *Atriplex halimus*, *Suaeda vera* and *Capparis sicula* (Brullo et al., 1985).

Syndynamism: As the salinity gradient decreases, the *Limonio catanzaroi-Salsoletum oppositifoliae* is replaced by the perennial dry grasslands of the *Astragalo huetii-Ampelodesmetum mauritanici* or by the maquis of the *Limonio catanzaroi-Salsoletum oppositifoliae*, which prefers more mature soils (Brullo et al., 2012).

Habitat reference: See class.

27.1.1.8. ***Limonio opulenti-Salsoletum oppositifoliae*** Brullo, Grillo & Scalia 1980, nom. inver. propos. Brullo et al. 2012

Halo-nitrophilous scrub with opulent sea lavender and opposite leaved saltwort of coastal badlands and marly surfaces.

Synonyms: *Salsolo oppositifoliae-Limonietum opulenti* Brullo, Grillo & Scalia 1980 (art. 42).

Holotypus: rel. 14, Tab. 1, Brullo et al. (1980).

Characteristic and differential species: L*imonium opulentum* (Lojac.) Greuter, *Herniaria fontanesii* Gay subsp. *empedocleana* (Lojac.) Brullo, *Suaeda kocheri* Guss. ex C. Brullo, Brullo & Giusso, *Reaumuria vermiculata* L.

Phytosociological table: From Brullo et al. (1980), table 1, 23 rel.

Char. association: *Limonium opulentum* (III), *Suaeda kocheri* (III), *Reamuria vermiculata* (III), *Herniaria fontanesii* subsp. *empedocleana* (I).

Char. alliance, order and class: *Salsola oppositifolia* (V), *Atriplex halimus* (V), *Suaeda vera* (V).

Geographical distribution: This association is restricted to the marly coast near Porto Empedocle (Brullo et al., 1980).

Structure and ecology: The *Limonio opulenti-Salsoletum oppositifoliae* represents a very peculiar vegetation, which is linked to particularly dry environments, as coastal badlands and steep eroded marly outcrops. It appears as a chamaephytic and nanophanerophytic vegetation dominated by *Salsola oppositifolia*, *Atriplex halimus* and *Suaeda vera*. The occurrence of some narrow endemic species, as *Limonium opulentum*, *Suaeda kocheri* and *Herniaria fontanesii* subsp. *empedocleana*, as well as the presence of *Reamuria vermiculata*, a rare South-Mediterranean and Saharo-Syndic species, allows to distinguish the association at issue from the other syntaxon belonging to the *Salsolo vermiculatae-Peganetalia harmalae* (Brullo et al., 1980).

Syndynamism: This vegetation must be considered a permanent edaphophilous vegetation of the lower dry thermo-Mediterranean bioclimatic belt. In less sloping places it is replaced by the *Euphorbietum dendroidis* Guinochet in Guinochet & Drounieau 1944. Actually, the *Limonio opulenti-Salsoletum oppositifoliae* results a very rare and endagered vegetation, due to deregulated urban sprawl, stone-quarries and landfills (Brullo et al., 2012).

Habitat reference: See class.

27.1.1.9. ***Salsolo oppositifoliae-Suaedetum pelagicae*** Bartolo. Brullo, Miniss. & Spamp. 1990

Halo-nitrophilous scrub with opposite leaved saltwort and Pelagian seepweed of marly outcrops.

Holotypus: rel. 4, Tab. 11, Bartolo et al. (1988).

Characteristic and differential species: *Suaeda pelagica* Bartolo, Brullo & Pavone

Phytosociological table: From Bartolo et al. (1988), table 11, 8 rel.

Char. association: *Suaeda pelagica* (V).

Char. alliance, order and class: *Atriplex halimus* (V), *Salsola oppositifolia* (V), *Suaeda vera* (V), *Lycium intricatum* (III), *Artemisia arborescens* (I).

Geographical distribution: This association occurs only in Lampedusa island (Bartolo et al., 1990a).

Structure and ecology: The steep south-facing marly outcrops near the sea of Lampedusa are colonized by a specialized vegetation with the endemic *Suaeda pelagica*. It is the *Salsolo oppositifoliae-Suaedetum pelagicae*, which is a very thermo-xerophilous vegetation well adapted to intense direct sunlight, frequent coastal winds and salt spray. Its physiognomy is given mainly by *Salsola oppositifolia*, *Atriplex halimus* and *Suaeda vera*. Besides, the class is represented also by *Lycium inticatum* and *Artemisia arborescens* (Brullo et al., 2012).

Syndynamism: This community takes catenal contacts with the *Limonietum lopadusani*, which occours in the rocky surfaces closer to the sea and with the *Chiliadenetum lopadusani* on vertical cliffs (Bartolo et al., 1990a).

Habitat reference: See class.

27.1.1.10. ***Suaedo verae-Limoniastretum monopetali*** Bartolo, Brullo, Miniss. & Spamp. 1990

Halo-nitrophilous scrub with shrubby sea-blite and shrubby limoniastrum of loamy soils.

Holotypus: rel. 2, Tab. 12 , Bartolo et al. (1990a).

Characteristic and differential species: *Limoniastrum monopetalum* (L.) Boiss.

Phytosociological table: From Brullo et al. (2012), table 3, 11. rel.

Char. association: *Limoniastrum monopetalum* (V).

Char. alliance, order and class: *Salsola oppositifolia* (V), *Suaeda vera* (IV), *Asparagus stipularis* (IV), *Capparis sicula* (III), *Atriplex halimus* (II), *Lycium intricatum* (I).

Other species: *Lygeum spartum* (IV), *Euphorbia dendroides* (IV), *Phagnalon rupestre* (III), *Thymelaea hirsuta* (II), *Limbarda crithmoides* subsp. *longifolia* (II).

Geographical distribution: This association was described from Lampedusa by Bartolo et al. (1990a), but was surveyed also in various coastal localities of southern and western Sicily (Brullo et al., 2012).

Structure and ecology: Usually, *Limoniastrum monopetalum* is linked to coastal salt marshes vegetation belonging to *Salicornietea fruticosae* class. Hovewer, in the context of *Pegano-Salsoletea* class, this species characterizes a peculiar community named *Suaedo verae-Limoniastretum monopetali*, which grows on south-facing flat or slightly sloping coastal places subject to sea-agents. It prefers loamy soils with a slight edaphic humidity, deriving from the weathering of marly clays, marls, and carbonatic sandstones. Its stucture is determined by the large prostrate shrubs of *Limoniastrum monopetalum*, occurring together with some Chenopodiaceae, as *Suaeda vera*, *Salsola oppositifolia* and *Atriplex halimus* (Bartolo et al., 1990a).

Syndynamism: This vegetation is a permanent edaphophilous aspect of the thermo- and infra-Mediterranean dry bioclimatic belt. In cooler and shady places it is replaced by the maquis of *Oleo-Ceratonion* and *Periplocion angustifoliae* (Brullo et al., 2012).

27.1.1.11. ***Thapsio pelagicae-Salsoletum oppositifoliae*** Brullo, Giusso, Guarino, Miniss., Sciandr. & Spamp. 2012

Halo-nitrophilous scrub with Pelagian deadly carrot and opposite leaved saltwort of nitrophyllic marly substrata.

Synonyms: *Suaedo verae-Salsoletum oppositifoliae* Bartolo et al. 1990 non Rivas Goday & Rigual 1958.

Holotypus: rel. 5, tab. 10, Bartolo et al. (1990a).

Characteristic and differential species: *Thapsia pelagica* Brullo, Guglielmo, Pasta, Pavone & Salmeri, *Reichardia tingitana* (L.) Roth.

Phytosociological table: From Bartolo et al. (1990a), table 10, 7 rel.
Char. association: *Thapsia pelagica* (IV), *Reichardia tingitana* (I).
Char. alliance, order and class: *Salsola oppositifolia* (V), *Atriplex halimus* (V).
Other species: *Lobularia maritima* (V), *Ferula communis* (V), *Carduus argyroa* (V), *Asparagus acutifolius* (V), *Capparis spinosa* (V), *Senecio leucanthemifolius* (IV), *Arisarum vulgare* (IV), *Prasium majus* (IV), *Sonchus oleraceus* (III).

Geographical distribution: This association occurs only in Lampedusa island (Brullo et al., 2012).

Structure and ecology: The *Thapsio pelagicae-Salsoletum oppositifoliae* is a thermo-xerophilous vegetation, occurring in the marly surfaces dunged by seabirds. It appears as a nano-phanerophytic community with a dense layer of *Salsola oppositifolia*, *Suaeda vera* and *Atriplex halimus*, growing together with the endemic *Thapsia pelagica*, which represents the differential species of this syntaxon (Brullo et al., 2012).

Syndynamism: This vegetation is a permanent edaphophilous community of the infra-Mediterranean semi-arid bioclimatic belt. It takes catenal contact inwards with the maquis vegetation of *Periplocion angustifoliae* (Brullo et al., 2012).

Habitat reference: See class.

27.1.2. Alliance: ***Artemision arborescentis*** Géhu & Biondi in Géhu et al. 1986

Thermo-mediterranean sub-nitrophilous coastal scrub of disturbed places.

Synonyms: *Artemision arborescentis* Géhu & Biondi 1994 (art. 22).

Holotypus: *Cinerario maritimae-Artemisietum arborescentis* Géhu, Biondi, Géhu-Franck 1986 (art. 8).

Characteristic and differential species: *Anagyris foetida* L., *Artemisia arborescens* (Vaill.) L.

Geographical distribution: This vegetation is widespread in the thermoatlantic and mediterranean coasts (Biondi et al., 2014).

Structure and ecology: This alliance replaces the previous one on disturbed habitat with nitrogen and phosphates rich soils, as clayish slopes near human settlements, roadsides, and folds. Besides, if compared to the *Salsolo oppositifoliae-Suaedion fruticosae*, this vegetation shows more mesophilous requirements, occurring in the thermo and meso-mediterranean belts. Under the floristic profile, this syntaxon is well characterized by some sub-nitrophilous shrubs, as *Artemisia arborescens*, *Anagyris foetida*, *Atriplex halimus*, *Suaeda vera*, etc.

Syndynamism: The associations belonging to the alliance at issue are linked to anthropized environments, near the sea or in inner areas, falling in the *Oleo-Ceratonion* series.

Habitat reference: See class.

27.1.2.1. ***Atriplici halimi-Artemisietum arborescentis*** Biondi 1988

Subnitrophilous scrub vegetation with Mediterranean saltbush and tree wormwood of disturbed places.

Holotypus: rel. 4, tab. 1, Biondi (1988).

Characteristic and differential species: *Artemisia arborescens* (Vaill.) L., *Atriplex halimus* L.

Phytosociological tables: From Brullo et al. (2012), table 6, 5 rel. (subass. *salsoletosum oppositifoliae*).

Char. association: *Artemisia arborescens* (V).

Char. subassociation: *Salsola oppositifolia* (V)

Char. alliance, order and class: *Atriplex halimus* (V), *Anagyris foetida* (III), *Suaeda vera* (II).

Other species: *Asparagus albus* (IV), *Asparagus acutifolius* (IV), *Lygeum spartum* (IV), *Dactylis hispanica* (IV), *Euphorbia dendroides* (IV), *Thymelaea hirsuta* (II), *Thapsia garganica* (II).

From Brullo et al. (1988), table 3, 19 rel. (subass. *halimionetosum portulacoidis*).

Char. association: *Artemisia arborescens* (3).

Char. subassociation: *Halimione portulacoides* (3)

Char. alliance, order and class: *Atriplex halimus* (3), *Suaeda vera* (3), *Moricandia arvensis* (2).

Other species: *Daucus carota* (2), *Dactylis hispanica* (2), *Scolymus grandiflorus* (2), *Phragmites australis* (2), *Anisantha sterilis* (2).

Geographical distribution: This association is found in Southern Italy (Tremiti Islands, Gargano, and northern Calabria), Sardinia and Sicily, where it is spread in the eastern and

southern areas, including some small islands (Brullo et al., 1988, 2012; Bonanno, 2008, 2014; Sciandrello et al., 2017).

Structure and ecology: The coastal sites with marly or conglomeratic substrata, sometimes used as dumping places for urban waste and rubbles, are covered by a synanthropic shrubland with *Artemisia arborescens* and *Atriplex halimus* (Biondi, 1988). It is the *Atriplici halimi-Artemisietum arborescentis*, a quite poor vegetation, where the higher syntaxa are represented only by *Anagyris foetida*, *Atriplex halimus*, *Suaeda vera* and *Moricandia arvensis*. Costanzo et al. (2005) and Brullo et al. (2012) distinguished two aspects within this syntaxon: the subass. *salsoletosum oppositifoliae* is linked to dwelling steep marly cliffs near the sea; the subass. *halimionetosum portulacoidis* is found on the loamy soils of coastal salt marshes.

Syndynamism: This vegetation is a permanent edaphophilous vegetation of the thermo-Mediterranean dry to subhumid bioclimatic belts. It takes catenal contact with the maquis vegetation of *Oleo-Ceratonion* (Brullo et al., 2012).

27.1.2.2. ***Coronillo valentinae-Artemisietum arborescentis*** Brullo, Giusso, Guarino, Miniss., Sciandr. & Spamp. 2012

Subnitrophilous scrub with shrubby scorpion-vetch and tree wormwood of steep marly slopes.

Holotypus: rel. 21, tab. 7, Brullo et al. (2012).

Characteristic and differential species: *Coronilla valentina* L., *Ruta chalepensis* L.

Phytosociological tables: From Brullo et al. (2012), table 7, 5 rel.

Char. association: *Coronilla valentina* (V), *Ruta chalepensis* (V).

Char. alliance, order and class: *Artemisia arborescens* (V), *Salsola oppositifolia* (V), *Anagyris foetida* (V).

Other species: *Bituminaria bituminosa* (V), *Asperula aristata* subsp. *scabra* (V), *Osyris alba* (V), *Sedum sediforme* (III), *Rhamnus alaternus* (III), *Asparagus acutifolius* (III).

Geographical distribution: This association is restricted to central and northern Sicily (Brullo et al., 2012).

Structure and ecology: The steep and heavily eroded marly slopes, within the thermomediterranean subhumid bioclimatic belt between 400 and 500 m a.s.l., are colonized by the *Coronillo valentinae-Artemisietum arborescentis*. This vegetation is constituted by scattered shrubs of *Artemisia arborescens*, *Salsola oppositifolia* and *Anagyris foetida*, growing together with *Coronilla valentina* and *Ruta chalepensis* (Brullo et al., 2012).

Syndynamism: This vegetation shows a specialized character, being linked to quite fine-grained debris frequently disturbed by the deposition of new eroded material. In more stable surfaces, it is replaced by the shrubby vegetation of *Oleo-Ceratonion* (Brullo et al., 2012).

Habitat reference: See class.

27.1.2.3. ***Limonio optimae-Salsoletum oppositifoliae*** Brullo, Giusso, Guarino, Miniss., Sciandr. & Spamp. 2012

Halo-nitrophilous scrub with Optima's sea lavender and opposite leaved saltwort of marly limestone and warps with a high salt concentration.

Holotypus: rel. 5, tab. 7, Brullo et al. (2012).

Characteristic and differential species: *Limonium optimae* Raimondo.

Phytosociological tables: From Brullo et al. (2012), table 7, 10 rel.

Char. association: *Limonium optimae* (V).

Char. alliance, order and class: *Artemisia arborescens* (V), *Salsola oppositifolia* (V), *Moricandia arvensis* (IV), Capparis sicula (III).

Other species: *Elytrigia atherica* (V), *Tamarix africana* (IV), *Dittrichia viscosa* (III), *Piptantherum miliaceum* (III), *Spergularia salina* (II), *Festuca arundinacea* (II).

Geographical distribution: This association occurs only in Central Sicily, particularly in the Salso river valley near Caltanissetta (Brullo et al., 2012).

Structure and ecology: The *Limonio optimae-Salsoletum oppositifoliae* is a very peculiar community, which is found on marly limestone and warps nearby river and streams with very salty waters. This vegetation shows an open physiognomy, being characterized by sparse shrubs of *Salsola oppositifolia* and *Artemisia arborescens* mixed with denser clumps of *Limonium optimae* (Brullo et al., 2012).

Syndynamism: This vegetation is a permanent edaphophilous vegetation of the thermo-Mediterranean subhumid bioclimatic belt, having catenal contacts with the *Juncetea maritimi* communities on wetter soils.

Habitat reference: See class.

27.1.2.4. ***Lycio europaei-Artemisietum arborescentis*** Brullo, Giusso, Guarino, Miniss., Sciandr. & Spamp. 2012

Subnitrophilous scrub with European tea-tree and tree wormwood of disturbed clayey substrata.

Synonyms: aggr. *Lycium europaeum* Costanzo et al. (2005)**.**

Holotypus: rel. 15, Tab. 7, Brullo et al. (2012).

Characteristic and differential species: *Lycium europaeum* L.

Phytosociological tables: From Brullo et al. (2012), table 7, 10 rel.

Char. association: *Lycium europaeum* (V).

Char. alliance, order and class: *Artemisia arborescens* (V), *Salsola oppositifolia* (V), *Moricandia arvensis* (IV), Capparis sicula (III).

Other species: *Elytrigia atherica* (V), *Tamarix africana* (IV), *Dittrichia viscosa* (III), *Piptantherum miliaceum* (III), *Spergularia salina* (II), *Festuca arundinacea* (II).

Geographical distribution: This association is found in the inner part of northern and central Sicily (Brullo et al., 2012).

Structure and ecology: The clayey surfaces near urban and rural settlements, within the meso-Mediterranean dry to subhumid bioclimatic belt (500–700 m a.s.l.), are colonized by the *Lycio europaei-Artemisietum arborescentis*. It is a vegetation with a nitrophilous character, showing more mesophilous requirements in comparison with the other syntaxon of alliance. Its structure is quite dense, being constituted by the big shrubs of *Lycium europaeum*, *Artemisia arborescens* and *Atriplex halimus*. Besides the order and the class are represented by *Salsola oppositifolia*, *Moricandia arvensis* and *Capparis sicula* (Brullo et al., 2012).

Syndynamism: This community must be considered a secondary vegetation, colonizing road-sides, pathways, embankments and other disturbed habitats.

Habitat reference: See class.

27.1.2.5. ***Lycio intricati-Salsoletum oppositifoliae*** Brullo, Giusso, Guarino, Miniss., Sciandr. & Spamp. 2012

Halo-nitrophilous scrub with southern tea-tree and opposite leaved saltwort of marly and clayish soils near the sea.

Synonyms: *Suaedo verae-Salsoletum oppositifoliae* Brullo et al. 2000 non Rivas Goday & Rigual 1958.

Holotypus: rel. 14, tab. 5, Brullo et al. (2012).

Characteristic and differential species: *Lycium intricatum* Boiss.

Phytosociological tables: From Brullo et al. (2012), table 5, rel. 9.
Char. association: *Lycium intricatum* (V).
Char. alliance, order and class: *Artemisia arborescens* (V), *Asparagus stipularis* (V), *Atriplex halimus* (V), *Suaeda vera* (V), *Salsola oppositifolia* (V), *Capparis sicula* (III).
Other species: *Lygeum spartum* (V), *Thymelaea hirsuta* (V), *Dactylis hispanica* (V), *Prasium majus* (V), *Piptantherum miliaceum* (IV), *Ephedra fragilis* (IV), *Charybdis pancration* (IV), *Phagnalon saxatile* (IV).

Geographical distribution: This community occurs in the coasts of southern Sicily, from Realmonte (Agrigento) to Gela (Brullo et al., 2012).

Structure and ecology: The steep marly slopes and the clayey badlands near the sea, often with southern exposures, are colonized by a peculiar halo-nitrophilous vegetation, which is named *Lycio intricati-Salsoletum oppositifoliae*. This community is characterized by a dense and intricate structure, where some xerophilous species, as *Lycium intricatum*, *Salsola oppositifolia* and *Asparagus stipularis* have high coverage values, growing together with various species of alliance and class, as *Artemisia arborescens*, *Atriplex halimus*, *Suaeda vera* and *Capparis sicula* (Brullo et al., 2012).

Syndynamism: This vegetation occurs both in rather natural and disturbed places, within the thermo-Mediterranean dry bioclimatic belt. In the most anthropized environments *Artemisia arborescens* becomes progressively dominant, while on gently sloping sites it is progressively replaced by the *Lygeum spartum* grasslands (Brullo et al., 2012).

Habitat reference: See class.

27.1.2.6. ***Medicagini arboreae-Salsoletum oppositifoliae*** Brullo, Giusso, Guarino, Minis., Sciandr. & Spamp. 2012

Halo-nitrophilous scrub with shrub medick and opposite leaved saltwort of limestone and carbonatic sandstones near the sea.

Holotypus: rel. 19, tab. 5, Brullo et al. (2012).

Characteristic and differential species: *Medicago arborea* L.

Phytosociological table: From Brullo et al. (2012), table 5, 5 rel.

Char. association: *Medicago arborea* (V).

Char. alliance, order and class: *Artemisia arborescens* (V), *Salsola oppositifolia* (V), *Salsola oppositifolia* (V), *Asparagus stipularis* (IV), *Atriplex halimus* (III), *Suaeda vera* (III), *Capparis sicula* (III), *Anagyris foetida* (I).

Other species: *Prasium majus* (IV), *Dactylis hispanica* (IV), *Daucus gingidium* (IV), *Teucrium flavum* (III), *Ephedra fragilis* (III), *Euphorbia dendroides* (II).

Geographical distribution: This community was surveyed only near Licata, southern Sicily (Brullo et al., 2012).

Structure and ecology: On limestone and carbonatic sandstones disturbed by the sea-spray and dunged by the seabirds, the previous associationis replaced by the *Medicagini arboreae-Salsoletum oppositifoliae*. From the floristic point of view, it is characterized by the occurrence of *Medicago arborea*, a very rare species in Sicily, which constitutes a dense vegetation together with *Salsola oppositifolia*, *Artemisia arborescens*, *Suaeda vera* and *Atriplex halimus* (Brullo et al., 2012).

Syndynamism: This community represents an edaphic vicariant of the *Lycio intricati-Salsoletum oppositifoliae* (Brullo et al., 2012).

Habitat reference: See class.

28. Class: ***Nicotiano glaucae-Ricinetea communis*** Brullo et al. 2020

Thermo-nitrophilous perennial vegetation dominated by neophytes of arid and anthropized habitats.

Holotypus: *Nicotiano glaucae-Ricinetalia communis* Rivas-Martínez, Fernández-González & Loidi 1999.

Characteristic and differential species: *Ipomoea indica* (Burm.) Merr., *Nicotiana glauca* L., *Ricinus communis* L., *Withania somnifera* (L.) Dunal.

Geographical distribution: This class occurs in the Mediterranean and Macaronesian territories (Brullo et al., 2020).

Structure and ecology: The nitrified soils of disturbed places, within the infra- and thermomediterranean belt, are colonized by a shrubby vegetation rich in fast-growing neophytes, as *Ipomoea indica*., *Nicotiana glauca*, *Ricinus communis*, *Withania somnifera*, etc. Firstly, it was arranged by Rivas-Martinez (1999) at order rank within the *Pegano-Salsoletea* class, despite the lacking of the typical species belonging to this syntaxon and its strictly synanthropic character. Therefore, Brullo et al. (2020) proposed a new class, named *Nicotiano glaucae-Ricinetea communis*, which includes these ruderal perennial phytocoenosis of very anthropized environments, as ravine beds, volcanic ash quarries, abandoned arable fields and roadsides.

Syndynamism: This vegetation has a secondary character and its spread is linked to human activities.

Habitat reference: F6.8 Mediterranean halo-nitrophilous scrub.

28.1. Order: ***Nicotiano glaucae-Ricinetalia communis*** Rivas-Martínez, Fernández-González & Loidi 1999

Thermo-nitrophilous perennial vegetation dominated by neophytes of arid and anthropized habitats.

Holotypus: *Nicotiano glaucae-Ricinion communis* Rivas-Martínez, Fernández-González & Loidi 1999.

Characteristic and differential species: See class.

Geographical distribution: See class.

Structure and ecology: See class.

Syndynamism: See class.

Habitat reference: See class.

28.1.1. Alliance: ***Nicotiano glaucae-Ricinion communis*** Rivas-Martínez, Fernández-González & Loidi 1999

Thermo-nitrophilous perennial vegetation dominated by neophytes of arid and anthropized habitats.

Holotypus: *Tropaeolo majoris-Ricinetum communis* Rivas-Martínez et al. 1993.

Characteristic and differential species: See class.

Geographical distribution: See class.

Structure and ecology: See class.

Syndynamism: See class.

Habitat reference: See class.

28.1.1.1. ***Tropaeolo majoris-Ricinetum communis*** Rivas-Martínez et al. 1993

Halo-nitrophilous scrub with castor bean and indian cress of nitrified deep soils.

Holotypus: rel. 1, tab. 41, Rivas-Martinez et al. (1993).

Characteristic and differential species: *Tropaeolum majus* L.

Phytosociological table: 6 unpublished relevés, North-eastern Sicily, Brullo, 2009-2010.
Char. association: *Tropaeolum majus* (V).
Char. alliance, order and class: *Nicotiana glauca* (V), *Ricinus communis* (V), *Ipomoea purpurea* (V), *Ipomoea indica* (III).
Other species: *Euphorbia ceratocarpa* (V), *Calystegia sylvatica* (V), *Rubus ulmifolius* (V), *Ailanthus altissima* (III), *Ficus carica* (II), *Ferula communis* (II), *Robinia pseuodacacia* (II).

Geographical distribution: This association was described from the Canary Islands and later reported from Portugal (Costa et al., 2000). Recently, it was surveyed also in Sicily, where it is quite rare.

Structure and ecology: The *Tropaeolo majoris-Ricinetum communis* in Sicily occurs in the deep and well nitrified soils along the roadsides, within the subhumid thermo-mediterranean belt. It is a synanthropic vegetation with a rich neophytic component, dominated by *Tropaeolum majus* and *Ricinus communis*. In particular, the first one is native to South America, while the second one is a thermo-xerophilous species having an African origin, which grows frequently in rubbish dumps, wet ravine beds and other disturbed habitats (Rivas-Martinez et al., 1993).

Syndynamism: See class.

Habitat reference: See class.

28.1.1.2. ***Nicotiano glaucae-Ricinetum communis*** de Foucault 2013

Halo-nitrophilous scrub with tree tobacco and castor bean of nitrified dry soils.

Synonyms: broussaille à *Ricinus* et *Nicotiana* Braun-Blanquet & Maire 1924; *Nicotiano glaucae-Ricinetum communis* (Br.-Bl. & Maire 1924) De Foucault 2003 (nom. inval. art. 2b, 3f).

Holotypus: rel. pag. 6, De Foucault (2013).

Characteristic and differential species: *Nicotiana glauca* L.

Phytosociological table: 5 unpublished relevés, southern Sicily, Brullo, 2005-2009.
Char. association: *Nicotiana glauca* (V).
Char. alliance, order and class: *Ricinus communis* (V).
Other species: *Rubus ulmifolius* (V), *Euphorbia ceratocarpa* (III), *Ailanthus altissima* (II).

Geographical distribution: This vegetation occurs throughout the Macaronesian and the Mediterranean territories, including Sicily, where it is very frequent (Rivas-Martinez et al., 1993; De Foucault, 2013; Brullo et al., 2020).

Structure and ecology: The *Nicotiano glaucae-Ricinetum communis* replaces the previous community in more arid places, as roadsides, uncultivated fields, urban stands, quarries, rocky surfaces dunged by seabirds, etc. It is linked to the dry thermomediterranean belt. Its structure is given by the tall bushes of some xenophytes, as *Ricinus communis* and *Nicotiana glauca*, an invasive species of American origin (Brullo et al., 2020)..

Syndynamism: See class.

Habitat reference: See class.

28.1.1.3. ***Ipomaeo purpureae-Ricinetum communis*** ass. nov. provv.

Nitrophilous scrub with common morning-glory and castor bean of nitrified deep soils.

Holotypus: Not designated.

Characteristic and differential species: *Ipomoea purpurea* (L.) Roth.

Phytosociological table: 5 unpublished relevés, near Catania, Brullo, 2009-2010.
Char. association: *Ipomoea purpurea* (V).
Char. alliance, order and class: *Nicotiana glauca* (V), *Ricinus communis* (V), *Ipomoea indica* (II).
Other species: *Rubus ulmifolius* (V), *Euphorbia ceratocarpa* (IV), *Calystegia sylvatica* (IV), *Ailanthus altissima* (II), *Ferula communis* (III), *Ficus carica* (I).

Geographical distribution: This vegetation currently was surveyed only in Sicily, where it is spread in the eastern part of the island.

Structure and ecology: This association is localized in stands at low altitude, with very deep soils of volcanic origin, within the thermomediterranean sub-humid belt. It is differentiated by the occurrence of *Ipomoea purpurea*, native of Central America, which usually shows wide high coverage values, growing together with *Nicotiana glauca* and *Ricinus communis*.

Syndynamism: See class.

Habitat reference: See class.

29. Class: ***Polygono-Poetea annuae*** Rivas-Martínez 1975

Subcosmopolitan nitrophilous micro-therophytic vegetation of trampled soils.

Synonyms: *Coronopodo-Polygonetea avicularis* Lohmeyer 1970 (art. 3b); *Polygono-Poetea annuae* Rivas-Martinez in Géhu 1973 (art. 2d).

Holotypus: *Polygono-Poetalia annuae* Tüxen in Géhu, Richard & Tüxen 1972.

Characteristic and differential species: *Coronopus didymus* (L.) Sm., *Eleusine indica* (L.) Gaertn., *Euphorbia maculata* L., *Euphorbia prostrata* Aiton, *Plantago coronopus* L., *Poa annua* L., *Polygonum aviculare* L. s.l., *Polygonum arenastrum* Boreau, *Sagina apetala* Ard., *Spergularia rubra* (L.) J. & C. Presl.

Geographical distribution: This class has a subcosmopolitan distribution (Rivas-Martinez, 1975).

Structure and ecology: The pioneer communities with therophytic species of trampled surfaces are arranged within the *Polygono-Poetea annuae* class. This vegetation occurs mainly in rural roadsides, paths, gardens, pathways, edge of pavements, playgrounds and parking lots (Rivas-Martinez, 1975). The floristic set is constituted by several cosmopolitan or subcosmopolitan annual species, as well as by neophytes, which are characterized by a

ruderal or stress-tolerant life strategy (C4). In fact, most of these species shows a dwarf prostrate habitus with creeping stolons or leaf rosettes and results well adapted to seed dispersion through human or animal feet and vehicle wheels. Among them can be cited *Poa annua*, *Eleusine indica*, *Coronopus didymum*, *Euphorbia postrata*, *Sagina apetala*,, *Polygonum aviculare*, *P. arenastrum*, etc. (Brullo, 1980).

Syndynamism: This vegetation is linked to synanthropic habitats and has a piooner character, being linked to stands affected by a continuous disturbance that prevents any further evolution. In fact, the man's or animal's walking and vehicle driving causes the soil compaction and subsequently decreases the soil aeration and the access to soil water and nutrients. At the same time the trampling damages the above-ground vegetative organs of the plants (Frenkel, 1970; Blom, 1976). Only a few well adapted species are able to survive in these conditions. Therefore, these plants have a competitive advantage over species with fragile morphology, which are subject to damage by trampling (Carni & Mucina, 1998).

Habitat reference: See class.

29.1. Order: ***Polygono -Poetalia annuae*** R.Tx. in Gèhu, Richard & R.Tx. 1972

Subcosmopolitan nitrophilous micro-therophytic vegetation of trampled soils.

Synonyms: *Coronopodo-Polygonetalia* Lohmeyer 1970 (art.3b), *Polygono-avicularis-Poetalia annuae* R. Tx. in Géhu et al. 1972 (art.43); *Poo annuae-Polygonetalia arenastri* R. Tx. in Géhu et al. 1972 corr. Rivas-Martinez et al. 1991 nom. invers. propos.; *Bryo-Saginetalia procumbentis* Vicedo, Gomis, Alonso & de la Torre 1997; *Sagino apetalae-Polycarpetalia tetraphylli* de Foucault 2010.

Holotypus: *Saginion procumbentis* Tüxen & Ohba in Géhu, Richard & Tüxen 1972.

Characteristic and differential species: See class.

Geographical distribution: This class has a subcosmopolitan distribution (Mucina et al., 2016).

Structure and ecology: See class.

Syndynamism: See class.

Habitat reference: See class.

29.1.1. Alliance: ***Polycarpion tetraphylli*** Rivas-Martínez 1975

Thermophilous micro-therophytic vegetation in trampled sunny habitats of Mediterranean territories.

Holotypus: *Solivetum stoloniferae* Rivas-Martínez 1975.

Characteristic and differential species: *Amaranthus deflexus* L., *Euphorbia chamaesyce* L., *Herniaria cinerea* DC., *Matricaria aurea* (L.) Shultz-Bip., *Oxalis corniculata* L., *Polycarpon tetraphyllum* L.,, *Trifolium suffocatum* L.

Geographical distribution: This vegetation is widespread in the Mediterranean area (Rivas-Martinez, 1975; Biondi et al., 2014; Mucina et al., 2016).

Structure and ecology: The alliance at issue groups the thermophilous communities of trampled surfaces with sunny exposure and in areas with mild to warm winters (Costa et al., 2012). The structure of this vegetation is given by therophytes with spring or summer development, such as *Coronopus didymum*, *Plantago coronopus, Polycarpon tetraphyllum*, *Sagina apetala*, *Trifolium suffocatum*, etc.

Syndynamism: See class.

Habitat reference: See class.

29.1.1.1. ***Euphorbio chamaesyces-Oxalidetum corniculatae*** Lorenzoni 1964

Late micro-therophytic vegetation with small spurge and procumbent yellow sorrel of trampled habitats.

Holotypus: Last relevé, table 1, Lorenzoni (1964).

Characteristic and differential species: *Euphorbia chamaesyce* L., *Oxalis corniculata* L.

Phytosociological table: From Brullo (1980), table 4, rel. 10.

Char. association: *Oxalis corniculata* (V), *Euphorbia chamaesyce* (V).

Char. alliance: *Polycarpon tetraphyllum* (V), *Amaranthus deflexus* (IV).

Char. order and class: *Poa annua* (V), *Polygonum aviculare* s.l. (V), *Sagina apetala* (III), *Coronopus didymum* (I), *Plantago coronopus* (I).

Other species: *Conyza bonariensis* (V), *Cynodon dactylon* (IV), *Parietaria judaica* (IV), *Symphyotrichum squamatum* (IV), *Hordeum leporinum* (III), *Nothoscordum inodorum* (II).

Geographical distribution: This association was described by Lorenzoni (1964) for Veneto, but it is widespread in the euro-mediterranean territories (Carni & Mucina, 1998; Orellana & De Mera, 2003; Brullo et al., 2001; Šilc, 2006). Even in Sicily it is very frequent throughout the island (Brullo, 1980).

Structure and ecology: The association colonizes the small crevices of paving stones or cobbled surfaces, as well as the old stairways of church and historical buildings. It is a prostrate xerophilous vegetation with summer development, dominated by *Euphorbia chamaesyce* and *Oxalis corniculata*, growing together with some species of higher rank, as *Polycarpon tetraphyllum*, *Amaranthus deflexus*, *Poa annua*, *Polygonum aviculare*, *Sagina apetala* and *Coronopus didymum* (Brullo, 1980).

Syndynamism: During the winter-spring period this vegetation is replaced by the *Arabidopsio-Cardaminetum hirsutae*, but only limited to the cooler stands.

Habitat reference: See class.

29.1.1.2. ***Crassulo tillaeae-Saginetum apetalae*** Rivas-Martínez 1975

Micro-therophytic vegetation with mossy stonecrop and annual pearlwort of wet trampled habitats.

Lectotypus: rel. 3, tab. 5, Rivas-Martínez (1975), here designated.

Characteristic and differential species: *Tillaea muscosa* L. (= *Crassula tillaea* Lest.-Garl.).

Phytosociological table: From Brullo (1980), table 5, 5 rel.

Char. association: *Tillaea muscosa* (V).

Char. alliance: *Polycarpon tetraphyllum* (V), *Trifolium suffocatum* (V), *Veronica arvensis* (V), *Spergularia rubra* (II).

Char. order and class: *Poa annua* (V), *Sagina apetala* (V).

Other species: *Musci* (V), *Erodium cicutarium* (V), *Catapodium rigidum* (IV), *Trifolium tomentosum* (IV), *Capsella rubella* (IV), *Andryala integrifolia* (IV), *Trisetaria aurea* (II).

Geographical distribution: This syntaxon was described by Rivas-Martinez (1975) for the Iberian Peninsula. According to Brullo (1980), its Sicilian distribution is limited to Etna mountain.

Structure and ecology: The annual vegetation of quite humid trampling surfaces, as cracks of paved surfaces, paths and roads subject to frequent waterlogging, is ascribed to the *Crassulo-Saginetum apetalae* (Loidi, 2017). This community is characterized by the presence of a dense bryophytic layer, mixed with some ephemeral spring therophytes, as *Tillaea muscosa*, *Polycarpon tetraphyllum*, *Trifolium suffocatum*, *Veronica arvensis*, *Spergularia rubra*, etc. Besides, the class is represented by *Sagina apetala* and *Poa annua*.

Syndynamism: This vegetation replaces the *Trisetario aureae-Crepidetum bursifoliae* in the more humid and disturbed stands (Brullo, 1980).

Habitat reference: See class.

29.1.1.3. ***Polycarpo tetraphylli-Spergularietum rubrae*** Brullo & Marcenò 1976

Micro-therophytic vegetation with red sand-spurry and four-leaved allseed of incoherent trampled soils.

Holotypus: rel. 18, tab. 1, Brullo & Marcenò (1976).

Characteristic and differential species: *Arenaria leptoclados* (Reich.) Guss., *Minuartia mediterranea* (Link) Mali.

Phytosociological table: From Brullo & Marcenò (1976), table 1, 21 rel.
Char. association: *Minuartia mediterranea* (IV), *Arenaria leptoclados* (II).
Char. alliance: *Polycarpon tetraphyllum* (V), *Spergularia rubra* (V), *Herniaria cinerea* (II).
Char. order and class: *Sagina apetala* (V), *Poa annua* (II), *Plantago coronopus* (II).
Other species: *Catapodium rigidum* (V), *Plantago afra* (III), *Parapholis incurva* (III), *Filago pyramidata* (III), *Evax pygmaea* (II), *Silene nocturna* (II).

Geographical distribution: This vegetation occurs only in Sicily, where it is quite frequent throughout the island, including some nearby islets as Lampedusa, Linosa and Aeolian islands (Brullo & Marcenò, 1976; Brullo, 1980; Bartolo et al., 1988; Brullo & Furnari, 1990; Brullo & Siracusa, 1996; Corbetta et al., 2002). Besides, it occurs also in Southern Italy (Brullo et al., 2001).

Structure and ecology: The *Polycarpo tetraphylli-Spergularietum rubrae* is a therophytic vegetation, which occurs along the roadsides or in the paths, where the soil has a significant sandy component mixed with gravels. Originally, Brullo & Marcenò (1976) referred this syntaxon to *Thero-Brachypodietea* class, while later Brullo (1980) reported it to *Polygono-Poetea*, emphasizing the xerophilic character of this association and the scarce presence of the more mesophilous species of the latter class, such as *Poa annua* and *Polygonum aviculare* and on the contrary the high coverage of the more thermophilous species, such as *Sagina apetala*, *Spergularia rubra* and *Polycarpon tetraphyllum*. Besides, *Minuartia mediterranea* and *Arenaria leptoclados* are considered as differential species of this community, being ephemeral plants typical of dry and barren soils.

Syndynamism: If over time the soil is enriched by the silty-clay component, this vegetation tends to evolve towards the *Trisetario-Crepidetum bursifoliae*, a more stable and floristically rich community (Brullo, 1980).

Habitat reference: See class.

29.1.1.4. ***Trisetario aureae-Crepidetum bursifoliae*** Brullo 1980

Micro-therophytic vegetation with golden oat and Italian hawksbeard of sunny trampled habitats.

Holotypus: rel. 17, tab. 1, Brullo (1980).

Characteristic and differential species: *Crepis bursifolia* L., *Trisetaria aurea* (Ten.) Pignatti, *Crepis neglecta* L. subsp. *corymbosa* (Ten.) Nyman.

Phytosociological table: From Brullo (1980), table 1, 24 rel.

Char. association: *Crepis bursifolia* (V), *Trisetaria aurea* (V), *Crepis neglecta* subsp. *corymbosa* (II).

Char. alliance: *Polycarpon tetraphyllum* (V), *Amaranthus deflexus* (IV), *Spergularia rubra* (IV), *Herniaria cinerea* (II), *Trifolium suffocatum* (I), *Oxalis corniculata* (I).

Char. order and class: *Poa annua* (V), *Polygonum aviculare* (V), *Sagina apetala* (V), *Plantago coronopus* (I), *Coronopus didymum* (II).

Other species: *Cynodon dactylon* (IV), *Conyza bonariensis* (IV), *Rostraria cristata* (IV), *Catapodium rigidum* (IV), *Hordeum leporinum* (IV), *Plantago serraria* (III), *Parietaria judaica* (III), *Symphyotrichum squamatum* (III), *Veronica arvensis* (II).

Geographical distribution: This community is restricted to Calabria (Brullo et al., 2001; Passalacqua et al., 2007) and Sicily, where it is widespread (Brullo, 1980; Gianguzzi et al., 2005, 2009; Guglielmo et al., 2006; Minissale et al., 2007).

Structure and ecology: The *Trisetario-Crepidetum bursifoliae*, colonizing sunny trumpled surfaces, is a dwarf annual community with spring development. This community occurs mainly on the edges of country roads, as well as in paths, gardens and cracks between paved surfaces. Under the floristic profile, it is characterized by the dominance of *Trisetaria aurea*, which is usually found in semi-rupestrian habitats, and *Crepis bursifolia*, an endemic species of southern Italy and Sicily. The other differential species, *Crepis neglecta* subsp. *corymbosa*, results quite rare in Sicily and occurs only in this community. The alliance is represented by *Polycarpon tetraphyllum*, *Amaranthus deflexus*, *Spergularia rubra*, *Veronica arvensis*, *Herniaria cinerea*, *Plantago coronopus*, etc., while *Poa annua*, *Polygonum aviculare*, *Sagina apetala* and *Coronopus didymum* belong to the class (Brullo et al., 1980).

Syndynamism: See class.

Habitat reference: See class.

29.1.1.5. ***Arabidopsio thalianae-Cardaminetum hirsutae*** Brullo 1980

Micro-therophytic vegetation with thale cress and hairy bittercress of shady trampled habitats.

Holotypus: rel. 4, tab. 3, Brullo (1980).

Characteristic and differential species: *Arabidopsis thaliana* (L.) Heynh., *Arabis verna* (L.) R. Br., *Cardamine hirsuta* (L.), *Erophila verna* (L.) Chevall subsp. *verna.*

Phytosociological table: From Brullo (1980), table 3, 13 rel.

Char. association: *Cardamine hirsuta* (V), *Arabidopsis thaliana* (V), *Erophila verna* subsp. *verna* (V), *Arabis verna* (II).

Char. alliance: *Polycarpon tetraphyllum* (V), *Trifolium suffocatum* (II), *Oxalis corniculata* (I).

Char. order and class: *Poa annua* (V), *Sagina apetala* (V).

Other species: *Musci* (V), *Stellaria media* (V), *Senecio vulgaris* (V), *Veronica arvensis* (IV), *Catapodium rigidum* (III), *Rostraria cristata* (III), *Capsella rubella* (III), *Parietaria judaica* (II), *Veronica persica* (II), *Euphorbia peplus* (II).

Geographical distribution: This community is quite frequent in Sicily and probably also in Italy (Brullo, 1980; Gueli & Lo Giudice, 2007; Minissale et al., 2007).

Structure and ecology: The shady and cool trampled stands, mainly garden paths with gravel or clayey soils, are colonized by a ephemeral vegetation with late winter-early spring optimum. This community, described by Brullo (1980) as *Arabidopsio-Cardaminetum hirsutae*, is dominated by small annual Brassicaceae, as *Cardamine hirsuta*, *Arabidopsis thaliana*, *Erophila verna* subsp. *verna* and *Arabis verna*, which grow on a dense moss layer. Besides, the syntaxa of higher rank are represented by *Poa annua*, *Polycarpon tetraphyllum*, *Trifolium suffocatum*, etc.

Syndynamism: The vegetation at issue replaces the *Trisetario aureae-Crepidetum bursifoliae* in places with more mesophilous conditions. During the summer this vegetation tends to disappear completely and sometimes is replaced by the *Euphorbio chamaesyces-Oxalidetum corniculatae* (Brullo, 1980).

Habitat reference: See class.

29.1.1.6. ***Galio muralis-Cotuletum australis*** Guarino, Lo Cascio, Mustica & Pasta 2018

Micro-therophytic vegetation with small goosegrass and annual buttonweed of basepoor siliceous trampled soils.

Holotypus: rel. 1, tab. 1, Guarino (2018).

Characteristic and differential species: *Cotula australis* (Sieber ex Spreng.) Hook., *Galium murale* (L.) All.

Phytosociological table: From Guarino et al. (2018), table 1, 5 rel.

Char. association: *Cotula australis* (V), *Galium murale* (V).

Char. alliance: *Spergularia rubra* (III), *Trifolium suffocatum* (III), *Polycarpon tetraphyllum* (II), *Oxalis corniculata* (I).

Char. order and class: *Sagina apetala* (V), *Poa annua* (IV), *Plantago coronopus* (III).

Other species: *Catapodium rigidum* (IV), *Stellaria media* (III), *Hypochoeris achyrophorus* (III), *Mercurialis annua* (III), *Sonchus oleraceus* (III), *Silene gallica* (II).

Geographical distribution: This community was surveyed only in Lipari, Aeolian Islands (Guarino et al., 2018).

Structure and ecology: The *Galio muralis-Cotuletum australis* is a rare dwarf vegetation restricted to the interstices of the cobblestones of Lipari acropolis, colonizing volcanic sands. It is characterized by the dominance of *Cotula australis*, a prostrate creeping herbs native to Australia and only recently reported as naturalized for Sicily by Guarino et al. (2018), growing together with some therophytes and small perennial herbs with wide distribution, as *Galium murale*, *Poa annua*, *Sagina apetala*, *Spergularia rubra*, *Plantago coronopus* subsp. *commutata*, *Trifolium suffocatum*, etc.

Syndynamism: See class.

Habitat reference: See class.

30. Class: ***Papaveretea rhoeadis*** Brullo, Scelsi & Spampinato 2001

Annual weed segetal vegetation of cereal fields.

Synonyms: *Ruderali-Secalietea* Br.-Bl. in Br.-Bl., Gajevscki, Wraber & Walas 1936 p.p. nom. inval. (art. 3f); *Secalietea* Br.-Bl. in Br.-Bl., Roussine & Negre 1952 nom. inval. (art. 3f); *Stellarietea mediae* R. Tx. et al. in R. Tx. 1950 p.p. (art. 2b); *Stellarietea mediae* R.Tx. et al. in R.Tx. ex von Rochow 1951 p.p. nom. ambig. (art. 36).

Holotypus: *Papaveretalia rhoeadis* Hüppe & Hofmeister ex Theurillat et al. 1995 em. Brullo et al. 2001.

Characteristic and differential species: *Agrostemma githago* L.*, Avena barbata* Pott ex Link, *Buglossoides arvensis* (L.) I. M. Johnst., *Bupleurum fontanesii* Guss. Ex Caruel*, Galium tricornutum* Dandy*, Legousia falcata* (Ten.) Fritsch, *Muscari comosum* (L.) Mill., *Lolium rigidum* Gaud.*, L. temulentum* L., *Medicago ciliaris* (L.) Krock., *Neslia apiculata* Fisch., C.A. Mey. & Ave'-Lall, *Papaver dubium* L., *P. hybridum* L., *P. rhoeas* L., *Ranunculus arvensis* L., *Sinapis arvensis* L., *Vicia villosa* Roth subsp. *varia* (Host) Corb.

Geographical distribution: This class has a wide distribution in the Eurasian territories, showing its greater diversification in the Mediterranean area (Brullo et al., 2001).

Structure and ecology: The thermophilous segetal vegetation of cereal fields was ascribed by Braun Blanquet into the *Secalietea* class, which however is an invalid syntaxon from the nomenclatural point of view since there are no species of the genus *Secale* in the tables quoted by the author. Brullo et al. (2001) proposed the new name *Papaveretea rhoeadis* for this vegetation, highlighting its floristic and ecological autonomy compared to the *Chenopodietea* class, which brings together the nitrophilous or ruderal communities of crops, garden and

roadsides. The structure of this vegetation is given by therophytes and to a lesser extent also geophytes, having a spring cycle almost synchronized with cultivated species. Considering that the cultivation of cereals began 10 thousand years ago, the flora of these environments is quite rich and specialized, often with a significant phytogeographic interest (Ferro, 1990; Brullo & Guarino, 2007). According to some authors (Zohary, 1950; Brullo, 1983aa), the floristic set of these communities is constituted mainly by four kinds of species: 1. obligate weed species (e.g. *Agrostemma githago*, *Neslia apiculata*, *Papaver* sp. pl., *Cephalaria syriaca*, *Legousia falcata*) are archaeophytes that grows only in cereal fields; 2. facultative weed species occurs also in grasslands and meadows (e.g. *Muscari comosum*, *Bupleurum fontanesii*, *Vicia villosa* subsp. *varia*); 3. pseudo-facultative weed species can colonize also other types of anthropized environment (e.g. *Sinapis arvensis*, *Ranunculus arvensis*, *Avena barbata*); 4. not segetal species, which grew in the natural habitat before cultivation and persist as relict plants.

Syndynamism: This vegetation has a pioneer character and can rapidly colonize a field, competing with the cultivated species. However, the use of herbicides in agriculture has led to the rarefaction and disappearance of a large part of the segetal flora (Brullo et al., 2001).

Habitat reference: 1.3 Arable land with unmixed crops grown by low-intensity agricultural methods.

30.1. Order: ***Aperetalia spicae-venti*** R. & J. Tx. in Malato-Beliz et al. 1960

Weed vegetation of cereal fields on acidic and nutrient-poor soils.

Synonyms: *Spergularietalia arvensis* Hüppe & Hofmeister 1990 p.p.; *Centauretalia cyani* R. Tx. ex von Rochow 1951, p.p.

Holotypus: *Scleranthion annui* (Kruseman & Vlieger 1939) Sissingh in Westhoff, Dijk & Passchier 1946.

Characteristic and differential species: *Arabidopsis thaliana* (L.) Heynh., *Cerastium glomeratum* Thuill., *Fallopia convolvulus* (L.) Á. Löve, *Lathyrus sativus* L.*, Veronica arvensis* L.*, Veronica hederifolia* L.*.*

Geographical distribution: This syntaxon has its higher diversity in Central and Western Europe, but occurs also in the Mediterranean area (Malato-Beliz et al., 1960). In Sicily is restricted to the North-Eastern part (Bartolo et al. 1988, Guarino, 1997).

Structure and ecology: This order groups the therophitic weedy communities of crops with siliceous loamy and sandy soils. It is a vegetation with winter-spring development, occurring within the meso- and supramediterranean humid bioclimatic belts (Brullo et al., 2007).

Syndynamism: It is dynamically linked to the series of *Erico-Quercion ilicis*.

Habitat reference: See class.

30.1.1. Alliance: ***Scleranthion annui*** (Kruseman & Vlieger 1939) Sissingh in Westhoff et al. 1946

Weed segetal vegetation of winter cereal crops on neutral to acidic loamy and sandy-loamy soils.

Synonyms: *Agrostion spicae-venti* R. Tx. 1947 (art. 2b); *Aperion spicae-venti* R. Tx. ex Oberd. 1949 (syntax.syn.)*; Agrostion spicae-venti* R. Tx. ex von Rochow 1951 (syntax. syn.)*; Aperion spicae-venti* Tx. ex Oberd. 1957 (art. 31); *Aphanion arvensis* J.Tx. & R.Tx. in Malato-Beliz et al. 1960 (syntax.syn.); *Arnoseridion minimae* Malato-Beliz et al. 1960 (syntax. syn.); *Arabidopsion thalianae* Passarge 1964 (syntax. syn.).

Holotypus: *Aphanes arvensis-Matricarietum chamomillae* Tüxen 1937 num. mut.

Characteristic and differential species: *Anthemis arvensis* L. *subsp. arvensis, Scleranthus annuus* L.

Geographical distribution: See order.

Structure and ecology: The order *Aperetalia spicae-venti* includes the only alliance *Scleranthion annui*, which in Sicily is represented by the suballiance *Scleranthenion*. This syntaxon gathers the segetal communities with winter-spring development of base-poor sandy soils (Brullo et al., 2007).

Syndynamism: See order.

Habitat reference: See class.

30.1.1.1. ***Legousio speculum-veneris-Brizetum minoris*** Brullo & Furnari 1982 in Barbagallo et al. 1982

Weed segetal vegetation with spicate venus's looking glass and lesser quaking-grass of cereal crops on acidic sandy soils.

Holotypus: rel. 6, tab. 7, Barbagallo et al. (1982).

Characteristic and differential species: *Briza minor* L., *Bunias erucago* L.

Phytosociological table: From Bartolo et al. (1988), table 1, 8 rel.

Char. association: *Briza minor* (V), *Bunias erucago* (I).

Char. alliance and order: *Arabidopsis thaliana* (V), *Cerastium glomeratum* (IV), *Veronica hederifolia* (IV), *Veronica arvensis* (I), *Fallopia convolvulus* (I), *Raphanus raphanistrum* (I).

Char. class: *Vicia sativa* (IV), *Lolium rigidum* (IV), *Papaver rhoeas* (III), *Legousia falcata* (III), *Catapodium rigidum* (III), *Anthemis arvensis* (III), *Scandix pecten-veneris* (III), *Gladiolus segetum* (III), *Papaver hybridum* (III), *Torilis nodosa* (III), *Sinapis arvensis* (I), *Lathyrus sativus* (I), *Asperula arvensis* (I), *Agrostemma githago* (I), *Bifora testiculata* (I), *Leopoldia comosa* (I).

Other species: *Capsella rubella* (V), *Medicago hispida* (V), *Poa sylvicola* (V), *Stellaria media* (V), *Galinsoga parviflora* (V), *Avena barbata* (V), *Euphorbia peplus* (IV), *Glebionis segetum* (III), *Trifolium campestre* (III).

Geographical distribution: This association currently is known from Calabria (Barbagallo et al., 1982) and Sicily, where it was surveyed by Bartolo et al. (1988) in the Fiumedinisi valley (Peloritani mountains).

Structure and ecology: The *Legousio-Brizetum minoris* is a very peculiar segetal vegetation under the floristic profile, being characterized by some species with quite mesophilous requirements, as *Briza minor*, *Arabidopsis thaliana*, *Veronica arvensis*, *V. hederifolia*, *Fallopia convolvulus*, *Bunias erucago*, *Poa sylvicola*, *Galinsoga parviflora*, etc. Usually, this community is found in cereal fields (mainly *Triticum aestivum*) rotated with horticultural crops, like potatoes and legumes. It is linked to acidic and relatively humid sandy soils, within the meso- and supramediterranean subhumid bioclimatic belts (Bartolo et al., 1988).

Syndynamism: See order.

Habitat reference: See class.

30.2. Order: ***Papaveretalia rhoeadis*** Hüppe & Hofmeister ex Theurillat et al. 1995 em. Brullo, Scelsi & Spampinato 2001

Weed segetal vegetation of arable crops on base-rich soils.

Synonyms: *Secalietalia* Libbert 1932 (art. 3f); *Secalino-Violetalia* Br.-Bl. & R. Tx. 1943 (orig. form) (art. 3f); *Secalino-Violetalia* Br.-Bl. & R. Tx. ex Sissingh in Westhoff et al. 1946 (orig.form) (art.3f); *Papaveretalia rhoeadis* Hüppe & Hofmeister 1990 (art. 5); *Stachyetalia annuae* Ries 1992 (art. 5); *Papaveretalia rhoeadis* Hüppe & Hofmeister ex Manthey in Dengler et al. 2003 (art. 31).

Holotypus: *Caucalidion lappulae* Tüxen ex von Rochow 1951.

Characteristic and differential species: *Allium nigrum* L., *Anacyclus tomentosus* DC., *Coronilla scorpioides* (L.) W.D.J.Koch, *Euphorbia falcata* L., *Filago germanica* L., *F. pyramidata*

L.*, Galium verrucosum* Huds.*, Geropogon hybridus* (L.) Sch. Bip., *Gladiolus italicus* Mill.*, Lathyrus cicera* L.*, L. ochrus* (L.) DC.*, Lolium multiflorum* Lam., *Melilotus sulcatus* Desf.*, Misopates orontium* (L.) Raf., *Nigella damascena* L.*, Polygonum patulum* M. Bieb*, Rapistrum rugosum* (L.) All.*, Rhagadiolus stellatus* (L.) Gaertn., *Silene fuscata* Brot., *Valerianella eriocarpa* Desv., *Valerianella microcarpa* Loisel.

Geographical distribution: The order at issue is widely distributed in Europe and in particular in the Mediterranean area. In Sicily it is widespread throughout the island and nearby islets (Brullo et al., 2007).

Structure and ecology: The segetal communities of neutral to basic soils, like limestone, clay and sometimes basalt, are ascribed to *Papaveretalia rhoeadis* order. This vegetation occurs from the termo- to supramediterranean humid bioclimatic belts (Brullo et al., 2001, 2007).

Syndynamism: It is dynamically linked to the series of *Quercetea ilicis.*

Habitat reference: See class.

30.2.1. Alliance: ***Ridolfion segeti*** Négre ex Rivas-Martínez et al. 1999

Weed segetal vegetation of arable crops on neutral loamy-clayey soils in the thermo- and mesomediterranean belts.

Synonyms: *Ridolfion segeti* Négre 1977 (art. 2b); *Ridolfion segeti* Négre ex El Antri 1983 (art. 5).

Holotypus: *Ridolfio segeti-Capnophylletum peregrini* Guinochet 1978.

Characteristic and differential species: *Adonis microcarpa* DC., *Bupleurum lancifolium* Hornem., *Phalaris paradoxa* L.*, Ridolfia segetum* Moris, *Silene diversifolia* Otth.

Geographical distribution: This alliance is distributed in Central and Western Mediterranean area (Brullo et al., 2001).

Structure and ecology: The syntaxon at issue groups the therophitic weedy vegetation with spring development of arable crops, growing on neutral to slightly basic loamy or clayish soils, within thermo- to lower mesomediterranean belts (Costa et al., 2012).

Syndynamism: It is connected with the dynamyc series of *Quercetalia calliprini* (Brullo et al., 2007).

Habitat reference: See class.

30.2.1.1. ***Capnophyllo peregrini-Medicaginetum ciliaris*** Di Martino & Raimondo 1976

Thermo-xerophilous segetal vegetation with capnophyllum and ciliate medick of cereal crops on clayish soils.

Holotypus: Not designated.

Characteristic and differential species: *Capnophyllum peregrinum* (L.) Lag.*, Medicago ciliaris* (L.) Krock.*, Medicago intertexta* (L.) Miller, *Melilotus siculus* (Turra) Steud., *Ranunculus trilobus* Desf.*, Scorpiurus vermiculatus* L.

Phytosociological table: From Di Martino & Raimondo (1976), table 2, 20 rel.

Char. association: *Medicago ciliaris* (IV), *Capnophyllum peregrinum* (III), *Ranunculus trilobus* (III), *Melilotus siculus* (III), *Scorpiurus vermiculatus* (II), *Medicago intertexta* (I).

Char. alliance: *Phalaris paradoxa* (V), *Ridolfia segetum* (V), *Bupleurum lancifolium* (III), *Adonis microcarpa* (I).

Char. order: *Silene fuscata* (V), *Melilotus sulcatus* (V), *Bupleurum fontanesii* (IV), *Polygonum patulum* (IV), *Galium tricornutum* (III), *Lathyrus ochrus* (II), *Lolium multiflorum* (II), *Filago pyramidata* (II), *Ranunculus arvensis* (II), *Allium nigrum* (II), *Nigella damascena* (I), *Lolium temulentum* (I), *Misopates orontium* (I), *Valerianella microcarpa* (I), *Rapistrum rugosum* (I), *Anacyclus tomentosus* (I).

Char. class: *Phalaris canariensis* subsp. *canariensis* (IV), *Phalaris canariensis* subsp. *brachystachys* (IV), *Anagallis arvensis* (IV), *Avena barbata* (IV), *Papaver rhoeas* (IV), *Sherardia arvensis* (III), *Sinapis arvensis* (III), *Gladiolus segetum* (III), *Vicia sativa* subsp. *macrocarpa* (III), *Scandix pecten-veneris* (II), *Ornithogalum pyramidale* (II), *Papaver hybridum* (II), *Lolium rigidum* (I), *Leopoldia comosa* (I), *Legousia falcata* (I),

Other species: *Helminthotheca echioides* (V), *Kickxia spuria* subsp. *integrifolia* (V), *Sonchus oleraceus* (IV), *Euphorbia exigua* (IV).

Geographical distribution: This vegetation is quite rare in western and southern Sicily, as well as near Catania (Di Martino & Raimondo, 1976; Bartolo et al., 1983; Ferro. 1990)

Structure and ecology: The segetal vegetation of cereal fields (*Triticum durum*) found on clayish alluvial or vertic soils with alkaline pH, is attributed to the *Capnophyllo peregrini-Medicaginetum ciliaris*. It is a weed community dominated by *Phalaris paradoxa* and *Ridolfia segetum*, growing together with some xerophilous taxa, as *Medicago ciliaris*, *Capnophyllum peregrinum*, *Ranunculus trilobus*, *Melilotus siculus*, *Scorpiurus vermiculatus* and *Medicago intertexta*, which represent the characteristic species. Infact, this thermophilous association occurs within the thermediterranean dry to subhumid bioclimatic belt and can be considered a geographical vicariant of *Ridolfio segeti-Capnophylletum peregrini* Guinochet 1977, from Tunisia, and *Capnophylletum peregrini* El Antri & Montégut ex Ferro 1990, from Morocco (Brullo et al., 2007).

Syndynamism: See order.

Habitat reference: See class.

30.2.1.2. ***Calendulo tripterocarpae-Hypecoetum procumbentis*** Bartolo, Brullo, Miniss. & Spamp. 1990

Thermo-xerophilous segetal vegetation with three-winged marigold and sickle-fruited hypecoum of red soils.

Holotypus: rel. 4, tab. 27, Bartolo et al. (1990a).

Characteristic and differential species: *Calendula tripterocarpa* Rupr., *Hypecoum procumbens* L.

Phytosociological table: From Bartolo et al. (1990), table 27, 6 rel.

Char. association: *Calendula tripterocarpa* (V), *Hypecoum procumbens* (V).

Char. alliance and order: *Galium verrucosum* (V), *Adonis microcarpa* (V), *Papaver hybridum* (V), *Gladiolus segetum* (IV), *Nigella damascena* (IV), *Lathyrus ochrus* (III), *Coronilla scorpioides* (III), *Rhagadiolus stellatus* (II), *Leopoldia comosa* (II), *Lathyrus cicera* (I), *Silene diversifolia* (I).

Char. class: *Scandix pecten-veneris* (V), *Papaver rhoeas* (IV), *Torillis nodosa* (IV), *Lolium rigidum* (III), *Papaver dubium* (I).

Other species: *Melilotus sulcata* (V), *Sherardia arvensis* (V), *Anagallis arvensis* (V), *Oxalis pes-caprae* (IV).

Geographical distribution: This vegetation is restricted to Lampedusa and Malta, where it is quite rare (Bartolo et al., 1990; Brullo et al., 2020).

Structure and ecology: The *Calendulo tripterocarpae-Hypecoetum procumbentis* is a thermoxerophilous weedy vegetation found on red soils of limestone, within the thermediterranean dry bioclimatic belt (Bartolo et al., 1990). Under the floristic profile, is a very peculiar community, since some rare species for Sicily, as *Calendula tripterocarpa* and *Hypecoum procumbens*, are restricted to this habitat. The *Ridolfion segeti* and higher syntaxa are represented by several species, such as *Galium verrucosum*, *Adonis microcarpa*, *Papaver hybridum*, *Gladiolus segetum*, *Nigella damascena*, *Scandix pecten-veneris*, *Papaver rhoeas*, etc.

Syndynamism: This association is linked to the dynamic series of *Periplocion angustifoliae* (Brullo et al., 2007).

Habitat reference: See class.

30.2.2. Alliance: ***Roemerion hybridae*** Rivas-Martinez, Fernàndez Gonzàlez & Loidi in Loidi et al. 1997

Weed segetal vegetation of arable crops on basic substrates in the meso- and supramediterranean belts.

Synonyms: *Secalion* Br.-Bl. 1931 (art. 2b, 3f); *Secalion* Br.-Bl. in Br.-Bl. et al. 1936 (art. 3f)*; Secalion mediterraneum* R. Tx. 1937 (art. 3f); *Austro-Secalinion* Rothmaler 1943 (2b); *Secalinion orientale* Oberd. 1954 (art. 3f); *Veronico chaubardii-Scandicion graecae* Ferro & Scammacca 1985 (syntax.syn.); *Vicio narbonensis-Milion vernalis* Ferro & Scammacca 1985 (syntax.syn.).

Holotypus: *Caucalido platycarpae-Scandicetum pectenveneris* Libbert ex Tüxen 1937.

Characteristic and differential species: *Anchusa azurea* Mill.*, Bifora testiculata* (L.) Spreng.*, Buglossoides arvensis* (L.) I. M. Johnst.*, Linaria chalepensis* (L.) Mill.*, L. triphylla* (L.) Mill.*, Neslia paniculata* (L.) Desv. subsp. *tracica* (Velen.) Bornm.

Geographical distribution: This alliance is distributed mainly in Central and Western Mediterranean territories (Costa et al., 2012).

Structure and ecology: The syntaxon at issue includes the therophitic weedy vegetation of basic loamy or clayish soils, preferably in the upper meso- to supramediterranean thermotypes (Brullo et al., 2007). However, it may be present also in the thermo- and lower mesomediterranean belts with humid ombrotypes (Bartolo et al., 1983; Ferro, 1988; 1990, 2005; Lo Cicero & Piccione, 1977).

Syndynamism: It is connected with the dynamyc series of *Quercetalia ilicis* (Brullo et al., 2007).

Habitat reference: See class.

30.2.2.1. ***Legousio hybridae-Biforetum testiculatae*** Di Martino & Raimondo 1976

Segetal vegetation with venus's looking-glass and european bishop of brown to vertic soils.

Holotypus: Not designated.

Characteristic and differential species: *Legousia hybrida* (L.) Delarbre

Phytosociological table: From Di Martino & Raimondo (1976), table 1, 25 rel.

Char. association: *Legousia hybrida* (V).

Char. alliance: *Bifora testiculata* (V), *Linaria chalepensis* (II), *Anchusa azurea* (I), *Neslia paniculata* subsp. *thracica* (I).

Char. order: *Galium tricornutum* (V), *Silene fuscata* (V), *Ranunculus arvensis* (V), *Lolium multiflorum* (V), *Polygonum patulum* (IV), *Melilotus sulcatus* (IV), *Misopates orontium* (IV), *Nigella damascena* (III), *Allium nigrum* (III), *Coronilla scorpioides* (III), *Anacyclus tomentosus*

(III), *Bupleurum fontanesii* (III), *Rhagadiolus stellatus* (II), *Lathyrus ochrus* (I), *Lolium temulentum* (I), *Geropogon glaber* (I), *Valerianella eriocarpa* (I), *Valerianella microcarpa* (I). Char. class: *Scandix pecten-veneris* (V), *Papaver rhoeas* (V), *Lysimachia foemina* (V), *Avena barbata* (V), *Phalaris canariensis* subsp. *canariensis* (V), *Anagallis arvensis* (IV), *Papaver hybridum* (IV), *Legousia falcata* (IV), *Gladiolus italicus* (IV), *Vicia sativa* subsp. *macrocarpa* (IV), *Sinapis arvensis* (IV), *Catapodium ridigum* (III), *Lolium rigidum* (III), *Ornithogalum pyramidale* (III), *Muscari comosum* (III), *Sherardia arvensis* (II), *Glebionis segetum* (II), *Rhaphanus raphanistrum* (I), *Anthemis arvensis* (I), *Calendula arvensis* (I).

Other species: *Phalaris paradoxa* (V), *Ridolfia segetum* (V), *Helminthoteca echioides* (V), *Torillis nodosa* (V).

Geographical distribution: This community occurs mainly in the inner areas of central Sicily and in particular in the Agrigentine district, with some scattered stands in the Drepano-Panormitan and Madonie ones (Di Martino & Raimondo, 1976; Ferro, 1990).

Structure and ecology: The *Triticum durum* crops growing on brown to vertic soils, with neutral to subalkaline pH, are infested by a therophitic weedy vegetation, named *Legousio hybridae-Biforetum testiculatae*. This community is found within within the thermo- and mesomediterranean bioclimatic belts (Brullo et al., 2007). It is characterized by the high coverage of *Legousia hybrida*, which is associated with some species belonging to *Roemerion hybridae* alliance, as *Bifora testiculata*, *Linaria chalepensis*, *Anchusa azurea*, *Neslia paniculata* subsp. *thracica*. The order and the class are represented by several taxa, among them *Galium tricornutum*, *Silene fuscata*, *Ranunculus arvensis*, *Lolium multiflorum*, *Polygonum patulum*, *Melilotus sulcatus*, *Misopates orontium*, etc. (Di Martino & Raimondo, 1976).

Syndynamism: See alliance.

Habitat reference: See class.

30.2.2.2. ***Adonido cupanianae-Anthemidetum incrassatae*** Bartolo et al. 1983

Segetal vegetation with Cupani's pheasant's-eye and corn chamomile of brown soils deriving from Miocenic limestones.

Holotypus: rel. 3, tab. 1, Bartolo et al. (1983).

Characteristic and differential species: *Adonis annua* L. subsp. *cupaniana* (Guss.) C.Steinb., *Allium trifoliatum* Cirillo, *Anthemis arvensis* L. subsp. *incrassata* (Loisel.) Nyman, *Rumex acetosella* L., *Silene vulgaris* (Moench) Garcke subsp. *angustifolia* Hayek, *Vicia peregrina* L.

Phytosociological table: From Bartolo et al. (1983), table 1, 18 rel.

Char. association: *Anthemis arvensis* subsp. *incrassata* (V), *Adonis annua* subsp. *cupaniana* (V), *Silene vulgaris* subsp. *angustifolia* (V), *Rumex acetosella* (IV), *Vicia peregrina* (III), *Allium trifoliatum* (II).

Char. alliance: *Neslia paniculata* subsp. *thracica* (V), *Bifora testiculata* (V), *Linaria triphylla* (IV), *Linaria chalepensis* (II), *Buglossoides arvensis* (I),

Char. order: *Galium tricornutum* (V), *Nigella damascena* (V), *Filago pyramidata* (V), *Rhagadiolus stellatus* (V), *Gladiolus italicus* (IV), *Melilotus sulcatus* (IV), *Misopates orontium* (IV), *Euphorbia falcata* (IV), *Allium nigrum* (IV), *Coronilla scorpioides* (III), *Lolium temulentum* (II), *Valerianella eriocarpa* (II), *Valerianella microcarpa* (II), *Geropogon glaber* (II), *Lathyrus ochrus* (II), *Ranunculus arvensis* (II), *Silene fuscata* (I), *Lathyrus cicera* (I), *Polygonum patulum* (I), *Bupleurum fontanesii* (I).

Char. class: *Scandix pecten-veneris* (V), *Papaver rhoeas* (V), *Avena barbata* (V), *Lolium rigidum* (V), *Muscari comosum* (V), *Sherardia arvensis* (V), *Sinapis arvensis* (IV), *Phalaris canariensis* subsp. *canariensis* (IV), *Vicia sativa* subsp. *sativa* (IV), *Glebionis segetum* (IV), *Papaver hybridum* (IV), *Anagallis arvensis* (IV), *Catapodium ridigum* (IV), *Vicia lutea* (III), *Rhaphanus raphanistrum* (III), *Orlaya daucoides* (II), *Ornithogalum pyramidale* (II), *Calendula arvensis* (II), *Agrostemma githago* (I), *Papaver dubium* (I),

Other species: *Legousia hybrida* (V), *Fumaria officinalis* (V), *Hypericum triquetrifolium* (V), *Bupleurum lancifolium* (V).

Geographical distribution: This vegetation is restricted to the Hyblaean area (Bartolo et al., 1983; Ferro, 1990).

Structure and ecology: The *Adonido cupanianae-Anthemidetum incrassatae* is a therophitic weedy vegetation, occurring on brown soils deriving from Miocenic limestones, within the thermo- and mesomediterranean belts (Brullo et al., 2007). The structure of this vegetation is given by *Anthemis arvensis* subsp. *incrassata*, *Adonis annua* subsp. *cupaniana* and *Silene vulgaris* subsp. *angustifolia*, growing together with some species of alliance, as *Neslia paniculata* subsp. *thracica*, *Bifora testiculata*, *Linaria triphylla, Linaria chalepensis* and *Buglossoides arvensis*. The syntaxa of higher rank are well represented by *Scandix pecten-veneris*, *Papaver rhoeas*, *Avena barbata*, *Lolium rigidum*, *Muscari comosum*, *Sherardia arvensis*, *Sinapis arvensis*, *Scandix pecten-veneris*, *Papaver rhoeas*, *Avena barbata*, *Lolium rigidum*, *Muscari comosum*, etc.

Syndynamism: This association belongs to the dynamic series of *Oleo-Quercetum virgilianae* and *Pistacio-Quercetum ilicis*.

Habitat reference: See class.

30.2.2.3. ***Vicio bithynicae-Ranunculetum arvensis*** Bartolo et al. 1983

Segetal vegetation with bithynian vetch and corn buttercup of andosoils deriving from basaltic rocks.

Holotypus: rel. 3, Tab. 2, Bartolo et al. (1983).

Characteristic and differential species: *Vicia bithynica* (L.) L.*, Poa trivialis* L.*, Asperula arvensis* L.*, Trisetaria parviflora* (Desf.) Maire.

Phytosociological table: From Bartolo et al. (1983), table 2, 8 rel.

Char. association: *Vicia bithynica* (V), *Poa trivialis* (IV), *Asperula arvensis* (IV), *Trisetaria parviflora* (IV).

Char. alliance: *Neslia paniculata* subsp. *thracica* (V), *Bifora testiculata* (V), *Linaria chalepensis* (IV), *Buglossoides arvensis* (II), *Anchusa azurea* (I).

Char. order: *Ranunculus arvensis* (V), *Galium tricornutum* (V), *Lathyrus ochrus* (V), *Filago pyramidata* (V), *Gladiolus italicus* (V), *Allium nigrum* (IV), *Silene fuscata* (IV), *Rhagadiolus stellatus* (IV), *Bupleurum fontanesii* (IV), *Lolium temulentum* (III), *Nigella damascena* (II), *Coronilla scorpioides* (II), *Polygonum patulum* (II), *Misopates orontium* (II), *Lathyrus cicera* (II), *Valerianella eriocarpa* (II), *Valerianella microcarpa* (II).

Char. class: *Scandix pecten-veneris* (V), *Papaver rhoeas* (V), *Sherardia arvensis* (V), *Avena barbata* (V), *Lolium rigidum* (V), *Vicia sativa* subsp. *sativa* (V), *Glebionis segetum* (V), *Anagallis arvensis* (V), *Catapodium ridigum* (IV), *Vicia lutea* (IV), *Anthemis arvensis* (IV), *Muscari comosum* (IV), *Rhaphanus raphanistrum* (III), *Ornithogalum pyramidale* (III), *Sinapis arvensis* (II), *Phalaris canariensis* subsp. *canariensis* (II), *Papaver hybridum* (II), *Legousia falcata* (II), *Agrostemma githago* (I).

Other species: *Medicago polymorpha* (V), *Lathyrus aphaca* (IV), *Dasypyrum villosum* (IV).

Geographical distribution: This vegetation occurs only in the Hyblaean area and Aeolian islands (Bartolo et al., 1983; Ferro, 1990; Brullo & Furnari, 1990).

Structure and ecology: The therophytic weedy vegetation, growing on oligotrophic andosoils deriving from basaltic rocks, within the upper meso- and supramediterranean humid belts, is attributed to the *Vicio bithynicae-Ranunculetum arvensis* (Brullo et al., 2007). This segetal community is linked to *Triticum durum* or *Hordeum vulgare* crops and is characterized by the dominance of *Vicia bithynica* and *Ranunculus arvensis*. Besides, *Poa trivialis*, *Asperula arvensis* and *Trisetaria parviflora* are considered the characteristic species of this syntaxon. The alliance is represented by *Neslia paniculata* subsp. *thracica*, *Bifora testiculata*, *Linaria chalepensis*, *Buglossoides arvensis* and *Anchusa azurea*.

Syndynamism: This association is connected with the dynamic series of *Mespilo-Quercetum virgilianae.*

Habitat reference: See class.

30.2.2.4. ***Rapistro rugosi-Melilotetum infestae*** Bartolo et al. 1983

Segetal vegetation with annual bastard-cabbage and weed sweet clover of marly to clayish soils.

Holotypus: rel. 7, tab. 3, Bartolo et al. (1983).

Characteristic and differential species: *Malva trimestris* (L.) Salisb., *Melilotus infestus* Guss., *Rapistrum rugosum* (L.) All., *Silene neglecta* Ten., *Tetragonolobus conjugatus* (L.) Link.

Phytosociological table: From Bartolo et al. (1983), table 2, 8 rel.

Char. association: *Melilotus infestus* (V), *Rapistrum rugosum* (V), *Tetragonolobus conjugatus* (V), *Silene neglecta* (III), *Malva trimestris* (III).

Char. alliance: *Linaria chalepensis* (III), *Buglossoides arvensis* (II), *Neslia paniculata* subsp. *thracica* (I), *Bifora testiculata* (I), *Anchusa azurea* (I).

Char. order: *Galium tricornutum* (V), *Gladiolus italicus* (V), *Allium nigrum* (IV), *Rhagadiolus stellatus* (IV), *Filago pyramidata* (III), *Ranunculus arvensis* (III), *Valerianella eriocarpa* (III), *Euphorbia falcata* (III), *Nigella damascena* (III), *Melilotus sulcatus* (III), *Coronilla scorpioides* (III), *Polygonum patulum* (III), *Misopates orontium* (III), *Bupleurum fontanesii* (III), *Geropogon glaber* (II), *Lathyrus ochrus* (II), *Silene fuscata* (I), *Galium verrucosum* (I).

Char. class: *Scandix pecten-veneris* (V), *Anagallis arvensis* (V), *Avena barbata* (V), *Muscari comosum* (V), *Papaver rhoeas* (V), *Lolium rigidum* (V), *Sinapis arvensis* (V), *Vicia sativa* subsp. *sativa* (IV), *Glebionis segetum* (IV), *Sherardia arvensis* (III), *Phalaris canariensis* subsp. *canariensis* (III), *Catapodium ridigum* (II), *Rhaphanus raphanistrum* (II), *Ornithogalum pyramidale* (II), *Calendula arvensis* (II), *Orlaya grandiflora* (II), *Vicia lutea* (II), *Papaver dubium* (II), *Agrostemma githago* (I), *Papaver hybridum* (I),

Other species: *Medicago polymorpha* (V), *Hypericum triquetrifolium* (V), *Bupleurum lancifolium* (V).

Geographical distribution: This vegetation is restricted to the Hyblaean area (Bartolo et al., 1983; Ferro, 1990).

Structure and ecology: The *Rapistro rugosi-Melilotetum infestae* is a weedy vegetation of *Triticum durum* crops, found on marly to clayish soils, within the mesomediterranean subhumid bioclimatic belt (Brullo et al., 2007). Its physiognomy is given by *Melilotus infestus* and *Rapistrum rugosum*, growing together with *Tetragonolobus conjugatus*, *Silene neglecta*, *Malva trimestris* and some species of alliance, as *Linaria chalepensis*, *Buglossoides arvensis*, *Neslia paniculata* subsp. *thracica*, *Bifora testiculata* and *Anchusa azurea*.

Syndynamism: This association is connected with the dynamic series of *Oleo-Quercetum virgilianae*.

Habitat reference: See class.

30.2.2.5. ***Valerianello dentatae-Medicaginetum scutellatae*** Ferro 1988

Segetal vegetation with and narrow fruited cornsalad and snail clover of clayish soils.

Holotypus: rel. 5 , tab. 1 , Ferro (1988).

Characteristic and differential species: *Medicago scutellata* (L.) Mill., *Lactuca serriola* L., *Valerianella dentata* (L.) All.

Phytosociological table: From Ferro (1988), table 1, 10 rel.

Char. association: *Medicago scutellata* (IV), *Lactuca serriola* (IV), *Valerianella dentata* (IV).

Char. alliance: *Bifora testiculata* (IV), *Neslia paniculata* subsp. *thracica* (II), *Anchusa azurea* (I).

Char. order: *Galium tricornutum* (IV), *Gladiolus italicus* (IV), *Filago pyramidata* (IV), *Ranunculus arvensis* (IV), *Valerianella microcarpa* (IV), *Silene fuscata* (IV), *Melilotus sulcatus* (IV), *Bupleurum fontanesii* (IV), *Allium nigrum* (III), *Rhagadiolus stellatus* (III), *Polygonum patulum* (II), *Lolium temulentum* (I), *Lolium multiflorum* (I), *Rapistrum rugosum* (I), *Nigella damascena* (I), *Geropogon glaber* (I), *Valerianella eriocarpa* (I).

Char. class: *Scandix pecten-veneris* (V), *Avena sterilis* (V), *Sinapis arvensis* (V), *Ornithogalum pyramidale* (IV), *Papaver rhoeas* (IV), *Phalaris canariensis* subsp. *brachystachys* (IV), *Lolium rigidum* (III), *Anagallis arvensis* (III), *Papaver hybridum* (III), *Avena barbata* (II), *Vicia sativa* subsp. *sativa* (II), *Papaver dubium* (II), *Lysimachia foemina* (II), *Glebionis segetum* (I), *Sherardia arvensis* (I), *Catapodium ridigum* (I), *Calendula arvensis* (I), *Anthemis arvensis* (I).

Other species: *Helminthotheca echioides* (V), *Sonchus oleraceus* (V), *Medicago polymorpha* (IV).

Geographical distribution: This community is mainly found near Catania, with some outposts in the Agrigentine district and Nebrodi area (Ferro 1988, 1990).

Structure and ecology: The segetal vegetation of *Triticum durum* crops with clayish soils, within the mesomediterranean upper dry to lower subhumid bioclimatic belt, is ascribed to the *Valerianello dentatae-Medicaginetum scutellatae.* The occurrence of *Medicago scutellata*, *Lactuca serriola* and *Valerianella dentata* allows to distinguish this syntaxon under the floristic profile (Ferro, 1988). The alliance is represented by *Bifora testiculata*, *Neslia paniculata* subsp. *thracica* and *Anchusa azurea*.

Syndynamism: This association is connected with the dynamic series of *Quercion ilicis*.

Habitat reference: See class.

30.2.2.6. ***Lolio rigidi-Raphanetum raphanistri*** Ferro 2005

Segetal vegetation with annual ryegrass and wild radish of andosoils.

Holotypus: rel. 7, tab. 1 , Ferro (2005).

Characteristic and differential species: *Lolium rigidum* Gaud., *Rhaphanus raphanistrum* L.

Phytosociological table: From Ferro (2005), table 1, 7 rel.

Char. association: *Lolium rigidum* (V), *Rhaphanus raphanistrum* (V).

Char. alliance: *Anchusa azurea* (III).

Char. order: *Lolium multiflorum* (III), *Lathyrus ochrus* (III), *Allium nigrum* (III), *Gladiolus italicus* (III), *Misopates orontium* (III), *Galium verrucosum* (III), *Filago germanica* (III).

Char. class: *Papaver rhoeas* (V), *Glebionis segetum* (IV), *Sherardia arvensis* (III), *Vicia sativa* subsp. *sativa* (III), *Avena sterilis* (III), *Anagallis arvensis* (III), *Scandix pecten-veneris* (II), *Anthemis arvensis* (II).

Other species: *Glebionis coronaria* (III), *Lamium amplexicaulis* (III).

Geographical distribution: This vegetation is restricted to the Aeolian islands (Ferro, 2005).

Structure and ecology: The heliophilous weedy vegetation, found on andosoils deriving from volcanic rocks, was described by Ferro (2005) as *Lolio rigidi-Raphanetum raphanistri*. This community finds its optimum within the thermo- to mesomediterranean humid bioclimatic belts. infesting crops of *Triticum durum*. From the floristic point of view, it is a quite poor vegetation, whose structure is given by *Lolium rigidum* and R*haphanus raphanistrum*, growing together with some species of alliance, order and class, as *Anchusa azurea*, *Lolium multiflorum*, *Lathyrus ochrus*, *Allium nigrum*, *Gladiolus italicus*, *Misopates orontium*, *Galium verrucosum, Papaver rhoeas*, etc.

Syndynamism: This association is dynamically connected with the series of *Erico-Quercion ilicis.*

Habitat reference: See class.

31. Class: ***Chenopodietea*** Br.-Bl. in Br.-Bl. et al. 1952

Nitrophilous and ruderal vegetation of crops, gardens and roadsides.

Synonyms: *Ruderali-Secalietea* Br.-Bl. et al. 1936 p.p. (art. 3f); *Stellarietea mediae* R. Tx. et al. in R. Tx. 1950 p.p. (art. 2b); *Stellarietea mediae* R.Tx. et al. in R.Tx. ex von Rochow 1951 p.p. nom. ambig. (art. 36); *Cardaminetea hirsutae* Géhu 2000; *Anthrisco caucalidis-Geranietea purpurei* Rivas-Martinez et al. 2001 (art. 2b); *Geranio purpurei-Cardaminetea hirsutae* Rivas-Martinez et al. (1999) Rivas-Martinez et al. 2002; *Digitario sanguinalis-Eragrostietea minoris* Mucina, Lososovà & Šilc in Mucina et al. 2016.

Holotypus: *Chenopodietalia muralis* Br.-Bl. in Br.-Bl., Gajewski, Wraber & Walas 1936 em. Rivas-Martínez 1977.

Characteristic and differential species: *Amaranthus deflexus* L.*, Amaranthus viridis* L.*, Ammi majus* L.*, Ammi visnaga* (L.) Lam.*, Anisantha rigida* (Roth) Hyl.*, Agrostis stolonifera* L.*, Borago officinalis* L., *Diplotaxis erucoides* (L.) DC.*, Capsella bursa-pastoris* (L.) Medik., *Chenopodium album* L.*, Chenopodium murale* L.*, Chenopodium vulvaria* L., *Centaurea melitensis* L.*, Conyza bonariensis* (L.) Cronquist., *Conyza canadensis* L.*, Diplotaxis viminea* (L.) DC., *Ecballium elaterium* (L.) A. Rich., *Emex spinosa* (L.) Campd., *Erodium cicutarium* (L.) L'Hér., *Erodium*

ciconium (L.) L'Hér., *Erodium malacoides* (L.) L'Hér., *Euphorbia helioscopia* L., *Euphorbia peplus* L., *Fumaria capreolata* L., *Fumaria officinalis* L., *Fumaria parviflora* Lam., *Fumaria densiflora* DC., *Geranium molle* L., *Lamium amplexicaule* L., *Malva multiflora* (Cav.) Soldano & al., *Malva sylvestris* L., *Mercurialis annua* L., *Oxalis pes-caprae* L., *Senecio vulgaris* L. , *Solanum nigrum* L., *Sonchus asper* (L.) Hill, *Sonchus oleraceus* L., *Stellaria media* (L.) Vill., *Stellaria neglecta* Weihe, *Symphyotrichum squamatum* (Spreng.) G. L. Nesom, *Urtica urens* L., *Urtica membranacea* Poir., *Xanthium spinosum* L.

Geographical distribution: This class has a cosmopolitan distribution, except warm tropical territories (Costa et al., 2012). It is widespread all over the Sicilian territory (Maugeri, 1980; Brullo & Marcenò, 1979, 1985; Brullo, 1983a, 1983b; Brullo & Spampinato, 1985; Bartolo et al., 1990; Guarino, 1997).

Structure and ecology: The nitrophilous and ruderal vegetation, consisting of annual ephemeral plants or more rarely also adventitious geophytes, is classified within the *Chenopodietea* class. It is found on disturbed soil in urban and agricultural areas, including fringe of paths and roads, hoed fields, crops, gardens, etc. These communities are well differentiated according to frequency and intensity of disturbance, soil nutrients and moisture, climate and life-cycle (Chytrý et al., 2017). For the latter, it is possible to observe two main types of ruderal vegetation in Sicily: one has a winter-spring development and one has its optimum in the summer-fall period (Brullo et al., 2007).

Syndynamism: This vegetation is stricly connected with the nitrification due to agricultural practices or urbanization. The abandonment of the crops and the reduction of the anthropic disturbance cause its progressive replacement with the steppe grasslands belonging to *Lygeo-Stipetea* class or with the mesophilous meadows of *Molinio-Arrhenatheretea* (Brullo et al., 2001).

Habitat reference: 1.3 Arable land with unmixed crops grown by low-intensity agricultural methods.

31.1. Order: ***Polygono-Chenopodietalia polispermi*** R.Tx. & Lohmeyer in R.Tx. 1950 em. J.Tx. in Lohmeyer et al. 1962

Weed vegetation of hoed fields with winter-spring development.

Synonyms: *Solano nigri-Polygonetalia convolvuli* (Sissingh in Westhoff, Dijk & Passchier 1946) O. Bolòs 1962 p. p.; *Polygono-Chenopodietalia albi* R. Tx. & Lohm. in R. Tx. 1950 em. J. Tx. 1966.

Lectotypus: Not designated.

Characteristic and differential species: *Calendula arvensis* (Vaill.) L., *Erodium cicutarium* (L.) L'Hér., *Euphorbia helioscopia* L., *Euphorbia peplus* L., *Lamium amplexicaule* L., *Sonchus asper* (L.) Hill.

Geographical distribution: This order has a Mediterranean and Eurosiberian distribution (Brullo et al., 2001).

Structure and ecology: The weedy vegetation of hoed crops, both herbaceous and woody cultivations, is ascribed to the *Polygono-Chenopodietalia polispermi* order. In the Mediterranean area, these communities have a winter-spring cycle, occurring in several different kinds of substrata. (Brullo et al., 2001, 2007).

Syndynamism: During the summer, this vegetation is replaced by the communities belonging to the *Solano-Polygonetalia convolvuli* order, which have similar ecological requirements. Both are dynamically connected to the perennial grasslands of *Lygeo-Stipetea*.

Habitat reference: See class.

31.1.1. Alliance: ***Fumarion wirtgenii-agrariae*** Brullo in Brullo & Marcenò 1985

Weed vegetation of hoed crops with winter-spring development in the thermomediterranean belt.

Synonyms: *Diplotaxio erucoidis-Urticion urentis* Carretero et Aguilella 1995 (syntax.syn.)

Holotypus: *Diplotaxietum viminio-erucoidis* Brullo & Marcenò 1985

Characteristic and differential species: *Fumaria agraria* Lag., *Fumaria flabellata* Gasparr., *Fumaria gaillardotii* Boiss., *Fumaria officinalis* L. subsp. *wirtgenii* (W. D. J. Koch) Arcang, *Fumaria parviflora* Lam., *Linaria reflexa* Desf., *Rumex bucephalophorus* L., *Veronica cymbalaria* Bodard.

Geographical distribution: This alliance is distributed in Central and Western Mediterranean area (Mucina et al., 2016).

Structure and ecology: The *Fumarion wirtgenii-agrariae* includes the winter-spring weedy vegetation of hoed and fertilized cultivations, vineyeards and orchads, within the thermomediterranean bioclimatic belt or more rarely also in the lower mesomediterranean one (Brullo & Marcenò, 1985).

Syndynamism: It is connected with the dynamyc series of *Quercion ilicis and Oleo-Ceratonion*. The abandonment of cultivation led to the progressive replacement of this vegetation with the coenoses of *Echio-Galactition*, which can further evolve towards the perennial subnitrophilous

grasslands of *Bromo-Oryzopsion miliaceae* and finally to the dry grasslands of *Hyparrhenion hirtae* (Brullo et al., 2007).

Habitat reference: See class.

31.1.1.1. ***Diplotaxietum vimineo-erucoidis*** Brullo & Marcenò 1985

Weedy vegetation with southen rocket and white rocket of woody cultivations on marly to clayish soils.

Holotypus: rel. 2 , tab. 2, Brullo & Marcenò (1985).

Characteristic and differential species: *Diplotaxis viminea* (L.) DC.

Phytosociological table: From Brullo & Marcenò (1985), table 2, 8 rel.

Char. association: *Diplotaxis viminea* (V).

Char. alliance: *Rumex bucephalophorus* (V), *Fumaria gaillardotii* (V), *Fumaria officinalis* subsp. *wirtgenii* (IV), *Fumaria agraria* (IV), *Fumaria parviflora* (IV), *Veronica cymbalaria* (IV), *Linaria reflexa* (III).

Char. order: *Calendula arvensis* (V), *Sonchus asper* (V), *Lamium amplexicaulis* (V), *Euphorbia peplus* (IV), *Euphorbia helioscopia* (II).

Char. class: *Oxalis pes-caprae* (V), *Sonchus oleraceus* (V), *Diplotaxis erucoides* (V), *Erodium malacoides* (V), *Emex spinosa* (V), *Senecio vulgaris* (V), *Hypericum triquetrifolium* (V), *Mercurialis annua* (IV), *Borago officinalis* (IV), *Glebionis segetum* (IV), *Stellaria media* (III), *Cerinthe major* (III), *Raphanus raphanistrum* (I).

Other species: *Anisantha madritensis* (V), *Convolvulus arvensis* (V), *Urospermum picroides* (V), *Papaver hybridum* (V), *Anisantha sterilis* (IV), *Anagallis arvensis* (IV).

Geographical distribution: This association is widely distributed in Sicily, occuring in coastal and hilly sites of central, southern and western parts (Brullo & Marcenò, 1985).

Structure and ecology: The woody crops, as vineyards, olive and almond groves, on marly to clayish soils, are colonized by a weedy vegetation ascribed to the *Diplotaxietum vimineo-erucoidis*. This community finds its optimum within the thermomediterranean bioclimatic belt below 300 m a.s.l., but sometimes is recorded also in the mesomediterranean one. Its structure is given by *Diplotaxis erucoides* and *D. viminea*, growing with some species of alliance, as *Rumex bucephalophorus*, *Fumaria gaillardotii*, *Fumaria officinalis* subsp. *wirtgenii*, *Fumaria agraria*, *Fumaria parviflora*, *Veronica cymbalaria*, *Linaria reflexa*, etc. (Brullo & Marcenò, 1985).

Syndynamism: This association is dynamically connected with the series of *Quercion ilicis* and *Oleo-Ceratonion*.

Habitat reference: See class.

31.1.1.2. ***Fumario densiflorae-Veronicetum hederifoliae*** Brullo & Marcenò 1985

Semi-heliophilous weedy vegetation with dense flowered fumitory and ivy-leaved speedwell of herbaceous broad-leaved cultivations.

Holotypus: rel. 5, tab. 1, Brullo & Marcenò (1985).

Characteristic and differential species: *Fumaria densiflora* DC.*, Veronica hederifolia* L.

Phytosociological table: From Brullo & Marcenò (1985), table 3, 10 rel.

Char. association: *Fumaria densiflora* (V), *Veronica hederifolia* (V).

Char. alliance: *Fumaria parviflora* (V), *Veronica cymbalaria* (V), *Fumaria officinalis* subsp. *wirtgenii* (V), *Fumaria agraria* (IV), *Linaria reflexa* (II), *Rumex bucephalophorus* (II).

Char. order: *Calendula arvensis* (V), *Lamium amplexicaulis* (IV), *Sonchus asper* (II), *Euphorbia peplus* (II), *Euphorbia helioscopia* (II).

Char. class: *Sonchus oleraceus* (V), *Raphanus raphanistrum* (V), *Senecio vulgaris* (V), *Oxalis pes-caprae* (III), *Diplotaxis erucoides* (III), *Borago officinalis* (III), *Glebionis segetum* (III), *Stellaria media* (II), *Chenopodium album* (II), *Solanum nigrum* (II), *Galium aparine* (II), *Emex spinosa* (II), *Mercurialis annua* (I), *Malva sylvestris* (I).

Other species: *Papaver rhoeas* (V), *Heliotropium bocconei* (V), *Anagallis arvensis* (V), *Glebionis coronaria* (IV), *Medicago polymorpha* (IV).

Geographical distribution: This association occurs in Southern Sicily, as well as in the Aeolian Islands and near Catania (Brullo & Marcenò, 1985).

Structure and ecology: The *Fumario densiflorae-Veronicetum hederifoliae* is a semi-heliophilous weedy vegetation, linked to herbaceous broad-leaved cultivations, as legumes (*Vicia faba*, *Pisum sativum*, *Lens culinaris*, *Cicer arietinum*), artichokes and potatoes. This community prefers the quite shady and cool clay soils, within the thermomediterranean bioclimatic belt. It is dominated by *Fumaria densiflora* and *Veronica hederifolia*, two species rarely present in other associations of alliance. The presence of several species belonging to Papaveretea roheadis is due to the rotation with cereal fields,

Syndynamism: This association is dynamically connected with the series of *Oleo-Ceratonion*.

Habitat reference: See class.

31.1.1.3. ***Fumario parviflorae-Geranietum tuberosi*** Brullo & Marcenò 1985

Subsciaphilous weedy vegetation with fineleaf fumitory and tuberous wild geranium of cultivations on brown soils.

Holotypus: rel. 2, tab. 4, Brullo & Marcenò (1985).

Characteristic and differential species: *Geranium tuberosum* L.

Phytosociological table: From Brullo & Marcenò (1985), table 4, 8 rel.

Char. association: *Geranium tuberosum* (V).

Char. alliance: *Fumaria parviflora* (V), *Veronica cymbalaria* (V), *Rumex bucephalophorus* (V), *Fumaria officinalis* subsp. *wirtgenii* (V), *Fumaria agraria* (IV), *Veronica hederifolia* (III), *Linaria reflexa* (II).

Char. order: *Calendula arvensis* (IV), *Lamium amplexicaulis* (IV), *Sonchus asper* (IV), *Euphorbia peplus* (IV), *Erodium cicutarium* (III).

Char. class: *Sonchus oleraceus* (V), *Diplotaxis erucoides* (V), *Senecio vulgaris* (IV), *Hypericum triquetrifolium* (IV), *Oxalis pes-caprae* (IV), *Erodium malacoides* (IV), *Borago officinalis* (III), *Stellaria media* (III), *Emex spinosa* (III), *Malva sylvestris* (III), *Chenopodium album* (II).

Other species: *Papaver rhoeas* (V), *Anagallis arvensis* (V), *Muscari comosum* (V), *Buglossoides arvensis* (IV).

Geographical distribution: This association is distributed in southern Sicily (Brullo & Marcenò, 1985).

Structure and ecology: The mixed woody and herbaceous cultivations on brown soils (e.g. olive-, almond- and carob groves, associated with horticultural crops) are infested by a subsciaphilous weedy vegetation, named *Fumario parviflorae-Geranietum tuberosi*. From the floristic point of view, this community is characterized by the occurrence of *Geranium tuberosum*, an ephemeral geophyte quite rare in Sicily. It is associated with some nitrophilous species of alliance, as *Fumaria parviflora*, *Veronica cymbalaria*, *Rumex bucephalophorus*, *Fumaria officinalis* subsp. *wirtgenii*, *Fumaria agraria*, *Veronica hederifolia* and *Linaria reflexa* (Brullo & Marcenò, 1985).

Syndynamism: This association is dynamically connected with the series of *Oleo-Ceratonion*.

Habitat reference: See class.

31.1.1.4. ***Sileno coloratae-Lobularietum libycae*** Brullo & Marcenò 1985

Heliophilous weedy vegetation with Mediterranean catchfly and Lybian sweet alison of vineyards on coastal sandy soils.

Holotypus: rel. 7, Tab. 5, Brullo & Marcenò (1985).

Characteristic and differential species: *Lobularia lybica* (Viv.) Webb. & Berth., *Silene colorata* Poir.

Phytosociological table: From Brullo & Marcenò (1985), table 5, 12 rel.

Char. association: *Lobularia lybica* (V), *Silene colorata* (V).

Char. alliance: *Fumaria gaillardotii* (V), *Rumex bucephalophorus* (V), *Fumaria parviflora* (IV), *Fumaria officinalis* subsp. *wirtgenii* (IV), *Fumaria agraria* (IV).

Char. order: *Lamium amplexicaulis* (V), *Calendula arvensis* (IV), *Sonchus asper* (IV), *Euphorbia helioscopia* (II).

Char. class: *Oxalis pes-caprae* (V), *Sonchus oleraceus* (V), *Diplotaxis erucoides* (V), *Raphanus raphanistrum* (V), *Stellaria media* (IV), *Borago officinalis* (III), *Geranium molle* (III), *Conyza canadensis* (III), *Senecio vulgaris* (II), *Erodium malacoides* (II), *Chenopodium murale* (I).

Other species: *Euphorbia terracina* (V), *Papaver rhoeas* (V), *Senecio coronopifolius* (V), *Papaver hybridum* (V).

Geographical distribution: This association occurs only in the south-eastern corner of Sicily (Brullo & Marcenò, 1985).

Structure and ecology: The vineyards on coastal sandy soils, within the thermomediterranean dry bioclimatic belt, are colonized by a peculiar weedy vegetation. It is the *Sileno coloratae-Lobularietum libycae*, a community characterized by the occurrence of the southern Mediterranean species Lobularia lybica, growing together with Silene colorata and some taxa of alliance, as *Fumaria gaillardotii*, *Rumex bucephalophorus*, *Fumaria parviflora*, *Fumaria officinalis* subsp. *wirtgenii* and *Fumaria agraria* (Brullo & Marcenò, 1985).

Syndynamism: This association is linked with the dynamic series of *Ephedro-Juniperetum macrocarpae* and *Junipero-Quercetum calliprini*. After the abandonment of the agricultural practices, this vegetation is replaced by the natural psammophilous annual vegetation of *Vulpietalia*, whose species are frequently found within the association at issue (Brullo et al., 2007).

Habitat reference: See class.

31.1.1.5. ***Raphano raphanistri-Erucetum sativae*** Brullo & Marcenò 1985

Weedy vegetation with wild radish and wild rocket of legume-fields on sandy soils.

Holotypus: rel. 2, tab. 6, Brullo & Marcenò (1985).

Characteristic and differential species: *Eruca sativa* (Mill.).

Phytosociological table: From Brullo & Marcenò (1985), table 6, 6 rel.

Char. association: *Eruca sativa* (V).

Char. alliance: *Rumex bucephalophorus* (V), *Fumaria officinalis* subsp. *wirtgenii* (V), *Fumaria agraria* (IV), *Fumaria parviflora* (II).

Char. order: *Euphorbia helioscopia* (V), *Calendula arvensis* (V), *Lamium amplexicaulis* (III), *Sonchus asper* (II).

Char. class: *Oxalis pes-caprae* (V), *Sonchus oleraceus* (V), *Emex spinosa* (V), *Raphanus raphanistrum* (V), *Erodium malacoides* (V), *Stellaria media* (IV), *Mercurialis annua* (III), *Malva sylvestris* (II), *Solanum nigrum* (II).

Other species: *Muscari comosum* (V), *Avena barbata* (V), *Anisantha rigida* (V), *Silene colorata* (V).

Geographical distribution: This association occurs only in south-eastern Sicily (Brullo & Marcenò, 1985).

Structure and ecology: The *Raphano raphanistri-Erucetum sativae* is a therophitic weedy vegetation of legume-fields (*Vicia faba*, *Pisum sativum*, *Vignea* spp., *Phaseolus* spp., *Lens* culinaris, etc.) on sandy soils, within the thermomediterranean bioclimatic belt. Under the floristic profile, it is characterized by the dominance of the nitrophilous species Eruca sativa, which is associated with *Rumex bucephalophorus*, *Fumaria officinalis* subsp. *wirtgenii*, *Fumaria agraria*, *Fumaria parviflora*, *Euphorbia helioscopia*, *Calendula arvensis*, *Oxalis pes-caprae*, *Sonchus oleraceus*, etc. (Brullo & Marcenò, 1985).

Syndynamism: It is dynamically connected with the thermophilous and psammophilous series of *Stipo bromoidis-Quercetum suberis* (Brullo et al., 2007).

Habitat reference: See class.

31.1.1.6. ***Ammio maji-Torilidetum nodosae*** Brullo & Marcenò 1985

Heliophilous weedy vegetation with false Queen Anne's lace and knotted hedgeparsley of carrot cultivations subjected to drastic agricultural practices.

Holotypus: rel. 3, tab. 7, Brullo & Marcenò (1985).

Characteristic and differential species: *Ammi majus* L., *Torillis nodosa* (L.) Gaertn.

Phytosociological table: From Brullo & Marcenò (1985), table 7, 6 rel.

Char. association: *Ammi majus* (V), *Torillis nodosa* (V).

Char. alliance: *Fumaria gaillardotii* (V), *Rumex bucephalophorus* (V), *Fumaria officinalis* subsp. *wirtgenii* (V), *Fumaria agraria* (V), *Veronica cymbalaria* (IV), *Fumaria parviflora* (IV), *Fumaria densiflora* (II), *Linaria reflexa* (II).

Char. order: *Lamium amplexicaulis* (V), *Calendula arvensis* (V), *Sonchus asper* (V), *Euphorbia helioscopia* (IV), *Euphorbia peplus* (IV).

Char. class: *Oxalis pes-caprae* (V), *Sonchus oleraceus* (V), *Senecio vulgaris* (V), *Glebionis coronaria* (V), *Glebionis segetum* (V), *Mercurialis annua* (V), *Raphanus raphanistrum* (III), *Stellaria media* (III), *Geranium molle* (III), *Fedia graciliflora* (IV), *Convolvulus arvensis* (III), *Borago officinalis* (III), *Anisantha sterilis* (III), *Vicia sativa* (II), *Malva sylvestris* (II), *Galium aparine* (II).

Other species: *Papaver hybridum* (V), *Avena barbata* (V), *Anagallis arvensis* (V), *Hedypnois cretica* (V).

Geographical distribution: This association occurs only in the south-eastern corner of Sicily (Brullo & Marcenò, 1985).

Structure and ecology: The carrot field, often subject to intensive agricultural practices, including the use of herbicides, are infested by a floristic poor weedy vegetation. It is the *Ammio maji-Torilidetum nodosae*, which is found in the thermomediterranean bioclimatic belt. Its physiognomy is defined by two apiaceae, Ammi majus and Torillis nodosa, which grow together with some species of alliance and order, as *Fumaria gaillardotii*, *Rumex bucephalophorus*, *Fumaria officinalis* subsp. *wirtgenii*, *Fumaria agraria*, *Veronica cymbalaria*, *Fumaria parviflora*, Lamium *amplexicaulis*, *Calendula arvensis*, *Sonchus asper*, etc. Besides, the more represented species of class are *Oxalis pes-caprae*, *Sonchus oleraceus*, *Senecio vulgaris*, *Glebionis coronaria*, *Glebionis segetum* and *Mercurialis annua* (Brullo & Marcenò, 1985).

Syndynamism: This association is linked with the dynamic series of *Oleo-Ceratonion.*

Habitat reference: See class.

31.1.1.7. ***Herniario glabrae-Sperguletum arvensis*** Brullo & Marcenò 1985 corr. Ferro 2005

Heliophilous weedy vegetation with smooth rupturewort and corn spurry of vineyeards on volcanic sandy soils.

Holotypus: rel. 3, tab. 8, Brullo & Marcenò (1985).

Characteristic and differential species: *Herniaria glabra* L., *Spergula arvensis* L.

Phytosociological table: From Brullo & Marcenò (1985), table 8, 6 rel.

Char. association: *Spergula arvensis* (V), *Herniaria hirsuta* (V).

Char. alliance: *Fumaria agraria* (V), *Fumaria officinalis* subsp. *wirtgenii* (V), *Fumaria parviflora* (V), *Rumex bucephalophorus* (III).

Char. order: *Calendula arvensis* (V), *Euphorbia helioscopia* (IV), *Sonchus asper* (III).

Char. class: *Stellaria media* (V), *Senecio vulgaris* (V), *Brassica fruticulosa* (V), *Papaver setigerum* (V), *Glebionis segetum* (V), *Oxalis pes-caprae* (IV), *Mercurialis annua* (III), *Chenopodium album* (III), *Vicia sativa* (III), *Solanum nigrum* (III), *Cyperus rotundus* (I), *Geranium molle* (I).

Other species: *Anisantha madritensis* (V), *Anagallis arvensis* (V), *Silene gallica* (IV), *Catapodium rigidum* (IV).

subass. *chondrilletosum junceae* from Ferro (2005), table 2, 5 rel.

Char. association and subassociation: *Vicia villosa* subsp. *ambigua* (V), *Chondrilla juncea* (V), *Anisantha madritensis* (III), *Festuca ligustica* (III), *Cladanthus mixtus*(I), *Spergula arvensis* (I), *Andryala integrifolia* (I), *Tolpis virgata* (I), *Herniaria hirsuta* (I).

Char. order: *Erigeron sumatrensis* (I).

Char. class: *Anisantha sterilis* (IV), *Avena barbata* (IV), *Glebionis segetum* (III), *Senecio vulgaris* (II), *Brassica fruticulosa* (II), *Sonchus oleraceus* (II), *Silene vulgaris* (II), *Rostraria cristata* (II), *Achillea ligustica* (II), *Lagurus ovatus* (I), *Hordeum murinum* subsp. *leporinum* (I), *Echium plantagineum* (I), *Trifolium nigrescens* (I), *Solanum nigrum* (I), *Raphanus raphanistrum* (I), *Crepis vesicaria* (I).

Other species: *Trifolium arvense* (V), *Cynodon dactylon* (IV), *Rubus ulmifolius* (III).

Geographical distribution: This association is restricted to the Aeolian Islands (Brullo & Marcenò, 1985; Brullo & Furnari, 1990; Ferro, 2005).

Structure and ecology: The *Herniario glabrae-Sperguletum arvensis* is an heliophilous weedy vegetation, colonizing vineyards on volcanic sands, within the thermomediterranean subhumid bioclimatic belt. It is characterized by the dominance of acidophilous species, as *Spergula arvensis* and *Herniaria hirsuta*. The alliance is represented by *Fumaria agraria*, *Fumaria officinalis* subsp. *wirtgenii*, *Fumaria parviflora* and *Rumex bucephalophorus* (Brullo & Marcenò, 1985). The subass. *chondrilletosum junceae* Ferro 2005 is linked to crops not subject to the elimination of weeds during the winter period. Under the floristic profile, it is characterized by the low presence of the characteristic species of the syntaxon at issue and by the high coverage of *Trifolium arvense*, which become dominant in the abandoned vineyards.

Syndynamism: This community tends to disappear following the widespread abandonment of vineyards in the Aeolian Islands, leading to the estabilishment of grasslands and maquis connected with the dynamic series of *Erico-Quercion ilicis* (Brullo et al., 2007).

Habitat reference: See class.

31.1.1.8. ***Loto subbiflori-Anthemidetum incrassatae*** Brullo & Marcenò 1985

Weedy vegetation with field chamomille of woody cultivations on sandy andosoils in the mesomediterranean belt.

Holotypus: rel. 3, tab. 9, Brullo & Marcenò (1985).

Characteristic and differential species: *Anthemis arvensis* L. subsp. *incrassata* (Loisel) Nyman, *Lotus subbiflorus* Lag., *Medicago tornata* (L.) Mill.

Phytosociological table: From Brullo & Marcenò (1985), table 9, 8 rel.

Char. association: *Anthemis arvensis* subsp. *incrassata* (V), *Lotus subbiflorus* (V), *Medicago tornata* (V).

Char. alliance: *Rumex bucephalophorus* (V), *Fumaria officinalis* subsp. *wirtgenii* (V), *Fumaria parviflora* (IV), *Linaria reflexa* (IV), *Veronica cymbalaria* (IV).

Char. order: *Calendula arvensis* (V), *Erodium cicutarium* (IV), *Euphorbia helioscopia* (IV), *Lamium amplexicaule* (III), *Euphorbia peplus* (III), *Sonchus asper* (III).

Char. class: *Sonchus oleraceus* (V), *Oxalis pes-caprae* (V), *Geranium molle* (IV), *Senecio vulgaris* (IV), *Stellaria media* (III), *Brassica fruticulosa* (III), *Rumex pulcher* (III), *Convolvulus arvensis* (III), *Chenopodium album* (III), *Erodium malacoides* (III), *Emex spinosa* (II), *Anisantha sterilis* (II), *Mercurialis annua* (II), *Fedia graciliflora* (II), *Malva sylvestris* (II), *Glebionis segetum* (II).

Other species: *Vicia villosa* (V), *Daucus carota* (V), *Trifolium nigrescens* (IV), *Cynosurus echinatus* (IV).

Geographical distribution: This vegetation occurs only in the northen side of Etna mountain (Brullo & Marcenò, 1985).

Structure and ecology: The woody cultivations (vineyards and orchards) on sandy andosoils, usually above 700 m, are infested by an annual community named *Loto subbiflori-Anthemidetum incrassatae*. This vegetation is linked to the mesomediterranean bioclimatic belt and is characterized by the occurrence of *Anthemis arvensis* subsp. *incrassata*, *Lotus subbiflorus* and *Medicago tornata*. The syntaxa of higher rank are represented by several species, including *Rumex bucephalophorus*, *Fumaria officinalis* subsp. *wirtgenii*, *Fumaria parviflora*, *Calendula arvensis*, *Erodium cicutarium*, *Sonchus oleraceus*, *Oxalis pes-caprae*, *Geranium molle*, *Senecio vulgaris*, etc. (Brullo & Marcenò, 1985).

Syndynamism: This community is linked to the acidophilous decidous woody forest of *Erico-Quercion* ilicis (Brullo et al., 2007).

Habitat reference: See class.

31.1.1.9. ***Fumarietum parviflorae-bastardii*** Bartolo, Brullo, Miniss. & Spamp. 1990

Weedy vegetation of legume-fields and other hoed cultivations, occurring on Mediterranean red soils.

Holotypus: rel. 6, Tab. 43, Bartolo et al. (1990).

Characteristic and differential species: *Fumaria bastardii* Boreau

Phytosociological table: From Bartolo et al. (1990), table 43, 10 rel.

Char. association: *Fumaria bastardii* (V).

Char. alliance: *Fumaria officinalis* subsp. *wirtgenii* (V), *Fumaria parviflora* (V), *Fumaria agraria* (V), *Fumaria gaillardotii* (IV).

Char. order: *Euphorbia helioscopia* (V), *Sonchus asper* (IV), *Euphorbia peplus* (II), *Lamium amplexicaule* (I).

Char. class: *Sonchus oleraceus* (V), *Convolvulus arvensis* (V), *Anisantha sterilis* (V), *Emex spinosa* (V), *Glebionis coronaria* (V), *Oxalis pes-caprae* (V), *Erodium malacoides* (V), *Malva nicaeensis* (V), *Stellaria media* (IV), *Senecio vulgaris* (III), *Chenopodium murale* (III),

Mercurialis annua (III), *Urtica urens* (II), *Vicia sativa* subsp. *angustifolia* (II), *Diplotaxis erucoides* (I).

Other species: *Melilotus sulcata* (V), *Anagallis arvensis* (V), *Calendula tripterocarpa* (V), *Lolium rigidum* (V).

Geographical distribution: This vegetation was described by Bartolo et al. (1990) for Lampedusa island.

Structure and ecology: The *Fumarietum parviflorae-bastardii* is a semi-heliophilous weedy vegetation of legumefields and other hoed cultivations, growing on Mediterranean red soils within the thermomediterranean dry bioclimatic belt. Its floristic set is constituted by nitrophilous species, which are well adapted to agricultural practices, such as hoeing, fertilization and sometimes even irrigation. *Fumaria bastardii* is considered the characteristic species, occurring together with some specie of alliance, as *Fumaria officinalis* subsp. *wirtgenii*, *Fumaria parviflora*, *Fumaria agraria* and *Fumaria gaillardotii*. The order and class are represented by several species, among them *Euphorbia helioscopia*, *Sonchus asper*, *Sonchus oleraceus*, *Convolvulus arvensis*, *Anisantha sterilis* and *Emex spinosa* (Bartolo et al., 1990).

Syndynamism: This community is connected with the dynamic series of the *Periplocion angustifoliae* (Brullo et al., 2007).

Habitat reference: See class.

31.1.1.10. ***Fumario parviflorae-Resedetum luteae*** Bartolo, Brullo, Miniss. & Spamp. 1990

Weedy vegetation with fineleaf fumitory and yellow mignonette of woody cultivations on sandy soils, within the dry thermomediterranean belt.

Holotypus: rel. 1, tab. 44, Bartolo et al. (1990).

Characteristic and differential species: *Reseda lutea* L.

Phytosociological table: From Bartolo et al. (1990), table 44, 5 rel.

Char. association: *Reseda lutea* (V).

Char. alliance: *Fumaria parviflora* (V), *Fumaria officinalis* subsp. *wirtgenii* (IV), *Fumaria agraria* (III).

Char. order: *Euphorbia helioscopia* (V), *Sonchus asper* (II).

Char. class: *Sonchus oleraceus* (V), *Erodium malacoides* (V), *Oxalis pes-caprae* (V), *Convolvulus arvensis* (V), *Anisantha sterilis* (V), *Emex spinosa* (IV), *Malva parviflora* (III), *Stellaria pallida* (III), *Glebionis coronaria* (II), *Diplotaxis erucoides* (II), *Borago officinalis* (I), *Mercurialis annua* (I).

Other species: *Calendula tripterocarpa* (V), *Reseda alba* (III), *Astragalus boeticus* (II), *Papaver hybridum* (I).

Geographical distribution: This community occurs only in Lampedusa island (Bartolo et al., 1990).

Structure and ecology: The *Fumarietum parviflorae-bastardii* is replaced by another weedy vegetation in the vineyards growing on sandy soils, within the dry thermomediterranean belt. It is the *Fumario parviflorae-Resedetum luteae,* which is characterized by the occurrence of *Reseda lutea*, while *Fumaria bastardii* is completely absent. Besides, this vegetation is dominated by other nitrophilous species with a spring cycle, as *Fumaria parviflora*, *F. officinalis* subsp. *wirtgenii*, *F. agraria*, *Euphorbia helioscopia*, *Sonchus asper*, *S. oleraceus*, *Erodium malacoides*, etc. (Bartolo et al., 1990).

Syndynamism: This community is connected with the dynamic series of the *Periplocion angustifoliae* (Brullo et al., 2007).

Habitat reference: See class.

31.2. Order: ***Solano nigri-Polygonetalia convolvuli*** (Sissingh in Weshtoff et al. 1946) O. Bolòs 1962

Weed vegetation of hoed fields with summer-fall development.

Synonyms: *Eragrostietalia* J. Tx. ex Poli 1966; *Eragrostietalia* J.Tx. in Müller 1963 (art. 2b); *Amarantho-Echinochloetalia* V. Solomakha et al. in V. Solomakha 1987.

Holotypus: *Polygono convolvuli-Chenopodion polyspermi* Koch 1926 em. Oberdofer 1957.

Characteristic and differential species: *Amaranthus albus* L., *Amaranthus blitoides* S.Wats., *Amaranthus graecizans* L., *Amaranthus retroflexus* L., *Chenopodium opulifolium* W.D.J.Koch & Ziz., *Cyperus rotundus* L., *Digitaria sanguinalis* (L.) Scop., *Eragrostis cilianensis* (All.) Vignolo ex Janch., *Euphorbia chamaesyce* L. subsp. *chamaesyce*, *Heliotropium europaeum* L., *Portulaca oleracea* L., *Setaria decipiens* de Wit, *Setaria glauca* (L.) P.Beauv., *Setaria verticillata* (L.) P.Beauv., *Solanum luteum* Mill., *Sorghum halepensis* (L.) Pers., *Trilobus terrestris* L.

Geographical distribution: This order has a Mediterranean and Eurosiberian distribution (Brullo et al., 2001).

Structure and ecology: This order groups the weedy communities of hoed fields, with optimum in summer and autumn. They occur in several kinds of substrate and in irrigated or not irrigated crops (Brullo et al., 2001). Recently, Mucina et al. (2016) proposed to include this order in a separate class named *Digitario sanguinalis-Eragrostietea minoris* Mucina,

Lososovà & Šilc 2016, regarding the synanthropic communities dominated by summer annual C4 plants of southern Europe.

Syndynamism: The *Solano-Polygonetalia convolvuli* vegetation replaces during the summer period the *Polygono-Chenopodietalia polispermi* communities. Both are dynamically linked to the perennial grasslands of *Lygeo-Stipetea* (Brullo et al., 2007).

Habitat reference: See class.

31.2.1. Alliance: ***Chenopodion botryos*** Brullo & Marcenò 1980

Summer weedy vegetation of non irrigated hoed and fertilized cultivations, on acidic siliceous soils.

Holotypus: *Eragostrio-Chenopodietum botryos* Br.-Bl. 1936.

Characteristic and differential species: *Brassica fruticulosa* Cirillo, *Dysphania botrys* (L.) Mosyakin & Clemants (=*Chenopodium botrys* L.), *Euphorbia chamaesyce* L.

Geographical distribution: This alliance occurs in the Central and Western Mediterranean areas. In Sicily it is restricted to the Nort-Eastern part and Linosa island (Brullo & Marcenò, 1980; Brullo & Siracusa 1996; Ferro, 2005).

Structure and ecology: The alliance at issue groups the therophytic weedy communities of hoed and fertilized cultivations, as vineyards and orchards not watered during the summer period. It replaces the *Diplotaxion erucoidis* on acidic siliceous soils, within the thermo- and mesomediterranean bioclimatic belts.

Syndynamism: See order.

Habitat reference: See class.

31.2.1.1. ***Heliotropietum bocconei*** Brullo & Marcenò 1980

Weedy vegetation with Boccone's heliotrope of hoed and fertilized cultivations on volcanic soils, within the meso- and supra mediterranean belts.

Holotypus: rel. 10, tab. 2, Brullo & Marcenò (1980).

Characteristic and differential species: *Heliotropium bocconei* Guss.

Phytosociological table: From Brullo & Marcenò (1980), table 2, 19 rel.
Char. association: *Heliotropium bocconei* (V).
Char. alliance: *Brassica fruticulosa* (V), *Dysphania botrys* (IV).

Char. order: *Portulaca oleracea* (IV), *Tribolus terrestris* (III), *Euphorbia chamaesyce* (III), *Setaria verticillata* (III), *Amaranthus retroflexus* (III), *Heliotropium europaeum* (II), *Amaranthus graecizans* (II), *Setaria glauca* (II), *Digitaria sanguinalis* (I), *Amaranthus albus* (I), *Sorghum halepensis* (I).

Char. class: *Chenopodium album* (V), *Chenopodium vulvaria* (III), *Erodium ciconium* (III), *Erigeron canadensis* (II), *Sonchus oleraceus* (II), *Amaranthus lividus* (II), *Solanum nigrum* (II), *Chenopodium murale* (I), *Erigeron bonariensis* (I), *Senecio vulgaris* (I), *Amaranthus deflexus* (I), *Capsella bursa-pastoris* (I), *Malva nicaeensis* (I), *Erigeron sumatrensis* (I).

Other species: *Chondrilla juncea* (IV), *Fallopia convolvulus* (III).

Geographical distribution: This community occurs only in the Etna area and Aeolian islands (Brullo & Marcenò, 1980; Brullo & Furnari, 1990).

Structure and ecology: The *Heliotropietum bocconei* is a therophitic weedy vegetation, colonizing hoed and fertilized cultivations on andosoils derived from volcanic rocks. It is a mesophilous vegetation, occurring in vineyards and orchards within the meso- and supramediterranean bioclimatic belts. Its physiognomy is given by the endemic *Heliotropium bocconei*, growing together with some species of alliance and order, as *Brassica fruticulosa*, *Dysphania* botrys, *Portulaca oleracea*, *Tribolus terrestris*, *Euphorbia chamaesyce*, *Setaria verticillata*, *Amaranthus retroflexus*, etc. (Brullo & Marcenò, 1980).

Syndynamism: This community is connected with the dynamic series of the *Erico-Quercion ilicis* (Brullo et al., 2007).

Habitat reference: See class.

31.2.1.2. ***Heliotropietum dolosi*** Brullo & Marcenò 1980

Weedy vegetation with greater heliotrope of hoed and fertilized cultivations on volcanic soils, within the thermomediterranean belt.

Synonyms: *Heliotropio dolosi-Brassicetum fruticulosae* Ferro & Zizza 2001.

Holotypus: rel. 8, tab. 3, Brullo & Marcenò (1980).

Characteristic and differential species: *Heliotropium dolosum* De Not., *Silene behen* L.

Phytosociological table: From Brullo & Siracusa (1996), table 16, 11 rel.

Char. association: *Heliotropium dolosum* (V), *Silene behen* (I).

Char. alliance: *Brassica fruticulosa* (V).

Char. order: *Heliotropium europaeum* (V), *Misopates orontium* (III), *Portulaca oleracea* (III), *Tribulus terrestris* (II), *Chenopodium opulifolium* (II), *Amaranthus graecizans* (I).

Char. class: *Glebionis coronaria* (V), *Fumaria parviflora* (V), *Chenopodium album* (IV), *Sonchus oleraceus* (IV), *Chenopodium murale* (III), *Solanum nigrum* (III), *Vicia sativa* (II),

Erigeron bonariensis (II), *Malva nicaeensis* (II), *Lamium amplexicaule* (I), *Erodium cicutarium* (I), *Malva sylvestris* (I).

Other species: *Andryala integrifolia* (V), *Anagallis arvensis* (V), *Polycarpon tetraphyllum* (IV).

Geographical distribution: This community is restricted to Linosa island (Brullo & Marcenò, 1980; Brullo & Siracusa, 1996).

Structure and ecology: The weedy vegetation of vineyards, or more rarely also orchards and horticultural fields, on andosoils derived from volcanic roks, within the thermomediterranean dry bioclimatic belt, is ascribed to the *Heliotropietum dolosi*. It occurs mainly on crops subject to periodic hoeing and fertilization and has is optimum during the summer period, despite sometimes due to the xeric climate it develops already in late spring. Under the floristic profile, it is dominated by *Heliotropium dolosum*, growing with some species belonging to order and alliance, such as *Brassica fruticulosa*, *Heliotropium europaeum*, *Misopates orontium*, *Portulaca oleracea*, *Tribulus terrestris*, *Chenopodium opulifolium*, *Amaranthus graecizans*, etc. (Brullo & Siracusa, 1996).

Syndynamism: This community is connected with the dynamic series of the *Periplocion angustifoliae* (Brullo et al., 2007).

Habitat reference: See class.

31.2.2. Alliance: ***Diplotaxion erucoidis*** Br.-Bl. in Br.-Bl. et al. 1936 em. Brullo & Marcenò 1980

Summer weedy vegetation of non irrigated hoed and fertilized cultivations on neutral-basic soils.

Synonyms: *Diplotaxion* Br.-Bl. 1931 (art. 2b); *Heliotropion* Oberd. 1954 (syntax.syn.); *Calendulo arvensis-Heliotropion europaei* Trinajstić 2008 (art. 2b, 5).

Holotypus: *Amarantho delilei-Diplotaxietum erucoidis* Br.-Bl. in Br.-Bl., Gajewski, Wraber & Walas 1936.

Characteristic and differential species: *Ammi visnaga* (L.) Lam., *Chrozophora tinctoria* (L.) A. Juss., *Helminthotheca echioides* (L.) Holub., *Hypericum triquetrifolium* Turra.

Geographical distribution: This alliance has a Mediterranean distribution (Brullo et al., 2001; Costa et al., 2012).

Structure and ecology: The weedy communities of non irrigated hoed and fertilized cultivations, growing on neutral to alkaline soils deriving from limestones, marls and clay deposits, are classified within the *Diplotaxion erucoidis alliance.* This vegetation occurs in the

thermo- and mesomediterranean bioclimatic belts (Bartolo et al., 1990; Brullo & Marcenò, 1980, 1985; Ferro, 1980).

Syndynamism: See order.

Habitat reference: See class.

31.2.2.1. ***Chrozophoro tinctoriae-Kickxietum integrifoliae*** Brullo & Marcenò 1980

Weedy vegetation with turnasol and round leaved fluellen of hoed and fertilized cultivations on clayish soils.

Holotypus: rel. 6, tab. 1, Brullo & Marcenò (1980).

Characteristic and differential species: *Andrachne telephioides* L.*, Echinophora tenuifolia* L.*, Kickxia spuria* (L.) Dumort. subsp. *integrifolia* (Brot.) R. Fern.*, Teucrium spinosum* L..

Phytosociological table: From Brullo & Marcenò (1980), table 1, 46 rel. (subass. *typicum*).

Char. association: *Kickxia spuria* (V), *Andrachne telephioides* (III), *Echinophora tenuifolia* (I).

Char. alliance: *Chrozophora tinctoria* (V), *Hypericum triquetrifolium* (IV), *Helminthotheca echioides* (III), *Ammi visnaga* (I).

Char. order: *Heliotropium europaeum* (V), *Euphorbia chamaesyce* (II), *Amaranthus albus* (II), *Chenopodium opulifolium* (II), *Portulaca oleracea* (I), *Setaria verticillata* (I), *Amaranthus retroflexus* (I), *Amaranthus graecizans* (I), *Sorghus halepensis* (I), *Eragrostis cilianensis* (I), *Amaranthus blitoides* (I).

Char. class: *Diplotaxis erucoides* (III), *Chenopodium album* (III), *Sonchus oleraceus* (III), *Solanum nigrum* (II), *Chenopodium vulvaria* (II), *Erigeron bonariensis* (II), *Ecballium elaterium* (II), *Erigeron canadensis* (I), *Chenopodium murale* (I), *Glebionis coronaria* (I), *Malva sylvestris* (I), *Senecio vulgaris* (I), *Amaranthus deflexus* (I), *Lamium amplexicaule* (I), *Sonchus asper* (I), *Amaranthus lividus* (I), *Euphorbia peplus* (I), *Symphyotrichum squamatum* (I), *Chenopodium ambrosioides* (I), *Xanthium spinosum* (I).

Other species: *Convolvulus arvensis* (IV), *Cynodon dactylon* (IV), *Polygonum aviculare* (II).

From Brullo & Marcenò (1980), table 1, 4 rel. (subass. *teucrietosum spinosi*).

Char. association: *Kickxia spuria* (4), *Teucrium spinosum* (4).

Char. alliance: *Helminthotheca echioides* (4), *Ammi visnaga* (3).

Char. class: *Erigeron bonariensis* (3), *Malva sylvestris* (3), *Erigeron canadensis* (2), *Sonchus asper* (1), *Symphyotrichum squamatum* (1).

Other species: *Anagallis arvensis* (4), *Convolvulus arvensis* (3).

Geographical distribution: This community occurs in Western, central and southern Sicily. The subass. *teucrietosum spinosi* is restricted to the mountains near Palermo, near Piana degli Albanesi (Brullo & Marcenò, 1980).

Structure and ecology: The hoed and fertilized cultivations on clayish soils are infested by an heliophilous weedy vegetation, named *Chrozophoro tinctoriae-Kickxietum integrifoliae*. Its typical aspect (subass. *typicum*) is linked to the thermo- and mesomediterranean belts, while the subass. *teucrietosum spinosi* occurs in the supramediterranean belt. Usually, this community is found in vineyards, orchards and cotton- or stubble fields. The floristic set is characterized by the presence of *Andrachne telephioides*, *Echinophora tenuifolia, Kickxia spuria* subsp. *integrifolia* and *Teucrium spinosum*, growing together with some species of alliance and order, as *Chrozophora tinctoria*, *Hypericum triquetrifolium*, *Helminthotheca echioides*, *Ammi visnaga*, *Heliotropium europaeum*, *Euphorbia chamaesyce*, *Amaranthus albus*, etc. (Brullo & Marcenò, 1980).

Syndynamism: This community is connected with the dynamic series of *Quercion ilicis* and *Oleo-Ceratonion* (Brullo et al., 2007).

Habitat reference: See class.

31.2.2.2. ***Amarantho lividi-Eragrostietum barrelieri*** Brullo & Marcenò 1985

Weedy vegetation with least amaranth and Mediterranean lovegrass of hoed and fertilized cultivations on sandy soils.

Holotypus: rel. 2, tab. 10, Brullo & Marcenò (1985).

Characteristic and differential species: *Amaranthus lividus* L.*, Eragrostis barrelieri* Day.

Phytosociological table: From Brullo & Marcenò (1985), table 10, 6 rel.

Char. association: *Eragrostis barrelieri* (V), *Amaranthus lividus* (V).

Char. alliance: *Hypericum triquetrifolium* (IV).

Char. order: *Amaranthus retroflexus* (V), *Amaranthus graecizans* (V), *Heliotropium europaeum* (IV), *Portulaca oleracea* (IV), *Amaranthus albus* (IV), *Setaria verticillata* (IV), *Chenopodium opulifolium* (III), *Cyperus rotundus* (III), *Tribulus terrestris* (III).

Char. class: *Diplotaxis erucoides* (V), *Senecio vulgaris* (IV), *Convolvulus arvensis* (IV), *Erigeron bonariensis* (III), *Chenopodium album* (III), *Malva sylvestris* (III), *Capsella rubella* (III), *Chenopodium vulvaria* (III), *Glebionis coronaria* (II), *Solanum nigrum* (II).

Other species: *Dittrichia graveolens* (IV), *Chondrilla juncea* (IV), *Launaea resedifolia* (IV).

Geographical distribution: This community was surveyed only in Southern Sicily and in particular in the Santo Pietro wood near Caltagirone (Brullo & Marcenò, 1980).

Structure and ecology: On sandy soils, the previous association is replaced by a different weedy community, ascribed to the *Amarantho lividi-Eragrostietum barrelieri.* This vegetation occurs mainly in vineyards within the thermomediterranean bioclimatic belt. *Eragrostis barrelieri* and *Amaranthus lividus* are considered the characteristic species of this syntaxon, growing together with some species of alliance and order, as *Hypericum triquetrifolium*, *Amaranthus retroflexus*, *Amaranthus graecizans*, *Heliotropium europaeum* , *Portulaca oleracea*, *Amaranthus albus*, etc. ((Brullo & Marcenò, 1985).

Syndynamism: This community is connected with the dynamic series of *Stipo bromoidis-Quercetum suberis* (Brullo et al., 2007).

Habitat reference: See class.

31.2.2.3. ***Chrozophoro tinctoriae-Heliotropietum dolosi*** Bartolo, Brullo, Miniss. & Spamp 1990

Weedy vegetation with turn sole and greater heliotrope of hoed and fertilized cultivations on alkaline soils deriving from limestones.

Holotypus: rel. 5, tab. 42, Bartolo et al. (1990).

Characteristic and differential species: *Heliotropium dolosum* De Not.

Phytosociological table: From Bartolo et al. (1990), table 42, 5 rel.

Char. association: *Heliotropium dolosum* (V).

Char. alliance and order: *Heliotropium europaeum* (V), *Portulaca oleracea* (IV), *Chrozophora tinctoria* (IV), *Setaria verticillata* (IV), *Amaranthus graecizans* (III), *Digitaria sanguinalis* (II).

Char. class: *Chenopodium murale* (V), *Sonchus oleraceus* (V), *Chenopodium vulvaria* (IV), *Fumaria parviflora* (IV), *Ecballium elaterium* (III), *Chenopodium opulifolium* (III), *Fumaria densiflora* (II), *Capsella rubella* (II), *Emex spinosa* (II), *Glebionis coronaria* (II), *Anisantha sterilis* (II), *Solanum nigrum* (II), *Malva parviflora* (II), *Erodium cicutarium* (II), *Reseda lutea* (II), *Centaurea melitensis* (II), *Erodium malacoides* (II), *Sonchus asper* (II), *Sonchus asper* (II), *Amaranthus viridis* (I), *Calendula tripterocarpa* (I), *Chenopodium album* (I), *Malva multiflora* (I).

Other species: *Convolvulus arvensis* (V), *Anagallis arvensis* (V), *Beta macrocarpa* (IV).

Geographical distribution: This vegetation is restricted to Lampedusa island (Bartolo et al., 1990).

Structure and ecology: The *Chrozophoro tinctoriae-Heliotropietum dolosi* is a weedy vegetation of hoed and fertilized cultivations (vineyards) on alkaline soils deriving from limestones, within the thermo- and inframediterranean dry bioclimatic belts. The structure of this community is gived by few nitrophilous species, as *Heliotropium dolosum*, *Chrozophora tinctoria* and *Heliotropium europaeum*, growing together with some species of order and class,

as *Portulaca oleracea*, *Setaria verticillata*, *Amaranthus graecizans*, *Digitaria sanguinalis*, *Chenopodium murale*, *Sonchus oleraceus*, etc. (Bartolo et al., 1990).

Syndynamism: It is connected with the dynamic series of *Periplocion angustifoliae* (Brullo et al., 2007).

Habitat reference: See class.

31.2.3. Alliance: ***Panico-Setarion viridis*** Sissingh in Weshtoff et al. 1946

Summer weedy vegetation of irrigated hoed and fertilized cultivations.

Synonyms: *Panico-Setarion* Sissingh in Westhoff et al. 1946; *Digitario ischaemi-Setarieion viridis* (Sissingh in Westhoff et al. 1946) Oberd. 1957 nom. mut.; *Polygonion tomentosi* Sissingh 1942 (art. 2b); *Amaranthion* Tx. & Preising 1942 p.p. (art. 2b).

Holotypus: *Echinochloo-Setarietum* Krusem. & Vlieg. (1939) 1940.

Characteristic and differential species: *Echinochloa crus-galli* (L.) P.Beauv., *Galinsoga parviflora* Cav., *Setaria viridis* (L.) P.Beauv.

Geographical distribution: See order.

Structure and ecology: The therophytic weedy vegetation of hoed and fertilized cultivations, regularly watered during the summer months, is ascribed to the *Panico-Setarion viridis*. In Sicily, it is found in citrus groves, corn and horticultural fields, within the thermo- and mesomediterranean bioclimatic belts (Brullo et al., 2007).

Syndynamism: See order.

Habitat reference: See class.

31.2.3.1. ***Setario glaucae-Echinochloetum colonum*** A. & O. Bolòs ex O. Bolòs 1956

Weedy vegetation with jungle rice and yellow foxtail of irrigated corn and horticultural fields on alluvial soils.

Synonyms: *Amarantho-Cyperetum rotundi echinochloetosum coloni* Maugeri et al. 1980, nom. inval. (Art. 5).

Holotypus: rel. 1, pg. 78-79, A. Bolòs (1950). Designated by Ninot et al. (2011).

Characteristic and differential species: *Echinochloa colona* (L.) Link.; *Setaria pumila* (Poir.) Roem. & Schult. (= *Setaria glauca* (L.) Beauv.).

Phytosociological table: From Brullo & Marcenò (1985), table 12, 10 rel.
Char. association: *Echinochloa colonum* (V).
Char. alliance: *Setaria pumila* (V), *Echinochloa crus-galli* (IV), *Galinsoga parviflora* (II).
Char. order: *Cyperus rotundus* (V), *Heliotropium europaeum* (V), *Amaranthus retroflexus* (V), *Portulaca oleracea* (V), *Setaria verticillata* (V), *Amaranthus blitoides* (IV), *Digitaria sanguinalis* (IV), *Chenopodium opulifolium* (IV), *Eragrostis cilianensis* (IV), *Amaranthus graecizans* (IV), *Setaria verticilliformis* (IV), *Solanum luteum* (III), *Sorghum halepense* (II).
Char. class: *Chenopodium album* (V), *Sonchus oleraceus* (IV), *Erigeron canadensis* (IV), *Malva sylvestris* (III), *Euphorbia nutans* (III), *Chenopodium vulvaria* (III), *Diplotaxis erucoides* (III), *Glebionis coronaria* (II), *Datura stramonium* (II).
Other species: *Agrostis stolonifera* (IV), *Cynodon dactylon* (IV), *Convolvulus arvensis* (III).

Geographical distribution: This vegetation was described for the Iberian Peninsula by Bolòs (1956) and later surveyed also in Calabria (Brullo et al., 2001) and Sicily, where it is widespread in the Etnean, Catanense and Hyblaean districts (Maugeri, 1980; Brullo & Marcenò 1985).

Structure and ecology: The irrigated corn and horticultural fields (peppers, eggplants, tomatoes, pumpkins, cucumbers, marrows, water- and honey melons), growing on alluvial soils, are colonized by a weedy vegetation with summer optimum. It is the *Setario glaucae-Echinochloetum colonum*, a rather diverse assemblage of weeds, including *Echinochloa colonum, Setaria pumila*, *Echinochloa crus-galli*, *Galinsoga parviflora*, *Cyperus rotundus*, *Heliotropium europaeum*, ecc. This vegetation occurs within the thermo- and mesomediterranean bioclimatic belts (Brullo & Marcenò 1985; Ninot et al., 2011).

Syndynamism: It is connected with the dynamic series of *Oleo-Quecetum virgilianae* (Brullo et al., 2007).

Habitat reference: See class.

31.2.3.2. ***Setario ambiguae-Cyperetum rotundi*** Brullo, Scelsi & Spamp. 2001

Sciaphilous weedy vegetation with ambiguous bristlegrass and nut grass of citrus groves on alluvial soils**.**

Synonyms: *Fumario-Cyperetum rotundi* Brullo & Marcenò 1985 non Horvatić 1960; *Amaranto-Cyperetum rotundi* Maugeri 1980, nom. inval. (Art. 5).

Holotypus: rel. 3, tab. 187, Brullo et al. (2001).

Characteristic and differential species: *Cyperus esculentus* L., *Setaria verticilliformis* Dumort. (=*Setaria ambigua* Guss.).

Phytosociological table: From Brullo & Marcenò (1985), table 11, 9 rel.

Char. association: *Cyperus rotundus* (V), *Setaria verticilliformis* (V), *Cyperus esculentus* (III).

Char. alliance: *Setaria viridis* (IV), *Echinochloa crus-galli* (IV), *Galinsoga parviflora* (IV), *Erodium cicutarium* (IV).

Char. order: *Setaria verticillata* (V), *Amaranthus graecizans* (V), *Portulaca oleracea* (V), *Digitaria sanguinalis* (IV), *Amaranthus retroflexus* (III), *Heliotropium europaeum* (III), *Chenopodium opulifolium* (III).

Char. class: *Solanum nigrum* (V), *Urtica membranacea* (V), *Chenopodium album* (V), *Sonchus oleraceus* (III), *Chenopodium murale* (III), *Amaranthus deflexus* (III), *Brassica fruticulosa* (II), *Urtica urens* (II), *Rumex pulcher* (II), *Capsella rubella* (II), *Calendula arvensis* (I), *Erigeron bonariensis* (I).

Other species: *Parietaria judaica* (V), *Convolvulus arvensis* (III), *Cynodon dactylon* (III).

Geographical distribution: This community was surveyed for much of Sicily, including Drepano-Panormitan, Etnean, Catanense and Hyblaean districts (Maugeri, 1980; Brullo & Marcenò 1985; Brullo et al., 2001, 2007; Corbetta et al., 2002). It occurs also in southern Calabria.

Structure and ecology: The citrus groves on alluvial soils, within the thermo- and mesomediterranean bioclimatic belts, are infested by a sciaphilous weedy vegetation, ascribed to the *Setario ambiguae-Cyperetum rotundi* (Brullo et al., 2007). Less frequently, this vegetation is also found in other hoed and fertilized crops, which are capable of providing sufficient shade, as well as in gardens and flowerbeds. Its structure is given by some species with summer-autumn development, as *Cyperus rotundus*, *Cyperus esculentus*, *Setaria verticilliformis*, *Galinsoga parviflora*, *Setaria verticillata*, ecc.

Syndynamism: It is connected with the dynamic series of *Oleo-Quecetum virgilianae* (Brullo et al., 2007).

Habitat reference: See class.

31.2.3.3. ***Amarantho graecizantis-Setarietum verticillati*** Ferro 2005

Heliophilous weedy vegetation with lesser amaranth and bristly foxtail of hoed and fertilized cultivations on volcanic sandy soils.

Holotypus: rel. 4, tab. 3, Ferro (2005).

Characteristic and differential species: *Amaranthus graecizans* L., *Setaria verticillata* (L.) P.Beauv.

Phytosociological table: From Ferro (2005), table 3, 8 rel. (subass. *digitarietosum sanguinalis*).

Char. association: *Setaria verticillata* (V), *Amaranthus graecizans* (III).

Char. alliance: *Cyperus rotundus* (IV), *Erigeron sumatrensis* (IV), *Chenopodium ficifolium* (I).

Char. order: *Portulaca oleracea* (IV), *Digitaria sanguinalis* (IV), *Amaranthus retroflexus* (IV), *Trilobus terrestris* (II), *Eragrostis cilianensis* (II), *Heliotropium europaeum* (II).

Char. class: *Chenopodium murale* (V), *Solanum nigrum* (V), *Brassica fruticulosa* (IV), *Chenopodium album* (II), *Sonchus oleraceus* (I), *Raphanus raphanstrum* (I), *Capsella bursa-pastoris* (I), *Erigeron canadensis* (I), *Glebionis coronaria* (I).

Other species: *Cynodon dactylon* (IV), *Datura stramonium* (II), *Chondrilla juncea* (II).

From Ferro (2005), table 3, rel. 8. (subass. *digitarietosum sanguinalis*).

Char. association: *Setaria verticillata* (V), *Amaranthus graecizans* (III).

Char. alliance: *Cyperus rotundus* (IV), *Erigeron sumatrensis* (II).

Char. order: *Portulaca oleracea* (II), *Eragrostis cilianensis* (II), *Trilobus terrestris* (I), *Chenopodium opulifolium* (I).

Char. class: *Oxalis pes-caprae* (V), *Stellaria media* (V), *Solanum nigrum* (V), *Brassica fruticulosa* (V), *Senecio vulgaris* (IV), *Sonchus oleraceus* (IV), *Calendula arvensis* (IV), *Chenopodium murale* (II), *Chenopodium album* (II), *Euphorbia helioscopia* (II), *Capsella bursa-pastoris* (II), *Lamium amplexicaule* (II), *Amaranthus viridis* (II), *Erigeron canadensis* (I), *Mercurialis annua* (I); *Glebionis coronaria* (I), *Raphanus raphanistrum* (I), *Urtica membranacea* (I).

Other species: *Cynodon dactylon* (IV), *Datura stramonium* (II), *Lobularia maritima* (II).

Geographical distribution: This community is restricted the Aeolian islands (Ferro, 2005).

Structure and ecology: The *Amarantho graecizantis-Setarietum verticillati* is an heliophilous weedy vegetation, colonizing vineyards on volcanic sandy soils, within the thermomediterranean bioclimatic belts. Ferro (2005) distinguished two subassociations: the subass. *digitarietosum sanguinalis* have its blossom in full summer; the subass. *oxalidetusum pedis-caprae* grows after the first autumnal rains. The physiognomy of this community is given by *Setaria verticillata* and *Amaranthus graecizans*, growing together with many species of order and class, such as *Cyperus rotundus*, *Erigeron sumatrensis, Portulaca oleracea*, *Eragrostis cilianensis*, *Trilobus terrestris*, *Chenopodium opulifolium*, *Oxalis pes-caprae*, *Stellaria media*, *Solanum nigrum*, *Brassica fruticulosa*, *Senecio vulgaris*, etc.

Syndynamism: It is connected with the dynamic series of *Erico-Quercion ilicis* (Brullo et al., 2007).

Habitat reference: See class.

31.3. Order: ***Brometalia rubenti-tectorum*** (Rivas Goday & Rivas-Martinez 1973) Rivas-Martinez & Izco 1977

Thermoxerophilous annual vegetation of ruderal habitats.

Synonyms: *Thero-Brometalia annua* Rivas Goday & Rivas-Martinez 1963 (art. 3b); *Thero-Brometalia annua* Rivas Goday & Rivas-Martinez ex Esteve 1973 (art. 3f); *Thero-Brometalia* Rivas Goday et Rivas-Martinez ex O. de Bolòs 1975 nom. ambig. (art. 36).

Holotypus: *Taeniathero-Aegilopion geniculatae* Rivas Martínez & Izco 1977.

Characteristic and differential species: *Anisantha madritensis* (L.) Nevski, *Anisantha sterilis* (L.) Nevski, *Astragalus hamosus* L., *Avena barbata* Link, *Avena sterilis L., Bromus hordeaceus* L., *Catapodium rigidum* (L.) C.E.Hubb., *Glebionis coronaria* (L.) Cass. ex Spach, *Echium plantagineum* L., *Galactites elegans* (All.) Nyman ex Soldano, *Hedypnois cretica* (L.) Dum., *Hirschfeldia incana* (L.) Lagr.-Foss., *Lolium rigidum* Gaud., *Lotus ornithopodioides* L., *Malva nicaeensis* All., *Malva parviflora* L., *Medicago orbicularis* (L.) All., *Medicago polymorpha* L., *Medicago truncatula* Gaertn., *Sulla coronaria* (L.) Medik., *Vicia villosa* Roth.

Geographical distribution: This order occurs in the western and central Mediterranean territories (Mucina et al., 2016).

Structure and ecology: The subnitrophilous thermoxerophilous vegetation, growing in abandoned fields, uncultivated lands, ruderal areas, road sides and other disturbed habitats, is ascribed to the *Brometalia rubenti-tectorum*. Sometimes, this vegetation is found also in woody cultivations and in particular vineyards. It is spread from the thermo- to supramediterranean belts (Brullo et al., 2007).

Syndynamism: The communities belonging to this order are dynamically connected to the series of *Quercetea ilicis*. The reduction or disappearance of disturbance factors leads to the establishment of annual dry grasslands of *Stipo-Trachynietea dystachiae*, which progressively tend to forms a patchy mosaic with the perennial grasslands of *Lygeo-Stipetea* (Brullo et al., 2007).

Habitat reference: See class.

31.3.1. Alliance: ***Fedio graciliflorae-Convolvulion cupaniani*** Brullo & Spamp. 1986

Subnitrophilous weedy vegetation of vineyards, abandoned fields and road-sides on clayish to loamy soils.

Synonyms: *Cerintho majoris-Convolvulion cupaniani* (S. Brullo & Spampinato 1986) de Foucault 2012.

Holotypus: *Chamaemelo fusci-Silenetum fuscatae* Brullo & Spamp. 1986.

Characteristic and differential species: *Brassica oleracea* L., *Cerinthe major* L., *Convolvulus tricolor* L. subsp. *cupanianus* (Tod.) Cavara & Grande, *Fedia caput-bovis* Pomel, *Fedia*

graciliflora Fisch. & C.A. Mey, *Ficaria verna* Huds., *Geranium dissectum* L., *Medicago intertexta* (L.) Mill., *Melilotus infesta* Guss., *Scorpiurus vermiculatus* L., *Senecio vernus* Biv., *Vicia sicula* (Raf.) Guss.

Geographical distribution: This alliance is restricted to Western Sicily (Brullo & Spampinato, 1986).

Structure and ecology: The alliance at issue groups the thermo-xerophilous subnitrophilous weedy communities, colonizing vineyards, abandoned fields and road-sides on clayish to loamy soils, neutral to alkaline, within the thermo- and mesomediterranean bioclimatic belts (Brullo et al., 2007). This syntaxon is well defined by its floristic set, which maintains its characteristic species also in rather different anthropic habitats, due to the edaphic uniformity of western Sicily (Brullo & Spampinato, 1986).

Syndynamism: See order.

Habitat reference: See class.

31.3.1.1. ***Chamaemelo fusci-Silenetum fuscatae*** Brullo & Spamp. 1986

Subnitrophilous weedy vegetation with dusky dogfenne and dark campion of vineyards, on vertisoils derived from marl and clay deposits.

Holotypus: rel. 6, tab. 1, Brullo & Spampinato (1986).

Characteristic and differential species: *Allium dentiferum* Webb & Berthel., *A. pallens* L., *A. trifoliatum* Cirillo, *Chamaemelum fuscatum* (Brot.) Vasc., *Silene fuscata* Brot.

Phytosociological table: From Brullo & Spampinato (1986), table 1, 23 rel.

Char. association: *Silene fuscata* (V), *Allium dentiferum* (V), *Chamaemelum fuscatum* (IV), *Allium pallens* (II), *Allium trifoliatum* (II).

Char. alliance: *Fedia graciliflora* (V), *Brassica oleracea* (IV), *Cerinthe major* (IV), *Convolvulus tricolor* subsp. *cupanianus* (IV), *Ficaria verna* (IV), *Geranium dissectum* (III), *Medicago intertexta* (III), *Senecio vernus* (III), *Melilotus infesta* (II), *Scorpiurus vermiculatus* (II), *Vicia sicula* (I).

Char. order: *Galactites elegans* (V), *Medicago polymorpha* (IV), *Anisantha sterilis* (IV), *Sulla coronaria* (III), *Avena barbata* (III), *Anisantha madritensis* (III), *Hirschfeldia incana* (II), *Lotus ornithopodioides* (II), *Medicago orbicularis* (II), *Echium plantagineum* (II), *Lolium rigidum* (II), *Bromus hordeaceus* (I), *Catapodium rigidum* (I), *Avena sterilis* (I), *Hedypnois cretica* (I), *Astragalus hamosus* (I), *Medicago tribuloides* (I), *Vicia villosa* (I).

Char. class: *Helminthotheca echioides* (V), *Oxalis pes-caprae* (V), *Diplotaxis erucoides* (IV), *Chenopodium album* (I), *Sonchus oleraceus* (V), *Sonchus asper* (IV), *Mercurialis annua* (I), *Calendula arvensis* (III), *Senecio vulgaris* (III), *Stellaria media* (III), *Euphorbia helioscopia* (III), *Erodium malacoides* (II), *Lamium amplexicaule* (II), *Malva sylvestris* (II), *Fumaria officinalis*

(II), *Borago officinalis* (II), *Solanum nigrum* (I), *Raphanus raphanistrum* (I), *Ammi majus* (I), *Fumaria densiflora* (I), *Malva multiflora* (I), *Sinapis arvensis* (I), *Ammi visnaga* (I).
Other species: *Convolvulus arvensis* (II), *Cynodon dactylon* (I).

Geographical distribution: This community occurs only in Western Sicily (Brullo & Spampinato, 1986).

Structure and ecology: The *Chamaemelo fusci-Silenetum fuscatae* is an heliophilous subnitrophilous weedy vegetation of vineyards, growing on vertisoils derived from marl and clay deposits, within the thermo- and mesomediterranean bioclimatic belts. Its structure is given by many therophytes and some geophytes, among them *Silene fuscata*, *Allium dentiferum, Chamaemelum fuscatum*, *Allium pallens* and Allium *trifoliatum*. The alliance is represented by *Fedia graciliflora*, *Brassica oleracea*, *Cerinthe major, Convolvulus tricolor* subsp. *cupanianus*, *Ficaria verna*, *Geranium dissectum, Medicago intertexta*, etc. (Brullo & Spampinato, 1986).

Syndynamism: This community is connected with the dynamic series of *Quercion ilicis* (Brullo et al., 2007).

Habitat reference: See class.

31.3.1.2. ***Ononido alopecuroidis-Vicietum siculi*** Brullo & Marcenò 1985

Subnitrophilous and mesophilous vegetation with Salzmann's restharrow and Sicilian vetch of uncultivated lands.

Holotypus: rel. 1, tab. 26, Brullo & Marcenò (1985).

Characteristic and differential species: *Daucus muricatus* (L.) L., *Ononis alopecuroides* L., *Vicia sicula* (Rafin.) Guss.

Phytosociological table: From Brullo & Marcenò (1985), table 26, 7 rel.

Char. association: *Vicia sicula* (V), *Ononis alopecuroides* (IV), *Daucus muricatus* (III).

Char. alliance: *Convolvulus tricolor* subsp. *cupanianus* (V), *Geranium dissectum* (IV), *Silene fuscata* (III), *Medicago intertexta* subsp. *ciliaris* (III), *Brassica oleracea* (II), *Ficaria verna* (II), *Melilotus infesta* (II), *Fedia graciliflora* (I).

Char. order: *Sulla coronaria* (V), *Galactites elegans* (IV), *Anisantha madritensis* (IV), *Avena barbata* (III), *Lotus ornithopodioides* (III), *Hedypnois cretica* (II), *Hirschfeldia incana* (I), *Vicia villosa* (I), *Medicago polymorpha* (I),

Char. class: *Helminthotheca echioides* (V), *Sonchus asper* (V), *Vicia sativa* (IV), *Cerinthe major* (III), *Senecio vulgaris* (II).

Other species: *Daucus carota* (V), *Tetragonolobus purpureus* (IV), *Sherardia arvensis* (IV), *Ranunculus arvensis* (III).

Geographical distribution: This community occurs only in Western and Central Sicily (Brullo & Marcenò, 1985).

Structure and ecology: The uncultivated lands and fields of stands above 600-700 m a.s.l. are colonized by a peculiar weedy vegetation dominated by *Vicia sicula*, growing together with *Ononis alopecuroides* and *Daucus muricatus*. It is the *Ononido-Vicietum siculi*, a mesophilous community of clay or marly soils, which are quite wet and fresh during the spring (Brullo & Marcenò, 1985). Sometimes, it occurs also along roadsides. The alliance is represented by *Convolvulus tricolor* subsp. *cupanianus*, *Geranium dissectum*, *Silene fuscata*, *Medicago intertexta* subsp. *ciliaris*, *Brassica oleracea*, *Ficaria verna*, *Melilotus infesta* and *Fedia graciliflora*.

Syndynamism: It is dynamically connected with the series of *Oleo oleaster-Quercetum virgilianae*. After the abandonment of crops, the uncultivated surfaces are colonized by the vegetation at issue, which tends to be replaced by *Arundo plinii* monophytic populations on the sloped places. In the flat surfaces, dynamic processes lead to the establishment of *Festuca arundinacea* and *Phalaris coerulescens grasslands* (Gianguzzi & La Mantia, 2004).

Habitat reference: See class.

31.3.1.3. ***Vulpio ligusticae-Tetragonolobetum biflori*** Brullo & Spamp. 1986

Subnitrophilous vegetation with Ligurian fescue and yellow winged pea of roadsides, paths and uncultivated lands, subject to moderate trampling.

Holotypus: rel. 10, tab. 2, Brullo & Spampinato (1986).

Characteristic and differential species: *Coleostephus myconis* (L.) Rchb. f., *Festuca ligustica* (All.) Bertol., *Tetragonolobus biflorus* (Desr.) DC.

Phytosociological table: From Brullo & Marcenò (1986), table 2, 17 rel.

Char. association: *Tetragonolobus biflorus* (V), *Festuca ligustica* (V), *Coleostephus myconis* (V).

Char. alliance: *Fedia caput-bovis* (V), *Convolvulus tricolor* subsp. *cupanianus* (V), *Fedia graciliflora* (IV), *Tetragonolobus purpureus* (IV), *Scorpiurus vermiculatus* (IV), *Geranium dissectum* (III), *Brassica oleracea* (III), *Senecio vernus* (III), *Melilotus infesta* (II).

Char. order: *Sulla coronaria* (V), *Galactites elegans* (V), *Medicago polymorpha* (V), *Anisantha madritensis* (V), *Echium plantagineum* (V), *Avena barbata* (V), *Hedypnois cretica* (IV), *Catapodium rigidum* (III), *Lotus ornithopodioides* (III), *Dasypyrum villosum* (III), *Trifolium stellatum* (III), *Medicago truncatula* (II), *Lotus edulis* (II), *Lolium rigidum* (I), *Trifolium angustifolium* (I), *Bromus rubens* (I), *Lupinus angustifolius* (I).

Char. class: *Cerinthe major* (V), *Anisantha sterilis* (V), *Sonchus oleraceus* (IV), *Malva sylvestris* (III), *Oxalis pes-caprae* (III), *Helminthotheca echioides* (III), *Borago officinalis* (II), *Erodium malacoides* (II), *Senecio vulgaris* (II), *Glebionis coronaria* (I), *Raphanus raphanistrum*

(II), *Euphorbia helioscopia* (II), *Vicia sativa* (I), *Mercuralis annua* (I), *Geranium molle* (I), *Malva nicaeensis* (I) .

Other species: *Crepis vesicaria* (V), *Reichardia picroides* (IV), *Sixalix atropurpurea* subsp. *maritima* (III).

Geographical distribution: This community occurs only in Western Sicily (Brullo & Spampinato, 1986).

Structure and ecology: The *Vulpio-Tetragonolobetum biflori* is found on roadsides, paths and uncultivated lands, showing a slight nitrophilous character. It is linked to soils not affected by cultivation practices and results well adapted to trampling. In fact, it is physiognomically dominated by *Tetragonolobus biflorus*, forming showy yellow-orange carpets during the flowering time. Among the reptant plants also *Festuca ligustica* and *Coleostephus myconis* are quite frequent. The *Fedio-Convolvulion cupaniani* is represented by *Fedia caput-bovis*, *Anisantha madritensis*, *Sulla coronaria*, *Galactites tomentosa*, *Convolvulus tricolor* subsp. *cupanianus*, *Fedia graciliflora*, etc. (Brullo & Spampinato, 1986).

Syndynamism: This vegetation replaces the *Hordeion leporini* communities on calcareous substrata. It is dynamically linked to the *Quercion ilicis* series.

Habitat reference: See class.

31.3.1.4. ***Hedysaro coronarii-Lathyretum hirsuti*** Brullo & Spamp. 1986

Subnitrophilous vegetation with Italian sainfoin and caley pea of shaded and fresh roadsides and uncultivated lands.

Holotypus: rel. 4, tab. 4, Brullo & Spampinato (1986).

Characteristic and differential species: *Lathyrus hirsutus* L.

Phytosociological table: From Brullo & Marcenò (1986), table 4, 5 rel.

Char. association: *Lathyrus hirsutus* (V).

Char. alliance: *Fedia caput-bovis* (IV), *Medicago intertexta* (V), *Convolvulus tricolor* subsp. *cupanianus* (V), *Fedia graciliflora* (IV), *Tetragonolobus purpureus* (IV), *Trisetaria parviflora* (III), *Brassica oleracea* (III), *Melilotus infesta* (III), *Geranium dissectum* (II), *Silene bellidifolia* (I), *Vicia sicula* (I).

Char. order: *Sulla coronaria* (V), *Galactites elegans* (V), *Avena barbata* (V), *Anisantha madritensis* (IV), *Bromus hordeaceus* (III), *Medicago orbicularis* (III), *Lotus ornithopodioides* (III), *Lolium rigidum* (III), *Echium plantagineum* (III), *Catapodium rigidum* (II), *Medicago hispida* (II), *Aegilops geniculata* (II), *Dasypyrum villosum* (II), *Bromus racemosus* (II), *Medicago truncatula* (II), *Trifolium angustifolium* (I), *Stipa capensis* (I).

Char. class: *Helminthotheca echioides* (V), *Vicia sativa* (IV), *Cerinthe major* (III), *Oxalis pes-caprae* (III), *Ammi majus* (III), *Sonchus oleraceus* (II), *Anisantha sterilis* (I), *Malva sylvestris* (I), *Euphorbia helioscopia* (I), *Erodium malacoides* (I).

Other species: *Daucus carota* (V), *Phalaris coerulescens* (IV), *Trifolium squarrosum* (IV), *Trifolium campestre* (IV).

Geographical distribution: This community occurs only in Western Sicily (Brullo & Spampinato, 1986).

Structure and ecology: In the cool and shaded stands, the previous association is replaced by a community characterized by the occurrence and often dominance of *Lathyrus hirsutus*. This community, named *Hedysaro-Lathyretum hirsuti*, occurs mainly along roadsides with quite sloped surfaces and sometimes also in the humid uncultivated lands, having its optimum in the belt between 400 and 600 m. The alliance is represented by several species, as *Fedia caput-bovis*, *Medicago intertexta*, *Convolvulus tricolor* subsp. *cupanianus*, *Fedia graciliflora*, *Tetragonolobus purpureus*, *Trisetaria parviflora, Brassica oleracea*, etc. Among the species of higher rank, *Sulla coronaria*, *Galactites elegans*, *Avena barbata*, *Anisantha madritensis*, *Helminthotheca echioides*, *Vicia sativa* and *Cerinthe major* are frequent (Brullo & Spampinato, 1985).

Syndynamism: See alliance.

Habitat reference: See class.

31.3.1.5. ***Lotetum angustissimo-conimbricensis*** Brullo & Spamp. 1986

Nitrophilous and mesophilous vegetation with slender bird's foot trefoil and white bird's foot trefoil of uncultivated lands and fields on marly and clay soils.

Holotypus: rel. 1, tab. 5, Brullo & Spampinato (1986).

Characteristic and differential species: *Lathyrus hirsutus* L.

Phytosociological table: From Brullo & Marcenò (1986), table 5, 5 rel.

Char. association: *Lotus angustissimus* (V), *Trifolium glomeratum* (V), *Lotus conimbricensis* (V), *Trifolium phleoides* (V), *Trifolium strictum* (V), *Trifolium leucanthum* (V), *Trifolium striatum* (V), *Gastridium ventricosum* (V).

Char. alliance: *Medicago intertexta* (V), *Silene bellidifolia* (V), *Trisetaria parviflora* (V), *Brassica oleracea* (IV), *Convolvulus tricolor* subsp. *cupanianus* (III), *Fedia graciliflora* (III), *Fedia caput-bovis* (III), *Geranium dissectum* (II).

Char. order: *Lolium rigidum* (V), *Galactites elegans* (V), *Echium plantagineum* (V), *Trifolium angustifolium* (V), *Avena barbata* (V), *Sulla coronaria* (IV), *Anisantha madritensis* (III), *Medicago truncatula* (III), *Dasypyrum villosum* (III), *Medicago hispida* (III), *Lupinus*

angustifolius (III), *Vicia villosa* (II), *Catapodium rigidum* (II), *Hedypnois cretica* (II), *Bromus hordeaceus* (I).

Char. class: *Glebionis coronaria* (IV), *Vicia sativa* (IV), *Anisantha sterilis* (IV), *Helminthotheca echioides* (III), *Cerinthe major* (III), *Senecio vulgaris* (II), *Euphorbia helioscopia* (II), *Sonchus oleraceus* (I).

Other species: *Gaudinia fragilis* (V), *Phalaris coerulescens* (V), *Trifolium squarrosum* (V), *Parentucellia viscosa* (V).

Geographical distribution: This community occurs only in the mountain area of Western Sicily and in particular on Rocca Busambra and Sicani area (Brullo & Spampinato, 1986; Marino et al., 2005).

Structure and ecology: In the stands above 600 m, the uncultivated lands and fields with clay and marly soils are colonized by a nitrophilous community, which is dominated by some leguminous plants belonging to *Lotus* and *Trifolium* genera. This vegetation, named *Lotetum angustissimo-conimbricensis*, can be considered a mesophilous vicariant of the *Centauretum schouwii*, an association of *Echio-Galactition tomentosae* described by Brullo (1983) for Central Sicily. Under the floristic profile, *Lotus angustissimus*, *L. conimbricensis*, *Trifolium glomeratum*, *T. phleoides*, *T. strictum*, *T. leucanthum*,*T. striatum* and *Gastridium ventricosum* are the characteristic species of this syntaxon. The alliance and the order are represented by *Silene bellidifolia*, *Medicago intertexta*, *Echium plantagineum*, *Galactites tomentosa*, *Avena barbata*, *Lolium rigidum*, *Trisetaria parviflora*, *Brassica oleracea*, *Sulla coronaria*, *Fedia caput - bovis*, *Trifolium angustifolium*, etc. (Brullo & Spampinato, 1986).

Syndynamism: In the ruderal stands (e.g roadsides), this vegetation takes contact with the *Ononido-Vicietum siculae*.

Habitat reference: See class.

31.3.2. Alliance: ***Hordeion leporini*** Br.-Bl. in Br.-Bl. et al. 1936 corr. O. de Bolòs 1962

Ruderal vegetation of road-sides, paths and dumps.

Synonyms: *Hordeion murini* Br.-Bl. 1931 (art. 2b); *Hordeion murini* Br.-Bl. in Br.-Bl. et al. 1936; *Rudereto-Hordeion* Rothmaler 1943 (art. 2b, 3a); *Hordeion* Br.-Bl. in Br.-Bl. et al. 1947 (art. 2b).

Lectotypus: *Hordeetum leporini* Br.-Bl. in Br.-Bl. et al. 1936.

Characteristic and differential species: *Anacyclus clavatus* (Desf.) Pers., *Bromus scoparius* L., *Echium plantagineum* L., *Erodium ciconium* (L.) L'Hér., *Glebionis coronaria* (L.) Spach., *Hirschfeldia incana* (L.) Lagr.-Foss., *Hordeum murinum* L. subsp. *leporinum* (Link) Arcang.,

Plantago lagopus L., *Reseda alba* L., *Rostraria cristata* (L.) Tzvelev, *Sisymbrium officinale* L. (Scop.).

Geographical distribution: This alliance has a wide Mediterranean distribution (Costa et al., 2012).

Structure and ecology: The ruderal vegetation with winter-spring optimum, colonizing roadsides, garden paths, dumps and hedges, is ascribed to the *Hordeion murini* class. It occurs in the coastal area and hills with a dry thermo-mediterranean bioclimate (Rivas-Martinez, 1978a).

Syndynamism: The communities of this syntaxon belong to the dynamic series of *Quercetea ilicis*. They have an intermediate position between the associations of *Polycarpion tetraphylli*, growing on trampled surfaces, and the slightly nitrophilous vegetation of *Bromo-Oryzopsion miliaceae* (Brullo, 1983a).

Habitat reference: See class.

31.3.2.1. ***Hordeo leporini-Sisymbrietum orientalis*** Oberd. 1954

Ruderal vegetation with wall barley and eastern rocket of dry stands near the sea.

Lectotypus: Not designated.

Characteristic and differential species: *Sisymbrium orientale* L.

Phytosociological table: From Brullo (1983), table 4, 12 rel.

Char. association: *Sisymbrium orientale* (V).

Char. alliance: *Hordeum murinum* subsp. *leporinum* (V), *Glebionis coronaria* (V), *Sisymbrium officinale* (V), *Carduus pycnocephalus* (V), *Rostraria cristata* (V), *Anacyclus clavatus* (IV), *Reseda alba* (IV), *Podospermum laciniatum* (III), *Plantago lagopus* (III), *Rumex pulcher* (III).

Char. order: *Galactites elegans* (V), *Echium plantagineum* (V), *Avena barbata* (V), *Anisantha madritensis* (V), *Hirschfeldia incana* (V), *Lolium rigidum* (V), *Hedypnois cretica* (V), *Medicago polymorpha* (IV), *Bromus hordeaceus* (III), *Stipa capensis* (III), *Bromus rubens* (III).

Char. class: *Malva sylvestris* (V), *Sonchus oleraceus* (V), *Chenopodium murale* (IV), *Malva nicaeensis* (IV), *Mercurialis annua* (IV), *Raphanus raphanistrum* (IV), *Euphorbia helioscopia* (IV), *Conyza bonariensis* (IV), *Symphyotrichum squamatum* (III), *Chenopodium album* (III), *Stellaria media* (III), *Galium aparine* (III), *Capsella rubella* (III), *Scolymus grandiflorus* (III), *Silybum marianum* (III), *Anthemis arvensis* (III), *Sisymbrium irio* (III), *Anisantha sterilis* (III).

Other species: *Parietaria diffusa* (V), *Lobularia maritima* (IV), *Cynodon dactylon* (IV), *Piptatherum miliaceum* (IV).

Geographical distribution: This community is quite spread in Sicily, including some surrounding islands (Brullo, 1983a; Bartolo et al., 1990a; Marino et al., 2005).

Structure and ecology: The ruderal environments near the sea, including suburban stands and roadsides, are colonized by a nitrophilous vegetation characterized by the occurrence and often dominance of *Sisymbrium orientale*. It is the *Hordeo-Sisymbrietum orientalis*, a vegetation found on various kinds of substrata, as limestones, marls, volcanic rocks, etc. This community is clearly referable to *Hordeion murini* alliance for the presence of *Hordeum murinum* subsp. *leporinum*, *Glebionis coronaria*, *Sisymbrium officinale, Carduus pycnocephalus*, *Rostraria cristata*, *Anacyclus clavatus*, *Reseda alba*, etc. Among the species of higher rank *Galactites elegans*, *Echium plantagineum*, *Avena barbata*, *Anisantha madritensis*, *Hirschfeldia incana*, *Lolium rigidum*, *Hedypnois cretica*, *Malva sylvestris*, *Sonchus oleraceus*, *Chenopodium murale* and *Malva nicaeensis* are very frequent (Brullo, 1983a).

Syndynamism: See alliance.

Habitat reference: See class.

31.3.2.2. ***Malvo parviflorae-Chrysanthemetum coronarii*** Ferro 1980

Ruderal vegetation with cheeseweed of sunny stands with calcareous or marly substrata.

Holotypus: rel. 12, tab. 13, Ferro (1980).

Characteristic and differential species: *Malva parviflora* L., *Reseda lutea* L.

Phytosociological table: From Brullo (1983), table 1, 10 rel.

Char. association: *Malva parviflora* (V), *Reseda lutea* (IV).

Char. alliance: *Hordeum murinum* subsp. *leporinum* (V), *Glebionis coronaria* (V), *Reseda alba* (V), *Carduus pycnocephalus* (IV), *Rostraria cristata* (IV), *Anacyclus clavatus* (IV), *Podospermum laciniatum* (IV), *Plantago lagopus* (IV), *Sisymbrium officinale* (III), *Erodium ciconium* (III), *Rumex pulcher* (II), *Bromus scoparius* (II).

Char. order: *Galactites elegans* (V), *Echium plantagineum* (V), *Anisantha madritensis* (V), *Hirschfeldia incana* (V), *Lolium rigidum* (V), *Avena barbata* (IV), *Hedypnois cretica* (IV), *Medicago polymorpha* (IV), *Bromus hordeaceus* (IV), *Stipa capensis* (IV), *Medicago truncatula* (III), *Festuca danthonii* (III), *Bromus rubens* (III), *Anisantha tectorum* (III), *Avena sterilis* (II), *Aegilops geniculata* (II), *Trifolium scabrum* (II) .

Char. class: *Borago officinalis* (V), *Malva sylvestris* (IV), *Anisantha sterilis* (IV), *Sonchus oleraceus* (IV), *Malva nicaeensis* (IV), *Onopordon illyricum* (IV), *Raphanus raphanistrum* (IV), *Scolymus grandiflorus* (IV), *Mercurialis annua* (III), *Hypericum triquetrifolium* (III), *Plantago afra* (III), *Oxalis pes-caprae* (III), *Carthamus lanatus* (II), *Vicia sativa* (II), *Fedia graciliflora* (II), *Diplotaxis erucoides* (II), *Euphorbia helioscopia* (II), *Cynara cardunculus* (I), *Geranium molle* (I),

Other species: *Centaurea sicula* (V), *Sixalix atropurpurea* (V), *Lotus edulis* (IV), *Calendula arvensis* (IV).

Geographical distribution: This community was described by Ferro (1980) for Butera and later surveyed by Brullo (1983a) also in other localities of southern and eastern Sicily (Agrigento, Caltanissetta and Hyblaean areas). Besides, it occurs also in Lampedusa island (Bartolo et al., 1990a).

Structure and ecology: The sunny roadsides and garden paths on limestone or marly substrata are colonized by a ruderal vegetation dominated by *Glebionis coronaria*. It is the *Malvo parviflorae-Chrysanthemetum coronarii*, a thermophilous community of coastal and inner localities within the *Oleo-Ceratonion* and *Quercion ilicis* belts. *Malva parviflora* and *Reseda lutea* are considered the differential species of this syntaxon, growing together with some species of alliance, as *Hordeum murinum* subsp. *leporinum*, *Reseda alba*, *Carduus pycnocephalus*, *Rostraria cristata*, *Anacyclus clavatus*, *Podospermum laciniatum*, *Plantago lagopus*, etc. The order and the class are represented by *Galactites elegans*, *Echium plantagineum*, *Anisantha madritensis*, *Hirschfeldia incana*, *Lolium rigidum*, *Avena barbata*, *Hedypnois cretica*, *Medicago polymorpha*, *Borago officinalis*, *Malva sylvestris*, *Anisantha sterilis*, *Sonchus oleraceus*, etc. (Ferro, 1980; Brullo, 1983a).

Syndynamism: In more xeric conditions, this community is replaced by the *Hordeo-Carduetum argyroae* Brullo & Marcenò, 1985 (Bartolo et al., 1990a).

Habitat reference: See class.

31.3.2.3. ***Hordeo leporini-Vulpietum ligusticae*** Brullo 1983

Ruderal vegetation with Ligurian fescue and hare barley of metamorphic incoherent substrata.

Holotypus: rel. 2, tab. 7, Brullo (1983).

Characteristic and differential species: *Vulpia ligustica* (All.) Link.

Phytosociological table: From Brullo (1983), table 7, 6 rel.

Char. association: *Vulpia ligustica* (V).

Char. alliance: *Hordeum murinum* subsp. *leporinum* (V), *Plantago lagopus* (V), *Bromus scoparius* (V), *Rostraria cristata* (V), *Anacyclus clavatus* (V), *Carduus pycnocephalus* (V), *Erodium ciconium* (IV), *Glebionis coronaria* (IV), *Podospermum laciniatum* (II), *Crepis foetida* (II).

Char. order: *Galactites elegans* (V), *Echium plantagineum* (V), *Anisantha tectorum* (V), *Anisantha madritensis* (V), *Lolium rigidum* (V), *Avena barbata* (V), *Hedypnois cretica* (V), *Medicago polymorpha* (V), *Trifolium stellatum* (IV), *Vicia villosa* (IV), *Stipa capensis* (IV), *Festuca danthonii* (III), *Lupinus angustifolius* (III), *Anisantha sterilis* (III), *Aegilops geniculata* (III), *Catapodium rigidum* (III).

Char. class: *Malva sylvestris* (V), *Sonchus oleraceus* (V), *Capsella rubella* (V), *Mercurialis annua* (V), *Senecio vulgaris* (V), *Euphorbia helioscopia* (V), *Anisantha sterilis* (IV), *Malva*

nicaeensis (III), *Erodium malacoides* (III), *Geranium molle* (III), *Chenopodium murale* (III), *Euphorbia peplus* (III), *Brassica fruticulosa* (III), *Vicia sativa* (II), *Erigeron bonariensis* (II), *Glebionis segetum* (II), *Stellaria media* (II).

Other species: *Lobularia maritima* (V), *Pallenis spinosa* (V), *Silene gallica* (V), *Ornithopus compressus* (IV), *Lathyrus articulatus* (IV).

Geographical distribution: This community was originally described for the hills around Messina, the Peloritani mountains and later recorded also in Sardinia (Brullo, 1983a; Bartolo et al., 1988; Mossa et al., 2005).

Structure and ecology: The *Hordeo-Vulpietum ligusticae* is a ruderal community of roadsides and paths, occurring in areas with annual rainfall above 700 mm on metamorphic incoherent substrata. It is an edaphic vicariant of the *Hordeo-Senecionetum squalidi*, replacing it on well drained sandy soils. Its physiognomy is given by *Vulpia ligustica* and *Hordeum murinum* subsp. *leporinum*. Among the species of alliance, *Hordeum murinum* subsp. *leporinum*, *Plantago lagopus*, *Bromus scoparius*, *Rostraria cristata*, *Anacyclus clavatus* and *Carduus pycnocephalus* are frequent. The order and the class are represented by *Galactites elegans*, *Echium plantagineum*, *Anisantha tectorum*, *Anisantha madritensis*, *Lolium rigidum*, *Avena barbata*, *Hedypnois cretica*, *Medicago polymorpha*, *Malva sylvestris*, *Sonchus oleraceus*, *Capsella rubella*, *Mercurialis annua*, *Senecio vulgaris*, *Euphorbia helioscopia*, etc.

Syndynamism: This vegetation belongs to the dynamic series of *Erico-Quercion ilicis* (Brullo, 1983a).

Habitat reference: See class.

31.3.2.4. ***Carduetum marmorati*** Brullo 1983 corr. Brullo et al. 2020

Ruderal vegetation with Arabian thistle of very dry soils.

Synonyms: *Carduetum australis* Brullo 1983.

Holotypus: rel. 2, tab. 8, Brullo (1983).

Characteristic and differential species: *Carduus australis* L. subsp. *marmoratus* (Boiss. & Heldr.) Kazmi.

Phytosociological table: From Brullo (1983), table 8, 6 rel.

Char. association: *Carduus australis* subsp. *marmoratus* (V).

Char. alliance: *Hordeum murinum* subsp. *leporinum* (V), *Carduus pycnocephalus* subsp. *pycnocephalus* (IV), *Glebionis coronaria* (IV), *Rostraria cristata* (III).

Char. order: *Vicia villosa* (V), *Anisantha madritensis* (V), *Avena barbata* (III).

Char. class: *Stellaria media* (V), *Chenopodium vulvaria* (V), *Geranium molle* (IV), *Fumaria parviflora* (IV), *Mercurialis annua* (IV), *Galium spurium* (IV), *Erodium cicutarium* (IV), *Marrubium vulgare* (III), *Fumaria capreolata* (III), *Urtica membranacea* (I).

Other species: *Lobularia maritima* (V), *Calendula arvensis* (V), *Convolvulus althaeoides* (V), *Andryala integrifolia* (IV), *Parietaria judaica* (IV).

Geographical distribution: This community occurs only in the islands of Sicilian Channel, as Linosa, Lampedusa and Maltese Archipelago (Brullo, 1983a; Bartolo et al., 1990a; Brullo & Siracusa, 1996; Brullo et al., 2018).

Structure and ecology: The dry stands with clayey, volcanic or marly substrata are covered by a ruderal vegetation dominated by *Carduus australis* subsp. *marmoratus*. It is the *Carduetum marmorati*, a very floristically poor vegetation growing in road-sides, shaded places near dry walls or more rarely also ruble accumulations. The alliance is represented by few species, such as *Hordeum murinum* subsp. *leporinum*, *Glebionis coronaria* and *Rostraria cristata*. As regards the syntaxa of higher rank, *Vicia villosa*, *Anisantha madritensis*, *Avena barbata*, *Stellaria media*, *Chenopodium vulvaria* and *Geranium molle* result quite frequent (Brullo, 1983a).

Syndynamism: This vegetation is linked to the dynamic series of *Periploco angustifoliae-Euphorbietum dendroidis* (Brullo et al., 2018).

Habitat reference: See class.

31.3.2.5. ***Hypochoerido hispidae-Plantaginetum serrariae*** Brullo 1983

Ruderal vegetation with Sicilian cat's-ear and toothed plantain of shaded stands with clay soils.

Holotypus: rel. 3, tab. 2, Brullo (1983).

Characteristic and differential species: *Hypochaeris hispida* Willd., *Lolium perenne* L., *Plantago serraria* L., *Trifolium spumosum* L.

Phytosociological table: From Brullo (1983), table 2, 14 rel.

Char. association: *Plantago serraria* (V), *Hypochaeris hispida* (V), *Lolium perenne* (V), *Trifolium spumosum* (IV).

Char. alliance: *Hordeum murinum* subsp. *leporinum* (V), *Glebionis coronaria* (IV), *Rostraria cristata* (IV), *Anacyclus clavatus* (III), *Erodium ciconium* (III), *Carduus pycnocephalus* subsp. *pycnocephalus* (II), *Bromus scoparius* (II), *Reseda alba* (II).

Char. order: *Lolium rigidum* (V), *Catapodium rigidum* (V), *Anisantha madritensis* (IV), *Avena sterilis* (IV), *Hedypnois cretica* (IV), *Medicago polymorpha* (IV), *Bromus hordeaceus* (IV), *Galactites elegans* (III), *Echium plantagineum* (III), *Aegilops geniculata* (III), *Bromus rubens* (III), *Stipa capensis* (III), *Astragalus hamosus* (III), *Trifolium angustifolium* (III), *Medicago truncatula* (II), *Trifolium stellatum* (II), *Festuca danthonii* (II), *Hirschfeldia incana* (II), *Medicago orbicularis* (II), *Trifolium scabrum* (II), *Anisantha tectorum* (I).

Char. class: *Stellaria media* (), *Sonchus oleraceus* (IV), *Borago officinalis* (III), *Anisantha sterilis* (III), *Erodium malacoides* (III), *Malva sylvestris* (III), *Cerinthe major* (III), *Lamium amplexicaule* (II), *Hypericum triquetrifolium* (II), *Oxalis pes-caprae* (II), *Capsella rubella* (II), *Malva parviflora* (II), *Euphorbia helioscopia* (II), *Geranium molle* (II), *Plantago afra* (II), *Scolymus grandiflorus* (I), *Vicia sativa* (I), *Anthemis arvensis* (I).

Other species: *Crepis vesicaria* (IV), *Filago pyramidata* (IV), *Pallenis spinosa* (III), *Anagallis arvensis* (III), *Trachynia distachya* (III).

Geographical distribution: This community was surveyed only in the Hyblaean area (Brullo, 1983a).

Structure and ecology: The ruderal shaded stands with clay or marly-clay soils are colonized by a quite mesophilous vegetation, named *Hypochoerido hispidae-Plantaginetum serrariae.* The structure of this community is given by some hemicryptophytes with spring development, as *Plantago serraria*, *Hypochoeris hispida*, *Lolium perenne* and *Trifolium spumosum* (Brullo, 1983a). These differential species are associated with some taxa of alliance, as *Hordeum murinum* subsp. *leporinum*, *Glebionis coronaria*, *Rostraria cristata*, *Anacyclus clavatus*, *Erodium ciconium*, etc. The order and the class are represented by *Catapodium rigidum*, *Anisantha madritensis*, *Avena sterilis*, *Hedypnois cretica*, *Medicago polymorpha*, *Bromus hordeaceus*, etc. (Brullo, 1983a).

Syndynamism: This vegetation is linked to the dynamic series of *Oleo-Ceratonion* and *Quercion ilicis* (Brullo et al., 2018).

Habitat reference: See class.

31.3.2.6. ***Centauretum napifoliae*** Brullo 1983

Ruderal vegetation with roman cornflower of roadsides on heavy clay soils.

Holotypus: rel. 2, tab. 3, Brullo (1983).

Characteristic and differential species: *Centaurea napifolia* L.

Phytosociological table: From Brullo (1983), table 3, 10 rel.

Char. association: *Centaurea napifolia* (V).

Char. alliance: *Hordeum murinum* subsp. *leporinum* (V), *Anacyclus clavatus* (V), *Podospermum laciniatum* (V), *Glebionis coronaria* (IV), *Carduus pycnocephalus* subsp. *pycnocephalus* (IV), *Rostraria cristata* (III), *Rumex pulcher* (III).

Char. order: *Lolium rigidum* (V), *Anisantha madritensis* (V), *Avena barbata* (V), *Hirschfeldia incana* (V), *Sulla coronaria* (V), *Medicago polymorpha* (V), *Galactites elegans* (V), *Echium plantagineum* (IV), *Stipa capensis* (IV), *Aegilops geniculata* (IV), *Avena sterilis* (III), *Bromus hordeaceus* (III), *Catapodium rigidum* (III), *Medicago ciliaris* (II), *Trifolium stellatum* (II), *Medicago orbicularis* (II).

Char. class: *Sonchus oleraceus* (IV), *Notobasis syriaca* (IV), *Scolymus grandiflorus* (IV), *Malva sylvestris* (IV), *Anisantha sterilis* (III), *Euphorbia helioscopia* (III), *Ammi visnaga* (III), *Sonchus asper* (III), *Geranium molle* (III), *Erodium malacoides* (III), *Diplotaxis erucoides* (II), *Carthamus lanatus* (II), *Oxalis pes-caprae* (II), *Vicia sativa* (II), *Cardaria draba* (II), *Ecballium elaterium* (I), *Fumaria capreolata* (I), *Senecio vulgaris* (I).

Other species: *Glycyrrhiza glabra* (V), *Anagallis arvensis* (IV), *Melilotus siculus* (III), *Phalaris brachystachys* (III), *Beta maritima* (III).

Geographical distribution: This community occurs in the floodplains near Catania and Syrac use (Brullo, 1983a).

Structure and ecology: The ruderal places with clay and silty-clay soils of alluvial origin are colonized y a nitrophilous vegetation dominated by Centaurea napifolia. It is the *Centauretum napifoliae*, which is found along roadsides, paths and embankments (Brullo, 1983a). In this vegetation *Glycyrrhiza glabra* is quite frequent, as well as some species of alliance, as *Hordeum murinum* subsp. *leporinum*, *Anacyclus clavatus*, *Podospermum laciniatum*, *Glebionis coronaria*, *Carduus pycnocephalus* subsp. *pycnocephalus*, etc. The order and the class are represented by *Lolium rigidum*, *Anisantha madritensis*, *Avena barbata*, *Hirschfeldia incana*, *Sulla coronaria*, *Medicago polymorpha*, *Galactites elegans*, *Sonchus oleraceus*, *Notobasis syriaca*, *Scolymus grandiflorus*, *Malva sylvestris*, etc. (Brullo, 1983a).

Syndynamism: This vegetation is linked to the dynamic series of *Oleo-Ceratonion* (Brullo et al., 2018).

Habitat reference: See class.

31.3.2.7. ***Hordeo leporini-Senecionetum squalidi*** Brullo 1983

Ruderal vegetation with wall barley and oxford ragwort of roadsides on volcanic soils.

Holotypus: rel. 1, tab. 5, Brullo (1983).

Characteristic and differential species: *Senecio squalidus* L., *Picris hieracioides* L.

Phytosociological table: From Brullo (1983), table 5, 9 rel.

Char. association: *Senecio squalidus* (V), *Picris hieracioides* (IV).

Char. alliance: *Hordeum murinum* subsp. *leporinum* (V), *Glebionis coronaria* (V), *Anacyclus clavatus* (IV), *Rostraria cristata* (IV), *Carduus pycnocephalus* subsp. *pycnocephalus* (IV), *Plantago lagopus* (IV), *Sisymbrium officinale* (IV), *Reseda alba* (IV), *Podospermum laciniatum* (IV), *Bromus scoparium* (III), *Erodium ciconium* (III), *Crepis foetida* (II).

Char. order: *Anisantha madritensis* (V), *Avena barbata* (V), *Galactites elegans* (V), *Hirschfeldia incana* (IV), *Lolium rigidum* (IV), *Catapodium rigidum* (IV), *Echium plantagineum* (IV), *Stipa capensis* (IV), *Festuca danthonii* (IV), *Anisantha tectorum* (IV), *Avena sterilis* (III),

Medicago polymorpha (III), *Trifolium stellatum* (III), *Lupinus angustifolius* (II), *Bromus hordeaceus* (II).

Char. class: *Conyza bonariensis* (V), *Malva sylvestris* (IV), *Anisantha sterilis* (IV), *Sonchus oleraceus* (IV), *Sisymbrium irio* (III), *Malvia nicaeensis* (III), *Symphyotrichum squamatum* (III), *Geranium molle* (III), *Carthamus lanatus* (II), *Scolymus grandiflorus* (II), *Mercurialis annua* (II), *Chenopodium murale* (II), *Euphorbia peplus* (II), *Euphorbia helioscopia* (II), *Vicia sativa* (II).

Other species: *Parietaria judaica* (V), *Piptatherum miliaceum* (IV), *Rumex bucephalophorus* (IV), *Daucus carota* (IV), *Silene colorata* (III).

Geographical distribution: This community was recorded for the Aeolian islands, Etna and Mount Lauro (Hyblaean area) (Brullo, 1983a).

Structure and ecology: The *Hordeo-Senecionetum squalidi* is a ruderal vegetation of roadsides, growing on acidic volcanic soils. It is a thermophilous vegetation, strictly linked to sunny stands with shallow soils rich in the coarse component. From the floristic point of view, this community is characterized by the occurrence of *Senecio squalidus*. Among the species of alliance, *Hordeum murinum* subsp. *leporinum*, *Glebionis coronaria*, *Anacyclus clavatus*, *Rostraria cristata*, *Carduus pycnocephalus* subsp. *pycnocephalus* and *Plantago lagopus* are quite frequent. The species of higher rank include *Anisantha madritensis*, *Avena barbata*, *Galactites elegans*, *Hirschfeldia incana*, *Lolium rigidum*, *Conyza bonariensis*, *Malva sylvestris*, *Anisantha sterilis*, *Sonchus oleraceus*, etc.

Syndynamism: This vegetation is linked to the dynamic series of *Oleo-Ceratonion* and *Erico-Quercion ilicis* (Brullo et al., 2018).

Habitat reference: See class.

31.3.2.8. ***Hordeo leporini-Erodietum acaulis*** Brullo 1983

Ruderal vegetation with wall barley and acaulescent stork's-bill of submountains roadsides on acidic soils.

Holotypus: rel. 8, tab. 6, Brullo (1983).

Characteristic and differential species: *Erodium acaule* (L.) Becherer & Thell.

Phytosociological table: From Brullo (1983), table 6, 10 rel.

Char. association: *Erodium acaule* (V).

Char. alliance: *Hordeum murinum* subsp. *leporinum* (V), *Erodium ciconium* (V), *Glebionis coronaria* (V), *Anacyclus clavatus* (V), *Rostraria cristata* (IV), *Carduus pycnocephalus* subsp. *pycnocephalus* (IV), *Plantago lagopus* (IV), *Reseda alba* (III), *Podospermum laciniatum* (III), *Bromus scoparium* (II), *Sisymbrium officinale* (II).

Char. order: *Anisantha madritensis* (V), *Avena barbata* (V), *Hirschfeldia incana* (V), *Medicago polymorpha* (V), *Lolium rigidum* (V), *Festuca danthonii* (IV), *Bromus hordeaceus* (IV),

Anisantha tectorum (IV), *Catapodium rigidum* (III), *Galactites elegans* (III), *Echium plantagineum* (III), *Medicago orbicularis* (III), *Trifolium stellatum* (II), *Bromus rigidus* (II), *Bromus rubens* (II), *Medicago truncatula* (I), *Vicia villosa* (I).

Char. class: *Malva sylvestris* (V), *Anisantha sterilis* (IV), *Fedia graciliflora* (IV), *Euphorbia helioscopia* (IV), *Geranium molle* (IV), *Cerinthe major* (IV), *Sonchus oleraceus* (IV), *Malvia nicaeensis* (III), *Anthemis arvensis* (III), *Diplotaxis erucoides* (III), *Borago officinalis* (III), *Plantago afra* (III), *Sisymbrium irio* (II), *Hypericum triquetrifolium* (II), *Galium aparine* (I).

Other species: *Crepis vesicaria* (V), *Sixalix atropurpurea* (IV), *Foeniculum vulgaris* (IV), *Calendula arvensis* (IV), *Bellardia trixago* (IV).

Geographical distribution: This community was recorded for the Aeolian islands, Etna and Mount Lauro (Hyblaean area) (Brullo, 1983a).

Structure and ecology: The ruderal stands with heavy soils of the low mountain belt are colonized by the *Hordeo-Erodietum acaulis*. This community is found mainly on acidic volcanic or metamorphic substrata, preferring humid and shaded places. It is characterized by the occurrence of *Erodium acaule*, growing together with some species of alliance, as *Hordeum murinum* subsp. *leporinum*, *Erodium ciconium*, *Glebionis coronaria*, *Anacyclus clavatus*, *Rostraria cristata*, *Carduus pycnocephalus* subsp. *pycnocephalus* and *Plantago lagopus*. The class and the order are represented by *Anisantha madritensis*, *Avena barbata*, *Hirschfeldia incana*, *Medicago polymorpha*, *Lolium rigidum*, *Festuca danthonii*, *Bromus hordeaceus*, *Malva sylvestris*, *Anisantha sterilis*, *Fedia graciliflora*, *Euphorbia helioscopia*, *Geranium molle*, etc. (Brullo, 1983a).

Syndynamism: This vegetation is dynamically linked to the mesophilous meadows of *Plantaginion cupanii* (Brullo, 1983a).

Habitat reference: See class.

31.3.2.9. ***Senecioni cosyrensis-Hordetum leporini*** Brullo 1983

Thermophilous vegetation of ruderal stands with Pantelleria ragwort and wall barley on volcanic soils.

Holotypus: rel. 3, tab. 9, Brullo (1983).

Characteristic and differential species: *Senecio leucanthemifolius* Poir. var. *cosyrense* Lojac.

Phytosociological table: From Brullo (1983), table 9, 5 rel.

Char. association: *Senecio leucanthemifolius* var. *cosyrense* (V).

Char. alliance: *Hordeum murinum* subsp. *leporinum* (V), *Glebionis coronaria* (V), *Carduus pycnocephalus* subsp. *pycnocephalus* (IV), *Reseda alba* (III), *Rostraria cristata* (II).

Char. order: *Anisantha madritensis* (V), *Lolium rigidum* (V), *Hirschfeldia incana* (IV), *Medicago polymorpha* (IV), *Galactites elegans* (IV), *Echium plantagineum* (III), *Trifolium angustifolium* (III), *Trifolium stellatum* (III), *Hedypnois cretica* (II).

Char. class: *Sonchus oleraceus* (V), *Sonchus asper* (IV), *Mercurialis annua* (IV), *Anisantha sterilis* (IV), *Malva sylvestris* (III), *Erigeron bonariensis* (III), *Fumaria densiflora* (III), *Erodium malacoides* (III).

Other species: *Coleostephus myconis* (V), *Rumex bucephalophorus* (V), *Reichardia picroides* (V), *Parietaria judaica* (IV), *Hypochoeris achyrophorus* (IV).

Geographical distribution: This community is restricted to Pantelleria island (Brullo, 1983a).

Structure and ecology: In Pantelleria island the *Carduetum australis* is replaced by a peculiar community, which is characterized by the occurrence of *Senecio leucanthemifolius* var. *cosyrensis*. It is the *Senecioni cosyrensis-Hordetum leporini*, which is found in the country roads and also in suburban areas on volcanic soils until 300 m a.s.l. (Brullo, 1983a). Under the floristic profile, the alliance is represented by *Hordeum murinum* subsp. *leporinum*, *Glebionis coronaria*, *Carduus pycnocephalus* subsp. *pycnocephalus*, *Reseda alba*, *Rostraria cristata*, etc. The syntaxa of higher rank include *Anisantha madritensis*, *Lolium rigidum*, *Hirschfeldia incana*, *Medicago polymorpha*, *Sonchus oleraceus*, *Sonchus asper*, *Mercurialis annua*, *Anisantha sterilis*, *Malva sylvestris*, etc. (Brullo, 1983a).

Syndynamism: This vegetation is linked to the dynamic series of *Periploco-Euphorbietum dendroidis or Pino-Genistetum aspalathoidis* (Brullo, 1983a).

Habitat reference: See class.

31.3.2.10. ***Hordeo leporini-Centauretum macracanthae*** Brullo 1983

Nitrophilous vegetation with wall barley and big-thorned cornflower of ruderal stands in urban and suburban areas.

Holotypus: rel. 1, tab. 10, Brullo (1983).

Characteristic and differential species: *Centaurea macroacantha* Guss.

Phytosociological table: From Brullo (1983), table 10, 5 rel.

Char. association: *Centaurea macroacantha* (V).

Char. alliance: *Hordeum murinum* subsp. *leporinum* (V), *Carduus pycnocephalus* subsp. *pycnocephalus* (V), *Bromus scoparius* (V), *Rostraria cristata* (IV), *Plantago lagopus* (IV), *Sisymbrium officinale* (IV), *Glebionis coronaria* (III), *Rumex pulcher* (III), *Reseda alba* (III), *Anacyclus clavatus* (III).

Char. order: *Avena barbata* (V), *Anisantha madritensis* (V), *Lolium rigidum* (V), *Hirschfeldia incana* (V), *Medicago polymorpha* (V), *Galactites elegans* (V), *Hedypnois cretica* (IV), *Astragalus*

hamosus (IV), *Medicago orbicularis* (III), *Echium plantagineum* (III), *Avena sterilis* (III), *Catapodium rigidum* (II), *Bromus hordeaceus* (II).

Char. class: *Sonchus oleraceus* (V), *Capsella rubella* (V), *Chenopodium album* (V), *Malva sylvestris* (V), *Helminthotheca echioides* (IV), *Malva multiflora* (IV), *Galium aparine* (IV), *Erodium moschatum* (IV), *Malva parviflora* (III), *Sorghum halepense* (III), *Euphorbia helioscopia* (III), *Mercurialis annua* (III), *Euphorbia peplus* (III), *Senecio vulgaris* (III), *Symphyotrichum squamatum* (III), *Emex spinosa* (III), *Anisantha sterilis* (III), *Sisymbrium irio* (III).

Other species: *Trisetaria aurea* (V), *Polygonum aviculare* (IV), *Pallenis spinosa* (IV), *Melilotus infesta* (IV), *Parietaria judaica* (IV).

Geographical distribution: This community occurs in the outskirts of Palermo, quite distant from the sea (Brullo, 1983a).

Structure and ecology: The *Hordeo-Centauretum macracanthae* is a peculiar nitrophilous vegetation dominated by *Centaurea macroacantha*, which occurs in suburban and urban places. It replaces the *Hordeo-Sisymbrietum orientalis* in the areas further from the sea, originating transitional aspects between the two communities in some places. Under the floristic profile, some species of alliance are quite frequent, such as *Hordeum murinum* subsp. *leporinum*, *Carduus pycnocephalus* subsp. *pycnocephalus*, *Bromus scoparius*, *Rostraria cristata*, *Plantago lagopus*, *Sisymbrium officinale*, etc. The order and the class are represented by *Avena barbata*, *Anisantha madritensis*, *Lolium rigidum*, *Hirschfeldia incana*, *Medicago polymorpha*, *Galactites elegans*, *Hedypnois cretica*, etc. (Brullo, 1983a).

Syndynamism: See alliance.

Habitat reference: See class.

31.3.2.11. ***Chrysanthemo coronarii-Silybetum marianae*** Brullo 1983

Nitrophilous vegetation with garland chrysanthemum and marian thistle of rubbish near the road.

Holotypus: rel. 1, tab. 11, Brullo (1983).

Characteristic and differential species: *Silybum marianum* (L.) Gaertn.

Phytosociological table: From Brullo (1983), table 11, 5 rel.

Char. association: *Silybum marianum* (V).

Char. alliance: *Hordeum murinum* subsp. *leporinum* (V), *Glebionis coronaria* (V), *Carduus pycnocephalus* subsp. *pycnocephalus* (V), *Sisymbrium officinale* (IV), *Rostraria cristata* (III), *Reseda alba* (III), *Rumex pulcher* (II), *Anacyclus clavatus* (II).

Char. order: *Anisantha madritensis* (V), *Lolium rigidum* (V), *Galactites elegans* (V), *Medicago polymorpha* (V), *Echium plantagineum* (V), *Hirschfeldia incana* (IV), *Bromus hordeaceus* (IV), *Avena sterilis* (IV), *Catapodium rigidum* (III), *Anisantha tectorum* (I).

Char. class: *Sonchus oleraceus* (V), *Erodium malacoides* (V), *Anisantha sterilis* (V), *Erigeron bonariensis* (IV), *Helminthotheca echioides* (IV), *Mercurialis annua* (IV), *Carthamus lanatus* (III), *Geranium molle* (III), *Galium aparine* (II), *Senecio vulgaris* (II), *Symphyotrichum squamatum* (II), *Solanum nigrum* (II), *Erigeron canadensis* (II), *Scolymus grandiflorus* (II), *Borago officinalis* (II), *Vicia sativa* (II), *Chenopodium album* (II), *Euphorbia helioscopia* (II), *Urtica urens* (II), *Plantago afra* (II), *Ammi majus* (II), *Raphanus raphanistrum* (I), *Sisymbrium irio* (I) *Chenopodium murale* (I), *Malva sylvestris* (I), *Notobasis syriaca* (I).

Other species: *Beta maritima* (IV), *Lotus ornithopodioides* (III), *Dittrichia viscosa* (III), *Piptatherum miliaceum* (III).

Geographical distribution: This community results quite frequent in Sicily (Brullo, 1983a).

Structure and ecology: The accumulations of rubble and rubbish, usually near the roads, are colonized by a ruderal vegetation dominated by *Silybum marianum*. It is the *Chrysanthemo-Silybetum marianae*, a xerophilous community clearly belonging to the *Hordeion murini* alliance for the occurrence of *Hordeum murinum* subsp. *leporinum*, *Glebionis coronaria*, *Carduus pycnocephalus* subsp. *pycnocephalus*, *Sisymbrium officinale*, etc. Besides, the syntaxa of higher rank are represented by *Anisantha madritensis*, *Lolium rigidum*, *Galactites elegans*, *Medicago polymorpha*, *Echium plantagineum*, *Hirschfeldia incana*, etc. (Brullo, 1983a).

Syndynamism: See alliance.

Habitat reference: See class.

31.3.2.12. ***Hordeo leporini-Onopordetum illyrici*** Brullo & Marcenò 1985

Ruderal vegetation with wall barley and Illyrian thistle of rubbles near roads and paths.

Holotypus: rel. 2, tab. 24, Brullo & Marcenò (1985).

Characteristic and differential species: *Onopordum illyricum* L.

Phytosociological table: From Brullo & Marcenò (1985), table 24, 7 rel.

Char. association: *Onopordum illyricum* (V).

Char. alliance: *Hordeum murinum* subsp. *leporinum* (V), *Glebionis coronaria* (V), *Carduus pycnocephalus* subsp. *pycnocephalus* (V), *Rostraria cristata* (V), *Bromus scoparius* (IV), *Sisymbrium officinale* (III), *Plantago lagopus* (II).

Char. order: *Avena barbata* (V), *Anisantha tectorum* (V), *Anisantha madritensis* (V), *Echium plantagineum* (V), *Lolium rigidum* (V), *Galactites elegans* (V), *Medicago polymorpha* (IV), *Vicia villosa* (III), *Lupinus angustifolius* (III), *Hirschfeldia incana* (II).

Char. class: *Sonchus oleraceus* (V), *Anisantha sterilis* (V), *Helminthotheca echioides* (III), *Mercurialis annua* (III), *Galium aparine* (III), *Brassica fruticulosa* (III), *Glebionis segetum* (III), *Euphorbia helioscopia* (II), *Geranium molle* (II), *Borago officinalis* (II), *Senecio vulgaris* (II), *Fumaria flabellata* (II).

Other species: *Rubus ulmifolius* (V), *Reichardia picroides* (IV), *Dactylis glomerata* (III), *Lagurus ovatus* (III).

Geographical distribution: This community is quite rare, being known only for Aeolian islands and Hyblaean plateau (Brullo & Marcenò, 1985). Besides, it was surveyed also for Korfu island (Brandes, 1996).

Structure and ecology: In the mountain stands the tall thistle *Onopordum illyricum* is usually linked to *Carthametalia* order, while in the more thermophilous places it is a member of *Hordeion murini* communities, as the *Hordeo-Onopordetum illyrici*. This vegetation grows on rubbles near roads and paths, occurring only in areas with precipitation above 600 mm per year. Its floristic set is characterized by the presence of several species belonging to alliance, as *Hordeum murinum* subsp. *leporinum*, *Glebionis coronaria*, *Carduus pycnocephalus* subsp. *pycnocephalus*, *Rostraria cristata*, *Bromus scoparius*, *Sisymbrium officinale*, etc. As regards the order and the class, *Avena barbata*, *Anisantha tectorum*, *Anisantha madritensis*, *Echium plantagineum*, *Lolium rigidum*, *Galactites elegans*, *Sonchus oleraceus*, *Anisantha sterilis*, *Helminthotheca echioides* and *Mercurialis annua* are very frequent (Brullo & Marcenò, 1985).

Syndynamism: See alliance.

Habitat reference: See class.

31.3.2.13. ***Hordeo leporini-Carduetum argyroae*** Brullo & Marcenò 1985

Thermo-xerophilous vegetation with wall barley and plumeless thistle of rubbish accumulations near roads.

Holotypus: rel. 3, tab. 25, Brullo & Marcenò (1985).

Characteristic and differential species: *Carduus argyroa* Biv.

Phytosociological table: From Brullo & Marcenò (1985), table 25, 13 rel.

Char. association: *Carduus argyroa* (V).

Char. alliance: *Hordeum murinum* subsp. *leporinum* (V), *Rostraria cristata* (V), *Plantago lagopus* (V), *Glebionis coronaria* (V), *Anacyclus clavatus* (V), *Erodium ciconium* (IV), *Bromus scoparius* (IV), *Carduus pycnocephalus* subsp. *pycnocephalus* (IV), *Reseda alba* (IV), *Sisymbrium officinale* (III),

Char. order: *Avena barbata* (V), *Galactites elegans* (V), *Anisantha madritensis* (V), *Echium plantagineum* (V), *Lolium rigidum* (IV), *Medicago polymorpha* (IV), *Hirschfeldia incana* (IV), *Catapodium rigidum* (IV), *Hedypnois cretica* (III).

Char. class: *Malva nicaeensis* (V), *Oxalis pes-caprae* (V), *Anisantha sterilis* (V), *Euphorbia helioscopia* (V), *Diplotaxis erucoides* (V), *Raphanus raphanistrum* (V), *Erodium malacoides* (V), *Malva sylvestris* (IV), *Sinapis alba* (IV), *Borago officinalis* (IV), *Capsella rubella* (IV), *Sonchus oleraceus* (IV), *Marrubium vulgare* (IV), *Lamium amplexicaule* (IV), *Urtica membranacea* (III), *Stellaria media* (III), *Calendula arvensis* (III), *Sisymbrium irio* (II), *Chenopodium murale* (II), *Notobasis syriaca* (II), *Mercurialis annua* (II), *Chenopodium album* (II), *Fumaria densiflora* (II).

Other species: *Reichardia picroides* (V), *Melilotus sulcata* (IV), *Piptatherum miliaceum* (III), *Beta maritima* (III).

Geographical distribution: This community occurs only in the coastal areas of Southern Sicily and Lampedusa (Brullo & Marcenò, 1985; Bartolo et al., 1990).

Structure and ecology: The country roadsides affected by a significant accumulation of rubbish, in quite xerophilous conditions, are colonized by the *Hordeo-Carduetum argyroae*. This community occurs only in some coastal areas with an average rainfall lower than 500 mm. It is dominated by *Carduus argyroa*, growing together with some species of alliance, among them *Hordeum murinum* subsp. *leporinum*, *Rostraria cristata*, *Plantago lagopus*, *Glebionis coronaria*, *Anacyclus clavatus*, *Erodium ciconium*, *Bromus scoparius*, etc. The order and the alliance are represented by *Avena barbata*, *Galactites elegans*, *Anisantha madritensis*, *Echium plantagineum*, *Malva nicaeensis*, *Oxalis pes-caprae*, *Anisantha sterilis*, *Euphorbia helioscopia*, *Diplotaxis erucoides*, etc. (Brullo & Marcenò, 1985).

Syndynamism: This association is linked with the dynamic series of *Oleo-Ceratonion*. If it is compared with the *Malvo parviflorae-Chrysanthemetum coronarii*, the vegetation at issue shows a more nitrophilous character and is strictly linked to coastal localities (Brullo & Marcenò, 1985).

Habitat reference: See class.

31.3.2.14. ***Evaco asterisciflorae-Filaginetum congestae*** Bartolo, Brullo, Miniss. & Spamp. 1990

Ruderal vegetation with dwarf cudweed of dirt roads edges.

Holotypus: rel. 4, tab. 34, Bartolo et al. (1990).

Characteristic and differential species: *Filago asterisciflora* (Lam.) Sweet. (= *Evax asterisciflora* (Lam.) Pers.), *Filago congesta* Guss.

Phytosociological table: From Bartolo et al. (1990), table 34, 8 rel.

Char. association: *Filago congesta* (V), *Filago asterisciflora* (V).

Char. alliance: *Hordeum murinum* subsp. *leporinum* (V), *Rostraria cristata* (IV), *Erodium ciconium* (IV), *Bromus scoparius* (IV), *Reseda alba* (III), *Glebionis coronaria* (III), *Carduus pycnocephalus* subsp. *pycnocephalus* (II).

Char. order: *Anisantha madritensis* (V), *Echium plantagineum* (V), *Medicago hispida* (V), *Astragalus hamosus* (V), *Stipa capensis* (IV), *Hedypnois cretica* (IV), *Astragalus sesameus* (IV), *Lotus edulis* (IV), *Avena barbata* (II), *Catapodium rigidum* (II), *Lolium rigidum* (I).

Char. class: *Geranium molle* (IV), *Anisantha sterilis* (IV), *Malva nicaeensis* (III), *Sonchus oleraceus* (III), *Oxalis pes-caprae* (II), *Malva parviflora* (I), *Erodium malacoides* (I).

Other species: *Trachynia distachya* (V), *Medicago litoralis* (V), *Plantago afra* (V), *Salvia verbenaca* (V).

Geographical distribution: This community was surveyed by Bartolo et al. (1990) in Lampedusa island.

Structure and ecology: The edges and rarely also the central part of dirt roads is colonized by a therophytic vegetation dominated by *Filago congesta* and *F. asterisciflora*. It is the *Evaco asterisciflorae-Filaginetum congestae*, a ruderal community well adapted to moderate disturbance. Under the floristic profile, the alliance is represented by *Hordeum murinum* subsp. *leporinum*, *Rostraria cristata*, *Erodium ciconium*, *Bromus scoparius*, *Reseda alba*, *Glebionis coronaria*, and *Carduus pycnocephalus* subsp. *pycnocephalus*. Among the species of higher rank, *Anisantha madritensis*, *Echium plantagineum*, *Medicago hispida*, *Astragalus hamosus*, *Geranium molle* and *Anisantha sterilis* are very frequent (Bartolo et al., 1990).

Syndynamism: The trampling increase led to very dry edaphic conditions due to soil thinning, which favor the establishment of *Polygono-Poetea annuae* vegetation in replacement of the community at issue (Bartolo et al., 1990).

Habitat reference: See class.

31.3.2.15. ***Volutario lippii-Hordeetum leporini*** Brullo & Siracusa 1996

Thermo-xerophilous vegetation with Lippi cornflower and wall barley of small walls near roads and paths.

Holotypus: rel. 3, tab. 19, Brullo & Marcenò (1985).

Characteristic and differential species: *Volutaria lippii* (L.) Maire

Phytosociological table: From Brullo & Marcenò (1985), table 19, 6 rel.

Char. association: *Volutaria lippii* (V).

Char. alliance: *Hordeum murinum* subsp. *leporinum* (V), *Glebionis coronaria* (V), *Rostraria cristata* (V), *Anisantha madritensis* (V), *Carduus pycnocephalus* subsp. *pycnocephalus* (IV), *Bromus rubens* (I).

Char. order: *Avena barbata* (IV), *Anisantha diandra* (IV), *Plantago coronopus* (II), *Vicia villosa* subsp. *varia* (II), *Erodium cicutarium* (II), *Echium plantagineum* (I), *Medicago polymorpha* (I).

Char. class: *Malva parviflora* (V), *Reichardia tingitana* (V), *Sonchus oleraceus* (IV), *Emex spinosa* (IV), *Brassica fruticulosa* (IV), *Mercurialis annua* (III), *Urtica membranacea* (I), *Erigeron sumatrensis* (I),

Other species: *Euphorbia pinea* (IV), *Lobularia maritima* (IV), *Silene nocturna* (IV), *Rumex bucephalophorus* subsp. *aegeus* (IV), *Urospermum picroides* (III).

Geographical distribution: This community is known only for Linosa island (Brullo & Siracusa, 1996).

Structure and ecology: The rare north-african species *Volutaria lippii* characterizes a peculiar ruderal vegetation, which is found in the small walls near country roads and paths. It is the *Volutario lippii-Hordeetum leporini*, a thermo-xerophilous community belonging to *Hordeion murini*. In fact some species of this alliance, as *Hordeum murinum* subsp. *leporinum*, *Glebionis coronaria*, *Rostraria cristata*, *Anisantha madritensis* and *Carduus pycnocephalus* subsp. *pycnocephalus*, result quite frequent. The order and the class are represented by *Avena barbata*, *Anisantha diandra*, *Malva parviflora*, *Reichardia tingitana*, *Sonchus oleraceus*, *Emex spinosa*, *Brassica fruticulosa*, etc. (Brullo & Siracusa, 1996).

Syndynamism: In less xerophilous environments, this vegetation is replaced by the *Carduetum australis* (Brullo & Siracusa, 1996).

Habitat reference: See class.

31.3.2.16. ***Hordeo leporini-Sisymbrietum erysimoidis*** Brullo & Scelsi 1998

Ruderal vegetation with wall barley and French rocket of urban roadsides.

Holotypus: rel. 6, tab. 11, Brullo & Scelsi (1998).

Characteristic and differential species: *Sisymbrium erysimoides* Desf.

Phytosociological table: From Brullo & Scelsi (1998), table 11, 8 rel.

Char. association: *Sisymbrium erysimoides* (V).

Char. alliance: *Hordeum murinum* subsp. *leporinum* (V), *Glebionis coronaria* (V), *Rostraria cristata* (IV), *Reseda alba* (III).

Char. order: *Galactites elegans* (V), *Hirschfeldia incana* (V), *Medicago hispida* (V), *Anisantha madritensis* (IV), *Avena barbata* (III).

Char. class: *Anisantha sterilis* (V), *Sonchus oleraceus* (V), *Stellaria media* (V), *Senecio vulgaris* (V), *Malva nicaeensis* (V), *Erodium malacoides* (V), *Chenopodium album* (III), *Diplotaxis erucoides* (III), *Setaria viridis* (III), *Urtica membranacea* (III), *Emex spinosa* (II), *Malva parviflora* (II), *Fumaria densiflora* (I), *Chenopodium murale* (I), *Urtica urens* (I).

Other species: *Poa annua* (IV), *Cynodon dactylon* (III).

Geographical distribution: This community occurs in the south-eastern part of Sicily (Sampieri), as well as near Catania and Reggio Calabria (Brullo & Scelsi, 1998). It probably occurs also in the urban areas of Palermo (Giardina, 2001).

Structure and ecology: The roadsides, sidewalks, pavements and flower beds of urban places are colonized by a ruderal vegetation dominated by *Sisymbrium erysimoides*. This community, named *Hordeo-Sisymbrietum erysimoidis*, shows a thermophilous character and is attributable to Hordeion murini alliance for the occurrence of several species belonging to this syntaxon, as *Hordeum murinum* subsp. *leporinum*, *Glebionis coronaria*, *Rostraria cristata* and *Reseda alba*- As regard order and class, *Galactites elegans*, *Hirschfeldia incana*, *Medicago hispida*, *Anisantha sterilis*, *Sonchus oleraceus*, *Stellaria media*, *Senecio vulgaris*, *Malva nicaeensis* and *Erodium malacoides* result very frequent (Brullo & Scelsi, 1998).

Syndynamism: See alliance.

Habitat reference: See class.

31.3.2.17. ***Lavatero creticae-Chrysanthemetum coronarii*** Ferro & Zizza in Ferro 2005

Ruderal vegetation with cornish mallow and garland chrysanthemum of country houses and roadsides on volcanic soils.

Holotypus: rel. 10, tab. 5, Ferro (2005).

Characteristic and differential species: *Malva multiflora* (Cav.) Soldano et al.

Phytosociological table: From Ferro (2005), table 5, 10 rel.

Char. association: *Malva multiflora* (V).

Char. alliance: *Glebionis coronaria* (V), *Hordeum murinum* subsp. *leporinum* (III), *Rostraria cristata* (III), *Malva parviflora* (I).

Char. order: *Galactites elegans* (V), *Avena barbata* (IV), *Echium plantagineum* (II), *Anisantha madritensis* (I), *Catapodium rigidum* (I), *Geranium molle* (I).

Char. class: *Brassica fruticulosa* (V), *Anisantha sterilis* (IV), *Avena sterilis* (III), *Oxalis pes-caprae* (III), *Sonchus oleraceus* (III), *Glebionis segetum* (II), *Mercurialis annua* (II), *Euphorbia helioscopia* (II), *Fumaria flabellata* (I), *Lolium rigidum* (I), *Chenopodium album* (I), *Borago officinalis* (I), *Marrubium vulgare* (I), *Anchusa azurea* (I), *Plantago afra* (I), *Solanum nigrum* (I), *Stellaria media* (I), *Phalaris paradoxa* (I), *Vicia villosa* subsp. *ambigua* (I), *Trifolium nigrescens* (I), *Capsella bursa-pastoris* (I), *Erigeron canadensis* (I), *Lathryrus clymenum* (I), *Geranium lanuginosum* (I), *Spergula arvensis* (I), *Euphorbia terracina* (I), *Plantago lanceolata* (I).

Other species: *Silene gallica* (III), *Artemisia arborescens* (III).

Geographical distribution: This community was surveyd only in the Aeolian islands (Ferro, 2005).

Structure and ecology: The disturbed places, as country houses, roadsides and path, are colonized by the *Lavatero creticae-Chrysanthemetum coronarii*. This community can be considered as an edaphic vicariant of *Malvo parviflorae-Chrysanthemetum coronarii*, occurring on volcanic substrata rather than limestones and clays. Its appearance is characterized by the showy flowering of *Glebionis coronaria*, growing together with *Malva multiflora*, which is favored by the accumulation of road material in the soil. The alliance is represented mainly by *Glebionis coronaria*, *Hordeum murinum* subsp. *leporinum* and *Rostraria cristata*, while among the species of higher rank *Galactites elegans*, *Avena barbata*, *Brassica fruticulosa*, *Anisantha sterilis* are very frequent (Ferro, 2005).

Syndynamism: The decrease of the anthropic disturbance leads to the establishment of shrub vegetation, while the maintenance of the community at issue is guaranteed by human activities (Ferro, 2005).

Habitat reference: See class.

31.3.3. Alliance: ***Echio plantaginei-Galactition tomentosae*** O. Bolòs & Molinier 1969

Tall or medium herb ruderal vegetation of uncultivated lands.

Holotypus: *Galactito tomentosae-Vulpietum membranaceae* O. Bolòs & Molinier 1969 corr. O. Bolòs, Molinier & P. Montserrat 1970.

Characteristic and differential species: *Carlina lanata* L., *Centaurea diluta* Aiton, *Hypochaeris achyrophorus* L., *Lotus ornithopodioides* L., *Medicago murex* Willd., *Reichardia intermedia* (Sch. Bip.) Samp., *Reichardia picroides* (L.) Roth., *Tordylium apulum* L., *Trifolium nigrescens* Viv. subsp. *nigrescens*, *Urospermum picroides* (L.) Schmidt.

Geographical distribution: This alliance is distributed in the central and western Mediterranean area, as well as in the Macaronesian islands (Brullo, 1983b; Fanelli & Lucchese, 1998; Costa et al., 2012; Mucina et al., 2016; Del Arco Aguilar & Delgado, 2018).

Structure and ecology: The *Echio plantaginei-Galactition tomentosae* alliance groups the semi-nitrophilous communities with tall or medium herbs, occurring in fallow land and abandoned farmland, on rich mesotrophic soils. This vegetation has it optimum during winter and spring periods and is linked to a subhumid oceanic thermo-mesomediterranean bioclimate (Costa et al., 2012).

Syndynamism: Usually, the communities belonging to this alliance replace the segetal vegetation of *Papaveretea rhoeadis* on cereal fields, following the crops abandonment. A further decrease in the anthropic disturbance leads to the stabilization of a more mature vegetation, as the steppe grasslands of *Hyparrhenietalia hirtae* or the psammophilous communities of *Ammophiletea*. On the other hand, the increase of organic matter in the soil,

due to anthropic disturbance, should lead to the replacement of *Echio-Galactition* vegetation with more markedly ruderal aspects, such as those ones belonging to *Hordeion murini* (Brullo et al., 1983b; 2001).

Habitat reference: See class.

31.3.3.1. ***Hedysaro coronarii-Lavateretum trimestris*** Maugeri 1975

Vegetation with sulla clover and annual mallow of forage crops.

Holotypus: rel. 11, tab. 1, Maugeri (1975), designed by Brullo (1983b)

Characteristic and differential species: *Ammi crinitum* Guss., *Malva trimestris* (L.) Salisb., *Medicago ciliaris* (L.) All., *Melilotus siculus* (Turra) Steud., *Trifolium resupinatum* L.

Phytosociological table: From Maugeri (1975), table 1, 34 rel.

Char. association: *Ammi crinitum* (V), *Malva trimestris* (IV), *Medicago ciliaris* (IV), *Trifolium resupinatum* (III), *Melilotus siculus* (II).

Char. alliance: *Urospermum picroides* (I).

Char. order: *Sulla coronaria* (V), *Melilotus sulcata* (IV), *Galactites elegans* (IV), *Anacyclus clavatus* (IV), *Bromus hordeaceus* (III), *Anisantha madritensis* (II), *Scolymus maculatus* (II), *Glebionis coronaria* (II), *Carthamus lanatus* (I), *Bellardia trixago* (I), *Tetragonolobus purpureus* (I), *Centaurea napifolia* (I), *Carduus pycnocephalus* (I), *Malva multiflora* (I), *Reseda alba* (I), *Hordeum murinum* subsp. *leporinum* (I), *Avena barbata* (I).

Char. class: *Lolium rigidum* (V), *Helminthotheca echioides* (V), *Avena sterilis* (V), *Sonchus oleraceus* (IV), *Ammi majus* (II), *Geranium dissectum* (III), *Euphorbia helioscopia* (II), *Sherardia arvensis* (II), *Rumex pulcher* (II), *Symphyotrichum squamatum* (I), *Conyza bonariensis* (I), *Fumaria officinalis* (I), *Chenopodium opulifolium* (I), *Solanum nigrum* (I), *Veronica persica* (I), *Euphorbia falcata* (I), *Oxalis pes-caprae* (I), *Malva parviflora* (I), *Sonchus asper* (I), *Cardaria draba* (I), *Ecballium elaterium* (I), *Diplotaxis erucodies* (I), *Erodium malacoides* (I), *Anisantha sterilis* (I).

Other species: *Sinapis arvensis* (IV), *Torillis nodosa* (III).

Geographical distribution: This community was described for the Catania plain by Mugeri (1975) and later reported also for Ficuzza area and Vallone Piano della Corte, near Agira (Gianguzzi & La Mantia, 2004; Costanzo et al., 2005), but it results widespread in Sicily.

Structure and ecology: The cereal fields on alkaline or subalkaline clay soils are often subject to rotation with forage crops of *Sulla coronaria*. This species can be considered a native species, which find its primary habitat on sloped clay surfaces, but it is frequently cultivated in the fields for its value as fodder, giving the physiognomy to a peculiar community named *Hedysaro-Lavateretum trimestris*. Usually, this vegetation grows after the first rains and has its optimum during the spring, when *Sulla coronaria* with its showy red flowering characterizes the landscape of many inner areas of Sicily. Under the floristic profile, it is a

quite heterogeneous community, since its floristic set is slightly affected by some factors, as sowing method, irrigation and grazing (Costanzo et al., 2005). Among the characteristic species of this association, *Ammi crinitum*, *Malva trimestris*, *Medicago ciliaris*, *Trifolium resupinatum* and *Melilotus siculus* are quite common, while the syntaxa of higher rank are represented by *Melilotus sulcata*, *Galactites elegans*, *Anacyclus clavatus, Lolium rigidum*, *Helminthotheca echioides*, *Avena sterilis*, *Sonchus oleraceus*, etc. (Maugeri, 1975).

Syndynamism: The decrease of anthropogenic disturbance leads to the replacement of *Hedysaro-Lavateretum trimestris* with the *Thero-Brachypodion ramosi* vegetation, while on the other hand the increase of human activity favors the establishment of segetal and ruderal communities, as those ones belonging to *Papaveretea* and *Hordeion leporini* (Maugeri, 1975).

Habitat reference: See class.

31.3.3.2. ***Eruco sativae-Chamaemeletum mixtae*** Brullo 1983

Ruderal vegetation with wild rocket and moroccan chamomile of disturbed sandy coastal places.

Holotypus: rel. 2, tab. 10, Brullo (1983b).

Characteristic and differential species: *Cladanthus mixtus* (L.) Chevall. (= *Chamaemelum mixtum* (L.) All.), *Eruca sativa* Mill.

Phytosociological table: From Brullo (1983b), table 10, 9 rel.

Char. association: *Cladanthus mixtus* (V), *Eruca sativa* (IV).

Char. alliance: *Urospermum picroides* (IV), *Carlina lanata* (IV), *Medicago murex* (III), *Reichardia picroides* (III), *Hypochoeris achyrophorus* (III).

Char. order: *Lolium rigidum* (V), *Hirschfeldia incana* (V), *Anisantha madritensis* (V), *Avena barbata* (IV), *Trifolium angustifolium* (IV), *Medicago truncatula* (IV), *Echium plantagineum* (III), *Medicago polymorpha* (III), *Catapodium rigidum* (III), *Bromus rubens* (III).

Char. class: *Anisantha sterilis* (V), *Galactites elegans* (V), *Glebionis coronaria* (V), *Anisantha rigida* (V), *Sonchus oleraceus* (IV), *Erigeron bonariensis* (III), *Senecio vulgaris* (III), *Erodium malacoides* (III), *Hordeum murinum* subsp. *leporinum* (III), *Diplotaxis erucoides* (II), *Malva parviflora* (II), *Solanum nigrum* (II), *Emex spinosa* (II).

Other species: *Plantago lagopus* (V), *Medicago littoralis* (IV), *Festuca pyramidata* (IV), *Anagallis arvensis* (III).

Geographical distribution: This community was surveyed in the Ionian coast, between Catania and Agnone (Brullo, 1983b; Pavone et al., 2007).

Structure and ecology: The sandy soils near the sea, which are affected by a more or less intense anthropic disturbance, are colonized by a subnitrophilous vegetation characterized by the occurrence of *Eruca sativa* and *Cladanthus mixtus*. The alliance is represented by

Urospermum picroides, *Carlina lanata*, *Medicago murex*, *Reichardia picroides*, *Hypochoeris achyrophorus*. Among the species of higher rank, *Avena barbata*, *Lolium rigidum*, *Hirschfeldia incana*, *Anisantha madritensis*, *Avena barbata*, *Anisantha sterilis*, *Galactites elegans*, *Glebionis coronaria*, *Anisantha rigida* and *Sonchus oleraceus* are frequent (Brullo, 1983b).

Syndynamism: The cessation of anthropogenic disturbance can lead to the evolution towards a more natural vegetation, as the annual psammophilous communities belonging to *Vulpietalia* and later to *Ammophiletalia* communities (Brullo, 1983b).

Habitat reference: See class.

31.3.3.3. ***Galactito elegantis-Isatidetum canescentis*** Brullo 1983

Ruderal vegetation with milk thistle and dyer's woad of roadsides and uncultivated lands on incoherent soils.

Holotypus: rel. 4, tab. 12, Brullo (1983b).

Characteristic and differential species: *Isatis tinctoria* L. subsp. *canescens* (DC.) Arcang.

Phytosociological table: From Brullo (1983b), table 12, 8 rel.

Char. association: *Isatis tinctoria* subsp. *canescens* (V).

Char. alliance: *Urospermum picroides* (V), *Medicago murex* (IV), *Reichardia picroides* (V), *Hypochoeris achyrophorus* (IV), *Trifolium nigrescens* (IV), *Urospermum dalechampii* (III), *Festuca geniculata* (II).

Char. order: *Avena barbata* (V), *Hirschfeldia incana* (V), *Anisantha madritensis* (V), *Vicia villosa* subsp. *varia* (IV), *Medicago orbicularis* (IV), *Echium plantagineum* (V), *Medicago polymorpha* (V), *Lolium rigidum* (IV), *Hedypnois cretica* (IV), *Avena sterilis* (IV), *Anisantha tectorum* (IV), *Trifolium angustifolium* (IV), *Catapodium rigidum* (IV), *Lotus edulis* (III), *Bromus hordeaceus* (II), *Lupinus angustifolius* (II), *Bromus rigidus* (II).

Char. class: *Anisantha sterilis* (V), *Sonchus oleraceus* (V), *Galactites elegans* (V), *Glebionis coronaria* (IV), *Mercurialis annua* (IV), *Euphorbia helioscopia* (IV), *Geranium rotundifolium* (IV), *Capsella rubella* (IV), *Erigeron bonariensis* (IV), *Senecio vulgaris* (IV), *Hordeum murinum* subsp. *leporinum* (IV), *Anacyclus clavatus* (IV), *Malva sylvestris* (III), *Erodium malacoides* (III), *Solanum nigrum* (III), *Oxalis pes-caprae* (III), *Chenopodium album* (III), *Anthemis arvensis* (III), *Urtica urens* (II), *Brassica fruticulosa* (II).

Other species: *Lobularia maritima* (V), *Daucus carota* (V), *Centranthus ruber* (IV), *Piptatherum miliaceum* (III).

Geographical distribution: Currently, this community is known for Etna and Hyblaean mountains, where it is very frequent (Brullo, 1983b).

Structure and ecology: The uncultivated lands and the country roadsides with incoherent soils, which are constituted by an abundant stony component, are colonized by the *Galactito-*

Isatidetum canescentis. This community is found both on limestone and volcanic rocks, occurring from the seal level until 500 m. Its floristic set is characterized by the dominance of *Isatis tinctoria* subsp. *canescens*, growing together with some species of alliance, as *Urospermum picroides*, *Medicago murex*, *Reichardia picroides*, *Hypochoeris achyrophorus*, *Trifolium nigrescens*, *Urospermum dalechampii* and *Festuca geniculata*. Among the species of higher rank, *Galactites elegans*, *Avena barbata*, *Hirschfeldia incana*, *Anisantha madritensis*, *Anisantha sterilis* and *Sonchus oleraceus* are common (Brullo 1983b).

Syndynamism: This vegetation is linked with the dynamic series of *Quercetalia ilicis*. In fact, the cessation of anthropic disturbance lead to the establishment of the *Bromo-Oryzpsion* and therefore of the *Saturejo-Hyparrhenion hirtae* (Brullo, 1983b).

Habitat reference: See class.

31.3.3.4. ***Galactito elegantis-Knautietum hybridae*** Brullo 1983

Mesophilous vegetation with milk thistle and whole-leaved scabious of roadsides and uncultivated lands on sileceous soils.

Holotypus: rel. 3, tab. 11, Brullo (1983b).

Characteristic and differential species: *Knautia integrifolia* (L.) Bertol. (= *Knautia hybrida* (All.) Coult.), *Senecio leucanthemifolius* Poir.

Phytosociological table: From Brullo (1983b), table 11, 7 rel.

Char. association: *Knautia integrifolia* (V), *Senecio leucanthemifolius* (IV).

Char. alliance: *Lotus ornithopodioides* (V), *Festuca geniculata* (V), *Hypochoeris achyrophorus* (V), *Reichardia picroides* (IV), *Urospermum picroides* (III), *Urospermum dalechampii* (III).

Char. order: *Avena barbata* (V), *Trifolium stellatum* (V), *Anisantha madritensis* (V), *Lolium rigidum* (V), *Echium plantagineum* (IV), *Anisantha tectorum* (IV), *Festuca danthonii* (IV), *Catapodium rigidum* (IV), *Medicago polymorpha* (IV), *Hedypnois cretica* (IV), *Vicia villosa* subsp. *varia* (III).

Char. class: *Anisantha sterilis* (V), *Fedia graciliflora* (V), *Sonchus oleraceus* (V), *Galactites elegans* (V), *Lathyrus aphaca* (IV), *Euphorbia helioscopia* (III), *Geranium molle* (III), *Carduus pycnocephalus* subsp. *pycnocephalus* (III), *Senecio vulgaris* (III).

Other species: *Trifolium campestre* (V), *Briza maxima* (V), *Festuca bromoides* (V), *Lagurus ovatus* (III).

Geographical distribution: This vegetation occurs in the mountain area of north-eastern Sicily and in particular in the eastern side of Etna and Peloritani (Brullo, 1983b).

Structure and ecology: The *Galactito-Knautietum hybridae* is linked to mountain stands with sileceous substrata and an average rainfall above 800 mm for year. It occurs in roadsides and uncultivated lands, preferring quite humid and fresh soils. Under the floristic profile, *Knautia*

integrifolia and *Senecio leucanthemifolius*, considered as the characteristic species of this syntaxon, are associated with some species of alliance, as *Lotus ornithopodioides*, *Festuca geniculata*, *Hypochoeris achyrophorus*, *Reichardia picroides*, *Urospermum picroides* and *Urospermum dalechampii*. Regarding class and order, *Avena barbata*, *Trifolium stellatum*, *Anisantha madritensis*, *Lolium rigidum*, *Anisantha sterilis*, *Fedia graciliflora*, *Sonchus oleraceus* and *Galactites elegans* have high coverage values (Brullo 1983b).

Syndynamism: This vegetation is linked with the dynamic series of acidophilous oak forests belonging to *Erico-Quercion ilicis*. In particular, it can evolve towards the annual grasslands of *Tuberarion guttatae* and later into *Cisto-Ericion* shrubby vegetation (Brullo 1983b).

Habitat reference: See class.

31.3.3.5. ***Linario multicaulis-Euphorbietum terracinae*** Brullo 1983

Subnitrophilous vegetation with many-stemmed toadflax and coastal spurge of roadsides and uncultivated lands on sandy soils.

Holotypus: rel. 1, tab. 8, Brullo (1983b).

Characteristic and differential species: *Euphorbia terracina* L., *Cerastium semidecandrum* L., *Linaria multicaulis* (L.) Mill., *Trigonella monspeliaca* L.

Phytosociological table: From Brullo (1983b), table 8, 5 rel.

Char. association: *Euphorbia terracina* (V), *Cerastium semidecandrum* (V), *Linaria multicaulis* (IV), *Trigonella monspeliaca* (III).

Char. alliance: *Lotus ornithopodioides* (V), *Trifolium nigrescens* (V), *Hypochoeris achyrophorus* (V), *Reichardia picroides* (V), *Urospermum picroides* (II).

Char. order: *Anisantha rigida* (V), *Trifolium stellatum* (V), *Anisantha madritensis* (V), *Lolium rigidum* (V), *Anisantha tectorum* (V), *Hirschfeldia incana* (V), *Medicago polymorpha* (V), *Catapodium rigidum* (V), *Medicago orbicularis* (V), *Echium plantagineum* (IV), *Avena barbata* (IV), *Lotus edulis* (IV), *Astragalus hamosus* (IV), *Trifolium scabrum* (IV), *Medicago truncatula* (III), *Vicia villosa* subsp. *varia* (III).

Char. class: *Glebionis coronaria* (V), *Anisantha sterilis* (V), *Hordeum murinum* subsp. *leporinum* (V), *Fedia graciliflora* (), *Sonchus oleraceus* (V), *Galactites elegans* (V), *Anthemis arvensis* (V), *Raphanus raphanistrum* (V), *Euphorbia helioscopia* (V), *Senecio vulgaris* (IV), *Erodium cicutarium* (IV), *Carthamus lanatus* (IV), *Diplotaxis erucoides* (IV), *Sonchus asper* (IV), *Onopordon illyricum* (IV), *Reseda alba* (IV) *Capsella rubella* (III), *Glebionis segetum* (II), *Veronica arvensis* (II).

Other species: *Silene colorata* (V), *Rumex bucephalophorus* (V), *Dasypyrum villosum* (V), *Papaver rhoeas* (V).

Geographical distribution: This vegetation was surveyed by Brullo (1983b) in Southern Sicily and in particular in the Erei mountains near Niscemi, Pizza Armerina and Caltagirone.

Structure and ecology: The uncultivated lands and the grazing fields with sandy soils of inner fossil dunes are colonized by a peculiar thermophilous community, named *Linario-Euphorbietum terracinae* (Brullo 1983b). This vegetation has a psammophilous character, as as highlighted by the high coverage of *Festuca fasciculata*, *Alkanna tinctoria*, *Medicago littoralis*, *M. tornata* and *Erodium laciniatum*. Its structure is given by *Euphorbia terracina*, *Cerastium semidecandrum*, *Linaria multicaulis* and *Trigonella monspeliaca*, growing together with some species of alliance, as *Lotus ornithopodioides*, *Trifolium nigrescens*, *Hypochoeris achyrophorus*, *Reichardia picroides*, *Urospermum picroides*, etc. (Brullo, 1983b).

Syndynamism: Following the crop abandonment, this vegetation tends to evolve into *Vulpietalia* and after *Cisto-Ericion* communities (Brullo, 1983b).

Habitat reference: See class.

31.3.3.6. ***Meliloto siculi-Hordetum marini*** Brullo 1983

Subnitrophilous vegetation with Sicilian melilot of disturbed river edges.

Holotypus: rel. 4, tab. 9, Brullo (1983b).

Characteristic and differential species: *Hordeum marinum* Huds., *Melilotus siculus* (Turra) Steud., *Bromus lanceolatus* Roth, *Trifolium resupinatum* L., *Carduus argentatus* Bertol. subsp. *acicularis* (Bertol.) Meikle.

Phytosociological table: From Brullo (1983b), table 9, 7 rel.

Char. association: *Hordeum marinum* (V), *Melilotus siculus* (V), *Bromus lanceolatus* (V), *Trifolium resupinatum* (V), *Carduus argentatus* subsp. *acicularis* (V).

Char. alliance: *Medicago ciliaris* (V), *Hypochoeris achyrophorus* (V), *Trifolium nigrescens* (IV), *Reichardia picroides* (IV), *Urospermum picroides* (III), *Carlina lanata* (III).

Char. order: *Anisantha madritensis* (V), *Lolium rigidum* (V), *Medicago polymorpha* (V), *Catapodium rigidum* (V), *Avena sterilis* (IV), *Hirschfeldia incana* (IV), *Hedypnois cretica* (IV), *Trifolium angustifolium* (IV), *Avena barbata* (IV), *Echium plantagineum* (III), *Bromus hordeaceus* (III), *Trifolium stellatum* (III), *Anisantha tectorum* (III).

Char. class: *Anisantha sterilis* (V), *Galactites elegans* (V), *Sonchus oleraceus* (V), *Vicia sativa* (V), *Carduus pycnocephalus* subsp. *pycnocephalus* (IV), *Cardaria draba* (III), *Geranium molle* (III), *Malva nicaeensis* (III), *Euphorbia helioscopia* (III), *Plantago afra* (III), *Carthamus lanatus* (III), *Erodium ciconium* (III), *Senecio vulgaris* (II), *Galium aparine* (I), *Anacyclus clavatus* (I).

Other species: *Festuca arundinacea* (V), *Trifolium scabrum* (V), *Trifolium campestre* (V), *Anagallis arvensis* (V).

Geographical distribution: This vegetation was described by Brullo (1983b) for the Simeto river near Catania and later reported by Bonanno (2008) for Salso river near Licata (Southern Sicily).

Structure and ecology: The disturbed edges of river banks and salt marshes with loamy-clay soils, as uncultivated lands and grazing fieds, are colonized by a peculiar community. It is the *Meliloto-Hordetum marini*, a subhalophilous vicariant of the *Convolvuletum tricoloris* (Brullo, 1983b). Its floristic set is characterized by the occurrence of *Hordeum marinum*, *Melilotus siculus*, *Bromus lanceolatus*, *Trifolium resupinatum* and *Carduus argentatus* subsp. *acicularis*. As regards the alliance, *Medicago ciliaris*, *Hypochoeris achyrophorus*, *Trifolium nigrescens*, *Reichardia picroides*, *Urospermum picroides* and *Carlina lanata* are very frequent. The order and the class are represented by *Anisantha madritensis*, *Lolium rigidum*, *Medicago polymorpha*, *Catapodium rigidum*, *Anisantha sterilis*, *Galactites elegans*, *Sonchus oleraceus*, *Vicia sativa*, etc.

Syndynamism: This vegetation occupies the the stands that are potentially covered by the riparian woodlands of *Nerio-Tamaricetea* or the halophilous communities of *Salicornietalia* and *Juncetalia* (Brullo, 1983b).

Habitat reference: See class.

31.3.3.7. ***Senecioni delphinifolii-Stachyetum hirtae*** Brullo 1983

Acidophilous vegetation with larkspur leaved ragwort and hairy woundwort of uncultivated lands on volcanic soils.

Holotypus: rel. 3, tab. 2, Brullo (1983b).

Characteristic and differential species: *Geranium dissectum* L., *Lathyrus gorgoni* Parl., *Senecio delphinifolius* Bertol, *Silene bellidifolia* Jacq., *Stachys ocymastrum* (L.) Briq. (= *Stachys hirta* L.).

Phytosociological table: From Brullo (1983b), table 2, 17 rel.

Char. association: *Senecio delphinifolius* (V), *Lathyrus gorgoni* (V), *Geranium dissectum* (V), *Stachys ocymastrum* (IV), *Silene bellidifolia* (III).

Char. alliance: *Lotus ornithopodioides* (V), *Trifolium nigrescens* (V), *Vulpiella tenuis* (V), *Hypochoeris achyrophorus* (V), *Medicago ciliaris* (IV), *Malva trimestris* (IV), *Reichardia picroides* (III), *Urospermum picroides* (III), *Tordylium apulum* (III), *Urospermum dalechampii* (II), *Gastridium ventricosum* (II), *Carlina lanata* (II), *Medicago murex* (I).

Char. order: *Anisantha madritensis* (V), *Lolium rigidum* (V), *Medicago polymorpha* (V), *Hirschfeldia incana* (IV), *Avena barbata* (V), *Echium plantagineum* (V), *Trifolium stellatum* (IV), *Bromus hordeaceus* (IV), *Catapodium rigidum* (III), *Hedypnois cretica* (III), *Medicago rigidula* (III), *Avena sterilis* (III), *Medicago truncatula* (III), *Anisantha tectorum* (II), *Lotus edulis* (II), *Festuca danthonii* (II), *Trifolium angustifolium* (II), *Aegilops geniculata* (II), *Trifolium scabrum* (I), *Stipa capensis* (I), *Bromus rubens* (I), *Medicago orbicularis* (I), *Vicia villosa* (I).

Char. class: *Anisantha sterilis* (V), *Galactites elegans* (V), *Borago officinalis* (IV), *Carthamus lanatus* (III), *Geranium molle* (III), *Vicia sativa* (III), *Sonchus oleraceus* (III), *Scolymus*

grandiflorus (III), *Anthemis arvensis* (III), *Glebionis segetum* (III), *Euphorbia helioscopia* (III), *Fedia graciliflora* (II), *Adonis microcarpa* (II), *Notobasis syriaca* (II), *Silybum marianum* (I), *Oxalis pes-caprae* (I), *Carduus pycnocephalus* subsp. *pycnocephalus* (I), *Ammi majus* (I), *Plantago afra* (I), *Euphorbia peplus* (I), *Senecio vulgaris* (I), *Linaria triphylla* (I).

Other species: *Anagallis arvensis* (IV), *Foeniculum vulgare* subsp. *piperitum* (IV), *Sixalix atropurpurea* (IV), *Trifolium campestre* (IV).

Geographical distribution: This vegetation is restricted to the Hyblaean mountains and in particular to Monte Lauro (Brullo, 1983b).

Structure and ecology: The *Senecioni-Stachyetum hirtae* is an acidophilous community, occurring in the uncultivated lands on Miocene basalts. It is characterized by the occurrence of *Senecio delphinifolius, Lathyrus gorgoni, Geranium dissectum, Stachys hirta* and *Silene bellidifolia*, growing together with some species of alliance, such as *Lotus ornithopodioides*, *Trifolium nigrescens*, *Vulpiella tenuis*, *Hypochoeris achyrophorus*, *Medicago ciliaris*, *Malva trimestris*, *Reichardia picroides*, *Urospermum picroides*, *Tordylium apulum*, *Urospermum dalechampii*, *Gastridium ventricosum*, *Carlina lanata*, *Medicago murex*, etc. The typical aspect (subass. *stachyetosum*) occurs between 200 and 500 m and is dominated by *Stachys hirta* and *Senecio delphinifolius*, which become rare above 500, where *Anthemis arvensis* and *Glebionis segetum* are dominant (subass. *chrysanthemetosum*). Among the taxa of higher rank, *Anisantha madritensis*, *Lolium rigidum*, *Medicago polymorpha*, *Anisantha sterilis* and *Galactites elegans* are very common (Brullo 1983b).

Syndynamism: This vegetation is linked to the dynamic series of *Erico-Quercion ilicis*. It is an edaphic vicariant of *Convolvulo-Carduetum corymbosi* on volcanic substrata (Brullo, 1983b).

Habitat reference: See class.

31.3.3.8. ***Theligono cynocrambis-Smyrnietum rotundifolii*** Brullo 1983

Sciaphilous vegetation with dog cabbage of carob groves.

Holotypus: rel. 7, tab. 3, Brullo (1983b).

Characteristic and differential species: *Smyrnium perfoliatum* L. subsp. *rotundifolium* (Mill.) Hartvig, *Cerinthe major* L., *Allium subhirsutum* L., *Ranunculus neapolitanus* Ten., *Theligonum cynocrambe* L.

Phytosociological table: From Brullo (1983b), table 3, 8 rel.

Char. association: *Smyrnium perfoliatum* subsp. *rotundifolium* (V), *Cerinthe major* (V), *Allium subhirsutum* (V), *Ranunculus neapolitanus* (V), *Theligonum cynocrambe* (V).

Char. alliance: *Tordylium apulum* (V), *Lotus ornithopodioides* (IV), *Trifolium nigrescens* (IV), *Hypochoeris achyrophorus* (IV), *Urospermum picroides* (IV), *Urospermum dalechampii* (II).

Char. order: *Hedypnois cretica* (V), *Anisantha madritensis* (IV), *Lolium rigidum* (IV), *Medicago polymorpha* (IV), *Hirschfeldia incana* (IV), *Trifolium stellatum* (IV), *Avena barbata* (III), *Medicago orbicularis* (III), *Lotus edulis* (III).

Char. class: *Euphorbia peplus* (V), *Anthemis arvensis* (V), *Notobasis syriaca* (V), *Galactites elegans* (V), *Anisantha sterilis* (V), *Sonchus oleraceus* (V), *Geranium molle* (V), *Borago officinalis* (IV), *Galium verrucosum* (IV), *Fedia graciliflora* (IV), *Chenopodium murale* (IV), *Mercurialis annua* (IV), *Sonchus oleraceus* (), *Fumaria capreolata* (III), *Plantago afra* (III), *Euphorbia helioscopia* (), *Carthamus lanatus* (III), *Stellaria media* (III), *Senecio vulgaris* (II), *Erodium malacoides* (II), *Euphorbia helioscopia* (II), *Sonchus asper* (II), *Rumex acetosella* (II), *Glebionis segetum* (II), *Scolymus grandiflorus* (II), *Fedia caput-bovis* (II), *Sisymbrium irio* (II), *Vicia sativa* (I), *Hordeum murinum subsp. leporinum* (I), *Linaria triphylla* (I).

Other species: *Anagallis arvensis* (V), *Nigella damascena* (V), *Asparagus acutifolius* (IV), *Torillis nodosa* (IV).

Geographical distribution: This vegetation occurs in south-eastern Sicily (Brullo, 1983b).

Structure and ecology: The undergrowth *of Carob* groves is colonized by a sciaphilous community, named *Theligono-Smyrnietum rotundifolii*, which is characterized by the occurrence of *Smyrnium perfoliatum* subsp. *rotundifolium*, *Cerinthe major*, *Allium subhirsutum*, *Ranunculus neapolitanus* and *Theligonum cynocrambe*. The alliance is well represented by the occurrence of *Tordylium apulum*, *Lotus ornithopodioides*, *Trifolium nigrescens*, *Hypochoeris achyrophorus*, *Urospermum picroides* and *Urospermum dalechampii*. This vegetation finds its optimum in the inner areas with more than 450-500 mm, being rare in coastal places (Brullo 1983b).

Syndynamism: This vegetation is linked to the dynamic series of *Oleo-Ceratonion* (Brullo, 1983b).

Habitat reference: See class.

31.3.3.9. ***Trifolio glomerati-Vicietum bithynicae*** Brullo 1983

Acidophilous vegetation with clustered clover and notched vetch of uncultivated lands on wet and humified soils.

Holotypus: rel. 8, tab. 4, Brullo (1983b).

Characteristic and differential species: *Trifolium glomeratum* L., *Linaria pelisseriana* (L.) Mill., *Vicia bithynica* (L.) L.

Phytosociological table: From Brullo (1983b), table 4, 12 rel.

Char. association: *Trifolium glomeratum* (V), *Linaria pelisseriana* (V), *Vicia bithynica* (V).

Char. alliance: *Lotus ornithopodioides* (V), *Trifolium nigrescens* (IV), *Hypochoeris achyrophorus* (IV), *Urospermum picroides* (III), *Vulpiella tenuis* (III), *Reichardia picroides* (III), *Tordylium apulum* (II).

Char. order: *Anisantha madritensis* (V), *Medicago truncatula* (V), *Trifolium stellatum* (V), *Lolium rigidum* (V), *Catapodium rigidum* (V), *Medicago polymorpha* (V), *Trifolium angustifolium* (IV), *Echium plantagineum* (IV), *Anisantha tectorum* (IV), *Avena barbata* (IV), *Hedypnois cretica* (IV), *Lotus edulis* (IV), *Hirschfeldia incana* (III), *Trifolium scabrum* (III), *Medicago rigidula* (III), *Stipellula capensis* (III), *Avena sterilis* (III), *Bromus rubens* (I).

Char. class: *Galactites elegans* (V), *Vicia sativa* (V), *Glebionis segetum* (III), *Notobasis syriaca* (III), *Anthemis arvensis* (III), *Sonchus oleraceus* (III), *Carthamus lanatus* (II), *Erodium malacoides* (II), *Geranium molle* (II), *Borago officinalis* (II), *Hordeum murinum* subsp. *leporinum* (II), *Fedia caput-bovis* (I), *Brassica fruticulosa* (I).

Other species: *Trifolium campestre* (V), *Aira cupaniana* (V), *Vicia peregrina* (V), *Lathyrus cicera* (IV).

Geographical distribution: This vegetation was surveyed in Monte Lauro (Hyblaean area), Aeolian islands and Peloritani mountains (Brullo, 1983b).

Structure and ecology: The acidophilous vegetation of uncultivated fields on quite deep and well humified soils should be attributed to the *Trifolio-Vicietum bithynicae*. This vegetation is linked to humid places from the sea level until 900 m a.s.l., occurring only in places with more than 600 mm of annual rainfall. Brullo (1983b) distinguished two aspects: the subass. *vulpietosum* is restricted to the Aeolian islands and is characterized by the high coverage of therophytes belonging to *Tuberarietea guttatae*, such as *Festuca bromoides*, *Festuca muralis*, *Briza maxima*, *Trifolium arvense*, *T. subterraneum*, etc.; the subass. *chrysanthemetosum* represents the typical aspect and if compared to the previous one shows a more mesophilous and nitrophilous character, as emphasized by the occurrence of *Glebionis segetum*, *Coleostephus myconis*, *Anthemis arvensis*, *Lolium temulentum*, *Raphanus raphanistrum*, *Dasypyrum villosum*, *Trifolium tomentosum*, etc.

Syndynamism: This vegetation is linked to the dynamic series of *Erico-Quercion ilicis*. It tends to evolve into annual grasslands of *Tuberarion guttatae* at low altitude or mesophilous meadows of *Plantaginion cupanii* in the higher places (Brullo, 1983b).

Habitat reference: See class.

31.3.3.10. ***Vicio pseudocraccae-Echietum pustulati*** Brullo 1983

Psammophilous vegetation with thinned vetch and viper's bugloss of sandy uncultivated lands.

Holotypus: rel. 3, Tab. 6, Brullo (1983b).

Characteristic and differential species: *Echium vulgare* L. subsp. *pustulatum* (Sm.) Em. Schmid & Gams, *Echium sabulicola* Pomel., *Vicia pseudocracca* Bertol., *Lathyrus sphaericus* Retz.

Phytosociological table: From Brullo (1983b), table 6, 7 rel.

Char. association: *Echium vulgare* subsp. *pustulatum* (V), *Vicia pseudocracca* (V), *Echium sabulicola* (IV), *Lathyrus sphaericus* (III).

Char. alliance: *Hypochoeris achyrophorus* (V), *Reichardia picroides* (V), *Medicago murex* (IV), *Lotus ornithopodioides* (II), *Carlina lanata* (II).

Char. order: *Anisantha madritensis* (V), *Lolium rigidum* (V), *Avena sterilis* (V), *Lupinus angustifolius* (V), *Bromus rigidus* (V), *Anisantha tectorum* (IV), *Catapodium rigidum* (III), *Trifolium stellatum* (II), *Vicia villosa* (II), *Lotus edulis* (I).

Char. class: *Galactites elegans* (V), *Brassica fruticulosa* (V), *Anisantha sterilis* (V), *Reseda alba* (V), *Sonchus oleraceus* (V), *Mercurialis annua* (IV), *Anthemis arvensis* (III), *Fedia graciliflora* (III), *Euphorbia helioscopia* (III), *Hordeum murinum* subsp. *leporinum* (II), *Geranium molle* (II), *Glebionis segetum* (II).

Other species: *Lagurus ovatus* (V), *Festuca fasciculata* (V), *Rumex bucephalophorus* (V), *Silene gallica* (V).

Geographical distribution: This vegetation occurs only in the coast of Capo Peloro, as well as in the sandy hills of Messina (Brullo, 1983b).

Structure and ecology: The uncultivated lands with siliceous sandy soils near the sea or in inner stands are colonized by the *Vicio-Echietum pustulati*, whose psammophilous character is shown by the occurrence of *Festuca fasciculata*, *Corynephorus fasciculatus* and *Ononis diffusa*. The physiognomy of this vegetation is given by *Echium vulgare* subsp. *pustulatum*, *Vicia pseudocracca*, *Echium sabulicola* and *Lathyrus sphaericus*, which are associated with some species of alliance, as *Hypochoeris achyrophorus*, *Reichardia picroides*, *Medicago murex*, *Lotus ornithopodioides* and *Carlina lanata* (Brullo, 1983b).

Syndynamism: This vegetation replaces the *Trifolio-Vicietum bithynicae* in the stands with more xerophilous conditions and loose soils. In the coastal places the community at issue is dynamically linked to *Vulpietalia* and *Ammophiletea* series, while in the inner stands it can evolve towards *Oleo-Ceratonion* vegetation.

Habitat reference: See class.

31.3.3.11. ***Centauretum schouwii*** Brullo 1983

Subnitrophilous vegetation with summer cornflower of uncultivated lands on marly and clayey soils.

Synonyms: *Dauco-Centauretum schouwii* Brullo et al. 1980 (nom. nud.); aggr. a *Centaurea schouwii* Ferro 1980.

Holotypus: rel. 10, tab. 7, Brullo (1983b).

Characteristic and differential species: *Centaurea solstitialis* L. subsp. *schouwii* (DC.) Gugler, *Hainardia cylindrica* (Willd.) Greuter.

Phytosociological table: From Brullo (1983b), table 6, 7 rel.

Char. association: *Centaurea solstitialis* subsp. *schouwii* (V), *Hainardia cylindrica* (V).

Char. alliance: *Carlina lanata* (V), *Urospermum picroides* (V), *Hypochoeris achyrophorus* (IV), *Medicago ciliaris* (IV), *Lotus ornithopodioides* (IV), *Malva trimestris* (III), *Reichardia picroides* (II), *Reichardia intermedia* (III).

Char. order: *Anisantha madritensis* (V), *Bromus hordeaceus* (V), *Lolium rigidum* (V), *Avena barbata* (V), *Aegilops geniculata* (V), *Hedypnois cretica* (V), *Medicago polymorpha* (V), *Bromus rubens* (IV), *Catapodium rigidum* (IV), *Echium plantagineum* (II), *Festuca danthonii* (II), *Avena sterilis* (II).

Char. class: *Galactites elegans* (V), *Sulla coronaria* (V), *Ammi visnaga* (V), *Carduus pycnocephalus* subsp. *pycnocephalus* (IV), *Notobasis syriaca* (IV), *Sonchus oleraceus* (IV), *Scolymus grandiflorus* (IV), *Ecballium elaterium* (III), *Anacyclus clavatus* (III), *Euphorbia helioscopia* (III), *Carthamus lanatus* (III).

Other species: *Bellardia trixago* (V), *Rostraria cristata* (V), *Anagallis arvensis* (V), *Phalaris paradoxa* (V).

Geographical distribution: This vegetation is widespread in Central and North-Western Sicily, including Agrigento, Enna, Caltanissetta, Catania and Palermo provinces (Brullo, 1983b; Gianguzzi et al., 2009, 2011).

Structure and ecology: The uncultivated lands with marly and clayey soils are colonized by a subnitrophilous vegetation dominated by *Centaurea solstitialis* subsp. *schouwii.* It is referable to *Centauretum schouwii*, which shows two different aspects: the subass. *typicum* occurs between 600 and 800 m a.s.l., while the subass. *daucetosum* is restricted to the places below 500 m and is differentiated by *Daucus aureus* and *Ononis oligophylla*, which can be considered transgressive species of *Dauco-Catananchion*. The *Echio-Galactition* alliance is represented by *Carlina lanata*, *Urospermum picroides*, *Hypochoeris achyrophorus*, *Medicago ciliaris*, *Lotus ornithopodioides*, *Malva trimestris*, *Reichardia picroides* and *Reichardia intermedia*, while the syntaxa of higher rank include *Anisantha madritensis*, *Bromus hordeaceus*, *Lolium rigidum*, *Avena barbata*, *Aegilops geniculata*, *Hedypnois cretica*, *Galactites elegans*, *Sulla coronaria*, *Ammi visnaga*, etc. (Brullo, 1983b).

Syndynamism: This vegetation can evolve into dry grasslands with *Lygeum spartum* belonging to *Dauco-Catananchion luteae* and later into *Pegano-Salsoletea* shrubby vegetation (Brullo, 1983b).

Habitat reference: See class.

31.3.3.12. ***Convolvuletum tricoloris*** Brullo 1983

Xerophilous vegetation with dwarf morning-glory of fields on loamy-clay soils.

Holotypus: rel. 3, Tab. 5, Brullo (1983b).

Characteristic and differential species: *Convolvulus tricolor* L. subsp. *cupanianus* (Tod.) Cavara & Grande

Phytosociological table: From Brullo (1983b), table 5, 5 rel.

Char. association: *Convolvulus tricolor* subsp. *cupanianus* (V)

Char. alliance: *Medicago ciliaris* (V), *Carlina lanata* (III), *Trifolium nigrescens* (III), *Reichardia picroides* (II), *Urospermum picroides* (II), *Lotus ornithopodioides* (II).

Char. order: *Anisantha madritensis* (V), *Lolium rigidum* (V), *Avena sterilis* (V), *Echium plantagineum* (IV), *Medicago polymorpha* (IV), *Anisantha tectorum* (III), *Hedypnois cretica* (III), *Bromus hordeaceus* (III), *Trifolium angustifolium* (III), *Vicia villosa* (I).

Char. class: *Galactites elegans* (V), *Sulla coronaria* (V), *Anisantha sterilis* (V), *Oxalis pes-caprae* (V), *Picris echioides* (V), *Sonchus oleraceus* (V), *Malva parviflora* (V), *Scolymus grandiflorus* (IV), *Carthamus lanatus* (IV), *Cardaria draba* (III), *Anthemis arvensis* (III), *Kickxia spuria* (II), *Glebionis coronaria* (II), *Vicia sativa* (II).

Other species: *Sinapis arvensis* (V), *Anagallis arvensis* (V), *Phalaris truncata* (V), *Phalaris paradoxa* (V).

Geographical distribution: This vegetation occurs almost everywhere in Sicily and is particularly frequent in the central and southern areas (Brullo, 1983b; Bonanno, 2008; Giusso et al., 2008).

Structure and ecology: The uncultivated lands and the grazing fields with loamy-clay soils are colonized by a peculiar community dominated by *Convolvulus tricolor* subsp. *cupanianus* (Brullo, 1983b). It is the *Convolvuletum tricoloris*, a thermophilous community linked to stands with less than 500 mm of annual rainfall. Under the floristic profile, this community is characterized by the occurrence of some species typical of *Echio-Galactition*, as *Medicago ciliaris*, *Carlina lanata*, *Trifolium nigrescens*, *Reichardia picroides*, *Urospermum picroides* and *Lotus ornithopodioides* (Brullo, 1983b; Bonanno, 2008; Giusso et al., 2008).

Syndynamism: This vegetation is linked with the dynamic series of *Oleo-Ceratonion* and often occurs in the areas potentially covered by the *Myrto-Lentiscetum* (Brullo, 1983b).

Habitat reference: See class.

31.3.3.13. ***Convolvulo pentapetaloidi-Carduetum corymbosi*** Brullo 1983

Basophilous vegetation with corymbated thistle of pastures and fields.

Synonyms: Aggr. ad *Anthemis arvensis* var. *nicaeensis* Gentile 1962.

Holotypus: rel. 5, tab. 1, Brullo (1983b).

Characteristic and differential species: *Carduus corymbosus* Ten., *Convolvulus pentapetaloides* L., *Convolvulus siculus* L., *Trifolium vesiculosum* Savi, *Hippocrepis unisiliquosa* L., *Ammoides pusilla* (Brot.) Breistr, *Ajuga chamaepitys* (L.) Screb.

Phytosociological table: From Brullo (1983b), table 1, 28 rel.

Char. association: *Carduus corymbosus* (V), *Convolvulus pentapetaloides* (IV), *Convolvulus siculus* (II), *Trifolium vesiculosum* (III), *Hippocrepis unisiliquosa* (III), *Ammoides pusilla* (III), *Ajuga chamaepitys* (II).

Char. alliance: *Hypochoeris achyrophorus* (V), *Tordylium apulum* (V), *Lotus ornithopodioides* (V), *Reichardia picroides* (IV), *Trifolium nigrescens* (IV), *Urospermum picroides* (III), *Carlina lanata* (III), *Medicago murex* (III), *Festuca geniculata* (II), *Vulpiella tenuis* (II), *Medicago ciliaris* (II), *Urospermum dalechampii* (II).

Char. order: *Catapodium rigidum* (V), *Hirschfeldia incana* (V), *Medicago orbicularis* (V), *Anisantha madritensis* (V), *Lolium rigidum* (III), *Festuca danthonii* (III), *Avena sterilis* (), *Echium plantagineum* (), *Medicago polymorpha* (V), *Medicago truncatula* (IV), *Avena barbata* (IV), *Trifolium stellatum* (IV), *Trifolium scabrum* (IV), *Medicago rigidula* (IV), *Anisantha tectorum* (III), *Hedypnois cretica* (V), *Bromus hordeaceus* (III), *Trifolium angustifolium* (III), *Lotus edulis* (III), *Bromus rubens* (II), *Echium plantagineum* (II), *Astragalus hamosus* (II), *Aegilops geniculata* (II), *Stipellula capensis* (II), *Medicago rugosa* (II).

Char. class: *Anthemis arvensis* (V), *Euphorbia helioscopia* (V), *Anisantha sterilis* (V), *Galactites elegans* (IV), *Notobasis syriaca* (IV), *Calendula arvensis* (IV), *Carthamus lanatus* (IV), *Adonis annua* (IV), *Geranium molle* (IV), *Plantago afra* (IV), *Sonchus oleraceus* (IV), *Senecio vulgaris* (IV), *Mercurialis annua* (III), *Diplotaxis erucoides* (III), *Linaria triphylla* (III), *Fedia graciliflora* (III), *Borago officinalis* (III), *Fedia caput-bovis* (III), *Reseda alba* (III), *Hordeum murinum* subsp. *leporinum* (II), *Malva sylvestris* (II), *Sonchus asper* (II), *Glebionis segetum* (II), *Erodium malacoides* (II), *Vicia sativa* (II), *Glebionis coronaria* (II), *Euphorbia peplus* (II), *Malva paviflora* (II), *Capsella rubella* (II), *Lamium amplexicaule* (II).

Other species: *Anagallis arvensis* (V), *Filago pyramidata* (V), *Rumex bucephalophorus* (V), *Sherardia arvensis* (IV).

Geographical distribution: This vegetation is quite frequent in Southern Sicily, mainly in the Hyblaean mountains (Brullo, 1983b; Minissale et al., 2007).

Structure and ecology: The *Convolvulo pentapetaloidi-Carduetum corymbosi* is a basophilous vegetation, which is linked to pastures subject to rotation with cereal fields on calcareous (or sometimes also marly-clay) substrata, from the sea level until 600-700 m a.s.l. Its physiognomy is determined by some annual big-size thistles, as *Galactites elegans* and *Carduus corymbosus*, occurring together with several species of pabular interest with spring optimum, as *Trifolium vesiculosum*, *Lotus ornithopodioides*, *Trifolium nigrescens*, *Medicago murex*, *Medicago ciliaris*, *Medicago orbicularis*, *Anisantha madritensis*, *Medicago polymorpha, Medicago truncatula*, *Trifolium stellatum*, *Trifolium scabrum*, *Medicago rigidula*, *Anisantha tectorum*, *Trifolium angustifolium, Lotus edulis, Medicago rugosa*, etc. (Brullo, 1983b).

Syndynamism: In the rocky places the community at issue can evolve towards tha annual grasslands of *Trachynion distachyae* (e.g. *Vulpio-Trisetetum aurei*), while in deeper soils it can be replaced by the perennial subnitrophilous vegetation of *Bromo-Oryzopsion miliaceae*. The following stages are represented by the dry grasslands with *Hyparrhenia hirta* or *Ampelodesmos mauritanicus* and later by the shrubby vegetation of *Oleo-Ceratonion* (Brullo, 1983b).

Habitat reference: See class.

31.3.3.14. ***Phleo echinati-Silenetum tenuiflorae*** Bartolo, Miniss., Sorbello & Spamp. 1988

Subnitrophilous vegetation with ovoid timothy and cretan catchfly of fields and uncultivated lands on metamorphic soils.

Holotypus: rel. 3, tab. 2, Bartolo et al. (1988).

Characteristic and differential species: *Silene tenuiflora* Guss., *Phleum echinatum* Host., *Anchusella cretica* (Mill.) Bigazzi & al.

Phytosociological table: From Bartolo et al. (1988), table 2, 5 rel.

Char. association: *Silene tenuiflora* (V), *Phleum echinatum* (V), *Anchusella cretica* (III).

Char. alliance: *Hypochoeris achyrophorus* (V), *Tordylium apulum* (V), *Trifolium nigrescens* (V), *Urospermum picroides* (IV), *Urospermum dalechampii* (III), *Lotus ornithopodioides* (II), *Malva trimestris* (I).

Char. order: *Hirschfeldia incana* (V), *Carduus pycnocephalus* subsp. *pycnocephalus* (V), *Festuca danthonii* (V), *Medicago polymorpha* (V), *Avena barbata* (V), *Anisantha madritensis* (IV), *Rostraria cristata* (IV), *Bromus hordeaceus* (IV), *Hordeum murinum* subsp. *leporinum* (IV), *Echium plantagineum* (IV), *Crepis foetida* (III), *Catapodium rigidum* (III), *Medicago orbicularis* (II), *Medicago tornata* (II), *Trifolium stellatum* (II), *Vicia villosa* (II), *Galactites elegans* (II), *Dasypyrum villosum* (II), *Anisantha tectorum* (II), *Lolium rigidum* (I), *Hedypnois cretica* (I), *Rumex pulcher* (I), *Plantago lagopus* (I), *Medicago truncatula* (I), *Lotus edulis* (I).

Char. class: *Euphorbia helioscopia* (IV), *Malva sylvestris* (IV), *Geranium molle* (IV), *Torilis nodosa* (III), *Euphorbia peplus* (III), *Capsella rubella* (III), *Glebionis segetum* (II), *Anisantha sterilis* (II), *Fedia graciliflora* (I), *Stellaria media* (I), *Sonchus oleraceus* (I), *Cerinthe major* (I).

Other species: *Rumex bucephalophorus* (V), *Trifolium campestre* (V), *Ornithopus compressus* (IV), *Sherardia arvensis* (IV).

Geographical distribution: This community is found only in the Peloritani mountains and in particular near Fiumedinisi (Bartolo et al., 1988).

Structure and ecology: The abandoned crops and fields of sub-mountain stands with metamorphic substrata are colonized by a very peculiar community, which is well differentiated under the floristic profile for the occurrence of *Silene tenuiflora*, *Anchusella*

cretica and *Phleum echinatum*. It is the *Phleo-Silenetum tenuiflorae*, a subnitrophilous vegetation with a quite rich floristic set, including *Hypochoeris achyrophorus*, *Tordylium apulum*, *Trifolium nigrescens*, *Urospermum picroides*, *Hirschfeldia incana*, *Carduus pycnocephalus* subsp. *pycnocephalus*, *Festuca danthonii*, *Medicago polymorpha*, *Avena barbata*, *Euphorbia helioscopia*, *Malva sylvestris*, *Geranium molle*, etc. (Bartolo et al., 1988).

Syndynamism: The reduction of anthropic disturbance leads to the establishment of the acidophilous annual grasslands belonging to *Tuberarietea guttatae* and later to the woody communities linked to the dynamic series of *Erico-Quercetum virgilianae* (Bartolo et al., 1988).

Habitat reference: See class.

31.3.3.15. ***Plantagini afrae-Carrichteretum annuae*** Bartolo, Brullo, Miniss. & Spamp 1990

Subnitrophilous and xerophilous vegetation with glandular plantain and annual carrichtera of fallow fields on calcareous soils.

Holotypus: rel. 4, Tab. 28, Bartolo et al. (1990).

Characteristic and differential species: *Plantago afra* L. subsp. *afra, Carrichtera annua* (L.) DC.

Phytosociological table: From Bartolo et al. (1990), table 28, 10 rel.

Char. association: *Plantago afra* subsp. *afra* (V), *Carrichtera annua* (V).

Char. alliance: *Lotus ornithopodioides* (V), *Tordylium apulum* (V), *Urospermum picroides* (V), *Reichardia intermedia* (IV), *Hypochoeris achyrophorus* (IV), *Reichardia picroides* (II).

Char. order: *Medicago polymorpha* (V), *Hedypnois cretica* (V), *Stipellula capensis* (V), *Echium plantagineum* (V), *Avena barbata* (V), *Lotus edulis* (V), *Anisantha madritensis* (V), *Astragalus hamosus* (IV), *Medicago truncatula* (IV), *Astragalus sesameus* (III), *Hordeum murinum* subsp. *leporinum* (III), *Catapodium rigidum* (II), *Bromus rubens* (I), *Lolium rigidum* (I).

Char. class: *Euphorbia helioscopia* (V), *Sonchus oleraceus* (V), *Oxalis pes-caprae* (V), *Convolvulus arvensis* (V), *Anisantha sterilis* (IV), *Glebionis coronaria* (III), *Erodium malacoides* (III), *Malva parviflora* (II), *Melilotus sulcata* (II), *Coronilla scorpioides* (II), *Geranium molle* (II), *Erodium moschatum* (II), *Mercurialis annua* (II), *Carduus argyroa* (II), *Euphorbia peplus* (II), *Malva sylvestris* (I), *Senecio vulgaris* (I), *Reseda alba* (I), *Malva multiflora* (I).

Other species: *Calendula tripterocarpa* (V), *Convolvulus althaeoides* (V), *Scorpiurus subvillosus* (V), *Anagallis arvensis* (V).

Geographical distribution: This community is restricted to Lampedusa island (Bartolo et al., 1990).

Structure and ecology: The arid fallow fields delimited by drywalls, often subject to sheep pasture, are colonized by a subnitrophilous vegetation dominated by *Plantago afra* subsp. *afra*

and *Carrichtera annua*. This community, named *Plantagini-Carrichteretum annuae*, is clearly attributable to *Echio-Galaction* alliance for the occurrence of *Lotus ornithopodioides*, *Tordylium apulum*, *Urospermum picroides*, *Reichardia intermedia*, *Hypochoeris achyrophorus*, and *Reichardia picroides,* while the order and the class are represented by *Medicago polymorpha*, *Hedypnois cretica*, *Stipellula capensis*, *Echium plantagineum*, *Avena barbata*, *Lotus edulis*, *Anisantha madritensis*, *Euphorbia helioscopia*, *Sonchus oleraceus*, *Oxalis pes-caprae*, *Convolvulus arvensis*, etc. (Bartolo et al., 1990).

Syndynamism: This vegetation can evolve towards the arid grasslands of the *Hyparrhenietalia hirtae* and in particular the *Thapsio-Feruletum communis* (Bartolo et al., 1990).

Habitat reference: See class.

31.3.3.16. ***Hippocrepido ciliatae-Astragaletum epiglottis*** Bartolo, Brullo, Miniss. & Spamp 1990

Subnitrophilous and xerophilous vegetation with lesser horseshoe and triangle-pod milkvetch of uncultivated fields on sandy soils.

Holotypus: rel. 5, tab. 29, Bartolo et al. (1990).

Characteristic and differential species: *Astragalus epiglottis* L., *Hippocrepis ciliata* Willd.

Phytosociological table: From Bartolo et al. (1990), table 29, 5 rel.

Char. association: *Astragalus epiglottis* (V), *Hippocrepis ciliata* (V).

Char. alliance: *Lotus ornithopodioides* (V), *Hypochoeris achyrophorus* (V), *Tordylium apulum* (III), *Urospermum picroides* (III), *Reichardia picroides* (III).

Char. order: *Echium plantagineum* (V), *Lotus edulis* (V), *Anisantha madritensis* (V), *Aegilops geniculata* (V), *Hedypnois cretica* (V), *Medicago polymorpha* (IV), *Avena barbata* (IV), *Stipellula capensis* (III), *Lolium rigidum* (III), *Astragalus hamosus* (II).

Char. class: *Oxalis pes-caprae* (V), *Erodium malacoides* (V), *Euphorbia helioscopia* (V), *Anisantha sterilis* (IV), *Sonchus oleraceus* (III), *Mercurialis annua* (III), *Glebionis coronaria* (II), *Malva parviflora* (II).

Other species: *Trachynia distachya* (V), *Foeniculum vulgare* subsp. *piperitum* (V), *Plantago afra* subsp. *afra* (V), *Arisarum vulgare* (V).

Geographical distribution: This vegetation occurs only in Lampedusa island (Bartolo et al., 1990).

Structure and ecology: On quite incoherent soils with a rich sandy component the *Plantagini-Carrichteretum annuae* is replaced by a different community characterized by the occurrence of *Astragalus epiglottis* and *Hippocrepis ciliata*. These species allow to identify the *Hippocrepido-Astragaletum epiglottis*, which is found mainly on abandoned fields. The floristic set includes some species of alliance, as *Lotus ornithopodioides*, *Hypochoeris achyrophorus*,

Tordylium apulum, *Urospermum picroides* and *Reichardia picroides*. As concern the syntaxa of higher order, *Echium plantagineum*, *Lotus edulis*, *Anisantha madritensis*, *Aegilops geniculata*, *Hedypnois cretica*, *Oxalis pes-caprae*, *Erodium malacoides* and *Euphorbia helioscopia* are very frequent (Bartolo et al., 1990).

Syndynamism: As the anthropic disturbance decreases, this vegetation is replaced by almost pure populations of *Foeniculum vulgare* subsp. *piperitum*, which later are followed by *Thapsio-Feruletum communis* (Bartolo et al., 1990).

Habitat reference: See class.

31.3.3.17. ***Chrysanthemo coronarii-Hyppocrepidetum multisiliquosae*** Brullo & Siracusa 1996

Subnitrophilous vegetation with garland chrysanthemum and many-flowered horseshoe vetch of fallow fields on incoherent soils.

Holotypus: rel. 1, tab. 17, Brullo & Siracusa (1996).

Characteristic and differential species: *Hippocrepis multisiliquosa* L., *Lotus peregrinus* L., *Ononis diffusa* Ten., *Reichardia tingitana* (L.) Roth.

Phytosociological table: From Brullo & Siracusa (1996), table 17, 5 rel.

Char. association: *Hippocrepis multisiliquosa* (V), *Ononis diffusa* (V), *Reichardia tingitana* (IV), *Lotus peregrinus* (IV).

Char. alliance and order: *Glebionis coronaria* (V), *Stipellula capensis* (V), *Rostraria cristata* (V), *Astragalus boeticus* (V), *Avena barbata* (V), *Lupinus cosentinii* (V), *Anisantha madritensis* (V), *Lotus edulis* (IV), *Hordeum murinum* subsp. *leporinum* (IV), *Hedypnois cretica* (IV), *Catapodium rigidum* (IV), *Festuca danthonii* (IV), *Anisantha diandra* (III), *Medicago polymorpha* (III).

Char. class: *Brassica fruticulosa* (V), *Calendula arvensis* (V), *Sonchus oleraceus* (IV), *Mercurialis annua* (IV), *Senecio vulgaris* (I).

Other species: *Rumex bucephalophorus* (V), *Medicago littoralis* (V), *Lobularia maritima* (V), *Euphorbia terracina* (V).

Geographical distribution: This vegetation was surveyed in Linosa island, as well as in Southern Sicily and Malta (Brullo & Siracusa, 1996).

Structure and ecology: In very xeric conditions, the abandoned crops and the fields are colonized by a subnitrophilous community named *Chrysanthemo-Hyppocrepidetum multisiliquosae*, which is differentiated by the dominance of *Hippocrepis multisiliquosa* and the occurrence of some species linked to sandy and incoherent soils, as *Lotus peregrinus* and *Ononis diffusa.* The thermophilous character of this association is shown by *Reichardia tingitana*, a rare species that in Sicily is known only for Linosa and Lampedusa. Among the

species of higher rank, *Glebionis coronaria*, *Stipellula capensis*, *Rostraria cristata*, *Astragalus boeticus*, *Avena barbata*, *Lupinus cosentinii*, *Anisantha madritensis*, *Brassica fruticulosa*, *Calendula arvensis* and *Sonchus oleraceus* are very frequent

Syndynamism: This vegetation is dynamically linked to the *Periploco-Euphorbietum dendroidis* series (Bartolo et al., 1990).

Habitat reference: See class.

31.3.3.18. ***Reichardio picroidis-Stipetum capensis*** Rivas-Martínez, Costa & Loidi 1992

Ephemeral annual vegetation with common brighteyes and Mediterranean needle grass of abandoned cereal fields.

Holotypus: rel. 1, tab. 45, Rivas-Martínez et al. (1992).

Characteristic and differential species: *Stipellula capensis* (Thunb.) Röser & Hamasha

Phytosociological table: From Gianguzzi et al. (1996), table 11, 4 rel.

Char. association: *Stipellula capensis* (4).

Char. alliance: *Reichardia picroides* (4), *Hypochoeris achyrophorus* (4).

Char. order: *Trifolium stellatum* (4), *Medicago truncatula* (4), *Catapodium rigidum* (3), *Avena barbata* (2), *Plantago lagopus* (2), *Lotus edulis* (1).

Char. class: *Oxalis pes-caprae* (3), *Echium plantagineum* (2), *Euphorbia helioscopia* (1), *Galactites elegans* (1), *Euphorbia peplus* (1), *Erodium cicutarium* (1), *Erodium malacoides* (I).

Other species: *Lagurus ovatus* (3), *Festuca myuros* (3), *Medicago littoralis* (2).

Geographical distribution: This vegetation was described by Rivas-Martinez et al. (1992) from Balearic Islands and later reported for Western Sicily by Gianguzzi et al. (1996) and Pasta et al. (2008).

Structure and ecology: The abandoned cereal fields on various kinds of soils, subject to a moderate grazing, are colonized by a subnitrophilous annual community with spring optimum. It is the *Reichardio picroidis-Stipetum capensis,* a thermophilous vegetation dominated by *Stipellula capensis*, growing with some species of alliance and order, as *Reichardia picroides*, *Trifolium stellatum*, *Hypochoeris achyrophorus*, *Medicago truncatula*, *Catapodium rigidum*, *Avena barbata*, *Plantago lagopus* and *Lotus edulis* (Rivas-Martinez et al., 1992).

Syndynamism: This vegetation can evolve towards the dry grasslands of *Hyparrhenietum hirto-pubescentis* or other communities belonging to *Hyparrhenenion hirtae.*

Habitat reference: See class.

31.3.3.19. ***Loto halophili-Stipetum capensis*** Miniss. & Sciandrello 2005

Thermo-xerophilous vegetation with halophytic bird's foot trefoil and Mediterranean needle grass of abandoned cereal fields on sandy soils.

Holotypus: rel. 5, Tab. 11, Rivas-Martínez et al. (1992).

Characteristic and differential species: *Lotus halophilus* Boiss. & Spruner, *Medicago littoralis* Loisel., *Filago eriocephala* Guss.

Phytosociological table: From Minissale & Sciandrello (2005), table 11, 16 rel.

Char. association: *Lotus halophilus* (V), *Medicago littoralis* (V), *Filago eriocephala* (V).

Char. alliance: *Hippocrepis unisiliqua* (III), *Hypochoeris achyrophorus* (III), *Trifolium nigrescens* (II), *Lotus ornithopodioides* (I).

Char. order: *Stipellula capensis* (V), *Ononis reclinata* (V), *Festuca danthonii* (V), *Plantago lagopus* (V), *Rostraria cristata* (V), *Avena barbata* (V), *Hedypnois ragadioloides* (II), *Lotus edulis* (II), *Medicago truncatula* (II), *Trifolium angustifolium* (I), *Dasypirum villosum* (I), *Medicago polymorpha* (I), *Trifolium stellatum* (I).

Char. class: *Erodium chium* (V), *Plantago afra* subsp. *afra* (II), *Echium plantagineum* (II), *Filago pyramidata* (II), *Calendula arvensis* (II), *Astragalus hamosus* (I), *Emex spinosa* (I).

Other species: *Bellardia trixago* (V), *Vicia sativa* (V), *Silene gallica* (V), *Convolvulus altheoides* (V).

Geographical distribution: This community was described by Minissale & Sciandrello (2005) for Piano Stella near Gela.

Structure and ecology: The old uncultivated fields with sandy soils are colonized by a thermo-xerophilous vegetation, which is differentiated by the occurrence of *Lotus halophilus* and *Medicago littoralis*, sometimes associated with *Filago eriocephala*. The structure of this community, named *Loto halophili-Stipetum capensis*, is given by *Stipellula capensis*, growing together with several subnitrophilous and nitrophilous species, as *Ononis reclinata*, *Rostraria cristata*, *Festuca danthonii*, *Avena barbata*, *Dasypyrum villosum*, *Plantago afra*, *Glebionis coronaria*, *Raphanus raphanistrum*, ecc.

Syndynamism: The progressive reduction of human activities can lead to estabilishment of *Vulpietalia* communities, as the *Alkanno-Noneetum vesicariae* Brullo e Scelsi 1998, which usually replaces the community at issue in less disturbed stands.

Habitat reference: See class.

31.3.3.20. ***Plantago afrae-Galactitetum elegantis*** Ferro & Privitera 2010

Subnitrophilous vegetation with glandular plantain and milk thistle of abandoned cereal fields on calcareous or clayey soils.

Holotypus: rel. 4, Tab. 1, Ferro & Privitera (2010).

Characteristic and differential species: *Plantago afra* L. subsp. *afra*, *Ammi majus* L., *Lolium multiflorum* Lam., *Bellardia trixago* (L.) All.

Phytosociological table: From Ferro & Privitera (2010), table 1, 6 rel (subass. *glebionidetosum segetum*).

Char. association: *Plantago afra* subsp. *afra* (V), *Ammi majus* (V), *Lolium multiflorum* (III), *Bellardia trixago* (II).

Char. subassociation.: *Vicia hybrida* (IV), *Rumex acetosa* (III), *Trifolium pallidum* (II).

Char. alliance: *Urospermum dalechampii* (V), *Lotus ornithopodioides* (III), *Reichardia picroides* (I), *Urospermum picroides* (I), *Hypochoeris achyrophorus* (I).

Char. order: *Anisantha madritensis* (IV), *Dasypirum villosum* (III), *Medicago truncatula* (III), *Avena barbata* (III), *Carduus pycnocephalus* subsp. *pycnocephalus* (II), *Aegilops geniculata* (II), *Hirschfeldia incana* (I), *Medicago polymorpha* (I), *Hordeum murinum* subsp. *leporinum* (I).

Char. class: *Galactites elegans* (V), *Anthemis arvensis* (V), *Glebionis segetum* (V), *Avena sterilis* (V), *Silene bellidifolia* (IV), *Sinapis arvensis* (IV), *Echium plantagineum* (IV), *Notobasis syriaca* (IV), *Bromus hordeaceus* (IV), *Phalaris brachystachys* (III), *Coleostephus myconis* (III), *Lolium rigidum* (III), *Diplotaxis erucoides* (II), *Sonchus oleraceus* (II), C*alendula arvensis* (I), *Erodium malacoides* (I), *Senecio gallicus* (I), *Malva parviflora* (I), *Euphorbia helioscopia* (I), *Malva trimestris* (I), *Silene fuscata* (I), *Medicago scutellata* (I), *Linaria reflexa* (I), *Phalaris truncata* (I).

Other species: *Hypericum perforatum* (II), *Echium arenarium* (II), *Romulea bulbocodium* (II).

From Ferro & Privitera (2010), table 1, 4 releves (subass. *helminthothecetosum echioidis*).

Char. association: *Plantago afra* subsp. *afra* (4), *Ammi majus* (2), *Lolium multiflorum* (2), *Bellardia trixago* (1).

Char. subassociation.: *Helminthotheca echioides* (4), *Beta vulgaris* subsp. *maritima* (2).

Char. alliance: *Reichardia picroides* (3), *Hypochoeris achyrophorus* (2), *Urospermum dalechampii* (1), *Lotus ornithopodioides* (1), *Urospermum picroides* (1).

Char. order: *Anisantha madritensis* (4), *Carduus pycnocephalus* subsp. *pycnocephalus* (3), *Aegilops geniculata* (3), *Hirschfeldia incana* (1), *Medicago polymorpha* (2), *Hordeum murinum* subsp. *leporinum* (2), *Avena barbata* (2).

Char. class: *Galactites elegans* (4), *Bromus hordeaceus* (4), *Anthemis arvensis* (2), *Glebionis coronaria* (3), *Diplotaxis erucoides* (2), *Avena sterilis* (3), *Sinapis arvensis* (3), *Echium plantagineum* (1), *Phalaris brachystachys* (3), *Lolium rigidum* (2), *Sonchus oleraceus* (1), C*alendula arvensis* (1), *Phalaris coerulescens* (1), *Erodium malacoides* (1), *Senecio gallicus* (1), *Diplotaxis tenuifolia* (1), *Borago officinalis* (1), *Lolium perenne* (1), *Ecballium elaterium* (1), *Convolvulus arvensis* (1), *Melilotus sulcatus* (1), *Medicago ciliaris* (1).

Other species: *Hypericum perforatum* (2), *Echium arenarium* (1), *Foeniculum vulgare* subsp. *piperitum* (1).

Geographical distribution: According to Ferro & Privitera (2010), this vegetation occurs in Eastern Sicily and in particular between Catania and Enna.

Structure and ecology: The *Plantago afrae-Galactitetum elegantis* was described by Ferro & Privitera (2010) for the abandoned cereal fields of coastal and hilly areas, on clayey soils or on calcareous substrata with a thin layer of sand. This vegetation has a spring optimum, when *Galactites elegans*, the dominant species of this association, characterizes the country landscape with its flowering. From the syntaxonomical point of view, *Plantago afra* subsp. *afra*, *Lolium multiflorum*, *Ammi majus* and *Bellardia trixago* must be considered the characteristic and differential species, growing together with some species of *Echio-Galactition*, such as *Urospermum dalechampii*, *Lotus ornithopodioides*, *Reichardia picroides*, *Urospermum picroides* and *Hypochoeris achyrophorus*. The authors distinguished two subassociations: the first one, named subass. *glebionidetosum segetum*, represents the typical aspect and occurs in the surfaces covered by a sandy layer, being differentiated by *Vicia hybrida*, *Rumex acetosa* and *Trifolium pallidum*; the second one, named subass. *helminthothecetosum echioidis*, is linked to soils almost without a layer of superficial sands and is characterized by the high coverage of *Helminthotheca echioides*, *Reichardia picroides* and *Beta vulgaris* subsp. *maritima*.

Syndynamism: This community is linked to the dynamic series of *Oleo-Ceratonion* and in a lesser extent also *Quercion ilicis*.

Habitat reference: See class.

31.3.3.21. ***Achilleo ligusticae-Galactitetum tomentosae*** Ferro 2005

Subnitrophilous vegetation with southern yarrow and milk thistle of uncultivated fields on volcanic soils.

Holotypus: rel. 5, tab. 4, Ferro (2005).

Characteristic and differential species: *Achillea ligustica* All.*, Lathyrus clymenum* L.

Phytosociological table: From Ferro (2005), table 4, 8 rel.

Char. association: *Achillea ligustica* (V), *Lathyrus clymenum* (IV).

Char. alliance: *Lotus ornithopodioides* (IV), *Trifolium nigrescens* (I), *Reichardia picroides* (I).

Char. order: *Avena barbata* (III), *Avena sterilis* (II), *Anisantha madritensis* (II), *Medicago polymorpha* (I), *Medicago truncatula* (I).

Char. class: *Galactites elegans* (V), *Brassica fruticulosa* (IV), *Sulla coronaria* (IV), *Glebionis coronaria* (IV), *Echium plantagineum* (III), *Mercurialis annua* (II), *Coleostephus myconis* (II), *Plantago lanceolata* (II), *Melilotus sulcata* (II), *Gastridium ventricosum* (II), *Bromus hordeaceus* (II), *Anisantha sterilis* (II), *Malva multiflora* (I), *Anchusa azurea* (I), *Medicago scutellata* (I), *Convolvulus arvensis* (I).

Other species: *Foeniculum vulgare* subsp. *piperitum* (V), *Convolvulus althaeoides* (V), *Dactylis glomerata* (III).

Geographical distribution: This community was described by Ferro (2005) for Lipari (Aeolian Islands).

Structure and ecology: The fields with volcanic soils, abandoned for at least 5 years and often subject to an intense grazing, are colonized by the *Achilleo ligusticae-Galactitetum tomentosae*. This association is found from the sea level until 400-500 m a.s.l. From the physiognomic point of view, this community is dominated by *Galactites elegans*, growing together with some species of higher syntaxa, as *Lotus ornithopodioides*, *Avena barbata*, *A. sterilis*, *Anisantha madritensis*, *Brassica fruticulosa*, *Sulla coronaria*, *Glebionis coronaria*, etc. The differential species of this syntaxon are *Achillea ligustica* and *Lathyrus clymenum* (Ferro, 2005).

Syndynamism: This vegetation tends to evolve towards the *Calicotomo villosae-Artemisietum arborescentis* Ferro 2005, as evidenced by the sporadic presence of *Artemisia arborescens* in the more mature aspects of the association at issue.

Habitat reference: See class.

31.4. Order: ***Urtico-Scrophularietalia peregrinae*** Brullo in Brullo & Marcenò 1985

Nitro-sciaphilous annual vegetation with annual nettle of ruderal habitats and cultivated lands.

Holotypus: *Allion triquetri* O. Bolòs 1967.

Characteristic and differential species: *Arisarum vulgare* O. Targ. Tozz., *Arum italicum* Mill., *Fumaria capreolata* L. subsp. *capreolata*, *Galium aparine* L., *Parietaria Judaica* L., *Scrophularia peregrina* L., *Urtica membranacea* Poir.

Geographical distribution: This order occurs in the western and central Mediterranean areas (Brullo & Marcenò, 1985).

Structure and ecology: According to Brullo & Marcenò (1985), the nitrophilous and sciaphilous annual communities of ruderal stands and also cultivated places (citrus groves) are grouped within the *Urtico-Scrophularietalia peregrinae* order. Conversely, Mucina et al. (2016) prefer to treat this syntaxon within the *Geranio purpurei-Cardaminetalia hirsutae*, despite in its original description this order included only slightly nitrophilous annual communities of natural woody stands. The vegetation at issue is linked to quite humid and deep soils and shows thermophilous requirements, occurring between 0 and 500 m a.s.l. Its structure is given by several annual species, among them *Fumaria capreolata*, *Scrophularia peregrina*, *Urtica membranacea*, *Urtica urens*, *Galium aparine*, as well as some geophytes and hemicryptophytes, as *Smyrnium olusatrum*, *Allium triquetrum*, *Arum italicum*, *Arisarum vulgare*, *Parietaria judaica*, etc.

Syndynamism: The communities belonging to this order are connected to the dynamic series of *Oleo-Ceratonion*.

Habitat reference: See class.

31.4.1. Alliance: ***Allion triquetri*** O. Bolòs 1967

Nitrophilous annual vegetation of shady and wet ruderal stands.

Synonyms: *Smyrnion olusatri* Rivas Goday 1964 (art. 3b).

Holotypus: *Urtico-Smyrnietum olusatri* A. & Bolòs ex O. Bolòs & Molinier 1958.

Characteristic and differential species: *Allium triquetrum* L., *Cynoglossum creticum* Mill., *Smyrnium olusatrum* L.

Geographical distribution: This alliance occurs in Spain, Balearic Islands, France, central-southern Italy and northern Sicily (Bolòs, 1967; Anzalone & Caputo, 1976; Izco & Géhu, 1978; Brullo & Marcenò, 1985).

Structure and ecology: The *Allion triquetri* gathers the nitrophilous communities with winter-spring optimum, which are linked to humid and shady ruderal stands. Their physiognomy is given by many annual species of *Chenopodietea* and by few large-size geophytes and hemicryptophytes, as *Allium triquetrum*, *Cynoglossum creticum* and *Smyrnium olusatrum*. It is a quite thermophilous vegetation, generally linked to coastal stands but sometimes is found also in hilly places (Brullo & Marcenò, 1985).

Syndynamism: See order.

Habitat reference: See class.

31.4.1.1. ***Acantho mollis-Smyrnietum olusatri*** Brullo & Marcenò 1985

Annual sciaphilous vegetation with bear's breeches and alexanders of abandoned gardens, country walls and farmhouses.

Holotypus: rel. 1, tab. 15, Brullo & Marcenò (1985).

Characteristic and differential species: *Acanthus mollis* L.

Phytosociological table: From Brullo & Marcenò (1985), table 15, 12 rel.
Char. association: *Acanthus mollis* (V).

Char. alliance: *Smyrnium olusatrum* (V), *Cynoglossum creticum* (IV), *Allium triquetrum* (II).

Char. order: *Urtica membranacea* (V), *Arum italicum* (V), *Galium aparine* (V), *Parietaria judaica* (V), *Scrophularia peregrina* (IV), *Fumaria capreolata* (III), *Arisarum vulgare* (III).

Char. class: *Oxalis pes-caprae* (V), *Glebionis coronaria* (V), *Mercurialis annua* (V), *Geranium molle* (IV), *Sonchus oleraceus* (IV), *Anisantha sterilis* (IV), *Erodium malacoides* (III), *Solanum nigrum* (III), *Malva nicaeensis* (III), *Avena barbata* (III), *Senecio vulgaris* (III), *Chenopodium album* (III), *Euphorbia peplus* (III), *Stellaria media* (II), *Malva sylvestris* (II), *Capsella rubella* (II), *Sonchus asper* (II), *Rumex pulcher* (II), *Borago officinalis* (I), *Erigeron bonariensis* (I).

Other species: *Veronica cymbalaria* (III), *Anagallis arvensis* (III).

Geographical distribution: This community is widespread in Sicily and some neighboring islands (Brullo & Marcenò, 1985; Bartolo et al. 1990; Brullo & Furnari, 1990; Brullo et al., 2019), as well as in various territories of southern Tirreno as Sardinia and Italian Peninsula (Biondi et al .1988; Ceschin et al. 2003).

Structure and ecology: The ruderal stands of urban and suburban places under the shade of trees or walls, as abandoned gardens and parks, old buildings, archeological sites and farmhouses, are colonized by the *Acantho-Smyrnietum olusatri*. Under the floristic profile, it is characterized by the occurrence of *Acanthus mollis*, growing together with some species of alliance, as *Smyrnium olusatrum*, *Cynoglossum creticum* and *Allium triquetrum* and order, as *Urtica membranacea*, *Arum italicum*, *Galium aparine*, *Parietaria judaica*, *Scrophularia peregrina*, *Fumaria capreolata* and *Arisarum vulgare* (Brullo & Marcenò, 1985).

Syndynamism: This community is connected with the dynamic series of *Quercion ilicis*.

Habitat reference: See class.

31.4.1.2. ***Delphinio staphysagriae-Stellarietum cupanianae*** Brullo & Marcenò 1985

Nitrophilous vegetation with stavesacre and Cupani's chickweed of very shaded stands.

Holotypus: rel. 4, tab. 16, Brullo & Marcenò (1985).

Characteristic and differential species: *Delphinium staphysagria* L., *Stellaria neglecta* Weihe subsp. *cupaniana* (Jord. & Fourr.) Gutermann.

Phytosociological table: From Brullo & Marcenò (1985), table 16, 8 rel.

Char. association: *Stellaria neglecta* subsp. *cupaniana* (V), *Delphinium staphysagria* (IV)

Char. alliance: *Smyrnium olusatrum* (IV), *Cynoglossum creticum* (IV).

Char. order: *Urtica membranacea* (IV), *Fumaria capreolata* (IV), *Galium aparine* (IV), *Parietaria judaica* (III), *Scrophularia peregrina* (III), *Arisarum vulgare* (II), *Arum italicum* (II).

Char. class: *Oxalis pes-caprae* (V), *Scandix pecten-veneris* (V), *Mercurialis annua* (V), *Sonchus oleraceus* (V), *Fedia graciliflora* (V), *Geranium molle* (IV), *Cerinthe major* (IV), *Euphorbia peplus*

(IV), *Borago officinalis* (III), *Torillis nodosa* (III), *Urtica pilulifera* (III), *Vicia sativa* (II), *Rumex pulcher* (I).

Other species: *Asparagus acutifolius* (V), *Allium subhirsutum* (V).

Geographical distribution: This community was surveyed only in the Hyblaean mountains (Brullo & Marcenò, 1985).

Structure and ecology: The *Delphinio-Stellarietum cupanianae* is linked to very shady stands under carob groves, where the the sporadic stationing of the livestock supplies a sufficient quantity of organic matter. Its physiognomy is given by *Delphinium staphysagria* and *Stellaria neglecta* subsp. *cupaniana*, two species that can be considered quite rare in Sicily (Brullo & Marcenò, 1985). The alliance and the order are represented by *Smyrnium olusatrum*, *Cynoglossum creticum*, *Urtica membranacea*, *Fumaria capreolata*, *Galium aparine*, *Parietaria judaica*, *Scrophularia peregrina*, *Arisarum vulgare* and *Arum italicum*.

Syndynamism: This community is connected with the dynamic series of *Oleo-Ceratonion*. It is replaced by the *Theligono-Smyrnietum rotundifolii* in the carob groves with more xeric conditions and dispersed trees.

Habitat reference: See class.

31.4.1.3. ***Succowio balearicae-Smyrnietum olusatri*** Bartolo, Brullo, Minissale & Spampinato 1990

Nitrophilous vegetation with Balearic succowia and Alexanders of shady stands under carob trees and prickly pears.

Holotypus: rel. 2, tab. 39, Bartolo et al. (1990).

Characteristic and differential species: *Succowia balearica* (L.) Medik.

Phytosociological table: From Bartolo et al. (1990), table 39, rel. 5.

Char. association: *Succowia balearica* (V).

Char. alliance: *Smyrnium olusatrum* (V).

Char. order: *Parietaria judaica* (V), *Galium aparine* (V), *Urtica membranacea* (IV), *Arisarum vulgare* (III), *Urtica urens* (I).

Char. class: *Oxalis pes-caprae* (V), *Scandix pecten-veneris* (), *Mercurialis annua* (IV), *Sonchus oleraceus* (IV), *Anisantha sterilis* (III), *Fumaria flabrllata* (III), *Erodium malacoides* (II), *Senecio vuglaris* (), *Malva multiflora* (II), *Stellaria media* (II), *Malva nicaeensis* (II), *Geranium molle* (I), *Solanum nigrum* (I).

Other species: *Foeniculum vulgare* subsp. *piperitum* (IV), *Convolvulus arvensis* (II).

Geographical distribution: This community is restricted to Lampedusa island (Bartolo et al., 1990).

Structure and ecology: The shady places under carob trees or between the prickly pears hedges are colonized by the *Succowio-Smyrnietum olusatri*, a thermophilous community dominated by *Smyrnium olusatrum*, which grows together with the rare *Succowia balearica*. Besides, the order is represented by *Parietaria judaica*, *Galium aparine*, *Urtica membranacea*, *Arisarum vulgare*, *Urtica urens*, etc.

Syndynamism: This vegetation is linked with the dynamic series of *Periplocion angustifoliae*.

Habitat reference: See class.

31.4.1.4. ***Fumario flabellatae-Parietarietum judaicae*** Bartolo, Brullo, Minissale & Spampinato 1990

Nitrophilous vegetation with southern ramping fumitory of open and ventilated shady places.

Holotypus: rel. 1, tab. 40, Bartolo et al. (1990).

Characteristic and differential species: *Fumaria flabellata* Gasp.

Phytosociological table: From Bartolo et al. (1990), table 40, 6 rel.

Char. association: *Fumaria flabellata* (V).

Char. alliance: *Smyrnium olusatrum* (V).

Char. order: *Galium aparine* (V), *Parietaria judaica* (V), *Urtica membranacea* (III), *Arisarum vulgare* (III), *Urtica urens* (I).

Char. class: *Malva nicaeensis* (V), *Anisantha sterilis* (V), *Geranium molle* (V), *Mercurialis annua* (V), *Sonchus oleraceus* (IV), *Echium plantagineum* (IV), *Chenopodium murale* (III), *Carduus argyroa* (II), *Carduus pycnocephalus* subsp. *marmoratus* (II), *Geranium rotundifolium* (II), *Anisantha madritensis* (II), *Erodium malacoides* (I), *Vicia sativa* (I), *Oxalis pes-caprae* (I).

Other species: *Hyoseris radiata* (V), *Lobularia maritima* (V).

Geographical distribution: This community occurs only in Lampedusa island (Bartolo et al., 1990).

Structure and ecology: In quite open and ventilates stands, as the small crevices of disturbed rocky surfaces with northern exposure near shelters for livestock, the *Succowio-Smyrnietum olusatri* is replaced by another nitrophilous community dominated by *Fumaria flabellata*. This vegetation, named *Fumario flabellatae-Parietarietum judaicae,* is clearly referable to *Allion triquetri* alliance and *Urtico-Scrophularietalia* order for the occurrence of *Smyrnium olusatrum, Galium aparine*, *Parietaria judaica*, *Urtica membranacea*, *Arisarum vulgare*, *Urtica urens*, etc. Bartolo et al. (1990) distinguished two subassociations: the typical aspect (subass. *fumarietosum flabellatae*) is linked to rather open places and is characterized by the low

coverage of *Smyrnium olusatrum*; the subass. smyrnietosum olusatri occurs in more closed places, usually near caves, where *Smyrnium olusatrum* becomes dominant.

Syndynamism: This vegetation is linked with the dynamic series of *Periplocion angustifoliae*.

Habitat reference: See class.

31.4.1.5. ***Succowio balearicae-Castellietum tuberculosae*** Brullo & Siracusa 1996

Nitrophilous vegetation with Balearic succowia and castellia grass of shady stands within thermophilous maquis.

Holotypus: rel. 9, tab. 25, Brullo & Siracusa (1996).

Characteristic and differential species: *Castellia tuberculosa* (Moris) Bor., *Succowia balearica* (L.) Medik.

Phytosociological table: From Brullo & Siracusa (1996), table 25, rel. 11.
Char. association: *Castellia tuberculosa* (V), *Succowia balearica* (V).
Char. order: *Urtica membranacea* (V), *Parietaria judaica* (V), *Urtica urens* (V), *Scrophularia peregrina* (V), *Arisarum vulgare* (V), *Galium aparine* (I), *Arum italicum* (I).
Char. class: *Oxalis pes-caprae* (V), *Mercurialis annua* (V), *Sonchus oleraceus* (III), *Stellaria pallida* (III), *Geranium molle* (III), *Senecio vulgaris* (II), *Malva multiflora* (II), *Carduus pycnocephalus* subsp. *pycnocephalus* (II), *Brassica fruticulosa* (I), *Malva parviflora* (I), *Torillis pseudonodosa* (I).
Other species: *Anisantha diandra* (III), *Centranthus calcitrapa* (III).

Geographical distribution: This community is restricted to Linosa island (Brullo & Siracusa, 1996).

Structure and ecology: The *Succowio-Smyrnietum olusatri* is a nitrophilous vegetation growing only in the shady places under the large shrubs of the thermo-xerophilous maquis belonging to *Periploco-Euphorbietum dendroidis*. From the floristic point of view, this community is characterized by the occurrence of two rare species, as *Succowia balearica* and *Castellia tuberculosa*, which are associated with some species of alliance, such as *Urtica membranacea*, *Parietaria judaica*, *Urtica urens*, *Scrophularia peregrina*, *Arisarum vulgare*, etc. (Brullo & Siracusa, 1996).

Syndynamism: This vegetation is linked with the dynamic series of *Periplocion angustifoliae*.

Habitat reference: See class.

31.4.1.6. ***Geranio robertiani-Smyrnietum olusatri*** Ferro 2005

Nitrophilous vegetation with herb-Robert and alexanders of shady roadsides on volcanic soils.

Holotypus: rel. 1, tab. 6, Ferro (2005).

Characteristic and differential species: *Geranium robertianum* L.

Phytosociological table: From Brullo & Siracusa (1996), table 6, 6 rel.

Char. association: *Geranium robertianum* (V).

Char. alliance: *Smyrnium olusatrum* (V),

Char. order: *Galium aparine* (IV), *Fumaria capreolata* (IV), *Urtica membranacea* (II).

Char. class: *Anisantha sterilis* (V), *Geranium molle* (V), *Parietaria judaica* (V), *Stellaria media* (V), *Galactites elegans* (V), *Oxalis pes-caprae* (V), *Sonchus oleraceus* (V), *Avena barbata* (IV), *Glebionis coronaria* (IV), *Glebionis segetum* (IV), *Borago officinalis* (III), *Geranium lanuginosum* (III), *Brassica fruticulosa* (III), *Avena sterilis* (II), *Malva multiflora* (II), *Echium platagineum* (II), *Vicia villosa* (II), *Euphorbia terracina* (II), *Lagurus ovatus* (II), *Lolium perenne* (II), *Marrubium vulgare* (II), *Anisantha madritensis* (I), *Achillea ligustica* (I), *Reichardia picroides* (I), *Mercurialis annua* (I), *Raphanus raphanistrum* (I), *Sherardia arvensis* (I), *Carduus pycnocephalus* subsp. *pycnocephalus* (I), *Senecio vulgaris* (I).

Other species: *Silene vulgaris* (IV), *Pteridium aquilinum* (III).

Geographical distribution: This community was described by Ferro (2005) for Lipari (Aeolian islands).

Structure and ecology: The *Geranio robertiani-Smyrnietum olusatri* occurs in the shaded roadsides on deep and quite humid volcanic soils. Its physiognomy is given by *Smyrnium olusatrum*, growing together with *Geranium robertianum* and some species of order, as *Galium aparine*, *Fumaria capreolata* and *Urtica membranacea*. As regard the class, it is represented by many species, among them *Anisantha sterilis*, *Geranium molle*, *Parietaria judaica*, *Stellaria media*, *Galactites elegans*, *Oxalis pes-caprae*, *Sonchus oleraceus*, *Avena barbata*, *Glebionis coronaria* and *Glebionis segetum* (Ferro, 2005).

Syndynamism: This community can evolve towards the annual grasslands of *Thero-Brachypodietea ramosi*.

Habitat reference: See class.

31.4.2. Alliance: ***Veronico-Urticion urentis*** Brullo in Brullo & Marcenò 1985

Nitrophilous and sciaphilous vegetation of Citrus groves

Holotypus: *Fumario parviflorae-Stellarietum neglectae* Maugeri ex Brullo & Marcenò 1985

Characteristic and differential species: *Urtica urens* L.., *Veronica persica* Poir.

Geographical distribution: This alliance occurs in the Central and Western Mediterranean area (Brullo & Marcenò, 1985).

Structure and ecology: The communities belonging to *Veronico-Urticion urentis* shows a nitro-sciaphilous character, colonizing the shady undergrowth of fertilized and irrigated citrus groves on alluvial soils. Under the floristic profile, this vegetation is quite similar to *Allion triquetri* alliance, but is distinguished for the occurrence of *Urtica urens* and *Veronica persica* (Brullo & Marcenò, 1985).

Syndynamism: See order.

Habitat reference: See class.

31.4.2.1. ***Fumario capreolatae-Stellarietum neglectae*** Maugeri ex Brullo & Marcenò 1985

Nitrophilous and sciaphilous vegetation with white ramping fumitory and greater chickweed of Citrus groves on volcanic soils.

Synonyms: *Fumario-Stellarietum neglectae* Maugeri 1980 nom. inval.

Holotypus: rel. 14, tab. 1, Maugeri (1980).

Characteristic and differential species: *Stellaria neglecta* Weihe subsp. *neglecta*

Phytosociological table: From Brullo & Marcenò (1985), table 17, 23 rel.

Char. association: *Stellaria neglecta* subsp. *neglecta* (V).

Char. alliance: *Urtica urens* (V), *Veronica persica* (III).

Char. order: *Urtica membranacea* (V), *Galium aparine* (V), *Fumaria capreolata* (V), *Parietaria judaica* (IV), *Scrophularia peregrina* (IV), *Arum italicum* (IV), *Arisarum vulgare* (II).

Char. class: *Oxalis pes-caprae* (V), *Sonchus oleraceus* (V), *Avena barbata* (V), *Mercurialis annua* (IV), *Anisantha sterilis* (IV), *Malva nicaeensis* (III), *Sonchus asper* (III), *Erodium malacoides* (III), *Galinsoga parviflora* (III), *Solanum nigrum* (III), *Rumex pulcher* (II), *Convolvulus arvensis* (II), *Geranium rotundifolium* (II), *Malva sylvestris* (II), *Capsella rubella* (II), *Borago officinalis* (II), *Stellaria media* (II), *Chenopodium album* (II), *Sisymbrium officinale* (II), *Fumaria officinalis* subsp. *wirtgenii* (II), *Raphanus raphanistrum* (II).

Other species: *Hordeum murinum* subsp. *leporinum* (IV), *Lolium rigidum* (III).

Geographical distribution: This community was surveyd only in the Hyblaean area and Etna mountain (Maugeri, 1980; Brullo & Marcenò, 1985).

Structure and ecology: The citrus groves on volcanic soils are infested by a winter-spring annual vegetation with nitro-sciaphilous requirements, named *Fumario-Stellarietum neglectae*. This vegetation is characterized by the occurrence of *Stellaria neglecta*, growing together with some species of higher rank, as *Urtica urens*, *Veronica* persica, *Urtica*

membranacea, *Galium aparine*, *Fumaria capreolata*, *Parietaria judaica* , *Scrophularia peregrina*, *Arum italicum* and *Arisarum vulgare* (Brullo & Marcenò, 1985).

Syndynamism: This community is connected with the dynamic series of *Quercion ilicis* and *Oleo-Ceratonion*.

Habitat reference: See class.

31.4.2.2. ***Bromo sterili-Brassicetum sylvestris*** Brullo & Marcenò 1985

Nitrophilous and sciaphilous vegetation with napa cabbage of Citrus groves on clayey soils.

Holotypus: rel. 2, tab. 18, Brullo & Marcenò (1985).

Characteristic and differential species: *Brassica rapa* L. subsp. *sylvestris* (L.) Janchen.

Phytosociological table: From Brullo & Marcenò (1985), table 18, 8 rel.

Char. association: *Brassica rapa* subsp. *sylvestris* (V).

Char. alliance: *Urtica urens* (V), *Veronica persica* (IV).

Char. order: *Arum italicum* (V), *Urtica membranacea* (IV), *Parietaria judaica* (IV), *Galium aparine* (IV), *Scrophularia peregrina* (III), *Fumaria capreolata* (III).

Char. class: *Oxalis pes-caprae* (V), *Senecio vulgaris* (V), *Sonchus oleraceus* (V), *Anisantha sterilis* (V), *Borago officinalis* (V), *Mercurialis annua* (IV), *Avena barbata* (IV), *Erodium malacoides* (IV), *Glebionis coronaria* (IV), *Stellaria media* (IV), *Malva nicaeensis* (III), *Chenopodium album* (III), *Chenopodium album* (II), *Solanum nigrum* (II), *Euphorbia helioscopia* (II), *Glebionis segetum* (II), *Euphorbia peplus* (I), *Vicia sativa* (I), *Fumaria officinalis* subsp. *wirtgenii* (I).

Other species: *Hordeum murinum* subsp. *leporinum* (III), *Medicago polymorpha* (III).

Geographical distribution: This community is widely distributed in Sicily (Raimondo et al., 1980; Brullo & Marcenò, 1985).

Structure and ecology: The weedy vegetation with winter-spring optimum of citrus groves on clayey soils derived from limestones or marls is represented by the *Bromo-Brassicetum sylvestris*. This community finds it optimum in the more mature crops, where the trees determine remarkable shaded conditions. From the floristic point of view, this vegetation is dominated by *Brassica rapa* subsp. *sylvestris*, occurring with some species of alliance and order, as *Urtica urens*, *Veronica persica*, *Arum italicum*, *Urtica membranacea*, *Parietaria judaica*, *Galium aparine*, *Scrophularia peregrina*, *Fumaria capreolata*, etc. (Brullo & Marcenò, 1985).

Syndynamism: This community is linked with the dynamic series of *Quercion ilicis* and *Oleo-Ceratonion*.

Habitat reference: See class.

31.5. Order: ***Chenopodietalia muralis*** Br.-Bl. in Br.-Bl. et al. 1936 em. Rivas-Martínez 1977

Nitrophilous ruderal vegetation of urban roadsides, old walls and rubbles.

Synonyms: *Chenopodietalia* Br.-Bl. 1931 (art. 2b); *Chenopodietalia muralis* Br.-Bl. 1931 (phantom); *Chenopodietalia medioeuropaea* R. Tx. 1937 (art. 34a); *Austro-Chenopodietalia* Rothmaler 1943 (art. 2b).

Holotypus: *Chenopodion muralis* Br.-Bl. in Br.-Bl. et al. 1936 em. Brullo in Brullo & Marcenò 1985

Characteristic and differential species: *Chenopodium murale* L., *Chondrilla juncea* L., *Ecballium elaterium* (L.) Richard., *Emex spinosa* (L.) Campd., *Erigeron bonariensis* L., *Erigeron sumatrensis* Retz., *Heliotropium curassavicum* L., *Hyoscyamus albus* L., *Sisymbrium irio* L., *Solanum linnaeanum* Hepper & P.-M.L. Jaeger.

Geographical distribution: This order is widely distributed in the Euri-Mediterranean and Macaronesian territories (Mucina et al., 2016).

Structure and ecology: The annual nitrophilous vegetation of urban stands, as roadsides, rubbles and old walls, is classified within the *Chenopodietalia muralis* order. It is linked to open and sunny places on many kinds of soils and is characterized by some species well adapted to disturbed surfaces, as *Chenopodium murale*, *Erigeron bonariensis, Sisymbrium irio*, *Erigeron sumatrensis*., *Emex spinosa*, *Ecballium elaterium* and *Hyoscyamus albus* (Brullo & Marcenò, 1985).

Syndynamism: The communities of this order are connected to many dynamic series, as those ones belonging to *Oleo-Ceratonion*, *Quercions ilicis*, etc.

Habitat reference: See class.

31.5.1. Alliance: ***Chenopodion muralis*** Br.-Bl. in Br.-Bl. et al. 1936 em. Brullo in Brullo & Marcenò 1985

Nitrophilous vegetation with summer-autumn growth of urban stands.

Synonyms: *Chenopodion murali* Br.-Bl. 1931 (orig. form) (art. 2b); *Rudereto-Chenopodion* Rothmaler 1943 (orig. form) (art. 2b, 3c); *Vicion cordati-variae* Levon 1996 (syntax.syn.).

Holotypus: *Chenopodietum muralis* Br.-Bl. in Br.-Bl., Gajewski, Wraber & Walas 1936

Characteristic and differential species: *Amaranthus deflexus* L., *Amaranthus muricatus* Gillies, *Atriplex rosea* L., *Chenopodium ambrosioides* L., *Chenopodium opulifolium* Schrader., *Chenopodium vulvaria* L., *Xanthium spinosum* L.

Geographical distribution: See order.

Structure and ecology: According to Brullo & Marcenò (1985), the alliance at issue groups the summer-autumn communities of urban and sub-urban stands. This vegetation is characterized by the dominance of many *Chenopodium* species and some xenophytes, as *Amaranthus* sp. pl. and *Xanthium spinosum*.

Syndynamism: See order.

Habitat reference: See class.

31.5.1.1. ***Chenopodietum muralis*** Br.-Bl. in Br.-Bl. et al. 1936

Ruderal vegetation with nettle leaved goosefoot of urban roadsides.

Synonyms: *Chenopodietum muralis* Br.-Bl. 1931 (art. 2b, 7).

Holotypus: rel. 15, single tab., Braun-Blanquet (1978).

Characteristic and differential species: *Chenopodium murale* L.

Phytosociological table: From Brullo & Marcenò (1985), table 19, 6 rel.

Char. association: *Chenopodium murale* (V).

Char. alliance: *Amaranthus deflexus* (V), *Amaranthus muricatus* (IV), *Chenopodium opulifolium* (III), *Chenopodium vulvaria* (II).

Char. order: *Erigeron bonariensis* (V), *Sisymbrium irio* (V), *Erigeron sumatrensis* (III), *Emex spinosa* (II), *Ecballium elaterium* (II).

Char. class: *Mercurialis annua* (V), *Urtica urens* (IV), *Solanum nigrum* (IV), *Chenopodium album* (IV), *Sonchus oleraceus* (IV), *Stellaria media* (III), *Capsella rubella* (III), *Setaria verticillata* (II), *Urtica membranacea* (II), *Symphyotrichum squamatum* (II), *Amaranthus graecizans* (I), *Matricaria chamomilla* (I).

Other species: *Hordeum murinum* subsp. *leporinum* (V), *Cynodon dactylon* (V).

Geographical distribution: This vegetation is widely distributed in the Mediterranean area, including Sicily, where it is particularly frequent in the northern and eastern parts, but occurs everywhere (Brullo & Marcenò, 1985; Marino et al., 2005; Gueli & Lo Giudice, 2007).

Structure and ecology: The *Chenopodietum muralis* is a ruderal vegetation colonizing urban roadsides and other very disturbed habitats with an high presence of nitrates. It is found in

sunny stands, preferring the cracks between the paving stones and the base of walls. Its floristic set is quite heterogeneous, due to the unstable nature of these environments (Loidi, 2017), but it is generally characterized by the dominance of *Chenopodium murale* and *Amaramthus deflexus*, occurring with some species of alliance and order, such as *Sisymbrium irio*, *Erigeron bonariensis*, *Chenopodium opulifolium*, *C. vulvaria*, *Amaranthus muricatus*, etc.

Syndynamism: See order.

Habitat reference: See class.

31.5.1.2. ***Amarantho muricati-Chenopodietum ambrosioidis*** O. Bolòs 1967

Thermophilous vegetation with wormseed of urban roadsides and rubbles.

Synonyms: *Chenopodietum muralis* Braun-Blanq. 1936 *chenopodietosum ambrosioidis* O. Bolòs 1962.

Holotypus: rel. 17, tab. 59, Bolòs (1962).

Characteristic and differential species: *Chenopodium ambrosioides* L., *Mirabilis jalapa* L., *Amaranthus blitoides* Watson.

Phytosociological table: From Brullo & Marcenò (1985), table 10, 7 rel.

Char. association: *Chenopodium ambrosioides* (V), *Mirabilis jalapa* (V), *Amaranthus blitoides* (IV).

Char. alliance: *Amaranthus muricatus* (V), *Chenopodium opulifolium* (IV), *Chenopodium vulvaria* (III), *Amaranthus deflexus* (III).

Char. order: *Erigeron bonariensis* (V), *Erigeron sumatrensis* (IV), *Ecballium elaterium* (III), *Chenopodium murale* (III), *Hyoscyamus albus* (II).

Char. class: *Chenopodium album* (V), *Sonchus oleraceus* (V), *Setaria verticillata* (V), *Hypericum triquetrifolium* (IV), *Symphyotrichum squamatum* (IV), *Convolvulus arvensis* (III), *Heliotropium europaeum* (III), *Solanum nigrum* (III), *Amaranthus retroflexus* (III), *Amaranthus graecizans* (II), *Euphorbia chamaesyce* (II).

Other species: *Cynodon dactylon* (V), *Polygonum aviculare* (III).

Geographical distribution: This community was described from Catalonia by Bolòs (1962, 1967), occurring also in France (Julve, 1993) and Italy, where it was surveyd by Brullo & Marcenò (1985) for several localities of southern and western Sicily.

Structure and ecology: In more xeric conditions the previous association is replaced by a thermophilous community named *Amarantho muricati-Chenopodietum ambrosioidis*. This vegetation is found in roadsides and rubbles within urban centers. From the floristic point of view, it is dominated by *Chenopodium ambrosioides*, growing with *Mirabilis jalapa* and *Amaranthus blitoides*, as well as with some species of alliance and order, as *Amaranthus muricatus*, *Chenopodium opulifolium*, *Chenopodium vulvaria*, *Amaranthus deflexus*, *Erigeron*

bonariensis, *Ecballium elaterium*, *Erigeron sumatrensis*, *Chenopodium murale*, *Hyoscyamus albus*.

Syndynamism: See order.

Habitat reference: See class.

31.5.1.3. ***Amarantho viridis-Chenopodietum muralis*** Bartolo, Brullo, Minissale & Spampinato 1990

Ruderal vegetation with green amaranth of urban sunny walls.

Holotypus: rel. 2, Tab. 38, Bartolo, Brullo, Minissale & Spampinato (1990).

Characteristic and differential species: *Amaranthus viridis* L.

Phytosociological table: From Bartolo et al. (1990), table 38, 3 rel.
Char. association: *Amaranthus viridis* (3).
Char. order: *Erigeron bonariensis* (3), *Chenopodium murale* (3), *Sisymbrium irio* (2), *Heliotropium curassavicum* (1), *Ecballium elaterium* (1), *Hyoscyamus albus* (1).
Char. class: *Sonchus oleraceus* (3), *Symphyotrichum squamatum* (3), *Chenopodium album* (2), *Mercurialis annua* (2).
Other species: *Cynodon dactylon* (1), *Nicotiana glauca* (1).

Geographical distribution: This community occurs only in Lampedusa island (Bartolo et al., 1990).

Structure and ecology: The community at issue is linked to xeric ruderal stands and in particular grows near small walls of urban places. From the floristic point of view, it is characterized by the occurrence of *Amaranthus viridis* and many species of order, as *Erigeron bonariensis*, *Chenopodium murale*, *Sisymbrium irio*, *Heliotropium curassavicum*, *Ecballium elaterium* and *Hyoscyamus albus* (Bartolo et al., 1990).

Syndynamism: See order.

Habitat reference: See class.

31.5.1.4. ***Xanthio italici-Erigeronetum canadensis*** Bonanno & Lo Giudice 2009

Hyper-nitrophytic vegetation with guernsey fleabane of sandy soils.

Holotypus: rel. 2, tab. 18, Bonanno & Lo Giudice (2009).

Characteristic and differential species: *Amaranthus viridis* L.

Phytosociological table: From Bartolo et al. (1990), table 18, 8 rel.

Char. association: *Xanthium orientale* subsp. *italicum* (Moretti) Greuter

Char. alliance and order: *Erigeron sumatrensis* (V), *Erigeron bonariensis* (III), *Emex spinosa* (III), *Sisymbrium irio* (III), *Chenopodium vulvaria* (II).

Char. class: *Sonchus asper* (III), *Symphyotrichum squamatum* (III), *Solanum nigrum* (III), *Anisantha madritensis* (II), *Urospermum picroides* (II), *Helminthotheca echioides* (II), *Oxalis pes-caprae* (II), *Glebionis coronaria* (I), *Sonchus oleraceus* (I), *Carlina sicula* (I).

Other species: *Chondrilla juncea* (I), *Trachynia distachya* (I).

Geographical distribution: This community was described by Bonanno & Lo Giudice (2009) from Acquicella stream near Catania.

Structure and ecology: The *Xanthio italici-Erigeronetum canadensis* is a pioneer and hyper-nitrophytic community colonizing very disturbed sandy surfaces near small watercourses. Its structure is given by the differential species *Xantium orientale* subsp. *italicum* and *Erigeron canadensis*, which are associated with some species of *Chenopodietalia muralis* order, as *Erigeron bonariensis*, *Sisymbrium irio*, *Chenopodium vulvaria* and *Emex spinosa* (Bonanno & Lo Giudice, 2009).

Syndynamism: See order.

Habitat reference: See class.

31.5.2. Alliance: ***Malvion parviflorae*** (Rivas-Martínez 1978) Brullo in Brullo & Marcenò 1985

Nitrophilous vegetation with spring optimum of disturbed stands.

Synonyms: *Chenopodion murali* subass. *malvenion parviflorae* Rivas-Martinez 1978.

Holotypus: *Sisymbrio irionis-Malvetum parviflorae* Rivas-Martinez 1978

Characteristic and differential species: *Lavatera arborea* (L.) Webb & Berthel., *Malva multiflora* (Cav.) Soldano, Banfi & Galasso, *Malva parviflora* L.

Geographical distribution: See order.

Structure and ecology: The *Malvion parviflorae* groups the nitrophilous communities with spring optimum of deep and well nitrified soils. The differential and characteristic species of this syntaxon are *Lavatera arborea***,** *Malva multiflora* and *Malva parviflora* (Brullo & Marcenò, 1985).

Syndynamism: See order.

Habitat reference: See class.

31.5.2.1. ***Lavateretum arboreae*** Br.-Bl. & Molinier 1935

Woody nitrophilous vegetation with tree mallow of disturbed dry coastal stands.

Synonyms: associàtion à *Lavatera arborea* Br.-Bl. & Molinier 1935; *Lavateretum ruderale* Br.-Bl. 1952 (phantom); *Lavateretum arboreo-cretici* Rivas-Martinez (nom. superfl. art. 29c).

Lectotypus: Not designated.

Characteristic and differential species: *Lavatera arborea* (L.) Webb & Berthel.

Phytosociological table: From Brullo & Marcenò (1985), table 22, 5 rel.
Char. association and alliance: *Lavatera arborea* (V), *Malva parviflora* (V).
Char. order: *Chenopodium murale* (V), *Sisymbrium irio* (IV), *Hyoscyamus albus* (III), *Erigeron bonariensis* (II), *Ecballium elaterium* (II).
Char. class: *Glebionis coronaria* (V), *Oxalis pes-caprae* (V), *Sonchus oleraceus* (IV), *Solanum nigrum* (IV), *Erodium malacoides* (IV), *Urtica membranacea* (IV), *Lolium rigidum* (IV), *Hirschfeldia incana* (III), *Mercurialis annua* (III), *Chenopodium album* (III), *Geranium molle* (II), *Euphorbia helioscopia* (II), *Anisantha sterilis* (II), *Vicia sativa* (II), *Brassica fruticulosa* (II).
Other species: *Piptatherum miliaceum* (IV), *Glaucium flavum* (III).

Geographical distribution: This community was surveyed in many Mediterranean countries (see Brullo et al., 2019). In Sicily it is quite frequent in the coastal areas, including some small islands.

Structure and ecology: The ruble accumulations or deposits rich in nitrates, within urban or rural areas mainly near the coast, are colonized by a woody ruderal vegetation dominated by *Lavatera arborea*. Moreover, also *Malva parviflora* plays a physiognomic relevant role together with some species of order, as *Chenopodium murale*, *Sisymbrium irio*, *Hyoscyamus albus*, *Erigeron bonariensis* and *Ecballium elaterium*. As regards the class, it is represented by *Glebionis coronaria*, *Oxalis pes-caprae*, *Sonchus oleraceus*, *Solanum nigrum*, *Erodium malacoides*, *Urtica membranacea* and *Lolium rigidum*.

Syndynamism: See order.

Habitat reference: See class.

31.5.2.2. ***Lavatero creticae-Malvetum nicaeensis*** Brullo et al. 2019

Hyper-nitrophilous spring vegetation with Cretan mallow and bull mallow of deep soils.

Synonyms: *Malvetum parvifloro-nicaensis* sensu Brullo & Marcenò 1985

Holotypus: rel. 5, Tab. 87, Brullo et al. (2019).

Characteristic and differential species: *Malva multiflora* (Cav.) Soldano, *Malva nicaeensis* All.

Phytosociological table: From Brullo & Marcenò (1985), table 21, 8 rel.

Char. association and alliance: *Malva parviflora* (V), *Malva multiflora* (V), *Malva nicaeensis* (IV).

Char. order: *Chenopodium murale* (V), *Sisymbrium irio* (V), *Erigeron bonariensis* (V), *Emex spinosa* (III), *Erigeron sumatrensis* (III), *Hyoscyamus albus* (I).

Char. class: *Sonchus oleraceus* (V), *Urtica urens* (V), *Capsella rubella* (IV), *Senecio vulgaris* (IV), *Stellaria media* (III), *Hirschfeldia incana* (III), *Chenopodium album* (III), *Mercurialis annua* (III), *Euphorbia helioscopia* (III), *Erodium cicutarium* (II), *Malva sylvestris* (II), *Solanum nigrum* (III), *Anisantha sterilis* (I).

Other species: *Parietaria judaica* (IV), *Poa annua* (IV).

Geographical distribution: This community occurs in Sicily and adjacent islands, including Malta (Brullo et al., 2019).

Structure and ecology: The ruderal stands with deep and well nitrified soils, as abandoned flowerbeds, ruble accumulations, archeological sites and old buildings, are colonized by an annual spring vegetation dominated by *Malva parviflora*, *M. multiflora* and *M. nicaeensis*. The taxa of higher rank are represented by *Chenopodium murale*, *Sisymbrium irio*, *Erigeron bonariensis*, *Emex spinosa*, *Erigeron sumatrensis*, *Hyoscyamus albus*, *Sonchus oleraceus*, *Urtica urens*, *Capsella rubella* and *Senecio vulgaris* (Brullo & Marcenò, 1985).

Syndynamism: See order.

Habitat reference: See class.

31.5.2.3. ***Chenopodio muralis-Parietarietum diffusae*** Brullo & Marcenò 1985

Nitrophilous spring vegetation with spreading pellitory and nettle-leaved goosefoot of fresh and shady places.

Holotypus: rel. 4, tab. 23, Brullo & Marcenò (1985).

Characteristic and differential species: *Parietaria judaica* L.

Phytosociological table: From Brullo & Marcenò (1985), table 23, 7 rel.

Char. association and alliance: *Parietaria judaica* (V).

Char. alliance: *Malva parviflora* (V), *Malva multiflora* (IV).

Char. order: *Erigeron bonariensis* (V), *Chenopodium murale* (V), *Sisymbrium officinale* (IV), *Erigeron sumatrensis* (III).

Char. class: *Sonchus oleraceus* (V), *Mercurialis annua* (IV), *Chenopodium album* (IV), *Capsella rubella* (III), *Stellaria media* (III), *Malva sylvestris* (III), *Sisymbrium officinale* (III), *Solanum nigrum* (II), *Urtica urens* (II).

Other species: *Oxalis corniculata* (IV), *Crepis bursifolia* (III).

Geographical distribution: This community is quite frequent in Sicily and neighboring islands (Brullo & Marcenò, 1985; Bartolo et al., 1990; Brullo & Siracusa, 1996; Gueli & Lo Giudice, 2007).

Structure and ecology: In the shady and fresh stands the *Chenopodietum muralis* is replaced by a different community dominated by *Parietaria judaica*, which shows more mesic requirements. This vegetation, named *Chenopodio muralis-Parietarietum diffusae*, covers narrow surfaces at the base of the walls around the streets and sidewalks of urban areas. The occurrence of *Malva parviflora* and *M. multiflora* allows to refer this association to the *Malvion parviflorae* alliance. Among the species belonging to order, *Erigeron bonariensis*, *Chenopodium murale*, *Sisymbrium officinale* and *Erigeron sumatrensis* are quite frequent (Brullo & Marcenò, 1985).

Syndynamism: See order.

Habitat reference: See class.

31.5.3. Alliance: ***Mesembryanthenion crystallini*** Rivas-Martínez et al. 1993

Ephemeral subhalophilous succulent therophytic vegetation.

Holotypus: *Mesembryanthemetum crystallini* Sunding 1972.

Characteristic and differential species: *Beta macrocarpa* Guss., *Heliotropium curassavicum* L., *Mesembryanthemum crystallinum* L., *M. nodiflorum* L.

Geographical distribution: This syntaxon is well represented in the Western Mediterranean area and in the Macaronesian islands (Mucina et al., 2016).

Structure and ecology: The alliance groups nitrophilous communities dominated by ephemeral succulent species with prostrate habit linked to halophilous environments characterized by clay or marly soils. This vegetation constitutes a dense carpet covering more or less large surfaces during the spring period, generally occurring in disturbed habitat near the sea or also inland in the territories with a dry thermo-inframediterranean bioclimate. Firstly, these communities, despite being characterized by annual species, were attributed by Bolòs (1957) to *Salsolo vermiculatae-Peganion harmalae*, alliance including shrubby associations. This arrangment was followed also by Bartolo et al. (1982), while Brullo et al. (1985) considered more appropriate to include this vegetation within *Chenopodion muralis*. Later, Rivas Martinez et al. (1993) proposed for this type of vegetation a new alliance, named *Mesembryanthenion crystallini*, referring it to *Chenopodietalia muralis* for its nitrophilous

requirements, arrangment followed also by Brullo & Siracusa (1996), Rivas-Martinez et al. (2002) and Biondi et al. (2014). More recently, Mucina et al. (2016) arranged this alliance in the *Saginetea maritimae* class, but this proposal is not acceptable, since this class includes only microphytic communities linked to natural habitats with early biological cycle.

Syndynamism: Usually, the associations belonging to this alliance grow in disturbed stands characterized by marly or clay substrata. Sometimes, these communities colonize also the rocky surfaces near the sea subject to intense frequentation of seagulls, which determine a strong presence of nitrates in the soil. Usually, these communities show catenal contacts with nitrophilous association belonging to *Malvion parviflorae* and also with shrublands of the *Pegano-Salsoletea*.

Habitat reference: See class.

31.5.3.1. ***Mesembryanthemetum crystallino-nodiflori*** O. Bolòs 1957

Ephemeral subhalophilous succulent therophytic vegetation with slenderleaf iceplant and crystalline ice plant.

Synonyms: *Gausoletum crystallino-nodiflori* O. Bolòs 1957

Lectotypus: Not designated.

Characteristic and differential species: *Mesembryanthemum crystallinum* L., *M. nodiflorum* L.

Phytosociological table: From Bartolo et al. (1982), tab. 26, 10 rel.

Char. association and alliance: *Mesembryanthemum crystallinum* (V), *Mesembryanthemum nodiflorum* (V).

Char. order and class: *Beta vulgaris* subsp. *maritima* (V), *Sonchus oleraceus* (IV), *Hordeum murinum* subsp. *leporinum* (IV), *Chenopodium murale* (II), *Hyoscyamus albus* (II),

Other species: *Parapholis incurva* (III), *Plantago coronopus* (III), *Crithmum maritimum* (III), *Salsola oppositifolia* (II), *Limonium sinuatum* (II), *Salsola soda* (II), *Frankenia pulverulenta* (II), etc.

Geographical distribution: This association occurs in the Iberian Peninsula (Bolòs, 1957), Tunisia (Pottier-Alapetite, 1954; Vanden Berghen, 1979), Corse (Géhu et al., 1988), Sardinia (Biondi et al., 2001) and Sicily, where it is widespread (Bartolo et al., 1982, 1988).

Structure and ecology: The disturbed surfaces near the sea with an high amount of nitrates, often in sub-urban stands, are covered by a dense vegetal carpet, which is constituted by *Mesembryanthemum crystallinum* and *M. nodiflorum,* two annual succulent species with a prostrate habitus. This community, named *Mesembryanthemetum crystallino-nodiflori,* results quite poor under the floristic profile, since the above mentioned species are associated only with some nitrophilous species, such as *Heliotropium curassavicum*, *Lavatera cretica*, *Malva*

parviflora, *Sonchus oleraceus*, *Hordeum murinum* subsp. *leporinum*, *Beta vulgaris* subsp. *maritima*, *Chenopodium murale*, *Hyoscyamus albus*, etc. (Bartolo et al., 1982, 1988).

Syndynamism: See alliance.

Habitat reference: See class.

31.5.3.2. ***Mesembryanthemetum crystallini*** Sunding 1972

Ephemeral subhalophilous succulent therophytic vegetation with crystalline ice plant.

Lectotypus: Not designated.

Characteristic and differential species: *Mesembryanthemum crystallinum*, *Patellifolia procumbens* (C. Sm.) A.J. Scott, Ford-Lloyd & J.T. Williams

Phytosociological table: From Brullo & Siracusa (1996), tab. 22, 13 rel.

Char. association: *Patellifolia procumbens* (V).

Char. alliance: *Mesembryanthemum crystallinum* (V), *Mesembryanthemum nodiflorum* (V), *Beta macrocarpa* (I), *Heliotropium curassavicum* (I).

Char. order and class: *Sonchus oleraceus* (V), *Chenopodium murale* (V), *Malva parviflora* (V), *Emex spinosa* (IV), *Urospermum picroides* (IV), *Brassica fruticulosa* (IV), *Hordeum murinum* subsp. *leporinum* (IV), *Lavatera cretica* (III), *Solanum nigrum* (II).

Other species: *Reichardia tingitana* (V), *Euphorbia pinea* (V), *Rumex bucephalophorus* (IV), *Glaucium flavum* (IV), *Lobularia maritima* (IV), *Cakile maritima* (III), etc.

Geographical distribution: This association was described by Sunding (1972) for the Canary Islands, but occurs also in North Africa and Linosa (Brullo & Siracusa, 1996).

Structure and ecology: The *Mesembryanthemetum crystallini* is a highly halo-nitrophilous vegetation with a xerophilous character, which colonizes ruderal stands near the sea, as walls and rubbles. It replaces the *Mesembryanthemetum crystallino-nodiflori* in the territories with a dry inframediterranean or subdesertic bioclimate. These two associations result quite differentiated also under the floristic profile, since the rare *Patellifolia procumbens* (=*P. patellaris*) has an important physiognomic role in the *Mesembryanthemetum crystallini*, while it is completely absent in the *Mesembryanthemetum crystallino-nodiflori*. Besides, the structure of this vegetation is defined by others large-size succulent species with a prostrate-reptant life form, such as *Mesembryanthemum crystallinum*, *M. nodiflorum*, *Beta macrocarpa* and *Heliotropium curassavicum* (Brullo & Siracusa, 1996).

Syndynamism: See alliance.

Habitat reference: See class.

31.5.3.3. ***Mesembryanthemo crystallini-Paronychietum argenteae*** Brullo & Siracusa 1996

Ephemeral subhalophilous succulent therophytic vegetation with crystalline ice plant and silver chickweed.

Holotypus: rel. 5, tab. 23, Brullo & Siracusa (1996).

Characteristic and differential species: *Paronychia argentea* Lam.

Phytosociological table: From Brullo & Siracusa (1996), tab. 23, 5 rel.

Char. association: *Paronychia argentea* (V).

Char. alliance: *Mesembryanthemum crystallinum* (V), *Mesembryanthemum nodiflorum* (V).

Char. order and class: *Echium sabulicola* (V)**,** *Malva parviflora* (V)**,** *Lavatera cretica* (IV)**,** *Sonchus oleraceus* (IV), *Chenopodium murale* (III).

Other species: *Plantago coronopus* (V)**,** *Plantago afra* subsp. *zwierleinii* (V)**,** *Euphorbia pinea* (V)**,** *Reichardia tingitana* (V)**,** *Spergularia rubra* (V)**,** *Stipa capensis* (V)**,** *Vulpia ciliata* (IV)**,** *Trifolium scabrum* (IV), etc.

Geographical distribution: This association occurs only in Linosa island (Brullo & Siracusa, 1996).

Structure and ecology: In the rocky stands with a very thin layer of soil, the *Mesembryanthemetum crystallini* is substituted by another community with a less marked nitrophilous character, where *Paronychia argentea* has an important physiognomic role. This species allows to identify a different association, named *Mesembryanthemo crystallini-Paronychietum argenteae*, This vegetation is linked to dry rocky places with basaltic substrata occurring in disturbed stands (Brullo & Siracusa, 1996).

Syndynamism: See alliance.

Habitat reference: See class.

31.5.3.4. ***Mesembryanthemo crystallini-Hyoscyametum albi*** Brullo & Siracusa 1996

Ephemeral subhalophilous succulent therophytic vegetation with crystalline ice plant and yellow henbane.

Holotypus: rel. 2, tab. 24, Brullo & Siracusa (1996).

Characteristic and differential species: *Hyoscyamus albus* L.

Phytosociological table: From Brullo & Siracusa (1996), tab. 24, 6 rel.

Char. association: *Hyoscyamus albus* (V).

Char. alliance: *Mesembryanthemum crystallinum* (V), *Mesembryanthemum nodiflorum* (III), *Beta macrocarpa* (III).

Char. order and class: *Chenopodium murale* (V), *Sonchus oleraceus* (V), *Carduus australis* subsp. *marmoratus* (V), *Fumaria bicolor* (V), *Anisantha madritensis* (V).

Other species: *Glacium flavum* (V), *Euphorbia pinea* (V), *Parietaria judaica* (V), *Rumex bucephalophorus* (V), *Medicago littoralis* (V), *Reichardia tingitana* (IV).

Geographical distribution: This association occurs only in Linosa island (Brullo & Siracusa, 1996).

Structure and ecology: The *Mesembryanthemo crystallini-Hyoscyametum albi* is a ruderal vegetation, which is linked to coastal rocky stands subject to accumulation of rubbish, where *Hyoscyamus albus* often results dominant. Besides, its floristic set is constituted also by *Mesembryanthemum crystallinum*, *M. nodiflorum*, *Chenopodium muralis*, *Lavatera cretica*, *Malva parviflora*, *Beta macrocarpa* and some species of *Chenopodietea* class (Brullo & Siracusa, 1996).

Syndynamism: See alliance.

Habitat reference: See class.

31.6. Order: ***Geranio purpurei-Cardaminetalia hirsutae*** Brullo in Brullo & Marcenò 1985

Annual nitrophilous vegetation of natural shaded habitats.

Synonyms: *Cardamino hirsutae-Geranietalia purpureae* S. Brullo in S. Brullo & Marcenò 1985 nom. invers. propos. (art. 42)*; Urtico-Scrophularietalia peregrinae* S. Brullo in S. Brullo & Marcenò 1985 (art. 5); *Bromo sterilis-Cardaminetalia hirsutae* de Foucault 2009 (syntax.syn.); *Urtico-Scrophularietalia peregrinae* S. Brullo ex Biondi, Blasi, Casavecchia & Gasparri in Biondi et al. 2014 (syntax. syn.).

Holotypus: *Geranio-Anthriscion caucalidis* Rivas-Martinez 1978.

Characteristic and differential species: *Cardamine hirsuta* L.*, Centranthus calcitrapa* (L.) Dufr., *Galium spurium* L., *Geranium lucidum* L., *Geranium purpureum* Vill.*, Geranium rotundifolium* L., *Myosotis ramosissima* Rochel, *Parietaria lusitanica* L., *Ranunculus parviflorus* L., *Rhagadiolus stellatus* (L.) Gaertn., *Theligonum cynocrambe* L., *Torilis nodosa* (L.) Gaertn.

Geographical distribution: This order is widely distributed in the (sub)Mediterranean area and Macaronesian islands (Mucina et al., 2016).

Structure and ecology: The annual communities belonging to the *Geranio purpurei-Cardaminetalia hirsutae* are well differentiated from all the others syntaxa of *Chenopodietea*. In fact this vegetation occurs in (semi)natural stands within forest or maquis communities or at their edges, as small niches and micro-ledges of rocks and walls with well nitrified soils and under the shade of trees or shrubs. Sometimes, it is found also in shady edges of paths inside woods. The floristic set is characterized by the presence of some sciaphilous and nitrophilous microphytes, as *Cardamine hirsuta*, *Galium spurium*, *Geranium lucidum*, *G. purpureum, G.*

rotundifolium, *Myosotis ramosissima*, *Parietaria lusitanica*, *Theligonum cynocrambe*, *Torilis nodosa*, etc. Most of these species find its primary habitat in these environments, from which they has spread in synanthropic stands (Brullo & Marcenò, 1985; Brullo et al., 2007). Some authors (Géhu, 1999; Rivas-Martinez et al., 1999, 2002; Bardat et al., 2004; Brullo et al., 2007; Biondi et al., 2014) proposed to refer this order to a separate class (*Cardaminetea hirsutae* Géhu 1999 and *Cardamino hirsutae-Geranietea purpurei* (Rivas-Martínez et al. 1999) Rivas-Martínez et al. 2002), but this arrangment is not acceptable, since the communities of this order are very rich in elements of *Chenopodietea* class, that highlight its nitrophilous character. Therefore, it is considered more appropriate to maintain the *Geranio purpurei-Cardaminetalia hirsutae* within the *Chenopodietea* class, in agreement also with Mucina et al. (2016).

Syndynamism: The occurrence of this vegetation is permitted by the high presence of organic material of animal and vegetal origin, while the human disturbance is quite low. It is dynamically linked with the series of *Quercetea ilicis*.

Habitat reference: See class.

31.6.1. Alliance: ***Valantio muralis-Galion muralis*** Brullo & Marcenò 1985

Thermophilous annual vegetation in shaded mesic habitats of natural stands.

Synonyms: *Stellario neglectae-Urticion membranaceae* Fanelli in Bianco et al. 2002 (syntax. syn.)

Holotypus: *Torilido-Cerastietum pentandri* Brullo & Marcenò, 1985

Characteristic and differential species: *Arabis verna* (L.) R. Br., *Arabidopsis thaliana* (L.) Heynh., *Arenaria leptoclados* Guss., *Campanula dichotoma* L., *Campanula erinus* L., *Draba muralis* L., *Erophila verna* (L.) Chevall., *Galium murale* L., *Valantia muralis* L.

Geographical distribution: This alliance occurs in the Central Mediterranean area (Brullo & Marcenò, 1985).

Structure and ecology: The *Valantio muralis-Galion muralis* represents a geographical vicariant of *Geranio-Anthriscion caucalidis*, which occurs in the Iberian Peninsula (Brullo & Marcenò, 1985) It is found from the infra- to mesomediterranean bioclimatic belts (Brullo et al., 2007).

Syndynamism: See order.

Habitat reference: See class.

31.6.1.1. ***Torilido nemoralis-Cerastietum pentandri*** Brullo & Marcenò 1985

Nitrophilous vegetation with nemoral hedgeparsley and little mouse ear of sandy soils.

Holotypus: rel. 6, tab. 28, Brullo & Marcenò (1985).

Characteristic and differential species: *Cerastium pentandrum* L., *Torilis nemoralis* (Brullo) Brullo & Giusso, *Valerianella microcarpa* Loisel.

Phytosociological table: From Brullo & Marcenò (1985), table 28, 15 rel.

Char. association: *Cerastium pentandrum* (V), *Torilis nemoralis* (V), *Valerianella microcarpa* (IV).

Char. alliance: *Galium murale* (V), *Valantia muralis* (V), *Arenaria leptoclados* (IV), *Campanula erinus* (III), *Arabidopsis thaliana* (I).

Char. order: *Geranium purpureum* (V), *Parietaria lusitanica* (V), *Centranthus calcitrapae* (V), *Cardamine hirsuta* (IV), *Myosotis ramosissima* (IV), *Theligonum cynocrambe* (II).

Char. class: *Urtica membranacea* (V), *Euphorbia peplus* (V), *Stellaria media* (IV), *Urtica urens* (III), *Mercurialis annua* (III), *Geranium molle* (III), *Veronica arvensis* (III), *Oxalis pes-caprae* (III), *Oxalis pes-caprae* (II), *Senecio vulgaris* (II), *Sonchus oleraceus* (II), *Erodium malacoides* (II), *Capsella rubella* (I), *Cerinthe major* (I), Vicia sativa (I), *Fedia graciliflora* (I), *Borago officinalis* (I), *Fumaria flabellata* (I).

Other species: *Rumex bucephalophorus* (V), *Plantago afra* (V).

Geographical distribution: This vegetation occurs only in South-Eastern Sicily (Brullo & Marcenò, 1985; Brullo et al., 1998).

Structure and ecology: The *Torilido nemoralis-Cerastietum pentandri* is a nitrophilous and sciaphilous vegetation, which is found within the coastal maquis communities of sandy soils, as *Ephedro fragilis-Juniperetum macrocarpae*, *Junipero turbinatae-Quercetum calliprini*, *Myrto communis-Pistacetum lentisci* and *Asparago horridi-Retametum gussonei*. Some rare psammophilous microphytes, as *Cerastium pentandrum*, *Torilis nemoralis* and *Valerianella microcarpa*, play a significant physiognomic role in this association, growing together with several species of alliance and order, as *Galium murale*, *Valantia muralis*, *Arenaria leptoclados*, *Campanula erinus*, *Geranium purpureum*, *Parietaria lusitanica*, *Centranthus calcitrapae*, *Cardamine hirsuta* and *Myosotis ramosissima* (Brullo & Marcenò, 1985).

Syndynamism: See order.

Habitat reference: See class.

31.6.1.2. ***Laguro vestiti-Erodietum maritimi*** Brullo & Marcenò 1985

Nitrophilous vegetation with hare's-tail and sea stork's bill of small niches in shaded limestone rocks.

Holotypus: rel. 3, tab. 33, Brullo & Marcenò (1985).

Characteristic and differential species: *Erodium maritimum* (L.) L'Her., *Lagurus ovatus* L. subsp. *vestitus* (Messeri) Brullo.

Phytosociological table: From Brullo & Marcenò (1985), table 28, 15 rel.

Char. association: *Erodium maritimum* (V), *Lagurus ovatus* subsp. *vestitus* (V).

Char. alliance: *Galium murale* (V), *Campanula erinus* (V), *Valantia muralis* (IV), *Arabis verna* (IV), *Arenaria leptoclados* (III).

Char. order: *Geranium purpureum* (V), *Myosotis ramosissima* (V), *Cardamine hirsuta* (V), *Theligonum cynocrambe* (V), *Centranthus calcitrapae* (IV), *Parietaria lusitanica* (III), *Galium spurium* (III).

Char. class: *Urtica membranacea* (V), *Euphorbia peplus* (V), *Erodium moschatum* (V), *Mercurialis annua* (IV), *Senecio vulgaris* (IV), *Stellaria media* (IV), *Geranium molle* (IV), *Veronica arvensis* (III), *Erodium malacoides* (III).

Other species: *Ononis mitissima* (V), *Rumex bucephalophorus* (V).

Geographical distribution: This association is endemic to Marettimo island (Egadi Archipelago), where is restricted to few localities in the higher part (Brullo & Marcenò, 1985; Gianguzzi et al., 2006).

Structure and ecology: The small niches of shaded limestone rocks, limitedly to the cacuminal stands of Marettimo, are covered by a microphytic vegetation dominated by the schizoendemism *Lagurus ovatus* subsp. *vestitus* and *Erodium maritimum*, a species with a norther-central Tyrrhenian distribution that is found only here in Sicily. This community, named *Laguro vestiti-Erodietum maritimi,* prefers semi-chasmophilous stands with northern exposure or under the shade of the large shrubs belonging to *Erico-Micromerietum fruticulosae* woody vegetation. Its floristic set includes several species of alliance and order, among them *Galium murale*, *Campanula erinus*, *Valantia muralis*, *Arabis verna*, *Geranium purpureum*, *Myosotis ramosissima*, *Cardamine hirsuta*, *Theligonum cynocrambe* and *Centranthus calcitrapae* (Brullo & Marcenò, 1985).

Syndynamism: See order.

Habitat reference: See class.

31.6.1.3. ***Cruciato pedemontanae-Buglossoidetum splitgerberi*** Brullo & Marcenò 1985

Nitrophilous vegetation with piedmont bedstraw and Splitgerber's gromwell of shaded nemoral stands with volcanic soils.

Holotypus: rel. 2, tab. 30, Brullo & Marcenò (1985).

Characteristic and differential species: *Buglossoides incrassata* (Guss.) I.M. Johnst. subsp. *splitgerberi* (Guss.) E. Zippel & Selvi, *Cardamine graeca* L., *Cerastium brachypetalum* Desp. ex Pers. subsp. *tenoreanum* (Ser.) Soó, *Cruciata pedemontana* (Bellardi) Ehrend.,

Phytosociological table: From Brullo & Marcenò (1985), table 30, rel. 7.

Char. association: *Buglossoides incrassata* subsp. *splitgerberi* (V), *Cerastium brachypetalum* subsp. *tenoreanum* (V), *Cruciata pedemontana* (V), *Cardamine graeca* (III).

Char. alliance: *Erophila verna* (V), *Galium murale* (IV), *Arenaria leptoclados* (IV), *Arabidopsis thaliana* (IV), *Draba muralis* (III).

Char. order: *Geranium purpureum* (V), *Myosotis ramosissima* (V), *Cardamine hirsuta* (V), *Geranium lucidum* (IV), *Centranthus calcitrapae* (II).

Char. class: *Stellaria media* (V), *Erodium moschatum* (III), *Lamium bifidum* (III), *Veronica arvensis* (III), *Sonchus oleraceus* (III), *Euphorbia peplus* (III).

Other species: *Sedum amplexicaule* subsp. *tenuifolium* (V), *Aira cupaniana* (V).

Geographical distribution: This association occurs only in the North-Western side of Etna mountain (Brullo & Marcenò, 1985).

Structure and ecology: The small paths within deciduous woods belonging to *Erico-Quercion ilicis* between 600 and 1000 m a.s.l. are covered by a nitrophilous vegetation named *Cruciato pedemontanae-Buglossoidetum splitgerberi*. This community is found only on volcanic substrata and is characterized by the dominance of some sciaphilous species, as *Buglossoides incrassata* subsp. *splitgerberi*, *Cardamine graeca*, *Cerastium brachypetalum* subsp. *tenoreanum* and *Cruciata pedemontana*. The alliance and the order are represented by several species, including *Erophila verna*, *Galium murale*, *Arenaria leptoclados*, *Arabidopsis thaliana*, *Draba* muralis, Geranium *purpureum*, *Myosotis ramosissima*, *Cardamine hirsuta*, *Geranium lucidum* and *Centranthus calcitrapae* (Brullo & Marcenò, 1985).

Syndynamism: See order.

Habitat reference: See class.

31.6.1.4. ***Geranio purpurei-Saxifragetum bulbiferae*** Brullo & Marcenò 1985

Nitrophilous vegetation with little robin and bulbous saxifrage of semi-rupicolous cacuminal stands.

Holotypus: rel. 6, tab. 38, Brullo & Marcenò (1985).

Characteristic and differential species: *Saxifraga bulbifera* L.

Phytosociological table: From Brullo & Marcenò (1985), table 38, rel. 6.

Char. association: *Saxifraga bulbifera* (V).

Char. alliance: *Erophila verna* (V), *Galium murale* (IV), *Arabidopsis thaliana* (IV).

Char. order: *Geranium purpureum* (V), *Myosotis ramosissima* (V), *Cardamine hirsuta* (V), *Parietaria lusitanica* (IV), *Theligonum cynocrambe* (II).

Char. class: *Mercurialis annua* (V), *Stellaria media* (V), *Senecio vulgaris* (IV), *Euphorbia peplus* (IV), *Sonchus oleraceus* (IV), *Geranium molle* (III), *Vicia sativa* (III), *Capsella rubella* (III).

Other species: *Hypochoeris laevigata* (V), *Umbilicus rupestris* (III).

Geographical distribution: This association was surveyed only from Hyblean and Peloritani mountains (Brullo & Marcenò, 1985; Brullo et al., 2007).

Structure and ecology: The shady semi-rupicolous stands with siliceous substrata near paths and roadsides are colonized by an ephemeral nitrophilous community dominated by *Saxifraga bulbifera*. This vegetation, named *Geranio purpurei-Saxifragetum bulbiferae*, is linked to the vegetation belt of acidophilous deciduous oak woods with average rainfall of 700-800 mm (Brullo & Marcenò, 1985). Under the floristic profile, the syntaxa of higher rank are represented by *Erophila verna*, *Galium murale*, *Arabidopsis thaliana, Geranium purpureum*, *Myosotis ramosissima*, *Cardamine hirsuta*, *Parietaria lusitanica*, *Theligonum cynocrambe*, etc.

Syndynamism: See order.

Habitat reference: See class.

31.6.1.5. ***Valerianello eriocarpae-Cerastietum glomerati*** Brullo & Marcenò 1985

Nitrophilous vegetation with sticky chickweed and Italian cornsalad of xeric shady stands within maquis.

Holotypus: rel. 2, tab. 36, Brullo & Marcenò (1985).

Characteristic and differential species: *Cerastium glomeratum* Thuill., *Valerianella eriocarpa* Desv.

Phytosociological table: From Brullo & Marcenò (1985), table 36, 5 rel.

Char. association: *Cerastium glomeratum* (V), *Valerianella eriocarpa* (V).

Char. alliance: *Valantia muralis* (V), *Campanula erinus* (V), *Arenaria leptoclados* (IV), *Galium murale* (IV), *Erophila verna* (II).

Char. order: *Geranium purpureum* (V), *Cardamine hirsuta* (V).

Char. class: *Veronica arvensis* (V), *Scandix pecten-veneris* (V), *Euphorbia peplus* (V), *Capsella rubella* (IV), *Sonchus oleraceus* (III), *Oxalis pes-caprae* (III), *Fedia caput-bovis* (III), *Geranium molle* (III).

Other species: *Galium varrucosum* (V), *Silene colorata* (IV).

Geographical distribution: This association occurs only in southern Sicily, between Pozzallo and Donnalucata (Brullo & Marcenò, 1985; Brullo et al., 2007).

Structure and ecology: The undergrowth of the thermo-xerophilous maquis of *Calicotomo-Rhoetum tripartitae* is colonized by a microphytic annual vegetation with *Cerastium glomeratum* and *Valerianella eriocarpa*. It is the *Valerianello eriocarpae-Cerastietum glomerati,* whose floristic set includes several species of alliance and order, as *Campanula erinus*, *Valantia muralis*, *Galium murale*, *Arenaria leptoclados*, *Erophila verna*, *Geranium purpureum* and *Cardamine hirsuta* (Brullo & Marcenò, 1985).

Syndynamism: See order.

Habitat reference: See class.

31.6.1.6. ***Sedetum litoreo-stellati*** Brullo & Marcenò 1985

Nitrophilous vegetation with coastal stonecrop of shady dry walls in the coastal belt.

Holotypus: rel. 4, tab. 32, Brullo & Marcenò (1985).

Characteristic and differential species: *Sedum litoreum* Guss., *Sedum stellatum* L., *Sedum rubens* L.

Phytosociological table: From Brullo & Marcenò (1985), table 32, 8 rel.

Char. association: *Sedum litoreum* (V), *Sedum stellatum* (V), *Sedum rubens* (V).

Char. alliance: *Campanula erinus* (V), *Galium murale* (IV), *Campanula dichotoma* (III).

Char. order: *Geranium purpureum* (V), *Parietaria lusitanica* (V), *Theligonum cynocrambe* (V), *Myosotis ramosissima* (III), *Cardamine hirsuta* (II), *Centranthus calcitrapae* (II), *Geranium rotundifolium* (II) .

Char. class: *Sonchus oleraceus* (IV), *Mercurialis annua* (IV), *Stellaria apetala* (IV), *Fumaria flabellata* (III), *Geranium molle* (II).

Other species: *Umbilicus rupestris* (V), *Cheilanthes pteridioides* (IV).

Geographical distribution: This association has a scattered distribution in Sicily, Marettimo island and Eolian islands (Brullo & Marcenò, 1985; Brullo et al., 2007).

Structure and ecology: The shady dry walls near the sea, sometimes within the thermophilous maquis of *Oleo-Euphorbietum dendroidis* or *Periploco-Euhporbietum dendroidis*, are colonized by a peculiar community named *Sedetum litoreo-stellati*. This vegetation is dominated by some succulent therophytes, as *Sedum litoreum*, *S. rubens* and *S. stellatum*, occurring together with some species of alliance and order, such as *Campanula erinus*, *Galium murale*, *Campanula dichotoma*, *Geranium purpureum*, *Parietaria lusitanica*, *Theligonum cynocrambe*, *Myosotis ramosissima*, *Cardamine hirsuta*, *Centranthus calcitrapae* and *Geranium rotundifolium*.

Syndynamism: See order.

Habitat reference: See class.

31.6.1.7. ***Parietario lusitanicae-Veronicetum cymbalariae*** Brullo & Marcenò 1985

Nitrophilous vegetation with mediterranean pellitory-of-the-wall and pale speedwell of shady dry walls in interior areas.

Synonyms: aggr. a *Theligonum cynocrambe* e *Veronica cymbalaria* O. Bolòs, Molinier & P. Montserrat 1970.

Holotypus: rel. 1, tab. 31, Brullo & Marcenò (1985).

Characteristic and differential species: *Veronica cymbalaria* Bodard

Phytosociological table: From Brullo & Marcenò (1985), table 31, 15 rel.

Char. association: *Veronica cymbalaria* (V).

Char. alliance: *Campanula erinus* (V), *Erophila verna* (IV), *Valantia muralis* (IV), *Arenaria leptoclados* (III), *Galium murale* (III), *Campanula dichotoma* (II), *Arabidopsis thaliana* (II).

Char. order: *Geranium purpureum* (V), *Parietaria lusitanica* (V), *Cardamine hirsuta* (V), *Theligonum cynocrambe* (IV), *Myosotis ramosissima* (III), *Centranthus calcitrapae* (II).

Char. class: *Scandix pecten-veneris* (V), *Stellaria media* (IV), *Sonchus oleraceus* (IV), *Mercurialis annua* (IV), *Oxalis pes-caprae* (III), *Fumaria officinalis* subsp. *wirtgenii* (III), *Geranium molle* (III), *Urtica membranacea* (III), *Senecio vulgaris* (III), *Veronica arvensis* (III), *Fumaria flabellata* (III), *Lamium amplexicaulis* (III), *Capsella rubella* (II).

Other species: *Umbilicus rupestris* (V), *Cerastium semidecandrum* (IV).

Geographical distribution: This community occurs in Southern Italy (Aspromonte), Spain (Catalonia) and Sicily, where is circumscribed to the Hyblaean area (Brullo & Marcenò, 1985; Brullo et al., 2007).

Structure and ecology: According to Brullo & Marcenò (1985), the *Parietario lusitanicae-Veronicetum cymbalariae* replaces the previous community in the hilly belt between 200 and 600 m a.s.l.. In fact, it is found in the dry walls and calcareous rocks near roads and paths, which are shaded by secular carobs, oaks or olives. The physiognomy of this community is given by *Veronica cymbalaria*, growing together with some species of alliance and order, as *Campanula erinus*, *Erophila verna*, *Valantia muralis*, *Arenaria leptoclados*, *Galium murale*, *Campanula dichotoma*, *Arabidopsis thaliana*, *Geranium purpureum*, *Parietaria lusitanica*, *Cardamine hirsuta*, *Theligonum cynocrambe*, *Myosotis ramosissima* and *Centranthus calcitrapae*.

Syndynamism: See order.

Habitat reference: See class.

31.6.1.8. ***Valantio muralis-Polycarpetum alsinifolii*** Brullo & Marcenò 1985

Nitrophilous vegetation with wall valantia and few flowered allseed of shady semi-rupicolous stands with calcareous substrata.

Holotypus: rel. 4, tab. 35, Brullo & Marcenò (1985).

Characteristic and differential species: *Polycarpon tetraphyllum* (L.) L. subsp. *alsinifolium* (Biv.) Ball.

Phytosociological table: From Brullo & Marcenò (1985), table 35, 5 rel.
Char. association: *Polycarpon tetraphyllum* subsp. *alsinifolium* (V).
Char. alliance: *Valantia muralis* (V), *Arenaria leptoclados* (IV), *Campanula erinus* (IV).
Char. order: *Geranium purpureum* (IV), *Parietaria lusitanica* (IV), *Cardamine hirsuta* (IV), *Theligonum cynocrambe* (II).
Char. class: *Euphorbia peplus* (V), *Euphorbia helioscopia* (III), *Senecio vulgaris* (III), *Sonchus oleraceus* (III), *Urtica membranacea* (II), *Hirschfeldia incana* (II), *Sisymbrium irio* (I).
Other species: *Allium subhirsutum* (IV), *Festuca danthonii* (III).

Geographical distribution: This vegetation is restricted to the mountains near Palermo (NW Sicily) (Brullo & Marcenò, 1985; Brullo et al., 2007).

Structure and ecology: The shady semi-rupicolous stands or the small surfaces shaded by the shrubs of thermophilous maquis (or also under the large clumps of *Ampelodesmos mauritanicus*), which are rich in organic matter, are colonized by the *Valantio muralis-Polycarpetum alsinifolii*. This community does not exceed 200-300 m of altitude and shows a quite poor floristic set., being characterized by the occurrence of *Polycarpon tetraphyllum* subsp. *alsinifolium* and few other species of order and alliance, among them *Valantia muralis*, *Arenaria leptoclados* , *Campanula erinus, Geranium purpureum*, *Parietaria lusitanica* and *Cardamine hirsuta* (Brullo & Marcenò, 1985).

Syndynamism: See order.

Habitat reference: See class.

31.6.1.9. ***Ranunculo parviflori-Senecionetum lividi*** Brullo & Marcenò 1985

Nitrophilous vegetation with smallflower buttercup and lividus ragwort of volcanic semi-rupicolous surfaces.

Holotypus: rel. 4, tab. 34, Brullo & Marcenò (1985).

Characteristic and differential species: *Ranunculus parviflorus* L., *Senecio lividus* L.

Phytosociological table: From Brullo & Marcenò (1985), table 34, rel. 5.
Char. association: *Ranunculus parviflorus* (V), *Senecio lividus* (V).
Char. alliance: *Galium murale* (V), *Arabidopsis thaliana* (IV), *Campanula erinus* (III).

Char. order: *Geranium purpureum* (V), *Cardamine hirsuta* (V), *Myosotis ramosissima* (IV), *Centranthus calcitrapae* (IV).

Char. class: *Geranium molle* (V), *Mercurialis annua* (IV), *Sonchus oleraceus* (IV), *Fumaria flabellata* (III), *Stellaria media* (II).

Other species: *Rumex bucephalophorus* (V), *Polypodium cambricum* subsp. *cambricum* (IV).

Geographical distribution: This vegetation is circumscribed to Pantelleria island (Brullo & Marcenò, 1985).

Structure and ecology: The semi-rupicolous stands and the dry walls with volcanic substrata and under the shade of holm oaks or shrubs of *Genista aspalathoides*, are colonized by a microphytic community dominated by *Ranunculus parviflorus* and *Senecio lividus*. This vegetation, referable to the *Ranunculo parviflori-Senecionetum lividi*, can be considered a geographic vicariant of the *Laguro vestiti-Erodietum maritimi*. Its floristic set includes some species of alliance and order, as *Galium murale*, *Arabidopsis thaliana*, *Campanula erinus, Geranium purpureum*, *Cardamine hirsuta*, *Myosotis ramosissima* and *Centranthus calcitrapae* (Brullo & Marcenò, 1985).

Syndynamism: See order.

Habitat reference: See class.

31.6.1.10. ***Galio murali-Sedetum cepaeae*** Brullo & Marcenò 1985

Nitrophilous vegetation with wall bedstraw and pink stonecrop of siliceous semi-rupicolous surfaces and walls.

Holotypus: rel. 14, tab. 29, Brullo & Marcenò (1985).

Characteristic and differential species: *Sedum cepaea* L.

Phytosociological table: From Brullo & Marcenò (1985), table 29, 14 rel.

Char. association: *Sedum cepaea* (V).

Char. alliance: *Galium murale* (V), *Arabidopsis thaliana* (IV), *Campanula erinus* (IV), *Campanula dichotoma* (IV), *Erophila verna* (III), *Arenaria leptoclados* (III).

Char. order: *Geranium purpureum* (V), *Myosotis ramosissima* (V), *Centranthus calcitrapae* (V), *Theligonum cynocrambe* (IV), *Cardamine hirsuta* (IV), *Geranium lucidum* (IV), *Galium spurium* (III), *Geranium rotundifolium* (II).

Char. class: *Euphorbia peplus* (V), *Mercurialis annua* (V), *Sonchus oleraceus* (IV), *Stellaria media* (IV), *Urtica membranacea* (II), *Oxalis pes-caprae* (II), *Geranium molle* (II), *Capsella rubella* (II), *Fumaria flabellata* (I).

Other species: *Umbilicus rupestris* (V), *Hypochoeris achyrophorus* (IV).

Geographical distribution: This vegetation occurs in some mountain ranges of Northen Sicily, as Madonie, Nebrodi and Peloritani, as well as in Etna and Aeolian islands (Brullo & Marcenò, 1985).

Structure and ecology: The shady siliceous cliffs or walls within forest communities belonging to *Erico-Quercion ilicis* are colonized by the *Galio murali-Sedetum cepaeae*. This vegetation prefers (semi)rupicolous stands covered by a more or less dense moss carpet, where the succulent therophyte *Sedum cepaea* finds its optimum. The floristic set is completed by some species of alliance, as *Galium murale*, *Arabidopsis thaliana*, *Campanula erinus*, *Campanula dichotoma*, *Erophila verna* and *Arenaria leptoclados*, as well as by several taxa belonging to order and class, as *Geranium purpureum*, *Myosotis ramosissima*, *Centranthus calcitrapae*, *Theligonum cynocrambe*, *Cardamine hirsuta*, *Geranium lucidum*, *Galium spurium*, *Euphorbia peplus*, *Mercurialis annua*, *Sonchus oleraceus*, *Stellaria media*, etc. (Brullo & Marcenò, 1985).

Syndynamism: See order.

Habitat reference: See class.

31.6.1.11. ***Valerianello carinatae-Cerastietum luridi*** Brullo & Marcenò 1985

Nitrophilous and mesophilous vegetation with gray chickweed of shady surfaces with acidic soils.

Holotypus: rel. 2, tab. 37, Brullo & Marcenò (1985).

Characteristic and differential species: *Cerastium brachypetalum* Desp. ex Pers. subsp. *roeseri* (Boiss. & Heldr.) Nyman (= *Cerastium luridum* Guss.), *Valerianella carinata* Loisel.

Phytosociological table: From Brullo & Marcenò (1985), table 37, 7 rel.

Char. association: *Cerastium brachypetalum* subsp. *roeseri* (V), *Valerianella carinata* (V).

Char. alliance: *Erophila verna* (V), *Arenaria leptoclados* (V), *Draba muralis* (III), *Arabis verna* (III), *Galium murale* (I).

Char. order: *Geranium purpureum* (V), *Cardamine hirsuta* (V), *Geranium lucidum* (IV), *Myosotis ramosissima* (II), *Galium spurium* (II).

Char. class: *Veronica arvensis* (V), *Scandix pecten-veneris* (V), *Vicia sativa* (V), *Stellaria media* (V), *Geranium molle* (V), *Euphorbia peplus* (V), *Capsella rubella* (V), *Fedia graciliflora* (IV), *Sonchus oleraceus* (III), *Euphorbia helioscopia* (III), *Linaria reflexa* (III), *Sisymbrium officinale* (II), *Geranium dissectum* (II).

Other species: *Myosotis sylvatica* subsp. *elongata* (IV), *Sherardia arvensis* (IV).

Geographical distribution: This vegetation is circumscribed to the Madonie mountains (Brullo & Marcenò, 1985).

Structure and ecology: The *Valerianello carinatae-Cerastietum luridi* represents the more mesophilous aspect among the *Valantio muralis-Galion muralis* communities of Sicily. In fact, it is found in the small surfaces with acidic soils under the shade of the shrubby vegetation belonging to *Pruno-Rubion ulmifolii*, occurring only between 700 and 1000 m a.s.l. From the floristic point of view, this vegetation is dominated by *Cerastium brachypetalum* subsp. *tauricum* and *Valerianella carinata*, growing together with some species of higher syntaxa, such as *Erophila verna*, *Arenaria leptoclados*, *Geranium purpureum*, *Cardamine hirsuta*, *Geranium lucidum*, *Veronica arvensis*, *Scandix pecten-veneris*, *Vicia sativa*, *Stellaria media*, etc. (Brullo & Marcenò, 1985).

Syndynamism: See order.

Habitat reference: See class.

31.6.1.12. ***Valantio muralis-Solenopsidetum mothianae*** Brullo, Scelsi & Siracusa 1994 corr.

Nitrophilous vegetation with Mozia solenopsis of shady and wet surfaces inside maquis.

Synonyms: *Valantio muralis-Solenopsidetum annuae* Brullo, Scelsi & Siracusa 1994.

Holotypus: rel. 3, tab. 12, Brullo et al. (1994).

Characteristic and differential species: *Solenopsis mothiana* C. Brullo & al.

Phytosociological table: From Brullo et al. (1994), table 12, 5 rel.

Char. association: *Solenopsis mothiana* (V).

Char. alliance and order: *Valantia muralis* (V), *Galium murale* (V), *Campanula erinus* (IV), *Torillis nodosa* (II).

Char. class: *Euphorbia peplus* (V), *Senecio vulgaris* (V), *Erodium malacoides* (V), *Oxalis pes-caprae* (V), *Galactites elegans* (III), *Sonchus oleraceus* (II).

Other species: *Polypogon subspathaceus* (V), *Blackstonia acuminata* (V).

Geographical distribution: This community is found only in the Isola Grande dello Stagnone, near Marsala (Brullo et al., 1994).

Structure and ecology: The *Valantio muralis-Solenopsidetum mothianae* is an ephemeral microphytic vegetation, which is linked to shady and quite humid stands under the shrubs of coastal maquis. Under the floristic profile, it is well differentiated from the other syntaxa belonging to *Valantion muralis-Galion muralis* for the occurrence of the endemic *Solenopsis mothiana*, whose presence indicates a certain humidity of the soil. Among the species of higher syntaxa, *Valantia muralis*, *Galium murale*, *Campanula erinus, Euphorbia peplus*, *Senecio vulgaris* and *Erodium malacoides* are very frequent (Brullo et al., 1994).

Syndynamism: See order.

Habitat reference: See class.

31.6.1.13. ***Galio murali-Catapodietum zwierleinii*** Bartolo, Brullo, Minissale & Spampinato 1990

Nitrophilous and thermophilous vegetation with Zwierlein ferngrass of shady stands under dry walls and shrubs.

Holotypus: rel. 4, tab. 41, Bartolo et al. (1990).

Characteristic and differential species: *Catapodium zwierleinii* (Lojac.) Brullo, *Centaurium pulchellum* (Sw.) Druce, *Festuca danthonii* Asch. & Graebn.

Phytosociological table: From Bartolo et al. (1994), table 41, rel. 7.

Char. association: *Catapodium zwierleinii* (V), *Centaurium pulchellum* (V), *Festuca danthonii* (IV).

Char. alliance and order: *Valantia muralis* (V), *Galium murale* (V), *Theligonum cynocrambe* (V), *Torillis nodosa* (III), *Campanula erinus* (III).

Char. class: *Rostraria cristata* (V), *Geranium molle* (V), *Euphorbia peplus* (V), *Bromus rubens* (III), *Anisantha madritensis* (III), *Sonchus oleraceus* (III).

Other species: *Plantago afra* subsp. *afra* (V), *Sherardia arvensis* (V).

Geographical distribution: This community is restricted to Lampedusa island (Bartolo et al., 1990).

Structure and ecology: The small surfaces under the shade of dry walls or shrubs are colonized by a peculiar subnitrophilous vegetation. It is the *Galio murali-Catapodietum zwierleinii*, a thermophilous community characterized by the occurrence of *Catapodium zwierleinii, Centaurium pulchellum* and *Festuca danthonii*, which in Lampedusa are restricted to this habitat. They grow together with various species of alliance and order, as *Valantia muralis*, *Galium murale*, *Theligonum cynocrambe*, *Torillis nodosa* and *Campanula erinus* (Bartolo et al., 1990).

Syndynamism: See order.

Habitat reference: See class.

31.6.1.14. ***Valerianello puberulae-Galietum calvescentis*** Brullo & Siracusa 1996

Nitrophilous vegetation with pubescent cornsalad of cacuminal rocky surfaces.

Holotypus: rel. 1, tab. 26, Brullo & Siracus (1996).

Characteristic and differential species: *Galium murale* (L.) Moris var. *calvescens* Somm., *Valerianella puberula* (Bertol.) DC.

Phytosociological table: From Brullo & Siracusa (1996), table 26, 8 rel.

Char. association: *Galium murale* var. *calvescens* (V), *Valerianella puberula* (V).

Char. alliance: *Valantia muralis* (V), *Galium murale* var. *murale* (IV).

Char. order: *Centranthus calcitrapa* (V), *Parietaria lusitanica* (IV), *Torilis pseudonodosa* (II), *Geranium purpureum* (II).

Char. class: *Geranium molle* (V), *Stellaria pallida* (V), *Sonchus oleraceus* (V), *Senecio vulgaris* (V), *Euphorbia peplus* (V), *Urtica urens* (V), *Erodium cicutarium* (IV), *Brassica fruticulosa* (III).

Other species: *Rumex bucephalophorus* (V), *Lysimachia linum-stellatum* (V).

Geographical distribution: This community is restricted to Linosa island (Brullo & Siracusa, 1996).

Structure and ecology: The crevices of shady rocky surfaces in the cacuminal area of Linosa are colonized by a peculiar nitro-sciaphilous community, which is attributable to the *Valerianello puberulae-Galietum calvescentis*. Its physiognomy is given by some microphytes, such as *Galium murale* var. *calvescens* and *Valerianella puberula*, growing together with some species of alliance and order, among them *Valantia muralis*, *Galium murale* var. *murale, Centranthus calcitrapa*, *Parietaria lusitanica*, *Torilis pseudonodosa* and *Geranium purpureum*.

Syndynamism: This community can have catenal contact with the *Plantagini-Erodietum linosae*, which is linked to sunny surfaces.

Habitat reference: See class.

31.6.1.15. ***Erophilo vernae-Sedetum hispanici*** Brullo & Siracusa in Brullo & al. 2007

Acidophilous vegetation with precocious draba and spanish stonecrop of shady ledges and small sags on ancient lava flows.

Holotypus: rel. 15, tab. 2, Brullo et al. (2007).

Characteristic and differential species: *Sedum hispanicum* L.

Phytosociological table: From Brullo et al. (2007), table 2, 6 rel.

Char. association: *Sedum hispanicum* (V).

Char. alliance and order: *Erophila verna* (V), *Arabidopsis thaliana* (IV), *Myosotis ramosissima* (IV), *Sedum rubens* (IV), *Geranium purpureum* (II), *Centranthus calcitrapae* (II), *Geranium lucidum* (I), *Arabis verna* (I).

Char. class: *Veronica arvensis* (V), *Anisantha tectorum* (II), *Galium aparine* (I).

Other species: *Poa bulbosa* (V), *Galium divaricatum* (IV).

Geographical distribution: This community occurs in the eastern side of Etna mountain (Brullo et al., 2007).

Structure and ecology: The *Erophilo vernae-Sedetum hispanici* is an acidophilous vegetation dominated by *Sedum hispanicum*, occurring in the shady ledges and small sags on ancient lava flows. It is a mesophilous community, being linked to the meso- and supramediterranean bioclimatic belt. From the floristic point of view, it is a quite poor association, but some species of alliance and order are rather frequent, as *Erophila verna*, *Arabidopsis thaliana*, *Myosotis ramosissima*, *Sedum rubens*, *Geranium purpureum*, *Centranthus calcitrapae*, *Geranium lucidum* and *Arabis verna* (Brullo et al., 2007).

Syndynamism: See order.

Habitat reference: See class.

31.6.1.16. ***Geranio purpurei-Cardaminetum graecae*** Brullo & Siracusa in Brullo & al. 2007

Subnitrophilous vegetation with little robin and southern bittercress of moist and shaded ledges on lavic surfaces.

Holotypus: rel. 8, tab. 2, Brullo et al. (2007).

Characteristic and differential species: *Cardamine graeca* L.

Phytosociological table: From Brullo et al. (2007), table 2, 8 rel.

Char. association: *Cardamine graeca* (V).

Char. alliance and order: *Fumaria capreolata* (V), *Arabidopsis thaliana* (V), *Cardamine hirsuta* (V), *Geranium purpureum* (V), *Geranium lucidum* (V), *Myosotis ramosissima* (III), *Arabis verna* (II).

Char. class: *Stellaria media* (V), *Anisantha madritensis* (IV), *Mercurialis annua* (III).

Other species: *Geranium dissectum* (V), *Festuca myuros* (III).

Geographical distribution: This community is circumscribed to the north-eastern side of Etna mountain (Brullo et al., 2007).

Structure and ecology: The moist and shaded ledges of lavic rocks in small gorges are colonized by a peculiar subnitrophilous community dominated by *Cardamine graeca*. It is the *Geranio purpurei-Cardaminetum graecae*, which is found in its typical aspect on mounds of partially undecomposed humus, within the mesomediterranean humid bioclimatic belt. Its floristic set includes some specie of alliance and order, as *Fumaria capreolata*, *Arabidopsis thaliana*, *Myosotis ramosissima*, *Cardamine hirsuta*, *Geranium purpureum*, *Centranthus calcitrapae*, *Geranium lucidum* and *Arabis verna* (Brullo et al., 2007).

Syndynamism: See order.

Habitat reference: See class.

31.6.1.17. ***Cardamino hirsutae-Stachyetum arvensis*** Brullo & Siracusa in Brullo & al. 2007

Acidophilous vegetation with field woundwort and hairy bittercress of initial soils and pyroclastic dregs.

Holotypus: rel. 3, tab. 2, Brullo et al. (2007).

Characteristic and differential species: *Stachys arvensis* (L.) L.*, Sedum stellatum* L.

Phytosociological table: From Brullo et al. (2007), table 2, 5 rel.

Char. association: *Stachys arvensis* (V), *Sedum stellatum* (V).

Char. alliance and order: *Arabidopsis thaliana* (V), *Cardamine hirsuta* (V), *Geranium purpureum* (V), *Geranium lucidum* (V), *Myosotis ramosissima* (IV), *Arenaria leptoclados* (IV), *Parietaria lusitanica* (IV), *Centranthus calcitrapae* (III), *Campanula erinus* (III), *Galium murale* (II).

Char. class: *Veronica arvensis* (V), *Sonchus oleraceus* (V), *Euphorbia peplus* (V), *Anisantha madritensis* (IV), *Senecio vulgaris* (IV), *Medicago hispida* (IV), *Scrophularia peregrina* (II).

Other species: *Geranium dissectum* (V), *Trifolium cherleri* (III), *Trifolium stellatum* (III).

Geographical distribution: This community is circumscribed to the north-eastern side of Etna mountain (Brullo et al., 2007).

Structure and ecology: The initial soils and pyroclastic dregs on flat or gently sloping sites are colonized by an acidophilous vegetation dominated by *Stachys arvensis*. It is the *Cardamino hirsutae-Stachyetum arvensis*, a thermophilous community with several species belonging to alliance and order, as *Arabidopsis thaliana*, *Cardamine hirsuta*, *Geranium purpureum*, *Geranium lucidum*, *Myosotis ramosissima*, *Arenaria leptoclados*, *Parietaria lusitanica*, *Centranthus calcitrapae*, *Campanula erinus* and *Galium murale* (Brullo et al., 2007).

Syndynamism: See order.

Habitat reference: See class.

31.6.1.18. ***Sedo stellati-Campanuletum dichotomae*** Brullo, Guarino & Siracusa in Brullo & al. 2007

Acidophilous vegetation with starry stonecrop and mediterranean bellflower of debris surfaces with volcanic and metamorphic substrata.

Holotypus: rel. 4, tab. 3, Brullo et al. (2007).

Characteristic and differential species: *Campanula dichotoma* L., *Sedum stellatum* L.

Phytosociological table: From Brullo et al. (2007), table 3, 12 rel.

Char. association: *Sedum stellatum* (V), *Campanula dichotoma* (IV).

Char. alliance: *Campanula erinus* (V), *Valantia muralis* (V), *Parietaria lusitanica* (V), *Theligonum cynocrambe* (V), *Arenaria leptoclados* (II), *Draba muralis* (II), *Galium murale* (II).

Char. order: *Veronica cymbalaria* (V), *Geranium purpureum* (III), *Cardamine hirsuta* (II), *Centranthus calcitrapae* (III), *Sedum rubens* (II), *Centranthus calcitrapae* (I).

Char. class: *Mercurialis annua* (V), *Capsella rubella* (III), *Euphorbia peplus* (III), *Anisantha madritensis* (III), *Galium verrucosum* (III), *Anisantha sterilis* (III), *Fumaria agraria* (I), *Sonchus oleraceus* (I), *Fumaria gaillardotii* (I).

Other species: *Hypochoeris achyrophorus* (V), *Bituminaria bituminosa* (V).

Geographical distribution: This community is restricted to Etna and Peloritani mountains (Brullo et al., 2007).

Structure and ecology: The debris deposits in small rocky surfaces and stone-walls with volcanic or metamorphic substrata are colonized by the *Sedo stellati-Campanuletum dichotomae*. This community is linked to fresh and moist places, often exposed to some hours of direct sunlight and prefers the thermomediterranean subhumid bioclimatic belt, but sometimes it can be found also in the mesomediterranean one. *Sedum stellatum* and *Campanula dichotoma* play a relevant physiognomic role, growing together with some species of alliance and order, as *Valantia muralis*, *Parietaria lusitanica*, *Theligonum cynocrambe*, *Campanula erinus*, *Arenaria leptoclados*, *Draba muralis*, *Veronica cymbalaria*, *Geranium purpureum*, *Cardamine hirsuta*, etc. (Brullo et al., 2007).

Syndynamism: See order.

Habitat reference: See class.

31.6.1.19. ***Saxifrago tridactylitis-Hornungietum petraeae*** Brullo & Guarino in Brullo & al. 2007

Acidophilous vegetation with rue-leaved saxifrage and hutchinsia of small ledges and crevices on siliceous rocks.

Holotypus: rel. 15, tab. 3, Brullo et al. (2007).

Characteristic and differential species: *Hornungia petraea* (L.) Rchb., *Saxifraga tridactylites* L.

Phytosociological table: From Brullo et al. (2007), table 3, 6 rel.

Char. association: *Hornungia petraea* (V), *Saxifraga tridactylites* (IV).

Char. alliance and order: *Cardamine hirsuta* (V), *Erophila verna* (V), *Arabis verna* (IV), *Valantia muralis* (IV), *Geranium lucidum* (IV), *Campanula erinus* (III), *Galium murale* (III).

Char. class: *Stellaria apetala* (III),

Other species: *Sedum amplexicaule* subsp. *tenuifolium* (IV), *Hyoseris radiata* (III).

Geographical distribution: This community occurs only in the Peloritani mountains (Brullo et al., 2007).

Structure and ecology: The *Saxifrago tridactylitis-Hornungietum petraeae* is a litophilous community dominated by *Hornungia petraea* and *Saxifraga tridactylites*, colonizing small ledges and crevices of metamorphic rocks in the mesomediterranean humid bioclimatic belt. It is a quite poor vegetation, since the syntaxa of higher rank are represented only by few species, as *Cardamine hirsuta*, *Erophila verna*, *Arabis verna*, *Valantia muralis*, *Geranium lucidum*, *Campanula erinus*, *Galium murale* and *Stellaria apetala* (Brullo et al., 2007).

Syndynamism: See order.

Habitat reference: See class.

31.6.1.20. ***Parietario lusitanicae-Hornungietum pauciflorae*** ass. nov. provv.

Sciaphilous and nitrophilous vegetation with oval shepherd's purse.

Holotypus: Not designated.

Characteristic and differential species: *Hornungia pauciflora* (W.D.J.Koch) Soldano et al.

Phytosociological table: 2 unpublished relevès, Grotta del Leone (2017),
Char. association: *Hornungia pauciflora* (2).
Char. alliance and order: *Parietaria lusitanica* (2), *Valantia muralis* (2), *Campanula erinus* (1).
Char. class: *Sonchus oleraceus* (2), *Carduus pycnocephalus* subsp. *pycnocephalus* (1), *Hyoscyamus albus* (1).
Other species: *Lobularia maritima* (2), *Hyoseris radiata* (1).

Geographical distribution: This very rare association is restricted to a small cave near Trabia, known as «Grotta del Leone», near Trabia (NW Sicily).

Structure and ecology: This vegetation is linked to a very peculiar habitat, colonizing the small ledges and rocky crevices of caves, which are characterized by very shaded conditions and a considerable accumulation of organic matter due to the livestock stationing. From the floristic point of view, it is a very poor community dominated by *Parietaria lusitanica* and the very rare *Hornungia pauciflora*.

Syndynamism: This permanent vegetation don't shows catenal contacts with other communities.

Habitat reference: See class.

32. Class: ***Poetea bulbosae*** Rivas Goday & Rivas-Martínez in Rivas-Martínez 1978

Perennial and ephemeroid pastures in the thermo- to oromediterranean belts.

Holotypus: *Poetalia bulbosae* Rivas Goday & Rivas-Martínez in Rivas Goday & Ladero 1970.

Characteristic and differential species: *Bellis sylvestris* Cirillo, *Leontodon tuberosus* L., *Moraea sisyrinchium* (L.) Ker Gawl., *Poa bulbosa* L.

Geographical distribution: This class has its greater diversification in the Iberian peninsula and in the Atlas Mountains of Morocco (Galán De Mera et al., 2000; Cano et al., 2007), but it is known also in Provence, Italy and Greece (Ladero et al., 1992; Mucina et al., 2016).

Structure and ecology: The dwarf caespitose perennial pastures, dominated by small prostrate hemicryptophytes as *Poa bulbosa* and several species of *Trifolium*, are classified within the *Poetea bulbosae* class. These communities are linked to anthropized environments with a well marked dry season from the thermo- to supramediterranean bioclimatic belt, having their optimum during the winter and spring period, when give a favourable habitat to the development of therophytic plants. Conversely, this vegetation dries completely during the summer, starting its cycle after the first autumn rains (Rivas-Martinez, 1978b).

Syndynamism: This vegetation is maintained by intensive sheep grazing on dry soils and its distribution is generally linked with the traditional grazing areas and livestock transhumance routes (Costa et al., 2012). Generally, these perennial pastures derives from the pioneer annual meadows of *Helianthemetea* class, or sometimes also *Stipo-Trachynietea distachyae* and *Polygono-Poetea annuae* communities, as a result of dynamic succession. On the other hand, their establishment can be determined by the disturbance of the perennial grasslands belonging to *Lygeo-Stipetea* class, as the *Hyparrhenia hirta* or *Ampelodesmos mauritanicus* communities.

Habitat reference: E1.3a Mediterranean closely grazed dry grassland.

32.1. Order: ***Poetalia bulbosae*** Rivas Goday et Rivas-Martinez in Rivas Goday et Ladero 1970

Perennial and ephemeroid pastures in the thermo- to oromediterranean belt.

Holotypus: *Periballio-Trifolion subterranei* Rivas Goday 1964 nom. inv.

Characteristic and differential species: *Erodium botrys* (Cav.) Bertol., *Herniaria glabra* L., *Parentucellia latifolia* (L.) Caruel, *Paronychia argentea* Lam., *Ranunculus paludosus* Poir., *Romulea ramiflora* Ten., *Scorpiurus vermiculatus* L., *Taraxacum obovatum* (Willd.) DC., *Trifolium nigrescens* Viv., *T. pallidum* Waldst. & Kit., *T. subterraneum* L., *T. suffocatum* L., *T. tomentosum* L.

Geographical distribution: See class.

Structure and ecology: See class.

Syndynamism: See class.

Habitat reference: See class.

32.1.1. Alliance: ***Trifolio subterranei-Periballion minutae*** Rivas Goday 1964

Siliceous and slightly acidophilous ephemeroid pastures.

Synonyms: *Periballio minutae-Trifolion subterranei* Rivas Goday 1964 (art. 42); *Molineriello minutae-Trifolion subterranei* Rivas Goday 1964 (art. 42, 45); *Trifolion subterranei* Rivas Goday & Ladero 1970.

Holotypus: *Poo bulbosae-Trifolietum subterranei* Rivas Goday 1964.

Characteristic and differential species: *Aphanes microcarpa* (Boiss. & Reut.) Rothm., *Tillaea muscosa* L., *Onobrychis aequidentata* (Sm.) d'Urv., *Ranunculus millefoliatus* Vahl., *Trifolium glomeratum* L., *Trifolium subterraneum* L. subsp. *subterraneum*.

Geographical distribution: This alliance is reported for Spain, Portugal and northern Morocco (Galán de Mera et al., 2000; Cano et al., 2007; Silva et al., 2009; Ribeiro et al., 2012), as well as for Sardinia (Ladero et al., 1992) and Sicily (Siracusa, 1996; Sciandrello et al., 2013).

Structure and ecology: The alliance at issue groups the ephemeroid pastures communities of siliceous and slightly acidic soils, from the thermo- to supramediterranean bioclimatic belt.

Syndynamism: See class.

Habitat reference: See class.

32.1.1.1. ***Trifolio nigrescentis-Poetum bulbosae*** (Ladero, Biondi, Mossa & Amor 1992) Galán De Mera, Morales Alonso & Vicente Orellana 2000

Thermophilous ephemeroid pastures with small white clower and bulbous meadow-grass of siliceous soils.

Synonyms: *Poo bulbosae-Trifolietum subterranei* subass. *trifolietosum nigrescentis* Ladero et al. 1992.

Holotypus: rel. 1, tab. 2, Ladero et al. (1992).

Characteristic and differential species: *Trifolium nigrescens* Viv.

Phytosociological table: From Siracusa (1996), table 68, 5 rel.

Char. association: *Trifolium nigrescens* (V).

Char. alliance, order and class: *Trifolium subterraneum* subsp. *subterraneum* (V), *Poa bulbosa* (V), *Tillaea muscosa* (IV), *Trifolium suffocatum* (II), *Aphanes microcarpa* (I).

Other species: *Veronica arvensis* (V), *Filago gallica* (V), *Stipellula capensis* (V), *Silene gallica* (V), *Cerastium semidecandrum* (V), *Festuca danthonii* (V).

Geographical distribution: This association occurs in Sardinia (Galán De Mera et al., 2000; Farris et al., 2007), while in Sicily it was surveyd by Siracusa (1996) for Etna mountain.

Structure and ecology: The ephemeroid pastures with *Poa bulbosa* and *Trifolium nigrescens* are found in shallow and compact siliceous soils, which are subjected to intensive grazing, within the thermomediterranean bioclimatic belt. This vegetation, named *Trifolio nigrescentis-Poetum bulbosae*, has a winter-spring cycle, starting with the arrival of the first rains (Galàn De Mera et al., 2000). From the floristic point of view, some species of higher rank are frequent, as *Trifolium subterraneum*, *Tillaea muscosa*, *Trifolium suffocatum* and *Aphanes microcarpa*.

Syndynamism: See class.

Habitat reference: See class.

32.1.1.2. ***Poo bulbosae-Trifolietum subterranei*** Rivas Goday 1964

Mesophilous ephemeroid pastures with bulbous meadow grass and subterranean trefoil of siliceous soils.

Synonyms: *Trifolio subterranei-Poetum bulbosae* Rivas Goday 1964 nom. inv.; *Brizo minoris-Trifolietum subterranei* Rivas-Martinez et al. 2001 (syntax. syn.).

Lectotypus: Not designated.

Characteristic and differential species: *Trifolium subterraneum* L. subsp. *subterraneum*.

Phytosociological table: From Sciandrello et al. (2013), table 4, 9 rel. *(*subass. *plantaginetosum*).

Char. association and subassociation: *Trifolium subterraenum* subsp. *subterraeneum* (V), *Plantago serraria* (V).

Char. alliance, order and class: *Poa bulbosa* (V), *Trifolium cherleri* (I).

Other species: *Trifolium campestre* (IV), *Galium divaricatum* (IV), *Plantago bellardi* (III).

Geographical distribution: This association occurs in the Iberian peninsula (Galán De Mera et al., 2000) and was reported by Sciandrello et al. (2013) also for Sicily, near Taormina.

Structure and ecology: According to Sciandrello et al. (2013), the sicilian aspect of *Poo bulbosae-Trifolietum subterranei* has some ecological and floristic peculiarities if compared with the typical Iberian community. It was described as subass. *plantaginetosum*, showing a mesophilous character and an high coverage of *Plantago serraria*, in addition to *Trifolium subterraneum* and *Poa bulbosa*.

Syndynamism: See class.

Habitat reference: See class.

33. Class: ***Helianthemetea guttati*** Rivas Goday & Rivas-Martínez 1963

Annual dry grasslands of siliceous substrata.

Synonyms: *Tuberarietea guttatae* Rivas Goday & Rivas-Martinez 1963 nom. mut. propos. (art. 45); Helianthemetea annua Br.-Bl. ex Rivas Goday 1958 (art. 34a); *Xolanthetea guttati* Rivas Goday & Rivas-Martinez 1963 nom. mut. propos. (art. 45); *Therocistetea guttatae* Pinto da Silva in Correia & Pinto da Silva 1993 (art. 29, 34b); *Ononido variegatae-Cutandietea maritimae* de Foucault 1999 (art. 5).

Holotypus: *Helianthemetalia guttati* Br.-Bl. in Br.-Bl. & Wagner 1940

Characteristic and differential species: *Arenaria serpyllifolia* L.*, Centaurium maritimum* (L.) Fritsch, *Cerastium pumilum* Curtis*, C. semidecandrum* L., *Crucianella angustifolia* L.*, Filago gallica* L.*, Filago pygmaea* L.*, Galium parisiense* L.*, Helianthemum ledifolium* (L.) Mill.*, H. salicifolium* (L.) Mill., *Herniaria cinerea* DC.*, Hippocrepis ciliata* Willd.*, H. multisiliquosa* L.*, Lathyrus setifolius* L.*, Lysimachia linum-stellatum* L., *Medicago coronata* (L.) Bartal., *M. littoralis* Loisel.*, M. minima* (L.) L.*, Minuartia hybrida* (Vill.) Schischk., *Petrorhagia dubia* (Raf.) G. López & Romo, *Scleranthus annuus* L., *Sedum rubens* L.*, Silene colorata* Poir.*, S. conica* L.*, Trifolium campestre* Schreb.*, T. stellatum* L., *Tuberaria guttata* (L.) Fourr., *Valerianella dentata* (L.) Pollich, *Veronica praecox* All., *V. verna* L., *Vicia lathyroides* L..

Geographical distribution: This class has a wide Mediterranean distribution, with some occurrences in the atlantic, submediterranean and steppic areas of the Eurosiberian region (Brullo et al., 2001; Costa et al., 2012; Mucina et al., 2016). In Sicily it shows a great diversification, particularly in the eastern and southern part (Brullo & Marcenò, 1974; Brullo & Scelsi, 1998; Brullo et al., 1998; Brullo et al., 2001)

Structure and ecology: The therophytic grasslands with a short winter-spring vegetative cycle, growing on dry acidic soils, are ascribed to *Helianthemetea guttati* class (Rivas-Martinez, 1978b; De Foucault, 1999). It is an ephemeral and thermophilous non-nitrophilous

vegetation, which occurs mainly in the thermo-, meso- and supra-mediterranean bioclimatic belts. Its appearance is given by several annual pioneer plants with a small size, that colonize shallow soils in an early development stage, quite poor in organic matter and with a low water potential (Costa et al., 2012). The species composition varies greatly according to several factors, among them soil features (particularly pH and grain size), climatic conditions, phytogeographic region, orography, etc.

Syndynamism: This vegetation has a pioneer character, representing the first stage of plant colonization in poorly developed soils. Generally, it forms a patchy mosaic with the other communities belonging to the same dynamic series, as forests, maquis and perennial grasslands. The abandonment of tradiional grazing and the reduction of fires allow the expansion of shrubs and trees and the consequent establishment of more evolved woody communities belonging to *Quercetea ilicis*, *Cisto-Micromerietea* and *Cisto-Lavanduletea*, while overgrazing should favor the nitrophilous communities of *Chenopodietea*. Sometimes, the *Helianthemetea guttati* vegetation can represent an edaphic climax, due to the soil impossibility to a further evolution (Perez Prieto & Font, 2005).

Habitat reference: E1.3c Mediterranean annual-rich dry grassland; B1.4b Mediterranean and Macaronesian coastal dune grassland (grey dune).

33.1. Order: ***Helianthemetalia guttati*** Br.-Bl. in Br.-Bl. & Wagner 1940

Inland ephemeral vegetation on nutrient-poor shallow acidic soils.

Synonyms: *Tuberarietalia guttatae* Br.-Bl. in Br.-Bl. et al. 1940 nom.mut. propos. (art. 45).

Holotypus: *Helianthemion guttati* Br.-Bl. in Br.-Bl. et al. 1941.

Characteristic and differential species: *Aira caryophyllea* L., *A. cupaniana* Guss., *Andryala integrifolia* L., *Anthoxanthum gracile* Biv., *Briza maxima* L., *Cynosurus echinatus* L., *Festuca ligustica* (All.) Bertol., *Festuca myuros* L., *Filago lutescens* L., *Galium murale* (L.) All., *Helianthemum aegyptiacum* (L.) Mill., *Hymenocarpos circinnatus* (L.) Savi, *Jasione montana* L., *Linaria pelisseriana* (L.) Mill., *Linum trigynum* L., *Ornithopus compressus* L., *Plantago bellardi* All., *Psilurus incurvus* (Gouan) Gutermann, *Rumex bucephalophorus* L., *Silene gallica* L., *Tolpis umbellata* Bertol., *Trifolium arvense* L., *T. glomeratum* L., *T. cherleri* L., *T. striatum* L., *T. strictum* L.

Geographical distribution: See class.

Structure and ecology: This syntaxon groups the pioneer communities dominated by acidophilous therophytes, which grow on oligotrophic shallow soils with sandy or loamy texture, usually derived from granites, schists and other siliceous rocks (Perez Prieto & Font, 2005). This vegetation is found in flat or semi-casmophilous surfaces, as well as in the

clearings of garrigue and bushes, alluvial deposits and in the inland sandy soils (Brullo et al., 2001).

Syndynamism: The communities belonging to this order are dynamically linked with the woody acidophilous vegetation or dry grasslands, of which represent a degradation stage.

Habitat reference: E1.3c Mediterranean annual-rich dry grassland.

33.1.1. Alliance: ***Helianthemion guttati*** Br.-Bl. in Br.-Bl. & Wagner 1940

Therophytic grasslands on nutrient-poor sandy soils.

Synonyms: *Helianthemion guttati* Br.-Bl. 1931 (art. 2b); *Tuberarion guttatae* Br.-Bl. in Br.-Bl. et al. 1940 nom. mut. propos. (art. 45); *Moenchion erectae* Rivas Goday 1958; *Brachypodio-Paronychion* Rivas Goday 1964 (syntax.syn.); *Thero-Brachypodion siliceum* Rivas Goday 1964 (orig.form) (art. 34a).

Holotypus: *Tuberarietum guttatae* Br.-Bl. in Br.-Bl., Molinier & Wagner 1940 nom. mut.

Characteristic and differential species: *Aira tenorei* Guss., *Airopsis tenella* (Cav.) Coss. & Durieu, *Astragalus pelecinus* (L.) Barneby, *Avellinia festucoides* Savi, *Coleostephus myconis* (L.) Cass., *Corynephorus divaricatus* C. Presl, *Festuca danthonii* Asch. & Graebn, *Festuca muralis* Kunth., *Galium divaricatum* Lam., *Helianthemum sanguineum* (Lag.) Lag., *Hypochaeris glabra* L., *Onobrychis caput-galli* (L.) Lam., *Ornithopus pinnatus* (Mill.) Druce, *Paronychia echinulata* Chater, *Sedum caespitosum* (Cav.) DC., *Tolpis umbellata* Bertol., *Trifolium nigrescens* Viv.

Geographical distribution: This alliance occurs in the Mediterranean and Macaronesian areas (Brullo et al., 2001).

Structure and ecology: The annual communities with spring optimum and growing on siliceous sandy-loamy soil are ascribed to the *Helianthemion guttati.* This vegetation occurs from the thermo- to lower supramediterranean bioclimatic belt.

Syndynamism: See order.

Habitat reference: See order.

33.1.1.1. ***Trifolio nigrescentis-Andryaletum cosyrensis*** Brullo, Di Martino & Marcenò 1977

Annual grasslands with Pantelleria *Andryala* of siliceous soils derived from volcanic rocks

Holotypus: rel. 9, tab. 9, Brullo et al. (1977).

Characteristic and differential species: *Andryala cossyrensis* Guss., *Medicago truncatula* Gaertn. subsp. *truncatula* var. *cossyrensis* (Sommier) Fiori., *Trifolium nigrescens* Viv. subsp. *dolychodon* (Sommier) C. Brullo et al.

Phytosociological table: From Brullo et al. (1977), table 9, 19 rel.

Char. association: *Andryala cossyrensis* (IV), *Trifolium nigrescens* subsp. *dolychodon* (IV), *Medicago truncatula* subsp. *truncatula* var. *cossyrensis* (II).

Char. alliance: *Trifolium nigrescens* subsp. *nigrescens* (V), *Paronychia echinulata* (III), *Aira cupaniana* (III), *Astragalus pelecinus* (III), *Coleostephus myconis* (III), *Avellinia festucoides* (II), *Galium divaricatum* (I).

Char. order: *Festuca myuros* (V), *Galium murale* (IV), *Rumex bucephalophorus* (IV), *Trifolium glomeratum* (III), *Tolpis umbellata* (III), *Trifolium suffocatum* (III), *Plantago bellardi* (II), *Tillaea muscosa* (II), *Festuca danthonii* (II), *Ornithopus pinnatus* (II), *Trifolium cherleri* (III), *Festuca ligustica* (II), *Linum trigynum* (II), *Trifolium cherleri* (I), *Trifolium lappaceum* (I), *Erodium botrys* (I), *Briza maxima* (I).

Char. class: *Tuberaria guttata* (V), *Filago gallica* (V), *Hypochaeris glabra* (IV), *Trifolium arvense* (III), *Ornithopus compressus* (III), *Silene gallica* (III), *Briza maxima* (III), *Festuca bromoides* (III), *Petrorhagia dubia* (II), *Trifolium campestre* (II), *Aira caryophyllea* (I).

Other species: *Lupinus angustifolius* (II), *Trifolium subterraneum* (II).

Geographical distribution: This association occurs only in Pantelleria island (Brullo et al., 1977).

Structure and ecology: The small surfaces with very shallow soils under the thermophilous shrubby vegetation of *Pino-Genistetum aspalathoidis* are covered by annual grasslands characterized by the occurrence of some rare and endemic taxa of Pantelleria, such as *Andryala cossyrensis*, *Trifolium nigrescens* subsp. *dolychodon* and *Medicago truncatula* subsp. *truncatula* var. *cossyrensis*. The floristic set includes several siliceous species, among them *Trifolium nigrescens* subsp. *nigrescens*, *Paronychia echinulata*, *Aira cupaniana*, *Astragalus pelecinus*, *Avellinia festucoides*, *Festuca myuros*, *Trifolium glomeratum*, *Tolpis umbellata*, *Trifolium suffocatum*, *Plantago bellardi*, *Trifolium cherleri*, *Trifolium lappaceum*, *Erodium botrys*, *Tuberaria guttata*, etc. (Brullo et al., 1977).

Syndynamism: This vegetation is originated by the degradation of maquis belonging to *Pino-Genistetum aspalathoidis*.

Habitat reference: See order.

33.1.1.2. ***Tolpidetum gussonei*** Ferro & Furnari 1970

Annual grasslands with Gussone rush hawkweed of abandoned fields on volcanic sands.

Lectotypus: Not designated.

Characteristic and differential species: *Tolpis virgata* (Desf.) Bertol. subsp. *gussonei* (Fiori) Giardina & Raimondo

Phytosociological table: From Ferro & Furnari (1970), table 8, 15 rel.

Char. association: *Tolpis virgata* subsp. *gussonei* (V).

Char. alliance: *Trifolium nigrescens* subsp. *nigrescens* (V), *Corynephorus divaricatus* (II).

Char. order: *Silene gallica* (V), *Rumex bucephalophorus* (IV), *Festuca danthonii* (IV), *Festuca myuros* (III), *Trifolium cherleri* (III), *Trifolium glomeratum* (II), *Aira cupaniana* (II), *Andryala integrifolia* (II), *Tolpis umbellata* (II), *Ornithopus pinnatus* (I).

Char. class: *Ornithopus compressus* (V), *Filago gallica* (I), *Trifolium campestre* (I), *Herniaria hirsuta* (I).

Other species: *Vicia sativa* (V), *Vicia pseudocracca* (V), *Cladanthus mixtus* (IV), *Trifolium subterraneum* (III), *Lupinus angustifolius* (III).

Geographical distribution: This association is circumscribed to the Aeolian Islands (Ferro & Furnari, 1970; Ferro et al., 2006).

Structure and ecology: The uncultivated lands (often vineyards) on volcanic sands are colonized by ephemeral grasslands dominated by *Tolpis virgata* subsp. *gussonei*. The higher syntaxa are represented by several species, among them *Trifolium nigrescens* subsp. *nigrescens*, *Corynephorus divaricatus*, *Silene gallica*, *Rumex bucephalophorus*, *Festuca myuros*, *Trifolium cherleri*, *Trifolium glomeratum*, *Aira cupaniana*, *Andryala integrifolia* and *Ornithopus compressus* are very frequent.

Syndynamism: This community replaces the nitrophilous vegetation of *Chenopodietea* following the crops abandonment (Ferro & Furnari, 1970).

Habitat reference: See order.

33.1.1.3. ***Tolpidetum grandiflorae*** Brullo & Furnari in Barbagallo et al. 1982

Mesophilous ephemeral grasslands with rush hawkweed of siliceous soils derived from metamorphic rocks.

Holotypus: rel. 2, tab. 4, Barbagallo et al. (1982).

Characteristic and differential species: *Tolpis grandiflora* Ten.

Phytosociological table: From Guarino (1997), table 49, 8 rel.

Char. association: *Tolpis grandiflora* (V).

Char. alliance: *Coleostephus myconis* (V), *Aira cupaniana* (V), *Galium divaricatum* (IV), *Plantago bellardii* (III), *Psilurus incurvus* (II), *Trifolium cherleri* (I), *Andryala integrifolia* (I).

Char. order and class: *Briza maxima* (V), *Filago gallica* (V), *Ornithopus compressus* (V), *Rumex bucephalophorus* (V), *Silene gallica* (V), *Trifolium arvense* (V), *Tuberaria guttata* (V),

Aira caryophyllea (III), *Linum trigynum* (III), *Ornithopus pinnatus* (III), *Trifolium campestre* (III), *Festuca myuros* (III), *Cynosurus echinatus* (III).
Other species: *Lysimachia arvensis* (V), *Sherardia arvensis* (V), *Anchusa arvensis* (IV), *Hypochoeris achyrophorus* (III), *Leontodon tuberosus* (III), *Reichardia picroides* (III).

Geographical distribution: This association occurs in southern Calabria (Serre and Aspromonte) and Peloritani mountains in Sicily (Barbagallo et al., 1982; Bartolo et al., 1994; Brullo et al., 2001).

Structure and ecology: The *Tolpidetum grandiflorae* is linked to flat sandy surfaces of submountain stands in the clearings of shrubby mesophilous vegetation. Its structure is given by *Tolpis grandiflora*, a Sicilian and Calabrian endemism, as well as by many acidophilous therophytes belonging to the syntaxa of higher order, such as *Aira cupaniana*, *Plantago bellardi*, *Anthoxanthum ovatum*, *Festuca myuros*, *Trifolium glomeratum*, *Tuberaria guttata*, *Trifolium arvense*, etc. (Brullo et al., 2001).

Syndynamism: This community represents a depauperated stage of the shrubby vegetation belonging to *Violion messanensis*.

Habitat reference: See order.

33.1.1.4. ***Bupleuro semicompositi-Tuberarietum guttatae*** Bartolo, Brullo & Marcenò 1982

Acidophilous grasslands with grey hare's ear and spotted rock-rose of sandy surfaces.

Holotypus: rel. 11, tab. 12, Bartolo et al. (1982).

Characteristic and differential species: *Bupleurum semicompositum* L.*, Hypochaeris glabra* L.*, Echium arenarium* Guss.*, Rostraria pubescens* (Lam.) Trin.

Phytosociological table: From Bartolo et al. (1982), table 12, 11 rel.

Char. association: *Bupleurum semicompositum* (V), *Hypochaeris glabra* (IV), *Echium arenarium* (III), *Rostraria pubescens* (III).

Char. alliance and order: *Plantago bellardi* (V), *Trifolium cherleri* (V), *Tuberaria guttata* (V), *Filago gallica* (V), *Rumex bucephalophorus* (V), *Andryala integrifolia* (III), *Trifolium campestre* (III), *Festuca danthonii* (III), *Briza maxima* (I), *Vulpia myuros* (I).

Char. class: *Festuca pyramidata* (V), *Lagurus ovatus* (V), *Silene gallica* (IV), *Maresia nana* (II), *Coronilla repanda* (II), *Hippocrepis multisiliquosa* (II), *Lotus halophilus* (II), *Alkanna tinctoria* (I), *Senecio glaucus* subsp. *coronopifolius* (I).

Other species: *Anthemis arvensis* (V), *Aegilops geniculata* (IV), *Moraea sisyrinchium* (IV), *Lysimachia arvensis* (IV).

Geographical distribution: This association was surveyed by Bartolo et al. (1982) for South-Eastern Sicily.

Structure and ecology: The inner coastal stands with sandy soils are colonized by the annual grasslands of *Bupleuro-Tuberarietum guttatae*. This vegetation is found in the small open surfaces between the shrubby communities belonging to *Pistacio-Rhamnetalia alaterni* or *Cisto-Ericion*. Its floristic set is characterized by the occurrence of *Bupleurum semicompositum*, *Hypochaeris glabra*, *Echium arenarium* and *Rostraria pubescens*. The alliance and the order are represented by *Plantago bellardi*, *Trifolium cherleri*, *Tuberaria guttata*, *Filago gallica*, *Rumex bucephalophorus, Andryala integrifolia*, *Trifolium campestre* and *Festuca danthonii* (Bartolo et al., 1982).

Syndynamism: This vegetation is originated from the degradation of *Pistacio-Rhamnetalia alaterni* and *Cisto-Ericion* communities.

Habitat reference: See order.

33.1.1.5. ***Tuberario guttatae-Aphanetum microcarpae*** Barbagallo, Brullo & Signorello 1983

Acidophilous grasslands with spotted rock-rose and slender parsley piert of rocky siliceous surfaces.

Holotypus: rel. 6, tab. 5, Barbagallo et al. (1983).

Characteristic and differential species: *Aphanes microcarpa* (Boiss. & Reuter) Rothm.

Phytosociological table: From Barbagallo et al. (1983), table 5, 11 rel.

Char. association: *Aphanes microcarpa* (V).

Char. alliance: *Aira cupaniana* (V), *Trifolium suffocatum* (V), *Galium divaricatum* (V), *Festuca muralis* (III), *Plantago bellardi* (II), *Avellinia festucoides* (II), *Trifolium nigrescens* (II).

Char. order and class: *Tuberaria guttata* (V), *Festuca myuros* (V), *Filago gallica* (V), *Galium murale* (V), *Cerastium semidecandrum* (V), *Trifolium arvense* (V), *Rumex bucephalophorus* (IV), *Moenchia erecta* (IV), *Trifolium campestre* (III), *Psilurus incurvus* (III), *Ornithopus compressus* (III), *Linaria pelisseriana* (III), *Tillaea muscosa* (II), *Trifolium glomeratum* (II), *Hypochoeris glabra* (II), *Ornithopus pinnatus* (II), *Centaurium maritimum* (II), *Briza maxima* (II).

Other species: *Sagina apetala* (V), *Veronica arvensis* (V), *Myosotis ramosissima* (V).

Geographical distribution: This association occurs in the Aeolian Archipelago and Peloritani mountains (Barbagallo et al., 1983; Guarino, 1997).

Structure and ecology: The siliceous rocky outcrops above 500 m of altitude are colonized by an ephemeral grassland dominated by *Aphanes microcarpa*. This vegetation, named *Tuberario-Aphanetum microcarpae*, is linked to acidic volcanic or sedimentary substrates, mainly occurring in cacuminal stands subject to frequent fog and strong winds. The syntaxa of higher rank are represented by many species, as *Aira cupaniana*, *Trifolium suffocatum*, *Galium divaricatum*, *Festuca muralis*, *Tuberaria guttata*, *Festuca myuros*, *Filago gallica*, *Galium murale*,

Cerastium semidecandrum, *Trifolium arvense*, *Rumex bucephalophorus* and *Moenchia erecta* (Barbagallo er al., 1983).

Syndynamism: Generally, this vegetation has a primary role.

Habitat reference: See order.

33.1.1.6. ***Tuberario guttatae-Senecionetum lividi*** Barbagallo, Brullo & Signorello 1983

Acidophilous grasslands with spotted rock-rose and hoary ragwort of maquis clearings.

Holotypus: rel. 3, tab. 6, Barbagallo et al. (1983).

Characteristic and differential species: *Senecio lividus* L.

Phytosociological table: From Barbagallo et al. (1983), table 6, 13 rel.

Char. association: *Senecio lividus* (V).

Char. alliance: *Aira cupaniana* (V), *Plantago bellardi* (V), *Festuca muralis* (IV), *Avellinia festucoides* (IV), *Trifolium nigrescens* (II), *Anthoxanthum ovatum* (II), *Trifolium suffocatum* (II), *Galium divaricatum* (II).

Char. order and class: *Tuberaria guttata* (V), *Ornithopus compressus* (V), *Linaria pelisseriana* (V), *Trifolium arvense* (V), *Rumex bucephalophorus* (V), *Silene gallica* (V), *Galium murale* (V), *Linum trigynum* (IV), *Hypochoeris glabra* (V), *Festuca myuros* (IV), *Cerastium semidecandrum* (IV), *Filago gallica* (IV), *Lysimachia linum-stellatum* (IV), *Trifolium campestre* (IV), *Centaurium maritimum* (IV), *Aira caryophyllea* (III), *Festuca danthonii* (III), *Trifolium glomeratum* (III), *Tolpis umbellata* (III), *Ornithopus pinnatus* (II), *Briza maxima* (II), *Tillaea muscosa* (II), *Trifolium cherleri* (I), *Psilurus incurvus* (I).

Other species: *Euphorbia falcata* (V), *Sonchus bulbosus* (IV), *Myosotis ramosissima* (IV).

Geographical distribution: This association is circumscribed to the Aeolian Archipelago (Barbagallo et al., 1983).

Structure and ecology: The clearings of thermophilous maquis, or more rarely also the volcanic outcrops, are colonized by the annual grassland of *Tuberario-Senecionetum lividi*. This community is dominated by *Senecio lividus*, growing together with *Aira cupaniana*, *Plantago bellardi*, *Festuca muralis*, *Avellinia festucoides*, *Tuberaria guttata*, *Ornithopus compressus*, *Linaria pelisseriana*, *Trifolium arvense*, *Rumex bucephalophorus*, *Silene gallica* and other species of higher rank (Barbagallo er al., 1983).

Syndynamism: Generally, this vegetation represents a degradation stage of *Euphorbietum dendroidis* or *Genistetum tyrrhenae*.

Habitat reference: See order.

33.1.1.7. ***Coleostepho myconis-Trisetarietum aureae*** Brullo, Minissale, Scelsi & Spampinato 1993

Acidophilous grasslands with corn marigold and golden oat of volcanic soils.

Holotypus: rel. 4, tab. 13, Brullo et al. (1993).

Characteristic and differential species: *Trisetaria aurea* (Ten.) Pignatti

Phytosociological table: From Brullo et al. (1993), table 13, 7 rel.

Char. association: *Trisetaria aurea* (V).

Char. alliance and order: *Coleostephus myconis* (V), *Festuca ligustica* (V), *Festuca danthonii* (V), *Galium divaricatum* (V), *Aira cupaniana* (V), *Tolpis umbellata* (IV), *Trifolium arvense* (IV), *Festuca myuros* (III), *Plantago bellardi* (III).

Char. class: *Tuberaria guttata* (V), *Silene gallica* (IV), *Trifolium campestre* (IV), *Filago gallica* (III), *Trifolium lappaceum* (III), *Petrorhagia dubia* (III), *Trifolium cherleri* (III), *Gastridium ventricosum* (III), *Trifolium glomeratum* (II).

Other species: *Serapias lingua* (IV), *Euphorbia exigua* (IV), *Ornithogalum gussonei* (III).

Geographical distribution: This association occurs only in the Hyblaean mountains (Brullo et al., 1993).

Structure and ecology: The *Coleostepho-Trisetarietum aureae* colonizes small surfaces of open grounds with volcanic substrata, between 300 and 500 m a.s.l. This community is dominated by *Trisetaria aurea* and *Coleostephus myconis*, growing together with some species of higher rank, as *Festuca ligustica*, *Festuca danthonii*, *Galium divaricatum*, *Aira cupaniana*, *Tolpis umbellata*, *Trifolium arvense*, *Tuberaria guttata*, *Silene gallica*, *Trifolium campestre*, etc. (Brullo et al., 1993).

Syndynamism: This vegetation is replaced by the *Vulpio-Trisetarietum aureae* on calcareous soils.

Habitat reference: See order.

33.1.1.8. ***Tuberario guttati-Anemonetum palmatae*** Brullo, Scelsi & Siracusa 1994

Acidophilous vegetation with spotted rock-rose and yellow anemone of sandy-loamy soils.

Holotypus: rel. 1, tab. 1, Brullo et al. (1994).

Characteristic and differential species: *Anemone palmata* L., *Ranunculus paludosus* Poir.

Phytosociological table: From Brullo et al. (1994), table 1, 5 rel.

Char. association: *Anemone palmata* (V), *Ranunculus paludosus* (V).

Char. alliance and order: *Festuca pyramidata* (V), *Aira cupaniana* (V), *Linum trigynum* (V), *Trifolium arvense* (V), *Plantago bellardi* (V).

Char. class: *Tuberaria guttata* (V), *Silene gallica* (IV), *Filago gallica* (IV), *Tillaea muscosa* (III).

Other species: *Romulea columnae* (V), *Juncus capitatus* (V), *Eryngium bocconei* (IV).

Geographical distribution: This association is circumscribed to a small area near Marsala, Western Sicily (Brullo et al., 1994).

Structure and ecology: *Anemone palmata* is a south-western mediterranean species with a very restricted range in Sicily, where characterizes an annual community named *Tuberario-Anemonetum palmatae.* This vegetation occurs on small raised surfaces with sandy-loamy soils at the edges of coastal salt marshes. Under the structural profile, *Ranunculus paludosus* plays a significant physiognomic role, growing together with some species of higher rank, as *Festuca pyramidata*, *Aira cupaniana*, *Linum trigynum*, *Trifolium arvense*, *Plantago bellardi*, *Tuberaria guttata*, *Silene gallica*, *Filago gallica*, etc. (Brullo et al., 1994).

Syndynamism: This vegetation has a primary role.

Habitat reference: See order.

33.1.1.9. ***Trifolio bocconei-Tuberarietum guttatae*** Brullo et al.1998

Acidophilous vegetation with Boccone clover and spotted rock-rose of volcanic outcrops.

Holotypus: rel. 4, tab. 3, Brullo et al. (1998c).

Characteristic and differential species: *Helianthemum aegyptiacum* (L.) Mill.; *Trifolium bocconei* Savi.

Phytosociological table: From Brullo et al. (1998c), table 3, 10 rel.

Char. association: *Trifolium bocconei* (V), *Helianthemum aegyptiacum* (V).

Char. alliance and order: *Aira cupaniana* (V), *Coleostephus myconis* (V), *Festuca myuros* (V), *Gastridium ventricosum* (V), *Psilurus incurvus* (V), *Rumex bucephalophorus* (V), *Paronychia echinulata* (V), *Plantago bellardi* (V), *Briza maxima* (V), *Tolpis umbellata* (IV), *Linum trigynum* (IV), *Cynosurus echinatus* (IV), *Trifolium glomeratum* (IV), *Hypochoeris glabra* (IV), *Ornithopus compressus* (IV), *Trifolium arvense* (IV), *Aira caryophyllea* (III), *Trifolium cherleri* (III), *Linaria pelliseriana* (III), *Trifolium lappaceum* (II), *Moenchia erecta* (II), *Avellinia festucoides* (II).

Char. class: *Tuberaria guttata* (V), *Silene gallica* (V), *Filago gallica* (V), *Tuberaria plantaginea* (V), *Trifolium campestre* (IV), *Tillaea muscosa* (III), *Centaurium maritimum* (II).

Other species: *Gaudinia fragilis* (V), *Hypochoeris achyrophorus* (V), *Poa bulbosa* (V).

Geographical distribution: This association was surveyed by Brullo et al. (1998c) for Monte Lauro (Hyblaean area).

Structure and ecology: The small ledges of volcanic outcrops with very shallow soils are colonized by the annual vegetation of *Trifolio bocconei-Tuberarietum guttatae.* This

community is dominated by some xeric acidophilous species, such as *Trifolium bocconei*, *Helianthemum aegyptiacum*, *Tuberaria guttata*, *T. plantaginea*, *Filago gallica*, *Coleostephus myconis*, *Aira cupaniana*, *A. caryophyllea*, *Festuca myuros*, *Silene gallica*, *Psilurus incurvus*, etc. (Brullo et al., 1998c).

Syndynamism: This vegetation takes catenal contacts with the *Anagallido parviflorae-Molinerielletum minutae*, occurring on more humid soils, and the *Thero-Sedetum coerulei* on more xeric places.

Habitat reference: See order.

33.1.1.10. ***Tuberario guttati-Plantaginetum bellardii*** Aubert & Loisel 1971

Acidophilous vegetation with spotted rock-rose and Bellardi plantain of shallow siliceous soils.

Holotypus: Not designated.

Characteristic and differential species: *Plantago bellardii* All.

Phytosociological table: From Guarino (1997), table 47, 20 rel.

Char. association: *Plantago bellardi* (V).

Char. alliance: *Aira cupaniana* (V), *Briza maxima* (V), *Festuca danthonii* (IV), *Linaria pelisseriana* (III), *Coleostephus myconis* (III), *Psilurus incurvus* (II), *Galium divaricatum* (II), *Trifolium suffocatum* (II), *Trifolium cherleri* (I), *Andryala integrifolia* (I), *Biserrula pelecinus* (I), *Galium parisiense* (I), *Lathyrus sphaericus* (I), *Teesdalia nudicaulis* (I),

Char. order and class: *Cynosurus echinatus* (V), *Ornithopus compressus* (V), *Filago gallica* (V), *Rumex bucephalophorus* (IV), *Festuca myuros* (IV), *Trifolium arvense* (III), *Linum trigynum* (III), *Tuberaria guttata* (III), *Cerastium semidecandrum* (III), *Ornithopus pinnatus* (III), *Trifolium campestre* (III), *Tolpis umbellata* (II), *Reichardia picroides* (II), *Jasione montana* (II), *Aira caryophyllea* (II), *Galium murale* (I), *Asterolinon linum-stellatum* (I), *Trifolium glomeratum* (I), *Hypochoeris glabra* (I), *Tillaea muscosa* (I).

Other species: *Hypochoeris achyrophorus* (III), *Anthemis arvensis* subsp. *incrassata* (III).

Geographical distribution: This association was described by Aubert & Loisel (1971) from France and later was surveyed by Guarino (1997) also in the Peloritani mountains (NE Sicily).

Structure and ecology: The *Tuberario-Plantaginetum bellardii* is a pioneer vegetation of shallow siliceous soils with a gravelly texture, often occurring in the river-beds locally known as "fiumare". From the floristic point of view, this vegetation is not well differentiated from the other communities belonging to *Helianthemion guttati*, since it lacks of differential species. The typical aspect (subass. *airetosum cupanianae*) shows a thermophilous character and is characterized by the high coverage of *Plantago bellardi*, while the subass. *airetosum caryophylleae* is linked to mountain stands above 900 m a.s.l. and is differentiated by the

occurrence of *Festuca myuros*, *Lysimachia arvensis*, *Sherardia arvensis* and *Aira caryophyllea*.

Syndynamism: Usually, this vegetation is mixed with the pioneer vegetation dominated by *Helichrysum italicum* growing on gravelly river-beds or takes catenal contacts with the woody vegetation of *Quercetum virgilianae* or *Erico-Quercetum virgilianae* and with their earlier stage of development. The subass. *airetosum caryophylleae* shows catenal contacts with the *Calycotomo infestae-Adenocarpetum commutati* or the mesophilous meadows of *Plantaginion cupanii* (Guarino, 1997).

Habitat reference: See order.

33.1.1.11. ***Airo caryophyllaeae-Micropyretum tenelli*** Brullo, Scelsi & Spampinato 2001

Acidophilous vegetation with silver hairgrass and gravel fescue of small rocky ledges.

Holotypus: rel. 5, tab. 121, Brullo et al. (2001).

Characteristic and differential species: *Micropyrum tenellum* (L.) Link.

Phytosociological table: From Siracusa (1996), table 59, 19 rel.

Char. association: *Micropyrum tenellum* (V).

Char. alliance: *Aira cupaniana* (IV), *Briza maxima* (IV), *Andryala integrifolia* (III), *Galium divaricatum* (II), *Coleostephus myconis* (I).

Char. order and class: *Rumex bucephalophorus* (IV), *Trifolium arvense* (III), *Filago gallica* (II), *Jasione montana* (II), *Silene gallica* (I), *Petrorhagia dubia* (I), *Aira caryophyllea* (I), *Logfia heterantha* (I), *Ornithopus compressus* (I).

Other species: *Sedum tenuifolium* (IV), *Hypochaeris radicata* (II).

Geographical distribution: This association, originally described from Calabria, occurs also in Sardinia (Gennargentu range) and Sicily, where it was surveyed in the Etna mountain (Brullo et al., 2001).

Structure and ecology: The small ledges of volcanic rocks with a shallow layer of soil are colonized by an ephemeral vegetation characterized by the high coverage of *Micropyrum tenellum*. It is the *Airo caryophyllaeae-Micropyretum tenelli*, whose floristic set includes several species of *Helianthemion guttati* and higher syntaxa, among them *Aira cupaniana*, *Tolpis umbellata*, *Cynosurus echinatus*, *Festuca myuros*, *Aira caryophyllea*, *Cerastium semidecandrum*, *Briza maxima*, *Tuberaria guttata*, etc.

Syndynamism: This vegetation can be considered a permanent vegetation (Brullo et al., 2001).

Habitat reference: See order.

33.1.1.12. ***Airo caryophyllaeae-Oglifetum heteranthae*** Brullo, Scelsi & Spampinato 2001

Acidophilous vegetation with silver hairgrass and variable cottonroses of shallow siliceous soils.

Holotypus: rel. 1, tab. 125A, Brullo et al. (2001).

Characteristic and differential species: *Logfia heterantha* (Raf.) J.Holub

Phytosociological table: -

Geographical distribution: This association occurs in Calabria (Aspromonte) and Sicily (Brullo et al., 2001).

Structure and ecology: The *Airo caryophyllaeae-Oglifetum heteranthae* is an annual community of very shallow siliceous soils, occurring in the meso- and supramediterranean bioclimatic belts. Some mesophilous species characterize this community, such as *Logfia heterantha, Veronica arvensis*, *Scleranthuus annuus* and *Cardamine glauca*. The alliance and the order are represented by several species, including *Plantago bellardi*, *Aira cupaniana*, *Galium divaricatum*, *Aira elegans*, *Festuca myuros*, *Cynosurus echinatus*, *Trifolium glomeratum*, *Psilurus incurvus*, etc.

Syndynamism: This vegetation is linked with the dynamic series of *Teucrio-Quercetum ilicis*, representing its first stage of development (Brullo et al., 2001).

Habitat reference: See order.

33.1.1.13. ***Trifolio suffocati-Trisetarietum aureae*** Minissale & Sciandrello 2010

Acidophilous vegetation with suffocated clover and golden oat of trampled calcarenitic surfaces.

Holotypus: rel. 1, tab. 11, Minissale & Sciandrello (2010).

Characteristic and differential species: *Trifolium suffocatum* L.

Phytosociological table: From Minissale & Sciandrello (2010), table 11, 3 rel.

Char. association: *Trifolium suffocatum* (3).

Char. alliance, order and class: *Trisetaria aurea* (3), *Tillaea muscosa* (3), *Rumex bucephalophorus* (3), *Arenaria serpyllifolia* (3), *Filago gallica* (3), *Galium divaricatum* (3), *Evax pygmaea* (3), *Filago heterantha* (3), *Lysimachia linum-stellatum* (2).

Other species: *Polycarpon diphyllum* (3), *Plantago afra* (3), *Lysimachia arvensis* (3), *Festuca fasciculata* (3).

Geographical distribution: This vegetation was described by Minissale & Sciandrello (2010) from South-Eastern Sicily.

Structure and ecology: The trampled calcarenitic-sandy surfaces of coastal rocky stands with compact soil are covered by an ephemeral vegetation dominated by *Trifolium suffocatum*. It is the *Trifolio suffocati-Trisetarietum aureae*, whose floristic set includes several speceis of higher rank, as *Trisetaria aurea*, *Tillaea muscosa*, *Rumex bucephalophorus*, *Arenaria serpyllifolia*, *Filago gallica*, *Galium divaricatum*, *Evax pygmaea*, *Filago heterantha* and *Lysimachia linum-stellatum*.

Syndynamism: The occurrence of this community is determined by the intense anthropic disturbance of the coast and in particular by human trampling.

Habitat reference: See order.

33.1.1.14. ***Asterolino lini-stellati-Tuberarietum guttatae*** Ferro, Privitera & Puglisi 2006

Acidophilous vegetation with star flax and spotted rock-rose of volcanic surfaces.

Holotypus: rel. 10, tab. 1, Ferro et al. (2006).

Characteristic and differential species: *Arabis verna* (L.) R. Br., *Lysimachia linum-stellatum* L., *Veronica arvensis* L., *Valerianella microcarpa* Loisel.

Phytosociological table: From Ferro et al. (2006), table 1, 10 rel.

Char. association: *Lysimachia linum-stellatum* (V), *Veronica arvensis* (III), *Valerianella mIcrocarpa* (III), *Arabis verna* (II).

Char. alliance: *Aira cupaniana* (V), *Plantago bellardi* (II), *Avellinia festucoides* (II), *Festuca danthonii* (I), *Hypochoeris glabra* (I).

Char. order and class: *Filago gallica* (V), *Tuberaria guttata* (V), *Ornithopus pinnatus* (II), *Galium murale* (II), *Erodium botrys* (I), *Trifolium glomeratum* (I), *Briza maxima* (I), *Silene gallica* (I), *Trifolium arvense* (I), *Rumex bucephalophorus* (I), *Tillaea muscosa* (I).

Other species: *Euphorbia peplus* (III), *Selaginella denticulata* (III).

Geographical distribution: This association was described by Ferro et al. (2006) from Lipari (Aeolian Islands).

Structure and ecology: The community at issue occurs in coastal stands with shallow siliceous soils, as small ledges of volcanic rocks and between the shrubs of maquis. Under the floristic profile, *Lysimachia linum-stellatum*, *Veronica arvensis*, *Valerianella mIcrocarpa* and *Arabis verna* represent the differential species, while among the species of higher syntaxa, *Aira cupaniana*, *Plantago bellardi*, *Filago gallica* and *Tuberaria guttata* are very frequent. Moreover, the floristic set is enriched by some acidophilous bryophytes, as *Gongylanthus ericetorum*, *Hypnum cupressiforme*, *Scleropodium touretii*, etc. (Ferro et al., 2006).

Syndynamism: Generally, the *Asterolino lini-stellati-Tuberarietum guttatae* derives from the degradation of maquis with *Cistus* sp. pl., while more rarely it represents a primary vegetation.

Habitat reference: See order.

33.1.1.15. ***Galio divaricati-Tuberarietum guttatae*** Ferro, Privitera & Puglisi 2006

Acidophilous vegetation with Lamarck's bedstraw and spotted rock-rose of volcanic sands.

Holotypus: rel. 4, tab. 2, Ferro et al. (2006).

Characteristic and differential species: *Galium divaricatum* Lam.

Phytosociological table: From Ferro et al. (2006), table 2, 29 rel.

Char. association: *Galium divaricatum* (IV).

Char. alliance: *Aira cupaniana* (III), *Hypochoeris glabra* (III), *Festuca danthonii* (III), *Plantago bellardi* (II), *Trifolium nigrescens* (II), *Tolpis virgata* (II), *Avellinia festucoides* (II).

Char. order and class: *Tuberaria guttata* (V), *Filago gallica* (III), *Andryala integrifolia* (III), *Trifolium arvense* (III), *Silene gallica* (II), *Ornithopus compressus* (II), *Rumex bucephalophorus* (II), *Trifolium campestre* (II), *Petrorhagia dubia* (I), *Erodium botrys* (I), *Filago germanica* (I), *Trifolium glomeratum* (I), *Tillaea muscosa* (I), *Trifolium cherleri* (I), *Galium murale* (I), *Valerianella microcarpa* (I), *Festuca myuros* (I), *Aira caryophyllea* (I), *Briza maxima* (I).

Other species: *Moraea sisyrinchium* (II), *Bellis annua* (II), *Polycarpon tetraphyllum* subsp. *diphyllum* (II).

Geographical distribution: This association was described by Ferro et al. (2006) from Lipari (Aeolian Islands).

Structure and ecology: The *Galio divaricati-Tuberarietum guttatae* replaces the previous association on volcanic soils, growing in the clearings of perennial grasslands and maquis, as well as along the paths. Despite the lacking of characteristic species, this community shows an high-coverage of *Galium divaricatum*, occurring together with other species of higher rank, among them *Aira cupaniana*, *Hypochoeris glabra*, *Festuca danthonii*, *Plantago bellardi*, *Trifolium nigrescens*, *Tolpis virgata*, *Avellinia festucoides*, *Tuberaria guttata*, *Filago gallica*, *Andryala integrifolia* and *Trifolium arvense*. Ferro et al. (2006) distinguished three subassociations: the subass. *typicum*, the subass. *gynandriridetosum sisyrinchii*, which replaces the first one on very eroded surfaces and the subass. *tolpidetosum virgatae*, which is characterized by the occurrence of *Tolpis virgata* and by some bryophytes, as *Archidium alternifolium* and *Tortella flavovirens*.

Syndynamism: The community at issue is linked to open surfaces within maquis and perennial grasslands, tending to disappear in the most mature stages of shrubby vegetation.

Habitat reference: See order.

33.1.1.16. ***Loto conimbricensis-Tuberarietum plantagineae*** Sciandrello, D'Agostino & Minissale 2013

Acidophilous vegetation with white bird's-foot and spotted rock-rose of strongly eroded surfaces.

Holotypus: rel. 4, tab. 4, Sciandrello et al. (2013).

Characteristic and differential species: *Lotus conimbricensis* Brot., *Tuberaria plantaginea* (Willd.) Gallego.

Phytosociological table: From Sciandrello et al. (2013), table 4, 9 rel.

Char. association: *Lotus conimbricensis* (V), *Tuberaria plantaginea* (V).

Char. alliance: *Aira cupaniana* (V), *Plantago bellardi* (V), *Galium divaricatum* (IV), *Tolpis umbellata* (II), *Trifolium nigrescens* (I).

Char. order and class: *Linaria pelisseriana* (V), *Trifolium campestre* (V), *Ornithophus compressus* (V), *Trifolium cherleri* (V), *Briza maxima* (V), *Trifolium glomeratum* (V), *Centaurium maritimum* (V), *Lotus angustissimus* (V), *Trifolium arvense* (V), *Filago gallica* (IV), *Linum trigynum* (III), *Petrorhagia prolifera* (III), *Rumex bucephalophorus* (I).

Other species: *Hypochoeris achyrophorus* (V), *Lotus edulis* (I).

Geographical distribution: This association was described by Sciandrello et al. (2013) from the Taormina area (NE Sicily).

Structure and ecology: The very eroded siliceous soils derived from metamorphic rocks are colonized by an annual acidophilous grassland characterized by the occurrence of the rare *Lotus conimbricensis*. Moreover, the floristic set of this community includes also some species of higher rank, such as *Aira cupaniana*, *Plantago bellardi*, *Galium divaricatum*, *Linaria pelisseriana*, *Trifolium campestre*, *Ornithophus compressus*, *Trifolium cherleri*, *Briza maxima*, *Trifolium glomeratum*, *Centaurium maritimum*, *Lotus angustissimus*, *Trifolium arvense*, etc. (Sciandrello et al., 2013).

Syndynamism: This community is linked with the dynamic series of *Erico arboreae-Quercetum virgilianae*.

Habitat reference: See order.

33.1.1.17. ***Radiolo linoidis-Kichxietum cirrhosae*** Brullo, Di Martino & Marcenò 1977

Pioneer vegetation with *Radiola linoides* of volcanic fumarole.

Holotypus: rel. 10, tab. 11, Brullo et al. (1977).

Characteristic and differential species: *Centaurium maritimum* (L.) Fritsch, *Kickxia cirrhosa* (L.) Fritsch, *Lotus angustissimus* L.*, Lotus parviflorus* Desf.*, Plantago coronopus* L. *Radiola linoides* Roth*, Sideritis romana* L.

Phytosociological table: From Brullo et al. (1977), table 11, 21 rel.

Char. association: *Kickxia cirrhosa* (V), *Lotus angustissimus* (V)*, Radiola linoides* (V)*, Centaurium maritimum* (IV), *Sideritis romana* (III), *Lotus parviflorus* (III)*, Plantago coronopus* (II).

Char. alliance: *Aira cupaniana* (V), *Galium divaricatum* (III), *Plantago bellardi* (III), *Andryala cosyrensis* (I), *Coleostephus myconis* (I), *Avellinia festucoides* (I), *Festuca danthonii* (I).

Char. order: *Galium murale* (V), *Ornithopus pinnatus* (IV), *Stachys arvensis* (I), *Festuca ligustica* (I), *Trifolium glomeratum* (I).

Char. class: *Andryala integrifolia* (IV), *Festuca myuros* (IV), *Filago gallica* (III), *Hypochoeris glabra* (III) *Tuberaria guttata* (II), *Trifolium campestre* (II), *Silene gallica* (I), *Briza maxima* (I), *Rumex bucephalophorus* (I), *Trifolium arvense* (I), *Ornithopus pinnatus* (I).

Other species: *Centaurium erythraea* (III), *Hypochoeris achyrophorus* (III).

Geographical distribution: This community occurs only in Pantelleria island (Brullo et al., 1977).

Structure and ecology: The *Radiolo-Kichxietum cirrhosae* is a very specialized vegetation growing near the cracks of volcanic fumaroles, which are characterized by quite humid conditions due to the condensing of vapors on bryophytic vegetation. On the moss layer grows some small therophytes, as *Kickxia cirrhosa*, *Lotus angustissimus, Radiola linoides, Centaurium maritimum*, *Sideritis romana*, *Lotus parviflorus* and *Plantago coronopus,* which can be considered the characteristic species of this syntaxon. Despite some ecological similarities with the *Isoeto-Nanojuncetea* communities, this vegetation must be referred to *Helianthemetea guttati*, due to the occurrence of many species belonging to this syntaxon, as *Aira cupaniana*, *Galium divaricatum*, *Plantago bellardi*, *Galium murale*, *Ornithopus pinnatus*, *Festuca myuros*, *Filago gallica*, *Andryala integrifolia*, etc.

Syndynamism: This vegetation represents a permanent vegetation of very unstable environments due to secondary volcanic activity. It shows catenal contacts with hygrophilous moss communities growing closer to emission cracks.

Habitat reference: See order.

33.1.1.18. ***Bellido annuae-Solenopsidetum laurentiae*** Brullo, Scelsi & Siracusa 1994

Annual vegetation with small laurentia and annual daisy of wet loamy soils between the clumps of *Lygeum spartum*.

Holotypus: rel. 3, tab. 2, Brullo et al. (1994).

Characteristic and differential species: *Bellis annua* L., *Solenopsis laurentia* (L.) C. Presl.

Phytosociological table: From Brullo et al. (1994), table 2, 10 rel. (subass. *coleostephetosum*).
Char. association: *Solenopsis laurentia* (V)*, Bellis annua* (V).
Char. subassociation: *Radiola linoides* (IV).
Char. alliance: *Coleostephus myconis* (V), *Galium divaricatum* (V).
Char. order and class: *Filago gallica* (V), *Aira cupaniana* (V), *Rumex bucephalophorus* (V), *Trifolium arvense* (V), *Ornithopus pinnatus* (IV), *Trifolium campestre* (III), *Linaria pelisseriana* (III), *Trifolium cherleri* (III), *Linum trigynum* (III), *Silene gallica* (III), *Trifolium nigrescens* (II), *Galium divaricatum* (I), *Coleostephus myconis* (I), *Ornithopus pinnatus* (I), *Trifolium glomeratum* (I), *Trifolium cherleri* (I), *Linum trigynum* (I), *Tillaea muscosa* (II).
Other species: *Blackstonia perfoliata* (V), *Valerianella microcarpa* (V).

From Brullo et al. (1994), table 2, 8 rel. (subass. *valantietosum*)
Char. association: *Solenopsis laurentia* (V)*, Bellis annua* (V).
Char. subassociation: *Valantia muralis* (V), *Bupleurum glaucum* (V).
Char. alliance: *Galium divaricatum* (III).
Char. order and class: *Filago gallica* (V), *Aira cupaniana* (V), *Trifolium campestre* (V), *Rumex bucephalophorus* (V), *Trifolium arvense* (III), *Linaria pelisseriana* (III), *Trifolium cherleri* (III), *Ornithopus pinnatus* (II), *Linum trigynum* (II), *Tillaea muscosa* (III), *Silene gallica* (I).
Other species: *Blackstonia perfoliata* (V), *Valerianella microcarpa* (V).

Geographical distribution: This community occurs only in the Isola Grande dello Stagnone, Marsala (Brullo et al., 1994).

Structure and ecology: The clearings of *Lygeum spartum* grasslands on wet loamy soils are colonized by an annual vegetation characterized by the dominance of *Solenopsis laurentia* and *Bellis annua*. It is the *Bellido-Solenopsidetum laurentiae,* which can be attributed to *Helianthemetea guttati* class for the occurrence of many species belonging to this syntaxon, as *Filago gallica*, *Aira cupaniana*, *Rumex bucephalophorus*, *Trifolium arvense*, *Ornithopus pinnatus*, *Trifolium campestre*, *Linaria pelisseriana*, *Trifolium cherleri*, *Linum trigynum*, *Silene gallica*, etc. Brullo et al. (1994) identified two aspects: the subass. *coleostephetosum* is characterized by the high coverage of *Coleostephus myconis* and *Radiola linoides*, which are linked to quite humid conditions; the subass. *valantietosum* occurs in more xeric stands and is floristically differentiated by *Valantia muralis* and *Bupleurum semicompositum* subsp. *glaucum*.

Syndynamism: This vegetation colonized the disturbed surfaces of perennial grasslands with *Lygeum spartum*, which are not affected by periodic floodings.

Habitat reference: See order.

33.1.1.19. ***Rumici bucephalophori-Ophioglossetum lusitanici*** Médail, Pavon, Lo Cascio & Pasta 2016

Annual vegetation with curled dock and adder's-tongue ferns of nutrient-poor volcanic soils.

Holotypus: rel. 3, tab. 1, Médail et al. (2016).

Characteristic and differential species: *Ophioglossum lusitanicum* L.

Phytosociological table: From Médail et al. (2016), table 1, 5 rel.

Char. association: *Ophioglossum lusitanicum* (V).

Char. alliance, order and class: *Rumex bucephalophorus* (V), *Ornithopus compressus* (IV), *Tolpis virgata* subsp. *gussonei* (IV), *Erodium botrys* (III), *Ornithopus pinnatus* (III), *Aira caryophyllea* (II), *Briza maxima* (I), *Filago gallica* (I).

Other species: *Echium platagineum* (V), *Silene neglecta* (V), *Hyparrhenia hirta* (IV), *Lagurus ovatus* (IV), *Citrullus colocynthis* (I).

Geographical distribution: This community was surveyed by Médail et al. (2016) for Vulcano island (Aeolian Archipelago).

Structure and ecology: The *Rumici bucephalophori-Ophioglossetum lusitanici* colonizes the quite humid volcanic sands between the perennial grasslands of *Hyparrhenia hirta* or the thermophilous maquis. *Ophioglossum lusitanicum* plays a significant physiognomic role, growing together with some species of higher rank, as *Rumex bucephalophorus*, *Ornithopus compressus*, *Tolpis virgata* subsp. *gussonei*, *Erodium botrys*, *Ornithopus pinnatus*, *Aira caryophyllea*, *Briza maxima* and *Filago gallica* (Médail et al., 2016)

Syndynamism: Actually, this vegetation is strongly affected by anthropogenic disturbance (agriculture, tourism, urbanization), as shown by the high coverage of nitrophilous species belonging to *Echio-Galactition alliance*, as well as by the progressive spreading of the invasive *Citrullus colocynthis*.

Habitat reference: See order.

33.1.2. Alliance: ***Crassulo tillaeae-Sedion caespitosi*** De Foucault 1999

Succulent ephemeral vegetation on nutrient-poor sandy soils.

Synonyms: *Sedion caespitosi* (Rivas-Martinez 1978) P. Prieto & X. Font 2005 (syntax.syn.).

Holotypus: C*rassulo tillaeae-Sedetum caespitosi* Rivas Goday 1958.

Characteristic and differential species: *Sedum caespitosum* Cav. (DC.)*, S. hispanicum* L., *Tillaea alata* Viv., *T. basaltica* (Brullo & Siracusa). Brullo, Giusso & Siracusa*, T. campestris* (Eckl. & Zeyh.) Brullo, Giusso & Siracusa, *T. muscosa* L. (= *Crassula tillaea* Lest.-Garl.).

Geographical distribution: This alliance occurs in the Western Mediterranean area (Foucault, 1999; Guarino & Pasta, 2017).

Structure and ecology: The *Crassulo tillaeae-Sedion caespitosi* groups the annual communities dominated by ephemeral succulent species, which are linked to nutrient-poor sandy soils.

Syndynamism: See order.

Habitat reference: See order.

33.1.2.1. ***Crassulo tillaeae-Erodietum botrytis*** Ferro & Furnari 1970

Annual grasslands with mossy stonecrop and mediterranean stork's sill of siliceous soils derived from volcanic rocks.

Lectotypus: Not designated.

Characteristic and differential species: *Tillaea muscosa* L., *Erodium botrys* (Cav.) Bertol., *Sagina apetala* Ard.

Phytosociological table: From Ferro & Furnari (1970), table 7, 10 rel.

Char. association: *Sagina apetala* (V), *Tillaea muscosa* (V), *Erodium botrys* (III).

Char. alliance and order: *Corynephorus articulatus* (V), *Filago gallica* (V), *Rumex bucephalophorus* (IV), *Trifolium arvense* (III), *Ornithopus pinnatus* (III), *Avellinia festucoides* (III), *Plantago bellardi* (III), *Trifolium cherleri* (III), *Trifolium glomeratum* (III), *Aira cupaniana* (III), *Ornithopus compressus* (II), *Andryala integrifolia* (II), *Silene gallica* (II), *Briza maxima* (I).

Char. class: *Tuberaria guttata* (II), *Galium parisiense* (II).

Other species: *Festuca danthonii* (IV), *Hyparrhenia hirta* (IV), *Cladanthus mixtus* (I), *Hypochaeris radicata* (I), *Lupinus angustifolius* (I), *Trifolium subterraneum* (I).

Geographical distribution: This association was described by Ferro & Furnari (1970) from Vulcano (Aeolian islands).

Structure and ecology: The shallow and poorly developed soils derived from volcanic rocks are colonized by an annual pioneer vegetation named *Crassulo-Erodietum botrytis*. Usually, this community occupies the clearings of shrubby vegetation. Under the floristic profile, it is characterized by the high coverage of *Sagina apetala*, *Tillaea muscosa* and *Erodium botrys*. The syntaxa of higher rank are represented by several species, as *Corynephorus articulatus*, *Filago*

gallica, *Rumex bucephalophorus*, *Trifolium arvense*, *Ornithopus pinnatus*, *Avellinia festucoides*, *Plantago bellardi*, etc.

Syndynamism: This vegetation derives from the degredation of thermophilous maquis (e.g. *Genistetum tyrrhenae*) and garrigues with *Cistus creticus* and *C. salvifolius*. In the most unstable surfaces affected by secondary volcanism, such as those ones located near the "Gran Cratere", the community at issue is replaced by a more pioneer vegetation with an impoverished floristic set, which is dominated by *Filago gallica* and *Festuca danthonii* (Ferro & Furnari, 1970).

Habitat reference: See order.

33.1.2.2. ***Crassulo tillaeae-Sedetum cosyrensis*** Brullo, Di Martino & Marcenò 1977

Ephemeral vegetation with mossy stonecrop and Pantelleria stonecrop of very shallow soils derived from volcanic rocks.

Synonyms: Aggr. a *Bellium minutum* Brullo & Marcenò 1976.

Holotypus: rel. 4, tab. 10, Brullo et al. (1977).

Characteristic and differential species: *Sedum rubens* L. var. *cosyrense* Somm., *Sagina apetala* Ard., *Sedum stellatum* L.

Phytosociological table: From Brullo et al. (1977), table 10, 16 rel. (subass. *crassuletosum*).

Char. association: *Sagina apetala* (V)*, Sedum rubens* var. *cosyrense* (IV)*, Sedum stellatum* (II).

Char. alliance: *Tillaea muscosa* (V)

Char. order and class: *Tuberaria guttata* (V), *Galium murale* (IV), *Filago gallica* (IV), A*ira cupaniana* (IV) *Festuca myuros* (IV), *Plantago bellardi* (III), *Silene gallica* (II), *Trifolium arvense* (II), *Hypochoeris glabra* (II), *Trifolium suffocatum* (II), *Trifolium nigrescens* (II), *Galium divaricatum* (I), *Coleostephus myconis* (I), *Ornithopus pinnatus* (I), *Trifolium glomeratum* (I), *Trifolium cherleri* (I), *Linum trigynum* (I), *Rumex bucephalophorus* (I), *Briza maxima* (I), *Ornithopus compressus* (I).

Other species: *Lagurus ovatus* (I), *Plantago coronopus* (I).

From Brullo et al. (1977), table 10, 6 rel. (subass. *bellietosum*).

Char. association and subassociation: *Bellium minutum* (V), *Sedum rubens* var. *cosyrense* (V)*, Valantia muralis (V), Silene sedoides (IV), Hypochoeris achyrophorus (IV), Catapodium balearicum (IV), Sedum stellatum* (II), *Anthemis secundiramea* var. *cosyrensis* (II), *Catapodium rigidum* (II), *Lotus cytisoides* (I).

Char. alliance: *Tillaea muscosa* (II)

Char. order and class: *Filago gallica* (V), *Festuca ligustica* (IV), *Galium murale* (III), A*ira cupaniana* (I).

Other species: *Gastridium ventricosum* (), *Plantago coronopus* (II).

Geographical distribution: This community occurs only in Pantelleria island (Brullo et al., 1977).

Structure and ecology: On the very shallow soils the *Trifolio-Andryaletum cosyrensis* in replaced by another community dominated by some succulent therophytes, as *Tillaea muscosa*, *Sedum rubens* var. *cosyrensis* and *Sedum stellatum,* forming typical reddish patches on small surfaces. This vegetation was described by Brullo et al. (1977) and ascribed to *Helianthemetea* class, which is represented by some species with a dwarf habitus, as *Tuberaria guttata*, *Filago gallica*, A*ira cupaniana*, *Festuca myuros*, *Plantago bellardi*, *Silene gallica*, *Trifolium arvense*, etc. Generally, these microphytes grows above a moss layer. In addition to the typical aspect (subass. *crassuletosum*), the authors distinguished the subass. *bellietosum*, which represents a subhalophilous and xerophilous aspect, as emphasized by the occurrence of *Bellium minutum*, *Silene* sedoides, *Catapodium balearicum* and *Lotus cytisoides*.

Syndynamism: This vegetation is a pioneer vegetation of very poor and shallow soils which normally can not further evolve.

Habitat reference: See order.

33.1.2.3. ***Herniario cinereae-Crassuletum tillaeae*** Brullo, Scelsi & Siracusa 1994

Ephemeral vegetation with hairy rupturewort and mossy stonecrop of shallow loamy-sandy soils.

Holotypus: rel. 3, tab. 3, Brullo et al. (1994).

Characteristic and differential species: *Herniaria hirsuta* L. subsp. *cinerea* (DC.) Cout*., Plantago afra* L. subsp. *afra.*

Phytosociological table: From Brullo et al. (1994), table 3, 8 rel.

Char. association: *Herniaria hirsuta* subsp. *cinerea* (V)*, Plantago afra* subsp. *afra* (II).

Char. alliance: *Tillaea muscosa* (V).

Char. order and class: *Rumex bucephalophorus* (V), *Silene gallica* (V), *Filago gallica* (V), *Hypochoeris glabra* (V), *Aira cupaniana* (IV), *Trifolium arvense* (III).

Other species: *Ononis reclinata* (V), *Blackstonia perfoliata* (V), *Bellis annua* (V).

Geographical distribution: This community occurs only in the Isola Grande dello Stagnone, Marsala (Brullo et al., 1994).

Structure and ecology: The sunny stands with loamy-sandy soils, which are partially covered by a moss layer, are colonized by a specialized annual vegetation dominated by the *Tillaea muscosa* . Besides, the structure of this community, named *Herniario cinereae-Crassuletum*

tillaeae, is given by some therophytes, such as *Rumex bucephalophorus*, *Silene gallica*, *Filago gallica*, *Hypochoeris glabra*, *Aira cupaniana* and *Trifolium arvense*.

Syndynamism: The community at issue replaces the *Bellido-Solenopsidetum laurentiae* in stands with more xeric conditions (Brullo et al., 1994).

Habitat reference: See order.

33.2. Order: ***Vulpietalia*** Pignatti 1953

Ephemeral therophytic vegetation on coastal or inner dunes.

Synonyms: *Malcolmietalia* Rivas Goday 1958 (syntax. syn.); *Vulpietalia lacerate* Rivas Goday 1958 corr. de Foucault 1999 (corr.superfl.); *Ononido variegatae-Cutandietalia maritimae* de Foucault 1999 (art. 5); *Cutandietalia maritimae* Rivas-Martinez, Dièz Garretas & Asensi in Rivas-Martinez et al. 2002 (syntax. syn.).

Holotypus: *Psammo-Vulpion* Pignatti 1953.

Characteristic and differential species:*, Avellinia festucoides* (Link) Valdés & H. Scholz, *Cutandia maritima* (L.) Benth., *Chamaemelum fuscatum* (Brot.) Vasc., *Coronilla repanda* (Poir.) Guss., *Corynephorus articulatus* (Desf.) P. Beauv., *Cutandia maritima* (L.) Benth., *Erodium chium* (L.) Willd., *E. laciniatum (Cav.) Willd. Festuca membranacea* Forssk., *Filago asterisciflora* (Lam.) Sweet., *Lagurus ovatus* L. subsp. *ovatus*, *Loeflingia hispanica* L., *Lotus hispidus* DC., *Medicago littoralis* Loisel., *Neoschischkinia elegans* Tzvelev, *Ononis diffusa* Ten., *Ononis serrata* Forssk., *Silene nicaeensis* All., *Sulla spinosissima* (L.) B.H. Choi & H. Ohashi.

Geographical distribution: See class.

Structure and ecology: The *Vulpietalia* order groups the annual psammophilous communities with spring optimum of coastal or inner sandy soils (paleodunes). Typically, this vegetation occupies more or less extended surfaces in the stabilized sand dunes and retrodunal stands, between the shrubs of coastal maquis or in the clearings of *Ammophiletea* vegetation (Pignatti, 1953; Rivas Goday, 1957).

Syndynamism: The occurrence of this vegetation is linked to disturbance of human or natural origin. It is dynamically connected mainly with the series of *Crucianelletalia maritimae* and *Quercetalia calliprini*.

Habitar reference: B1.4b Mediterranean and Macaronesian coastal dune grassland (grey dune).

33.2.1. Alliance: ***Alkanno-Maresion nanae*** Rivas Goday ex Rivas Goday & Rivas-Martínez 1963 corr. Diaz-Garretas et al. 2001

Ephemeral therophytic vegetation on coastal dunes, under salt-spray influence

Synonyms: *Alkanno-Malcolmion parviflorae* Rivas Goday 1958 (art. 2b); *Alkanno-Malcolmion ramosissimae* Rivas Goday in Rivas Goday et Rivas-Martinez 1963 (art. 43); *Alkanno-Malcolmion parviflorae* Rivas Goday ex S. Brullo & Marcenò 1974 (art. 31); *Maresio-Malcolmion ramosissimae* (Rivas-Martinez 1978) Rivas-Martinez et al. 1992 (syntax.syn.); *Malcolmion ramosissimae* Géhu & Biondi in Géhu 1994 (art. 2b, 5); *Cutandio maritimae-Vulpion membranaceae* de Foucault et Géhu in de Foucault 1999 (phantom); *Ornithopodo pinnati-Malcolmion ramosissimae* (Rivas Goday 1958) de Foucault 1999 (phantom).

Holotypus: *Erodio laciniati-Malcolmietum parviflorae* Rivas Goday 1958 corr. Costa, Díez Garretas, Soriano & Pérez Badia in Pérez Badia 1997.

Characteristic and differential species: *Alkanna tinctoria* (L.) Tousch., *Brassica tournefortii* Gouan, *Cutandia divaricata* (Desf.) Benth., *Echium arenarium* Guss., *Lomelosia rutifolia* (Vahl) Avino & P. Caputo, *Malcolmia ramosissima* (Desf.) Gennari, *Maresia nana* (DC.) Batt., *Ononis variegata* L., *Rostraria litorea* (All.) Holub., *Romulea rollii* Parl., *R. melitensis* Bég., *Wahlenbergia nutabunda* (Guss.) DC.

Geographical distribution: This vegetation occurs in the Iberian Peninsula and the Ligurian-Tyrrhenian seaboards (Mucina et al., 2016).

Structure and ecology: This alliance includes the annual communities of coastal sandy dunes, occurring in the inner belt of *Crucianelletalia maritimae* vegetation (Rivas Goday, 1957).

Syndynamism: See order.

Habitat reference: See order.

33.2.1.1. ***Vulpio membranaceae-Leopoldietum gussonei*** Brullo & Marcenò 1974

Annual sabulicolous vegetation with bearded fescue and Gussone grape hyacinth of sandy dunes.

Lectotypus: rel. 16, tab. 1, Brullo & Grillo (1985).

Characteristic and differential species: *Muscari gussonei* (Parl.) Nyman, *Senecio glaucus* L. subsp. *coronopifolius* (Maire) C. Alexander, *Brassica tournefortii* Gouan, *Medicago tornata* (L.) Mill., *Lotus halophilus* Boiss. & Spruner, *Hippocrepis multisiliquosa* L.

Phytosociological table: From Brullo & Marcenò (1974), table 1, 18 rel.

Char. association: *Muscari gussonei* (V), *Senecio glaucus* subsp. *coronopifolius* (V), *Brassica tournefortii* (IV), *Medicago tornata* (III), *Lotus halophilus* (II), *Hippocrepis multisiliquosa* (II).

Char. alliance and order: *Festuca membranacea* (V), *Cutandia divaricata* (V), *Erodium laciniatum* (V), *Malcolmia ramosissima* (V), *Ononis serrata* (IV), *Lagurus ovatus* (III), *Polycarpon diphyllum* (III), *Coronilla repanda* (III), *Alkanna tinctoria* (II), *Medicago littoralis* (I), *Echium arenarium* (I).

Char. class: *Rumex bucephalophorus* (V), *Aira caryophyllea* (V), *Tuberaria guttata* (II), *Hypochoeris glabra* (I), *Galium parisiense* (I).

Other species: *Anisantha diandra* (V), *Cyperus capitatus* (V), *Launaea resedifolia* (IV),

Geographical distribution: This community occurs in South-Eastern Sicily, from Torre Manfria (Gela) to Capo Isola delle Correnti (Brullo et al., 1994; Brullo et al., 1998).

Structure and ecology: The stabilized sandy dunes and the retrodunal stands are colonized by a spring community dominated by the endemic *Muscari gussonei*. This vegetation, named *Vulpio-Leopoldietum gussonei*, grows in the clearings of coastal maquis (e.g. *Asparago stipularis-Retametum gussonei*) or occurs in the open surfaces of psammophilous vegetation belonging to *Centaureo-Ononidietum ramosissimae* (Brullo & Marcenò, 1974). Sometimes, it is found also in the xerophilous maquis (*Junipero-Quercetum calliprini*) on sandy soils of inner stands (Brullo et al., 1998). From the floristic point of view, some annual species play a significant role, as *Senecio glaucus* subsp. *coronopifolius*, *Brassica tournefortii*, *Medicago tornata*, *Lotus halophilus* and *Hippocrepis multisiliquosa*. Besides, the alliance and the order are represented by *Festuca membranacea*, *Cutandia divaricata*, *Erodium laciniatum*, *Malcolmia ramosissima*, *Ononis serrata*, *Lagurus ovatus*, *Polycarpon diphyllum*, *Coronilla repanda*, *Alkanna tinctoria*, etc.

Syndynamism: Generally, the community at issue can be considered an early development stage of *Centaureo-Ononidietum ramosissimae*, representing the first vegetation of inner dunes. In the inland stands it can evolve towards the *Helianthemion guttati* associations, while in the disturbed surfaces it can be replaced by nitrophilous communities belonging to *Chenopodietea* (Brullo & Marcenò, 1974).

Habitat reference: See order.

33.2.1.2. ***Lomelosietum rutifoliae*** Brullo, Di Martino & Marcenò 1974 corr.

Annual sabulicolous vegetation with ruta leaved-scabious of retrodunal stands.

Synonyms: *Scabiosetum rutifoliae* Brullo, Di Martino & Marcenò 1974 (origin. form).

Lectotypus: rel. 10, tab. 5, Brullo & Grillo (1985).

Characteristic and differential species: *Lomelosia rutifolia* (Vahl) Avino & P.Caputo.

Phytosociological table: From Brullo et al. (1974), table 5, 15 rel.

Char. association: *Lomelosia rutifolia* (V).

Char. alliance and order: *Silene colorata* (V), *Medicago littoralis* (V), *Ononis diffusa* (V), *Lagurus ovatus* (V), *Erodium laciniatum* (V), *Festuca membranacea* (IV), *Echium arenarium* (IV), *Corynephorus fasciculatus* (III), *Alkanna tinctoria* (III), *Polycarpon tetraphyllum* subsp. *diphyllum* (II).

Char. class: *Rumex bucephalophorus* (V), *Briza maxima* (II), *Festuca myuros* (I).

Other species: *Lotus creticus* (V), *Hedypnois cretica* (V), *Pseudorlaya pumila* (V), *Euphorbia terracina* (V), *Anisantha diandra* (V).

Geographical distribution: This community occurs in Western Sicily, from Capo Granitola to Selinunte (Brullo et al., 1974).

Structure and ecology: The abandoned vineyards occurring in the inner sandy dunes are colonized by a peculiar annual community dominated by *Lomelosia rutifolia*, a psammophilous species with a south-western Mediterranean distribution. It is the *Lomelosietum rutifoliae*, whose floristic set includes several species of alliance and order, as *Silene colorata*, *Medicago littoralis*, *Ononis diffusa*, *Lagurus ovatus*, *Erodium laciniatum*, *Festuca membranacea*, *Echium arenarium*, *Corynephorus fasciculatus*, *Alkanna tinctoria*, etc.

Syndynamism: See order.

Habitat reference: See order.

33.2.1.3. ***Sileno nicaeensis-Chamaemeletum mixti*** Brullo in Brullo et al. 1988

Annual sabulicolous vegetation with Nizza campion and wild chamomile of retrodunal stands.

Holotypus: rel. 1, tab. 4, Brullo et al. (1988).

Characteristic and differential species: *Chamaemelum mixtum* (L.) All., *Silene nicaeensis* All.

Phytosociological table: From Brullo et al. (1988), table 4, 6 rel.

Char. association: *Chamaemelum mixtum* (V), *Silene nicaeensis* (V).

Char. alliance and order: *Festuca membranacea* (V), *Medicago littoralis* (V), *Ononis diffusa* (IV), *Lagurus ovatus* (IV), *Echium arenarium* (II), *Polycarpon tetraphyllum* subsp. *diphyllum* (II).

Char. class: *Andryala integrifolia* (V), *Rumex bucephalophorus* (III), *Silene gallica* (II).

Other species: *Cutandia maritima* (V), *Lysimachia arvensis* (V), *Ononis variegata* (III), *Plantago coronopus* (III).

Geographical distribution: This community occurs in the sandy coast at the Simeteo mouth, near Catania (Brullo et al., 1988).

Structure and ecology: The open surfaces of flat retrodunal stands are covered by an annual community dominated by *Chamaemelum mixtum* and *Silene nicaeensis*. This vegetation, named *Sileno nicaeensis-Chamaemeletum mixti*, is rich in annual species belonging to the syntaxa of higher rank, as *Festuca membranacea*, *Medicago littoralis*, *Ononis diffusa*, *Lagurus ovatus*, *Echium arenarium* and *Polycarpon tetraphyllum* subsp. *diphyllum*.

Syndynamism: This vegetation is linked to disturbed sandy surfaces, representing a very early stage of *Centaureo-Ononidetum ramosissimae*.

Habitat reference: See order.

33.2.1.4. ***Onobrychido caput-galli-Cerastietum gussonei*** Brullo & Grillo 1985

Annual sabulicolous vegetation with cockscomb sainfoin and fourstamen chickweed of retrodunal stands.

Holotypus: rel. 3, tab. 2, Brullo & Grillo (1985).

Characteristic and differential species: *Cerastium diffusum* Pers. subsp. *gussonei* (Tod. ex Lojac.) P.D. Sell & Whitehead, *Onobrychis caput-galli* (L.) Lam.

Phytosociological table: From Brullo et al. (1988), table 5, 10 rel.

Char. association: *Cerastium diffusum* subsp. *gussonei* (V), *Onobrychis caput-galli* (V).

Char. alliance and order: *Festuca membranacea* (V), *Corynephorus fasciculatus* (V), *Ononis diffusa* (V), *Medicago littoralis* (V), *Lagurus ovatus* (V), *Polycarpon tetraphyllum* subsp. *diphyllum* (V), *Ononis diffusa* (IV), *Echium arenarium* (III), *Maresia nana* (III), *Erodium laciniatum* (I).

Char. class: *Rumex bucephalophorus* (V), *Trifolium campestre* (V), *Silene gallica* (V), *Andryala integrifolia* (III), *Aira cupaniana* (III), *Ornithopus compressus* (III), *Briza maxima* (III), *Festuca myuros* (II), *Trifolium arvense* (II), *Festuca danthonii* (I), *Trifolium cherleri* (I).

Other species: *Arenaria leptoclados* (V), *Silene colorata* (V), *Euphorbia terracina* (V), *Pseudorlaya pumila* (V), *Ononis ramosissima* (V), *Lysimachia arvensis* (V), *Asparagus acutifolius* (IV), *Medicago minima* (III).

Geographical distribution: This community occurs in the sandy coast at the Simeteo mouth near Catania (Brullo et al., 1988).

Structure and ecology: In the clearings of inner retrodunal stands covered by the *Centaureo-Ononidetum ramosissimae*, the previous association is replaced by the *Onobrychido-Cerastietum gussonei*. This community shows a remarkable floristic richness, being characterized by the occurrence of *Cerastium diffusum* subsp. *gussonei*, *Onobrychis caput-galli* and many species of alliance and order, such as *Festuca membranacea*, *Corynephorus fasciculatus*, *Ononis diffusa*, *Medicago littoralis*, *Lagurus ovatus*, *Polycarpon tetraphyllum* subsp.

diphyllum, *Medicago littoralis*, *Ononis diffusa*, *Echium arenarium*, *Maresia nana* and *Erodium laciniatum.*

Syndynamism: This heliophilous community is becoming remarkably rare due to reforestation of inner dunes with pines and eucalyptuses (Brullo & Grillo, 1985).

Habitat reference: See order.

33.2.1.5. ***Anthemido peregrinae-Centauretum conocephalae*** Brullo & Grillo 1985

Annual sabulicolous vegetation with sea chamomile *and* divaricate cornflower of flat sandy surfaces.

Holotypus: rel. 2 , tab. 1, Brullo & Grillo (1985).

Characteristic and differential species: *Anthemis peregrina* L., *Centaurea deusta* Ten. subsp. *divaricata* (Guss.) Matthäs, *Crepis foetida* L.

Phytosociological table: From Brullo & Grillo (1985), table 1, 5 rel.

Char. association: *Centaurea deusta* subsp. *divaricata* (V), *Crepis foetida* (IV), *Anthemis peregrina* (II).

Char. alliance and order: *Festuca membranacea* (V), *Corynephorus fasciculatus* (V), *Ononis diffusa* (V), *Medicago littoralis* (V), *Anisantha rigida* (V), *Lagurus ovatus* (IV), *Echium sabulicola* (III), *Polycarpon tetraphyllum* subsp. *diphyllum* (III).

Char. class: *Trifolium campestre* (V), *Trifolium arvense* (V), *Jasione montana* (V), *Andryala integrifolia* (V), *Aira cupaniana* (IV), *Plantago bellardi* (IV), *Lupinus angustifolius* (IV), *Filago gallica* (III), *Briza maxima* (III), *Hypochoeris glabra* (III), *Rumex bucephalophorus* (III).

Other species: *Lobularia maritima* (V), *Silene nicaeensis* (V), *Calystegia soldanella* (V), *Silene colorata* (V), *Lysimachia arvensis* (V).

Geographical distribution: This community is circumscribed to some small beaches near Messina, NE Sicily (Brullo & Grillo, 1985).

Structure and ecology: The association at issue colonizes the flat sandy surfaces near the sea, among the clumps of *Ammophila arenaria*. From the floristic point of view, it is characterized by the occurrence of two very rare species, as *Anthemis peregrina* and *Centaurea deusta* subsp. *divaricata*, as well as by *Crepis foetida*, which finds its optimum on these sandy soils. The higher syntaxa are represented by *Festuca membranacea*, *Corynephorus fasciculatus*, *Ononis diffusa*, *Medicago littoralis*, *Anisantha rigida*, *Lagurus ovatus*, *Echium sabulicola*, *Polycarpon tetraphyllum* subsp. *diphyllum*, *Trifolium campestre*, *Trifolium arvense*, *Jasione montana* V, *Andryala integrifolia*, etc. (Brullo & Grillo, 1985).

Syndynamism: This vegetation is strongly threatened by the tourist and urban development of the coastal areas.

Habitat reference: See order.

33.2.1.6. ***Maresio ramosissimae-Walenbergietum nutabundae*** Brullo & Grillo 1985

Ephemeral microphytic vegetation with dwarf branched maresia and small bellflower of sandy surfaces.

Holotypus: rel. 7, tab. 3, Brullo & Grillo (1985).

Characteristic and differential species: *Wahlenbergia lobelioides* (L. f.) Link subsp. *nutabunda* (Guss.) Murb.

Phytosociological table: From Brullo & Grillo (1985), table 3, 7 rel.

Char. association: *Wahlenbergia lobelioides* subsp. *nutabunda* (V).

Char. alliance and order: *Malcolmia ramosissima* (V), *Polycarpon tetraphyllum* subsp. *diphyllum* (V), *Festuca membranacea* (V), *Corynephorus fasciculatus* (V), *Lagurus ovatus* (V), *Anisantha rigida* (IV).

Char. class: *Rumex bucephalophorus* (V), *Festuca danthonii* (V), *Filago gallica* (V), *Silene gallica* (V), *Lupinus angustifolius* (IV), *Aira cupaniana* (IV), *Hypochoeris glabra* (IV), *Galium parisiense* (IV), *Ornithopus pinnatus* (IV), *Avellinia festucoides* (III), *Festuca myuros* (III), *Tillaea muscosa* (III), *Ornithopus compressus* (III).

Other species: *Lobularia maritima* (V), *Brassica fruticulosa* (V), *Cynodon dactylon* (V).

Geographical distribution: This vegetation occurs only in Panarea Island, belonging to Aeolian Archipelago (Brullo & Grillo, 1985).

Structure and ecology: The *Maresio-Walenbergietum nutabundae* is found only in a small sandy beach of Panarea, where is linked to quite sheltered stands between the shrubs. It is an ephemeral microphytic vegetation dominated by *Malcolmia ramosissima* and *Wahlenbergia lobelioides* subsp. *nutabunda*, a very rare Western Mediterranean species having its only Sicilian stands in this community (Brullo & Grillo, 1985). The alliance and the order are represented by *Polycarpon tetraphyllum* subsp. *diphyllum*, *Festuca membranacea*, *Corynephorus fasciculatus*, *Lagurus ovatus* and *Anisantha rigida*, while the class includes *Rumex bucephalophorus*, *Festuca danthonii*, *Filago gallica*, *Silene gallica*, *Lupinus angustifolius*, *Aira cupaniana*, etc.

Syndynamism: See order.

Habitat reference: See order.

33.2.1.7. ***Loto peregrini-Ononidetum serratae*** Brullo & Grillo 1985

Annual sabulicolous vegetation with pilgrim bird's foot trefoil and serrated restharrows of volcanic sands.

Holotypus: rel. 2, tab. 4, Brullo & Grillo (1985).

Characteristic and differential species: *Amberboa lippii* DC., *Lotus peregrinus* L., *Silene apetala* Willd.

Phytosociological table: From Brullo & Siracusa (1996), table 14, 9 rel.

Char. association: *Lotus peregrinus* (V), *Amberboa lippii* (III), *Silene apetala* (II).

Char. alliance: *Ononis serrata* (V), *Lotus halophilus* (V), *Echium sabulicolum* (V), *Brassica tournefortii* (III), *Alkanna tinctoria* (II).

Char. order: *Festuca membranacea* (V), *Erodium laciniatum* (V), *Lagurus ovatus* (IV), *Ononis diffusa* (III).

Char. class: *Rumex bucephalophorus* (V), *Andryala integrifolia* (IV), *Trifolium arvense* (II), *Avellinia festucoides* (I), *Trifolium campestre* (I), *Filago gallica* (I), *Aira cupaniana* (I), *Silene gallica* (I).

Other species: *Lobularia maritima* (V), *Reichardia tingitana* (V), *Euphorbia terracina* (IV).

Geographical distribution: This community occurs only in Linosa island, where is quite frequent (Brullo & Grillo, 1985; Brullo & Siracusa, 1996).

Structure and ecology: The *Loto-Ononidetum serratae* grows on stabilized volcanic sands and is characterized by the dominance of two eastern Mediterranean species, as *Ononis serrata* and *Lotus peregrinus*. Besides, also *Amberboa lippii* and *Silene apetala* can be considered the characteristic species of this association. The alliance and the order are represented by *Lotus halophilus*, *Echium sabulicolum*, *Brassica tournefortii*, *Festuca membranacea*, *Erodium laciniatum*, *Lagurus ovatus*, *Ononis diffusa*, etc. (Brullo & Siracusa, 1996).

Syndynamism: Usually this vegetation tends to colonize the abandoned crops, representing the first stage of the *Periplocion angustifoliae* series.

Habitat reference: See order.

33.2.1.8. ***Cutandio maritimae-Parapholietum marginatae*** Bartolo, Brullo, Minissale & Spampinato 1990

Annual sabulicolous vegetation with coastal cutandia grass and marginated hard-grass of flat sandy surfaces.

Holotypus: rel. 2, tab. 24, Bartolo et al. (1990a).

Characteristic and differential species: *Catapodium balearicum* (Willk.) H.Scholz, *Parapholis marginata* Runemark.

Phytosociological table: From Bartolo et al. (1990a), table 24, 5 rel.

Char. association: *Catapodium balearicum* (V), *Parapholis marginata* (V).

Char. alliance and order: *Cutandia maritima* (V), *Echium arenarium* (V), *Medicago littoralis* (V), *Erodium laciniatum* (IV), *Festuca membranacea* (III).

Other species: *Elytrigia juncea* (V), *Hedypnois cretica* (V), *Hordeum murinum* subsp. *leporinum* (V), *Rhodalsine geniculata* (IV), *Plantago coronopus* (IV).

Geographical distribution: This community is restricted to Lampedusa island (Bartolo et al., 1990).

Structure and ecology: The *Cutandio-Parapholietum marginatae* replaces the *Sporobolo-Agropyretum juncei* in the inner part of small sandy beaches, colonizing the open flat surfaces. Under the floristic profile, this community is characterized by the occurrence of *Parapholis marginata*. The alliance and the order are represented by few species, as *Cutandia maritima*, *Echium arenarium*, *Medicago littoralis*, *Erodium laciniatum* and *Festuca membranacea*.

Syndynamism: See order.

Habitat reference: See order.

33.2.1.9. ***Bupleuro semicompositi-Ononidetum reclinatae*** Brullo, Scelsi & Siracusa 1994

Annual sabulicolous vegetation with small restharrow and grey hare's ear of flat sandy surfaces.

Holotypus: rel. 5, tab. 4, Brullo et al. (1994).

Characteristic and differential species: *Bupleurum semicompositum* L. subsp. *glaucum* (Robill. & Castagne ex DC.) Rouy & E.G. Camus

Phytosociological table: From Brullo et al. (1994), table 4, 8 rel.

Char. association: *Bupleurum semicompositum* subsp. *glaucum* (V).

Char. alliance and order: *Ononis reclinata* (V), *Festuca membranacea* (V), *Medicago littoralis* (V), *Pseudorlaya pumila* (V), *Polycarpon tetraphyllum* subsp. *diphyllum* (V), *Lagurus ovatus* (V), *Echium arenarium* (IV).

Char. class: *Rumex bucephalophorus* (V), *Filago gallica* (V), *Avellinia festucoides* (V), *Hypochoeris glabra* (III), *Trifolium cherleri* (III), *Tillaea muscosa* (III), *Silene gallica* (III), *Trifolium campestre* (III), *Aira cupaniana* (III), *Trifolium arvense* (III), *Festuca myuros* (II).

Other species: *Bellis annua* (V), *Silene colorata* (V), *Blackstonia perfoliata* (V), *Valantia muralis* (V), *Evax pygmaea* (V), *Sonchus bulbosus* (V), *Catapodium balearicum* (IV), *Filago pyramidata* (IV).

Geographical distribution: This community is circumscribed to Isola Grande dello Stagnone, near Marsala (Brullo et al., 1988).

Structure and ecology: The *Bupleuro-Ononidetum reclinatae* is an annual community of xeric sandy surfaces, which is dominated by *Bupleurum semicompositum* subsp. *glaucum* and *Ononis reclinata*. The alliance and order are represented by *Ononis reclinata*, *Festuca membranacea*, *Medicago littoralis*, *Pseudorlaya pumila*, *Polycarpon tetraphyllum* subsp. *diphyllum*, *Lagurus ovatus* and *Echium arenarium*, while among the species of class, *bucephalophorus*, *Filago gallica*, *Avellinia festucoides*, *Hypochoeris glabra*, *Trifolium cherleri* and *Tillaea muscosa* are quite frequent.

Syndynamism: See order.

Habitat reference: See order.

33.2.1.10. ***Vulpio membranaceae-Cutandietum divaricatae*** Brullo & Scelsi 1998

Annual sabulicolous vegetation with bearded fescue and cutandia grass of retrodunal stands.

Holotypus: rel. 14, tab. 8, Brullo & Scelsi (1998).

Characteristic and differential species: *Cutandia divaricata* (Desf.) Benth.

Phytosociological table: From Brullo & Scelsi (1998), table 8, 14 rel.

Char. association: *Cutandia divaricata* (V).

Char. alliance and order: *Festuca membranacea* (V), *Erodium laciniatum* (V), *Senecio glaucus* subsp. *coronopifolius* (V), *Ononis variegata* (V), *Medicago littoralis* (V), *Cutandia maritima* (V), *Lagurus ovatus* (IV), *Pseudorlaya pumila* (IV), *Echium arenarium* (IV), *Maresia nana* (III), *Brassica tournefortii* (III).

Char. class: *Rumex bucephalophorus* (IV), *Erodium botrys* (III), *Andryala integrifolia* (II).

Other species: *Silene colorata* (V), *Euphorbia terracina* (V), *Launaea resedifolia* (IV).

Geographical distribution: This community occurs in the southern coast of Sicily, between Licata and Capo Passero (Brullo & Scelsi, 1998).

Structure and ecology: The stabilized sandy surfaces of retrodunal stands are colonized by an annual vegetation dominated by *Cutandia divaricata*. Generally, this community is found in the clearings of *Centaureo-Ononidetum ramosissimae*. The syntaxa of higher rank are represented by many species, including *Festuca membranacea*, *Erodium laciniatum*, *Senecio glaucus* subsp. *coronopifolius*, *Ononis variegata*, *Medicago littoralis*, *Cutandia maritima*,

Lagurus ovatus, *Pseudorlaya pumila*, *Echium arenarium*, *Maresia nana* and *Brassica tournerfortii*.

Syndynamism: See order.

Habitat reference: See order.

33.2.1.11. ***Vulpio membranaceae-Romuletum rollii*** Brullo & Scelsi 1998

Annual sabulicolous vegetation with bearded fescue and Rolli's sand crocus of retrodunal stands.

Holotypus: rel. 8, tab. 9, Brullo & Scelsi (1998).

Characteristic and differential species: *Romulea rollii* Parl.

Phytosociological table: From Brullo & Scelsi (1998), table 9, 12 rel.

Char. association: *Romulea rollii* (V).

Char. alliance and order: *Festuca membranacea* (V), *Erodium laciniatum* (V), *Senecio glaucus* subsp. *coronopifolius* (V), *Lagurus ovatus* (V), *Medicago littoralis* (V), *Echium arenarium* (V), *Polycarpon tetraphyllum* subsp. *diphyllum* (IV), *Silene nicaeensis* (IV), *Cutandia maritima* (IV), *Pseudorlaya pumila* (III), *Ononis variegata* (III), *Corynephorus fasciculatus* (II), *Maresia nana* (II), *Brassica tournefortii* (II).

Char. class: *Andryala integrifolia* (V), *Rumex bucephalophorus* (IV), *Trifolium campestre* (III), *Filago gallica* (III), *Cerastium semidecandrum* (II), *Plantago bellardi* (II).

Other species: *Silene colorata* (V), *Hedypnois rhagadioloides* (V), *Plantago afra* (III).

Geographical distribution: This community occurs in the Ionian coast of Hylaean area (Brullo & Scelsi, 1998).

Structure and ecology: The open sandy surfaces between the *Centaureo-Ononidetum ramosissimae* and the coastal maquis of *Ephedro-Juniperetum macrocarpae* are covered by an ephemeral community characterized by the occurrence of the rare *Romulea rollii*. It is the *Vulpio-Romuletum rollii*, whose structure is given by many therophytes of *Alkanno-Malcolmion* and *Vulpietalia*, as *Festuca membranacea*, *Erodium laciniatum*, *Senecio glaucus* subsp. *coronopifolius*, *Lagurus ovatus*, *Medicago littoralis*, *Echium arenarium*, *Polycarpon tetraphyllum* subsp. *diphyllum*, *Silene nicaeensis*, *Cutandia maritima*, etc.

Syndynamism: See order.

Habitat reference: See order.

33.2.1.12. ***Vulpio membranaceae-Hormuzakietum aggregatae*** Brullo, Guarino & Ronsisvalle 1998

Annual sabulicolous vegetation with bearded fescue and massed alkanet of xeric retrodunal stands.

Holotypus: rel. 9, tab. 20, Brullo et al. (1998).

Characteristic and differential species: *Hormuzakia aggregata* (Lehm.) Guşul.

Phytosociological table: From Brullo et al. (1998), table 20, 10 rel.

Char. association: *Hormuzakia aggregata* (V).

Char. alliance and order: *Festuca membranacea* (V), *Erodium laciniatum* (V), *Cutandia maritima* (V), *Senecio glaucus* subsp. *coronopifolius* (V), *Lagurus ovatus* (V), *Pseudorlaya pumila* (IV), *Medicago tornata* (IV), *Medicago littoralis* (III), *Silene nicaeensis* (III), *Brassica tournefortii* (II), *Ononis diffusa* (I), *Maresia nana* (I).

Char. class: *Rumex bucephalophorus* (II).

Other species: *Anisantha rigida* (V), *Silene colorata* (V), *Minuartia geniculata* (II).

Geographical distribution: This community was described by Brullo et al. (1998) from Torre Manfria near Gela, but occurs also in some stands of Agrigento coast.

Structure and ecology: The clearings of *Centaureo-Ononidetum ramosissimae* in very xeric stands are colonized by the *Vulpio membranaceae-Hormuzakietum aggregatae.* It is an annual community with a thermophilous character, which is dominated by the rare *Hormuzakia aggregata*. The alliance and the order are represented by *Festuca membranacea*, *Erodium laciniatum*, *Cutandia maritima*, *Senecio glaucus* subsp. *coronopifolius*, *Lagurus ovatus*, *Pseudorlaya pumila*, *Medicago tornata*, *Medicago littoralis*, etc.

Syndynamism: See order.

Habitat reference: See order.

33.2.1.13. ***Centrantho calcitrapae-Catapodietum hemipoae*** Brullo, Guarino & Ronsisvalle 1998

Annual sabulicolous vegetation with Spanish valerian of shady sandy surfaces.

Holotypus: rel. 3, tab. 23, Brullo et al. (1998).

Characteristic and differential species: *Catapodium hemipoa* (Delile ex Spreng.) M. Laínz, *Centranthus calcitrapae* (L.) Dufr.

Phytosociological table: From Brullo et al. (1998), table 23, 7 rel.

Char. association: *Catapodium hemipoa* (V), *Centranthus calcitrapae* (V).

Char. alliance and order: *Festuca membranacea* (V), *Lagurus ovatus* (V), *Silene colorata* (V), *Senecio glaucus* subsp. *coronopifolius* (V), *Erodium laciniatum* (IV), *Cutandia maritima* (IV), *Pseudorlaya pumila* (III), *Cutandia divaricata* (I), *Ononis variegata* (I).

Char. class: *Rumex bucephalophorus* (II).

Other species: *Anisantha rigida* (V), *Sonchus oleraceus* (II).

Geographical distribution: This vegetation occurs only in Torre Manfria near Gela (Brullo et al., 1998)

Structure and ecology: The *Centrantho-Catapodietum hemipoae* is an annual psammophilous community with a slightly nitrophilous and sciaphilous character, usually occurring in the undergrowth of the *Asparago stipularis-Retametum gussonei*. Its physiognomy is given by *Catapodium hemipoa* and *Centranthus calcitrapae*, growing together with some species of higher rank, as *Festuca membranacea*, *Lagurus ovatus*, *Silene colorata*, *Senecio glaucus* subsp. *coronopifolius*, *Erodium laciniatum*, *Cutandia maritima*, *Pseudorlaya pumila*, *Cutandia divaricata* and *Ononis variegata*.

Syndynamism: See order.

Habitat reference: See order.

33.2.1.14. ***Sileno coloratae-Ononidetum variegatae*** Gèhu & Gèhu-Franck 1986

Annual sabulicolous vegetation with mediterranean catchfly and villous restharrow of flat sandy surfaces.

Holotypus: rel. 5, tab. 6, Gèhu & Gèhu-Franck (1986).

Characteristic and differential species: *Ononis variegata* L., *Silene colorata* Poir.

Phytosociological table: From Brullo et al. (1998), table 21, 6 rel.

Char. association: *Ononis variegata* (V), *Silene colorata* (V).

Char. alliance and order: *Cutandia maritima* (V), *Silene nicaeensis* (V), *Erodium laciniatum* (V), *Senecio glaucus* subsp. *coronopifolius* (V), *Festuca membranacea* (IV), *Pseudorlaya pumila* (V), *Lagurus ovatus* (V).

Other species: *Anisantha rigida* (V), *Euphorbia terracina* (V).

Geographical distribution: This vegetation is quite frequent in the southern coast of Sicily (Brullo et al., 1998). It was originally described by Géhu & Gèhu-Franck (1986) from Tunisia.

Structure and ecology: The flat surfaces between dunes and the open retrodunal stands with unstabilized sands are colonized by an annual community dominated by *Silene colorata* and

Ononis variegata. It is the *Sileno coloratae-Ononidetum variegatae*, which is usually found mixed with the *Seseli-Crucianelletum maritimae* and *Medicagini-Ammophiletum* (Brullo et al., 1998). The floristic set includes some species of alliance and order, as *Cutandia maritima*, *Silene nicaeensis*, *Erodium laciniatum*, *Senecio glaucus* subsp. *coronopifolius*, *Festuca membranacea*, *Pseudorlaya pumila* and *Lagurus ovatus*.

Syndynamism: See order.

Habitat reference: See order.

33.2.1.15. ***Airo cupanianae-Bryetum argentei*** Bonanno & Lo Giudice 2009

Annual sabulicolous vegetation with southern hairgrass and silvery thread moss of sloping sandy surfaces.

Holotypus: rel. 3, tab. 21, Bonanno & Lo Giudice (2009).

Characteristic and differential species: *Bryum argenteum* Hedw.

Phytosociological table: From Bonanno & Lo Giudice (2009), table 21, 9 rel.
Char. association: *Bryum argenteum* (V).
Char. alliance and order: *Erodium laciniatum* (V), *Polycarpon tetraphyllum* subsp. *diphyllum* (III), *Ononis variegata* (II), *Anisantha rigida* (II), *Plantago bellardi* (I), *Silene colorata* (I).
Char. class: *Aira cupaniana* (V),
Other species: *Bryum bicolor* (IV), *Bryum caespiticium* (II).

Geographical distribution: This community was surveyed for Aquicella stream, near Catania (Bonanno & Lo Giudice, 2009).

Structure and ecology: The *Airo cupanianae-Bryetum argentei* is a subnitrophilous community linked to quite shady sandy slopes, often sheltered by perennial psammophilous vegetation. Under the floristic profile, it is differentiated by the occurrence of the moss *Bryum argenteum*, occurring together with *Aira cupaniana* and some species of alliance and order, as *Erodium laciniatum*, *Polycarpon tetraphyllum* subsp. *diphyllum*, *Ononis variegata*, *Anisantha rigida*, *Plantago bellardi* and *Silene colorata* (Bonanno & Lo Giudice, 2009).

Syndynamism: It is a pioneer vegetation of disturbed sandy surfaces.

Habitat reference: See order.

33.2.1.16. ***Sileno nicaeensis-Maresietum nanae*** Minissale & Sciandrello 2010

Annual sabulicolous vegetation with Nizza campion and dwarf maresia of stabilized sandy surfaces.

Holotypus: rel. 4, tab. 11, Minissale & Sciandrello (2010).

Characteristic and differential species: *Silene nicaeensis* All.

Phytosociological table: From Minissale & Sciandrello (2010), table 11, 5 rel.

Char. association: *Silene nicaeensis* (V).

Char. alliance and order: *Polycarpon tetraphyllum* subsp. *diphyllum* (V), *Maresia nana* (V), *Erodium laciniatum* (V), *Echium arenarium* (III), *Centranthus calcitrapa* (III), *Corynephorus divaricatus* (II).

Char. class: *Rumex bucephalophorus* (II), *Arenaria serpyllifolia* (I).

Other species: *Plantago afra* (V), *Lysimachia arvensis* (II).

Geographical distribution: This vegetation occurs in the south-eastern coast of Sicily (Minissale & Sciandrello, 2010).

Structure and ecology: The open sandy surfaces in the clearings of *Sarcopoterium spinosum* garrigue are colonized by an ephemeral vegetation dominated by *Silene nicaeensis* and *Maresia nana*. This community, named *Sileno nicaeensis-Maresietum nanae*, can be ascribed to *Vulpietalia* order and *Alkanno-Maresion nanae* alliance, which are represented by many species, as *Polycarpon tetraphyllum* subsp. *diphyllum*, *Maresia nana*, *Erodium laciniatum*, *Echium arenarium*, *Centranthus calcitrapa* and *Corynephorus divaricatus*.

Syndynamism: See order.

Habitat reference: See order.

33.2.2. Alliance: ***Filagini asterisciflorae-Linarion humilis*** Minissale & Sciandrello 2015

Ephemeral therophytic vegetation of fossil dunes.

Holotypus: *Filagini asterisciflorae-Loeingietum hispanicae* Minissale & Sciandrello 2015.

Characteristic and differential species: *Filago asterisciflora* (Lam.) Sweet., *Helianthemum aegyptiacum* (L.) Mill., *Linaria multicaulis* (L.) Mill. subsp. *humilis* (Guss.) De Leon., Giardina & Zizza, *Senecio glaucus* L. subsp. *hyblaeus* Brullo, *Tuberaria villosissima* (Pomel) Grosser. var. *sicula* Grosser, *Tuberaria praecox* Grosser.

Geographical distribution: This vegetation occurs only in southern Sicily (Camarino-Pachinense district) (Minissale & Sciandrello, 2015).

Structure and ecology: According to Minissale & Sciandrello (2015), this alliance groups the annual communities of fossil dunes and deep sandy soils. This vegetation is characterized by the occurrence of rare or endemic species, as *Filago* asterisciflora, *Linaria multicaulis* subsp. *humilis, Senecio glaucus* subsp. *hyblaeus*, *Tuberaria villosissima* var. *sicula* and *Tuberaria praecox*.

Syndynamism: See order.

Habitat reference: See order.

33.2.2.1. ***Filago asterisciflorae-Tuberarietum siculae*** Brullo & Grillo 1985 corr. Guarino et al. 2017

Annual sabulicolous vegetation with greater cudweed and Sicily annual rock-rose of inner sandy surfaces.

Synonyms: *Evaco-Tuberarietum siculae* Brullo & Grillo 1985.

Holotypus: rel. 5, tab. 5, Brullo & Grillo (1985).

Characteristic and differential species: *Tuberaria villosissima* (Pomel) Grosser. var. *sicula* Grosser.

Phytosociological table: From Brullo & Grillo (1985), table 5, 12 rel.

Char. association: *Tuberaria villosissima* var. *sicula* (V).

Char. alliance: *Filago asterisciflora* (V), *Senecio glaucus* subsp. *hyblaeus* (V), *Hippocrepis ciliata* (V), *Helianthemum aegyptiacum* (II).

Char. order and class: *Alkanna tinctoria* (V), *Rumex bucephalophorus* (V), *Filago gallica* (V), *Avellinia festucoides* (V), *Plantago bellardi* (V), *Festuca danthonii* (V), *Festuca membranacea* (V), *Coronilla repanda* (V), *Aira cupaniana* (IV), *Cerastium semidecandrum* (IV), *Erodium laciniatum* (IV), *Medicago littoralis* (IV), *Festuca myuros* (III), *Lagurus ovatus* (III), *Corynephorus articulatus* (III), *Briza maxima* (III), *Ornithopus compressus* (III), *Trifolium campestre* (III), *Maresia nana* (III), *Lupinus angustifolius* (III), *Silene gallica* (III), *Erodium botrys* (III), *Lysimachia linum-stellatum* (III), *Hypochoeris glabra* (III), *Psilurus incurvus* (III), *Lotus halophilus* (II), *Trifolium cherleri* (II), *Ornithopus pinnatus* (II), *Brassica tournerfortii* (II), *Tuberaria guttata* (I), *Tolpis umbellata* (I).

Other species: *Filago lutescens* (V), *Silene colorata* (V).

Geographical distribution: This community occurs in the inner areas of Central and southern Sicily (Brullo & Grillo, 1985).

Structure and ecology: The open stands of inner sandy surfaces are colonized by an annual grassland with a rich floristic set, including two endemic species as *Tuberaria villosissima* var. *sicula* and *Senecio glaucus* subsp. *hyblaeus*, as well as some annual species belonging to

alliance, as *Filago asterisciflora*, *Senecio glaucus* subsp. *hyblaeus*, *Hippocrepis ciliata* and *Helianthemum aegyptiacum*. Among the species of order and class, *Alkanna tinctoria*, *Rumex bucephalophorus*, *Filago gallica*, *Avellinia festucoides*, *Plantago bellardi*, *Festuca danthonii*, *Festuca membranacea*, *Coronilla repanda*, *Aira cupaniana*, *Cerastium semidecandrum*, *Erodium laciniatum*, *Medicago littoralis*, etc. (Brullo & Grillo, 1985).

Syndynamism: This vegetation has its primary stands on the on the clearings of cork oak woodlands belonging to *Stipo bromoidis-Quercetum suberis* or among the shrubs of *Thymo-Helichrysetum stoeachadis* and other kinds of garrigue. However, generally it derives from the degradation of woody vegetation, due to frequent fires and other disturbing factors (Brullo & Grillo, 1985).

Habitat reference: See order.

33.2.2.2. ***Alkanno tinctoriae-Nonetum vesicariae*** Brullo & Scelsi 1998

Annual sub-nitrophilous vegetation with dyer's alkanet and red monkswort of inner sandy surfaces.

Holotypus: rel. 1, tab. 10, Brullo & Scelsi (1998).

Characteristic and differential species: *Nonea vesicaria* (L.) Rchb.

Phytosociological table: From Brullo & Scelsi (1998), table 10, 5 rel.

Char. association: *Nonea vesicaria* (V).

Char. alliance and order: *Alkanna tinctoria* (V), *Erodium laciniatum* (V), *Festuca membranacea* (V), *Medicago littoralis* (V), *Polycarpon tetraphyllum* subsp. *diphyllum* (V), *Echium arenarium* (IV), *Brassica tournefortii* (IV), *Senecio glaucus subsp. coronopifolius* (III), *Maresia nana* (III).

Char. class: *Rumex bucephalophorus* (V), *Andryala integrifolia* (III), *Gastridium ventricosum* (III), *Trifolium campestre* (III), *Filago gallica* (II).

Other species: *Euphorbia terracina* (V), *Glebionis coronarium* (V).

Geographical distribution: This community occurs only in the inner area of South-Eastern Sicily, near Gela and Vittoria (Brullo & Scelsi, 1998; Minissale & Sciandrello, 2005, 2010).

Structure and ecology: The paleodunes of inner stands are colonized by an annual community with a sub-nitrophilous and thermophilous character. This vegetation, named *Alkanno-Nonetum vesicariae*, is dominated by the rare *Nonea vesicaria*, occurring with some species of higher rank, as *Alkanna tinctoria*, *Erodium laciniatum*, *Festuca membranacea*, *Medicago littoralis*, *Polycarpon tetraphyllum* subsp. *diphyllum*, *Echium arenarium*, *Brassica tournefortii*, *Senecio glaucus subsp. coronopifolius* and *Maresia nana*.

Syndynamism: This vegetation is dynamically connected with the *Junipero-Quercetum calliprini* series, replacing the *Vulpio-Leopoldietum gussonei* in more disturbed stands (Brullo & Scelsi, 1998).

Habitat reference: See order.

33.2.2.3. ***Filagini asterisciflorae-Loeflingietum hispanicae*** Minissale & Sciandrello 2015

Annual vegetation with greater cudweed and spanish loeflingia of inner sandy surfaces.

Holotypus: rel. 10, tab. 2, Minissale & Sciandrello (2015).

Characteristic and differential species: *Loeflingia hispanica* L.

Phytosociological table: From Minissale & Sciandrello (2015), table 2, rel. 12.

Char. association: *Loeflingia hispanica* (V).

Char. alliance: *Filago asterisciflora* (V), *Plantago afra* subsp. *zwierleinii* (III), *Tuberaria praecox* (III), *Senecio glaucus* subsp. *hyblaeus* (II).

Char. order and class: *Coronilla repanda* (V), *Maresia nana* (V), *Polycarpon tetraphyllum* subsp. *diphyllum* (V), *Filago congesta* (IV), *Filago gallica* (III), *Rumex bucephalophorus* (III), *Lotus halophilus* (III), *Lysimachia linum-stellatum* (III), *Avellinia festucoides* (III), *Galium murale* (III), *Tillaea muscosa* (II), *Alkanna tinctoria* (II), *Cerastium pentandrum* (II), *Festuca fasciculata* (II), *Andryala integrifolia* (I), *Herniaria hirsuta* (I).

Other species: *Euphorbia peploides* (IV), *Centaurium tenuiflorum* subsp. *tenuiflorum* (III).

Geographical distribution: This community was described by Minissale & Sciandrello (2015) from the paleodunes of the Gulf of Gela.

Structure and ecology: The *Filagini asterisciflorae-Loeflingietum hispanicae* is an annual community growing in the hardened sandy soils of inner areas between 100 and 250 m a.s.l. Generally, it is found in the clearings of *Juniperus turbinata* maquis or in the open surfaces of cork oak woods. It is characterized by the occurrenco of the rare *Loeflingia hispanica*, which is associated with some species of *Filagini asterisciflorae-Linarion humilis*, as *Filago asterisciflora*, *Plantago afra* subsp. *zwierleini*, *Tuberaria praecox* and *Senecio glaucus* subsp. *hyblaeus*. Moreover, the order and the class are represented by *Coronilla repanda*, *Maresia nana*, *Polycarpon tetraphyllum* subsp. *diphyllum*, *Filago congesta*, *Filago gallica*, *Rumex bucephalophorus*, *Lotus halophilus*, *Lysimachia linum-stellatum*, *Avellinia festucoides*, etc.

Syndynamism: See order.

Habitat reference: See order.

33.2.2.4. ***Rostrario litoreae-Tuberarietum villosissimae*** Minissale & Sciandrello 2015

Annual vegetation with hairy Mediterranean hairgrass and Sicily annual rock-rose of deep sandy surfaces.

Holotypus: rel. 10, tab. 3, Minissale & Sciandrello (2015).

Characteristic and differential species: *Rostraria litorea* (All.) Holub, *Tuberaria villosissima* (Pomel) Grosser var. *sicula* Grosser.

Phytosociological table: From Minissale & Sciandrello (2015), table 3, 20 rel.

Char. association: *Tuberaria villosissima* var. *sicula* (V), *Rostraria litorea* (V).

Char. alliance: *Filago asterisciflora* (V), *Linaria multicaulis* subsp. *humilis* (V), *Senecio glaucus* subsp. *hyblaeus* (V), *Viola kitaibeliana* (III), *Helianthemum aegyptiacum* (II), *Plantago afra* subsp. *zwierleinii* (I), *Gagea granatellii* (I), *Helianthemum sanguineum* (I).

Char. order and class: *Rumex bucephalophorus* (V), *Alkanna tinctoria* (V), *Filago gallica* (V), *Polycarpon tetraphyllum* subsp. *diphyllum* (), *Paronychia argentea* (V), *Medicago littoralis* (V), *Plantago bellardi* (V), *Cerastium diffusum* subsp. *gussonei* (V), *Silene colorata* (V), *Arenaria serpyllifolia* (IV), *Silene conica* (IV), *Hippocrepis ciliata* (IV), *Filago congesta* (IV), *Trifolium arvense* (IV), *Avellinia festucoides* (IV), *Ornithopus compressus* (IV), *Trifolium cherleri* (III), *Corynephorus articulatus* (III), *Tolpis umbellata* (II), *Galium murale* (II), *Trifolium pratense* (II), *Trifolium glomeratum* (II), *Petrorhagia prolifera* (I), *Herniaria glabra* subsp. *glabra* (I).

Other species: *Helianthemum salicifolium* (V), *Festuca myuros* (V).

Geographical distribution: This community is known only for Piazza Armerina (Minissale & Sciandrello, 2015).

Structure and ecology: The *Rostrario litoreae-Tuberarietum villosissimae* is an annual vegetation of deep sandy surfaces, occurring in the mesomediterranean bioclimatic belt between 500 and 850 m a.s.l. It is found in open areas or in abandoned fields, often mixed with the garrigue of *Coridothymo capitati-Helichrysetum stoechadis* or grasslands of *Stipo gussonei-Hyparrhenietum hirtae*. Under the floristic profile, this syntaxon is differentiated by the occurrence of *Rostraria litorea* and *Tuberaria villosissima* var. *sicula*. The alliance is represented by *Filago asterisciflora*, *Linaria multicaulis* subsp. *humilis*, *Senecio glaucus* subsp. *hyblaeus*, *Viola kitaibeliana*, *Helianthemum aegyptiacum*, *Plantago afra* subsp. *zwierleinii*, *Gagea granatellii* and *Helianthemum sanguineum*.

Syndynamism: See order.

Habitat reference: See order.

33.2.2.5. ***Astragalo kamarinensis-Coronilletum repandae*** Minissale & Sciandrello 2015

Annual vegetation with Camarina milkvetch and twisted scorpion vetch of dry sandy surfaces.

Holotypus: rel. 5, tab. 4, Minissale & Sciandrello (2015).

Characteristic and differential species: *Astragalus kamarinensis* C. Brullo, Brullo, Giusso, Miniss. & Sciandr.

Phytosociological table: From Minissale & Sciandrello (2015), table 4, 14 rel.

Char. association: *Astragalus kamarinensis* (IV).

Char. alliance: *Plantago afra* subsp. *zwierleinii* (V), *Filago asterisciflora* (III), *Linaria multicaulis* subsp. *humilis* (II), *Senecio glaucus* subsp. *hyblaeus* (I), *Tuberaria praecox* (I).

Char. order and class: *Rumex bucephalophorus* (V), *Coronilla repanda* (V), *Erodium laciniatum* (V), *Ononis diffusa* (V), *Erodium sabulicolum* (V), *Lagurus ovatus* (V), *Polycarpon tetraphyllum* subsp. *diphyllum* (V), *Andryala integrifolia* (V), *Lotus halophilus* (IV), *Medicago littoralis* (III), *Herniaria glabra* (II), *Festuca fasciculata* (II), *Tolpis umbellata* (II), *Corynephorus articulatus* (I), *Plantago bellardi* (I), *Alkanna tinctoria* (I), *Cutandia divaricata* (I), *Brassica tournefortii* (I).

Other species: *Trifolium arvense* (V), *Trifolium nigrescens* (IV).

Geographical distribution: This vegetation is known only for the paleodunes near Vittoria (Minissale & Sciandrello, 2015).

Structure and ecology: The community at issue occurs in the inner sandy surfaces of particularly xeric stands between 100 and m a.s.l., where the endemic *Astragalus kamarinensis* finds its optimum. In addition to this species, also *Coronilla repanda* plays an important physiognomic role, growing together with some species of alliance, as *Plantago afra* subsp. *zwierleinii*, *Filago asterisciflora*, *Linaria multicaulis* subsp. *humilis*, *Senecio glaucus* subsp. *hyblaeus* and *Tuberaria praecox*. The order and the class are represented by *Rumex bucephalophorus*, *Coronilla repanda*, *Erodium laciniatum*, *Ononis diffusa*, *Erodium sabulicolum*, *Lagurus ovatus*, *Polycarpon tetraphyllum* subsp. *diphyllum*, *Andryala integrifolia*, *Lotus halophilus*, etc.

Syndynamism: The *Astragalo kamarinensis-Coronilletum repandae* is originated from the degradation of woody vegetation belonging to *Junipero turbinatae-Quercetum calliprini* and *Stipo bromoidis-Quercetum suberis* (Minissale & Sciandrello, 2015).

Habitat reference: See order.

34. Class: ***Stipo-Trachynietea distachyae*** Brullo in Brullo et al. 2001

Calciphilous annual and ephemeroid swards and grasslands.

Synonyms: *Thero-Brachypodietea* Br.-Bl. ex A. Bolòs 1950 p.p.; *Stipo-Brachypodietea distachyae* S. Brullo 1985 (art. 5).

Holotypus: *Stipo-Bupleuretalia semicompositae* Brullo in Brullo, Scelsi & Spampinato 2001.

Characteristic and differential species: *Ajuga iva* (L.) Schreb. subsp. *iva, Arenaria leptoclados* (Rchb.) Guss., *Bromus rubens* L., *Campanula erinus* L., *Echium parviflorum* Moench., *Euphorbia exigua* L., *Filago pygmaea* L., *Gastridium ventricosum* (Gouan) Schinz & Thell., *Hedypnois rhagadioloides* (L.) F.W. Schmidt., *Helianthemum salicifolium* (L.) Mill., *Hippocrepis biflora* Spreng., *Hymenocarpos circinnatus* (L.) Savi, *Hyoseris scabra* L., *Hypochoeris achyrophorus* L., *Linum strictum* L., *Medicago minima* (L.) L., *M. truncatula* Gaertn., *Ononis reclinata* L., *Parentucellia latifolia* (L.) Caruel, *Romulea columnae* Sebast. & Mauri, *Sabulina mediterranea* (Ledeb. ex Link) Rchb., *Sedum rubens* L., *Sideritis romana* L., *Silene nocturna* L., *Stipellula capensis* (Thunb.) Röser & Hamasha, *Trachynia distachya* (L.) Link, *Trifolium angustifolium* L., *T. scabrum* L., *T. stellatum* L., *Tripodion tetraphyllum* (L.) Fourr., *Valantia muralis* L., *Valerianella coronata* (L.) DC.

Geographical distribution: This class has a wide Mediterranean distribution (Brullo et al., 2001; Mucina et al., 2016).

Structure and ecology: This syntaxon gathers together the annual ephemeral communities with a calciphilous character, occurring on basic or neutral soils, derived from limestone, dolomites, clays, marls, sandstones, sands and vulcanites. Usually, the physiognomy of these grasslands is given by many therophytes with a winter-spring cycle, as well as by some small geophytes. This vegetation is widespread from the thermo- to supramediterranean bioclimatic belt, showing a pioneer character on rocky surfaces with a very shallow layer of soil.

Syndynamism: Generally, the ephemeral grasslands belonging to *Stipo-Trachynietea* represent a very early development stage of dynamic series referable to the woody vegetation of *Quercetea ilicis*. However, in correspondence of small rocky ledges and semi-rupicolous environments it has a primary character of edaphic type (Brullo et al., 2001).

Habitat reference: E1.3c Mediterranean annual-rich dry grassland.

34.1. Order: ***Brachypodietalia distachyi*** Rivas-Martínez 1978

Ephemeral winter pastures on shallow sandy and loamy soils over limestone, dolomite and gypsum.

Synonyms: *Trachynietalia distachyae* Rivas-Martinez 1978 nom. mut. propos. (art. 45); *Linarietalia saturejoidis* Rivas Goday & G. Lòpez in G. Lòpez 1979.

Holotypus: *Trachynion distachyae* Rivas-Martinez 1978

Characteristic and differential species: *Catapodium rigidum* (L.) C.E.Hubb., *Hypochoeris achyrophorus* L., *Plantago afra* L. subsp. *afra, Polygala monspeliaca* L.

Geographical distribution: This order is represented in the Central and Western Mediterranean area (Mucina et al., 2016).

Structure and ecology: The *Brachypodietalia distachyi* groups the pioneer and basophilous annual communities with a subxerophilous character, growing on shallow sandy and loamy soils, derived from limestone, clay, gypsum, dolomite, serpentinites and mafic rocks. It is linked to slightly eutrophic surfaces and becoming dry during the summer (Costa et al., 2012).

Syndynamism: See class.

Habitat reference: E1.3c Mediterranean annual-rich dry grassland.

34.1.1. Alliance: ***Trachynion distachyae*** Rivas-Martínez 1978

Ephemeral winter pastures on shallow skeletal base-rich soils over calcareous substrates.

Synonyms: *Thero-Brachypodion calcicolum genuinum calcareoum* Rivas Goday 1964 (orig.form) (corresp.; as suballiance) (art. 34a); *Brachypodion distachyi* Rivas-Martinez 1978 nom. mut. propos. (mut.superfl.); *Sideritido romanae-Hypochaeridion achyrophori* de Foucault 1999 (phantom); *Sideritido romanae-Hypochaeridion achyrophori* de Foucault 2001 (art. 5); *Sideritido romanae-Brachypodion distachyi* de Foucault 2001 (art. 3f); *Asterisco-Velezion rigidae* Rivas Goday 1964 (art. 29)*; Asterisco-Velezion rigidae* (Rivas Goday 1964) S. Brullo 1985 (art. 31); *Hypochoeridion achyrophori* Biondi & Guerra 2008.

Holotypus: *Saxifrago tridactylitae-Hornungietum petraeae* Izco 1974.

Characteristic and differential species: *Astragalus sesameus* L., *Euphorbia exigua* L.*, Medicago polymorpha* L.*, M. rigidula* (L.) All.*, Sagina apetala* Ard., *Trigonella wojciechowskii* Coulot & Rabaute, *Trisetaria aurea* (Ten.) Pignatti.

Geographical distribution: See order.

Structure and ecology: The alliance at issue includes the basophilous ephemeral communities growing on very shallow calcareous soils.

Syndynamism: See class.

Habitat reference: See order.

34.1.1.1. ***Thero-Sedetum caerulei*** Brullo 1975

Ephemeral vegetation with azure stonecrop of shallow calcareous soils.

Holotypus: Not designated.

Characteristic and differential species: *Sedum caeruleum* L., *S. rubens* L.

Phytosociological table: From Bazan et al. (2006b), table 9, 2 rel. (subass. *typicum*)

Char. association: *Sedum caeruleum* (2), *Sedum rubens* (2).

Char. alliance, order and class: *Campanula erinus* (2), *Catapodium rigidum* (2), *Hypochoeris achyrophorus* (2), *Valantia muralis* (2), *Helianthemum salicifolium* (2), *Medicago minima* (1), *Trachynia distachya* (1).

Other species: *Vulpia ciliata* (2), *Sedum stellatum* (2), *Rumex bucephalophorus* (2), *Anisantha madritensis* (2), *Euphorbia peplus* (2), *Galium murale* (2), *Bromus hordeaceus* (2), *Poa bulbosa* (2), *Tolpis virgata* (2), *Avena barbata* (2).

From Brullo (1975), table 1, 26 rel. (subass. *sedetosum caespitosi*).

Char. association: *Sedum caeruleum* (V), *Sedum rubens* (III).

Char. subassociation: *Sedum caespitosum* (V), *Moraea sisyrinchium* (IV), *Plantago coronopus* (II), *Medicago littoralis* (II), *Catapodium balearicum* (II).

Char. alliance, order and class: *Plantago afra* (V), *Arenaria leptoclados* (III), *Catapodium rigidum* (III), *Hypochaeris achyrophorus* (III), *Trifolium scabrum* (III), *Sagina apetala* (III), *Sabulina mediterranea* (II), *Bromus rubens* (II), *Sideritis romana* (II), *Trifolium stellatum* (I), *Medicago polymorpha* (I), *Lotus edulis* (I), *Helianthemum salicifolium* (I), *Filago pygmaea* (I), *Euphorbia exigua* (I), *Trachynia distachya* (I), *Stipellula capensis* (I), *Medicago minima* (I), *Valantia muralis* (I), *Silene nocturna* (I), *Hedypnois rhagadioloides* (I), *Cerastium semidecandrum* (I).

Other species: *Poa bulbosa* (IV), *Trisetaria annua* (III), *Parapholis incurva* (III).

From Brullo (1975), table 1, 20 rel. (subass. *saxifragetosum tridactylitis*)

Char. association: *Sedum caeruleum* (V), *Sedum rubens* (III).

Char. subassociation: *Saxifraga tridactylites* (V), *Sedum stellatum* (V), *Erophila verna* (V), *Medicago littoralis* (II), *Catapodium balearicum* (II).

Char. alliance, order and class: *Plantago afra* (V), *Arenaria leptoclados* (IV), *Catapodium rigidum* (IV), *Hypochaeris achyrophorus* (II), *Trifolium scabrum* (IV), *Sagina apetala* (III), *Sabulina mediterranea* (III), *Bromus rubens* (II), *Sideritis romana* (II), *Trifolium stellatum* (II), *Medicago polymorpha* (II), *Lotus edulis* (II), *Helianthemum salicifolium* (), *Silene nocturna* (II), *Cerastium semidecandrum* (I), *Trachynia distachya* (I), *Stipellula capensis* (III), *Medicago minima* (III), *Valantia muralis* (III), *Campanula erinus* (I), *Hedypnois rhagadioloides* (I), *Filago pygmaea* (I).

Other species: *Poa bulbosa* (V), *Trisetaria annua* (III), *Plantago lagopus* (II).

Geographical distribution: This association is very frequent throughout Sicily (Brullo, 1975; Brullo & Ronsisvalle, 1975; Bartolo et al., 1982; Brullo et al., 1993; Costanzo et al., 1996; Gianguzzi et al., 1996; Bazan et al., 2006b; Zimmitti et al., 2007; Giusso et al., 2008).

Structure and ecology: The smalls ledges of flat rockys surfaces (limestone, marls, gypsum, etc.) with a thin layer of topsoil are colonized by an ephemeral succulent community with a

very short biological cycle. It is the *Thero-Sedetum caerulei*, which is found also along asphalted roadsides and in open shallow calcareous soils, where generally it covers small surfaces. This community is dominated by *Sedum caeruleum*, which gives a characteristic red color to this vegetation, usually associated with *Sedum rubens* and some species of higher rank, as *Campanula erinus*, *Catapodium rigidum*, *Hypochoeris achyrophorus*, *Valantia muralis*, *Helianthemum salicifolium*, *Medicago minima*, *Stipellula capensis*, *Trachynia distachya*, *Crupina crupinastrum*, *Sideritis romana*, *Ononis reclinata*, etc. In addition to the typical community, Brullo (1975) distinguished two peculiar aspects: the subass. *sedetosum caespitosi* is linked to xeric coastal stands and is characterized by the occurrence of *Sedum caespitosum* and *Plantago coronopus*; the subass. *saxifragetosum tridactylitis* shows a more mesophilous character, as evidenced by the high coverage of *Saxifraga tridactylites*, *Euphorbia peploides*, *Erophila verna*, *Filago pyramidata* and *Arabis verna*.

Syndynamism: This vegetation has a pioneer character and its establishment is favored by the soil erosion and the consequent surfacing of bare rock, generally due to the removal of plant cover because of frequent fires (Bazan et al., 2006b).
Habitat reference: See order.

34.1.1.2. ***Vulpio ciliatae-Trisetarietum aureae*** Brullo 1975

Ephemeral vegetation with fringed fescue and golden oat of shallow calcareous soils.

Lectotypus: Not designated.

Characteristic and differential species: *Festuca geniculata* (L.) Lag. & Rodr., *Festuca ligustica* (All.) Bertol., *Plantago lagopus* L., *Trifolium nigrescens* Viv., *Trisetaria aurea* (Ten.) Pignatti.

Phytosociological table: From Brullo (1975), table 2, 21 rel.

Char. association: *Trisetaria annua* (V), *Trifolium nigrescens* (V), *Plantago lagopus* (IV), *Festuca ligustica* (I), *Festuca geniculata* (I).

Char. alliance, order and class: *Hypochaeris achyrophorus* (IV), *Stipellula capensis* (III), *Medicago minima* (III), *Hedypnois rhagadioloides* (III), *Sideritis romana* (II), *Plantago afra* (II), *Medicago polymorpha* (II), *Trifolium scabrum* (II), *Sagina apetala* (I), *Lotus edulis* (I), *Helianthemum salicifolium* (I), *Euphorbia exigua* (I), *Trachynia distachya* (I), *Sedum rubens* (I), *Filago pygmaea* (I), *Campanula erinus* (I) *Catapodium rigidum* (I).

Other species: *Festuca danthonii* (V), *Erodium botrys* (III), *Poa bulbosa* (III).

Geographical distribution: This association occurs throughout Sicily (Brullo, 1975; Gianguzzi et al., 2009).

Structure and ecology: The *Vulpio ciliatae-Trisetarietum aureae* replaces the previous association on less shallow soils. It is dominated by *Trisetaria aurea*, which gives a typical yellowish color to this vegetation during the spring flowering, *Trifolium nigrescens* and *Plantago lagopus*. Among the species of higher rank, *Hypochaeris achyrophorus*, *Stipellula*

capensis, *Medicago minima*, *Hedypnois rhagadioloides*, *Sideritis romana*, *Plantago afra* and *Medicago polymorpha* are very frequent.

Syndynamism: See class.

Habitat reference: See order.

34.1.1.3. ***Astragalo sesamaei-Medicaginetum rectae*** Sciandrello, D'Agostino & Minissale 2013

Ephemeral vegetation with small-flowered milk vetch and bur medick of shallow calcareous soils.

Holotypus: rel. 10, tab. 4, Minissale & Sciandrello (2015).

Characteristic and differential species: *Astragalus sesameus* L., *Hippocrepis biflora* Spreng., *Onobrychis aequidentata* (Sm.) d'Urv., *Ptilostemon stellatus* (L.) Greuter.

Phytosociological table: From Minissale & Sciandrello (2015), table 4, 10 rel.

Char. association: *Onobrychis aequidentata* (V), *Astragalus sesameus* (IV), *Hippocrepis biflora* (III), *Ptilostemon stellatus* (III).

Char. alliance, order and class: *Trifolium stellatun* (V), *Lotus edulis* (V), *Trachynia distachya* (V), *Medicago minima* (V), *Hypochaeris achyrophorus* (IV), *Catapodium rigidum* (IV), *Euphorbia exigua* (III), *Stipellula capensis* (II), *Polygala monspeliaca* (I),

Other species: *Anisantha fasciculata* (IV), *Linum tryginum* (II).

Geographical distribution: This association was described by Sciandrello et al. (2013) from the Taormina area (NE Sicily).

Structure and ecology: The clearings of perennial grasslands belonging to *Seselio-Ampelodesmetum mauritanici* are colonized by an annual calciphilous community named *Astragalo sesamaei-Medicaginetum rectae*. Under the floristic profile, it is characterized by the dominance of *Onobrychis aequidentata* and *Astragalus sesameus*, which are associated with several species of higher rank, such as *Trifolium stellatun*, *Lotus edulis*, *Trachynia distachya*, *Medicago minima*, *Hypochaeris achyrophorus*, *Catapodium rigidum*, *Euphorbia exigua*, *Stipellula capensis* and *Polygala monspeliaca*.

Syndynamism: See class.

Habitat reference: See order.

34.1.1.4. ***Trifolio scabri-Hypochoeridetum achyrophori*** Lapraz ex Biondi, Izco, Ballelli & Formica 1997

Ephemeral vegetation with rough clover and small restharrow of shallow calcareous soils.

Holotypus: rel. 2, tab. 6, Guglielmo et al. (2006). (subass. *ononidetosum reclinatae*).

Characteristic and differential species: *Hypochoeris achyrophorus* L., *Trifolium scabrum* L.

Phytosociological table: From Guglielmo et al. (2006), table 6, 3 rel.

Char. association and subass.: *Hypochoeris achyrophorus* (3), *Trifolium scabrum* (3), *Ononis reclinata* (3).

Char. alliance, order and class: *Medicago minima* (3), *Trifolium tomentosum* (3), *Arenaria leptoclados* (3), *Campanula erinus* (3), *Trifolium campestre* (2), *Polygala monspeliaca* (2).

Other species: *Rostraria cristata* (3), *Festuca danthonii* (3).

Geographical distribution: The typical aspect of this community was described from Central Italy (Biondi et al., 1997), but a peculiar aspect named subass. *ononidetosum reclinatae* was surveyed in Sicily (Guglielmo et al., 2006).

Structure and ecology: The small calcareous surfaces with very shallows soils, as the small crevices of archaeological structures and rocks, are colonized by an ephemeral community dominated by *Hypochoeris achyrophorus* and *Trifolium scabrum*. This vegetation is ascribed to the *Trifolio scabri-Hypochoeridetum achyrophori*, which in Sicily is represented only by a thermo-xerophilous aspect with an high coverage of *Ononis reclinata* (subass. *ononidetosum reclinatae*). The syntaxa of higher rank are represented by some species, as *Medicago minima*, *Trifolium tomentosum*, *Arenaria leptoclados*, *Campanula erinus*, *Trifolium campestre* and *Polygala monspeliaca* (Guglielmo et al., 2006).

Syndynamism: See class.

Habitat reference: See order.

34.1.2. Alliance: ***Stipion retortae*** O. de Bolòs 1957

Annual grasslands with Mediterranean needle-grass on loamy soils over calcareous substrates.

Synonyms: *Stipion capensis* O. de Bolòs 1957 nom. mut. propos. (art. 45)*; Stipion retortae* Br.-Bl. et O. de Bolòs 1954 (art. 2b); *Stipion retortae* Br.-Bl. et O. de Bolòs ex Izco 1974 (art. 31); *Stipion capensis* Br.-Bl. et O. de Bolòs ex Izco 1974 nom. mut. propos. (mut.superfl.).

Holotypus: *Plantagini-Stipetum retortae* O. Bolòs 1956.

Characteristic and differential species: *Asteriscus aquaticus* (L.) Less., *Bellis annua* L.*, Anisantha fasciculata* C. Presl, *Filago eriocephala* Guss., *Moraea sisyrinchium* (L.) Ker Gawl., *Lagurus ovatus* L.*, Matricaria aurea* (Loefl.) Sch. Bip., *Ononis sieberi* DC.*, Paronychia argentea* Lam.*, Plantago coronopus* L.

Geographical distribution: This alliance occurs in the western and central Mediterranean area (Brullo, 1985).

Structure and ecology: The annual grasslands with *Stipellula capensis* occurring on dry calcareous soils are ascribed to the *Stipion retortae* alliance.

Syndynamism: See class.

Habitat reference: See order.

34.1.2.1. ***Trigonello monspeliacae-Stipetum capensis*** Tomaselli 1999

Annual grasslands with star fruited fenugreek and mediterranean needle grass on shallow soils.

Holotypus: rel. 2, tab. 11, Tomaselli (1999).

Characteristic and differential species: *Trigonella monspeliaca* L.

Phytosociological table: From Tomaselli (1999), table 11, 12 rel.

Char. association: *Trigonella monspeliaca* (V).

Char. alliance and order: *Stipellula capensis* (V), *Lotus ornithopodioides* (IIII), *Polygala monspeliaca* (III), *Crupina crupinastrum* (III), *Paronychia argentea* (II), *Onobrychis caput-galli* (II) *Astragalus sesameus* (I).

Char. class: *Hypochoeris achyrophorus* (V), *Trifolium stellatum* (V), *Helianthemum salicifolium* (V), *Lotus edulis* (IV), *Moraea sisyrinchium* (III), *Rostraria cristata* (III), *Euphorbia exigua* (III), *Melilotus sulcata* (III), *Trisetaria aurea* (II), *Plantago afra* subsp. *afra* (II), *Trifolium scabrum* (I), *Arenaria leptoclados* (I), *Medicago minima* (I), *Filago pygmaea* (I), *Medicago truncatula* (I).

Other species: *Ononis diffusa* (III), *Anthemis arvensis* (III), *Festuca danthonii* (III), *Salvia verbenaca* (III).

Geographical distribution: This vegetation was surveyed only near Militello Val di Catania by Tomaselli (1999).

Structure and ecology: The *Trigonello monspeliacae-Stipetum capensis* is linked to volcanic substrates with a thin layer of soil. It is a *Stipellula capensis*-dominated grassland, which is floristically differentiated by *Trigonella monspeliaca*, while the alliance and the order are represented by *Stipellula capensis*, *Lotus ornithopodioides*, *Polygala monspeliaca*, *Crupina crupinastrum*, *Paronychia argentea*, etc.

Syndynamism: This community is dynamically linked to the series of *Oleo-Ceratonion*, representing a regressive stage of *Hyparrhenietum hirto-pubescentis* (Tomaselli, 1999).

Habitat reference: See order.

34.1.2.2. ***Ononido breviflorae-Stipetum capensis*** Brullo, Guarino & Ronsisvalle 1998

Annual grasslands with sticky restharrow and mediterranean needle grass on shallow soils.

Holotypus: rel. 2, tab. 27, Brullo et al. (2000).

Characteristic and differential species: *Ononis breviflora* DC.

Phytosociological table: From Brullo et al. (1998), table 27, 6 rel.

Char. association and subass.: *Ononis breviflora* (V).

Char. alliance and order: *Moraea sisyrinchium* (V), *Hypochoeris achyrophorus* (V), *Plantago afra* subsp. *afra* (V), *Anisantha fasciculata* (III), *Plantago coronopus* (III),

Char. class: *Stipellula capensis* (V), *Helianthemum salicifolium* (V), *Trachynia distachya* (V), *Hippocrepis ciliata* (V), *Medicago minima* (V), *Echium parviflorum* (V), *Sulla spinosissima* (V), *Medicago littoralis* (V), *Crupina crupinastrum* (IV), *Silene nocturna* (IV), *Euphorbia exigua* (IV), *Linum strictum* (IV), *Filago eriocephala* (IV), *Lotus edulis* (IV), *Hedypnois rhagadioloides* (III), *Ononis reclinata* (III), *Trifolium stellatum* (III), *Trifolium angustifolium* (III), *Hyoseris scabra* (III), *Parapholis incurva* (III), *Atractylis cancellata* (III), *Reichardia intermedia* (II).

Other species: *Festuca danthonii* (V), *Medicago turbinata* (IV).

Geographical distribution: This association was described from Torre Manfria, near Gela (Brullo et al., 1998), but is quite widespread in Sicily.

Structure and ecology: The annual grasslands with *Stipellula capensis* growing on flat surfaces with shallow calcareous soils are ascribed to the *Ononido breviflorae-Stipetum capensis*. This community occurs both on limestone and gypsum substrata, often covering large surfaces. Its floristic set is characterized by the constant presence of *Ononis breviflora* and includes several species belonging to alliance and order, as *Moraea sisyrinchium*, *Hypochoeris achyrophorus*, *Plantago afra* subsp. *afra*, *Anisantha fasciculata* and *Plantago coronopus*. The class is represented by *Helianthemum salicifolium*, *Trachynia distachya*, *Hippocrepis ciliata*, *Medicago minima*, *Echium parviflorum*, *Sulla spinosissima*, *Medicago littoralis*, *Crupina crupinastrum*, etc.

Syndynamism: This vegetation is dynamically connected with the series of *Quercetea ilicis*, representing an early stage that tends to evolve towards the perennial grasslands of *Hyparrhenietum hirto-pubescentis*.

Habitat reference: See order.

34.1.3. Alliance: ***Sedo-Ctenopsion gypsophilae*** Rivas Goday & Rivas-Martínez ex Izco 1974

Ephemeral winter pastures on gypsum substrates.

Synonyms: *Crucianellion patulae* Rivas Goday et Borja 1959 (art. 2b); *Vulpion gypsophilae* Rivas Goday et Borja 1959 (art. 2b); *Sedo-Vulpion gypsophilae* Rivas Goday et Rivas-Martinez 1963 (art. 2b); *Sedo-Ctenopsion (Vulpion) gypsophilae* Rivas Goday & Rivas-Martinez ex Izco 1974 (orig.form).

Holotypus: *Chaenorrhino-Campanuletum fastigiatae* Rivas Martinez & Izco in Izco 1974

Characteristic and differential species: *Chaenorhinum rubrifolium* (Robill. & Castagne ex DC.) Fourr., *Erodium laciniatum* (Cav.) Willd. subsp. *laciniatum*, *Sedum gypsicola* Boiss. & Reuter.

Geographical distribution: This alliance occurs in the Iberian Peninsula (Brullo, 1985; Mucina et al., 2016).

Structure and ecology: The ephemeral vegetation on gypsum substrates is ascribed to the *Sedo-Ctenopsion gypsophilae* alliance. However, as was emphasized by Guarino & Pasta (2017), the gypsophilous communities of Sicily are floristically quite different from those ones of the Iberian Peninsula and probably should refer to a separate alliance.

Syndynamism: See class.

Habitat reference: See order.

34.1.3.1. ***Filagini eriocephalae-Chaenorrhinetum rubrifolii*** Brullo, Marcenò, Minissale & Spampinato 1989

Ephemeral vegetation with reddened flower heads cudweed and reddened dwarf snapdragons on gypsum substrates.

Holotypus: rel. 14, tab. 1, Brullo et al. (1989).

Characteristic and differential species: *Avellinia festucoides* (Link) Valdés & H. Scholz, *Filago eriocephala* Guss.

Phytosociological table: From Brullo et al. (1998), table 27, 6 rel.
Char. association and subass.: *Filago eriocephala* (V), *Avellinia festucoides* (IV).
Char. alliance: *Sedum gypsicola* (V), *Chaenorhinum rubrifolium* (IV),

Char. order and class: *Stipellula capensis* (V), *Campanula erinus* (V), *Catapodium rigidum* (V), *Valantia muralis* (V), *Helianthemum salicifolium* (V), *Hypochoeris achyrophorus* (IV), *Sedum caeruleum* (IV), *Crupina crupinastrum* (IV), *Anisantha fasciculata* (III), *Moraea sisyrinchium* (III), *Trifolium scabrum* (III), *Parentucellia latifolia* (III), *Medicago minima* (III), *Euphorbia exigua* (III), *Arenaria leptoclados* (II), *Linaria simplex* (II), *Ononis sieberi* (II), *Sulla spinosissima* (II), *Astragalus sesameus* (I), *Scorzonera deliciosa* (I), *Catapodium zwierleinii* (I), *Polygala monspeliaca* (I), *Atractylis cancellata* (I), *Sideritis romana* (I), *Hippocrepis unisiliquosa* (I), *Saxifraga tridactylites* (I), *Ononis reclinata* (I), *Sedum rubens* (I), *Hippocrepis ciliata* (I), *Linum decumbens* (I).

Other species: *Prospero autumnale* (V), *Poa bulbosa* (IV).

Geographical distribution: This association is linked to the geological formation known as gypsum-salt rock series, occurring in Central and Western Sicily (Brullo et al., 1989; Bazan et al., 2006b; Gianguzzi et al., 2007).

Structure and ecology: The gypsum outcrops are covered by a peculiar ephemeral vegetation, which is characterized by the dominance of *Sedum gypsicola*, *Filago eriocephala*, *Avellinia festucoides* and *Chaenorhinum rubrifolium*. This habitat is quite selective for the plants, since the chalky rocks are not very permeable and subject to a continuous erosion that does not allow the formation of evolved soils. Consequently, the *Filagini-Chaenorrhinetum rubrifolii* is a very specialized community with a pioneer and xerophilous character. The order and class are represented by many species, such as *Stipellula capensis*, *Campanula erinus*, *Catapodium rigidum*, *Valantia muralis*, *Helianthemum salicifolium*, *Hypochoeris achyrophorus*, *Sedum caeruleum*, *Crupina crupinastrum*, *Anisantha fasciculata*, etc. (Brullo et al., 1989).

Syndynamism: Usually, this community represents a primary vegetation on rupicolous and very sloped stands, but in the flat surfaces subject to less xeric conditions and more evolved soils it can be progressively replaced by mosses and lichens and later also by the *Thero-Sedetum caerulei*.

Habitat reference: See order.

34.2. Order: ***Stipo-Bupleuretalia semicompositi*** Brullo in Brullo, Scelsi & Spampinato 2001

Mediterranean xerophilous and subhalophilous therophytic swards.

Synonyms: *Stipo-Bupleuretalia semicompositi* S. Brullo 1985

Holotypus: *Plantagini-Catapodion marini* Brullo 1985

Characteristic and differential species: *Anisantha fasciculata* (C. Presl) Nevski, *Asteriscus aquaticus* (L.) Less., *Astragalus sesameus* L., *Atractylis cancellata* L., *Bupleurum semicompositum* L., *Catananche lutea* L., *Convolvulus lineatus* L., *Crupina crupinastrum* (Moris)

Vis., *Moraea sisyrinchium* (L.) Ker Gawl., *Hainardia cylindrica* (Willd.) Greuter, *Medicago littoralis* Loisel., *Ononis ornithopodioides* L., *Parapholis incurva* (L.) C. E. Hubb., *Platango albicans* L., *Reichardia intermedia* (Sch. Bip.) Samp., *Scorzonera deliciosa* Guss. ex DC., *Sulla capitata* (Desf.) BH Choi & H. Ohashi, *Sulla spinosissima* (L.) B.H.Choi & H.Ohashi, *Trigonella maritima* Poir., *Trigonella monspeliaca* L..

Geographical distribution: This order occurs in the southern mediterranean area and in the Macaronesian islands (Brullo et al., 2001).

Structure and ecology: The *Stipo-Bupleuretalia semicompositi* represents a thermo-xerophilous vicariant of *Brachypodietalia distachyi*. In fact, it groups the subhalophilous therophytic communities of dry basic substrates, as limestones, clays, marls, sands and volcanites, whose structure is given by many thermophilous therophytes with a southern Mediterranean or Turanic distribution. From the bioclimatic point of view, this order occurs in the infra- and thermomediterranean belts (Brullo, 1985; Brullo et al., 2001).

Syndynamism: This vegetation is connected with the dynamic series of *Pistacio-Rhamnetalia alaterni* and *Quercion ilicis*, being originated from the degradation of the woody vegetation. However, it has a primary role in semi-rupicolous and halophilous environments, as well as in clay badlands.

Habitat reference: E1.3c Mediterranean annual-rich dry grassland.

34.2.1. Alliance: ***Plantagini-Catapodion marini*** Brullo 1985

Tyrrhenian subhalophilous xerophilous therophytic swards.

Holotypus: *Filagini-Daucetum lopadusani* Brullo 1985

Characteristic and differential species: *Catapodium balearicum* (Willk.) H.Scholz., *Plantago coronopus* L.

Geographical distribution: This alliance occurs in the Tyrrhenian area, including Sicily, Sardinia, Corsica, Southern Italy, Southern France and Balearic Islands (Brullo et al., 2001).

Structure and ecology: The thermo-xerophilous ephemeral grasslands with a subhalophilous character are ascribed to the *Plantagini-Catapodion marini*. The physiognomy of this vegetation is given by some microphytes with a short cycle, which prefers the coastal stands (Brullo et al., 2001).

Syndynamism: This vegetation takes catenal contacts with the halophilous communities of *Crithmo-Limonietea* and *Sarcocornietea*. Sometimes, it is mixed with the dry perennial grasslands and the coastal maquis of *Oleo-Ceratonion* (Brullo, 1985).

Habitat reference: See order.

34.2.1.1. ***Anthemido secundirameae-Desmazerietum siculae*** Brullo 1985

Ephemeral vegetation with prostrate chamomile and Sicily fern grass on gypsum substrates.

Synonyms: Aggr. a *Desmazeria sicula* e *Anthemis secundiramea* Barbagallo, Brullo & Guglielmo 1979; *Anthemido-Desmazerietum siculae* Brullo in Brullo et al. 1980 n.n.

Holotypus: rel. 5, tab. 8, Brullo (1985).

Characteristic and differential species: *Allium lehmannii* Lojac., *Anthemis secundiramea* Biv., *Daucus carota* subsp. *drepanensis* (Lojac.) Heywood, *Desmazeria sicula* (Jacq.) Dumort., *Lonas annua* (L.) Vines & Druce.

Phytosociological table: From Brullo (1985), table 8, 17 rel.

Char. association and subass.: *Desmazeria sicula* (V), *Anthemis secundiramea* (V), *Daucus carota* subsp. *drepanensis* (V), *Allium lehmannii* (V), *Lonas annua* (III).

Char. alliance: *Plantago coronopus* (V), *Catapodium balearicum* (V).

Char. order: *Moraea sisyrinchium* (V), *Parapholis incurva* (V), *Medicago littoralis* (V), *Asteriscus aquaticus* (IV), *Atractylis cancellata* (III), *Crupina crupinastrum* (III), *Sulla spinosissima* (III), *Anisantha fasciculata* (II), *Scorzonera deliciosa* (II), *Convolvulus lineatus* (II), *Hainardia cylindrica* (II), *Ononis ornithopodioides* (II).

Char. class: *Filago pygmaea* (V), *Hedypnois cretica* (V), *Trifolium scabrum* (V), *Trachynia distachya* (V), *Valantia muralis* (V), *Hypochoeris achyrophorus* (V), *Stipellula capensis* (IV), *Trifolium stellatum* (IV), *Filago pyramidata* (IV), *Romulea columnae* (IV), *Catapodium rigidum* (IV), *Sideritis romana* (IV), *Helianthemum salicifolium* (III), *Bromus rubens* (III), *Medicago minima* (III), *Sedum rubens* (III), *Linum strictum* (III), *Lotus edulis* (III), *Euphorbia exigua* (II), *Helianthemum ledifolium* (II), *Plantago afra* (II), *Trifolium angustifolium* (II).

Other species: *Lolium rigidum* (V), *Reichardia picroides* (IV).

Geographical distribution: This association occurs in the north-western coast of Sicily between Palermo and Trapani, as wells as in the south-eastern part between Syracuse and Scoglitti (Barbagallo et al., 1979e; Brullo et al., 1980; Brullo, 1985).

Structure and ecology: The small surfaces with shallow skeletal base-rich soils between the *Crithmo-Limonietea* vegetation (or sometimes also within the coastal maquis) are colonized by an ephemeral community named *Anthemido-Desmazerietum siculae*. This vegetation appears as a dry grassland dominated by small therophytes and geophytes with spring optimum, as *Desmazeria sicula*, *Anthemis secundiramea*, *Daucus carota* subsp. *drepanensis*, *Allium lehmannii* and *Lonas annua*. Besides, many species of higher rank are quite frequent, among them *Plantago coronopus*, *Catapodium balearicum, Moraea sisyrinchium*, *Parapholis incurva*, *Medicago littoralis*, *Asteriscus aquaticus* and *Atractylis cancellata* (Brullo, 1985).

Syndynamism: This community represents a primary vegetation in the shallow and dry red soils at the edges of *Crithmo-Limonietea* belt. Sometimes, its settlement derives from the degradation of chamephytic and nanophanerophytic vegetation (Brullo, 1985).

Habitat reference: See order.

34.2.1.2. ***Filagini cossyrensis-Daucetum lopadusani*** Brullo 1985

Coastal vegetation with Pantelleria cudweed and Lampedusa wild carrot of shallow calcareous soils.

Holotypus: rel. 9, tab. 3, Brullo (1985).

Characteristic and differential species: *Allium hirtovaginum* Candargy, *Allium lopadusanum* Bartolo, Brullo & Pavone, *Daucus lopadusanus* Tineo, *Diplotaxis scaposa* DC.*, Filago cossyrensis* Lojac., *Linaria reflexa* (L.) Desf. subsp. *lubbockii* (Batt.) Brullo.

Phytosociological table: From Bartolo et al. (1990a), table 20, 20 rel. (subass. *typicum*).

Char. association and subass.: *Daucus lopadusanus* (V), *Filago cossyrensis* (V), *Linaria reflexa* subsp. *lubbockii* (IV), *Diplotaxis scaposa* (V), *Allium lopadusanum* (II), *Allium hirtovaginatum* (I).

Char. alliance: *Plantago coronopus* (V), *Catapodium balearicum* (V).

Char. order: *Bupleurum semicompositum* (V), *Convolvulus lineatus* (V), *Asteriscus aquaticus* (V), *Trigonella maritima* (IV), *Moraea sisyrinchium* (IV), *Anisantha fasciculata* (III), *Medicago littoralis* (III), *Parapholis incurva* (III), *Trigonella monspeliaca* (II), *Sulla spinosissima* (I).

Char. class: *Filago pygmaea* (V), *Euphorbia exigua* (V), *Trachynia distachya* (V), *Hypochoeris achyrophorus* (IV), *Linum strictum* (IV), *Plantago afra* subsp. *zwierleinii* (IV), *Sideritis romana* (III), *Hyoseris scabra* (III), *Stipellula capensis* (II), *Lagurus ovatus* (II), *Erodium chium* (II), *Catapodium rigidum* (II), *Echium parviflorum* (II), *Hippocrepis ciliata* (II), *Romulea columnae* (II), *Tripodion tetraphyllum* (I), *Trifolium scabrum* (I), *Valantia muralis* (I), *Ononis reclinata* (I), *Silene neglecta* (I), *Ononis sieberi* (I).

Other species: *Eryngium dichotomum* (V), *Reichardia picroides* (IV).

From Bartolo et al. (1990a), table 21, 6 rel. (subass. *rumicetosum*).

Char. association and subass.: *Daucus lopadusanus* (V), *Linaria reflexa* subsp. *lubbockii* (IV), *Diplotaxis scaposa* (V). *Filago cossyrensis* (I).

Char. subassociation: *Rumex bucephalophorus* subsp. *aegaeus* (V), *Anthemis lopadusana* (V).

Char. alliance: *Catapodium balearicum* (V), *Plantago coronopus* (IV).

Char. order: *Asteriscus aquaticus* (V), *Trigonella maritima* (V), *Medicago littoralis* (V), *Convolvulus lineatus* (IV), *Parapholis incurva* (III), *Trigonella monspeliaca* (III), *Bupleurum semicompositum* (II).

Char. class: *Euphorbia exigua* (V), *Valantia muralis* (V), *Hypochoeris achyrophorus* (V), *Lagurus ovatus* subsp. *nanus* (V), *Filago pygmaea* (IV), *Trachynia distachya* (IV), *Echium parviflorum* (II).

Other species: *Senecio leucanthemifolius* (V), *Lotus cytisoides* (V), *Eryngium dichotomum* (IV).

Geographical distribution: This association is restricted to Lampedusa island (Brullo, 1985; Bartolo et al., 1990a).

Structure and ecology: The *Filagini cossyrensis-Daucetum lopadusani* is an ephemeral vegetation occurring in the small ledges and crevices of limestone rocks near the sea. It is linked to very shallow soils, where only some annual microphytes can grow, among them the endemic *Daucus lopadusanus*, *Linaria reflexa* subsp. *lubbockii*, *Diplotaxis scaposa* and *Filago cossyrensis* can be considered the differential species of this syntaxon. The alliance and the order are well represented by *Catapodium balearicum*, *Plantago coronopus, Asteriscus aquaticus*, *Trigonella maritima*, *Medicago littoralis*, *Convolvulus lineatus*, *Parapholis incurva*, *Trigonella monspeliaca* and *Bupleurum semicompositum*. Besides, Bartolo et al. (1990a) reported the subass. *rumicetosum*, which is linked to more sciaphilous and slightly nitrophilous conditions, as the small crevices of rocky surfaces with northern exposure.

Syndynamism: See order.

Habitat reference: See order.

34.2.1.3. ***Sileno sedoides-Bellietum minuti*** Brullo 1985

Sciaphilous and coastal vegetation with hairy catchfly and miniature daisy of volcanic rocky crevices

Holotypus: rel. 4, tab. 4, Brullo (1985).

Characteristic and differential species: *Bellium minutum* L., *Silene sedoides* Poir.

Phytosociological table: From Brullo & Siracusa (1996), table 9, 11 rel.
Char. association: *Bellium minutum* (V), *Silene sedoides* (V).
Char. alliance: *Catapodium balearicum* (IV), *Plantago coronopus* (I),
Char. order: *Trigonella maritima* (IV), *Parapholis incurva* (I), *Medicago littoralis* (I).
Char. class: *Valantia muralis* (V), *Sedum litoreum* (IV), *Trifolium scabrum* (III), *Catapodium rigidum* (I).
Other species: *Rumex bucephalophorus* (V), *Parietaria lusitanica* (IV), *Frankenia hirsuta* (I).

Geographical distribution: This association occurs in Linosa and Pantelleria island (Brullo, 1985; Brullo & Siracusa, 1996).

Structure and ecology: The *Sileno-Bellietum minuti* colonizes the quite humid and shady crevices of volcanic rocky surfaces near the sea, which are covered by a thin layer of soil. It is a microphytic vegetation with spring flowering, dominated by *Bellium minutum* and *Silene sedoides*. Among the species of higher rank, *Catapodium balearicum*, *Plantago coronopus*,

Trigonella maritima, *Parapholis incurva* and *Medicago littoralis* are quite frequent (Brullo, 1985).

Syndynamism: This community has catenal contact with the halophilous vegetation of *Limonietum algusae*.

Habitat reference: See order.

34.2.1.4. ***Oglifetum lojaconoi*** Brullo 1985

Coastal and heliophilous vegetation with Lojacono cudweed of volcanic rocky crevices.

Holotypus: rel. 1, tab. 5, Brullo (1985).

Characteristic and differential species: *Logfia lojaconoi* (Brullo) C. Brullo & Brullo (= *Oglifa lojaconoi* Brullo).

Phytosociological table: From Brullo & Siracusa (1996), table 10, 8 rel.
Char. association: *Logfia lojaconoi* (V).
Char. alliance: *Plantago coronopus* (V), *Catapodium balearicum* (V).
Char. order: *Medicago littoralis* (V), *Parapholis incurva* (IV), *Trigonella maritima* (III).
Char. class: *Trifolium scabrum* (V), *Stipellula capensis* (III), *Lotus edulis* (III), *Catapodium rigidum* (II).
Other species: *Rumex bucephalophorus* (V), *Reichardia tingitana* (V).

Geographical distribution: This association is restricted to Linosa and Pantelleria island (Brullo, 1985; Brullo & Siracusa, 1996).

Structure and ecology: The *Oglifetum lojaconoi* replaces the previous association in the sunny surfaces with a layer of volcanic sands or incoherent soil. The endemic *Logfia lojaconoi* characterizes this syntaxon, occurring together with some species of higher rank, as *Plantago coronopus*, *Catapodium* balearicum, *Medicago littoralis*, *Parapholis incurva*, *Trigonella maritima*, *Trifolium scabrum*, *Stipellula capensis*, etc.

Syndynamism: See order.

Habitat reference: See order.

34.2.1.5. ***Plantagini coronopi-Erodietum linosae*** Brullo 1985

Ephemeral vegetation with buck's-horn plantain and Linosa stork's bill of cacuminal volcanic stands.

Holotypus: rel. 7, tab. 6, Brullo (1985).

Characteristic and differential species: *Catapodium zwierleinii* (Lojac.) Brullo., *Erodium neuradifolium* Delile ex Godr. var. *linosae* (Sommier) Brullo, *Linaria pseudolaxiflora* Lojac.

Phytosociological table: From Brullo & Siracusa (1996), table 7, 12 rel.

Char. association: *Erodium neuradifolium* var. *linosae* (V), *Catapodium zwierleinii* (IV), *Linaria pseudolaxiflora* (II).

Char. alliance: *Plantago coronopus* (IV), *Catapodium balearicum* (III).

Char. order: *Medicago littoralis* (IV), *Trigonella maritima* (III).

Char. class: *Lotus edulis* (V), *Plantago afra* subsp. *zwierleinii* (V), *Silene neglecta* (V), *Stipellula capensis* (V), *Lagurus ovatus* (V), *Trifolium stellatum* (IV), *Paronychia argentea* (III), *Trachynia distachya* (III), *Arenaria leptoclados* (III), *Echium parviflorum* (III), *Romulea columnae* (III), *Hedypnois cretica* (III), *Ononis reclinata* (III), *Medicago truncatula* (II), *Catapodium rigidum* (II), *Hippocrepis multisiliquosa* (II), *Medicago minima* (II), *Hyoseris scabra* (I).

Other species: *Rumex bucephalophorus* (V), *Andryala integrifolia* (V), *Reichardia tingitana* (V).

Geographical distribution: This association was described from Linosa island (Brullo, 1985; Brullo & Siracusa, 1996).

Structure and ecology: The *Plantagini-Erodietum linosae* is frequently found in the open surfaces with a thin layer of soil, but its more typical aspect is found in the cacuminal stands of volcanic slopes. Its physiognomy is given by some annual species, among them *Erodium neuradifolium* var. *linosae*, *Catapodium zwierleinii* and *Linaria pseudolaxiflora* represent the differential species. Despite its occurrence on volcanic soils, the acidophilous species of *Helianthemetea guttati* are quite rare in this vegetation and are replaced by many species of *Stipo-Trachynietea distachyae*, as *Lotus edulis*, *Plantago afra* subsp. *zwierleinii*, *Silene neglecta*, *Stipellula capensis*, *Lagurus ovatus*, *Trifolium stellatum*, *Paronychia argentea*, *Arenaria leptoclados*, *Echium parviflorum*, *Romulea columnae*, etc.

Syndynamism: This vegetation has a primary role only in small crevices of basaltic rocks, but it can cover large surfaces in the uncultivated fields and in the open stands where the maquis of *Periploco-Euphorbietum dendroides* has been depleted (Brullo, 1985).

Habitat reference: See order.

34.2.1.6. ***Sedo litorei-Valantietum calvae*** Brullo 1985

Ephemeral vegetation with coastal stonecrop and Linosa valantia of cacuminal windy stands.

Holotypus: rel. 4, tab. 7, Brullo (1985).

Characteristic and differential species: *Parietaria cretica* L., *Valantia calva* Brullo.

Phytosociological table: From Brullo & Siracusa (1996), table 8, 11 rel.

Char. association: *Valantia calva* (V), *Parietaria cretica* (V).

Char. alliance: *Catapodium balearicum* (IV), *Plantago coronopus* (I).

Char. class: *Sedum litoreum* (V), *Plantago afra* subsp. *zwierleinii* (III), *Silene neglecta* (V), *Stipellula capensis* (I), *Catapodium rigidum* (IV), *Medicago truncatula* (IV), *Trifolium scabrum* (III), *Trachynia distachya* (II), *Lotus edulis* (III), *Arenaria leptoclados* (I), *Valantia muralis* (I).

Other species: *Rumex bucephalophorus* (V), *Festuca pyramidata* (V), *Reichardia tingitana* (III).

Geographical distribution: This association is circumscribed to Linosa island (Brullo, 1985; Brullo & Siracusa, 1996).

Structure and ecology: The cacuminal stands of Linosa volcanoes, particularly the small crevices of rocks covered by volcanic slags and ashes, are colonized by an ephmeral community dominated by the endemic *Valantia calva* and *Parietaria cretica*. This vegetation, which is ascribed to *Sedo-Valantietum calvae*, shows a thermo-xerophilous character, since it is linked to very dry exposed and windy places. The syntaxa of higher rank are represented by *Catapodium balearicum*, *Plantago coronopus, Sedum litoreum*, *Plantago afra* subsp. *zwierleinii*, *Silene neglecta*, *Stipellula capensis*, *Catapodium rigidum*, *Medicago truncatula*, etc.

Syndynamism: It is a pioneer vegetation, having an edapho-climatophilous role.

Habitat reference: See order.

34.2.1.7. ***Catapodio marini-Sedetum litorei*** Bartolo, Brullo, Minissale & Spampinato 1990

Ephemeral vegetation with coastal stonecrop of shady calcareous surfaces.

Holotypus: rel. 2, tab. 22, Bartolo et al. (1990).

Characteristic and differential species: *Sedum caespitosum* (Cav.) DC., *S. litoreum* Guss.

Phytosociological table: From Bartolo et al. (1990), table 22, 5 rel.

Char. association and subass.: *Sedum litoreum* (V), *Sedum caespitosum* (V).

Char. alliance: *Catapodium balearicum* (V), *Plantago coronopus* (II).

Char. order: *Bupleurum semicompositum* (I), *Trigonella maritima* (I), *Parapholis incurva* (I).

Char. class: *Filago pygmaea* (III), *Lotus edulis* (III), *Euphorbia pycnophylla* (II), *Romulea columnae* (II), *Hedypnois cretica* (II), *Valantia muralis* (II), *Silene neglecta* (I), *Hyoseris scabra* (I), *Catapodium rigidum* (I), *Campanula erinus* (I).

Other species: *Reichardia picroides* var. *maritima* (IV).

Geographical distribution: This association was described from Lampedusa (Bartolo et al., 1990a).

Structure and ecology: The small shady ledges and crevices of calcareous rocky surfaces are covered by a microphytic vegetation dominated by succulent therophytes, as *Sedum litoreum* and *S. caespitosum*. It is a xerophilous and sciaphilous community with a subhalophilous character, which is classified as *Catapodio-Sedetum litorei* and framed within the *Stipo-Bupleuretalia semicompositi* for the occurrence of *Catapodium balearicum*, *Plantago coronopus*, *Bupleurum semicompositum*, *Trigonella maritima* and *Parapholis incurva*. This association shows some relationships with the *Thero-Sedetum caerulei* subass. *sedetosum caespitosi*, which is linked to sunny flat surfaces and it is floristically quite differentiated.

Syndynamism: This community replaces the *Filagini-Daucetum lopadusani* in the shady surfaces of coastal places (Bartolo et al., 1990a).

Habitat reference: See order.

34.2.1.8. ***Paronychio arabicae-Crassuletum tillaeae*** Bartolo, Brullo, Minissale & Spampinato 1990

Ephemeral vegetation with Arabian chickweed and mossy stonecrop of flooded rocky crevices.

Holotypus: rel. 9, tab. 23, Bartolo et al. (1990).

Characteristic and differential species: *Paronychia arabica* (L.) DC. subsp. *longiseta* Batt., *Tillaea muscosa* Lest.-Garl.

Phytosociological table: From Bartolo et al. (1990), table 23, 13 rel.

Char. association: *Tillaea muscosa* (V), *Paronychia arabica* subsp. *longiseta* (II).

Char. alliance: *Catapodium balearicum* (V), *Plantago coronopus* (IV).

Char. order: *Asteriscus aquaticus* (IV), *Parapholis incurva* (III), *Bupleurum semicompositum* (II), *Herniaria cinerea* (II), *Convolvulus lineatus* (II), *Trigonella monspeliaca* (I), *Anisantha fasciculata* (I).

Char. class: *Trachynia distachya* (V), *Stipellula capensis* (IV), *Filago pygmaea* (IV), *Sideritis romana* (II), *Echium parviflorum* (II), *Catapodium rigidum* (II), *Euphorbia pycnophylla* (I), *Hypochoeris achyrophorus* (I), *Hyoseris scabra* (I), *Lagurus ovatus* (I), *Romulea columnae* (I), *Linum strictum* (I), *Hippocrepis unisiliquosa* (I), *Erodium chium* (I).

Other species: *Barbula unguiculata* (V), *Bryum caespiticium* (IV), *Eryngium dichotomum* (IV).

Geographical distribution: This association was described from Lampedusa (Bartolo et al., 1990a).

Structure and ecology: The small crevices of limestone rocks, which are flooded for short periods during the winter, are colonized by an annual vegetation growing on a moss layer constituted by *Barbula unguiculata*, *Bryum caespiticium* and *Phaeoceros laevis*. It is the *Paronychio-Crassuletum tillaeae*, whose structure is given by *Tillaea muscosa* and some species of higher rank, as *Catapodium balearicum*, *Plantago coronopus, Asteriscus aquaticus*, *Parapholis incurva*, *Trachynia distachya*, *Stipellula capensis*, *Filago pygmaea*, etc. Besides, the very rare *Paronychia arabica* subsp. *longiseta* finds its optimum in this vegetation, allowing to distinguish the typical aspect of this association, which is linked to quite xeric conditions. Conversely, the more nitrophilous and mesophilous aspect was described by Bartolo et al. (1990) as subass. *saginetosum*, which is characterized by the occurrence of *Sagina apetala*, *Polycarpon diphyllum* subsp. *tetraphyllum*, *Bromus hordeaceus* and *Rostraria cristata*.

Syndynamism: The increase in anthropogenic disturbance can lead to the replacement of this community with more nitrophilous aspects, such as those ones belonging to the *Polygono-Poetea annuae* class.

Habitat reference: See order.

34.2.1.9. ***Atractylido cancellatae-Neatostenetum apuli*** Brullo, Scelsi & Siracusa 1994

Ephemeral vegetation with yellow gromwell of dry calcarenitic surfaces.

Holotypus: rel. 2, tab. 5, Brullo et al. (1994).

Characteristic and differential species: *Neatostema apulum* (L.) I. M. Johnston

Phytosociological table: From Brullo et al. (1994), table 5, 10 rel.

Char. association: *Neatostema apulum* (V).

Char. alliance and order: *Atractylis cancellata* (V), *Moraea sisyrinchium* (V), *Sulla spinosissima* (V), *Onobrychis caput-galli* (V), *Anisantha fasciculata* (V), *Catapodium balearicum* (IV), *Lagurus ovatus* subsp. *nanus* (III), *Parapholis incurva* (III), *Scorzonera deliciosa* (III), *Polygala monspeliaca* (I).

Char. class: *Trachynia distachya* (V), *Stipellula capensis* (III),*Tripodion tetraphyllum* (V), *Linum strictum* (V), *Trifolium scabrum* (V), *Ononis reclinata* (IV), *Trifolium stellatum* (IV), *Hypochoeris achyrophorus* (III), *Medicago minima* (III), *Filago pygmaea* (II), *Catapodium rigidum* (I).

Other species: *Aegilops geniculata* (V), *Kundmannia sicula* (V), *Anthemis arvensis* (IV).

Geographical distribution: This association occurs in the south-western coast of Sicily, near Siculiana (Brullo et al., 1994).

Structure and ecology: The coastal stands with calcarenitic rocks are colonized by an ephemeral vegetation with a xerophilous and subhalophilous character. It is the *Atractylido-Neatostenetum apuli*, which is usually found mixed with the thermophilous maquis of

Quercion ilicis. Under the floristic profile, it is characterized by the occurrence of the rare *Neatostema apulum*, growing together with some species of alliance and order, as *Atractylis cancellata*, *Moraea sisyrinchium*, *Sulla spinosissima*, *Onobrychis caput-galli*, *Anisantha fasciculata*, *Catapodium balearicum*, *Lagurus ovatus* subsp. *nanus*, *Parapholis incurva*, *Scorzonera deliciosa*, etc. (Brullo et al., 1994).

Syndynamism: This community represents a degradation stages of thermophilous shrubby vegetation.

Habitat reference: See order.

34.2.1.10. ***Catapodio marini-Valantietum intricatae*** Brullo & Siracusa 1996

Ephemeral vegetation with sea fern-grass and walls valantia of semi-rupicolous stands.

Holotypus: rel. 1, tab. 12, Brullo & Siracusa (1996).

Characteristic and differential species: *Valantia muralis* L. var. *intricata* (Lojac.) Brullo.

Phytosociological table: From Brullo & Siracusa (1996), table 12, 7 rel.

Char. association: *Valantia muralis* var. *intricata* (V).

Char. alliance and order: *Medicago littoralis* (V), *Sedum litoreum* (V), *Catapodium balearicum* (V), *Trigonella maritima* (V), *Parapholis incurva* (V), *Lagurus ovatus* subsp. *nanus* (V), *Plantago coronopus* (V), *Silene neglecta* (III), *Anisantha fasciculata* (II).

Char. class: *Trifolium scabrum* (V).

Other species: *Reichardia tingitana* (V), *Rumex bucephalophorus* (V), *Trifolium arvense* (V).

Geographical distribution: This association is circumscribed to Linosa (Brullo & Siracusa, 1996).

Structure and ecology: The semi-rupicolous stands of the rocky coast, which are not affected by salt-spray, are covered by an ephemeral vegetation dominated by *Valantia muralis* var. *intricata*. This community, named *Catapodio-Valantietum intricatae,* prefers the small crevices of basaltic rocks with a shallow layer of soil, often mixed with the thermophilous maquis of *Periploco-Euphorbietum dendroidis*. As regards its floristic set, the alliance and the order are represented by *Medicago littoralis*, *Sedum litoreum*, *Catapodium balearicum*, *Trigonella maritima*, *Parapholis incurva*, *Lagurus ovatus* subsp. *nanus*, *Plantago coronopus*, *Silene neglecta*, *Anisantha fasciculata*, etc.

Syndynamism: See order.

Habitat reference: See order.

34.2.1.11. ***Anthemido secundirameae-Allietum lehmanii*** Brullo & Scelsi 1998

Ephemeral vegetation with coastal chamomile and Lehman garlic of rocky coast.

Holotypus: rel. 11, tab. 1, Brullo & Scelsi (1998).

Characteristic and differential species: *Allium lehmanii* Lojac., *Anthemis secundiramea* Biv.

Phytosociological table: From Brullo & Scelsi (1998), table 1, 15 rel.

Char. association: *Allium lehmanii* (V), *Anthemis secundiramea* (V).

Char. alliance: *Plantago coronopus* (V), *Catapodium balearicum* (V).

Char. order: *Moraea sisyrinchium* (V), *Medicago littoralis* (V), *Scorzonera deliciosa* (V), *Parapholis incurva* (V), *Asteriscus aquaticus* (V), *Sulla spinosissima* (IV), *Bellis annua* (III), *Anisantha fasciculata* (III).

Char. class: *Valantia muralis* (V), *Filago pygmaea* (V), *Euphorbia exigua* (V), *Hypochoeris achyrophorus* (IV), *Helianthemum salicifolium* (IV), *Hedypnois cretica* (IV), *Catapodium rigidum* (IV), *Bromus rubens* (IV), *Linum strictum* (III), *Trifolium scabrum* (III), *Sedum rubens* (II), *Onobrychis caput-galli* (I), *Silene nocturna* (I).

Other species: *Centaurium pulchellum* (IV), *Anthemis arvensis* (II).

Geographical distribution: This association represents the geographic vicariant of the *Anthemido-Desmazerietum siculae* in the south-eastern coast of Sicily (Brullo & Scelsi, 1998; Minissale et al., 2011).

Structure and ecology: The small surfaces of calcareous rocks with a thin layer of red soil are covered by an annual community dominated by *Anthemis secundiramea* and *Allium lehmanii*. It is the *Anthemido-Allietum lehmanii*, which is usually found in the clearings of the coastal maquis belonging to *Myrto-Pistacietum lentisci* and *Calicotomo-Rhoetum tripartitae*. The occurrence of *Plantago coronopus*, *Catapodium balearicum*, *Moraea sisyrinchium*, *Medicago littoralis*, *Scorzonera deliciosa*, *Parapholis incurva*, *Asteriscus aquaticus*, *Sulla spinosissima*, *Bellis annua* and *Anisantha fasciculata* allows to refer this vegetation to *Stipo-Bupleuretalia semicompositi* and *Plantagini-Catapodion marini* (Brullo & Scelsi, 1998).

Syndynamism: This vegetation occurs in degradated places, potentially covered by coastal maquis.

Habitat reference: See order.

34.2.1.12. ***Echinarietum todaroanae*** Brullo, Scelsi, Siracusa & Tomaselli 1998

Ephemeral vegetation with Todaro's echinaria grass of clayey slopes.

Holotypus: rel. 5, tab. 4, Brullo et al. (1998c).

Characteristic and differential species: *Echinaria todaroana* Ces., *Ornithogalum collinum* Guss.

Phytosociological table: From Brullo et al. (1998c), table 4, 5 rel. (subass. *typicum*).

Char. association: *Echinaria todaroana* (V), *Ornithogalum collinum* (III).

Char. order: *Anisantha fasciculata* (V), *Crupina crupinastrum* (V), *Polygala monspeliaca* (IV), *Medicago littoralis* (IV), *Moraea sisyrinchium* (III), *Hippocrepis biflora* (III), *Onobrychis caput-galli* (III).

Char. class: *Stipellula capensis* (V), *Trifolium scabrum* (V), *Hypochoeris achyrophorus* (V), *Trachynia dystachia* (V), *Linum corymbulosum* (IV), *Linum strictum* (IV), *Catapodium rigidum* (IV), *Parentucellia latifolia* (IV), *Trifolium angustifolium* (IV), *Ononis reclinata* (III), *Valantia muralis* (II).

Other species: *Aegilops geniculata* (V), *Festuca danthonii* (V), *Poa bulbosa* (V), *Trifolium campestre* (V).

From Costanzo et al. (2005), table 16, 3 rel. (subass. *parapholideto pycnanthae*).

Char. association and subassociation: *Echinaria todaroana* (3), *Parapholis pycnantha* (3).

Char. order and class: *Trachynia dystachia* (3), *Gastridium scabrum* (3), *Hypochoeris achyrophorus* (3), *Linum tryginu* (3), *Catapodium rigidum* (3), *Euphorbia exigua* (2), *Atractylis cancellata* (1).

Other species: *Aegilops geniculata* (3), *Centaurium erythraea* (3), *Scorpiurus muricatus* (3).

Geographical distribution: This association was surveyed in the Hylaean area and in Central Sicily (Brullo et al., 1998c; Costanzo et al., 2005).

Structure and ecology: The *Echinarietum todaroanae* occurs in the eroded clayey slopes, often mixed with the perennial grasslands of *Lygeum spartum* or also with the mesophilous meadows of *Arrhenathero-Helictotrichetum*. This community is characterized by the dominance of *Echinaria todaroana*, growing together with *Anisantha fasciculata*, *Crupina crupinastrum*, *Polygala monspeliaca*, *Moraea sisyrinchium*, *Medicago littoralis*, *Onobrychis caput-galli*, *Stipellula capensis, Trifolium scabrum*, *Hypochoeris achyrophorus*, etc. Costanzo et al. (2005) distinguished the subass. *parapholideto pycnanthae*, a more thermo-xerophilous and subhalophilous aspect linked to very eroded badlands.

Syndynamism: This annual vegetation represents a degredation stage of perennial grasslands.

Habitat reference: See order.

34.2.1.13. ***Onobrychido caput-galli-Psiluretum incurvi*** Brullo & Scelsi 1998

Ephemeral vegetation with cockscomb sainfoin and bristle-tail grass of marly surfaces.

Holotypus: rel. 1, tab. 2, Brullo & Scelsi (1998).

Characteristic and differential species: *Psilurus incurvus* (Gouan) Schinz & Thell.

Phytosociological table: From Brullo & Scelsi (1998), table 2, 6 rel.

Char. association: *Psilurus incurvus* (V).

Char. alliance and order: *Anisantha fasciculata* (V), *Onobrychis caput-galli* (V), *Moraea sisyrinchium* (V), *Asteriscus aquaticus* (V), *Crupina crupinastrum* (IV), *Filago eriocephala* (IV).

Char. class: *Stipellula capensis* (V), *Trifolium stellatum* (V), *Euphorbia exigua* (V), *Linum strictum* (V), *Trifolium scabrum* (V), *Tripodion tetraphyllum* (IV), *Euphorbia falcata* (IV), *Lotus edulis* (IV), *Hyoseris scabra* (IV), *Hedypnois rhagadioloides* (IV), *Hypochoeris achyrophorus* (IV), *Bromus rubens* (IV), *Trachynia dystachia* (III), *Lathyrus sphaericus* (II), *Hymenocarpus circinnatus* (II).

Other species: *Festuca danthonii* (V), *Trifolium campestre* (IV).

Geographical distribution: This association was surveyed near Vittoria, SE Sicily (Brullo & Scelsi, 1998).

Structure and ecology: The *Onobrychido-Psiluretum incurvi* colonizes the marly surfaces with a thin layer of soil in the clearings of the pine-woods belonging to *Thymo-Pinetum halepensis*. It is a thermo-xerophilous vegetation, which is characterized by the high coverage of *Psilurus incurvus*. Among the species of higher rank, *Anisantha fasciculata*, *Onobrychis caput-galli*, *Moraea sisyrinchium*, *Asteriscus aquaticus*, *Crupina crupinastrum*, *Filago eriocephala, Stipellula capensis*, *Trifolium stellatum*, *Euphorbia exigua*, *Linum strictum* and *Trifolium scabrum* are frequent (Brullo & Scelsi, 1998).

Syndynamism: This community colonizes the open stands within the pinewoods.

Habitat reference: See order.

34.2.1.14. ***Podospermo cani-Plantaginetum deflexae*** Brullo, Guarino & Ronsisvalle 1998

Ephemeral vegetation with clay scorzonera and Bellardi's plantain of flat clay surfaces.

Holotypus: rel. 2, tab. 24, Brullo et al. (1998).

Characteristic and differential species: *Plantago bellardii* All.

Phytosociological table: From Brullo et al. (1998), table 24, 5 rel.

Char. association: *Plantago bellardii* (V).

Char. alliance and order: *Plantago coronopus* (V), *Medicago littoralis* (V), *Parapholis incurva* (V), *Podospermum canum* (V), *Sulla spinosissima* (V), *Bupleurum semicompositum* (V), *Atractylis cancellata* (IV), *Silene nocturna* (IV), *Anisantha fasciculata* (III).

Char. class: *Stipellula capensis* (V), *Plantago afra* subsp. *afra* (V), *Euphorbia exigua* (V), *Hypochoeris achyrophorus* (V), *Medicago minima* (IV), *Hyoseris scabra* (IV), *Medicago turbinata* (III), *Filago eriocephala* (III), *Trachynia dystachia* (III), *Trifolium stellatum* (II), *Herniaria cinerea* (I), *Hedypnois rhagadioloides* (I).

Other species: *Anacyclus tomentosum* (V), *Melilotus sulcata* (V), *Bellardia trixago* (IV).

Geographical distribution: This association has been surveyed in Torre Manfria, near Gela (Brullo et al., 1998).

Structure and ecology: The flat clay surfaces within the dry perennial grasslands of *Lygeum spartum* are colonized by the *Podospermo-Plantaginetum deflexae.* It is a therophytic vegetation with a thermo-xerophilous character, which is floristically characterized by the dominance of *Plantago bellardii* and *Podospermum canum*, growing together with some species of alliance and order, as *Plantago coronopus, Medicago littoralis*, *Parapholis incurva*, *Podospermum canum*, *Sulla spinosissima, Bupleurum semicompositum*, *Atractylis cancellata*, *Silene nocturna*, etc. (Brullo et al., 1998).

Syndynamism: This community derives from the degradation of perennial grassland, colonizing quite open surfaces.

Habitat reference: See order.

34.2.1.15. ***Parapholido incurvae-Asphodeletum tenuifolii*** Brullo, Guarino & Ronsisvalle 1998

Ephemeral vegetation with coast barbgrass and onionweed of small ledges.

Holotypus: rel. 4, tab. 25, Brullo et al. (1998).

Characteristic and differential species: *Asphodelus tenuifolius* Cav.

Phytosociological table: From Brullo et al. (1998), table 25, 6 rel.
Char. association: *Asphodelus tenuifolius* (V).
Char. alliance: *Plantago coronopus* (V), *Catapodium balearicum* (I).
Char. order: *Parapholis incurva* (V), *Sula spinosissima* (V), *Hippocrepis ciliata* (V), *Crupina crupinastrum* (III), *Atractylis cancellata* (III), *Medicago littoralis* (II).
Char. class: *Trachynia dystachia* (V), *Valantia muralis* (V), *Hypochoeris achyrophorus* (V), *Helianthemum salicifolium* (V), *Ononis reclinata* (IV), *Stipellula capensis* (IV), *Linum strictum* (III), *Lotus edulis* (II).
Other species: *Reichardia maritima* (III), *Convolvulus siculus* (I).

Geographical distribution: This association was described from Torre Manfria, near Gela (Brullo et al., 1998).

Structure and ecology: The *Parapholido-Asphodeletum tenuifolii* colonizes the small ledges with a very shallow soil of dry limestone cliffs near the sea, which are covered by the *Diplotaxio-Reaumurietum vermiculatae*. It is characterized by the occurrence of the rare *Asphodelus tenuifolius*, growing together with some specis of higher rank, as *Plantago coronopus*, *Catapodium balearicum*, *Trachynia dystachia*, *Parapholis incurva*, *Sula spinosissima*,

Hippocrepis ciliata, *Crupina crupinastrum*, *Atractylis cancellata*, *Valantia muralis*, *Hypochoeris achyrophorus*, *Helianthemum salicifolium*, etc.

Syndynamism: It is an edapho-xerophilous vegetation, having a permanent role.

Habitat reference: See order.

34.2.1.16. ***Sagino maritimae-Crassuletum tilleae*** Brullo, Guarino & Ronsisvalle 1998

Ephemeral vegetation with sea pearlwort and mossy stonecrop of flat gypsum surfaces.

Holotypus: rel. 1, tab. 26, Brullo et al. (1998).

Characteristic and differential species: *Tillaea muscosa* L., *Sagina maritima* Don.

Phytosociological table: From Brullo et al. (1998), table 26, 5 rel.

Char. association: *Tillaea muscosa* (V), *Sagina maritima* (V).

Char. alliance and order: *Medicago littoralis* (V), *Parapholis incurva* (IV), *Sula spinosissima* (IV), *Moraea sisyrinchium* (IV), *Plantago coronopus* (III), *Silene nocturna* (III), *Hippocrepis ciliata* (II), *Crupina crupinastrum* (I),

Char. class: *Stipellula capensis* (V), *Sedum caespitosum* (V), *Sedum rubens* (IV), *Euphorbia exigua* (IV), *Plantago afra* subsp. *afra* (IV), *Medicago minima* (III), *Trachynia distachya* (III), *Romulea columnae* (III), *Linum strictum* (II), *Hypochoeris achyrophorus* (II), *Herniaria cinerea* (II), *Sedum coeruleum* (II).

Other species: *Poa bulbosa* (V).

Geographical distribution: This association was described from Torre Manfria, near Gela (Brullo et al., 1998).

Structure and ecology: The flat surfaces of gypsum outcrops with a thin and compact layer of soil are covered by an ephemeral pioneer vegetation dominated by *Tillaea muscosa* and *Sagina maritima*. It is the *Sagino maritimae-Crassuletum tilleae*, whose subhalophilous character is highlighted by the presence of some species belonging to alliance and order, as *Medicago littoralis*, *Parapholis incurva*, *Sula spinosissima*, *Moraea sisyrinchium*, *Plantago coronopus*, *Silene nocturna*, etc. (Brullo et al., 1998).

Syndynamism: Anthropogenic disturbance can lead to the replacement of the community at issue with the nitrophilous vegetation of *Crassulo-Saginetum apetalae*.

Habitat reference: See order.

35. Class: ***Lygeo sparti-Stipetea tenacissimae*** Rivas-Martinez 1978

Pseudosteppes on calcareous rocky substrates and relict edaphic steppes on deep clayey soils.

Synonyms: *Thero-Brachypodietea* Br.-Bl. in Br.-Bl. et al. 1947 (art. 2b, 36); *Thero-Brachypodietea ramosi* Br.-Bl. ex A. Bolòs y Vayreda & O. de Bolòs 1950 nom. ambig. rejic. propos. (art. 10a, 36); *Thero-Brachypodietea* Br.-Bl. ex Br.-Bl. et al. 1952 nom. ambig. rejic. propos. (art. 36); *Phlomidi lychnitidis-Brachypodietea retusi* Rossellò 1994 (art. 2b).

Holotypus: *Lygeo-Stipetalia* Br.-Bl. & O. Bolòs 1958 nom. conserv. (art. 44a).

Characteristic and differential species: *Allium arvense* Guss., *Allium sphaerocephalon* L., *Anthyllis vulneraria* L. subsp. *maura* (Beck) Maire, *Asperula aristata* L. subsp. *scabra* Nyman, *Asphodeline lutea* (L.) Rchb., *Asphodelus ramosus* L., *Bituminaria bituminosa* (L.) C.H. Stirt., *Calendula suffruticosa* Vahl subsp. *fulgida* (Rafin.) Ohle, *Carlina hispanica* Lam. subsp. *globosa* (Arcang.) Meusel & Kästner, *Carlina sicula* Ten., *Centaurea sicula* L., *Charybdis pancration* (Steinh.) Speta, *Clinopodium nepeta* (L.) Kuntze subsp. *nepeta, Convolvulus cantabrica* L., *Convolvulus elegantissimus* Mill., *Dactylis hispanica* L., *Elaeoselinum meoides* (Desf.) DC., *Galium lucidum* All., *Hypericum perfoliatum* L., *Hypericum perforatum* L., *Lobularia maritima* (L.) Desv., *Micromeria graeca* (L.) Benth. ex Rchb. subsp. *consentina* (Ten.) Guinea, *Ornithogalum gussonei* Ten., *Piptatherum miliaceum* (L.) Coss., *Pallenis spinosa* (L.) Cass., *Petrorhagia illyrica* (Ard.) P. W. Ball & Heywood subsp. *haynaldiana* (F.N. Williams) P.W. Ball & Heywood, *Reichardia picroides* (L.) Roth, *Poterium sanguisorba* Scop., *Scorzonera villosa* subsp. *columnae* (Guss.) Nyman, *Sedum sediforme* (Jacq.) Pau., *Sixalix atropurpurea* (L.) Greuter & Burdet *Thapsia garganica* L., *Verbascum sinuatum* L.

Geographical distribution: This class has a wide distribution in the Mediterranean and Macaronesian areas (C. Brullo et al., 2010; Rivas-Martinez et al., 2011; Costa et al., 2012; Mucina et al., 2016).

Structure and ecology: The perennial herbaceous communities consisting of large size grasses with stiff leaves and deep roots are ascribed to the *Lygeo sparti-Stipetea tenacissimae* class (Costa et al., 2012). This vegetation has a thermo-xherophilous character, growing on dry basic substrates, as clays, marls, gypsum and limestone, without hidromorphy or salinity, and usually characterized by primitive and heavily eroded soils. These grasslands found their ideal bioclimatic conditions within the thermo- and mesomediterranean thermotypes with dry to subhumid ombrotypes (C. Brullo et al., 2010).

Syndynamism: Generally, the communities of *Lygeo-Stipetea* have a secondary role, being originated from the degradation of woody vegetation, due to fire, overgrazing, deforestation, and human over-exploitation. Therefore, they represents an early serial stage of oak woods (*Quercetalia ilicis*) or maquis (*Quercetalia calliprini*). However, they can be considered a primary vegetation in some particular edaphoclimacic conditions, like those occurring in the

most eroded badlands. The wide presence of these grasslands in Sicily is linked with the traditional agro-pastoral land use, consisting of frequent fires for creating suitable pastures (Bartolo et al., 1982; Gianguzzi et al., 1996; Ferro & Ladero-Alvarez, 1999; Minissale et al., 2007; C. Brullo et al., 2010).

Habitat reference: E1.3b Mediterranean tall perennial dry grassland; F5.53 Ampelodesmos mauritanica -dominated garrigues.

35.1. Order: ***Lygeo-Stipetalia*** Br.-Bl. & O. Bolòs 1958

Mediterranean edaphic steppes on deep clayey soils.

Synonyms: *Thero-Brachypodietalia* Br.-Bl. ex Bharucha 1933 nom. amb. (art. 36)

Holotypus: *Agropyro pectinati-Lygeion sparti* Br.-Bl. & O. Bolòs 1958 corr. Rivas-Martínez, T.E. Díaz, Fernández González, Izco, Loidi, Lousã & Penas 2002

Characteristic and differential species: *Carlina gummifera* (L.) Less., *Lygeum spartum* L., *Polygonum tenorei* C. Presl*, Reichardia intermedia* (Sch. Bip.) Samp., *Scorzonera deliciosa* Guss.

Geographical distribution: This order occurs in the mediterranean area (Brullo et al., 2002).

Structure and ecology: The perennial grasslands dominated by *Lygeum spartum*, linked to very arid and hot climatic conditions, are ascribed to the *Lygeo-Stipetalia* order. The edaphic features of the eroded clay badlands, where these communities are found, increase the xeric character of this vegetation. These coenoses occur from the sea level up to about 900 m a.s.l. within the thermo- and mesomediterranean dry to subhumid bioclimatic belt (C. Brullo et al., 2010).

Syndynamism: Generally, this vegetation represents a primary edapho-xerophilous vegetation, having catenal contacts with the halo-nitrophilous communities of *Pegano-Salsoletea*. Conversely, on less sloped stands where the soil evolution is possible, they are dynamically linked with maquis of *Oleo-Ceratonion* (Brullo et al., 1990; C. Brullo et al., 2010).

Habitat reference: E6.1- Mediterranean inland salt steppe.

35.1.1. Alliance: ***Moricandio-Lygeion sparti*** Brullo, De Marco & Signorello 1990

Thermo-mesomediterranean edaphic steppes on deep clayey soils.

Holotypus: *Loto cytisoidis-Lygetum sparti* Brullo, De Marco & Signorello 1990.

Characteristic and differential species: *Capparis sicula* Veill., *Eryngium dichotomum* Desf., *Eryngium triquetrum* Vahl., *Moricandia arvensis* (L.) DC.

Geographical distribution: This alliance is found in Southern Calabria, Sicily and Sardinia (Brullo et al., 1990; 2002).

Structure and ecology: The *Moricandio-Lygeion sparti* represents a geographical vicariant of *Eremopyro-Lygeion* Br.-Bl. & Bolòs 1958, occurring in the Western Mediterranean. This vegetation has a marked thermo-xerophilous character, colonizing steep slopes of badlands, strongly affected by water erosion. Its floristic set is characterized by some endemic species of Sicily, Sardinia and Southern Italy (C. Brullo et al., 1990).

Syndynamism: The communities belonging to this alliance can be considered as a primary edapho-xerophilous vegetation.

Habitat reference: See order.

35.1.1.1. ***Eryngio dichotomi-Lygeetum sparti*** Gentile & Di Benedetto 1961

Perennial grasslands with esparto grass and dichotomous eryngo of gently sloping clayey surfaces.

Synonyms: *Lygeo-Eryngietum dichotomi* Gentile & Di Benedetto 1961.

Lectotypus: rel. 1, tab. 4, Gentile & Di Benedetto (1961), designated by Brullo (1985).

Characteristic and differential species: *Eryngium dichotomum* Desf.

Phytosociological table: From Brullo & Siracusa (2000), table 14, 10 rel.

Char. association: *Eryngium dichotomum* (V).

Char. alliance: *Moricandia arvensis* (IV), *Capparis sicula* (III).

Char. order and class: *Lygeum spartum* (V), *Pallenis spinosa* (V), *Carlina corymbosa* subsp. *globosa* (IV), *Charybdis pancration* (III), *Asphodelus ramosus* subsp. *ramosus* (III), *Hyparrhenia hirta* (II).

Other species: *Suaeda vera* (V), *Atriplex halimus* (V), *Carlina lanata* (V), *Stipellula capensis* (V), *Asparagus aphyllus* (IV).

Geographical distribution: This association is quite frequent in Central Sicily (Gentile & Di Benedetto, 1961; Brullo & Siracusa, 2000; C. Brullo et al., 2010).

Structure and ecology: The flat or gently sloping clayey surfaces within thermomediterranean dry belt (0-300 m a.s.l.), are colonized by a thermo-xerophilous community dominated by *Lygeum spartum*. This perennial grassland is ascribed to *Eryngio dichotomi-Lygeetum sparti* and is floristically differentiated by the xeric species *Eryngium*

dichotomum and *E. triquetrum*, xerophytes coming from northern Africa. The higher syntaxa are represented by *Moricandia arvensis*, *Capparis* sicula, *Lygeum spartum*, *Pallenis spinosa*, *Carlina corymbosa* subsp. *globosa*, *Charybdis pancration*, etc. This vegetation plays an important role in the stabilization of clayey substrates (Brullo & Siracusa, 2000).

Syndynamism: This community takes catenal contact with the *Pegano-Salsoletea* shrubby vegetation.

Habitat reference: See order.

35.1.1.2. ***Tripolietum sorrentinoi*** Brullo 1985

Perennial vegetation with Sicily aster of steep clayey slopes.

Synonyms: *Asteretum sorrentinii* Brullo 1985 nom. mut.

Holotypus: rel. 1, tab. 2, Brullo (1985).

Characteristic and differential species: *Tripolium sorrentinoi* (Tod.) Raimondo & Greuter.

Phytosociological table: From Brullo (1985), table 2, 6 rel.

Char. association: *Tripolium sorrentinoi* (V).

Char. alliance and order: *Eryngium dichotomum* (IV), *Eryngium triquetrum* (II), *Lygeum spartum* (I).

Char. class: *Dactylis glomerata* subsp. *hispanica* (IV), *Reichardia picroides* (IV), *Asphodeline lutea* (II), *Sixalix atropurpurea* (II).

Other species: *Picris echioides* (V), *Daucus carota* (V), *Melilotus sulcata* (V), *Sulla coronaria* (V), *Lolium rigidum* (V).

Geographical distribution: This association has a scattered distribution in Central and Western Sicily (Brullo, 1985; Venturella et al., 1986; C. Brullo et al., 2010).

Structure and ecology: The quite steep slopes of clay badlands, within the mesomediterranean subhumid bioclimatic belt (up to 900 m a.s.l.), are colonized by a community with the endemic *Tripolium sorrentini*. This vegetation, named *Asteretum sorrentinii*, has a quite open structure, showing a low coverage. *Lygeum spartum* is sporadic and just few species of higher rank participate to this association, among them *Eryngium dichotomum*, *Eryngium triquetrum*, *Dactylis glomerata* subsp. *hispanica* and *Reichardia picroides* (Brullo, 1985).

Syndynamism: The *Asteretum sorrentinii* is a pioneer, edaphophilous vegetation, which is linked to the mesophilous deciduous oak woods of *Quercetalia ilicis* (C. Brullo et al., 2010).

Habitat reference: See order.

35.1.1.3. ***Malvo agrigentinae-Lygeetum sparti*** Brullo 1985 corr.

Perennial vegetation with Agrigento mallow and esparto grass of flat or gently sloping clay stands.

Synonyms: *Lygeo-Lavateretum agrigentinae* Brullo 1985.

Holotypus: rel. 5, tab. 1, Brullo (1985).

Characteristic and differential species: *Allium agrigentinum* Brullo & Pavone, *Limonium calcarae* (Janka) Pignatti, *Malva agrigentina* (Tineo) Soldano & al.

Phytosociological table: From Brullo (1985), table 1, 15 rel.

Char. association: *Malva agrigentina* (V), *Allium agrigentinum* (IV), *Limonium calcarae* (I).

Char. alliance and order: *Lygeum spartum* (V), *Eryngium triquetrum* (III), *Moricandia arvensis* (III), *Capparis sicula* (III).

Char. class: *Asphodeline lutea* (II), *Pallenis spinosa* (II), *Allium arvense* (II), *Dactylis glomerata* subsp. *hispanica* (I).

Other species: *Daucus aureus* (V), *Hainardia cylindrica* (V), *Catananche lutea* (V), *Mantisalca salmantica* (IV), *Podospermum laciniatum* (IV).

Geographical distribution: This association occurs in Central and Southern Sicily (Brullo, 1985; C. Brullo et al., 2010).

Structure and ecology: The flat or gently sloping clayey stands, within the thermo- and mesomediterranean dry-subhumid bioclimatic belt, are colonized by a quite dense grassland with *Lygeum spartum*. This community, named *Malvo agrigentinae-Lygeetum sparti*, is floristically well characterized by some endemis species, as *Malva agrigentina*, *Allium agrigentinum* and *Limonium calcarae*. The higher syntaxa are represented by *Eryngium triquetrum*, *Moricandia arvensis*, *Capparis sicula, Asphodeline lutea*, *Pallenis spinosa* and *Allium arvense* (Brullo, 1985).

Syndynamism: It is an edapho-xerophilous vegetation, which is dynamically linked to the shrubby vegetation of *Pegano-Salsoletea* (C. Brullo et al., 2010).

Habitat reference: See order.

35.1.1.4. ***Phagnalo annotici-Lygeetum sparti*** Biondi & Mossa 1993

Grassland with esparto grass and rock phagnalon of coastal badlands.

Holotypus: Not designated.

Characteristic and differential species: *Asparagus stipularis* Forssk., *Phagnalon rupestre* (L.) DC. subsp. *annoticum* (Burnat) Pignatti.

Phytosociological table: From Brullo et al. (1998), table 7, 4 rel.

Char. association: *Phagnalon rupestre subsp. annoticum* (4), *Asparagus stipularis* (3).

Char. alliance and order: *Moricandia arvensis* (4), *Lygeum spartum* (4), *Capparis sicula* (3).

Char. class: *Asphodelus ramosum* (4), *Hyparrhenia hirta* (4), *Charybdis pancration* (4), *Dactylis glomerata* subsp. *hispanica* (3), *Allium arvense* (2), *Pallenis spinosa* (1), *Ampelodesmos mauritanicus* (1), *Reichardia picroides* (1).

Other species: *Asparagus aphyllus* (4), *Salsola oppositifolia* (4), *Coridothymus capitatus* (4), *Diplotaxis crassifolia* (2), *Dittrichia viscosa* (1).

Geographical distribution: This association occurs in Southern Sardinia (Biondi & Mossa, 1992) and Southern Sicily (Brullo et al., 1998; Bazan et al., 2006b, Giusso et al., 2008; C. Brullo et al., 2010).

Structure and ecology: The *Phagnalo annotici-Lygeetum sparti* is linked to coastal badlands, which are directly affected by sea agents. It prefers the very steep clay slopes, within the thermomediterranean dry bioclimatic belt, appearing as a *Lygeum*-dominated grassland. Under the floristic profile, *Asparagus stipularis* and *Phagnalon rupestre* subsp. *annoticum* characterize this vegetation, growing together with *Moricandia arvensis*, *Capparis sicula*, *Asphodelus ramosum*, *Hyparrhenia hirta*, *Charybdis pancration*, *Dactylis glomerata* subsp. *hispanica*, etc. (Brullo et al., 1998).

Syndynamism: Similarly to the previous association, it is an edapho-xerophilous vegetation, which is connected with the dynamic series of *Pegano-Salsoletea* (C. Brullo et al., 2010).

Habitat reference: See order.

35.2. Order: ***Cymbopogono-Brachypodietalia ramosi*** Horvatić 1963

Mediterranean pseudosteppes on sandy-loamy soils over calcareous bedrock

Synonyms: *Thero-Brachypodietalia* Br.-Bl. 1931 (art. 2b); *Thero-Brachypodietalia* Br.-Bl. Ex Bharucha 1932 nom. ambig. rejic. propos. (art. 36); *Cymbopogono-Brachypodietalia* Horvatić 1957 (art. 2b); *Cymbopogono-Brachypodietalia* Horvatić 1958 (art. 2b); *Hyparrhenio hirtae-Brachypodietalia ramos* Horvati1963 nom. mut. propos. (art. 45); *Dauco-Hyparrhenietalia* Izco 1978 (art. 2b); *Hyparrhenietalia hirtae* Rivas-Martinez 1978 (art. 5); *Hyparrhenietalia podotrichae* Rivas-Martinez 1978 corr. Rivas-Martinez et al. 1992 (corr.superfl.); *Brachypodietalia retusi* Julve 1993 (art. 2b); *Convolvulo althaeoidis-Hyparrhenetalia villosae* (Rivas-Martinez 1978) Rosellò 1994 (art. 29); *Phlomido lychnitis-Brachypodietalia retusi* Rossellò 1994 (art. 5); *Brachypodio ramosi-Dactylidetalia hispanicae* Biondi et al. 2001 (syntax.syn.);*Dauco-Hyparrhenietalia* Izco 1978 (art. 2b); *Hyparrhenietalia hirtae* Rivas-

Martinez 1978 (art. 5); *Hyparrhenietalia podotrichae* Rivas-Martinez 1978 corr. Rivas-Martinez et al. 1992 (corr.superfl.); *Brachypodietalia retusi* Julve 1993 (art. 2b); *Convolvulo althaeoidis-Hyparrhenetalia villosae* (Rivas-Martinez 1978) Rosellò 1994 (art. 29); *Phlomido lychnitis-Brachypodietalia retusi* Rossellò 1994 (art. 5); *Brachypodio ramosi-Dactylidetalia hispanicae* Biondi et al. 2001 (syntax.syn.)

Holotypus: *Hyparrhenion hirtae* Br.-Bl., P. Silva & Rozeira 1956.

Characteristic and differential species: *Andropogon distachyos* L.*, Carlina gummifera* (L.) Less., *Cachrys libanotis* L., *Convolvulus althaeoides* L., *Ferula communis* L.*, Foeniculum vulgare* Mill. subsp. *piperitum* (Ucria) Bég., *Heteropogon contortus* (L.) Beauv., *Hyoseris radiata* L.*, Hyparrhenia hirta* (L.) Stapf., *Kundmannia sicula* (L.) DC., *Hyparrhenia sinaica* (Delile) Llauradó ex G. López, *Lathyrus articulatus* L., *Micromeria graeca* (L.) Benth. ex Rchb., *Phagnalon saxatile* (L.) Cass.

Geographical distribution: This order is widely distributed in the Mediterranean area (C. Brullo et al., 2010).

Structure and ecology: The perennial dry grasslands occurring on several substrata except for clays, such as limestones, dolomites, granites, marls, gneiss, metamorphic and volcanic rocks, are ascribed to *Cymbopogono-Brachypodietalia ramosi*. It is found mainly in the thermomediterranean belt, but sometimes also in the infra- and mesomediterranean belts. The physiognomy of this vegetation is given by perennial bunchgrasses, such as *Hyparrhenia hirta*, *Ampelodesmos mauritanicus*, *Piptatherum miliaceum*, *Stipa* sp. pl., *Arundo collina*, etc. (C. Brullo et al., 2010; Costa et al., 2012).

Syndynamism: The communities belonging to this syntaxon represent a secondary vegetation dynamically linked to the thermophilous woods of *Quercetalia ilicis* or *Quercetalia calliprini* maquis. Less frequently, they find primary stands in rocky outcrops or steep slopes with extreme edaphic and microclimatic conditions (C. Brullo et al., 2010).

Habitat reference: E1.432-Mediterranean feathergrass steppes; E1.434-Andropogonid grass steppes; E1.44-Cane Steppes; F5.53**-** *Ampelodesmos mauritanica*-dominated garrigues.

35.2.1. Alliance: ***Hyparrhenion hirtae*** Br.-Bl., P. Silva & Rozeira 1956

Thermo-mesomediterranean pseudosteppes with thatching grass on calcareous dry soils.

Synonyms: *Dauco criniti-Hyparrhenion hirtae* (Br.-Bl. et al. 1956) O. de Bolòs 1962 (art. 29a); *Ampelodesmion tenacis* Gentile 1960 (art.3b); *Micromerio graecae-Hyparrhenion hirtae* O. de Bolòs 1962 (art. 30, corr.illeg.); *Saturejo-Hyparrhenion hirtae* O. de Bolòs 1962 (syntax. syn.); *Micromerio graecae-Hyparrhenion podotrichae* O. de Bolòs 1962 corr. Rivas-Martinez et al. 1992 (30, corr. illeg.); *Hyparrhenion sinaicae* Br.-Bl., Pinto da Silva et Rozeira 1956 corr. J.C.

Costa et al. 2001 (corr.superfl.); *Panico repentis-Hyparrhenion hirtae* S. Brullo & Siracusa 2000 (syntax. syn.).

Holotypus: *Carici depressae-Hyparrhenietum sinaicae* Br.-Bl., P. Silva & Rozeira 1955 corr. J.C. Costa, Capelo, Espírito Santo & Lousã 2001.

Characteristic and differential species: see order.

Geographical distribution: This alliance is found in the Central and Western Mediterranean area (Mucina et al., 2016).

Structure and ecology: The alliance gathers the dry grasslands dominated by *Hyparrhenia hirta* growing in rocky habitats, within the (meso-)thermomediterranean bioclimatic belt. Brullo et al. (2010) distinguished two suballiances: the suball. *Hyparrhenenion hirtae* C. Brullo et al. 2010 (Holotypus: *Hyparrhenietum hirto-pubescentis* A.& O.Bolòs & Br.-Bl. in A. & O. Bolòs 1950) includes the typical communities of this syntaxon; the suball. *Panico repentis-Hyparrhenenion hirtae* (Brullo & Siracusa 2000) C. Brullo et al. 2010 is restricted to southern Italy and Sicily and is linked to quite humid stands with sufficient water availability during the summer.

Syndynamism: The communities of *Hyparrhenenion hirtae* represents a secondary vegetation, while those ones belonging to *Panico repentis-Hyparrhenenion hirtae* have a primary role in very peculiar edaphic conditions, where takes catenal contact with the *Phragmito-Magnocaricetea* vegetation (Brullo & Siracusa, 2000).

Habitat reference: E1.432-Mediterranean feathergrass steppes; E1.434-Andropogonid grass steppes.

35.2.1.1. ***Hyparrhenietum hirto-pubescentis*** A. & O.Bolòs & Br.-Bl. in A. & O.Bolòs 1950

Perennial grasslands with thatching grass of dry lithosoils.

Synonyms: *Andropogono distachyonis-Phagnaletum saxatilis* Molinier 1954; *Adropogonetum hirto-pubescentis lathyretosum* O. Bolòs (1962); *Hyparrhenietum hirto-podotrichae* Br.-Bl. et al. in A. Bolòs & O. Bolòs corr. Crespo 1989.

Lectotypus: rel. 5, pg. 102, A. Bolòs & O. Bolòs (1950), designated by O. Bolòs (1996).

Characteristic and differential species: *Andropogon distachyos* L.

Phytosociological table: From Bartolo et al. (1982), table 16, 8 rel.
Char. association: *Andropogon distachyos* (V).

Char. alliance and order: *Hyparrhenia hirta* (V), *Foeniculum vulgare* subsp. *piperitum* (V), *Phagnalon saxatile* (III), *Convolvulus althaeoides* (V), *Lathyrus articulatus* (IV), *Micromeria graeca* (IV), *Cachrys libanotis* (II).

Char. class: *Reichardia picroides* (IV), *Asphodelus ramosus* (IV), *Bituminaria bituminosa* (IV), *Verbascum siniatum* (III), *Clinopodium nepeta* (III), *Centaurea sicula* (III), *Brachypodium retusum* (III), *Anthyllis vulneraria* subsp. *maura* (II), *Thapsia garganica* (II), *Pallenis spinosa* (II).

Other species: *Stipellula capensis* (V), *Hedypnois rhagadioloides* (V), *Hypochoeris achyrophorus* (V), *Catapodium rigidum* (IV), *Sideritis romana* (IV).

Geographical distribution: This association is very frequent in the thermomediterranean belt of Sicily (Brullo & Di Martino, 1974; Bartolo et al., 1982; Brullo et al., 1993; Brullo et al., 1997; C. Brullo et al., 2010; Minissale et al., 2011). It has a wide Western Mediterranean distribution (Dièz Garretas & Asensi, 1999).

Structure and ecology: The dry lithosoils derived from the erosion of different substrates within the thermo- and mesomediterranean belt (0-1000 m a.s.l.) are colonized by a xerophilous grassland dominated by *Hyparrhenia hirta*. It is the *Hyparrhenietum hirto-pubescentis*, which is floristically differentiated by the high coverage of *Andropogon distachyos* and by the occurrence of some species belonging to alliance and order, as *Foeniculum vulgare* subsp. *piperitum*, *Phagnalon saxatile*, *Convolvulus althaeoides*, *Lathyrus articulatus*, *Micromeria graeca*, *Cachrys libanotis*, etc. (Bartolo et al., 1982). This vegetation can cover wide surfaces, on more or less steep slopes characterized by rocky outcrops and primitive soils (Brullo et al., 2010).

Syndynamism: The development of this association derives from the degradation of thermophilous oak woods or maquis belonging to the *Quercetea ilicis*, mainly due to frequent fires, overgrazing and cutting. On the other hand, these grasslands play an important role in the re-colonization of abandoned fields (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.1.2. ***Ferulo communis-Hyparrhenietum hirtae*** Brullo & Siracusa 1996

Perennial grasslands with thatching grass and giant fennel of deep soils.

Holotypus: rel. 11, tab. 5, Brullo & Siracusa (1996).

Characteristic and differential species: *Ferula communis* L.

Phytosociological table: From Brullo & Siracusa (1996), table 5, 11 rel.

Char. association: *Ferula communis* (V).

Char. alliance and order: *Hyparrhenia hirta* (V), *Lathyrus articulatus* (V), *Foeniculum vulgare* subsp. *piperitum* (V), *Phagnalon saxatile* (IV), *Convolvulus althaeoides* (II).

Char. class: *Reichardia picroides* (V), *Lobularia maritima* (V), *Charybdis pancration* (I).

Other species: *Asparagus acutifolius* (V), *Anisantha sterilis* (V), *Daucus carota* (V), *Brassica fruticulosa* (IV), *Prasium majus* (II).

Geographical distribution: Brullo & Siracusa (1996) described this association for the islet of Linosa (Pelagian Archipelago). Later, it was surveyed in other localities of Sicily (Bazan et al., 2006b; Minissale et al., 2007; C. Brullo et al., 2010).

Structure and ecology: The *Ferulo communis-Hyparrhenietum hirtae* is linked to deep soils derived from the degradation of different substrata (preferably siliceous), but always with a good content of clay. It is the one of the most mesophilous association of the alliance *Hyparrhenion hirtae*, occurring from the sea level up to about 600-700 m, within the thermo-mediterranean dry-subhumid belt (C. Brullo et al., 2010). Its physiognomy is given by *Hyparrhenia hirta* and *Ferula communis*, growing with other species of alliance and order, as *Lathyrus articulatus*, *Foeniculum vulgare* subsp. *piperitum*, *Phagnalon saxatile*, *Convolvulus althaeoides*, etc. (Brullo & Siracusa, 1996).

Syndynamism: This association derives from the degradation of woodlands or maquis belonging to *Quercetea ilicis*, but it plays also a relevant role in the colonization processes of fields and volcanic surfaces (Brullo et al., 2010).

Habitat reference: See alliance.

35.2.1.3. ***Ferulago nodosae-Hyparrhenietum hirtae*** Minissale, Sciandrello & Spampinato 2007

Perennial grasslands with eastern ferulago and thatching grass of shallow calcareous soils.

Holotypus: rel. 5, tab. 16, Minissale et al. (2007).

Characteristic and differential species: *Ferula communis* L.

Phytosociological table: From Minissale et al. (2007), table 16, 7 rel.

Char. association: *Ferulago nodosa* (V).

Char. alliance and order: *Hyparrhenia hirta* (V), *Foeniculum vulgare* subsp. *piperitum* (V), *Micromeria graeca* (V), *Andropogon distachyos* (IV), *Convolvulus althaeoides* (II), *Lathyrus articulatus* (II), *Carlina gummifera* (II).

Char. class: *Dactylis glomerata* subsp. *hispanica* (V), *Sixalix atropurpurea* (V), *Carlina hispanica* subsp. *globosa* (V), *Bituminaria bituminosa* (IV), *Charybdis pancration* (III), *Asphodelus ramosus* (III), *Pallenis spinosa* (III), *Gypsophila arrostii* (III), *Reichardia picroides* (III), *Galium lucidum* (III), *Hypericum perfoliatum* (III), *Asperula aristata* subsp. *scabra* (III), *Calendula suffruticosa* subsp. *fulgida* (III), *Gypsophila arrostii* (III), *Elaeoselinum meoides* (II),

Clinopodium nepeta (II), *Centaurea sicula* (II), *Poterium sanguisorba* (II), *Convolvulus elegantissimus* (I),

Other species: *Daucus carota* (V), *Centranthus ruber* (IV).

Geographical distribution: This vegetation is restricted to the Hyblaean area (Minissale et al., 2007; Brullo et al., 2010).

Structure and ecology: The eroded and initial soils, derived from Miocene limestones, are colonized by an *Hyparrhenia hirta*-dominated grassland, which is classified as *Ferulago nodosae-Hyparrhenietum hirtae* (C. Brullo et al., 2010). It is linked to steep rocky surfaces of deep river valleys, within the thermomediterranean sub-humid bioclimatic belt. From the floristic point of view, the occurrence of the eastern Mediterranean species *Ferulago nodosa* characterizes this association. The alliance and the order are represented by *Hyparrhenia hirta*, *Foeniculum vulgare* subsp. *piperitum*, *Micromeria graeca*, *Andropogon distachyos*, *Convolvulus althaeoides*, *Lathyrus articulatus* and *Carlina gummifera*.

Syndynamism: This community is dynamically connected with the series of *Pistacio-Quercetum ilicis* or *Oleo-Quercetum virgilianae* (Minissale et al., 2007).

Habitat reference: See alliance.

35.2.1.4. ***Cachryo pungentis-Hyparrhenietum hirtae*** Brullo, Minissale, Sciandrello in C. Brullo et al. 2010

Perennial grasslands with filiform basil and thatching grass of xeric sandy soils.

Holotypus: rel. 6, tab. 5, C. Brullo et al. (2010).

Characteristic and differential species: *Cachrys pungens* Guss.

Phytosociological table: From C. Brullo et al. (2010), table 5, 11 rel.

Char. association: *Cachrys pungens* (V).

Char. alliance and order: *Hyparrhenia hirta* (V), *Convolvulus althaeoides* (III), *Lathyrus articulatus* (III), *Phagnalon saxatile* (II), *Carlina gummifera* (II), *Andropogon distachyos* (II), *Foeniculum vulgare* subsp. *piperitum* (I).

Char. class: *Charybdis pancration* (V), *Asphodelus ramosus* (V), *Thapsia garganica* (IV), *Anthyllis vulneraria* subsp. *maura* (III), *Dactylis glomerata* subsp. *hispanica* (II), *Lobularia maritima* (II), *Hypericum perforatum* (II), *Reichardia picroides* (I), *Elaeoselinum meoides* (I), *Bituminaria bituminosa* (I), *Verbascum sinuatum* (I), *Carlina hispanica* subsp. *globosa* (I), *Piptatherum miliaceum subsp. miliaceum* (I).

Other species: *Cistus salviifolius* (V), *Dittrichia viscosa* (I).

Geographical distribution: This vegetation is circumscribed to Central and Southern Sicily (C. Brullo et al., 2010).

Structure and ecology: The *Cachryo pungentis-Hyparrhenietum hirtae* is linked to the flat sandy surfaces within the thermomediterranean belt (0-400 m a.s.l.), which are affected by very xeric conditions. These grasslands are characterized by the high coverage of *Cachrys pungens*, a thermophilous species with a south-western Mediterranean distribution (C. Brullo et al., 2010). Among the species of higher syntaxa, *Hyparrhenia hirta*, *Convolvulus althaeoides*, *Lathyrus articulatus*, *Phagnalon saxatile*, *Carlina gummifera*, *Andropogon distachyos*, *Charybdis pancration*, *Asphodelus ramosus* and *Thapsia garganica* are quite frequent.

Syndynamism: This vegetation belongs to the dynamic series of *Stipo bromoidis-Quercetum suberis*, deriving from the degradation of cork-woods. In fact, the frequent fires initially favour the establishment of psammophilous garrigues belonging to the *Cisto-Ericion* and, subsequently, the dry grasslands of *Cachryo pungentis-Hyparrhenietum hirtae* (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.1.5. ***Hyparrhenio hirtae-Festucetum humifusae*** Brullo & Guarino in C. Brullo et al. 2010

Perennial grasslands with *Festuca humifusa* of very steep coastal slopes.

Holotypus: rel. 2, tab. 6, C- Brullo et al. (2010).

Characteristic and differential species: *Festuca humifusa* Brullo & Guarino

Phytosociological table: From C. Brullo et al. (2010), table 6, 10 rel.

Char. association: *Festuca humifusa* (V).

Char. alliance and order: *Hyparrhenia hirta* (V), *Phagnalon saxatile* (V), *Hyoseris radiata* (V), *Micromeria graeca* (V), *Andropogon distachyos* (IV), *Convolvulus althaeoides* (I).

Char. class: *Dactylis glomerata* subsp. *hispanica* (V), *Lobularia maritima* (V), *Bituminaria bituminosa* (V), *Galium lucidum* (V), *Anthyllis vulneraria* subsp. *maura* (IV), *Carlina hispanica* subsp. *globosa* (IV), *Ampelodesmos mauritanicus* (IV), *Charybdis pancration* (III), *Allium sphaerocephalon* (II), *Thapsia garganica* (II), *Pallenis spinosa* (II), *Sedum sediforme* (II), *Reichardia picroides* (II), *Allium arvense* (I).

Other species: *Euphorbia dendroides* (V), *Centaurea seguenzae* (IV).

Geographical distribution: This vegetation is found only in the north-facing slopes of Tindari, NE Sicily (C. Brullo et al., 2010).

Structure and ecology: The community at issue is linked to very steep coastal slopes from the sea level up to 250 m a.s.l., within the thermomediterranean subhumid belt. It prefers

incoherent substrates with carbonatic or flyschoid soils. From the floristic point of view, this vegetation is characterized by the occurrence of *Festuca humifusa*, a rare Sicilian endemism, which together with *Hyparrhenia hirta* give the physiognomy to this community (C. Brullo et al., 2010). The order and the class are represented by *Phagnalon saxatile*, *Hyoseris radiata*, *Micromeria graeca*, *Andropogon distachyos*, *Convolvulus althaeoides*, *Dactylis glomerata* subsp. *hispanica*, *Lobularia maritima*, *Bituminaria bituminosa*, *Galium lucidum*, *Anthyllis vulneraria* subsp. *maura*, etc.

Syndynamism: This vegetation derived from the degradation of *Oleo-Ceratonion* maquis (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.1.6. ***Stipo gussonei-Hyparrhenietum hirtae*** Brullo & Scuderi in C. Brullo et al. 2010

Perennial grasslands with Gussone needle grass and thatching grass of flat sandy soils.

Holotypus: rel. 7, tab. 7, C. Brullo et al. (2010).

Characteristic and differential species: *Echinophora tenuifolia* L., *Stipa gussonei* Moraldo.

Phytosociological table: From C. Brullo et al. (2010), table 7, 7 rel.

Char. association: *Stipa gussonei* (V), *Echinophora tenuifolia* (III).

Char. alliance and order: *Hyparrhenia hirta* (V), *Lathyrus articulatus* (III), *Carlina gummifera* (II).

Char. class: *Asphodelus ramosus* (V), *Charybdis pancration* (IV), *Dactylis glomerata* subsp. *hispanica* (IV), *Pimpinella anisoides* (III), *Sixalix atropurpurea* (III), *Cachrys sicula* (III), *Convolvulus elegantissimus* (III), *Pallenis spinosa* (III), *Anthyllis vulneraria* subsp. *maura* (III), *Ornithogalum gussonei* (II), *Thapsia garganica* (I), *Poterium sanguisorba* (I), *Scorzonera columnae* (I), *Carlina sicula* (I), *Convolvulus cantabrica* (I), *Allium sphaerocephalon* (I).

Other species: *Alkanna tinctoria* (V), *Teucrium capitatum* (V).

Geographical distribution: This vegetation occurs in Central-southern and western Sicily (C. Brullo et al., 2010).

Structure and ecology: The xeric stands with sandy soils quite far from the coast, within the thermomediterranean dry bioclimatic belt, are colonized by a peculiar grassland, which is ascribed to *Stipo gussonei-Hyparrhenietum hirtae*. Generally, this association grows on flat surfaces and in particular on paleosoils with a low water capacity. Under the floristic profile, this association is differentiated by the endemic *Stipa gussonei* and the rare *Echinophora tenuifolia*, growing together with *Hyparrhenia hirta*, *Lathyrus articulatus*, *Carlina* gummifera, *Asphodelus ramosus*, *Charybdis pancration*, *Dactylis glomerata* subsp. *hispanica*, etc.

Syndynamism: This vegetation is linked with the dynamic series of cork-woods belonging to *Stipo bromoidis-Quercetum suberis* (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.1.7. ***Thapsietum pelagicae*** C. Brullo & Brullo in C. Brullo et al. 2010

Perennial grasslands with deadly carrots of flat or gently sloping surfaces.

Synonyms: *Thapsio-Feruletum communis* Bartolo, Brullo, Minissale & Spampinato 1990 non Brullo 1984.

Holotypus: rel. 5, tab. 2B, C. Brullo et al. (2010).

Characteristic and differential species: *Thapsia pelagica* Brullo, Guglielmo,. Pasta, Pavone & Salmeri.

Phytosociological table: From Bartolo et al. (1990), table 16, 7 rel.

Char. association: *Thapsia pelagica* (V).

Char. alliance and order: *Convolvulus althaeoides* (V), *Phagnalon saxatile* (V), *Foeniculum vulgare* subsp. *piperitum* (V), *Hyoseris radiata* (II).

Char. class: *Reichardia picroides* (V), *Asphodelus ramosus* (V), *Pallenis spinosa* (V), *Charybdis pancration* (IV), *Lobularia maritima* (IV), *Dactylis glomerata* subsp. *hispanica* (IV), *Piptatherum miliaceum subsp. miliaceum* (IV), *Verbascum sinuatum* (I), *Lygeum spartum* (I).

Other species: *Opuntia ficus-indica* (V), *Carlina involucrata* (V).

Geographical distribution: This vegetation is circumscribed to Lampedusa island (C. Brullo et al., 2010).

Structure and ecology: The *Thapsietum pelagicae* grows on flat or gently sloping surfaces with heavily eroded soils and rocky outcrops, within the inframediterranean arid bioclimatic belt. Under the floristic profile, it is characterized by the occurrence of the endemic *Thapsia pelagica*, growing with some species of higher rank, as *Convolvulus althaeoides*, *Phagnalon saxatile*, *Foeniculum vulgare* subsp. *piperitum*, *Hyoseris radiata*, *Reichardia picroides*, *Asphodelus ramosus*, *Pallenis spinosa*, *Charybdis pancration*, *Lobularia maritima*, *Dactylis glomerata* subsp. *hispanica*, etc.

Syndynamism: This community derives from the degradation of the climatophilous maquis belonging to *Periplocion angustifoliae* (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.1.8. ***Euphorbio terracinae-Hyparrhenietum hirtae*** Brullo & Siracusa 1996

Perennial grasslands with coastal spurge and thatching grass of volcanic incoherent substrata.

Holotypus: rel. 5, tab. 4, Brullo & Siracusa (1996).

Characteristic and differential species: *Euphorbia terracina* L.

Phytosociological table: From Brullo & Siracusa (1996), table 4, 8 rel.
Char. association: *Euphorbia terracina* (V).
Char. alliance and order: *Hyparrhenia hirta* (V), *Lobularia maritima* (V), *Phagnalon saxatile* (IV), *Lathyrus articulatus* (IV).
Char. class: *Charybdis pancration* (III).
Other species: *Astragalus boeticus* (V), *Pancratium linosae* (V).

Geographical distribution: This vegetation is restricted to Linosa island (Brullo & Siracusa, 1996; C. Brullo et al., 2010).

Structure and ecology: The association at issue colonizes incoherent volcanic ashes on very steep sloping stands, within the inframediterranean dry belt, in very xeric ecological conditions (Brullo & Siracusa, 1996). It is a grassland dominated by *Hyparrhenia hirta*, which is associated with *Euphorbia terracina* and just a few species of higher rank, as *Lobularia maritima*, *Phagnalon saxatile*, *Lathyrus articulatus* and *Charybdis pancration*.

Syndynamism: Generally, the *Euphorbio terracinae-Hyparrhenietum hirtae* represents a primary vegetation, which is linked to places where the normal soil evolution is extremely slow. Sometimes, it can grow also in secondary stands, as a degradation stage of *Periploco-Euphorbietum dendroidis* (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.1.9. ***Oryzopsio pauciflorae-Hyparrhenietum hirtae*** Bartolo, Brullo, Minissale & Spampinato 1990

Perennial grasslands with smilograss and thatching grass of sheltered stands with primitive soils.

Holotypus: rel. 4, tab. 13, Bartolo et al. (1990).

Characteristic and differential species: *Allium pallens* L., *Piptatherum miliaceum* (L.) Coss. subsp. *miliaceum.* f. *pauciflora* (Bég. & Vacc.) Maire & Weiller.

Phytosociological table: From Bartolo et al. (1990), table 13, 6 rel.

Char. association: *Piptatherum miliaceum* subsp. *miliaceum* f. *pauciflora* (V), *Allium pallens* (IV).

Char. alliance and order: *Hyparrhenia hirta* (V), *Convolvulus althaeoides* (V), *Phagnalon saxatile* (IV), *Lathyrus articulatus* (I), *Hyoseris radiata* (I), *Foeniculum vulgare* subsp. *piperitum* (I).

Char. class: *Asphodelus ramosus* (V), *Charybdis pancration* (V), *Dactylis glomerata* subsp. *hispanica* (V), *Reichardia picroides* (V), *Pallenis spinosa* (V) *Sedum sediforme* (IV).

Other species: *Coridothymus capitatus* (V), *Carlina involucrata* (V), *Lotus cytsoides* (V).

Geographical distribution: This vegetation is restricted to Lampedusa island (Bartolo et al., 1990; C. Brullo et al., 2010).

Structure and ecology: The *Oryzopsio pauciflorae-Hyparrhenietum hirtae* is linked to sheltered stands with primitive soils and rocky outcrops, mainly on flat or gently sloping stands, within the inframediterranean dry belt (Brullo et al., 2010). This grassland is characterized by the occurrence of *Piptatherum miliaceum* fo. *pauciflorum*, which together with *Hyparrhenia hirta* gives the physiognomy to this community. The order and the class are represented by *Convolvulus althaeoides*, *Phagnalon saxatile*, *Asphodelus ramosus*, *Charybdis pancration*, *Dactylis glomerata* subsp. *hispanica*, *Reichardia picroides*, *Pallenis spinosa*, etc.

Syndynamism: This vegetation has a primary role on steep rocky surfaces, but it can colonize also disturbed habitats, where represents a secondary vegetation in the dynamic series of *Periplocion angustifoliae* (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.1.10. ***Sanguisorbo verrucosae-Magydaretum pastinaceae*** Bartolo, Brullo, Minissale & Spampinato 1990

Perennial grasslands with verrucous burnet and false basilisk carot of sheltered stands with coarse soils.

Holotypus: rel. 3, tab. 14, Bartolo et al. (1990).

Characteristic and differential species: *Magydaris pastinacea* (Lam.) Paol.; *Sanguisorba verrucosa* (Link ex G. Don) Ces.

Phytosociological table: From Bartolo et al. (1990), table 14, 7 rel.

Char. association: *Magydaris pastinacea* (V), *Sanguisorba verrucosa* (V).

Char. alliance and order: *Foeniculum vulgare* subsp. *piperitum* (V), *Convolvulus althaeoides* (V), *Hyparrhenia hirta* (V), *Phagnalon saxatile* (V), *Lobularia maritima* (V), *Hyoseris radiata* (IV), *Piptatherum miliaceum* (III).

Char. class: *Pallenis spinosa* (V), *Dactylis glomerata* subsp. *hispanica* (V), *Charybdis pancration* (IV), *Verbascum sinuatum* (III) *Reichardia picroides* (III).

Other species: *Asparagus acutifolius* (V), *Smyrnium olusatrum* (V), *Carlina involucrata* (V), *Lotus edulis* (V), *Oxalis pes-caprae* (V), *Leontodon tuberosus* (V).

Geographical distribution: This vegetation was descibed by Bartolo et al. (1990) for Lampedusa island, but was surveyed also in north-western Sicily and Egadi Islands (Brullo et al., 2010).

Structure and ecology: The soils with a rich coarse component deriving from the erosion of calcareous cliffs, localized in the sheltered stands at the bottom of valleys, are colonized by the *Sanguisorbo verrucosae-Magydaretum pastinaceae*. This vegetation occurs in the infra- and thermomediterranean dry belt. The physiognomy of this vegetation is given by *Magydaris pastinacea*, which is associated with *Sanguisorba verrucosa* and some species of alliance and order, as *Foeniculum vulgare* subsp. *piperitum*, *Convolvulus althaeoides*, *Hyparrhenia hirta*, *Phagnalon saxatile*, *Lobularia maritima*, *Hyoseris radiata*, *Piptatherum miliaceum*, etc.

Syndynamism: This vegetation is a pioneer edaphophilous community, occurring in the belt of *Periplocion angustifoliae* and *Oleo-Ceratonion* (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.1.11. ***Imperato cylindricae-Hyparhenietum hirtae*** Brullo & Siracusa 2000

Perennial grasslands with cogongrass and thatching grass of gently sloping clayey soils.

Holotypus: rel. 3, tab. 15, Brullo & Siracusa (2000).

Characteristic and differential species: *Imperata cylindrica* (L.) Beauv.

Phytosociological table: From Brullo & Siracusa (2000), table 15, 8 rel.

Char. association: *Imperata cylindrica* (V).

Char. alliance: *Hyparrhenia hirta* (V), *Panicum repens* (V).

Char. order and class: *Asphodelus ramosus* (V), *Thapsia garganica* (V), *Verbascum sinuatum* (V), *Moraea sisyrinchium* (V), *Pallenis spinosa* (IV) *Reichardia picroides* (IV), *Andropogon distachyos* (IV), *Centaurea sicula* (II), *Foeniculum vulgare* subsp. *piperitum* (II), *Dactylis glomerata* subsp. *hispanica* (II), *Piptatherum miliaceum* (I), *Charybdis pancration* (I), *Lygeum spartum* (I).

Other species: *Asparagus albus* (V), *Asparagus aphyllus* (IV).

Geographical distribution: This vegetation occurs in Calabria and Sicily, where it was surveyed near Adrano (Etna) and along the southern coast of Sicily, between Pozzallo and Ragusa (Brullo & Siracusa, 2000; Brullo et al., 2010).

Structure and ecology: The *Imperato cylindricae-Hyparhenietum hirtae* occurs on flat or gently sloping clayey surfaces, which are subject to a short flooding period during the winter. Its optimal aspect is found on loamy soils, particularly rich in nitrates and chlorides, within the thermomediterranean dry bioclimatic belt. The physiognomy of this community is given by *Hyparrhenia hirta*, *Imperata cyclindrica* and *Panicum repens*, which are associated with some species of order and class, as *Asphodelus ramosus*, *Thapsia garganica*, *Verbascum siniatum*, *Moraea sisyrinchium*, *Pallenis spinosa*, *Reichardia picroides*, *Andropogon distachyos*, etc. (Brullo et al., 2010).

Syndynamism: This community is a permanent vegetation.

Habitat reference: See alliance.

35.2.1.12. ***Dichantio annulati-Hyparhenietum hirtae*** Brullo & Siracusa 2000

Perennial grasslands with marvel grass and thatching grass of steep clayey soils.

Holotypus: rel. 6, tab. 16, Brullo & Siracusa (2000).

Characteristic and differential species: *Dichanthium annulatum* (Forssk.) Stapf.

Phytosociological table: From Brullo & Siracusa (2000), table 16, 6 rel.

Char. association: *Dichanthium annulatum* (V).

Char. alliance: *Hyparrhenia hirta* (V), *Panicum repens* (V).

Char. order and class: *Asphodelus ramosus* (V), *Verbascum sinuatum* (V), *Dactylis glomerata* subsp. *hispanica* (V), *Charybdis maritima* (V), *Pallenis spinosa* (V), *Reichardia picroides* (V), *Centaurea sicula* (V), *Foeniculum vulgare* subsp. *piperitum* (V), *Carlina hispanica* subsp. *globosa* (V), *Eleoselinum asclepium* (II).

Other species: *Dittrichia viscosa* (V), *Sonchus bulbosus* (V).

Geographical distribution: This vegetation was described by Brullo & Siracusa (2000) from Adrano (E Sicily).

Structure and ecology: The *Dichantio annulati-Hyparhenietum hirtae* replaces the previous association in the loamy and clayey soils with a lower water capacity. Under the floristic profile, it is differentiated by *Dichanthium annulatum*, a very thermophilous grass mainly distributed in the tropical areas. Besides, also *Hyparrhenia hirta* and *Panicum repens* play a significant physiognomic role, growing together with *Asphodelus ramosus*, *Verbascum*

sinuatum, *Dactylis glomerata* subsp. *hispanica*, *Dactylis glomerata* subsp. *hispanica*, *Charybdis maritima*, *Pallenis spinosa*, *Reichardia picroides*, etc. (Brullo & Siracusa, 2000).

Syndynamism: This permanent vegetation takes catenal contact with the *Imperato cylindricae-Hyparrhenietum hirtae*.

Habitat reference: See alliance.

35.2.1.13. ***Phalarido coerulescentis-Hyparrhenietum hirtae*** Scuderi in C. Brullo et al. 2010

Perennial grasslands with bluish canary grass and thatching grass of humid clayey soils.

Holotypus: rel. 10, tab. 7, C. Brullo et al. (2010).

Characteristic and differential species: *Phalaris coerulescens* Desf.

Phytosociological table: From C. Brullo et al. (2010), table 7C, 2 rel.
Char. association: *Phalaris coerulescens* (2).
Char. alliance and order: *Hyparrhenia hirta* (2), *Panicum repens* (2), *Foeniculum vulgare* subsp. *piperitum* (1).
Char. class: *Reichardia picroides* (1), *Bituminaria bituminosa* (1).
Other species: *Daucus carota* (2), *Avena barbata* (2).

Geographical distribution: This vegetation occurs only in Trapani area (W Sicily) (C. Brullo et al., 2010).

Structure and ecology: This association is found on flat or gently clayey surfaces with a fairly good water availability, where the hygrophilous species *Phalaris coerulescens* finds optimal conditions. From the floristic point of view, it is a very poor vegetation dominated by *Hyparrhenia hirta* and *Panicum repens*, growing together with just a few species of higher rank, as *Foeniculum vulgare* subsp. *piperitum*, *Reichardia picroides* and *Bituminaria bituminosa* (C. Brullo et al., 2010).

Syndynamism: It is a permanent vegetation, placed between the hygrophilous communities of *Caricetum hispidae* and those more xeric of *Plantaginetalia majoris* (C. Brullo et al., 2010)

Habitat reference: See alliance.

35.2.2. Alliance: ***Aristido caerulescentis-Hyparrhenenion hirtae*** (Brullo, Scelsi & Spampinato 1997) C. Brullo et al. 2010

Pseudosteppes of very xeric stands.

Synonyms: *Aristido-Hyparrhenion hirtae* Brullo, Scelsi & Spampinato 1997.

Holotypus: *Cenchro ciliaris-Hyparrhenietum hirtae* Wildpret & Rodriguez in Rivas-Martínez et al. 1993.

Characteristic and differential species: *Aristida caerulescens* Desf., *Cenchrus ciliaris* L., *Pennisetum setaceum* (Forssk.) Chiov., *Tricholaena teneriffae* (L. f.) Link.

Geographical distribution: This alliance occurs in the Southern Mediterranean and Macaronesian area (C. Brullo et al., 2010).

Structure and ecology: This alliance groups the perennial grasslands dominated by *Hyparrhenia hirta*, which occur in particularly xeric places. These communities are linked to the thermo- or inframediterranean dry bioclimatic belt, where some thermophilous grasses with Saharo-Sindian distribution have their only stands in Sicily, among them *Aristida caerulescens*, *Cenchrus ciliaris*, *Heteropogon contortus*, *Bothriochloa insculpta* subsp. *panormitana* and *Tricholaena teneriffae* (C. Brullo et al., 2010).

Syndynamism: This vegetation derives from the degradation of woody vegetation belonging to *Oleo-Ceratonion* (Brullo et al., 1997).

Habitat reference: E1.432-Mediterranean feathergrass steppes; E1.434-Andropogonid grass steppes.

35.2.2.1. ***Tricholaeno teneriffae-Hyparrhenietum hirtae*** (Wildpret & Rodriguez in Rivas Martinez et al. 1993) Brullo, Scelsi & Spampinato 1997

Perennial grasslands with Tenerife tricholaena grass and thatching grass of xeric sandy surfaces.

Synonyms: *Cenchro ciliaris-Hyparrhenietum hirtae* Wildpret & Rodriguez in Rivas-Martínez et al. 1993 subass. *tricholaenetosum teneriffae* Wildpret & Rodriguez in Rivas-Martínez et al. 1993; *Andropogonetum hirto-pubescentis* Br.-Bl. in A. & O. Bolos 1950 *tricholaenetosum teneriffae* Díez-Garretas & Asensi 1999.

Holotypus: rel. 3, tab. 2, Brullo et al. (1997).

Characteristic and differential species: *Tricholaena teneriffae* (L. f.) Link.

Phytosociological table: From Brullo et al. (1997), table 2, 8 rel.

Char. association: *Tricholaena teneriffae* (V).

Char. alliance and order: *Hyparrhenia hirta* (V), *Convolvulus althaeoides* (V), *Lathyrus articulatus* (IV), *Hyparrhenia sinaica* (IV), *Micromeria graeca* (II), *Phagnalon saxatile* (II).

Char. class: *Reichardia picroides* (V), *Lobularia maritima* (V), *Carlina hispanica subsp. globosa* (V), *Dactylis glomerata* subsp. *hispanica* (IV), *Clinopodium nepeta* (IV), *Centaurea sicula* (III).

Other species: *Vicia villosa* (V), *Cynodon dactylon* (V).

Geographical distribution: This community occurs in the Canary Islands (Rivas-Martínez et al., 1993; Díez-Garretas & Asensi, 1999), Southern Calabria and Sicily, where it is found only near Messina.

Structure and ecology: The community at issue colonizes coastal stands (below 250 m a.s.l.) characterized by sandy soils, within the thermomediterranean subhumid bioclimatic belt. The soil composition and granulometry determines very xeric edaphic conditions. Physiognomically, *Hyparrhenia hirta* and *Tricholaena teneriffae* have a relevant role, growing with few other species, as *Convolvulus althaeoides*, *Lathyrus articulatus*, *Hyparrhenia sinaica*, *Reichardia picroides*, *Lobularia maritima*, *Carlina hispanica subsp. globosa*, etc. (Brullo et al., 1997).

Syndynamism: The *Tricholaeno teneriffae-Hyparrhenietum hirtae* represents a primary vegetation, since a further evolution is hampered by frequent landslides. However, this association may occur also in secondary stands, where the shrubby phytocoenoses of *Oleo-Ceratonion* have been depleted (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.2.2. ***Cenchro ciliaris-Hyparrhenietum hirtae*** Wildpret & Rodriquez in Rivas-Martínez et al. 1993

Perennial grasslands with buffel-grass and thatching grass of dry eroded surfaces.

Holotypus: rel. 10, tab. 26B, Rivas-Martinez et al. (1993).

Characteristic and differential species: *Cenchrus ciliaris* L.

Phytosociological table: From Brullo et al. (1997), table 1, 6 rel.

Char. association: *Cenchrus ciliaris* (V).

Char. alliance and order: *Hyparrhenia hirta* (V), *Foeniculum vulgare* subsp. *piperitum* (V), *Phagnalon saxatile* (V), *Convolvulus althaeoides* (V), *Lathyrus articulatus* (IV).

Char. class: *Reichardia picroides* (V), *Lobularia maritima* (V), *Dactylis glomerata* subsp. *hispanica* (V), *Verbascum sinuatum* (IV), *Bituminaria bituminosa* (IV), *Carlina hispanica* subsp. *globosa* (IV), *Asphodelus ramosus* (II), *Charybdis maritima* (I), *Micromeria consentina* (I).

Other species: *Dittrichia viscosa* (IV), *Euphorbia terracina* (IV).

Geographical distribution: This community is known from Canary Islands and Sicily, where it occurs near Palermo, Taormina and Aeolian Islands (Rivas-Martinez et al., 1993; Brullo et al., 1997; C. Brullo et al., 2010; Del Arco Aguilar et al., 2018).

Structure and ecology: The xeric stands with eroded soils deriving from the degradation of carbonatic, volcanic and metamorphic rocks are colonized by a dry grassland ascribed to *Cenchro ciliaris-Hyparrhenietum hirtae*. This vegetation is linked to south-facing sides, within the thermomediterranean subhumid belt. Under the floristic profile, this vegetation is characterized by the dominance of *Cenchrus ciliaris*, which is associated with *Hyparrhenia hirta* and some other species of alliance and order, as *Foeniculum vulgare* subsp. *piperitum*, *Phagnalon saxatile*, *Convolvulus althaeoides*, *Lathyrus articulatus*, etc. (C. Brullo et al., 2010).

Syndynamism: This vegetation finds its primary stands in the semi-rupestrian rocky places, while it can have a secondary role in the areas potentially covered by shrubby communities with *Euphorbia dendroides*.

Habitat reference: See alliance.

35.2.2.3. ***Botriochloo panormitanae-Hyparrhenietum hirtae*** Brullo, Scelsi & Spampinato 1997

Perennial grasslands with Palermo yellow bluestem and thatching grass of primitive calcareous surfaces.

Holotypus: rel. 14, tab. 5, Brullo et al. (1997).

Characteristic and differential species: *Bothriochloa insculpta* (A. Rich.) A. Camus subsp. *panormitana* (Parl.) Giardina & Raimondo, *Megathyrsus bivonianus* (Brullo & al.) Verloove.

Phytosociological table: From Brullo et al. (1997), table 5, 17 rel.

Char. association: *Bothriochloa insculpta* subsp. *panormitana* (V), *Megathyrsus bivonianus* (V).

Char. alliance and order: *Heteropogon contortus* (V), *Hyparrhenia hirta* (V), *Pennisetum setaceum* (V), *Andropogon distachyos* (V), *Lathyrus articulatus* (IV), *Phagnalon saxatile* (IV), *Convolvulus althaeoides* (IV), *Hyparrhenia sinaica* (IV), *Cenchrus ciliaris* (III), *Hyoseris radiata* (III), *Aristida caerulescens* (I), *Foeniculum vulgare* subsp. *piperitum* (I).

Char. class: *Reichardia picroides* (V), *Bituminaria bituminosa* (V), *Asphodelus ramosus* (IV), *Dactylis glomerata* subsp. *hispanica* (IV), *Lobularia maritima* (IV), *Pallenis spinosa* (III), *Charybdis pancration* (III), *Thapsia garganica* (III). *Allium sphaerocephalon* (II), *Asphodeline lutea* (II), *Sedum sediforme* (I).

Other species: *Arisarum vulgare* (V), *Carlina sicula* (V).

Geographical distribution: This community occurs in the coastal sites from Palermo to Trapani, NW Sicily (Brullo et al., 1997; Minissale et al., 2007; C. Brullo et al., 2010).

Structure and ecology: The *Botriochloo panormitanae-Hyparrhenietum hirtae* colonizes the mesozoic limestones with scarcely developed soils, having its optimum in coastal stands within the thermomediterranean dry bioclimatic belt. This grassland has an impoverished floristic set, due to the very arid conditions. *Bothriochloa insculpta* subsp. *panormitana* gives the physiognomy to this association, growing with other big bunchgrasses as *Megathyrsus bivonianus*, *Hyparrhenia hirta*, *Pennisetum setaceum*, *Cenchrus ciliaris*, *Aristida caerulescens* and *Heteropogon contortus*. Among the species of higher rank, *Andropogon distachyos*, *Lathyrus articulatus*, *Phagnalon saxatile*, *Convolvulus althaeoides*, *Foeniculum vulgare* subsp. *piperitum*, *Reichardia picroides*, *Bituminaria bituminosa*, *Asphodelus ramosus*, *Dactylis glomerata* subsp. *hispanica*, *Lobularia maritima*, etc. (Brullo et al., 1997).

Syndynamism: The primary stands of this vegetation are represented by steep and rocky slopes, while on screes or disturbed habitats it is dynamically connected to the maquis of *Oleo-Ceratonion* (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.2.4. ***Penniseto setacei-Hyparrhenietum hirtae*** Gianguzzi, Ilardi & Raimondo 1993

Perennial grasslands with crimson fountaingrass and thatching grass of disturbed dry surfaces.

Holotypus: rel. 5, tab. 10, Gianguzzi et al. (1993).

Characteristic and differential species: *Pennisetum setaceum* (Forssk.) Chiov.

Phytosociological table: From Gianguzzi et al. (1993), table 10, 7 rel.

Char. association: *Pennisetum setaceum* (V).

Char. alliance and order: *Heteropogon contortus* (V), *Hyparrhenia hirta* (V), *Lathyrus articulatus* (V), *Convolvulus althaeoides* (V), *Phagnalon saxatile* (IV), *Micromeria graeca* (IV), *Foeniculum vulgare* subsp. *piperitum* (III), *Andropogon distachyos* (III), *Carlina gummifera* (III), *Kundmannia sicula* (II).

Char. class: *Dactylis glomerata* subsp. *hispanica* (V), *Bituminaria bituminosa* (V), *Verbascum sinuatum* (V), *Clinopodium nepeta* (V), *Reichardia picroides* (IV), *Pallenis spinosa* (IV), *Brachypodium retusum* (IV). *Charybdis pancration* (III), *Asphodelus ramosus* (III), *Lobularia maritima* (III), *Asphodeline lutea* (III), *Sixalix atropurpurea* (III), *Ampelodesmos mauritanicus* (I).

Other species: *Oxalis pes-caprae* (V), *Carlina sicula* (V).

Geographical distribution: This community is restricted to the coastal territories of north-western Sicily (Gianguzzi et al., 1996) and eastern Sicily, near Catania (C. Brullo et al., 2010).

Structure and ecology: The *Penniseto setacei-Hyparrhenietum hirtae* is a pioneer dry grassland, colonizing abandoned fields, uncultivated ruderal areas and road sides within the thermomediterranean dry bioclimatic belt. It is found both on carbonatic and volcanic substrates. From the floristic poin of view, this community is differentiated by the high coverage of *Pennisetum setaceum*, an alien species coming form the subtropical region. Besides, also *Heteropogon contortus* and *Hyparrhenia hirta* play a significant physiognomic role, occurring together with *Lathyrus articulatus*, *Convolvulus althaeoides*, *Phagnalon saxatile*, *Micromeria graeca*, *Dactylis glomerata* subsp. *hispanica*, *Bituminaria bituminosa*, *Verbascum sinuatum*, *Clinopodium nepeta*, *Reichardia picroides*, etc. (C. Brullo et al., 2010).

Syndynamism: Generally, this vegetation has a secondary role, replacing other coenoses dominated by *Hyparrhenia hirta* in distured stands, which are affected by the invasion of *Pennisetum setaceum* (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.3. Alliance: ***Avenulo cincinnatae-Ampelodesmion mauritanici*** Minissale 1995

Mesomediterranean pseudosteppes with rope grass on deep soils.

Holotypus: *Helictotricho hyblaei-Ampelodesmetum mauritanici* Minissale 1995

Characteristic and differential species: *Avenula cincinnata* (Ten.) Holub., *Ampelodesmos mauritanicus* (Poir.) Dur. & Schinz, *Dianthus graminifolius* C. Presl*, Eryngium bocconei* Lam.*, Gypsophila arrostii* Guss.*, Helminthotheca aculeata* (Vahl) Lack, *Pimpinella anisoides* V. Brig., *Scorzonera villosa* Scop. subsp. *columnae* (Guss.) Nyman Consp.

Geographical distribution: According to C. Brullo et al. (2010), this alliance is distributed in the Central Mediterranean area (southern Italy, Sicily and Tunisia).

Structure and ecology: The *Avenulo cincinnatae-Ampelodesmion mauritanici* groups the communities dominated by *Ampelodesmos mauritanicus*, colonizing deep soils derived from marls, schists or limestones, within the meso- and thermomediterranean belt with quite mesic edaphic conditions. In addition to *Ampelodesmos mauritanicus*, a big caespitose bunchgrass with a south-western Mediterranean distribution, other Mediterranean bunchgrasses, such as *Helictotrichon convolutum*, *Hyparrhenia hirta* and *Stipa* sp. pl., play a significant physiognomic role (Minissale, 1995; C. Brullo et al., 2010). Mucina et al. (2016) treated the association at issue as a synonym of *Hyparrhenion hirtae*, despite the clear ecological, floristic and physiognomic differences (see Guarino & Pasta, 2017).

Syndynamism: The grasslands belonging to this alliance are connected with the dynamic series of *Quercetea ilicis*, and sometimes also with climatophilous communities of *Querco-Fagetea* class (Brullo et al., 1998). The degradation of deciduous or evergreen oak woods leads to the establishment of maquis or garrigues, where *Ampelodesmos mauritanicus* occurs only sporadically. However, the persistence of disturbing factors can determine a further regression, favoring these grasslands (Minissale, 1995; Brullo et al., 2001).

Habitat reference: E1.432-Mediterranean feathergrass steppes; F5.53 Ampelodesmos mauritanica -dominated garrigues.

35.2.3.1. ***Helichryso hyblaei-Ampelodesmetum mauritanici*** Minissale 1995

Perennial grasslands with hyblaean strawflower and thatching grass of calcareous surfaces.

Holotypus: rel. 8, tab. 1, Minissale (1995).

Characteristic and differential species: *Helichrysum hyblaeum* Brullo.

Phytosociological table: From Minissale (1995), table 1, 29 rel.

Char. association: *Helichrysum hyblaeum* (V).

Char. alliance: *Ampelodesmos mauritanicus* (V), *Avenula cincinnata* (IV), *Dianthus graminifolius* (II), *Scorzonera villosa* subsp. *columnae* (II), *Pimpinella anisoides* (I), *Gypsophila arrostii* (I).

Char. order: *Micromeria graeca* (V), *Carlina gummifera* (IV), *Kundmannia sicula* (II), *Hyoseris radiata* (II), *Hyparrhenia hirta* (II), *Andropogon distachyos* (II), *Lathyrus articulatus* (II). *Cachrys libanotis* (II), *Phagnalon saxatile* (I), *Convolvulus althaeoides* (I), *Foeniculum vulgare* subsp. *piperitum* (I), *Lathyrus sylvestris* (I).

Char. class: *Dactylis glomerata* subsp. *hispanica* (V), *Anthyllis vulneraria* subsp. *maura* (V), *Galium lucidum* (V), *Pallenis spinosa* (IV), *Bituminaria bituminosa* (IV), *Sixalix atropurpurea* (IV), *Asperula aristata* subsp. *scabra* (III), *Carlina hispanica* subsp. *globosa* (III), *Hypericum perfoliatum* (III), *Poterium sanguisorba* subsp. *minor* (II), *Convolvulus cantabrica* (II), *Charybdis maritima* (II), *Reichardia picroides* (II), *Asphodelus ramosus* (I), *Elaeoselinum meoides* (I).

Other species: *Lotus cytisoides* (V), *Daucus carota* (IV).

Geographical distribution: This community occurs in the Hyblaean area (Minissale, 1985; C. Brullo et al., 2010).

Structure and ecology: The *Helichryso-Ampelodesmetum mauritanici* colonizes the calcareous soils (limestones, marls, etc.), at an altitude of 200-800 m a.s.l. within the thermomediterranean subhumid bioclimatic belt. It is a homogeneous and dense grassland dominated by *Ampelodesmos mauritanicus*, where the endemic *Helichrysum hyblaeum* has an high coverage. The higher syntaxa are represented by *Ampelodesmos mauritanicus*, *Avenula*

cincinnata, *Dianthus graminifolius*, *Micromeria graeca*, *Carlina gummifera*, etc. (C. Brullo et al., 2010).

Syndynamism: This association derives from the degradation of oak woods belonging to *Oleo-Quercetum virgilianae* and *Doronico-Quercetum ilicis* (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.3.2. ***Helictotricho convoluti-Ampelodesmetum mauritanici*** Minissale 1995

Perennial grasslands with oat grass and rope grass of mesic stands.

Holotypus: rel. 10, tab. 2, Minissale (1995).

Characteristic and differential species: *Delphinium emarginatum* C. Presl, *Helictotrichon convolutum* (C. Presl) Henrard, *Eryngium crinitum* C. Presl, *Klasea flavescens* (L.) Holub. subsp. *mucronata* (Desf.) Cantó & Rivas Martinez, *Oncostema cerulea* (Raf.) Speta, *Patzkea coerulescens* (Desf.) H. Scholz, *Trisetum flavescens* (L.) P. Beauv.

Phytosociological table: From C. Brullo et al. (2010), table 9, 5 rel. (subass. *typicum*).

Char. association: *Helictotrichon convolutum* (V), *Oncostema cerulea* (II).

Char. alliance: *Ampelodesmos mauritanicus* (V), *Eryngium bocconei* (III), *Helminthotheca aculeata* (III), *Avenula cincinnata* (II), *Scorzonera villosa* subsp. *columnae* (II), *Dianthus graminifolius* (I), *Pimpinella anisoides* (I),

Char. order: *Carlina gummifera* (IV), *Kundmannia sicula* (III), *Micromeria graeca* (II).

Char. class: *Dactylis glomerata* subsp. *hispanica* (IV), *Asphodelus ramosus* (IV), *Anthyllis vulneraria* subsp. *maura* (III), *Bituminaria bituminosa* (III), *Galium lucidum* (II), *Elaeoselinum meoides* (II), *Asperula aristata* subsp. *scabra* (II), *Convolvulus cantabrica* (I),

Other species: *Eryngium campestre* (III), *Diplotaxis crassifolia* (III).

From C. Brullo et al. (2010), table 9, 5 rel. (subass. *stipetosum appendiculatae*).

Char. association: *Helictotrichon convolutum* (V), *Patzkea coerulescens* (V), *Eryngium crinitum* (V), *Klasea flavescens* subsp. *mucronata* (III).

Char. subassociation: *Stipa austroitalica* subsp. *appendiculata* (V), *Stipa barbata* (IV).

Char. alliance: *Ampelodesmos mauritanicus* (V), *Eryngium bocconei* (V), *Avenula cincinnata* (V), *Scorzonera villosa* subsp. *columnae* (V), *Pimpinella anisoides* (IV), *Helminthotheca aculeata* (I).

Char. order: *Micromeria graeca* (V), *Hyoseris radiata* (V), *Carlina gummifera* (III), *Kundmannia sicula* (III), *Phagnalon saxatile* (II).

Char. class: *Dactylis glomerata* subsp. *hispanica* (V), *Asphodelus ramosus* (V), *Galium lucidum* (V), *Pallenis spinosa* (V), *Elaeoselinum meoides* (V), *Reichardia picroides* (V), *Brachypodium retusum* (V), *Anthyllis vulneraria* subsp. *maura* (IV), *Carlina hispanica* subsp. *glabosa* (IV), *Asphodeline lutea* (II), *Sixalix atropurpurea* (I),

Other species: *Bromopsis erecta* (V), *Lolium rigidum* (IV), *Sonchus bulbosus* (IV).

Geographical distribution: This community occurs in Central and Western Sicily (Minissale, 1995; Gianguzzi et al., 1996; C. Brullo et al., 2010).

Structure and ecology: The typical aspect of the this association (subass. *typicum*) occurs on rocky stands characterized by initial soils derived from Mesozoic limestones, at an altitude of 50-1000 m, within the (thermo-)mesomediterranean subhumid belt. Its physiognomy is given by *Ampelodesmos mauritanicus*, which is associated with sparse individuals of *Helictotrichon convolutum* and some geophytes and hemicryptophytes, as *Patzkea coerulescens*, *Eryngium crinitum*, *E. bocconei*, *Klasea flavescens* subsp. *mucronata*, *Oncostema cerulea*, *Eryngium bocconei*, *Avenula cincinnata*, *Scorzonera villosa* subsp. *columnae*, *Pimpinella anisoides*, etc. In the windy and rocky ridges the vegetation at issue is represented by the subass. *stipetosum appendiculatae*, which is differentiated by the occurrence of *Stipa austroitalica* subsp. *appendiculata* and *S. barbata*.

Syndynamism: Generally, the *Helictotricho convoluti-Ampelodesmetum mauritanici* represents the regressive stage of various kinds of woodlands, as those ones belonging to *Rhamno-Quercetum ilicis* or *Aceri campestris-Quercetum ilicis* associations, occurring on north-facing stands of coastal sites or on mountain stands above 900 m of altitude (Minissale, 1995). In the inner aras this community is dynamically linked to the degradation processes of *Oleo-Quercetum virgilianae*. As regards the subass. *stipetosum appendiculatae*, it is an edaphophilous community colonizing semi-rupestrian habitats, taking catenal contact with the chasmophilous coenoses of *Dianthion rupicolae* (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.3.3. ***Seselio tortuosi-Ampelodesmetum mauritanici*** Minissale 1995

Perennial grasslands with tortuous carrot and rope grass of calcareous surfaces.

Holotypus: rel. 17, tab. 3, Minissale (1995).

Characteristic and differential species: *Klasea flavescens* (L.) Holub. subsp. *cichoracea* (L.) Greuter & Wagenitz, *Seseli tortuosum* L. subsp. *tortuosum.*

Phytosociological table: From Minissale (1995), table 3, 26 rel.

Char. association: *Seseli tortuosum subsp. tortuosum* (IV), *Klasea flavescens* subsp. *cichoracea* (II).

Char. alliance: *Ampelodesmos mauritanicus* (V), *Avenula cincinnata* (IV), *Gypsophila arrostii* (IV), *Dianthus graminifolius* (III), *Pimpinella anisoides* (II), *Eryngium bocconei* (I), *Scorzonera villosa* subsp. *columnae* (I), *Helminthotheca aculeata* (I).

Char. order: *Micromeria graeca* (IV), *Carlina gummifera* (III), *Kundmannia sicula* (III), *Andropogon distachyos* (II), *Hyparrhenia hirta* (II), *Hyoseris radiata* (I), *Phagnalon saxatile* (I). *Foeniculum vulgare* subsp. *piperitum* (I), *Lathyrus sylvestris* (I), *Convolvulus althaeoides* (I).

Char. class: *Dactylis glomerata* subsp. *hispanica* (V), *Asphodelus ramosus* (IV), *Bituminaria bituminosa* (IV), *Anthyllis vulneraria* subsp. *maura* (III), *Charybdis pancration* (III), *Asperula aristata* subsp. *scabra* (III), *Carlina hispanica* subsp. *globosa* (III), *Pallenis spinosa* (II), *Reichardia picroides* (II), *Galium lucidum* (II), *Sixalix atropurpurea* (II), *Elaeoselinum meoides* (II), *Allium arvense* (II), *Convolvulus cantabrica* (I), *Poterium sanguisorba* subsp. *minor* (II), *Sedum sediforme* (I).

Other species: *Eryngium campestre* (IV), *Teucrium capitatum* (IV).

Geographical distribution: This community is circumscribed to Southern Italy and Sicily, where it is spread in Central, southern and north-eastern Sicily (Minissale, 1985; C. Brullo et al., 2010).

Structure and ecology: The community at issue is linked to marly, carbonatic or calcarenitic substrates, between 300 and 800 m of altitude, within the thermo- and mesomediterranean subhumid bioclimatic belt. This *Ampelodesmos mauritanicus*-dominated grassland has an open structure, where *Klasea flavescens* subsp. *cichoracea* and *Seseli tortuosum* subsp. *tortuosum* are well represented. The floristic set includes also some species of higher rank, as *Avenula cincinnata*, *Gypsophila arrostii*, *Dianthus graminifolius*, *Micromeria graeca*, *Carlina gummifera*, *Kundmannia sicula*, *Dactylis glomerata* subsp. *hispanica*, *Asphodelus ramosus*, etc. (Minissale, 1995).

Syndynamism: This association is connected with the dynamic series of *Oleo-Quercetum virgilianae* (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.3.4. ***Galio aetnici-Ampelodesmetum mauritanici*** Minissale 1995

Perennial grasslands with Etna bedstraw and rope grass of siliceous soils.

Holotypus: rel. 13, tab. 4, Minissale (1995).

Characteristic and differential species: *Galium aetnicum* Biv.

Phytosociological table: From Minissale (1995), table 4, 21 rel.

Char. association: *Galium aetnicum* (V).

Char. alliance: *Ampelodesmos mauritanicus* (V), *Gypsophila arrostii* (II), *Helminthotheca aculeata* (II), *Pimpinella anisoides* (I), *Eryngium bocconei* (I).

Char. order: *Micromeria graeca* (V), *Hyparrhenia hirta* (V), *Carlina gummifera* (IV), *Andropogon distachyos* (III), *Lathyrus articulatus* (III), *Foeniculum vulgare* subsp. *piperitum*

(II), *Kundmannia sicula* (I), *Hyoseris radiata* (I), *Convolvulus althaeoides* (I), *Ferula communis* (I).

Char. class: *Carlina hispanica* subsp. *globosa* (V), *Dactylis glomerata* subsp. *hispanica* (IV), *Bituminaria bituminosa* (IV), *Asphodelus ramosus* (III), *Charybdis pancration* (III), *Reichardia picroides* (II), *Pallenis spinosa* (I), *Anthyllis vulneraria* subsp. *maura* (I), *Poterium sanguisorba* subsp*. minor* (I), *Clinopodium nepeta* (I).

Other species: *Centaurium erythraea* (IV), *Urospermum dalechampii* (III).

Geographical distribution: This community occurs in Southern Italy and Sicily, where it is restricted to the north-eastern area (Minissale, 1985; C. Brullo et al., 2010).

Structure and ecology: The *Galio aetnici-Ampelodesmetum mauritanici* is an acidophilous vegetation, which colonizes arenaceous or siliceous substrates with different metamorphism degree. It is found from the sea level up to 800 m of altitude, within the hermo- and mesomediterranean subhumid bioclimatic belt. From the physiognomic point of view, it appears as a dense grassland dominated by *Ampelodesmos mauritanicus*, mixed with scattered individuals of *Galium aetnicum* and some specie of higher rank, as *Gypsophila arrostii*, *Micromeria graeca*, *Hyparrhenia hirta*, *Carlina gummifera*, *Andropogon distachyos*, *Carlina hispanica* subsp. *globosa* and *Dactylis glomerata* subsp. *hispanica* (C. Brullo et al., 2010).

Syndynamism: This community derives from the degradation of acidophilous woodlands belonging to *Erico-Quercetum virgilianae* or also shrubby coenoses dominated by *Calicotome infesta* and *Cistus* sp. pl.

Habitat reference: See alliance.

35.2.3.5. ***Astragalo huetii-Ampelodesmetum mauritanici*** Minissale 1995

Perennial grasslands with Huet milkvetch and rope grass of xeric stands.

Holotypus: rel. 1, tab.5, Minissale (1995).

Characteristic and differential species: *Astragalus huetii* Bunge, *Cardopatum corymbosum* (L.) Pers.

Phytosociological table: From Minissale (1995), table 4, 21 rel.

Char. association: *Astragalus huetii* (V), *Cardopatum corymbosum* (II).

Char. alliance: *Ampelodesmos mauritanicus* (V), *Avenula cincinnata* (IV), *Eryngium bocconei* (IV), *Gypsophila arrostii* (II), *Helminthotheca aculeata* (II), *Patzkea coerulescens* (II), *Pimpinella anisoides* (I), *Helictotrichon convolutum* (I), *Scorzonera columnae* subsp. *villosa* (I), *Dianthus graminifolius* (I).

Char. order: *Micromeria graeca* (V), *Carlina gummifera* (IV), *Kundmannia sicula* (IV), *Hyparrhenia hirta* (II), *Ferula communis* (II), *Foeniculum vulgare* subsp. *piperitum* (II).

Char. class: *Dactylis glomerata* subsp. *hispanica* (IV), *Asphodelus ramosus* (IV), *Bituminaria bituminosa* (III), *Galium lucidum* (III), *Hypericum perfoliatum* (II), *Elaeoselinum meoides* (II), *Anthyllis vulneraria* subsp. *maura* (II), *Asperula aristata* subsp. *scabra* (II), *Pallenis spinosa* (I), *Charybdis pancration* (I), *Reichardia picroides* (I), *Carlina hispanica* subsp. *globosa* (I), *Sixalix atropurpurea* (I).

Other species: *Carlina sicula* (III), *Chamaerops humilis* (III).

Geographical distribution: This community occurs in Western and Southern Sicily (Minissale, 1985; C. Brullo et al., 2010).

Structure and ecology: The gently sloping stands surfaces with primitive soils, rich in skeleton, deriving from carbonatic, marly and chalky substrates, are colonized by the *Astragalo huetii-Ampelodesmetum mauritanici*. This vegetation has a marked thermo-xerophilous character, occurring within the thermomediterranean dry bioclimatic belt. The cover values of *Ampelodesmos mauritanicus* are not very high, allowing the occurrence of many other hemicryptophytes, as the rare *Astragalus huetii* and *Cardopatum corymosum* (Minissale, 1995). Besides, the alliance and the order are represented by *Avenula cincinnata*, *Eryngium bocconei*, *Gypsophila arrostii*, *Helminthotheca aculeata*, *Patzkea coerulescens*, *Pimpinella anisoides*, *Dianthus graminifolius*, *Micromeria graeca*, *Carlina gummifera*, *Kundmannia sicula*, etc.

Syndynamism: This grassland is dynamically linked with the series of *Quercetalia calliprini*, as the *Chamaeropo-Quercetum calliprini* or, in inland stands, the *Oleo-Quercetum virgilianae*.

Habitat reference: See alliance.

35.2.3.6. ***Astragalo monspessulani-Ampelodesmetum mauritanici*** Minissale 1995

Perennial grasslands with Montpellier milkvetch and rope grass of flyschoid soils.

Holotypus: rel. 2, tab. 6, Minissale (1995).

Characteristic and differential species: *Astragalus monspessulanus* L.

Phytosociological table: From Minissale (1995), table 6, 6 rel.

Char. association: *Astragalus monspessulanus* (V).

Char. alliance: *Ampelodemos mauritanicus* (V), *Dianthus graminifolius* (III), *Eryngium bocconei* (III), *Avenula cincinnata* (II).

Char. order: *Micromeria graeca* (V), *Hyparrhenia hirta* (III), *Carlina gummifera* (II), *Hyoseris radiata* (II), *Kundmannia sicula* (II), *Phagnalon saxatile* (II), *Foeniculum vulgare* subsp. *piperitum* (II), *Andropogon distachyos* (I).

Char. class: *Dactylis glomerata* subsp. *hispanica* (IV), *Asphodelus ramosus* (III), *Galium lucidum* (III), *Pallenis spinosa* (III), *Carlina hispanica* subsp. *globosa* (III), *Convolvulus cantabrica* (III), *Anthyllis vulneraria* subsp. *maura* (II), *Allium sphaerocephalon* (II), *Asphodeline lutea* (II), *Sixalix atropurpurea* (II), *Bituminaria bituminosa* (II), *Reichardia picroides* (I), *Charybdis pancration* (I), *Elaeoselinum meoides* (I), *Poterium sanguisorba* subsp. *minor* (I).

Other species: *Calicotome infesta* (V), *Spartium junceum* (III).

Geographical distribution: This community occurs in Southern Italy and Sicily, where it is restricted to the Nebrodi mountains (Minissale, 1995; C. Brullo et al., 2010).

Structure and ecology: The acid substrates (mainly flysch) within the mesomediterranean subhumid-humid bioclimatic belt (0-1000 m a.s.l.) are colonized by a grassland dominated by *Ampelodesmos mauritanicus*, which is ascribed to *Astragalo monspessulani-Ampelodesmetum mauritanici*. This vegetation has a mesic character, as emphasized floristically by the occurrence of *Astragalus monspessulanus*, which in Sicily is restricted to mountain places. Among the species of higher rank, *Micromeria graeca*, *Carlina gummifera*, *Hyoseris radiata*, *Dactylis glomerata* subsp. *hispanica*, *Asphodelus ramosus* and *Galium lucidum* are quite frequent (Minissale, 1995).

Syndynamism: This community derives from the degradation processes of woodlands referable to Genisto *aristatae-Quercetum suberis* and *Erico-Quercetum virgilianae* (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.3.7. ***Arrhenathero nebrodensis-Helictotrichetum convoluti*** Brullo, Scelsi, Siracusa & Tomaselli 1998

Perennial grasslands with Nebrodi button-grass and oat grass of mesic stands with volcanic soils.

Holotypus: rel. 2, tab. 5, Brullo et al. (1998).

Characteristic and differential species: *Arrhenatherum elatius* (L.) P.Beauv. subsp. *nebrodense* (Brullo & al.) Giardina & Raimondo, *Brachypodium rupestre* (Host) Roem. & Schult., *Festuca rubra* L.

Phytosociological table: From Brullo et al. (1998c), table 5, 6 rel.

Char. association: *Arrhenatherum elatius* subsp. *nebrodense* (V), *Festuca rubra* (V), *Brachypodium rupestre* (V).

Char. alliance: *Helictotrichon convolutum* (V), *Avenula cincinnata* (V).

Char. order: *Micromeria graeca* (V), *Lathyrus articulatus* (V), *Hyoseris radiata* (V), *Carlina gummifera* (III), *Thapsia garganica* (I).

Char. class: *Dactylis glomerata* subsp. *hispanica* (V), *Galium lucidum* (V), *Anthyllis vulneraria* subsp. *maura* (V), *Sixalix atropurpurea* (V), *Pallenis spinosa* (V), *Carlina hispanica* subsp. *globosa* (V), *Medicago lupulina* (V), *Asperula aristata* subsp. *scabra* (V), *Asphodeline lutea* (V), *Hypericum perforatum* (IV), *Poterium sanguisorba* subsp. *verrucosa* (IV), *Centaurea sicula* (III).

Other species: *Silene italica* subsp*. sicula* (V), *Daucus carota* (V), *Urospermum dalechampii* (V).

Geographical distribution: This community was described by Brullo et al. (1998c) for Monte Lauro, Hyblaean area.

Structure and ecology: The *Arrhenathero nebrodensis-Helictotrichetum convoluti* is differentiated by the most of other communities belonging to *Avenulo cincinnatae-Ampelodesmion mauritanici* for the absence of *Ampelodesmos mauritanicus*. This association occurs on the cacuminal stands of the Hyblaean Plateaux (about 900 n a.s.l.), colonizing stony and strongly eroded soils derived from Pliocene volcanic rocks, within the supramediterranean umid bioclimatic belt. Its physiognomy is given by some caespitose grasses, among them *Helictotrichon convolutum* represents the dominant species. Besides, *Arrhenatherum nebrodense*, *Brachypodium rupestre*, *Avenula cincinnata* and *Festuca rubra* have an high coverage. The order and the class are represented by *Micromeria graeca*, *Lathyrus articulatus*, *Hyoseris radiata*, *Dactylis glomerata* subsp. *hispanica*, *Galium lucidum*, *Anthyllis vulneraria* subsp. *maura*, *Sixalix atropurpurea*, etc. (Brullo et al., 1998c).

Syndynamism: This grassland derives from the degradation of mesophilous oak woodlands of *Mespilo-Quercetum virgilianae* and probably also the *Arrhenathero-Quercetum cerridis*, which are nowadays disappeared (Brullo et al., 1998c).

Habitat reference: See alliance.

35.2.3.8. ***Avenulo cincinnatae-Brachypodietum phoenicoidis*** Brullo, Minissale & Spampinato in Brullo et al. 2010

Perennial grasslands with southern wavy hair grass and purple false brome of mesic stands with brown soils.

Holotypus: rel. 3, tab. 11, C. Brullo et al. (2010).

Characteristic and differential species: *Brachypodium phoenicoides* (L.) Roem. & Schult.

Phytosociological table: From C. Brullo et al. (2010), table 11, 5 rel.

Char. association: *Brachypodium phoenicoides* (V).

Char. alliance: *Avenula cincinnata* (V), *Dianthus graminifolius* (IV), *Pimpinella anisoides* (III), *Gypsophila arrostii* (III).

Char. order: *Micromeria graeca* (V), *Hyoseris radiata* (V).

Char. class: *Dactylis glomerata* subsp. *hispanica* (V), *Anthyllis vulneraria* subsp. *maura* (V), *Clinopodium nepeta* (V), *Pallenis spinosa* (V), *Charybdis pancration* (V), *Asphodelus ramosus* (V), *Asphodeline lutea* (V), *Allium arvense* (V), *Reichardia picroides* (IV), *Carlina sicula* (IV), *Asperula aristata* subsp. *scabra* (IV), *Sixalix atropurpurea* (III), *Petrorhagia illyrica* subsp. *haynaldiana* (II).

Other species: *Festuca circummediterranea* (V), *Thymus spinulosus* (V), *Bonannia graeca* (V).

Geographical distribution: This community was surveyed by C. Brullo et al. (2010) near Gangi (Madonie mountains).

Structure and ecology: The association at issue colonizes the calcareous steep slopes with brown soils. within the mesomediterranean humid bioclimatic belt (900-1000 m a.s.l.). It prefers the north-facing slopes and the surfaces with a good accumulation of fine particles and organic matter. Physiognomically, Brachypodium phoenicoides is the dominant species, growing with other hemicryptophytes, such as *Avenula cincinnata*, *Dianthus graminifolius*, *Pimpinella anisoides*, *Gypsophila arrostii*, *Dactylis glomerata* subsp. *hispanica*, etc. (C. Brullo et al., 2010).

Syndynamism: This grassland derives from the degradation of mesophilous woodlands, such as the *Aceri campestris-Quercetum ilicis*.

Habitat reference: See alliance.

35.2.3.9. ***Avenulo cincinnatae-Stipetum siculae*** Brullo, Minissale & Spampinato in Brullo et al. 2010

Perennial grasslands with southern wavy hair grass and Sicily needle grass of mesic stands with brown soils.

Holotypus: rel. 6, tab. 12, C. Brullo et al. (2010).

Characteristic and differential species: *Stipa sicula* Moraldo, La Valva, Ricciardi & Caputo

Phytosociological table: From C. Brullo et al. (2010), table 12, 7 rel. (subass. *matthioletosum fruticulosae*).

Char. association: *Stipa sicula* (V).

Char. subassociation: *Matthiola fruticulosa* subsp. *fruticulosa* (V), *Koeleria splendens* subsp. *splendens* (IV).

Char. alliance: *Avenula cincinnata* (V), *Ampelodesmos mauritanicus* (V), *Scorzonera villosa subsp. columnae* (V), *Pimpinella anisoides* (V), *Dianthus graminifolius* (V), *Gypsophila arrostii* (V).

Char. order: *Micromeria graeca* (V), *Hyoseris radiata* (II), *Foeniculum vulgare* subsp, *piperitum* (I).

Char. class: *Asphodelus ramosus* (V), *Asperula aristata subsp. scabra* (V), *Pallenis spinosa* (V), *Dactylis hispanica* (V), *Anthyllis vulneraria* subsp*. maura* (V), *Asphodeline lutea* (V), *Reichardia picroides* (V), *Convolvulus cantabrica* (IV), *Allium arvense* (IV)*, Charybdis pancration* (III)*, Carlina sicula* (III).

Other species: *Euphorbia rigida* (IV), *Thymus spinulosus* (IV).

From C. Brullo et al. (2010), table 12, 5 rel. (subass. *hyparrhenietosum hirtae*).

Char. association: *Stipa sicula* (V).

Char. alliance: *Avenula cincinnata* (V), *Ampelodesmos mauritanicus* (V), *Scorzonera villosa* subsp. *columnae* (V), *Gypsophila arrostii* (III), *Pimpinella anisoides* (I).

Char. order: *Cachrys libanotis* (V), *Hyparrhenia hirta* (V), *Phagnalon saxatile* (V), *Andropogon distachyos* (V), *Foeniculum vulgare* subsp, *piperitum* (IV).

Char. class: *Asphodelus ramosus* (V), *Convolvulus elegantissimus* (V), *Sedum sediforme* (V), *Asperula aristata subsp. scabra* (IV), *Pallenis spinosa* (IV), *Dactylis hispanica* (III), *Bituminaria bituminosa* (III), *Anthyllis vulneraria* subsp*. maura* (III), *Asphodeline lutea* (II), *Convolvulus cantabrica* (I).

Other species: *Fumana thymifolia* (V), *Teucrium capitatum* (V).

Geographical distribution: This vegetation occurs in Central and Western Sicily (C. Brullo et al., 2010).

Structure and ecology: This typical aspect of *Avenulo cincinnatae-Stipetum siculae*, described as subass. *matthioletosum fruticulosae*, is found in exposed and windy mountain ridges or flattened plateaux with very primitive soils. It occurs within the mesomediterranean humid bioclimatic belt between 700 and 900 m a.s.l. This grassland is dominated by *Avenula cincinnata* and *Stipa sicula*, while *Ampelodesmos mauritanicus* has only a secondary role. Besides, the floristic set includes *Matthiola fruticulosa* subsp. *fruticulosa* and *Koeleria splendens* subsp. *splendens*, as well as many species of higher ranks, such as *Scorzonera villosa subsp. columnae*, *Pimpinella anisoides*, *Dianthus graminifolius*, *Gypsophila arrostii*, *Micromeria graeca*, *Asphodelus ramosus*, *Asperula aristata subsp. scabra*, *Pallenis spinosa*, *Dactylis hispanica*, *Anthyllis vulneraria* subsp*. maura,* etc. The subass. *hyparrhenietosum hirtae* replaces the previous subassociation at lower altitudes, showing more xerophilous requirements, within the mesomediterranean subhumid bioclimatic belt. In fact, the floristic set of this grassland includes some thermo-xerophilous species, as *Cachrys libanotis*, *Hyparrhenia hirta*, *Phagnalon saxatile*, *Andropogon distachyos*, etc. (C. Brullo et al., 2010).

Syndynamism: This community replaces the *Helictotricho convoluti-Ampelodesmetum mauritanici* on more windy and exposed stands. It is dynamically connected with the mesophilous woody vegetation of *Quercetea ilicis* and in particular to the *Aceri campestri-Quercetum ilicis* (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.3.10. ***Avenulo cincinnatae-Stipetum barbatae*** Brullo, Giusso & Scuderi in Brullo et al. 2010

Perennial grasslands with southern wavy hair grass and southern oat of mountain ridges.

Holotypus: rel. 3, tab. 13, C. Brullo et al. (2010).

Characteristic and differential species: *Stipa barbata* Desf.

Phytosociological table: From C. Brullo et al. (2010), table 13, rel. 11.

Char. association: *Stipa barbata* (V).

Char. alliance: *Scorzonera villosa* subsp. *columnae* (V), *Avenula cincinnata* (V), *Ampelodesmos mauritanicus* (IV), *Pimpinella anisoides* (III), *Dianthus graminifolius* (II), *Gypsophila arrostii* (I).

Char. order: *Kundmannia sicula* (IV), *Micromeria graeca* (IV), *Carlina gummifera* (III), *Foeniculum vulgare* subsp. *piperitum* (II).

Char. class: *Elaeoselinum meoides* (V), *Anthyllis vulneraria subsp. maura* (V), *Asphodelus ramosus* (V), *Convolvulus cantabrica* (V), *Dactylis hispanica* (IV), *Asperula aristata* subsp. *scabra* (III), *Pallenis spinosa* (IV), *Allium arvense* (III), *Sedum sediforme* (III), *Carlina hispanica subsp. globosa* (II), *Petrorhagia illyrica* subsp. *haynaldiana* (II), *Sixalix atropurpurea* (II), *Bituminaria bituminosa* (I), *Allium sphaerocephalon* (I), *Asphodeline lutea* (I), *Charybdis maritima* (I), *Galium lucidum* (I), *Centaurea sicula* (I).

Other species: *Eryngium campestre* (IV), *Petrorhagia saxifraga* subsp. *gasparrini* (IV), *Koeleria splendens* subsp. *splendens* (III).

Geographical distribution: This community is restricted to Western Sicily (C. Brullo et al., 2010).

Structure and ecology: The *Avenulo cincinnatae-Stipetum barbatae* is a mesophilous vegetation growing in inland mountain ridges, which are characterized by particularly windy conditions, within the mesomediterranean subhumidhumid bioclimatic belt (700-1000 m a.s.l.). Under the floristic profile, this vegetation is dominated by *Stipa barbata* and *Avenula cincinnata*, while *Ampelodesmos mauritanicus* is more scattered. The alliance and the order are represented by *Scorzonera villosa* subsp. *columnae*, *Pimpinella anisoides*, *Dianthus graminifolius*, *Kundmannia sicula, Micromeria graeca*, *Carlina gummifera*, *Foeniculum vulgare* subsp. *piperitum*, etc. Besides, the occurrence of some orophilous species belonging to the

class *Rumici-Astragaletea siculi* testifies the mesophilous character of this community (C. Brullo et al., 2010).

Syndynamism: The primary stands of the association at issue are found on exposed rocky surfaces, taking catenal contact with the dwarf shrubby communities of the *Cerastio-Astragalion nebrodensis*. Sometimes, it derives from the degradation of the woody vegetation of *Quercetea ilicis* (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.4. Alliance: ***Phlomido lychnitidis-Brachypodion retusi*** Mateo ex Theurillat & Mucina 2016

Semiarid pseudosteppes with mediterranean false brome on calcareous substrates.

Synonyms: *Thero-Brachypodion* Br.-Bl. 1925 nom. ambig. (art. 36); *Thero-Brachypodion ramosi* Br.-Bl. 1925 (40a, mut. superfl.); *Thero-Brachypodion retusi* Br.-Bl. 1925 (40a, mut. superfl.); *Phlomidi lychnitis-Brachypodion retusi* Mateo 1983 (orig.form) (art. 2b); *Scabioso turolensis-Brachypodion retusi* Rossellò 1994 (art. 2b); *Asphodelo aestivi-Brachypodion retusi* de Foucault 1999; *Bupleuro baldensis-Brachypodion distachyi* (Br.-Bl. 1925) de Foucault 1999 (phantom); *Asphodelo aestivi-Brachypodion retusi* Foucault 2001 (art. 2b); *Bupleuro baldensis-Brachypodion distachyi* de Foucault 2001 (art. 8); *Teucrio pseudochamaepitys-Brachypodion retusi* Rivas-Martinez in Rivas-Martinez et al. 2011 (art. 5).

Holotypus: *Phlomido lychnitidis-Brachypodietum retusi* Br.-Bl. 1925

Characteristic and differential species: *Brachypodium retusum* (Pers.) P. Beauv.

Geographical distribution: This vegetation has a Mediterranean distribution (Braun-Blanquet, 1925; Bolòs & Bolòs, 1950; C. Brullo et al., 2006, 2010).

Structure and ecology: The *Phlomido lychnitidis-Brachypodion retusi* groups the thermo-xerophilous grasslands dominated by *Brachypodium retusum*, growing on more or less rocky habitats with incoherent soils derived from various kinds of substrates. It is a pioneer vegetation constituted by hemicryptophytes and geophytes, occurring in the clearings of shrubby communities, garrigues or more mature grasslands (C. Brullo et al., 2010; Costa et al., 2012).

Syndynamism: In Sicily the communities belonging to this alliance are linked with the dynamic series of the *Quercetea ilicis* woodlands.

Habitat reference: E1.3b Mediterranean tall perennial dry grassland.

35.2.4.1. ***Pulicario odorae-Brachypodietum retusi*** Ferro & Ladero 1999

Perennial grasslands with Mediterranean false brome and mediterranean fleabane of siliceous primitive soils.

Holotypus: rel. 9, tab. 1, Ferro & Ladero (1999).

Characteristic and differential species: *Pulicaria odora* (L.) Rchb.

Phytosociological table: From Ferro & Ladero (1999), table 1, 10 rel.
Char. association: *Pulicaria odora* (V).
Char. alliance: *Brachypodium retusum* (V).
Char. order: *Convolvulus althaeoides* (IV), *Foeniculum vulgare* subsp. *piperitum* (IV), *Hyparrhenia hirta* (II), *Micromeria graeca* (I),
Char. class: *Dactylis glomerata* subsp. *hispanica* (IV), *Carlina hispanica subsp. globosa* (IV), *Reichardia picroides* (II), *Asphodelus ramosus* (I), *Poterium sanguisorba* subsp. *minor* (I), *Clinopodium nepeta* (I), *Hypericum perfoliatum* (I).
Other species: *Trifolium campestre* (V), *Silene gallica* (III).

Geographical distribution: This community occurs in the Aeolian Islands (C. Brullo et al., 2010).

Structure and ecology: The *Pulicario odorae-Brachypodietum retusi* is linked to siliceous primitive soils, derived from volcanic rocks. It occurs on flat or gently sloping stands, from the sea level up to 600 m of altitude, within the thermomediterranean subhumid bioclimatic belt (Ferro & Ladero-Alvarez, 1999). This grassland is dominated by *Brachypodium retusum*, while the differential species is *Pulicaria odora*, which is usually found in woodlands. The order and the class are represented by *Convolvulus althaeoides*, *Foeniculum vulgare* subsp. *piperitum*, *Hyparrhenia hirta*, *Dactylis glomerata* subsp. *hispanica*, *Carlina hispanica subsp. globosa*, etc.

Syndynamism: This association derives from the degradation of maquis or Holm oak woods belonging to *Erico-Quercion ilicis*. Moreover, this vegetation colonizes abandoned fields and with the decrease of the anthropic disturbance can shifts towards shrubby communities with *Artemisia arborescens* at low altitudes, or maquis at higher altitudes (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.4.2. ***Coronillo glaucae-Brachypodietum retusi*** C. Brullo, Brullo, Giusso & Tomaselli 2006

Perennial grasslands with shrubby scorpion vetch and Mediterranean false brome of eroded calcareous soils.

Holotypus: rel. 9, tab. 3, C. Brullo et al. (2006).

Characteristic and differential species: *Coronilla valentina* L. subsp. *glauca* (L.) Batt.

Phytosociological table: From C. Brullo et al. (2006), table 3, 6 rel.

Char. association: *Coronilla valentina* subsp. *glauca* (V).

Char. alliance: *Brachypodium retusum* (V).

Char. order: *Hyoseris radiata* (V), *Phagnalon saxatile* (V), *Foeniculum vulgare* subsp. *piperitum* (III), *Ferula communis* (III), *Convolvulus althaeoides* (I).

Char. class: *Dactylis glomerata* subsp. *hispanica* (V), *Reichardia picroides* (V), *Carlina hispanica subsp. globosa* (V), *Pallenis spinosa* (III), *Bituminaria bituminosa* (II), *Clinopodium nepeta* (I).

Other species: *Scorpiurus subvillosus* (V), *Dittrichia viscosa* (IV).

Geographical distribution: This community is known only from Marettimo (C. Brullo et al., 2006).

Structure and ecology: The community at issue is found on heavily eroded soils derived from Mesozoic limestones. Generally, it grows in the north-facing steep slopes with several rocky outcrops, within the thermomediterranean dry bioclimatic belt. From the physiognomical point of view, this grassland is dominated by *Brachypodium retusum* and also by two small phanerophytes, as *Coronilla valentina* subsp. *glauca* and *Phagnalon saxatile*. Among the species of higher rank, *Hyoseris radiata*, *Phagnalon saxatile*, *Foeniculum vulgare* subsp. *piperitum*, *Dactylis glomerata* subsp. *hispanica*, *Reichardia picroides*, *Carlina hispanica subsp. globosa*, etc. (C. Brullo et al., 2006).

Syndynamism: The *Coronillo glaucae-Brachypodietum retusi* is a pioneer community, which is dynamically connected with the series of *Erico-Micromerietum fruticulosae* (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.4.3. ***Helminthotheco aculeatae-Brachypodyetum retusi*** C. Brullo, Brullo, Giusso & Tomaselli 2006

Perennial grasslands with bristly oxtongue and Mediterranean false brome of stabilized screes.

Holotypus: rel. 3, tab. 3, C. Brullo et al. (2006).

Characteristic and differential species: *Allium lehmannii* Lojac., *Helminthotheca aculeata* (Vahl) DC.

Phytosociological table: From C. Brullo et al. (2006), table 3, 5 rel.

Char. association: *Helminthotheca aculeata* (V), *Allium lehmannii* (IV).

Char. alliance: *Brachypodium retusum* (V).

Char. order: *Convolvulus althaeoides* (IV), *Phagnalon saxatile* (IV), *Hyparrhenia hirta* (III).

Char. class: *Dactylis glomerata* subsp. *hispanica* (V), *Bituminaria bituminosa* (V), *Reichardia picroides* (IV), *Carlina hispanica subsp. globosa* (III), *Pallenis spinosa* (III), *Piptatherum miliaceum* subsp. *miliaceum* (III), *Charybdis pancration* (II), *Asphodelus ramosus* (II), *Galium lucidum* (II).

Geographical distribution: This community is circumscribed to North-western Sicily, in the coastal mountains between Palermo and Trapani (C. Brullo et al., 2006).

Structure and ecology: This association is linked to more or less stabilized screes and rocky slopes at the base of carbonatic cliffs. It occurs within the thermomediterranean dry bioclimatic belt, but prefers shady and sheltered stands where the microclimatic conditions are quite mesic. From the floristic point of view, it is an impoverished community dominated by *Brachypodium retusum*, which constitutes an homogeneous and dense grassland. The key species are Helminthotheca aculeata and Allium lehmannii, growing together with some species of order and class, as *Convolvulus althaeoides*, *Phagnalon saxatile*, *Hyparrhenia hirta, Dactylis glomerata* subsp. *hispanica*, *Bituminaria bituminosa*, *Reichardia picroides*, etc. (C. Brullo et al., 2006).

Syndynamism: This community derives from the degradation of Holm oak woods ascribed to the *Rhamno alterni-Quercetum ilicis* (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.4.4. ***Diantho graminifoli-Brachypodietum retusi*** Brullo, Giusso & Scuderi in Brullo et al. 2010

Perennial grasslands with grass leaved carnation and Mediterranean false brome of sloped calcareous stands.

Holotypus: rel. 6, tab. 15C, Brullo et al. (2006).

Characteristic and differential species: *Dianthus graminifolius* C. Presl.

Phytosociological table: From C. Brullo et al. (2010), table 15C, 7 rel.

Char. association: *Dianthus graminifolius* (V).

Char. alliance: *Brachypodium retusum* (V).

Char. order: *Kundmannia sicula* (V), *Foeniculum vulgare* subsp. *piperitum* (V), *Hyoseris radiata* (IV), *Micromeria graeca* (IV), *Ferula communis* (III), *Phagnalon saxatile* (II), *Carlina gummifera* (II), *Cachrys libanotis* (II), *Convolvulus althaeoides* (I).

Char. class: *Dactylis glomerata* subsp. *hispanica* (V), *Bituminaria bituminosa* (V), *Ampelodesmos mauritanicus* (V), *Anthyllis vulneraria* subsp. *maura* (V), *Asphodelus ramosus* (III), *Charybdis pancration* (III), *Pallenis spinosa* (III), *Elaeoselinum meoides* (III), *Avenula cincinnata* (III), *Reichardia picroides* (II), *Thapsia garganica* (II), *Pimpinella anisoides* (II), *Convolvulus cantabrica* (II), *Lobularia maritima* (I), *Petrorhagia illyrica* subsp. *haynaldiana* (I).

Geographical distribution: This community occurs in North-western Sicily (C. Brullo et al., 2010).

Structure and ecology: The *Diantho graminifoli-Brachypodietum retusi* is linked to more or less sloping surfaces with carbonatic substrates characterized by initial and eroded soils. Usually, it is found in north-facing slopes covered by debris mixed to rocky outcrops, within the thermomediterranean subhumid bioclimatic belt. Under the floristic profile, this grassland is dominated by *Brachypodium retusum*, while the key species is *Dianthus graminifolius*, a Sicilian endemism. The order and the class are represented by many species, among them *Kundmannia sicula*, *Foeniculum vulgare* subsp. *piperitum*, *Hyoseris radiata*, *Micromeria graeca*, *Ferula communis*, *Dactylis glomerata* subsp. *hispanica*, *Bituminaria bituminosa*, *Ampelodesmos mauritanicus*, *Anthyllis vulneraria* subsp. *maura*, etc. (C. Brullo et al., 2010).

.

Syndynamism: This community derives from the degradation of *Cisto-Ericion* garrigues (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.4.5. ***Cachryo siculae-Brachypodietum retusi*** Brullo, Giusso & Scuderi in Brullo et al. 2010

Perennial grasslands with Sicily basil and Mediterranean false brome of sloped calcareous stands.

Holotypus: rel. 19, tab. 15D, Brullo et al. (2006).

Characteristic and differential species: *Cachrys sicula* L.

Phytosociological table: From C. Brullo et al. (2010), table 15D, 6 rel.

Char. association: *Cachrys sicula* (V).

Char. alliance: *Brachypodium retusum* (V).

Char. order: *Hyoseris radiata* (IV), *Kundmannia sicula* (III), *Micromeria graeca* (II), *Ferula communis* (II), *Foeniculum vulgare* subsp. *piperitum* (II), *Ferula communis* (II), *Lathyrus articulatus* (I), *Hyparrhenia hirta* (I), *Carlina gummifera* (I).

Char. class: *Reichardia picroides* (V), *Bituminaria bituminosa* (V), *Dactylis glomerata* subsp. *hispanica* (IV), *Asphodelus ramosus* (III), *Pallenis spinosa* (III), *Anthyllis vulneraria* subsp.

maura (III), *Convolvulus cantabrica* (III), *Sixalix atropurpurea* (II), *Thapsia garganica* (II), *Ampelodesmos mauritanicus* (II), *Charybdis pancration* (II), *Centaurea sicula* (I), *Piptatherum miliaceum* subsp. *miliaceum* (I), *Lobularia maritima* (I), *Poterium sanguisorba subsp. minor* (I).

Other species: *Eryngium campestre* (III), *Avena barbata* (III).

Geographical distribution: This community occurs in North-Western Sicily (C. Brullo et al., 2010).

Structure and ecology: The stabilized screes and rocky surfaces with soils rich skeleton and coarse carbonatic stones are colonized by the *Cachryo siculae-Brachypodietum retusi*. It is found on coastal or hilly stands within the thermomediterranean dry or subhumid bioclimatic belt. This *Brachypodium retusum*-dominated grassland is differentiated by *Cachrys sicula*, which is associated with many species of order and class, as *Hyoseris radiata*, *Kundmannia sicula*, *Micromeria graeca*, *Reichardia picroides*, *Bituminaria bituminosa*, *Dactylis glomerata* subsp. *hispanica*, *Asphodelus ramosus*, etc. (C. Brullo et al., 2010).

Syndynamism: This vegetation has a secondary role and often is mixed with the grasslands of *Ampelodesmos mauritanicus* (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.5. Alliance: ***Bromo-Oryzopsion miliaceae*** O.Bolòs 1970

Thermomediterranean sub-ruderal perennial grasslands on disturbed road verges.

Synonyms: *Bromo-Piptatherion miliaceae* O.Bolòs 1970 *nom. mut. propos.* (art. 45).

Holotypus: *Inulo viscosae-Oryzopsietum miliaceae* A. & O. Bolòs ex Bolòs 1957.

Characteristic and differential species: *Dittrichia viscosa* (L.) Greuter, *Lepidium graminifolium* L., *Piptatherum miliaceum* (L.) Coss. subsp. *miliaceum, Plumbago europaea* L.

Geographical distribution: This alliance is widely distributed in the Western Mediterranean area, having its greater diversity in Sicily (C. Brullo et al., 2010; Costa et al., 2012; Mucina et al., 2016).

Structure and ecology: The sub-nitrophilous perennial grasslands dominated by big hemicryptophytes, such as *Piptatherum miliaceum* subsp. *miliaceum* and *Dittrichia viscosa*, are ascribed to the *Bromo-Oryzopsion miliaceae* alliance. Generally, this vegetation colonizes abandoned fields, uncultivated ruderal areas or roadsides within the (meso)thermomediterranean bioclimatic belt (C. Brullo et al., 2010). The syntaxonomical placement of this alliance is quite controversial, since several authors (Bolòs, 1970; Bolòs & Vigo, 1972; Rivas-Maritnez et al., 2002; Mucina et al., 2016) suggested its treatment into

different classes, among them *Chenopodietea* and *Artemisietea vulgaris*, although the vegetation at issue is not exclusively found in synanthropic environments and not shows a marked nitrophilous character. According to C. Brullo et al. (2010), for its floristic, structural and ecological features it should be classified within *Hyparrhenietalia hirtae* order.

Syndynamism: The communities belonging to this alliance have a pioneer character, being linked with an intensive and long-lasting agro-pastoral use of land. In the abandoned fields these communities replace the therophytic subnitrophilous vegetation of *Echio plantaginei-Galactition tomentosae*, while along roadsides and footpaths they follows the nitrophilous communities belonging to the *Hordeion leporini*. The decreasing of human disturbance leads to the establishment of less nitrophilous dry grasslands belonging to *Lygeo-Stipetea* class (C. Brullo et al., 2010).

Habitat reference: E1.3b Mediterranean tall perennial dry grassland.

35.2.5.1. ***Centrantho rubri-Euphorbietum ceratocarpae*** Brullo 1984

Subnitrophilous vegetation with red valerian and tintern spurge of disturbed stands.

Holotypus: rel. 15, tab. 1, Brullo (1984b).

Characteristic and differential species: *Centranthus ruber* (L.) DC., *Euphorbia ceratocarpa* Ten., *Jacobaea lycopifolia* (Desf. ex Poir.) Greuter & B. Nord.

Phytosociological table: From Brullo (1984b), table 1, 19 rel.

Char. association: *Euphorbia ceratocarpa* (V), *Centranthus ruber* (V), *Jacobaea lycopifolia* (II).

Char. alliance: *Piptatherum miliaceum* (V), *Dittrichia viscosa* (V), *Lobularia maritima* (V), *Lepidium graminifolium* (III), *Plumbago europaea* (I).

Char. order: *Hyparrhenia hirta* (V), *Foeniculum vulgare* subsp. *piperitum* (V), *Convolvulus althaeoides* (V), *Micromeria graeca* (IV), *Phagnalon saxatile* (III), *Andropogon distachyus* (III), *Scorpiurus muricatus* (II).

Char. class: *Reichardia picroides* (V), *Verbascum sinuatum* (V), *Sixalix atropurpurea* subsp. *maritima* (V), *Clinopodium nepeta* (IV), *Charybdis pancration* (IV), *Asphodelus ramosus* (IV), *Pallenis spinosa* (IV), *Centaurea sicula* (IV), *Dactylis glomerata* subsp. *hispanica* (IV), *Echium italicum* subsp. *siculum* (IV), *Bituminaria bituminosa* (IV), *Silene vulgaris* (IV), *Euphorbia pinea* (III), *Carlina globosa* subsp. *hispanica* (III), *Crepis vesicaria* (III), *Achillea ligustica* (III).

Other species: *Galactites elegans* (IV), *Lolium rigidum* (IV), *Avena barbata* (IV), *Hypochoeris achyrophorus* (IV), *Trifolium stellatum* (IV), *Echium plantagineum* (IV), *Stipellula capensis* (IV).

Geographical distribution: This community occurs in Southern Italy and Sicily, where it is very frequent in the Hyblaean area, North-Eastern part and Etna (Brullo, 1984b; Guglielmo et al., 2006; C. Brullo et al., 2010).

Structure and ecology: The roadsides or abandoned fields since a long time are colonized by a subnitrophilous vegetation dominated by *Euphorbia ceratocarpa*, an endemic species of Sicily and Southern Italy. This community, named *Centrantho rubri-Euphorbietum ceratocarpae* can grow on different substrata (limestones, marls, vulcanites, clays, etc.), within the thermomediterranean dry-subhumid bioclimatic belt. It is usually found between 100 and 500 m of altitude, in the inland areas and sometimes at higher altitudes (about 500-600 m a.s.l.) under the mesomediterranean thermotype (Brullo, 1984b). From the physiognomic point of view, this vegetation is characterized by the occurrence and often high coverage of *Centranthus ruber* and *Jacobaea lycopifolia*, which are considered the other characteristic species of this syntaxon. The floristic set is completed by some taxa of higher rank, as *Piptatherum miliaceum*, *Dittrichia viscosa*, *Lobularia maritima*, *Lepidium graminifolium*, *Hyparrhenia hirta*, *Foeniculum vulgare* subsp. *piperitum*, *Convolvulus althaeoides*, *Micromeria graeca*, *Phagnalon saxatile*, *Reichardia picroides*, *Verbascum sinuatum*, *Sixalix atropurpurea* subsp. *maritima*, etc.

Syndynamism: This association is linked with the dynamic series of *Quercion ilicis* and only marginally also *Oleo-Ceratonion*.

Habitat reference: See alliance.

35.2.5.2. ***Thapsio garganicae-Feruletum communis*** Brullo 1984

Perennial vegetation with deadly carrots and giant fennel of synanthropic habitats.

Holotypus: rel. 4, Tab. 2 , Brullo (1984b).

Characteristic and differential species: *Cachrys sicula* L., *Ferula communis* L., *Opopanax chironium* (L.) W.D.J.Koch, *Thapsia garganica* L.

Phytosociological table: From Brullo (1984b), table 2, 24 rel.

Char. association: *Ferula communis* (V), *Thapsia garganica* (IV), *Opopanax chironium* (III), *Cachrys sicula* (II).

Char. alliance: *Dittrichia viscosa* (V), *Piptatherum miliaceum* (V), *Lobularia maritima* (IV), *Plumbago europaea* (III), *Lepidium graminifolium* (II).

Char. order: *Foeniculum vulgare* subsp. *piperitum* (V), *Hyparrhenia hirta* (V), *Convolvulus althaeoides* (IV), *Phagnalon saxatile* (IV), *Micromeria graeca* (III), *Andropogon distachyus* (III), *Lathyrus articulatus* (II), *Scorpiurus muricatus* (II).

Char. class: *Asphodelus ramosus* (V), *Sixalix atropurpurea* subsp. *maritima* (V), *Clinopodium nepeta* (V), *Reichardia picroides* (V), *Verbascum sinuatum* (V), *Pallenis spinosa* (IV), *Charybdis pancration* (IV), *Centaurea sicula* (III), *Euphorbia pinea* (III), *Eryngium campestre* (III), *Bituminaria bituminosa* (II), *Dactylis glomerata* subsp. *hispanica* (II), *Echium italicum* subsp. *siculum* (III), *Crepis vesicaria* (II), *Convolvulus cantabrica* (II).

Other species: *Avena barbata* (III), *Galactites elegans* (III), *Glebionis coronarium* (IIII).

Geographical distribution: This community with a Central Mediterranean distribution occurs everywhere in Sicily (Brullo, 1984b; C. Brullo et al., 2010).

Structure and ecology: The roadsides, old abandoned fields, over-grazed pastures and others synanthropic or semi-natural habitats, are colonized by the *Thapsio garganicae-Feruletum communis*. Usually, this community is found in the coastal stands within the thermomediterranean bioclimatic belt, colonizing any kind of substrata (Brullo, 1984b). Its physiognomy is given by huge perennial umbellifers, such as *Ferula communis*, *Thapsia garganica* and *Opoponax chironium*, growing together with some species of alliance, as *Dittrichia viscosa*, *Piptatherum miliaceum*, *Lobularia maritima*, *Plumbago europaea* and *Lepidium graminifolium*. The occurrence of many steppic species, among them *Foeniculum vulgare* subsp. *piperitum, Hyparrhenia hirta*, *Convolvulus althaeoides*, *Micromeria graeca*, *Andropogon distachyus*, *Sixalix atropurpurea* subsp. *maritima*, *Clinopodium nepeta*, *Reichardia picroides*, *Verbascum sinuatum* and *Pallenis spinosa*, allows to ascribe this vegetation to *Lygeo-Stipetea* class, although Biondi et al. (2016) classified the nitrophilous communities dominated by *Ferula* species of the Mediterranean area within a new class proposed as *Charybdido pancratii-Asphodeletea ramosi*. However, as highlighted by Guarino et al. (2017), the aforementioned syntaxon has been described on the basis of surveys carried out in rather mesic areas of central Italy, lacking of some thermophilous species and representing only the northernmost and heterotopic aspect of a more widespread thermo-mediterranean vegetation, which is clearly referable to *Lygeo-Stipetea* class.

Syndynamism: The community at issue represents an early stage of the climatophilous woody vegetation belonging to *Quercetalia ilicis* or *Quercetalia calliprini*. Its persistence is guaranteed by over-grazing and frequent fires (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.5.3. ***Diplotaxio tenuifoliae-Oryzopsietum miliaceae*** Brullo 1984

Perennial vegetation with perennial wall-rocket and smilo grass of roadsides.

Holotypus: rel. 9, tab. 3, Brullo (1984b).

Characteristic and differential species: *Diplotaxis tenuifolia* (L.) DC.

Phytosociological table: From Brullo (1984b), table 3, 6 rel.

Char. association: *Diplotaxis tenuifolia* (V).

Char. alliance: *Dittrichia viscosa* (V), *Piptatherum miliaceum* (V), *Lepidium graminifolium* (I).

Char. order: *Foeniculum vulgare* subsp. *piperitum* (V), *Convolvulus althaeoides* (V), *Hyparrhenia hirta* (V), *Phagnalon saxatile* (V), *Micromeria graeca* (V), *Lathyrus articulatus* (IV).

Char. class: *Reichardia picroides* (V), *Asphodelus ramosus* (V), *Sixalix atropurpurea* subsp. *maritima* (V), *Lobularia maritima* (V), *Clinopodium nepeta* (V), *Verbascum sinuatum* (IV), *Pallenis spinosa* (IV), *Bituminaria bituminosa* (IV), *Charybdis pancration* (IV), *Anthyllis vulneraria* subsp. *maura* (IV), *Convolvulus cantabrica* (III), *Dactylis glomerata* subsp. *hispanica* (III)

Other species: *Daucus carota* (V), *Calendula arvensis* (IV), *Carlina sicula* (IIII).

Geographical distribution: In Sicily, this association is found mainly in the Ionian coast, occurring also in Pantelleria and Southern Calabria (Brullo, 1984b; Brullo et al., 2001; C. Brullo et al., 2010).

Structure and ecology: The roadsides with a sufficient accumulation of fine particles and organic matter are colonized by a perennial vegetation dominated by *Piptatherum miliaceum* subsp. *miliaceum* and *Diplotaxis tenuifolia*. This community, named *Diplotaxio tenuifoliae-Oryzopsietum miliaceae*, is linked to quite humid and shaded stands within the thermomediterranean bioclimatic belt (Brullo, 1984b). The syntaxa of higher rank are represented by many species, among them *Dittrichia viscosa*, *Foeniculum vulgare* subsp. *piperitum*, *Convolvulus althaeoides*, *Hyparrhenia hirta*, *Phagnalon saxatile*, *Micromeria graeca*, *Reichardia picroides* and *Asphodelus ramosus*.

Syndynamism: This vegetation shows a pioneer character, becoming a permanent community of constantly disturbed habitats. It is dynamically connected with the less xerophilous series of *Oleo-Ceratonion*, as those ones of *Myrto-Lentiscetum* and *Oleo-Euphorbietum dendroidis* (Brullo, 1984b).

Habitat reference: See alliance.

35.2.5.4. ***Sinapio pubescentis-Oryzopsietum miliaceae*** Brullo 1984

Perennial vegetation with pubescent mustard and smilo grass of disturbed volcanic surfaces.

Holotypus: rel. 9, Tab. 4, Brullo (1984b).

Characteristic and differential species: *Sinapis pubescens* L.

Phytosociological table: From Brullo (1984b), table 4, 10 rel.

Char. association: *Sinapis pubescens* (V).

Char. alliance: *Dittrichia viscosa* (V), *Piptatherum miliaceum* (V).

Char. order: *Foeniculum vulgare* subsp. *piperitum* (V), *Hyparrhenia hirta* (V), *Micromeria graeca* (V), *Convolvulus althaeoides* (V), *Andropogon distachyos* (IV), *Phagnalon saxatile* (IV), *Lathyrus articulatus* (I).

Char. class: *Reichardia picroides* (V), *Sixalix atropurpurea* subsp. *maritima* (V), *Lobularia maritima* (IV), *Verbascum sinuatum* (IV), *Clinopodium nepeta* (IV), *Bituminaria bituminosa* (IV), *Anthyllis vulneraria* (III), *Euphorbia pinea* (III), *Echium italicum* (III), *Carlina vulgaris* (III)

Other species: *Calendula arvensis* (IV), *Sonchus asper* (IV).

Geographical distribution: Actually, this vegetation is reported only for Hyblaean and Peloritani mountains (Brullo, 1984b; C. Brullo et al., 2010).

Structure and ecology: The *Sinapio pubescentis-Oryzopsietum miliaceae* is found along the roadsides on siliceous soils (vulcanites, schists and gneiss) between 400 and 800 m a.s.l., within the mesomediterranean subhumid bioclimatic belt. Its physiognomy is given by *Piptatherum miliaceum* susp. *miliaceum* and *Sinapis pubescens*, growing together with some species of higher rank, as *Dittrichia viscosa*, *Piptatherum miliaceum*, *Foeniculum vulgare* subsp. *piperitum*, *Hyparrhenia hirta*, *Micromeria graeca*, *Convolvulus althaeoides*, *Andropogon distachyos*, etc. (Brullo, 1984b).

Syndynamism: This coenosis has a pioneer character, colonizing disturbed stands, which are potentially covered by the climatophilous woodlands of *Erico-Quercion ilicis* (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.5.5. ***Tricholaeno teneriffae-Oryzopsietum miliaceae*** Brullo 1984

Perennial vegetation with Tenerife tricholaena and smilo grass of disturbed sandy soils.

Holotypus: rel. 6, Tab. 5, Brullo (1984b).

Characteristic and differential species: *Tricholaena teneriffae* (L. f.) Link.

Phytosociological table: From Brullo (1984b), table 5, 6 rel.

Char. association: *Tricholaena teneriffae* (V).

Char. alliance: *Dittrichia viscosa* (V), *Piptatherum miliaceum* (V).

Char. order: *Hyparrhenia hirta* (V), *Convolvulus althaeoides* (IV), *Micromeria graeca* (IV), *Andropogon distachyus* (IV), *Phagnalon saxatile* (III), *Lathyrus articulatus* (II).

Char. class: *Lobularia maritima* (V), *Clinopodium nepeta* (V), *Foeniculum vulgare* subsp. *piperitum* (V), *Dactylis glomerata* subsp. *hispanica* (V), *Reichardia picroides* (V), *Sixalix atropurpurea* subsp. *maritima* (V), *Pallenis spinosa* (IV), *Carlina vulgaris* (IV), *Silene vulgaris* (IV), *Bituminaria bituminosa* (IV), *Asphodelus ramosus* (III), *Verbascum sinuatum* (II).

Other species: *Rhus coriaria* (V), *Daucus carota* (V), *Sonchus oleraceus* (IV), *Cynodon dactylon* (IV).

Geographical distribution: This community is restricted to Southern Calabria and North-Eastern Sicily, where it is known for a small area near Messina (Brullo, 1984b; C. Brullo et al., 2010).

Structure and ecology: *Tricholaena teneriffae* is a rare thermo-xerophilous species, occurring along roadsides or in abandoned fields with arenaceous sandy soils, where characterizes a peculiar vegetation named *Tricholaeno teneriffae-Oryzopsietum miliaceae*. Its structure is given by some species of higher rank, among them *Dittrichia viscosa*, *Piptatherum miliaceum*, *Hyparrhenia hirta*, *Convolvulus althaeoides*, *Micromeria graeca*, *Lobularia maritima*, *Clinopodium nepeta*, *Foeniculum vulgare* subsp. *piperitum*, *Dactylis glomerata* subsp. *hispanica* and *Reichardia picroides*. This community is exclusively found in coastal sites within the thermomediterranean dry bioclimatic belt (C. Brullo et al., 2010).

Syndynamism: This association is dynamically connected with the woody vegetation of *Oleo-Ceratonion*, moving towards the *Hyparrhenia hirta* dry grasslands at the cessation of the anthropic disturbance. Often it has catenal contact with the ephemeral meadows of *Vulpietalia* or with the *Vicio-Echietum pustulati*, a nitrophilous coenosis belonging to *Echio-Galactition tomentosae* alliance (Brullo, 1984b).

Habitat reference: See alliance.

35.2.5.6. ***Euphorbietum cupanii*** Brullo 1984

Perennial vegetation with Cupani spurge of roadsides.

Holotypus: rel. 2, Tab. 6, Brullo (1984b).

Characteristic and differential species: *Euphorbia cupanii* Guss. ex Bertol.

Phytosociological table: From Brullo (1984b), table 6, 6 rel.

Char. association: *Euphorbia cupanii* (V).

Char. alliance: *Dittrichia viscosa* (V), *Piptatherum miliaceum* (V), *Plumbago europaea* (II).

Char. order: *Hyparrhenia hirta* (V), *Convolvulus althaeoides* (V), *Phagnalon saxatile* (III),

Char. class: *Foeniculum vulgare* subsp. *piperitum* (V), *Reichardia picroides* (V), *Verbascum sinuatum* (V), *Lobularia maritima* (IV), *Clinopodium nepeta* (IV), *Sixalix atropurpurea* subsp. *maritima* (IV), *Pallenis spinosa* (IV), *Asphodelus ramosus* (III), *Allium arvense* (III).

Other species: *Symphyotrichum squamatum* (V), *Conyza bonariensis* (V), *Sonchus oleraceus* (V), *Cynodon dactylon* (V).

Geographical distribution: This vegetation has a scattered distribution between Trapani and Marsala, W Sicily (Brullo, 1984b). It occurs also in Sardinia (C. Brullo et al., 2010).

Structure and ecology: The *Euphorbietum cupanii* colonizes the coastal roadsides and the paths, usually near small walls and within the thermomediterranean belt, which are characterized by marly or loamy soils. Its physiognomy is given by *Euphorbia cupanii*, an endemic species of Sardinia, Sicily and Corsica linked to disturbed habitats (Valsecchi, 1980; Brullo, 1984b). The floristic set is constituted by some species of alliance, as *Dittrichia viscosa*, *Piptatherum miliaceum* and *Plumbago europaea*, as well as by many taxa of higher rank, among them *Hyparrhenia hirta*, *Convolvulus althaeoides*, *Foeniculum vulgare* subsp. *piperitum*, *Reichardia picroides*, *Verbascum sinuatum* and *Lobularia maritima*.

Syndynamism: This vegetation is dynamically connected with the thermo-xerophilous maquis of *Oleo-Ceratonion* (C. Brullo et al., 2010).

35.2.5.7. ***Boerhaavio viscosae-Oryzopsietum miliaceae*** Brullo 1984

Perennial vegetation with purple spiderling and smilo grass of heavily disturbed stands.

Holotypus: rel. 1, Tab. 7, Brullo (1984b).

Characteristic and differential species: *Boerhaavia repens* L. subsp. *viscosa* (Choisy) Maire.

Phytosociological table: From Brullo (1984b), table 7, 7 rel.

Char. association: *Boerhaavia repens* subsp. *viscosa* (V).

Char. alliance: *Dittrichia viscosa* (V), *Piptatherum miliaceum* (V).

Char. order: *Hyparrhenia hirta* (III), *Convolvulus althaeoides* (III).

Char. class: *Verbascum sinuatum* (V), *Foeniculum vulgare* subsp. *piperitum* (IV), *Sixalix atropurpurea* subsp. *maritima* (IV), *Clinopodium nepeta* (IV), *Lobularia maritima* (III), *Convolvulus cantabrica* (III), *Pallenis spinosa* (III), *Reichardia picroides* (III), *Bituminaria bituminosa* (II).

Other species: *Conyza bonariensis* (IV), *Hypericum triquetrifolium* (IV), *Heliotropium europaeum* (IV), *Chenopodium album* (III).

Geographical distribution: This community occurs near Palermo and Bagheria (Brullo, 1984b; Gianguzzi et al., 1996; C. Brullo et al., 2010).

Structure and ecology: The very disturbed and sunny stands, usually localized near the sea, are colonized by a nitrophilous vegetation with the exotic species *Boerhavia repens* subsp. *viscosa*. It is the *Boerhaavio viscosae-Oryzopsietum miliaceae*, a pioneer community of roadsides with very primitive limestone soils within the thermomediterranean dry bioclimatic belt (Brullo, 1984b). Under the floristic profile, it is a quite poor vegetation, where among the species of higher rank, *Dittrichia viscosa*, *Piptatherum miliaceum, Hyparrhenia*

hirta, *Verbascum sinuatum*, *Foeniculum vulgare* subsp. *piperitum*, *Sixalix atropurpurea* subsp. *maritima* and *Clinopodium nepeta* are frequent.

Syndynamism: This community grows in the area potentially covered by *Oleo-Ceratonion* vegetation (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.5.8. ***Dittrichio viscosae-Ferulaginetum campestris*** Brullo 1984

Perennial vegetation with false yellowhead and field small fennel of disturbed mountain stands.

Holotypus: rel. 1, Tab. 8, Brullo (1984b).

Characteristic and differential species: *Ferulago campestris* (Besser) Grec.

Phytosociological table: From Brullo (1984b), table 8, 5 rel.

Char. association: *Ferulago campestris* (V).

Char. alliance: *Dittrichia viscosa* (V).

Char. order and class: *Clinopodium nepeta* (V), *Foeniculum vulgare* subsp. *piperitum* (IV), *Micromeria graeca* (IV), *Elaeoselinum meoides* (IV), *Dactylis glomerata* subsp. *hispanica* (IV), *Hypericum perforatum* (IV), *Sixalix atropurpurea* subsp. *maritima* (III), *Ampelodesmos mauritanicus* (III), *Carlina hispanica* subsp. *globosa* (III), *Allium arvense* (III), *Convolvulus althaeoides* (II), *Lathyrus sylvestris* (II), *Anthyllis vulneraria* subsp. *maura* (II).

Other species: *Cota triumfettii* (IV), *Galium verum* (IV), *Achillea ligustica* (IV), *Eryngium campestre* (IV).

Geographical distribution: This vegetation is restricted to the southern side of Madonie and Nebrodi ranges (Brullo, 1984b; C. Brullo et al., 2010).

Structure and ecology: According to C. Brullo et al. (2010), the *Dittrichio viscosae-Ferulaginetum campestris* represents the more mesophilous association of *Bromo-Oryzopsion miliaceae*, occurring between 800 and 1200 m a.s.l. within the meso- and supramediterranean subhumid bioclimatic belt. Generally, it colonizes the quite disturbed sunny stands near roads or paths, with marly-clayey substrates. Its structure is given by the rare *Ferulago campestris*, growing together with *Dittrichia viscosa* and some species of higher rank, among them *Clinopodium nepeta*, *Foeniculum vulgare* subsp. *piperitum*, *Micromeria graeca*, *Elaeoselinum meoides*, *Dactylis glomerata* subsp. *hispanica* and *Hypericum perforatum*.

Syndynamism: This community is connected with the dynamic series of mesophilous oak woods belonging to *Quercetalia ilicis* (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.5.9. ***Mantisalco salmanticae-Oryzopsietum miliaceae*** Bartolo, Brullo, Minissale & Spampinato 1990

Subnitrophilous vegetation with Salamanca cornflower and dagger flower of roadsides and paths.

Holotypus: rel. 5, Tab. 15, Bartolo et al. (1990).

Characteristic and differential species: *Daucus siculus* Tineo., *Mantisalca salmantica* (L.) Briq. & Cavill.

Phytosociological table: From Bartolo et al. (1990), table 15, 9 rel.

Char. association: *Daucus siculus* (V), *Mantisalca salmantica* (IV).

Char. alliance: *Piptatherum miliaceum* (V), *Dittrichia viscosa* (I).

Char. order: *Foeniculum vulgare* subsp. *piperitum* (V), *Convolvulus althaeoides* (V), *Phagnalon saxatile* (III).

Char. class: *Lobularia maritima* (IV), *Reichardia picroides* (III), *Verbascum sinuatum* (II), *Pallenis spinosa* (II), *Asphodelus ramosus* (II), *Charybdis pancration* (I).

Other species: *Beta vulgaris* (V), *Asparagus aphyllus* (III), *Asparagus acutifolius* (III), *Carrichtera annua* (III).

Geographical distribution: This vegetation is endemic of Lampedusa island (Bartolo et al., 1990; C. Brullo et al., 2010).

Structure and ecology: The *Mantisalco salmanticae-Oryzopsietum miliaceae* colonizes abandoned fields or ruderal areas within the inframediterranean dry bioclimatic belt. Because of the extreme edaphic dryness occurring in Lampedusa, this community is restricted to sheltered stands, as near abandoned buildings and stone-walls, where the wind action is less intense. Its physiognomy is given by *Piptatherum miliaceum*, growing with the endemic *Daucus siculus* and *Mantisalca salmantica*, a rare North African species. The syntaxa of higher rank are represented by *Foeniculum vulgare* subsp. *piperitum*, *Convolvulus althaeoides*, *Phagnalon saxatile*, *Lobularia maritima*, *Reichardia picroides*, etc. (Bartolo et al., 1990).

Syndynamism: The vegetation at issue is dynamically connected with the thermo-xerophilous maquis of *Periploco-Euphorbietum dendroidis* (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.5.10. ***Lathyro sphaerici-Oryzopsietum miliaceae*** Brullo & Siracusa 1996

Subnitrophilous vegetation with grass pea and smilo grass of shady and sheltered stands.

Holotypus: rel. 5, tab. 6, Brullo & Siracusa (1996).

Characteristic and differential species: *Lathyrus sphaericus* Retz., *Vicia benghalensis* L.

Phytosociological table: From Brullo & Siracusa (1996), table 6, 5 rel.

Char. association: *Lathyrus sphaericus* (V), *Vicia benghalensis* (V).

Char. alliance, order and class: *Piptatherum miliaceum* (V), *Phagnalon saxatile* (V), *Lathyrus articulatus* (V), *Lobularia maritima* (V), *Charybdis pancration* (V), *Hyparrhenia hirta* (IV), *Foeniculum vulgare* subsp. *piperitum* (IV).

Other species: *Daucus carota* (V), *Allium subvillosum* (V), *Asparagus acutifolius* (V), *Prasium majus* (V), *Vicia villosa* subsp. *varia* (V), *Ruta chalepensis* (V), *Castellia tuberculosa* (IV).

Geographical distribution: This vegetation is found only in Linosa island (Brullo & Siracusa, 1996).

Structure and ecology: The *Lathyro sphaerici-Oryzopsietum miliaceae* occurs only in shady and sheltered places with volcanic soils, where this community finds refuge stands in the very dry environmental conditions of Linosa. Floristically, this vegetation is dominated by *Piptatherum miliaceum* and is characterized by the occurrence of *Lathyrus sphaericus* and *Vicia benghalensis*. The higher syntaxa are represented by *Phagnalon saxatile*, *Lathyrus articulatus*, *Lobularia maritima*, *Charybdis pancration*, *Hyparrhenia hirta* and *Foeniculum vulgare* subsp. *piperitum* (Brullo & Siracusa, 1996).

Syndynamism: This vegetation is dynamically linked with the thermo-xerophilous maquis of *Periploco-Euphorbietum dendroidis* (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.5.11. ***Centauretum sonchifoliae*** Brullo & Siracusa in C. Brullo et al. 2010

Subnitrophilous vegetation with Sonchus-leaved cornflower of coastal disturbed stands.

Holotypus: rel. 1, Tab. 18, C. Brullo et al. (2010).

Characteristic and differential species: *Centaurea seridis* L. subsp. *sonchifolia* (L.) Greuter.

Phytosociological table: From C. Brullo et al. (2010), table 18, 8 rel.

Char. association: *Centaurea seridis* subsp. *sonchifolia* (V).

Char. alliance: *Piptatherum miliaceum* (V), *Dittrichia viscosa* (V).

Char. order and class: *Hyparrhenia hirta* (V), *Dactylis glomerata* subsp. *hispanica* (V), *Reichardia picroides* (V), *Thapsia garganica* (III), *Lobularia maritima* (III).

Other species: *Cynodon dactylon* (V), *Daucus carota* (V), *Reseda alba* (V), *Asparagus acutifolius* (V), *Lolium rigidum* (V), *Anisantha diandra* (V), *Smilax aspera* (V).

Geographical distribution: This vegetation was surveyed near Catania (C. Brullo et al., 2010).

Structure and ecology: The *Centauretum sonchifoliae* grows exclusively on volcanic rocky coasts near urbanized areas. It is a nitrophilous community of halomorphic soils, having its optimum within the thermomediterranean subhumid bioclimatic belt. The key species is *Centaurea seridis* subsp. *sonchifolia*, quite rare in Sicily, occurring together with some species of higher rank, among them *Piptatherum miliaceum*, *Dittrichia* viscosa, *Hyparrhenia hirta*, *Dactylis glomerata* subsp. *hispanica* and *Reichardia picroides*

Syndynamism: This community replaces the halo-nitrophilous vegetation of *Pegano-Salsoletea* when human disturbance increases (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.5.12. ***Dauco maximi-Oryzopsietum miliaceae*** O.Bolòs 1975

Subnitrophilous vegetation with wild carrot and smilo grass of dry disturbed stands.

Holotypus: rel. , tab., O.Bolòs (1975).

Characteristic and differential species: *Daucus carota* L. subsp. *maximus* (Desf.) Ball.

Phytosociological table: From C. Brullo et al. (2010), table 18, 6 rel.

Char. association: *Daucus carota* subsp. *maximus* (V).

Char. alliance: *Piptatherum miliaceum* (V), *Dittrichia viscosa* (V).

Char. order: *Convolvulus althaeoides* (I), *Ferula communis* (I), *Carlina gummifera* (I).

Char. class: *Foeniculum vulgare* subsp. *piperitum* (V), *Dactylis glomerata* subsp. *hispanica* (IV), *Lobularia maritima* (IV), *Bituminaria bituminosa* (III), *Verbascum sinuatum* (III), *Reichardia picroides* (II), *Carlina sicula* (I), *Centaurea sicula* (I).

Other species: *Cynodon dactylon* (III), *Avena barbata* (III), *Symphyotrichum squamatum* (III).

Geographical distribution: This community was described by O.Bolòs (1975) from Iberian Peninsula and later surveyed also in southern Calabria and Sicily, where it is widespread (Brullo et al., 2001; C. Brullo et al., 2010).

Structure and ecology: The disturbed stands with a remarkable edaphic aridity, as roadsides and abandoned fields, are colonized by a thermo-xerophilous vegetation dominated by *Piptatherum miliaceum* susp. *miliaceum* and *Daucus carota* subsp. *maximus*. It is the *Dauco*

maximi-Oryzopsietum miliaceae, occurring on different substrates (clays, marls, calcarenites, vulcanites, etc.), always within the thermomediterranean belt. The syntaxa of higher rank are represented by *Dittrichia viscosa*, *Foeniculum vulgare* subsp. *piperitum*, *Dactylis glomerata* subsp. *hispanica*, *Lobularia maritima*, *Bituminaria bituminosa*, *Verbascum sinuatum*, etc. (C. Brullo et al., 2010).

Syndynamism: This community represents a secondary vegetation of anthropized places, which in the absence of disturbance would tend to evolve towards the *Oleo-Ceratonion* maquis (C. Brullo et al., 2010).

Habitat reference: See alliance.

35.2.6. Alliance: ***Arundion collinae*** Brullo, Giusso, Guarino & Sciadrello in Brullo et al. 2010

Thermomediterranean sub-ruderal perennial terrestrial reed on wet clayey soils.

Holotypus: *Euphrobio ceratocarpae-Arundinetum collinae* Brullo, Giusso, Guarino & Sciandrello in Brullo et al. 2010

Characteristic and differential species: *Arundo collina* Ten.

Geographical distribution: This alliance occurs in Italy, Sicily, Greece and Crete (C. Brullo et al., 2010).

Structure and ecology: The alliance at issue groups the thermophilous and sub-hygrophilous communities dominated by *Arundo collina*, a big rhizomatous hemicryptophyte having its optimum in the clayey soils that are humid for most of the year.

Syndynamism: This vegetation is linked to very peculiar habitats, showing an intermediate position among the nitrophilous dry grasslands of *Bromo-Oryzopsion* and the xerophilous communities belonging to the *Moricandio-Lygeion sparti* of badlands.

Habitat reference: C3.31 *Saccharum ravennae* communities.

35.2.6.1. ***Euphorbio ceratocarpae-Arundinetum collinae*** Brullo, Giusso, Guarino & Sciandrello in Brullo et al. 2010

Subnitrophilous reed with hill reed and tintern spurge of wet clayey soils.

Holotypus: rel. 9, Tab. 19, C. Brullo et al. (2010).

Characteristic and differential species: *Euphorbia ceratocarpa* Ten.

Phytosociological table: From C. Brullo et al. (2010), table 19, 18 rel.

Char. association: *Euphorbia ceratocarpa* (V).

Char. alliance: *Arundo collina* (V).

Char. order and class: *Foeniculum vulgare* subsp. *piperitum* (V), *Dittrichia viscosa* (IV), *Ferula communis* (IV), *Dactylis glomerata* subsp. *hispanica* (III), *Ampelodesmos mauritanicus* (III), *Bituminaria bituminosa* (III), *Piptatherum miliaceum* subsp. *miliaceum* (II), *Pallenis spinosa* (II), *Reichardia picroides* (II), *Hypericum perfoliatum* (II), *Lathyrus articulatus* (II), *Sixalix atropurpurea* subsp. *maritima* (I), *Hypericum perforatum* (I), *Carlina hispanica* subsp. *globosa* (I), *Verbascum sinuatum* (I), *Hyoseris radiata* (I), *Clinopodium nepeta* (I), *Centaurea sicula* (I), *Gypsophila arrostii* (I), *Carlina gummifera* (I), *Convolvulus althaeoides* (I), *Kundmannia sicula* (I), *Elaeoselinum meoides* (I), *Poterium sanguisorba* (I), *Asphodelus ramosus* (I), *Thapsia garganica* (I).

Other species: *Rubus ulmifolius* (III), *Asparagus acutifolius* (III), *Acanthus mollis* (III), *Spartium junceum* (III).

Geographical distribution: This vegetation is quite frequent all over Sicily (C. Brullo et al., 2010).

Structure and ecology: The more or less steep clayey slopes and also the small hollows with deep soils, within the thermo- and mesomediterranean dry-subhumid bioclimatic belt, are colonized by a floristically poor community dominated by *Arundo collina*. It is the *Euphorbio ceratocarpae-Arundinetum collinae*, which is linked to synanthropic environments, such as abandoned fields, roadsides and quarries. From the floristic point of view, it is characterized by the occurrence of *Euphorbia ceratocarpa* and some species of higher rank, among them *Foeniculum vulgare* subsp. *piperitum*, *Dittrichia viscosa*, *Ferula communis*, *Dactylis glomerata* subsp. *hispanica*, *Ampelodesmos mauritanicus* and *Bituminaria bituminosa* (C. Brullo et al., 2010).

Syndynamism: The community at issue represents a permanent vegetation, dynamically linked with the synanthropic vegetation of *Echio-Galactition* and *Bromo-Oryzopsion* (C. Brullo et al., 2010).

Habitat reference: C3.31 *Saccharum ravennae* communities.

35.2.7. Alliance: ***Polygalo mediterraneae-Bromion erecti*** (Biondi, Allegrezza & Zuccarello 2005) Di Pietro in Di Pietro et al. 2015

Secondary grasslands with tor-grass of (sub)mountain stands.

Synonyms: *Polygalo mediterraneae-Bromenion erecti* Biondi, Allegrezza et Zuccarello 2005

Holotypus: *Centaureo bracteatae-Brometum erecti* Biondi, Ballelli, Allegrezza, Guitian & Taffetani 1986 in Biondi & al. 1986.

Characteristic and differential species: *Agrimonia eupatoria* L. subsp. *eupatoria*, *Arabis collina* Ten., *Blackstonia perfoliata* (L.) Huds., *Brachypodium rupestre* (Host.) Roem. & Schult., *Carduus nutans* L. subsp. *siculus* (Franco) Greuter, *Carex flacca* Schreb. subsp. *erythrostachys* (Hoppe) Holub, *Dianthus siculus* C. Presl, *Erysimum bonannianum* C. Presl, *Festuca circummediterranea* Patzke, *Helianthemum nummularium* (L.) Mill. subsp. *obscurum* (Ćelak) Holub, *Loncomelos narbonensis* (L.) Raf., *Stachys germanica* L. subsp. dasyanthes (Raf.) Arcang., *Trifolium incarnatum* L. subsp. *molinerii* (Balb. ex Homem.) Ces., *Trifolium ochroleucon* Huds., *Viola aethnensis* Parl. subsp. *messanensis* (W. Becker) Merxm & Lippert

Geographical distribution: This alliance is distributed from the Central Apennines to Sicily (Di Pietro et al., 2015; Gianguzzi et al., 2018).

Structure and ecology: This syntaxon gathers the meso-xerophilous grasslands dominated by *Brachypodium rupestre* of marl-arenaceous and clayey substrates in hilly and lower mountain stands (Di Pietro et al., 2015). These anthropic grazed grasslands are linked to deep soils rich in nutrients and subject to desiccation during the summer, within the thermo to supra-mediterranean bioclimatic belt. Under the syntaxonomical profile, this alliance was ascribed by Gianguzzi et al. (2018) to *Festuco-Brometea* Br.-Bl. & R. Tx. ex Br.-Bl. 1949, despite the atypical ecology and the very impoverished floristic set of these communities make this attribution controversial and deserving of further study. In fact the above mentioned class groups the zonal steppic vegetation of Eastern Europe (Mucina et al., 2016), while in the Mediterranean are it is represented mainly by relictual coenosis, whose southern boundaries were identified by Brullo et al. (2002, 2006) in the Pollino-Oromarso massif (Northern Calabria). Therefore, the *Brachypodium rupestre* grasslands of Sicily should be better classified within the *Lygeo-Stipetea* class for their occurrence in secondary stands and and also the absence or paucity of the typical species belonging to *Festuco-Brometea*.

Syndynamism: These grasslands result from the abandonement of intensively grazed and mown pastures. In the absence of human disturbance, they are quickly replaced by the shrubby vegetation belonging to *Crataego-Prunetea spinosae* (Bonanomi & Allegrezza, 2004; Bonanomi & al., 2006).

Habitat reference: E1.263 Middle European Brachypodium semidry grasslands.

35.2.7.1. ***Lolio pluriflori-Brachypodietum rupestris*** Gianguzzi, Caldarella & Di Pietro 2018

Secondary grasslands with tor-grass and Mediterranean false Brome of calcareous soils.

Holotypus: rel. 2, tab. 1, Gianguzzi et al. (2018).

Characteristic and differential species: *Anemone hortensis* L., *Lolium pluriflorum* (Schult.) Banfi, Galasso, Foggi, Kopecky & Ardenghi, *Medicago lupulina* L., *Picris hieracioides* L., *Thalictrum calabricum* Spreng.

Phytosociological table: From Gianguzzi et al. (2018), table 1, 26 rel. (subass. *typicum*).

Char. association: *Picris hieracioides* (IV), *Origanum vulgare* subsp. *viridulum* (IV), *Lolium pluriflorum* (III), *Anemone hortensis* (III), *Medicago lupulina* (III), *Thalictrum calabricum* (II).

Char. alliance: *Brachypodium rupestre* (V), *Blackstonia perfoliata* (I), *Trifolium ochroleucon* (III), *Carex flacca* Schreb. subsp. *erythrostachys* (II), *Trifolium incarnatum* subsp. *molineri* (I), *Stachys germanica* subsp. *dasyanthes* (I), *Lancomelos narbonensis* (I), *Agrimonia eupatoria* (I), *Arabis collina* (I), *Dianthus siculus* (I), *Erysimum bonannianum* (I),

Char. order and class: *Dactylis glomerata* (V), *Galium lacidum* (IV), *Hypericum perfoliatum* (III), *Asphodeline lutea* (II), *Allium sphaerocephalon* subsp. *sphaerocephalon* (I), *Poterium sanguisorba* subsp. *balearicum* (I), *Anthyllis vulneraria* subsp. *maura* (I), *Carlina sicula* (I), *Scorzonera hirsuta* (I), *Convolvulus cantabrica* (I).

Other species: *Trifolium campestre* (V), *Eryngium campestre* (IV), *Daucus carota* (IV), *Opopanax chironium* (IV), *Silene italica* subsp. *sicula* (III), *Anthoxanthum odoratum* (II), *Prangos ferulacea* (I), *Anacamptis pyramidalis* (I), *Allium roseum* (I), *Festuca sicula* (I), *Linum usitatissimus* subsp. *angustifolium* (I), *Ranunculus millefoliatus* (I), *Centaurea parlatoris* subsp. *parlatoris* (I).

From Gianguzzi et al. (2018), table 1, 4 rel. (subass. *violetosum ucrianae*).

Char. association and subassociation: *Picris hieracioides* (4), *Origanum vulgare* subsp. *viridulum* (4), *Thalictrum calabricum* (4), *Viola ucriana* (4), *Helleborus viridis* subsp. *bocconei* (4), *Clinopodium alpinum* subsp. *meridionalis* (4), *Eryngium crinitum* (4), *Allium subhirsutum* (4), *Lolium pluriflorum* (3), *Anemone hortensis* (2), *Medicago lupulina* (2).

Char. alliance: *Brachypodium rupestre* (4), *Carex flacca* Schreb. subsp. *erythrostachys* (4), *Blackstonia perfoliata* (2), *Stachys germanica* subsp. *dasyanthes* (2), *Arabis collina* (1), *Dianthus siculus* (1).

Char. order and class: *Dactylis glomerata* (4), *Asphodeline lutea* (4), *Hypericum perfoliatum* (3), *Poterium sanguisorba* subsp. *balearicum* (2).

Other species: *Opopanax chironium* (4), *Centaurea parlatoris* subsp. *parlatoris* (4), *Silene italica* subsp. *sicula* (4), *Anthoxanthum odoratum* (4), *Prangos ferulacea* (1).

Geographical distribution: This vegetation is mainly distributed in the mountains of Trapani and Palermo, as well as in the Sicani, Madonie and Nebrodi ranges. The subass. *violetosum ucrianae* is restricted to Pizzuta mountain near Palermo (Gianguzzi et al., 2018).

Structure and ecology: The long abandoned traditional cultivations, the terraced slopes with failed reforestation and also the areas that have been affected by recent fires are colonized by a close and homogenous grassland dominated by *Brachypodium rupestre*. This vegetation, named *Lolio pluriflori-Brachypodietum rupestris*, is linked to calcareous substrates, growing within the meso- and supramediterranean bioclimatic belt. Usually, it is found in the drainage

lines of steep slopes, as well as on deep and well-drained soils with a high clay content. The floristic set is differentiated by the occurrence of *Picris hieracioides*, *Origanum vulgare* subsp. *viridulum*, *Lolium pluriflorum, Anemone hortensis*, *Medicago lupulina* and *Thalictrum calabricum*. The alliance is represented by *Brachypodium rupestre*, *Blackstonia perfoliata*, *Trifolium ochroleucon*, *Carex flacca* Schreb. subsp. *erythrostachys*, *Stachys germanica* subsp. *dasyanthes*, etc. Among the species of class and order, *Dactylis glomerata*, *Galium lacidum*, *Hypericum perfoliatum*, *Asphodeline lutea* and *Allium sphaerocephalon* subsp. *sphaerocephalon* are frequent. A very peculiar aspect occurring in the humid north facing slopes was described as subass. *violetosum ucrianae*, where the rare endemic *Viola ucriana* has high values of coverage. Besides, an impoverished grassland with *Phleum hirsutum* subsp. *ambiguum* and a rich therophytic component replaces the typical community at higher altitudes (1000-1500 m a.s.l.), constituting small patches at the base of rocky cliffs.

Syndynamism: This community has a pioneer character, occupying fastly the bare surfaces. At the same time, it is quickly replaced by shrubland communities belonging to the series of mesophilous deciduous woods, except for the intensively grazed stands, where the *Lolio pluriflori-Brachypodietum* remain for longer time, since *Brachypodium rupestre* is unappetising to livestock (Gianguzzi et al., 2018).

Habitat reference: See alliance.

35.2.7.2. ***Tanaceto siculi-Brachypodietum rupestris*** Gianguzzi, Caldarella & Di Pietro 2018

Secondary grasslands with tor-grass and Sicilian tansy of siliceous soils.

Holotypus: rel. 38, Tab. 1, Gianguzzi et al. (2018).

Characteristic and differential species: *Helianthemum nummularium* (L.) Mill. subsp. *obscurum* (Čelak.) Holub, *Micromeria graeca* (L.) Benth. ex Rchb. subsp. *consentina* (Ten.) Guinea, *Tanacetum vulgare* L. subsp. *siculum* (Guss.) Raimondo & Spadaro, *Teucrium siculum* (Raf.) Guss., *Thymus longicaulis* C.Presl.

Phytosociological table: From Gianguzzi et al. (2018), table 1, 5 rel. (subass. *typicum*).

Char. association: *Tanacetum vulgare* subsp. *siculum* (V), *Teucrium siculum* (V), *Thymus longicaulis* (V), *Micromeria graeca* subsp. *consentina* (IV),

Char. alliance: *Brachypodium rupestre* (V), *Festuca circummediterranea* (IV), *Helianthemum nummularium* subsp. *obscurum* (IV), *Viola aethnensis* subsp. *messanensis* (III), *Stachys germanica* subsp. *dasyanthes* (II), *Carduus nutans* subsp. *siculus* (II),

Char. order and class: *Carlina hispanica* subsp. *globosa* (IV), *Galium lacidum* (IV), *Dactylis glomerata* (IV), *Allium sphaerocephalon* subsp. *sphaerocephalon* (III), *Asphodeline lutea* (III), *Hypericum perfoliatum* (II).

Other species: *Anthoxanthum odoratum* (V), *Trifolium campestre* (V), *Cynosurus cristatus* (III), *Daucus carota* (III), *Silene italica* subsp. *sicula* (III), *Centaurea parlatoris* subsp. *parlatoris* (II), *Allium roseum* (I).

Geographical distribution: This vegetation is distributed in the Nebrodi and Peloritani mountains (Gianguzzi et al., 2018).

Structure and ecology: In the subacidic soils rich in clay component of North-Eastern Sicily, namely metamophic and flysch substrates, the previous association is replaced by a different grassland with a lower coverage, which has been referred by Gianguzzi et al. (2018) to the new association *Tanaceto siculi-Brachypodietum rupestris*. It grows on the edges of the drainage lines, abandoned terraced crops and pastures between 800 and 1200 m. Under the floristic profile, this community is differentiated by *Tanacetum vulgare* subsp. *siculum*, *Teucrium siculum*, *Thymus longicaulis* and *Micromeria graeca* subsp. *consentina*. The higher syntaxa are represented by *Brachypodium rupestre*, *Helianthemum nummularium* subsp. *obscurum*, *Galium lacidum*, *Festuca circummediterranea*, *Carlina hispanica* subsp. *globosa*, *Allium sphaerocephalon* subsp. *sphaerocephalon*, etc.

Syndynamism: This vegetation is dynamically linked to the series of mesophilous deciduous woods belonging to *Conopodio-Quercetum congestae* Maniscalco & Raimondo 2009. In the stands with a more nitrophilous character it is replaced by the *Pteridio-Tanacetum siculi* Brullo & Marcenò 1985.

Habitat reference: See alliance.

36. Class: ***Molinio-Arrhenatheretea*** R.Tx.1937

Mesophilous and hygrophilous meadows.

Synonyms: *Molinieto-Arrhenatheretales* (Br.-Bl. 1930) R. Tx. 1937 (orig.form.) (art. 11); *Arrhenatheretea* Br.-Bl. in Br.-Bl. et al. 1947 (art. 2b); *Molinio-Juncetea acutiflori* Br.-Bl. in Br.-Bl. et al. 1947 (art. 2b); *Arrhenatheretea* Br.-Bl. 1950 (art. 2b); *Molinio-Juncetea acutiflori* Br.-Bl. 1950 (syntax.syn.); *Molinio-Juncetea acutiflori* Br.-Bl. ex A. Bolòs y Vayreda & O. de Bolòs in A. Bolòs y Vayreda 1950 (syntax.syn.)

Holotypus: *Arrhenatheretalia elatioris* R. Tx. 1932.

Characteristic and differential species: *Agrostis castellana* Boiss. & Reut., *Anthoxanthum odoratum* L., *Arrhenatherum elatius* (L.) P.Beauv. ex J.Presl & C.Presl, *Bellis perennis* L., *Bromus hordeaceus* L., *Bromus racemosus* L., *Cynosurus cristatus* L., *Dactylis glomerata* L., *Daucus carota* L., *Elymus repens* (L.) Gould, *Gaudinia fragilis* (L.) P.Beauv., *Jacobaea erratica* (Bertol.) Fourr., *Juncus articulatus* L., *Juncus fontanesii* J.Gay, *Lolium perenne* L., *Lotus corniculatus* L.,

Medicago lupulina L., *Oenanthe lachenalii* C. C. Gmel., *Oenanthe pimpinelloides* L., *Phleum pratense* L., *Plantago major* L., *Poa trivialis* L., *Prunella vulgaris* L., *Pulicaria dysenterica* (L.) Bernh., *Rumex crispus* L., *Scirpoides holoschoenus* (L.) Soják, *Trifolium fragiferum* L., *Trifolium leucanthum* M. Bieb., *Trifolium pratense* L., *Trifolium repens* L., *Trifolium resupinatum* L., *Trifolium squarrosum* L.

Geographical distribution: This class occurs in the Eurosiberian and Mediterranean territories (Brullo et al., 2001; Costa et al., 2012). Generally, in Sicily this vegetation is restricted to mountain stands and shows a certain floristic poverty (Brullo & Grillo, 1978).

Structure and ecology: The perennial herbaceous communities dominated by hemicryptophytes and geophytes are classified within the *Molinio-Arrhenatheretea* class. In particular, this vegetation is represented by mesophilous and/or hygrophilous meadows, occurring on deep and wet soils, which are only rarely submerged. In the mediterranean area it is linked to the supramediterranean bioclimatic belt, growing above 800-1000 m a.s.l., and is characterized by a marked floristic poverty. In fact, the physiognomy of these communities is given by the more thermophilous species belonging to this class, among them *Cynosurus cristatus*, *Lolium perenne*, *Poa trivialis*, *Dactylis glomerata*, *Trifolium pratense*, *Daucus carota*, *Bromus hordeaceus* and *Anthoxanthum odoratum* are very frequent (Brullo & Grillo, 1978).

Syndynamism: In the temperate areas this vegetation derives from the substitution of the riparian deciduous forests of *Salici-Populetea nigrae*, while in the Mediterranean territories it more often represents a secondary stage of anthropic origin, due to deforestation, pasture and mowing impacting on mesophilous forests (Brullo et al., 2001).

Habitat reference: E3.4a Moist or wet mesotrophic to eutrophic hay meadow; E3.2b Mediterranean short moist grassland of mountains; E1.5 Oromediterranean siliceous dry grassland.

36.1. Order: ***Holoschoenetalia*** Br.-Bl. ex Tchou 1948

Humid grass-rush meadows of the Mediterranean.

Synonyms: *Holoschoenetalia* Br.-Bl. 1931 (art. 2b); *Holoschoenetalia* Br.-Bl. in Br.-Bl. et al. 1947 (art. 2b); *Scirpoidetalia holoschoeni* Br.-Bl. ex Tchou 1948 nom. mut. propos. (art. 45); *Holoschoenetalia* Br.-Bl. ex Br.-Bl. et al. 1952 (art. 31); *Phalaridetalia coerulescentis* Galán de Mera et al. 1997 (syntax.syn.).

Holotypus: *Molinio arundinacea-Holoschoenion vulgaris* Br.-Bl. ex Tchou 1948

Characteristic and differential species: *Ajuga reptans* L., *Carex distans* L., *Cirsium creticum* (Lam.) D'Urv subsp. *triumfettii* (Lacaita) K. Werner, *Cyperus longus* L., *Eleocharis palustris* (L.) Roem. & Schult., *Galium debile* Desv., *Galium elongatum* C. Presl, *Jacobaea aquatica* (Hill) G. Gaertn., B. Mey. & Scherb., *Juncus articulatus* L., *Juncus conglomeratus* L., *Juncus effusus* L.,

Juncus inflexus L., *Lyhtrum junceum* Banks & Sol., *Mentha longifolia* (L.) L., *Oenanthe globulosa* L., *Poa trivialis* L., *Polypogon viridis* (Gouan) Breistr., *Potentilla reptans* L., *Ranunculus repens* L., *Rumex conglomeratus* Murray.

Geographical distribution: The order at issue is widely distributed in the Mediterranean area (Mucina et al., 2016).

Structure and ecology: The perennial meso-hygrophilous meadows of deep and wet soils, submerged for short periods, are classified within the *Holoschoenetalia* order. This vegetation is dominated by sedges and rushes, which are associated with many others big-size hemicryptophytes and geophytes (Brullo et al., 2001).

Syndynamism: This vegetation has an edaphic character, being linked to the duration of the submerging period.

Habitat reference: E3.2b Mediterranean short humid grassland.

36.1.1. Alliance: ***Dactylorhizo sacciferae-Juncion striati*** Brullo & Grillo 1978

Relict humid swards of high altitudes.

Holotypus: *Dactylorhizo sacciferae-Juncetum effusi* Brullo & Grillo 1978

Characteristic and differential species: *Ajuga orientalis* L., *Carex leporina* L., *Carex otrubae* Podp., *Chaerophyllum temulentum* L., *Eleocharis nebrodensis* Parl., *Epilobium parviflorum* Schreber, *Glyceria spicata* Guss., *Isolepis setacea* (L.) R. Br., *Juncus gerardii* Lois., *Juncus striatus* Schousb., *Lathyrus nissolia* L., *Ranunculus lanuginosus* L., *Ranunculus pratensis* C. Presl., *Veronica beccabunga* L.

Geographical distribution: This alliance is endemic of Sicily and Calabria (Brullo & Grillo, 1978; Brullo et al., 2001).

Structure and ecology: The *Dactylorhizo sacciferae-Juncion striati* gathers the meso-hygrophilous perennial communities of mountain stands, usually above 900 m a.s.l., which are characterized by the dominance of Juncaceae and Cyperaceae. This vegetation occurs on silty-clayey soils, which are subject to more or less long period of flooding.

Syndynamism: Usually, the community at issue represents a primary edaphic vegetation within the beech forest of *Anemono apenninae-Fagetum sylvaticae*.

Habitat reference: See order.

36.1.1.1. ***Dactylorhizo sacciferae-Juncetum effusi*** Brullo & Grillo 1978

Meso-hygrophilous meadows with sack-carrying dactylorhiza and common rush of humid clayey soils.

Holotypus: rel. 4, tab. 4, Brullo & Grillo (1978).

Characteristic and differential species: *Dactylorhiza saccifera* (Brongn.) Soò, *Juncus effusus* L., *Carex flacca* Schreb., *Montia fontana* L.

Phytosociological table: From Brullo & Grillo (1978), tab. 4, 21 rel.

Char. association: *Dactylorhiza saccifera* (V), *Juncus effusus* (V), *Carex flacca* (V), *Montia fontana* (I).

Char. alliance: *Juncus striatus* (V), *Ranunculus lanuginosus* (IV), *Epilobium parviflorum* (III), *Carex leporina* (III), *Carex otrubae* (III), *Ajuga orientalis* (II), *Ranunculus pratensis* (I), *Isolepis setacea* (I), *Lathyrus nissolia* (I), *Chaerophyllum temulum* (I).

Char. order: *Juncus inflexus* (IV), *Cirsium creticum* subsp. *triumfettii* (IV), *Mentha longifolia* (IV), *Oenanthe pimpinelloides* (III), *Holcus lanatus* (III), *Oenanthe globulosa* (III), *Lythrum junceum* (II), *Potentilla reptans* (II), *Ranunculus repens* (II), *Galium debile* (II), *Scirpoides holoschoenus* (I), *Juncus conglomeratus* (I), *Eleocharis palustris* (I), *Polypogon viridis* (I), *Carex distans* (I).

Char. class: *Cynosurus cristatus* (V), *Poa trivialis* (V), *Lolium perenne* (IV), *Trifolium repens* (IV), *Trifolium pratense* (III), *Bromus hordeaceus* (III), *Trifolium leucanthum* (III), *Lathyrus pratensis* (III), *Trifolium ochroleucon* (II), *Oenanthe lachenalii* (II), *Bellis perennis* (II), *Prunella vulgaris* (I), *Dactylis glomerata* (I), *Anthoxanthum odoratum* (I), *Trifolium resupinatum* (I), *Phleum pratense* (I), *Medicago lupulina* (I), *Trifolium fragiferum* subsp. *bonannii* (I), *Arrhenatherum elatius* (I).

Other species: *Apium nodiflorum* (V), *Mentha pulegium* (IV), *Cyperus longus* (III), *Equisetum palustre* (II), *Anacamptis laxiflora* (I),

Geographical distribution: This vegetation was originally described from Nebrodi mountains by Brullo & Grillo (1978) and after reported also for Calabria (Brullo et al., 2001).

Structure and ecology: The depressed surfaces with silty-clay soils subject to temporary floods, within the mountain belt (900-1600 m), are colonized by a hygrophilous vegetation with rushes and sedges, named *Dactylorhizo sacciferae-Juncetum effusi*. In particular, the more frequent and often dominant species are *Juncus striatus*, *J. conglomeratus*, J. *effusus*, *Carex distans*, *C. leporina*, *C. flacca* and *C. otrubae*, growing together with many geophytes, such as *Dactylorhiza saccifera, Equisetum palustre*, *Eleocharis palustris*, *Oenanthe globulosa*, *O. lachenalii* and *Ranunculus pratensis*. Besides, the hemicryptophytic component includes *Ajuga orientalis*, *Apium nodiflorum*, *Cirsium creticum* subsp. *triumfettii*, *Cynosurus cristatus*, *Epilobium parviflorum*, *Galium debile*, etc. Barbagallo et al. (1979) distinguished the typical aspect, occurring in stands with a very short flooding period, from the subass. *iridetosum pseudacori*, which is linked to places with a long submerging period, where *Iris pseudacoris*

has an high coverage. Moreover, the subass. *caricetosum pendulae* occurs in the humid and shady stands and is differentiated by *Carex pendula* and *Solanum dulcamara*.

Syndynamism: It is an edaphophilous vegetation, which is replaced by the mesophilous meadows of *Cynosuro-Leontodontetum siculi* in the drier raised places. Conversely, in the wettest stands with a longer flooding it can make contact with the hygrophilous communities of the *Phragmitetea*.

Habitat reference: See order.

36.1.1.2. ***Caricetum intricato-oederi*** Brullo & Grillo 1978

Meso-hygrophilous vegetation with black sedge and Oeder's sedge of streams and springs.

Holotypus: rel. 5, tab. 5, Brullo & Grillo (1978).

Characteristic and differential species: *Carex intricata* Tineo, *Carex oederi* Retz.

Phytosociological table: From Brullo & Grillo (1978), tab. 5, 7 rel.

Char. association: *Carex oederi* (V), *Carex intricata* (V),

Char. alliance: *Veronica beccabunga* (V), *Juncus gerardi* (III), *Ranunculus pratensis* (III), *Juncus striatus* (III), *Ranunculus lanuginosus* (III), *Epilobium parviflorum* (II), *Dactylorhiza saccifera* (II), *Isolepis setacea* (I), *Carex flacca* (I).

Char. order: *Eleocharis palustris* (III), *Carex distans* (III), *Juncus conglomeratus* (III), *Ajuga reptans* (III), *Lythrum junceum* (III).

Char. class: *Poa trivialis* (I), *Bellis perennis* (I).

Other species: *Glyceria spicata* (IV), *Carex remota* (III), *Apium nodiflorum* (II), *Poa infirma* (II).

Geographical distribution: According to Brullo & Grillo (1978), this community is restricted to Nebrodi mountain (NE Sicily), where it is quite frequent.

Structure and ecology: The banks of small streams or ponds, as well as the wet surfaces near springs, are covered by a perennial community, that is referable to *Caricetum intricato-oederi*. It is linked to mountain stands (1300-1700 m) with clear and cold waters, slight inclination, sunny exposure and clayey soils. The key species are *Carex oederi* and *Carex intricata*, growing together with some species of higher rank, as *Juncus conglomeratus*, *Eleocharis palustris*, *Ajuga reptans*, *Veronica beccabunga*, *Juncus gerardi* and *Ranunculus pratensis*. The occurrence of some species belonging to *Phragmitetea*, among them *Apium inundatum* and *Nasturtium officinale*, highlights the strong hygrophilous character of this vegetation. Brullo & Grillo (1978) identified two aspects: the subass. *caricetosum oederi* represents the typical community and is characterized by the dominance of *Carex oederi*, which prefers running waters; the subass. *caricetosum intricatae* is linked to flat surfaces with more or less calm

waters, where *Carex intricata*, *Juncus gerardi*, *Poa infirma* and *Veronica serpyllifolia* are very frequent.

Syndynamism: This vegetation has an edaphic character, covering small surfaces at the edges of mountains meadows belonging to *Cynosuro-Leontodontetum siculi*.

Habitat reference: See order.

36.2. Order: ***Cirsietalia vallis-demonis*** Brullo & Grillo 1978

Dry meso-acidophilous meadows of Sicily.

Holotypus: *Plantaginion cupanii* Brullo & Grillo 1978

Characteristic and differential species: *Ajuga tenorii* C. Presl in J. & C. Presl*, Cirsium vallis-demonis* Lojac., *Clinopodium alpinum* (L.) Merino subsp. *meridionale* (Nyman) Govaerts, *Crepis leontodontoides* All., *Hypochaeris radicata* L., *Knautia collina* Jord., *Plantago lanceolata* L., *Potentilla calabra* Ten., *Prunella laciniata* (L.) L., *Trifolium ochroleucon* Huds., *Trifolium phleoides* Willd., *Trifolium squarrosum* L., *Trifolium striatum* L., *Trifolium strictum* L., *Viola aethnensis* Parl. subsp. *messanensis* (W. Becker) Merxm & Lippert.

Geographical distribution: This order occurs only in the mountains of Sicily and probably central-southern Calabria (Brullo & Grillo, 1978; Brullo et al., 2001)

Structure and ecology: The dry mesophilous meadows of acid soils, occurring in Sicily and southern Italy, should be ascribed to *Cirsietalia vallis-demonis* order. Usually, this vegetation grows on flat surfaces with siliceous substrates, not subject to flooding, within the humid and hyperhumid supramediterranean bioclimatic belt. The syntaxonomic arrangement of this order it is quite controversial (cfr. Mucina et al., 2016; Di Pietro et al., 2017), since it is sometimes classified within the *Nardetea strictae* Rivas Goday & Borja Carbonell in Rivas Goday & Mayor Lòpez 1966. However, as evidenced by Guarino et al. (2017), the secondary mat-grass swards of low and mid-altitudes of the temperate, boreal and subarctic areas belonging to the above mentioned class are very distinct under the ecological and floristic profile from the endemite-rich meadows of the Calabrian and Sicilian mountains.

Syndynamism: This vegetation represents a secondary stage, deriving from degradation of beech forest bleonging to *Anemono apeninninae-Fagetum*. However, these meadows do not exhibit a marked anthropic influence, as they are not subject to regular cultivation practices, such as irrigation, mowing, fertilization and therefore maintain a certain heterogeneity (Brullo & Grillo, 1978).

Habitat reference: E1.5 Oromediterranean siliceous dry grassland.

36.2.1. Alliance: ***Plantaginion cupanii*** Brullo & Grillo 1978

Sicilian supramediterranean mesic seasonal perennial pastures.

Holotypus: *Cynosuro cristati-Leontodontetum siculi* Brullo & Grillo 1978

Characteristic and differential species: *Anthemis arvensis* L. subsp. *sphacelata* (C. Presl) R. Fern., *Crepis bivoniana* (Rchb.) Soldano & F. Conti, *Festuca sicula* C.Presl, *Hypochaeris cretensis* (L.) Bory & Chaub., *Plantago cupanii* Guss., *Tolpis virgata* (Desf.) Bertol. subsp. *sexaristata* (Biv.) Giardina & Raimondo, *Trifolium bivonae* Guss.

Geographical distribution: This alliance is endemic of Sicily. As regards the association of Calabria (*Barbareo-Bellidetum aspromontanae* Brullo et al. 2001), which was previously attributed by Brullo et al. (2001) to this syntaxon, it should be referred to another endemic alliance of southern Italy (*Cirsio vallis-demoni-Nardion strictae* Giacomini & Gentile ex Di Pietro & Theurillat 2015), framed within the *Nardetea scrictae* class (Di Pietro et al., 2015).

Structure and ecology: Actually, the syntaxon at issue should be considered the only alliance of *Cirsietalia vallis-demonis*, despite the placement of *Cirsio vallis-demoni-Nardion strictae* is still an open issue (see Guarino et al., 2017). Therefore, the attribution of *Plantaginion cupanii* by Mucina et al. (2016) to *Poetea bulbosae* class must be rejected, since it includes mesophilous meadows without a strong anthropogenic influence, where the occurrence and sometimes dominance of prostrate hemicryptophytes is linked not so much to trampling but rather to very peculiar edaphic and climatic conditions, as emphasized by the presence of many endemic species exclusively found in this environment.

Syndynamism: See order.

Habitat reference: See order.

36.2.1.1. ***Hypochoerido cretensis-Lotetum conimbricensis*** Brullo, Grillo & Terrasi 1976 corr.

Mesophilous meadows with Cretan cat's ear and white bird's foot trefoil of dry volcanic soil.

Holotypus: Not designated.

Characteristic and differential species: *Lotus conimbricensis* Brot., *Trifolium macropodum* Guss.

Phytosociological table: From Brullo et al. (1976), tab. 1, 35 rel.

Char. association: *Lotus conimbricensis* (V), *Trifolium macropodum* (V).

Char. alliance and order: *Hypochaeris cretensis* (V), *Hypochoeris radicata* (V), *Crepis bivoniana* (II), *Tolpis virgata* subsp. *sexaristata* (II), *Plantago lanceolata* (I).

Char. class: *Cynosurus cristatus* (V), *Oenanthe pimpinelloides* (V), *Trifolium repens* (V), *Bellis perennis* (V), *Lolium perenne* (V), *Ranunculus neapolitanus* (IV), *Dactylis glomerata* (III), *Trifolium leucanthum* (II), *Anthoxanthum odoratum* (I).

Other species: *Trifolium campestre* (V), *Trifolium cherleri* (V), *Parentucellia latifolia* (V), *Silene gallica* (IV),

Geographical distribution: This vegetation was described by Brullo et al. (1976) for the summit area of Monte Lauro (Hyblaean Mountains, SE Sicily).

Structure and ecology: The higher belt of the Hyblaean plateau above 800 m a.s.l. is characterized by quite extensive meadows, which show a rather homogeneous structure and composition because of uncontrolled grazing. This community, previously referred by Brullo et al. (1976) to *Helianthemetea guttati*, is ascribed to the *Hypochoerido cretensis-Lotetum conimbricensis,* which appears as a floristically impoverished association of *Molinio-Arrhenateretea*, due to non-optimal climatic conditions and the peculiar volcanic substrate. The key species are *Lotus conimbricensis* and the endemic *Trifolium macropodum*, growing together with few species of alliance and order, as *Hypochaeris cretensis*, *Hypochoeris radicata*, *Crepis bivoniana*, *Tolpis virgata* subsp. *sexaristata* and *Plantago lanceolata*. The class is represented by *Cynosurus cristatus*, *Oenanthe pimpinelloides*, *Trifolium repens*, *Bellis perennis*, *Lolium perenne*, *Ranunculus neapolitanus*, etc.

Syndynamism: The persistence of this vegetation is allowed mainly by grazing and the consequent nitrification of the soil. It is dynamically linked to the series of mesophilous deciduous oak woods, as those ones belonging to *Mespilo-Quercetum virgilianae* and likely *Arrhenathero-Quercetum cerridis*.

Habitat reference: See order.

36.2.1.2. ***Cynosuro cristati-Leontodontetum siculi*** Brullo & Grillo 1978

Mesophilous meadows with crested dog's-tail and Sicily hawkbits of clayey and flyshoid soils.

Synonyms: *Cynosuro cristati-Plantaginetum cupanii* Raimondo 1980 (syntax. syn.).

Holotypus: rel. 23, tab. 1, Brullo & Grillo (1978).

Characteristic and differential species: *Centaurium erythraea* Rafn., *Leontodon siculus* (Guss.) Nyman., *Polygala preslii* Spreng., *Trifolium incarnatum* L. subsp. *molinerii* (Balb. ex Hornem.) Ces.

Phytosociological table: From Brullo & Grillo (1978), tab. 1, 35 rel. (subass. *typicum*).

Char. association: *Centaurium erythraea* (IV), *Trifolium incarnatum* subsp. *molinerii* (IV), *Leontodon siculus* (II), *Polygala preslii* (II).

Char. alliance: *Anthemis arvensis* subsp. *sphacelata* (V), *Plantago cupanii* (V), *Festuca sicula* (III), *Crepis bivoniana* (III), *Tolpis virgata* subsp. *sexaristata* (III), *Trifolium bivonae* (II), *Hypochaeris cretensis* (II).

Char. order: *Trifolium striatum* (V), *Trifolium strictum* (IV), *Plantago lanceolata* (IV), *Prunella laciniata* (III), *Hypochoeris radicata* (II), *Trifolium pratense* subsp. *semipurpureum* (V), *Crepis leontodontoides* (IV), *Trifolium phleoides* (II), *Trifolium bivonae* (II), *Trifolium ochroleucon* (II), *Filago heterantha* (I), *Cirsium vallis-demonis* (I), *Clinopodium alpinum* subsp. *meridionale* (I), *Ajuga tenorii* (I).

Char. class: *Cynosurus cristatus* (V), *Dactylis glomerata* (V), *Lolium perenne* (V), *Trifolium leucanthum* (V), *Anthoxanthum odoratum* (III), *Trifolium repens* (III), *Oenanthe lachenalii* (III), *Bromus hordeaceus* (III), *Cichorium pumilum* (III), *Medicago lupulina* (III), *Trifolium squarrosum* (II), *Poa trivialis* (II), *Phleum pratense* (II), *Bellis perennis* (I), *Trifolium lappaceum* (I), *Barbarea bracteosa* (I), *Prunella vulgaris* (I), *Oenanthe pimpinelloides* (I), *Anacamptis laxiflora* (I), *Holcus lanatus* (I), *Rumex acetosa* (I), *Festuca rubra* (I), *Trifolium resupinatum* (I), *Lathyrus pratensis* (I), *Arrhenatherum elatius* (I).

Other species: *Trifolium campestre* (V), *Trifolium cherleri* (III), *Parentucellia latifolia* (III), *Aira cupaniana* (III), *Festuca danthonii* (II), *Petrorhagia dubia* (II), *Moenchia erecta* (II).

From Brullo & Grillo (1978), tab. 1, 14 rel. (subass. *helianthemetosum*).

Char. association: *Centaurium erythraea* (IV), *Trifolium incarnatum* subsp. *molinerii* (III), *Leontodon siculus* (III), *Polygala preslii* (III).

Char. subass.: *Helianthemum croceum* (IV), *Genista aristata* (III), *Lepidium hirtum* subsp. *nebrodense* (II), *Polycarpon tetraphyllum* subsp. *alsinifolium* (II).

Char. alliance: *Anthemis arvensis* subsp. *sphacelata* (V), *Plantago cupanii* (V), *Festuca sicula* (III), *Crepis bivoniana* (II), *Hypochaeris cretensis* (II), *Tolpis virgata* subsp. *sexaristata* (I), *Trifolium bivonae* (I).

Char. order: *Hypochoeris radicata* (V), *Trifolium pratense* subsp. *semipurpureum* (V), *Trifolium strictum* (IV), *Prunella laciniata* (IV), *Plantago lanceolata* (III), *Trifolium strictum* (III), *Filago heterantha* (III), *Trifolium ochroleucon* (II), *Cirsium vallis-demonis* (II), *Clinopodium alpinum* subsp. *meridionale* (II), *Ajuga tenorii* (II).

Char. class: *Cynosurus cristatus* (IV), *Lolium perenne* (IV), *Anthoxanthum odoratum* (IV), *Trifolium leucanthum* (III), *Oenanthe lachenalii* (III), *Bellis perennis* (III), *Dactylis glomerata* (II), *Cichorium pumilum* (II), *Trifolium repens* (II), *Bromus hordeaceus* (II), *Barbarea bracteosa* (II), *Medicago lupulina* (II), *Poa trivialis* (II), *Phleum pratense* (I), *Trifolium lappaceum* (I), *Prunella vulgaris* (I), *Oenanthe pimpinelloides* (I), *Anacamptis laxiflora* (I), *Holcus lanatus* (I), *Lathyrus pratensis* (I), *Arrhenatherum elatius* (I), *Rumex acetosa* (I).

Other species: *Aira cupaniana* (IV), *Trifolium campestre* (III), *Trifolium cherleri* (III), *Festuca danthonii* (III), *Crepis vesicaria* (III), *Parentucellia latifolia* (II).

Geographical distribution: This vegetation is frequent in the mountains of Northern Sicily, through Peloritani, Nebrodi and Madonie mountains (Brullo & Grillo, 1978; Brullo 1984b).

Structure and ecology: The mountain meadows of dry siliceous soils, mainly clay and numidian flysch, at an altitude of 1000-1600 m, are represented by the *Cynosuro cristati-Leontodontetum siculi*. This community is linked to sunny exposure and grazed areas, showing floristic peculiarities for the occurrence of some endemic species, as *Leontodon siculus* and *Polygala preslii*. The syntaxa of higher rank are represented by *Anthemis arvensis* subsp. *sphacelata*, *Plantago cupanii*, *Crepis bivoniana*, *Cynosurus cristatus*, *Cirsium vallis-demonis*, *Lolium perenne*, *Trifolium pratense*, *Anthoxanthum odoratum*, *Dactylis glomerata*, *Oenanthe lachenalii*, *Bromus hordeaceus*, *Trifolium leucanthum*, *Prunella laciniata*, *Bellis perennis*, etc. Brullo & Grillo (1978) distinguished two aspects: the subass. *typicum* is found until 1400-1500 m a.s.l., preferring xeric and sunny stands with friable and superficial soils, where some thermophilous annual species of *Helianthemetea guttatae* are quite frequent, among them *Aira cupaniana*, *Trifolium campestre*, *T. glomeratum*, *Moenchia erecta*, *Festuca danthonii* and *Briza maxima*; the subass. *helianthemetosum* is a more orophilous aspect, occurring usually from 1400 to 1700 m in more humid and fresh stands, as highlighted by the presence of *Helianthemum croceum*, *Genista aristata*, *Lepidium hirtum* subsp. *nebrodensis* and *Polycarpon tetraphyllum* subsp. *alsinifolium*. The *Cynosuro cristati-Plantaginetum cupanii* described by Raimondo (1980) for Madonie mountains probably represents only an impoverished aspect of the vegetation at issue, which is linked to heavily grazed stands.

Syndynamism: This community is dynamically linked with the mesophilous oak woods and in particular with the *Arrhenathero-Quercetum cerridis* (Peloritani and Nebrodi mountains) and *Ilici aquifolii-Quercetum austrothyrrenicae* (Madonie mountains) series, having a secondary character due to deforestation and grazing, but is not subject to cultivation practices as mowing, fertilization and plowing. In the upper belt of its occurrence, this association is progressively replaced by the *Genisto aristatae-Potentilletum calabrae* in the Nebrodi mountains or *Armerio nebrodensis-Plantaginetum cupanii* in the Madonie mountains, which have more orophilous requirements.

Habitat reference: See order.

36.2.1.3. ***Genisto aristatae-Potentilletum calabrae*** Brullo & Grillo 1978

Mountain meadows with Nebrodi broom and southern cinquefoils of Nebrodi cacuminal stands.

Holotypus: rel. 10, tab. 3, Brullo & Grillo (1978).

Characteristic and differential species: *Genista aristata* C. Presl, *Herniaria glabra* L. subsp. *nebrodensis* Nyman, *Leontodon cichoraceus* (Ten.) Sanguin., *Lepidium hirtum* (L.) Sm. subsp. *nebrodense* (Raf.) Thell., *Petrorhagia illyrica* (L.) P.W. Ball & Heywood, *Polycarpon tetraphyllum* (L.) L. subsp. *alsinifolium* (Biv.) Ball, *Scleranthus annuus* L.

Phytosociological table: From Brullo & Grillo (1978), tab. 3, 13 rel. (subass. *typicum*)

Char. association: *Scleranthus annuus* (V), *Petrorhagia illyrica* (V), *Lepidium hirtum* subsp. *nebrodense* (V), *Genista aristata* (III), *Herniaria glabra* subsp. *nebrodensis* (III), *Leontodon cichoraceus* (III), *Polycarpon tetraphyllum* subsp. *alsinifolium* (II).

Char. alliance: *Anthemis arvensis* subsp. *sphacelata* (IV), *Hypochaeris cretensis* (III), *Festuca sicula* (I).

Char. order: *Potentilla calabra* (V), *Plantago lanceolata* (V), *Clinopodium alpinum* subsp. *meridionale* (V), *Trifolium pratense* subsp. *semipurpureum* (IV), *Cirsium vallis-demonis* (II), *Filago heterantha* (II), *Bellis perennis* (II), *Ajuga tenorii* (II), *Trifolium ochroleucon* (I).

Char. class: *Lolium perenne* (V), *Festuca circummediterranea* (IV), *Trifolium repens* (IV), *Bromus hordeaceus* (III), *Cynosurus cristatus* (I), *Anthoxanthum odoratum* (I), *Trifolium lappaceum* (I), *Phleum pratense* (I), *Festuca rubra* (I), *Silene italica* (I).

Other species: *Poa bulbosa* (V), *Helianthemum croceum* (V), *Helianthemum cinereum* subsp. *rotundifolium* (III), *Galium verum* (III).

From Brullo & Grillo (1978), tab. 3, 19 rel. (subass. *airetosum*).

Char. association: *Scleranthus annuus* (IV), *Polycarpon tetraphyllum* subsp. *alsinifolium* (IV), *Genista aristata* (IV), *Leontodon cichoraceus* (III), *Petrorhagia illyrica* (III), *Lepidium hirtum* subsp. *nebrodense* (III).

Char. subass.: *Aira cupaniana* (V), *Carex flacca* subsp. *serrulata* (IV), *Trifolium striatum* (IV), *Crepis leontodontoides* (III), *Trifolium campestre* (II), *Trifolium arvense* (II), *Silene gallica* (II), *Moenchia erecta* (II), *Petrorhagia dubia* (II), *Polygala preslii* (I).

Char. alliance: *Anthemis arvensis* subsp. *sphacelata* (V), *Plantago cupanii* (V), *Festuca sicula* (IV), *Hypochaeris cretensis* (III).

Char. order: *Plantago lanceolata* (V), *Clinopodium alpinum* subsp. *meridionale* (IV), *Cirsium vallis-demonis* (IV), *Filago heterantha* (IV), *Trifolium strictum* (IV), *Trifolium pratense* subsp. *semipurpureum* (III), *Bellis perennis* (III), *Hypochoeris radicata* (II), *Trifolium ochroleucon* (II), *Prunella laciniata* (II), *Ajuga tenorii* (I).

Char. class: *Lolium perenne* (V), *Anthoxanthum odoratum* (V), *Cynosurus cristatus* (IV), *Festuca circummediterranea* (IV), *Bromus hordeaceus* (III), *Trifolium repens* (II), *Dactylis glomerata* (II), *Silene italica* (I), *Festuca rubra* (I), *Oenanthe lachenalii* (I), *Phleum pratense* (I), *Rumex acetosa* (I), *Oenanthe globulosa* (I), *Prunella vulgaris* (I), *Barbarea bracteosa* (I), *Trifolium fragiferum* (I).

Other species: *Cerastium semidecandrum* (V), *Poa bulbosa* (IV), *Helianthemum croceum* (IV), *Helianthemum cinereum* subsp. *rotundifolium* (III).

Geographical distribution: This vegetation is restricted to the higher belt of Nebrodi mountains (Brullo & Grillo, 1978).

Structure and ecology: The open stands above 1400 m with flyschoid substrata are colonized by a low vegetation constituted by prostrate or caespitose hemicryptophytes, which is ascribed to *Genisto aristatae-Potentilletum calabrae* (Brullo & Grillo, 1978). Its physiognomy is given by *Potentilla calabra*, *Petrorhagia illyrica*, *Genista aristata*, *Polycarpon tetraphyllum* subsp. *alsinifolium*, *Clinopodium alpinum* subsp. *meridionale* and *Anthemis arvensis* subsp. *sphacelata*. The typical aspect is linked to cacuminal places at 1600-1800 m with a long

snowing period and subject to strong winds, which determine very eroded soils and a sparse coverage, while in less extreme conditions at 1400-1600 m a more thermophilous aspect named subass. *airetosum* is characterized by a greater coverage and the occurrence of many annual thermophilous species of *Helianthemetea guttatae*.

Syndynamism: Generally, this vegetation represents an edaphic climax, occurring in the unsuitab. surfaces for the setting of beech forest, but sometimes it is found also in the clearings and at the edges of *Anemono apenninae-Fagetum sylvaticae*.

Habitat reference: See order.

36.2.1.4. ***Armerio nebrodensis-Plantaginetum cupanii*** Brullo & Marcenò in Brullo 1984

Mountain meadows with Nebrodi thrift and Cupani's plantain of Madonie cacuminal stands with siliceous soils.

Holotypus: rel. 5, tab. 20, Brullo (1984a).

Characteristic and differential species: *Armeria nebrodensis* Guss., *Leontodon tuberosus* L., *Ornithogalum montanum* Cirillo, *Petrorhagia saxifraga* (L.) Link subsp. *gasparrinii* (Guss.) Greuter & Burdet, *Scleranthus annus* L. subsp. *annus*.

Phytosociological table: From Brullo (1984a), tab. 20, 18 rel.

Char. association: *Leontodon tuberosus* (V), *Petrorhagia saxifraga* subsp. *gasparrinii* (V), *Armeria nebrodensis* (IV), *Scleranthus annus* subsp. *annus* (IV), *Ornithogalum montanum* (III).

Char. alliance: *Plantago cupanii* (V), *Festuca sicula* (V), *Anthemis arvensis* subsp. *sphacelata* (V), *Trifolium bivonae* (II), *Crepis bivoniana* (II), *Hypochaeris cretensis* (II), *Tolpis virgata* subsp. *sexaristata* (II).

Char. order: *Bellis perennis* (IV), *Potentilla calabra* (IV), *Trifolium pratense* subsp. *semipurpureum* (II), *Hypochoeris radicata* (II).

Char. class: *Lolium perenne* (IV), *Cynosurus cristatus* (IV), *Anthoxanthum odoratum* (IV), *Dactylis glomerata* (II), *Trifolium repens* (II), *Bromus hordeaceus* (II), *Prunella vulgaris* (I).

Other species: *Cerastium semidecandrum* (V), *Romulea columnae* (IV), *Trifolium campestre* (IV), *Festuca circummediterranea* (IV), *Trifolium striatum* (IV).

Geographical distribution: This community is endemic of Madonie mountains (Brullo 1984a).

Structure and ecology: In the summital area of Madonie mountains, the *Genisto aristatae-Potentilletum calabrae* is replaced by a vicariant community, which is named *Armerio nebrodensis-Plantaginetum cupanii*. This vegetation prefers the humid and flat surfaces at an altitude of 1500-1900 m, that are characterized by flyschoid soils. From a structural point of view, these two associations are very similar, since both are characterized by the dominance

of low prostrate herbaceous species, but the community at issue is floristically well differentiated for a peculiar set including *Leontodon tuberosus*, *Petrorhagia saxifraga* subsp. *gasparrinii*, *Armeria nebrodensis*, *Scleranthus annus* subsp. *annus* and *Ornithogalum montanum*.

Syndynamism: This vegetation has its primary stands within the belt of *Anemono apeninninae-Fagetum*, occupying the small areas whose edaphic features are not suitab. for the development of forest. However, it often tends to expand in areas subject to wood degradation, covering quite large surfaces. From the catenal point of view, this community can take contact with the primary orophilous vegetation of *Plantagini-Armerietum nebrodensis* in the exposed and windy places, as well as with the *Cynosuro cristati-Leontodontetum siculi* at lower altitudes.

Habitat reference: See order.

36.2.1.5. ***Micromerio canescentis-Trifolietum savianii*** Brullo, Guarino & Minissale 2000

Vegetation with hairy micromeria and one-flower clover of metamorphic mountain ridges.

Holotypus: rel. 6, tab. 1, Brullo et al. (2000).

Characteristic and differential species: *Micromeria graeca* (L.) Benth. subsp. *micrantha* (Brot.) Rivas Martinez, T. E. Díaz & Fern. Gonz., *Trifolium savianum* Guss.

Phytosociological table: From Brullo et al. (2000), tab. 1, 12 rel.

Char. association: *Trifolium savianum* (V), *Micromeria graeca* subsp. *micrantha* (V).

Char. alliance: *Anthemis arvensis* subsp. *sphacelata* (V), *Tolpis virgata* subsp. *sexaristata* (V), *Plantago cupanii* (IV), *Hypochaeris cretensis* (III),*Trifolium bivonae* (II).

Char. order: *Plantago lanceolata* (V), *Trifolium pratense* subsp. *semipurpureum* (III).

Char. class: *Lolium perenne* (V), *Dactylis glomerata* (V), *Cynosurus cristatus* (IV), *Rumex acetosella* (III), *Prunella laciniata* (III).

Other species: *Thymus spinulosus* (V), *Petrorhagia saxifraga* subsp. *gasparrinii* (V), *Centaurea parlatoris* (V), *Poa bulbosa* (V), *Helianthemum nummularium* subsp. *obscurum* (V).

Geographical distribution: This community is restricted to the Peloritani mountains and in particular in the Mandanici area (Brullo et al., 2000).

Structure and ecology: The *Micromerio canescentis-Trifolietum savianii* is a very peculiar and rare vegetation, which is linked to sunny and windy ridges with schistous rocks, usually at an altitude of 900-1200 m a.s.l., within the supramediterranean bioclimatic belt (Brullo et al., 2000). Under the structural and floristic profile, it is a low vegetation 15-20 cm high, which is characterized by the narrow endemic *Trifolium savianum*, growing together with *Micromeria graeca* subsp. *micrantha* and some species of higher rank, as *Anthemis arvensis* subsp.

sphacelata, *Tolpis virgata* subsp. *sexaristata*, *Plantago cupanii*, *Plantago lanceolata*, *Lolium perenne*, *Dactylis glomerata*, *Cynosurus cristatus*, etc.

Syndynamism: This pioneer community represents a very local edaphic climax, being exclusively linked to outcrops of phyllades and phylladic quartzites of stratigraphic unit of Mandanici. These rocks tend to break up easily, originating an incoherent soil with a rich phylladic component, which is unable to further evolution due to the remarkable steepness of slopes (Brullo et al., 2000).

Habitat reference: See order.

36.3. Order: ***Potentillo-Polygonetalia avicularis*** R. Tx. 1947

Temporarily flooded and grazed nutrient-rich meadows and pastures.

Synonyms: *Potentilletalia Anserinae* Oberd. 1949 (orig.form) (art. 2b); *Plantaginetalia majoris* R. Tx. (1947) 1950 (art. 2b); *Festucetalia arundinaceae* Doing 1963 (art. 2b)*; Agrostietalia stoloniferae* Oberd. in Oberd. et al. 1967 (art. 2b); *Agrostietalia stoloniferae* T. Müller & Görs in Görs 1968 (syntax.syn.); *Agrostietalia stoloniferae T.* Müller & Görs 1969 (phantom); *Trifolio fragiferae-Agrostietalia stoloniferae* (Oberd. in Oberd. et al. 1967) R. Tx. 1970 (art. 2b); *Galio palustris-Poetalia palustris* V. Solomakha 1996.

Holotypus: *Potentillion anserinae* R. Tx. 1947.

Characteristic and differential species: *Agrostis stolonifera* L., *Mentha pulegium* L., *Polygonum aviculare* L., *Potentilla reptans* L., *Pulicaria dysenterica* (L.) Bernh., *Ranunculus muricatus* L., *Rumex crispus* L.

Geographical distribution: This order is widely distributed in the Eurosiberian and Mediterranean territories (Brullo et al., 2001; Mucina et al., 2016).

Structure and ecology: The *Potentillo-Polygonetalia avicularis* includes the meso-hygrophilous meadows, which are linked to very humid deep soils with silty-clayey texture and a fair amount of organic matter. Usually, this vegetation is found near streams or wet depressions, as well as in humid uncultivated lands. Its structure is given by some rosulate and reptant hemicryptophytes with sub-nitrophilous requirements (Brullo & Marcenò, 1983a).

Syndynamism: This vegetation occurs in secondary stands, which are subject to trampling and grazing, often within the belt of *Querco-Fagetea*.

Habitat reference: E3.2b Mediterranean short moist grassland of mountains

36.3.1. Alliance: ***Potentillion anserinae*** R. Tx. 1947

Subnitrophilous meadows of trampled wet soils.

Synonyms: *Lolio-Potentillion anserinae* R. Tx. 1947; Potentillion anserinae von Rochow 1948 (art. 31); *Agrostion stoloniferae* Görs 1966 (art. 31); *Eu-Agropyro-Rumicion* Westhoff et Den Held 1969 (art. 2b, 34b); *Juncion effusi* Van Leeuwen & Westhoff in Doing 1963 (art. 2b); *Blysmo-Juncion compressi* Knapp 1971 (orig. form) (corresp.; as suballiance); *Poion palustris* Shelyag-Sosonko et al. 1985 (art. 1); *Poion palustris* Shelyag-Sosonko et al. 1986; *Ranunculo sardoi-Plantaginion intermediae* Julve 1993 (art. 5); *Festucion arundinaceae* Duvigneaud in Géhu 1999 (art. 2b, 5); *Lolio-Plantaginion majoris* Sissingh 1969.

Holotypus: *Ranunculo repentis-Alopecuretum geniculati* R. Tx. 1937

Characteristic and differential species: See order.

Geographical distribution: This alliance has its greatest diversification in Middle Europe, but occurs also in the Mediterranean area (Costa et al., 2012; Mucina et al., 2016).

Structure and ecology: The meso-hygrophilous meadows of temporarily flooded eutrophic soils, which are subject to grazing and trampling, are framed within the *Potentillion anserinae* alliance (Biondi et al., 2014).

Syndynamism: See order.

Habitat reference: See order.

36.3.1.1. ***Lolio perennis-Plantaginetum majoris*** (Link.) Beger emend. Sissingh 1969

Subnitrophilous vegetation with perennial ryegrass and broadleaf plantain of humid and shady places.

Synonyms: *Lolietum perennis* Gams 1927 (nom. ambig.); *Lolietum perennis* Felföldy 1942 (nom. ambig.); *Lolio perennis-Plantaginetum majoris* Beger 1930 (nom. ambig. p.p.).

Lectotypus: rel. 3, pG. 512, Beger (1932), designated by F. Jansen & Dengler.

Characteristic and differential species: *Lepidium didymum* L., *Lolium perenne* L., *Plantago major* L.

Phytosociological table: From Brullo & Marcenò (1983a), tab. 60, 2 rel.
Char. association: *Plantago major* (2), *Lolium perenne* (2), *Lepidium didymum* (1).

Char. alliance, order and class: *Polygonum aviculare* (2), *Plantago lanceolata* (1).

Other species: *Poa annua* (2), *Parietaria judaica* (2), *Spergularia rubra* (2), *Rumex conglomeratus* (1), *Cynodon dactylon* (1), *Sonchus oleraceus* (1), *Capsella rubella* (1).

Geographical distribution: This vegetation is widely distributed in the Euro-Mediterranean area, while it is quite scattered in Sicily (Brullo, 1983a).

Structure and ecology: The shady and humid stands of urban centers, which are subject to frequent mowing and slight or moderate trampling (e.g. gateways and footpaths), are colonized by a low vegetation dominated by *Plantago major* and *Lolium perennis* (Lancioni & Taffetani, 2012; Rodwell, 1992). It is the *Lolio perennis - Plantaginetum majoris*, which is quite rare today in Sicily, due to the replacement of the old pavements and walkways with concrete sidewalk (Brullo et al., 1983a).

Syndynamism: See order.

Habitat reference: See order.

36.3.2. Alliance: ***Mentho longifoliae-Juncion inflexi*** T. Müller & Görs ex de Foucault 2009

Tall-herb vegetation of temporarily flooded fringes in riparian and alluvial habitats.

Synonyms: *Mentho longifoliae-Juncion inflexi* T. Müller & Görs 1969 (art. 2b); *Juncion inflexi* Knapp 1971 (orig. form) (art. 2b); *Juncion inflexi* (Knapp 1971)Mucina 1991 (art. 2b); *Mentho aquaticae-Juncion inflexi* Julve 1993 (art. 2b); *Mentho suaveolentis-Juncion longicornis* Julve 1993 (art. 3b); *Scorpidio holoschoeni-Juncion inflexi* de Foucault in de Foucault & Catteau 2012 (syntax. syn.).

Holotypus: *Mentho longifoliae-Juncetum inflexi* Lohmeyer ex Oberd. 1957.

Characteristic and differential species: *Agropyron repens* L., *Agrostis castellana* Boiss. & Reut., *Juncus inflexus* L., *Mentha longifolia* (L.)L., *Mentha suaveolens* Ehrh., *Ranunculus pratensis* C. Presl, *Ranunculus sardous* Crantz subsp. *xatardii* (Lapeyr.) Rouy & Foucaud, *Teucrium siculum* (Raf.) Guss., *Trifolium fragiferum* L.

Geographical distribution: This alliance is widely distributed in the temperate and mediterranean areas of Europe (Biondi et al., 2014; Mucina et al., 2016).

Structure and ecology: The *Mentho longifoliae-Juncion inflexi* gathers the subnitrophilous herbaceous communities of wet soils with a short flooding period, which are located near streams and rivers, as well as at the bottom of deep valleys (Brullo & Marcenò, 1983a). Generally, the structure of this vegetation is given by tall hemicryptophytes, as *Agropyron repens*, *Agrostis castellana*, *Juncus inflexus*, *Mentha longifolia*, *M. suaveolens*, *Ranunculus*

pratensis, etc. According to Mucina et al. (2016), this alliance should be classified within the *Filipendulo ulmarie-Lotetalia uliginosi* Passarge 1975, despite this order is not clearly distinct under the ecological and floristic point of view from the *Potentillo-Polygonetalia avicularis*.

Syndynamism: See order.

Habitat reference: See order.

36.3.2.1. ***Junco inflexi-Menthetum longifoliae*** Lohm. 1953 ex Oberd. 1957

Hygrophilous vegetation of humid and sunny stands.

Synonyms: *Junco inflexi-Menthetum longifoliae* Lohmeyer 1953 prov. (art. 3b).

Holotypus: single relief, pg. 73, Lohmeyer (1953).

Characteristic and differential species: *Juncus inflexus* L., *Mentha longifolia* (L.) L.

Phytosociological table: From Brullo & Marcenò (1983a), tab. 63, 4 rel.

Char. association and alliance: *Juncus inflexus* (4), *Mentha longifolia* (4), *Ranunculus sardous* (2).

Char. order: *Plantago major* (4), *Polygonum aviculare* (4), *Mentha pulegium* (4), *Rumex crispus* (3), *Potentilla reptans* (3), *Pulicaria dysenterica* (3), *Agrostis stolonifera* (3).

Char. class: *Bellis perennis* (4), *Lolium perenne* (3), *Trifolium repens* (3), *Prunella vulgaris* (2), *Plantago lanceolata* (2).

Other species: *Lythrum junceum* (4), *Poa annua* (4), *Carex flacca* (3), *Centaurium tenuiflorum* (3), *Equisetum ramosissimum* (3), *Hypericum perforatum* (3), *Helminthotheca echioides* (3).

Geographical distribution: This association is quite frequent in Western and Central Europe (Hajková P. & Hájek in Chytrý et al., 2017; Loidi, 2017), while is restricted to the Hyblaean area in Sicily (Brullo & Marcenò, 1983a).

Structure and ecology: The sunny clearings of *Platanus orientalis* riparian forest (*Platano-Salicetum pedicellatae* Barbagallo et al. 1979) are colonized by a tall herbaceous vegetation, named *Junco inflexi-Menthetum longifoliae*. This community is linked to silty and nitrified soils, as near river loops. The floristic set includes *Juncus inflexus* and *Mentha longifolia*, which are the differential species, occurring together with some species of order, among them *Plantago major*, *Polygonum aviculare*, *Mentha pulegium*, *Rumex crispus*, *Potentilla reptans*, *Pulicaria dysenterica* and *Agrostis stolonifera* (Brullo & Marcenò, 1983a).

Syndynamism: See order.

Habitat reference: See order.

36.3.2.2. ***Eleocharido nebrodensis-Juncetum compressi*** Raimondo 1980

Hygrophilous vegetation with Nebrodi spikerushes and round fruited rush of mountains stands with wet soils.

Holotypus: rel. 2, tab. 3, Raimondo (1980).

Characteristic and differential species: *Juncus compressus* Jacq., *Barbarea bracteosa* Guss., *Eleocharis nebrodensis* Parl.

Phytosociological table: From Raimondo (1980), tab. 3, 3 rel.

Char. association: *Juncus compressus* (3), *Barbarea bracteosa* (3), *Eleocharis nebrodensis* (3).

Char. alliance and order: *Agrostis stolonifera* (3), *Potentilla reptans* (3), *Mentha pulegium* (3), *Ranunculus sardous* (2), *Juncus inflexus* (2), *Polygonum aviculare* (2), *Plantago major* (2), *Pulicaria dysenterica* (1), *Mentha longifolia* (1).

Char. class: *Carex leporina* (3), *Trifolium repens* (3), *Anthoxanthum odoratum* (3), *Cynosurus cristatus* (3), *Plantago cupanii* (3), *Leontodon tuberosus* (3), *Lolium perenne* (3), *Carex flacca* (3), *Trifolium fragiferum* (2), *Prunella vulgaris* (2), *Oenanthe globulosa* (2), *Poa trivialis* (1), *Carex distans* (1), *Festuca sicula* (1).

Other species: *Cerastium semidecandrum* (3), *Narcissus tazetta* (2), *Juncus bufonius* (2), *Peplis portula* (2), *Lepidium hirtum* subsp. *nebrodense* (2).

Geographical distribution: This association was described by Raimondo (1980) from Piano Battaglia (Madonie massif).

Structure and ecology: The *Eleocharido nebrodensis-Juncetum compressi* is a very rare vegetation occurring in wet flat surfaces with clayey substrata, above 1400 m and near springs and watershed, where it covers narrow areas. The physiognomy of this meadow is given by *Juncus compressus*, growing together with some mosses and various species of higher rank, as *Carex leporina*, *Agrostis stolonifera*, *Potentilla reptans*, *Mentha pulegium*, *Ranunculus sardous*, *Trifolium repens*, etc. Worthy of note it is the occurrence of the endemic *Eleocharis nebrodensis*, which gives a floristic peculiarity to this community. In addition to the typical aspect, Raimondo (1980) identified the subass. *barbuletosum*, which is differentiated by the occurrence of some calciphilous bryophytes, as *Barbula cylindrica* (Taylor) Schimp. ex Boulay, *Bryum pseudotriquetrum* (Hedw.) Gaertn. and *Cratoneuron filicinum* (Hedw.) Spruce.

Syndynamism: It is an edaphic vegetation, closely linked to the channels that convey water to the sinkhole. This vegetation has its optimum during the spring, being subject to desiccation and grazing in the summer period, that prevent any further evolution. However, without these disturbing factors this community could potentially be replaced by the mesophilous pastures of *Cynosuro cristati-Leontodontetum siculi*, whose establishment could be favored also by the drying up of soil due to natural burial processes (Raimondo, 1980).

Habitat reference: See order.

36.3.2.3. ***Teucrio siculi-Cirsietum italici*** Brullo & Marcenò 1983

Sub-nitrophilous vegetation with woodland germander and Italian thistle of surfaces periodically flooding near the mouth of the rivers**.**

Holotypus: rel. 1, tab. 61, Brullo & Marcenò (1983a).

Characteristic and differential species: *Cirsium italicum* (Savi) DC.

Phytosociological table: From Brullo & Marcenò (1983a), tab. 61, rel. 5.

Char. association: *Cirsium italicum* (V).

Char. all. and order: *Teucrium siculum* (V), *Mentha suaveolens* (V), *Pulicaria dysenterica* (V), *Elymus repens* (III), *Potentilla reptans* (III), *Polygonum aviculare* (III), *Plantago major* (II), *Agrostis stolonifera* (II).

Char. class: *Lolium perenne* (II), *Trifolium repens* (II).

Other species: *Samolus valerandi* (V), *Scirpoides holoschoenus* (V), *Dittrichia viscosa* (V), *Phragmites australis* (V), *Symphyotrichum squamatum* (V), *Dittrichia graveolens* (IV), *Daucus carota* (IV).

Geographical distribution: This vegetation occurs mainly in the southern coast of Sicily, being more frequent in the eastern side (Brullo & Marcenò, 1983a).

Structure and ecology: The external surfaces of rivers mouth, which are subject to periodic flooding during autumn and winter, are colonized by a very peculiar vegetation with subnitrophilous requirements, dominated by *Cirsium italicum*, which is a very rare species in the coastal areas. It is the *Teucrio siculi-Cirsietum italici*, which sometimes is found also in the bottom of the artificial channels. This vegetation has its optimum during the end of spring and summer, when *Cirsium italicum* is in bloom, as well as *Teucrium siculum*, a stoloniferous species that tends to cover large surfaces. Among the few species of alliance and order, *Mentha suaveolens*, *Pulicaria dysenterica*, *Elymus repens*, *Potentilla reptans* and *Polygonum aviculare* are frequent (Brullo & Marcenò, 1983a).

Syndynamism: See order.

Habitat reference: See order.

36.3.2.4. ***Teucrio siculi-Lotetum tenuis*** Brullo & Marcenò 1983

Sub-nitrophilous vegetation with woodland germander and narrow leaved bird's foot trefoil of disturbed wet surfaces near streams.

Holotypus: rel. 1, tab. 62, Brullo & Marcenò (1983a).

Characteristic and differential species: *Lotus tenuis* Waldst. & Kit. ex Willd.

Phytosociological table: From Brullo & Marcenò (1983a), tab. 62, 3 rel.

Char. association: *Lotus tenuis* (3).

Char. all.: *Teucrium siculum* (3), *Mentha suaveolens* (3), *Mentha pulegium* (3), *Mentha longifolia* (2), *Juncus inflexus* (1).

Char. order: *Agrostis stolonifera* (3), *Potentilla reptans* (3), *Pulicaria dysenterica* (3), *Plantago major* (2), *Polygonum aviculare* (2), *Rumex crispus* (1).

Char. class: *Oenanthe pimpinelloides* (3), *Bellis perennis* (3), *Trifolium pratense* (3), *Lolium perenne* (2), *Trifolium repens* (1), *Plantago lanceolata* (1).

Other species: *Juncus articulatus* (3), *Cirsium creticum* (3), *Paspalum paspaloides* (2), *Rumex conglomeratus* (2), *Rubus ulmifolius* (2).

Geographical distribution: The association at issue was described by Brullo & Marcenò (1983a) for the bottom of Hyblaean valleys known as "cave".

Structure and ecology: The disturbed wet surfaces near streams and rivers, as footpaths and other nitrified stands, are colonized by a subnitrophilous community named *Teucrio siculi-Lotetum tenuis*. This vegetation is characterized by the occurrence of *Lotus tenuis*, which represents the key species, and some species of alliance, as *Teucrium siculum*, *Mentha suaveolens*, *M. pulegium*, *M. longifolia* and *Juncus inflexus*. The order and the class are represented by *Agrostis stolonifera*, *Potentilla reptans*, *Pulicaria dysenterica*, *Oenanthe pimpinelloides*, *Bellis perennis*, *Lolium perenne*, etc.

Syndynamism: From the catenal point of view, this community takes contact with the shrubby vegetation of *Rhamno-Prunetea spinosae* near walls and in the less humid stands, while in the wettest places it can have contact with the hygrophilous vegetation of *Glycerio-Sparganion* (Brullo & Marcenò, 1983a).

Habitat reference: See order.

36.3.2.5. ***Carici otrubae-Juncetum inflexi*** Minissale & Spampinato 1987

Sub-hygrophilous vegetation with false fox-sedge and blue rush of periodically flooded surfaces.

Holotypus: rel. 3, tab. 5, Minissale & Spampinato (1987).

Characteristic and differential species: *Carex otrubae* Podp., *Jacobaea erratica* (Bertol.) Fourr.

Phytosociological table: From Minissale & Spampinato (1987), tab. 5, 5 rel.

Char. association: *Carex otrubae* (V).

Char. all. and order: *Juncus inflexus* (V), *Plantago major* (V), *Agrostis stolonifera* (V), *Mentha pulegium* (V), *Ranunculus pratensis* (V), *Pulicaria dysenterica* (V), *Potentilla reptans* (III), *Agropyron repens* (II), *Rumex crispus* (II).

Char. class: *Trifolium fragiferum* (V), *Jacobaea erratica* (V),*Trifolium resupinatum* (V), *Trifolium repens* (V), *Poa trivialis* (V), *Juncus articulatus* (IV), *Juncus fontanesii* (III), *Trifolium squarrosum* (II), *Bromus racemosus* (II),

Other species: *Rumex sanguineus* (V), *Bolboschoenus maritimus* (V), *Convolvulus arvensis* (IV), *Galium debile* (IV), *Lolium arundinaceum* (III).

Geographical distribution: This community occurs only in Gurrida lake (Minissale & Spampinato, 1987).

Structure and ecology: The *Carici otrubae-Juncetum inflexi* occupies the raised stations around the Gurrida lake with a short flooding period during the winter, enduring the complete desiccation in summer. Moreover, this vegetation shows slightly nitrophilous reuquirements, being linked to grazed surfaces (Minissale & Spampinato, 1987). Its physiognomy is given by *Carex otrubae* and *Juncus inflexus*, growing together with others nitro-hygrophilous species, among them *Jacobaea erratica*, *Plantago major*, *Agrostis stolonifera*, *Mentha pulegium*, *Ranunculus pratensis*, *Pulicaria dysenterica*, etc.

Syndynamism: This vegetation is replaced by the *Eleocharido-Alismetum lanceolati* in the more humid surfaces near the lake, which have a longer flooding period.

Habitat reference: See order.

36.3.2.6. ***Epilobio hirsuti-Agropyretum repentis*** Minissale & Spampinato 1987

Sub- hygrophilous vegetation with hairy willowherb and quack grass of slightly wet surfaces.

Holotypus: rel. 1, tab. 6, Minissale & Spampinato (1987).

Characteristic and differential species: *Epilobium hirsutum* L., *Epilobium tetragonum* L. subsp. *tournefortii* (Michalet) H. Lév.

Phytosociological table: From Minissale & Spampinato (1987), tab. 6, 3 rel.

Char. association: *Epilobium tetragonum* subsp. *tournefortii* (3), *Epilobium hirsutum* (2).

Char. all. and order: *Agropyron repens* (3), *Juncus inflexus* (3), *Plantago major* (3), *Agrostis stolonifera* (3), *Juncus inflexus* (3), *Pulicaria dysenterica* (3), *Mentha pulegium* (3), *Ranunculus pratensis* (3), *Potentilla reptans* (2), *Rumex crispus* (2).

Char. class: *Trifolium fragiferum* (3), *Trifolium resupinatum* (3), *Trifolium repens* (3), *Poa trivialis* (3), *Jacobaea erratica* (3), *Bromus racemosus* (2), *Juncus articulatus* (2), *Juncus fontanesii* (2), *Oenanthe globulosa* (1), *Lolium perenne* (1), *Scirpoides holoschoenus* (1),

Other species: *Verbena officinalis* (3), *Rumex sanguineus* (3), *Carex otrubae* (3), *Lythrum junceum* (3), *Helminthotheca echioides* (3).

Geographical distribution: This community was described by Minissale & Spampinato, (1987) for in Gurrida lake.

Structure and ecology: In the more xeric stands, moving away from the shores of lake, the previous association is replaced by a different community, named *Epilobio hirsuti-Agropyretum repentis*, which has only slightly hygrophilous requirements. In this community *Agropyron repens* becomes the dominant species, replacing *Juncus inflexus* and the other more hygrophilous species, while *Epilobium hirsutum*, *Epilobium tetragonum* subsp. *tournefortii Pulicaria dysenterica*, *Poa trivialis*, *Agrostis stolonifera* and other quite xeric species have high values of coverage (Minissale & Spampinato, 1987).

Syndynamism: This vegetation is found in more raised surfaces compared to those ones colonized by the *Carici otrubae-Juncetum inflexi*, with which it is often in catenal contact.

Habitat reference: See order.

36.3.2.7. ***Cirsio triunfetti-Eupatorietum cannabini*** Brullo & Spampinato 1990

Tall-herb vegetation with Cretan thistle and hemp-agrimony of nitrified riverbanks.

Holotypus: rel. 6, tab. 16, Brullo & Spampinato (1990).

Characteristic and differential species: *Cirsium creticum* (Lam.) d'Urv. subsp. *triumfetti* (Lacaita) K. Werner, *Eupatorium cannabinum* L.

Phytosociological table: From Brullo & Spampinato (1990), tab. 16, rel. 10.

Char. association: *Eupatorium cannabinum* (V), *Cirsium creticum* subsp. *triumfetti* (V).

Char. all. and order: *Pulicaria dysenterica* (V), *Mentha suaveolens* (IV), *Agrostis stolonifera* (I), *Potentilla reptans* (I).

Other species: *Equisetum ramosissimum* (IV), *Tussilago farfara* (IV), *Rubus ulmifolius* (IV), *Equisetum telmateja* (II), *Salix purpurea* (II), *Hypericum hircinum* (II), *Dittrichia viscosa* (II), *Scirpoides holoschoenus* (II), *Verbena officinalis* (I), *Lotus rectus* (I).

Geographical distribution: This community is restricted to North-Eastern Sicily (Brullo & Spampinato, 1990).

Structure and ecology: The banks of the waterways with a good amount of organic matter are colonized by a tall-herb vegetation, which is dominated by *Eupatorium cannabinum* and *Pulicaria dysenterica*. It is the *Cirsio triunfetti-Eupatorietum cannabini*, a hygrophilous community closely related to very humid surfaces between the riverbed and the riparian

woody vegetation, occurring at an altitude of 200-700 m within the meso-mediterranean bioclimatic belt (Brullo & Spampinato, 1990). From the floristic point of view, *Cirsium creticum* subsp. *triumfetti* represents the key species, while the syntaxa of higher order are represented by few species, as *Agrostis stolonifera*, *Potentilla reptans* and *Mentha suaveolens*.

Syndynamism: The community at issue is usually found in a very narrow belt near the riverbanks, where has its primary stands. However, following the degradation of riparian forest, it can colonize larger surfaces more distant from the riverbed.

Habitat reference: See order.

36.3.2.8. ***Phalarido coerulescentis-Agropyretum repentis*** Brullo & Spampinato 1990

Sub-hygrophilous vegetation with bluish canary grass and quack grass of clayey banks.

Holotypus: rel. 8, tab. 17, Brullo & Spampinato (1990).

Characteristic and differential species: *Phalaris coerulescens* Desf.

Phytosociological table: From Brullo & Spampinato (1990), tab. 17, 7 rel.

Char. association: *Phalaris coerulescens* (V).

Char. all., order and class: *Agropyron repens* (V), *Festuca arundinacea* (V), *Agrostis stolonifera* (V), *Polygonum aviculare* (III), *Bromus hordeaceus* (III), *Rumex crispus* (II), *Plantago major* (I).

Other species: *Phragmites australis* (V), *Atriplex prostrata* (V), *Hordeum marinum* (IV), *Anisantha sterilis* (III), *Dittrichia viscosa* (III), *Xanthium italicum* (III), *Daucus aureus* (III), *Melilotus sulcata* (III).

Geographical distribution: This vegetation occurs only in Central Sicily (Brullo & Spampinato, 1990).

Structure and ecology: The clay banks of watercourses subject to summer drying are colonized by dense stands of the stoloniferous species *Agropyron repens*. It characterizes a very poor vegetation with a slight halophilus character, named *Phalarido coerulescentis-Agropyretum repentis*, whose physiognomy in addition to the above mentioned species is given also by *Phalaris coerulescens*, *Festuca arundinacea*, *Agrostis stolonifera* and *Phragmites australis* (Brullo & Spampinato, 1990). Moreover, the alliance and the order are represented by *Polygonum aviculare*, *Bromus hordeaceus*, *Rumex crispus* and *Plantago major*.

Syndynamism: This edaphic community is strictly linked to the peculiar ecological features of Central Sicily waterways, which are subject to short winter floods and long dry summers.

Habitat reference: See order.

36.3.2.9. ***Kickxio commutatae-Teucrietum scordiodis*** Minissale, Musumarra & Sciandrello 2006

Sub-hygrophilous and nitrohpilous vegetation with Mediterranean fluellen and water germander of humid clayey surfaces.

Holotypus: rel. 2, tab. 6, Minissale et al. (2006).

Characteristic and differential species: *Kickxia commutata* (Bernh. Ex Rechb.) Fritsch, *Teucrium scordium* L. subsp. *scordioides* (Schreb.) Arcang.

Phytosociological table: From Minissale et al. (2006), tab. 6, 4 rel.

Char. association: *Kickxia commutata* (4), *Teucrium scordium* subsp. *scordioides* (4).

Char. all., order and class: *Pulicaria dysenterica* (4), *Mentha suaveolens* (4), *Polypogon monspeliensis* (4), *Carex distans* (3), *Polygonum aviculare* (3), *Juncus effusus* (2), *Lolium perenne* (1).

Other species: *Picris hieracioides* (4), *Juncus hybridus* (4), *Lythrum junceum* (4), *Sorghum halepense* (4), *Blackstonia perfoliata* (4), *Cynodon dactylon* (4), *Centaurium spicatum* (3), *Samolus valerandi* (3), *Verbena officinalis* (3), *Scirpoides holoschoenus* (3), *Lysimachia arvensis* (3), *Heliotropium europaeum* (2).

Geographical distribution: This vegetation was described by Minissale et al. (2006) from Vallone Racineci near Caltagirone.

Structure and ecology: The community at issue is linked to clayey surfaces that are flooded during the winter period and are still quite humid at the end of summer, when the *Kickxio commutatae-Teucrietum scordiodis* has its optimum (Minissale et al., 2006). Its structure comes from some nitrophilous species with quite hygrophilous requirements, as *Kickxia commutata*, *Teucrium scordium* subsp. *scordioides*, *Pulicaria dysenterica* and *Mentha suaveolens*. The higher syntaxa are represented by *Polypogon monspeliensis*, *Carex distans* (3), *Polygonum aviculare*, *Juncus effusus* and *Lolium perenne*.

Syndynamism: Even this association represents an edaphic climax, whose presence is related to the periodic flooding of streams, which prevent further evolution from the dynamic point of view.

Habitat reference: See order.

36.3.3. Alliance: ***Trifolion maritimi*** Br.-Bl. ex Br.-Bl. et al. 1952

Grazed and trampled communities of damp, compact and nutrient-rich soils.

Synonyms: *Trifolion maritimi* Br.-Bl. 1931 (art. 2b); *Trifolio fragiferi-Cynodontion* Br.-Bl. & O. de Bolòs 1958 (syntax.syn.); *Trifolion squamosi* Julve 1993 (art. 2b).

Holotypus: *Agropyro-Trifolietum maritimi* Br.-Bl. 1932.

Characteristic and differential species: *Cichorium pumilum* Jacq., *Cynodon dactylon* (L.) Pers., *Plantago coronopus* L., *Paspalum distichum* L., *Paspalum dilatatum* Poir.

Geographical distribution: This alliance occurs in the Mediterranean area (Mucina et al., 2016).

Structure and ecology: The alliance at issue gathers the meadows of humid, compact and nutrient-rich soils, which are dominated by low prostrate hemicryptophytes and therophytes. This vegetation occurs in grazed and trampled stands, within the (thermo)meso- supra-mediterranean bioclimatic belt.

Syndynamism: From the dynamic point of view, these communities are linked with the series of *Quercetea ilicis* and *Querco-Fagetea*.

Habitat reference: See order.

36.3.3.1. ***Kickxio commutatae-Trifolietum bocconei*** Brullo & Marcenò 1983

Ephemeral meadows with mediterranean fluellen and Boccone clover of acidic skeleton-rich soils.

Holotypus: rel. 3, tab. 64, Brullo & Marcenò (1983).

Characteristic and differential species: *Gastridium ventricosum* (Gouan) Schinz & Thell., *Kickxia commutata* (Bernh. Ex Rechb.) Fritsch, *Lotus angustissimus* L., *Trifolium bocconei* Savi.

Phytosociological table: From Brullo & Marcenò (1983), tab. 64, 5 rel.

Char. association: *Kickxia commutata* (V), *Trifolium bocconei* (V), *Gastridium ventricosum* (V), *Lotus angustissimus* (V).

Char. all.: *Cichorium pumilum* (V), *Cynodon dactylon* (V).

Char. order: *Polygonum aviculare* (III), *Agrostis stolonifera* (III), *Plantago major* (II).

Char. class: *Lolium perenne* (V), *Cynosurus cristatus* (IV), *Oenanthe pimpinelloides* (IV), *Prunella vulgaris* (IV), *Gaudinia fragilis* (III), *Hypochoeris radicata* (III), *Plantago lanceolata* (III), *Trifolium repens* (II).

Other species: *Trifolium lappaceum* (V), *Mentha pulegium* (V), *Medicago murex* (V), *Centaurium pulchellum* (IV), *Lysimachia arvensis* (IV), *Trifolium angustifolium* (III), *Sideritis romana* (III), *Scorpiurus subvillosus* (III), *Linum bienne* (III), *Silene bellidifolia* (III), *Helminthotheca echioides* (III), *Lythrum junceum* (II).

Geographical distribution: This vegetation is restricted to the hilly belt of Nebrodi mountains (Brullo & Marcenò, 1983a).

Structure and ecology: The acidic skeleton-rich soils with a sandy component within the mesomediterranean belt are colonized by a rare vegetation dominated by some annual species, as *Trifolium bocconei*, *Kickxia commutata*, *Lotus angustissimus* and *Gastridium ventricosum*. It is the *Kickxio commutatae-Trifolietum bocconei*, which is usually found in the clearings of mesophilous cork oak wood belonging to *Doronico-Quercetum suberis*. The alliance is represented only by *Cichorium pumilum* and *Cynodon dactylon*, while among the species of order and class, *Polygonum aviculare*, *Agrostis stolonifera*, *Lolium perenne*, *Cynosurus cristatus*, *Oenanthe pimpinelloides* and *Prunella vulgaris* are very frequent.

Syndynamism: This meadows is replaced by the *Holoschoenetalia* vegetation in the more humid surfaces, while it tends to move towards the annual communities of *Helianthemetea guttatae* in the dry stands (Brullo & Marcenò, 1983a).

Habitat reference: See order.

36.4. Order: ***Paspalo-Heleochloetalia*** Br.-Bl. ex Rivas Goday 1956

Perennial, nitrophilous and hygrophilous vegetation of periodically flooded subsaline nutrient-rich river alluvia.

Synonyms: *Paspalo-Heleochloetalia* Br.-Bl. in Br.-Bl. et al. 1952 (art. 3f); *Crypsio-Paspaletalia* Br.-Bl. in Br.-Bl. et al. 1952 nom. mut. propos. et nom. invers. propos. (art. 42, 45)*; Bidentetalia pilosae* sensu de Bolos 1988, non *Bidentetalia pilosae* Lebrun in Mullenders 1949 (pseudonym); *Paspalo distichi; Polypogonetalia semiverticillatae* Delpech & Gèhu in Bardat et al. 2004 (syntax. syn.).

Typus nominis: *Paspalo-Agrostion semiverticillati* Br.-Bl. in Br.-Bl. et al. 1952, designated by Theurillat in Di Pietro et al., 2015.

Characteristic and differential species: *Corrigiola littoralis* L., *Dysphania anthelmintica* (L.) Mosyakin & Clemants, *Panicum repens* L., *Polypogon viridis* (Gouan) Breistr., *Sporobolus schoenoides* (L.) P.M.Peterson, *Symphyotrichum squamatum* (Spreng.) G.L.Nesom, *Tagetes minuta* L.

Geographical distribution: This order is known throughout the Mediterranean area (Mucina et al., 2016). In Sicily, this syntaxon is quite frequent, particularly in coastal areas.

Structure and ecology: The order at issue was originally described by Braun-Blanquet in Braun-Blanquet et al. 1952, as a Mediterranean vicariant in subalophilous environments of

the *Bidentetalia* that would instead have a mainly Eurosiberian distribution. Subsequently, several authors (Tüxen & Oberdorfer, 1958; O. Bolòs, 1962; Rivas-Goday, 1964; Esteve, 1973) have framed the communities of *Paspalo-Heleochloetalia* within the *Plantaginetalia majoris* order (*Molinio-Arrhenatheretea* class), which includes the vegetation dominated by geophytes and hemicriptophytes of temporarily flooded and nutrient-rich surfaces. However, the communities belonging to the *Paspalo-Heleochloetalia*, unlike the other syntaxas of the *Plantaginetalia*, are closely linked to stands flooded even for long periods as the banks of rivers and lakes, showing some ecological affinities with the vegetation of the *Bidentetalia*, although they are clearly distinguished by being characterized by the predominance of perennial species, rather than by pioneering therophytes (Peinado Lorca et al., 1988). Therefore, *Paspalo-Heleochloetalia* can be considered a separate order with its own ecology, well defined both with respect to *Bidentetalia* and *Plantaginetalia*. Recently, Mucina et al. (2016) again ascribed the order at issue to the *Bidentetea* class.

Syndynamism: The communities belonging to this Order tend to replace the vegetation of the *Chenopodion rubri* in the stands characterized by an intense mechanical disturbance and subject to a shorter submerging period (Guarino & Pasta, 2017). From a dynamic point of view, this vegetation represents a degradation stage of riparian vegetation (Biondi et al., 2010).

Habitat reference: E3.4a Moist or wet mesotrophic to eutrophic hay meadow.

36.4.1 Alliance: ***Paspalo-Agrostion semiverticillati*** Br.-Bl. in Br.-Bl. Roussine & Negre 1952

Perennial meadows of subsaline surfaces with long flooding periods.

Synonyms: *Paspalo-Polypogonion semiverticillati* Br.-Bl. in Br.-Bl. et al. 1952 nom. mut. propos. (art. 45); *Paspalo-Polypogonion viridis* Br.-Bl. in Br.-Bl. et al. 1952 nom. mut. propos. (art. 45)*; Paspalo-Bidention* Rivas Goday 1964 (art. 3b); *Ecliption prostratae* sensu de Bolòs 1988, non *Ecliption albae* Lebrun 1947 (pseudonym).

Typus nominis: *Paspalo-Agrostietum* Br.-Bl. 1936

Characteristic and differential species: See order.

Geographical distribution: See order.

Structure and ecology: Inside the *Paspalo-Heleochloetalia* order, Rivas Goday (1964) recognized three alliances: *Heleochloion* Br.-Bl. 1952, *Paspalo-Bidention* Rivas Goday 1964 and *Paspalo-Agrostidion* Br.-Bl. 1952. Subsequently, Rivas Martinez (1966) attributes all the communities of the *Bidedentetea* occurring in the Mediterranean area to *Bidention*, making the *Paspalo-Bidention* alliance superfluous, while the communities of *Heleochloion* were referred to *Isoeto-Nanojuncetea* and those of *Paspalo-Agrostidion* to *Molinio-Arrhenatheretea* (Peinado Lorca et al., 1988). Conversely, Mucina et al. (2016) have framed the *Paspalo-Agrostidion* inside the *Bidentetea*, considering it as the only alliance of *Paspalo-Heleochloetalia*. The

syntaxon at issue is represented by subalophile meadow communities that colonize long-flooded and nutrient-rich surfaces. From a physiognomic point of view, this vegetation is dominated by perennial species, stoloniferous hemicryptophytes and geophytes, such as *Paspalum distichum*, *Lippia nodiflora*, *Panicum repens*, etc. (Biondi et al., 2014).

Syndynamism: See order.

36.4.1.1 ***Paspalo distichi-Polypogonetum viridis*** Br.-Bl. in Br.-Bl., Gajewski, Wraber & Walas 1936

Hygro-nitrophilous meadows with knotgrass and water bent of clayey-silty soils with a long flooding period.

Synonyms: *Paspalo distichi-Agrostietum verticillatae* Br.-Bl. in Br.-Bl., Gajewski, Wraber & Walas 1936 (art. 45); ass. à *Paspalum distichum* et *Agrostis verticillata* Br.-Bl. in Br.-Bl., Gajewski, Wraber & Walas 1936 (art. 10, 14).

Lectotypus: Not designated.

Characteristic and differential species: *Paspalum distichum* L.

Phytosociological table: 5 unpublished rel., 27.09.2017, Piana degli Albanesi (Palermo).
Char. association: *Paspalum distichum* (V).
Char. all. and order: *Symphyotrichum squamatum* (V), *Polypogon viridis* (II), *Corrigiola littoralis* (I), *Sporobolus schoenoides* (I).
Other species: *Cynodon dactylon* (V).

Geographical distribution: The association is distributed in much of the Mediterranean area (Pirone et al., 2003; Lastrucci 2010; Rivas Martinez, 2011). In Sicily the syntaxon is quite common near watercourses and artificial basins.

Structure and ecology: The banks of rivers and artificial basins with periodically flooded loamy soils, are colonized by a peculiar hygrophilous meadow dominated by *Paspalum distichum*, a xenophyte of tropical origin that is linked to nitrified surfaces (Loidi et al., 1995; Pirone et al., 2003). It is the *Paspalo distichi-Polypogonetum viridis*, which appears as a dense, monospecific population of *Paspalum distichum* with a prostrate habitus. Sometimes. its floristic set includes also *Cynodon dactylon* and other species of *Paspalo-Heleochloetalia*, such as *Polypogon viridis*, *Symphyotrichum squamatus*, *Sporobolus schoenoides*, etc. (Mereu et al., 2010).

Syndynamism: This community is generally considered as a secondary stage of hygrophilous woods (Baldoni & Biondi, 1993, Maiorca et al., 2007). From the catenal point of view, it can come into contact with the *Bidentetea* communities that colonize the most humid areas subject to a longer submerging period and with the *Trifolion maritimi* vegetation, which instead prefers the surfaces with a shorter flooding period (Bolòs, 1962).

Syndynamism: See order.

36.4.1.2 ***Lippio nodiflorae-Panicetum repentis*** O. Bolòs 1957

Subhalophilous vegetation with frog fruit and torpedograss of wet sandy soils.

Lectotypus: Not designated.

Characteristic and differential species: *Phyla nodiflora* (L.) Greene.

Phytosociological table: From Brullo & Sciandrello (2006), tab. 12, 5 rel.
Char. association: *Phyla nodiflora* (V).
Char. all. and order: *Panicum repens* (V), *Symphyotrichum squamatum* (V).
Char. class: *Lotus presli* (V), *Scirpoides holoschoenus* subsp. *australis* (V).
Other species: *Juncus maritimus* (V), *Conyza bonariensis* (V), *Polypogon monspeliensis* (V), *Phragmites australis* (IV), *Helminthotheca echioides* (IV), *Tamarix africana* (IV), *Daucus carota* subsp. *maritimus* (IV), *Dittrichia viscosa* (IV), *Calystegia sylvatica* (III), *Centaurium pulchellum* (III), *Cynodon dactylion* (II), *Imperata cylindrica* (II).

Geographical distribution: The association is distributed in the Iberian Peninsula and in Sicily (Braun Blanquet-Bolòs, 1957), where it is mainly represented in the salt-marshes of the south-eastern part from Vendicari to Biviere di Gela (Brullo & Marcenò, 1983a; Brullo & Sciandrello, 2006) .

Structure and ecology: The community at issue colonizes the humid sandy surfaces around the coastal salt lakes, often near drainage channels and depressions with a sufficient amount of organic matter. It is a dense and low vegetation with subnitrophilous and subalophilous requirements, characterized by the dominance of stoloniferous hemicryptophytes, such as *Phyla nodiflora* and *Panicum repens*, associated with some species of order and class, such as *Polygonum aviculare*, *Cichorium pumilum*, *Agrostis stolonifera*, *Plantago coronopus*, *Symphyotrichum squamatum, Lotus preslii*, *Scirpoides holoschoenus*, etc. (Brullo & Marcenò, 1983a).

Syndynamism: The *Lippio nodiflorae-Panicetum repentis* tends to replace the helophytic vegetation of *Bolboschoenetum maritimi* or *Imperato-Juncetum litoralis* in the less humid and nutrient-rich soils (Brullo & Sciandrello, 2006).

Syndynamism: See order.

37. Class: ***Rumici-Astragaletea siculi*** Pignatti & Nimis in Pignatti-Wikus et al. 1980

Sicilian and Calabrian hemicryptophytic and chamaephytic thorny cushion

oromediterranean vegetation.

Synonyms: *Ononido-Rosmarinetea* sensu Pignatti & Nimis in Pignatti et al. 1980 non Br.-Bl. 1947; *Cerastio-Carlinetea nebrodensis* S. Brullo 1983 (art. 2b); *Cerastio-Carlinetea nebrodensis* S. Brullo 1984 (syntax.syn.).

Holotypus: *Rumici-Astragaletalia siculi* Pignatti & Nimis in Pignatti-Wikus et al. 1980.

Characteristic and differential species: *Arabis rosea* DC., *Bellardiochloa variegata* (Lam.) Kerguélen subsp. *nebrodensis* (Asch. & Graebn.) C.Brullo, Brullo, Giusso & Sciandr., *Bunium petraeum* Ten., *Carlina nebrodensis* DC., *Centaurea parlatoris* Heldr., *Cerastium tomentosum* L., *Clinopodium alpinum* (L.) Merino subsp. *meridionalis* (Nyman) P. W. Ball., *Galium aetnicum* Biv., *Herniaria glabra* L. *subsp. nebrodensis* Jan ex Nyman, *Petrorhagia saxifraga* (L.) Link subsp. *gasparrinii* (Guss.) Greuter & Burdet., *Phleum hirsutum subsp. ambiguum* (Ten.) Cif. & Giacom., *Rumex multifidus* (L.) DC., *Saponaria sicula* Raf., *Scleranthus perennis* L. subsp. *marginatus* (Guss.) Nyman, *Silene italica* (L.) Pers. subsp. *sicula* (Ucria) Jeanm., *Tragopogon crocifolius* L. subsp. *nebrodensis* (Guss.) Raimondo, *Valeriana tuberosa* L.

Geographical distribution: This class has its maximum diversity on Etna and Madonie mountains, but occurs also on Sicani, Nebrodi and Peloritani massifs (Pignatti-Wikus et al., 1980; Raimondo, 1980; Brullo, 1984a; Brullo et al., 2005), as well as in the siliceous ranges of central-southern Calabria (Brullo et al., 2001, 2004).

Structure and ecology: The summit areas above the timber-line and also the exposed stands with rocky outcrops within the orophilous woodlands belt, are covered by the dwarf shrub communities belonging to *Rumici-Astragaletea siculi* (Pignatti-Wikus et al., 1980). The physiognomy of this vegetation is characterized by the dominance of chamaephytes with a thorny cushion habitus, which have a significant phytogeographic interest, being endemic and showing specific adaptations to the climatic and ecological conditions of the high mountains. In particular, these pulvinate species are very suitab. for exposed and windy places, with considerable temperature variations and shallow soils, constituting scattered and discontinuous patches on steep slopes and rocky stands (Brullo, 1984a). Moreover, these shrubs provide a sheltered habitat from the rugged surrounding environment for many geophytes, therophytes and hemicryptophytes, retaining a thin layer of soil and organic matter under their canopies. These communities are found on different substrata, as volcanites, basalts, limestones, sandstones flysch and metamorphites. From the bioclimatic point of view, they are linked to the supra- and the cryo-oromediterranean thermotype (only on the top of Etna), with subhumid to humid ombrotypes (Brullo et al., 2005). Some authors (Rivas-Martinez et al., 2011; Biondi et al., 2014) considered the content of *Rumici-Astragaletea* within the *Cisto-Lavanduletea* Br.-Bl. in Br.-Bl., Molinier & Wagner 1940, without providing further data to support this thesis.

Syndynamism: As noted above**,** the primary stands of this vegetation are located above 1800-1900 m, as well as in the rocky ridges and summit outcrops within the orophilous belt of *Querco-Fagetea* woods. However, it is found much more frequently in secondary habitats

above 1400 m a.s.l. on eroded soils and debris, which are originated by the degradation of forest communities due to anthropic or volcanic activity (Brullo et al., 2005).

Habitat reference: F6.6 Supramediterranean garrigue; F7.4b Central Mediterranean mountain hedgehog-heath; H6.1 Mediterranean and temperate volcanic field.

37.1. Order: ***Rumici-Astragaletalia siculi*** Pignatti & Nimis in Pignatti-Wikus et al. 1980

Upper meso- to oromediterranean xeric scrub on siliceous volcanic substrates of Sicily.

Synonyms: *Astragaletalia siculae* Giacomini & Gentile 1961 (art. 3b); *Astragaletalia siculae* Giacomini ex Poli 1965 (art. 3b).

Holotypus: *Rumici-Astragalion siculi* Poli 1965.

Characteristic and differential species: *Anthemis aetnensis* Spreng., *Astragalus siculus* Biv., *Bellardiochloa variegata* (Lam.) Kerguélen subsp. *aetnensis* (C.Presl) Giardina & Raimondo, *Erysimum etnense* Jord., *Robertia taraxacoides* (Loisel.) DC., *Rumex aetnensis* C. Presl, *Senecio squalidus* L. subsp. *aethnensis* (Jan ex DC.) Greuter, *Senecio squalidus* L. subsp. *chrysanthemifolius* (Poir.) Greuter, *Tanacetum vulgare* L. subsp. *siculum* (Guss.) Raimondo & Spadaro, *Viola aethnensis* (Ging. & DC.) Strobl subsp. *aethnensis*.

Geographical distribution: This order occurs only in Etna mountain (Brullo et al., 2005).

Structure and ecology: The order at issue groups the orophilous pioneer chamaephytic communities of volcanic substrata, having a discontinuous and scattered occurrence between 1400 and 2900 m a.s.l., within the (supra-)oro- and cryo-oromediterranean bioclimatic belt. The structure of this vegetation is given by thorny dwarf shrubs, such as *Astragalus siculus*, which gives a suitab. environment for many herbaceous species with a certain phytogeographic interest, as *Anthemis aetnensis*, *Rumex aetnensis*, *Senecio squalidus* subsp. *aethnensis, Viola aethnensis* subsp. *aethnensis*, etc.

Syndynamism: See class.

Habitat reference: H6.1 Mediterranean and temperate volcanic field.

37.1.1. Alliance: ***Rumici-Astragalion siculi*** Poli 1965

Oromediterranean xeric pulvinate scrub on siliceous volcanic substrates of Etna (Sicily).

Lectotypus: *Astragaletum siculi* (Frei 1940) Gilli 1943

Characteristic and differential species: See order.

Geographical distribution: See order.

Structure and ecology: See order.

Syndynamism: See class.

Habitat reference: See order.

37.1.1.1. ***Astragaletum siculi*** (Frei 1940) Gilli 1943 corr. Brullo et al. 2005

Pulvinate vegetation with Sicily milkvetch of Etna orophilous stands.

Synonyms: *Astragaletum siculum aetnense* Frei 1940 nom. illeg. (art. 34); *Astragaletum siculae* (Frei 1940) Gilli 1943 (art. 41a); *Astragaletum siculi* Poli 1965, nom. illeg. (art. 22).

Neotypus: rel. 5, Gilli (1943), designated by Brullo et al. (2005).

Characteristic and differential species: *Cuscuta epithymum* (L.) L. subsp. *kotschyi* (Des Moul.) Arcang., *Scleranthus aetnensis* Strobl.

Phytosociological table: From Brullo et al. (2005), tab. 1, 60 rel.

Char. association: *Cuscuta epithymum* subsp. *kotschyi* (III).

Char. alliance and order: *Astragalus siculus* (V), *Bellardiochloa variegata* subsp. *aetnensis* (V), *Rumex aetnensis* (IV), *Viola aethnensis* subsp. *aethnensis* (IV), *Senecio squalidus* subsp. *aethnensis* (III), *Robertia taraxacoides* (III), *Erysimum etnense* (III), *Anthemis aetnensis* (II), *Tanacetum vulgare* subsp. *siculum* (I), *Senecio squalidus* subsp. *chrysanthemifolius* (I).

Char. class: *Galium etnicum* (V), *Cerastium tomentosum* (IV), *Silene italica* subsp. *sicula* (IV), *Petrorhagia saxifraga* subsp. *gasparrinii* (II), *Saponaria sicula* (II), *Carlina nebrodensis* (II), *Phleum hirsutum* subsp. *ambiguum* (II), *Clinopodium alpinum* subsp. *meridionalis* (II), *Herniaria glabra* subsp. *nebrodensis* (II), *Tragopogon crocifolius* subsp. *nebrodensis* (II), *Centaurea parlatoris* (I), *Rumex multifidus* (I).

Other species: *Festuca circummediterranea* (V), *Secale strictum* (V), *Festuca rubra* (III), *Linaria purpurea* (III), *Achillea ligustica* (II), *Jasione montana* (II), *Calamagrostis epigejos* (II), *Potentilla calabra* (II), *Petrosedum tenuifolium* (I).

Geographical distribution: This vegetation occurs only in Etna massif (Brullo et al., 2005).

Structure and ecology: The *Astragaletum siculi* is an orophilous vegetation with a pioneer character, colonizing volcanic sands, eroded soils, windy stands and steep slopes between 1500-2200 m a.s.l. (Brullo et al., 2005). It appears as a pulvinate vegetation dominated by the thorny cushions of *Astragalus siculus*, 30-50 cm high, with discontinuous distribution, but locally with very high coverage. The floristic set includes several species of alliance and order,

among them *Bellardiochloa variegata* subsp. *aetnensis*, *Rumex aetnensis*, *Viola aethnensis* subsp. *aethnensis*, *Senecio squalidus* subsp. *aethnensis, Robertia taraxacoides*, *Erysimum etnense* and *Anthemis aetnensis* are very frequent. This vegetation has its optimum during the mid of June, when many of the above-mentioned species are in bloom.

Syndynamism: This vegetation has its primary stands within the supra- and oromediterranean belt, having a secondary role in the lower belt of orophilous woods. At higher altitudes, above 2200 m, is replaced by other communities, as *Festuco circummediterraneae-Bellardiochloetum aetnensis* and *Senecioni aetnensis-Anthemidetum aetnensis*.

Habitat reference: See order.

37.1.1.2. ***Senecioni aetnensis-Anthemidetum aetnensis*** Frei 1940

Pioneer vegetation with Etna groundsel and Etna chamomille of Etna recent lava.

Synonyms: *Senecio aetnensis-Anthemis aetnensis* ass. Frei 1940; *Rumici-Anthemidetum aetnensis* Poli 1965 nom. illeg. (art.22).

Neotypus: rel. 8, Gilli (1943), designated by Brullo et al. (2005).

Characteristic and differential species: *Cardamine glauca* Spreng. ex DC., *Scleranthus perennis* L. subsp. *vulcanicus* (Strobl) Bég.

Phytosociological table: From Brullo et al. (2005), tab. 2, 53 rel.

Char. association: *Scleranthus perennis* L. subsp. *vulcanicus* (III), *Cardamine glauca* (II).

Char. alliance and order: *Anthemis aetnensis* (V), *Rumex aetnensis* (V), *Senecio squalidus* subsp. *aethnensis* (IV), *Robertia taraxacoides* (III), *Viola aethnensis* subsp. *aethnensis* (I), *Astragalus siculus* (I), *Bellardiochloa variegata* subsp. *aetnensis* (I).

Char. class: *Saponaria sicula* (II), *Cerastium tomentosum* (II), *Rumex multifidus* (I), *Galium etnicum* (I), *Silene italica* subsp. *sicula* (I).

Other species: *Festuca circummediterranea* (III), *Potentilla calabra* (I), *Anisantha tectorum* (I), *Scleranthus aetnensis* (I), *Secale strictum* (I), *Trifolium pratense* subsp. *semipurpureum* (I).

Geographical distribution: This association is endemic of Etna massif (Brullo et al., 2005).

Structure and ecology: The highest vegetation belt of Etna (2200-2900 m a.s.l.) is occupied by a low hemicrypto-chamaephytic community, named *Senecioni aetnensis-Anthemidetum aetnensis*. It has a discontinuous coverage within the cryo-oromediterranean belt, growing on open stands with sandy or rocky substrata. Its physiognomy is given mainly by *Anthemis aetnensis*, *Rumex aetnensis* and *Senecio squalidus* subsp. *aethnensis*, which are associated with *Cardamine glauca*, *Scleranthus perennis* subsp. *vulcanicus* and few species of higher rank, as

Robertia taraxacoides, *Viola aethnensis* subsp. *aethnensis*, *Saponaria sicula*, *Cerastium tomentosum*, etc. Most of these species have their optimum during July.

Syndynamism: It is a markedly pioneer vegetation, colonizing the recent volcanic surfaces in the mountain stands, having a primary role only above 2200 m, where the extreme climatic conditions and the constant volcanic activity prevent a further evolution. Conversely, at lower altitudes, it represents the first serial stage in the plant colonization of young volcanic sands, being dynamically followed by the *Astragaletum siculi* (Brullo et al., 2005).

Habitat reference: See order.

37.1.1.3. ***Festuco circummediterraneae-Bellardiochloetum aetnensis*** Frei 1940 corr. Brullo et al. 2005

Hemicryptophytic and orophilous vegetation with mediterranean fescue and Etna bluegrass of windy rocky stands.

Synonyms: *Poa aetnensis-Festuca nebrodensis* ass. Frei 1941.

Neotypus: rel. 3, tab. 32, Poli (1965), designated by Brullo et al. (2005).

Characteristic and differential species: *Bellardiochloa variegata* (Lam.) Kerguélen subsp. *aetnensis* (C.Presl), *Festuca circummediterranea* Patzke.

Phytosociological table: From Brullo et al. (2005), tab. 3, 18 rel.

Char. association: *Bellardiochloa variegata* subsp. *aetnensis* (V), *Festuca circummediterranea* (V).

Char. alliance and order: *Astragalus siculus* (V), *Robertia taraxacoides* (III), *Anthemis aetnensis* (III), *Viola aethnensis* subsp. *aethnensis* (III), *Erysimum etnense* (II), *Rumex aetnensis* (II), *Senecio squalidus* subsp. *aethnensis* (I).

Char. class: *Cerastium tomentosum* (V), *Galium etnicum* (V), *Silene italica* subsp. *sicula* (V), *Herniaria glabra* subsp. *nebrodensis* (II), *Phleum hirsutum* subsp. *ambiguum* (II), *Clinopodium alpinum* subsp. *meridionalis* (II), *Centaurea parlatoris* (II), *Petrorhagia saxifraga* subsp. *gasparrinii* (II), *Carlina nebrodensis* (II), *Tragopogon crocifolius* subsp. *nebrodensis* (I), *Saponaria sicula* (I).

Other species: *Jasione montana* (IV), *Petrosedum tenuifolium* (IV), *Berberis aetnensis* (III), *Secale strictum* (III), *Achillea ligustica* (II).

Geographical distribution: This community is endemic of Etna (Brullo et al., 2005).

Structure and ecology: The windy ridges and the basis of volcanic dykes, between 1700 and 2300 m a.s.l., are colonized by a hemicryptophytic vegetation dominated by *Bellardiochloa variegata* subsp. *aetnensis*. It is the *Festuco circummediterraneae-Bellardiochloetum aetnensis*,

which is found mostly on eroded soils and rocky slopes within the oromediterranean bioclimatic belt. From the floristic point of view, some species of alliance and order are quite frequent, such as *Astragalus siculus*, *Robertia taraxacoides*, *Anthemis aetnensis*, *Viola aethnensis* subsp. *aethnensis*, *Erysimum etnense*, *Rumex aetnensis*, etc.

Syndynamism: It is an edaphic community, covering small and patchy surfaces on very shallow soils and exposed stands, which are unsuitable for the settlement of *Astragaletum siculi*.

Habitat reference: See order.

37.1.1.4. ***Phleo ambigui-Secaletum stricti*** Siracusa 1998

Hemicryptophytic and orophilous vegetation with southern cat's-tail and wild rye of flat or gently sloping surfaces.

Holotypus: rel. 1, tab. 1, Siracusa (1998).

Characteristic and differential species: *Secale strictum* (C. Presl) C. Presl.

Phytosociological table: From Brullo et al. (2005), tab. 3, 18 rel.

Char. association: *Secale strictum* (V).

Char. alliance and order: *Astragalus siculus* (V), *Robertia taraxacoides* (IV), *Rumex aetnensis* (III), *Tanacetum vulgare* subsp. *siculum* (III), *Viola aethnensis* subsp. *aethnensis* (III), *Erysimum etnense* (III), *Senecio squalidus* subsp. *aethnensis* (II), *Bellardiochloa variegata* subsp. *aetnensis* (II).

Char. class: *Phleum hirsutum* subsp. *ambiguum* (V), *Petrorhagia saxifraga* subsp. *gasparrinii* (V), *Galium etnicum* (V), *Tragopogon crocifolius* subsp. *nebrodensis* (V), *Silene italica* subsp. *sicula* (IV), *Centaurea parlatoris* (III), *Rumex multifidus* (III), *Cerastium tomentosum* (II), *Saponaria sicula* (I), *Clinopodium alpinum* subsp. *meridionalis* (I).

Geographical distribution: This community occurs only on Etna mountain (Siracusa, 1998; Brullo et al., 2005).

Structure and ecology: The flat or gently sloping surfaces with accumulation of volcanic sands and finer particles are covered by a vegetation dominated by two caespitose hemicryptophytes, as *Secale strictum* and *Phleum hirsutum* subsp. *ambiguum*. This community, named *Phleo ambigui-Secaletum stricti*, dwells hollowed places, quite sheltered from winds and with slightly humid soils, within the supra- and oromediterranean belts (1500- 1900 m a.s.l.). Sometimes, it occurs also at lower altitudes in forest clearings (Brullo et al., 2005). Its floristic set includes some species of higher rank, among them *Robertia taraxacoides*, *Rumex aetnensis*, *Tanacetum vulgare* subsp. *siculum*, *Viola aethnensis* subsp.

aethnensis, *Erysimum etnense*, *Petrorhagia saxifraga* subsp. *gasparrinii*, *Galium etnicum* and *Tragopogon crocifolius* subsp. *nebrodensis*.

Syndynamism: Generally, this vegetation occurs in the belt occupied by the *Astragaletum siculi*, which replaces it in the stands with dry shallow soils and more exposed and windy conditions.

Habitat reference: See order.

37.1.1.5. ***Festuco circummediterraneae-Populetum tremulae*** Brullo & Siracusa in Brullo et al. 2005

Nanophanerophytic vegetation with mediterranean fescue and common aspen of permanently humid volcanic sands.

Holotypus: rel. 6, tab. 4, Brullo et al. (2005).

Characteristic and differential species: *Populus tremula* L.

Phytosociological table: From Brullo et al. (2005), tab. 4, 11 rel.

Char. association: *Populus tremula* (V).

Char. alliance and order: *Astragalus siculus* (V), *Robertia taraxacoides* (V), *Viola aethnensis* subsp. *aethnensis* (V), *Bellardiochloa variegata* subsp. *aetnensis* (V), *Tanacetum vulgare* subsp. *siculum* (II), *Senecio squalidus* subsp. *aethnensis* (I), *Rumex aetnensis* (I), *Anthemis aetnensis* (I).

Char. class: *Galium etnicum* (V), *Silene italica* subsp. *sicula* (V).

Other species: *Festuca circumediterranea* (V).

Geographical distribution: This community is restricted to a small area of the southern flank of Etna (Timpa dell'Albanello)(Brullo et al., 2005).

Structure and ecology: The *Festuco circummediterraneae-Populetum tremulae* is found in the lavic sheers covered by a thin layer of volcanic sand, which is permanently soaked by snow-melting, since the water cannot percolate through the sheers (Brullo et al., 2005). It is a nanophanerophitic vegetation, 30-50 cm high, characterized by the dominance of *Festuca circumediterranea* and *Populus tremula*, which has a prostrate-pulvinate growth form. This floristically poor community includes also some species of higher rank, such as *Astragalus siculus*, *Robertia taraxacoides*, *Viola aethnensis* subsp. *aethnensis*, *Bellardiochloa variegata* subsp. *aetnensis*, *Galium etnicum*, *Silene italica* subsp. *sicula*, etc. From the bioclimatic point of view, it occurs in the cryo-oromediterranean belt, between 2300 and 2400 m a.s.l.

Syndynamism: It is a permanent vegetation not subject to dynamic processes.

37.1.1.6. ***Cerastio tomentosi-Hieracietum pallidi*** Brullo & Siracusa in Brullo et al. 2005

Casmophilous and orophilous vegetation with snow-in-summer and Etna hawkweed of volcanic outcrops.

Synonyms: aggr. a *Hieracium crinitum* e *Luzula sieberi* Poli 1965

Holotypus: rel. 10, tab. 5, Brullo et al. (2005).

Characteristic and differential species: *Hieracium pallidum* Biv. subsp. *aetnense* Gottschl. & al.

Phytosociological table: From Brullo et al. (2005), tab. 5, 17 rel.

Char. association: *Hieracium pallidum* subsp. *aetnense* (V).

Char. alliance and order: *Anthemis aetnensis* (V), *Robertia taraxacoides* (V), *Bellardiochloa variegata* subsp. *aetnensis* (III), *Rumex aetnensis* (II), *Erysimum etnense* (II).

Char. class: *Galium etnicum* (V), *Cerastium tomentosum* (V), *Silene italica* subsp. *sicula* (IV), *Saponaria sicula* (III), *Petrorhagia saxifraga* subsp. *gasparrini* (II), *Rumex multifidus* (I).

Other species: *Festuca circumediterranea* (V), *Trifolium pratense* subsp. *semipurpureum* (III), *Jasione montana* (III).

Geographical distribution: This association is restricted to the southern side of Valle del Bove, in the locality known as "Schiena dell'Asino" (SE flank of Etna)(Brullo et al., 2005).

Structure and ecology: The fractured volcanic dykes and steep rocky slopes with northern exposures, within the supra- and oromediterranean belt (1600-2000 m a.s.l.), are colonized by a chasmophilous vegetation dominated by some hemicryptophytes and chamaephytes. It is the *Cerastio tomentosi-Hieracietum pallidi*, which is floristically differentiated by the occurrence of the rare endemic *Hieracium pallidum* subsp. *aetnense*, growing together with *Cerastium tomentosum*, *Anthemis aetnensis*, *Robertia taraxacoides*, *Bellardiochloa variegata* subsp. *aetnensis*, *Galium etnicum*, etc.

Syndynamism: It is an edaphic vegetation without dynamic phenomena.

Habitat reference: See order.

37.2. Order: ***Erysimo-Jurineetalia bocconei*** Brullo 1984

Upper meso- to oromediterranean xeric scrub on calcareous and siliceous substrates of Sicily.

Synonyms: : *Erinacetalia* sensu Pignatti & Nimis in Pignatti et al. 1980, non Quezel 1953; *Lavanduletalia stoechadis* sensu Pignatti & Nimis in Pignatti et al. 1980, non Br.-Bl. 1941.

Holotypus: *Cerastio-Astragalion nebrodensis* Pignatti & Nimis ex Brullo 1984

Characteristic and differential species: *Allium cupanii* Raf., *Asperula aristata* L.f. subsp. *scabra* Nyman, *Dianthus arrostii* C. Presl, *Erysimum bonannianum* C. Presl, *Galium lucidum* All. subsp. *venustum* (Jord.) Arcang., *Helianthemum croceum* (Desf.) Pers., *Jurinea bocconei* (Guss.) Guss., *Koeleria splendens* C. Presl subsp. *splendens*, *Lomelosia crenata* (Cirillo) Greuter & Burdet subsp. *crenata*, *Pilosella hoppeana* (Schult.) F.W.Schultz & Sch.Bip. subsp. *sicula* Di Grist., Gottschl. & Raimondo, *Polycarpon tetraphyllum* (L.) L. subsp. *polycarpoides* (Biv.) Iamonico, *Sabulina verna* (L.) Rchb. subsp. *grandiflora* (C. Presl) Dillenb. & Kadereit, *Trisetaria flavescens* (L.) Baumg.

Geographical distribution: The syntaxon at issue occurs in the higher reliefs of Northern Sicily from Sicani to Peloritani mountains, having its greater diversification in the Madonie range (Brullo, 1984a; Brullo et al., 2005).

Structure and ecology: The orophilous communities growing on limestones, dolomites, quartzites and metamorphic (gneiss and schists) substrates are ascribed to the *Erysimo-Jurineetalia bocconei*. It is a herbaceo-chamaephytic vegetation, which occurs on shallow and eroded soils between 980 and 1950 m a.s.l., within the (meso-)supramediterranean bioclimatic belt (Brullo et al., 2005).

Syndynamism: See class.

Habitat reference: F6.6 Supramediterranean garrigue; F7.4b Central Mediterranean mountain hedgehog-heath.

37.2.1. Alliance: ***Cerastio-Astragalion nebrodensis*** Pignatti & Nimis ex Brullo 1984

Oromediterranean xeric pulvinate scrub of basophilous and neutrophilous substrates.

Synonyms: *Cerastio-Astragalion nebrodensis* Pignatti & Nimis in Pignatti et al. 1980, nom. illeg. (art. 5).

Holotypus: *Lino-Seslerietum siculae* Pignatti & Nimis 1980 em. Brullo 1984.

Characteristic and differential species: *Astragalus nebrodensis* (Guss.) Strobl, *Euphorbia myrsinites* L., *Helianthemum cinereum* (Cav.) Pers., *Helictochloa cincinnata* (Ten.) Romero Zarco, *Knautia calycina* (C. Presl) Guss., *Odontarrhena nebrodensis* (Tineo) L. Cecchi & Selvi subsp. *nebrodensis*, *Onosma canescens* C. Presl, *Pentanema montanum* (L.) D. Gut. Larr. et al., *Pimpinella tragium* Vill. subsp. *glauca* (C. Presl) C. Brullo & Brullo, *Prangos ferulacea* (L.) Lindl., *Sesleria nitida* Ten. subsp. *sicula* Brullo & Giusso, *Sideritis sicula* Ucria, Viola nebrodensis C. Presl.

Geographical distribution: See order.

Structure and ecology: The communities of basophilous and neutrophilous soils are grouped within the alliance at issue. In particular, they are found on limestones, dolomites, diagenized clays and flysch (Brullo et al., 2005).

Syndynamism: See class.

Habitat reference: See order.

37.2.1.1. ***Lino punctati-Seslieretum siculae*** Pignatti & Nimis in Pignatti et al. 1980 corr. Brullo et al. 2005

Orophilous vegetation with Sicily flax and Sicily nest moor grass of calcareous rocky slopes.

Synonyms: *Lino-Seslerietum nitidae* Pignatti & Nimis 1980 em. Brullo 1984.

Holotypus: rel. 74, tab. 8, Pignatti et al. (1980).

Characteristic and differential species: *Helianthemum nebrodense* Heldr., *Laserpitium siculum* Spreng., *Linum punctatum* C. Presl, *Teucrium montanum* L., *Stipa sicula* Moraldo, La Valva, Ricciardi & Caputo.

Phytosociological table: From Brullo (1984a), tab. 10, 20 rel.

Char. association: *Teucrium montanum* (V), *Laserpitium siculum* (IV), *Linum punctatum* (III), *Stipa sicula* (II), *Helianthemum nebrodense* (I).

Char. alliance: *Onosma canescens* (V), *Pimpinella tragium* subsp. *glauca* (V), *Sesleria nitida* subsp. *sicula* (V), *Astragalus nebrodensis* (V), *Helianthemum cinereum* (IV), *Odontarrhena nebrodensis* subsp. *nebrodensis* (III), *Pentanema montanum* (III), *Avenula cincinnata* (III), *Knautia calycina* (II), *Sideritis sicula* (II), *Euphorbia myrsinites* (II), *Prangos ferulacea* (II).

Char. order: *Helianthemum croceum* (V), *Koeleria splendens* subsp. *splendens* (V), *Asperula aristata* subsp. *scabra* (V), *Sabulina verna* subsp. *grandiflora* (V), *Lomelosia crenata* (V), *Pilosella hoppeana* s.l. (IV), *Galium lucidum* subsp. *venustum* (IV), *Dianthus arrostii* (III), *Jurinea bocconei* (II), *Allium cupanii* (II), *Erysimum bonannianum* (II), *Polycarpon tetraphyllum* subsp. *polycarpoides* (II).

Char. class: *Centaurea parlatoris* (IV), *Petrorhagia saxifraga* subsp. *gasparrinii* (III), *Arabis rosea* (III), *Clinopodium alpinum* subsp. *meridionalis* (III), *Cerastium tomentosum* (III), *Carlina nebrodensis* (III), *Bunium petraeum* (II), *Silene italica* subsp. *sicula* (II), *Phleum hirsutum* subsp. *ambiguum* (II), *Saponaria sicula* (II), *Tragopogon crocifolius* subsp. *nebrodensis* (I).

Other species: *Anthyllis vulneraria* subsp. *maura* (V), *Hypochoeris laevigata* (V), *Festuca circummediterranea* (IV), *Arenaria grandiflora* (IV), *Sedum album* (IV), *Anthemis cretica* (III), *Alyssum siculum* (III), *Micromeria juliana* (III), *Euphorbia rigida* (III), *Juniperus communis* subsp. *hemisphaerica* (III), *Rosa sicula* (II), *Daphne oleoides* (I).

Geographical distribution: This vegetation is restricted to Madonie mountains (Brullo, 1984a; Brullo et al., 2005).

Structure and ecology: The association at issue is linked to carbonatic and dolomitic substrates, colonizing steep slopes, lithosoils, rocky outcrops and consolidated debris in the supramediterranean belt, between 1200 and 1800 m a.s.l.. It forms a discontinuous layer, 20-45 cm high, showing a remarkable floristic richness (Brullo et al., 2005). In fact, its structure is given by many hemicriptophytic and chamaephytic species, which are often equally represented, among them *Teucrium montanum*, *Laserpitium siculum*, *Linum punctatum*, *Onosma canescens*, *Pimpinella tragium* subsp. *glauca*, *Astragalus nebrodensis*, *Helianthemum croceum*, *Koeleria splendens* subsp. *splendens* and *Asperula aristata* subsp. *scabra*. However, sometimes *Sesleria nitida* subsp. *sicula* clearly represents the dominant species. In addition to the typical community, Brullo (1984a) described the subass. *senecionetosum candidi*, which is a glareicolous aspect differentiated by the occurrence of *Jacobaea candida*.

Syndynamism: The *Lino punctati-Seslieretum siculae* represents a primary edapho-xerophilous vegetation of more or less stab. debris and screes, as well as of semi-rupestrian surfaces, where the settlement of forest communities is inhibited by the particular ecological conditions of these stands. However, the degradation of the woody vegetation has favored the extension of this association in secondary habitats, as often evidenced by the presence of scattered individuals of beech and holm oak (Brullo, 1984a). In the most unstable screes, it is replaced by the pioneer vegetation of *Arenario grandiflorae-Rumicetum scutati*, which can later evolve with the gradual consolidation of the clasts towards the vegetation at issue, through an intermediate phase represented by the subass. *senecionetosum candidi*. In the less inclined and more stable slopes this vegetation is replaced by the *Cerastio tomentosi-Juniperetum hemisphaericae*.

Habitat reference: See order.

37.2.1.2. ***Astragaletum nebrodensis*** Pignatti & Nimis in Pignatti et al. 1980

Orophilous pulvinate vegetation with Nebrodi milkvetch of calcareous outcrops

Holotypus: rel. 66, tab. 7, Pignatti et al. (1980).

Characteristic and differential species: *Astragalus nebrodensis* (Guss.) Strobl, *Dianthus siculus* C. Presl.

Phytosociological table: From Brullo (1984a), tab. 13, 10 rel.

Char. association: *Dianthus siculus* (II).

Char. alliance: *Astragalus nebrodensis* (V), *Sesleria nitida* subsp. *sicula* (V), *Avenula cincinnata* (V), *Odontarrhena nebrodensis* subsp. *nebrodensis* (IV), *Pimpinella tragium* subsp.

glauca (III), *Helianthemum cinereum* (III), *Laserpitium siculum* (II), *Linum punctatum* (I), *Pentanema montanum* (I), *Knautia calycina* (I), *Prangos ferulacea* (I), *Euphorbia myrsinites* (I), *Sideritis sicula* (I).

Char. order: *Galium lucidum* subsp. *venustum* (V), *Lomelosia crenata* subsp. *crenata* (V), *Helianthemum croceum* (IV), *Koeleria splendens* subsp. *splendens* (IV), *Asperula aristata* subsp. *scabra* (III), *Pilosella hoppeana* s.l. (III), *Dianthus arrostii* (III), *Allium cupanii* (II), *Erysimum bonannianum* (II), *Jurinea bocconei* (I), *Polycarpon tetraphyllum* subsp. *polycarpoides* (I).

Char. class: *Cerastium tomentosum* (V), *Centaurea parlatoris* (V), *Clinopodium alpinum* subsp. *meridionalis* (IV), *Arabis rosea* (III), *Petrorhagia saxifraga* subsp. *gasparrinii* (III), *Bunium petraeum* (III), *Phleum hirsutum* subsp. *ambiguum* (V), *Silene italica* subsp. *sicula* (V), *Carlina nebrodensis* (IV), *Saponaria sicula* (I).

Other species: *Festuca circummediterranea* (V), *Hyoseris radiata* (V), *Anthyllis vulneraria* subsp. *maura* (IV), *Juniperus communis* subsp. *hemisphaerica* (IV), *Anthemis cretica* (IV), *Euphorbia rigida* (IV), *Hypochoeris laevigata* (IV), *Rosa sicula* (I),

Geographical distribution: This association is endemic of Madonie mountains (Pignatti et al., 1980; Brullo, 1984a; Brullo et al., 2005).

Structure and ecology: The *Astragaletum nebrodensis* grows on eroded soils rich in skeleton, stony slopes, flaky clays and windy ridges at an altitude of 1400-1900 m a.s.l., showing a marked pioneer character. It is a low pulvinate vegetation, 30-70 cm high, dominated by the dwarf shrubs of *Astragalus siculus*, whose thorny cushions provide a sheltered habitat for some herbaceous species, such as *Sesleria nitida* subsp. *sicula*, *Avenula cincinnata*, *Odontarrhena nebrodensis* subsp. *nebrodensis*, *Pimpinella tragium* subsp. *glauca*, *Allium cupanii*, *Dianthus siculus*, *Centaurea parlatoris*, *Viola nebrodensis*, etc. Despite the substantial lack of differential species from the floristic point of view, this community is well defined for its physiognomy, allowing its distinction from the *Lino punctati-Seslieretum siculae* (Brullo et al., 1984a). The optimal aspect of this association occurs in the supramediterranean belt, but this vegetation can be found also at lower altitudes, in secondary habitats (Brullo et al., 2005).

Syndynamism: Probably, *Astragalus nebrodensis* has its primary stands in the rocky calcareous ridges, within the *Lino punctati-Seslieretum siculae* community, but has also a pioneer role in colonizing eroded and incoherent soils of stands with rather extreme climatic conditions. Sometimes, the *Astragaletum nebrodensis* is found also in flat surfaces, where it can potentially evolve towards the beech forest (Brullo, 1984a).

Habitat reference: See order.

37.2.1.3. ***Prangetum ferulaceae*** Raimondo 1980 corr.

Mountain pastures with common basilisk.

Synonyms: *Cerastio-Cachryetum ferulaceae* Brullo & Marcenò 1984 (art. 22).

Holotypus: rel. 1, tab. 5, Raimondo (1980).

Characteristic and differential species: *Astragalus depressus* L., *Prangos ferulacea* (L.) Lindl.

Phytosociological table: From Brullo et al. (2005), tab. 9, 16 rel.

Char. association: *Astragalus depressus* (IV).

Char. alliance: *Prangos ferulacea* (V), *Euphorbia myrsinites* (IV), *Astragalus nebrodensis* (III), *Pentanema montanum* (III), *Odontarrhena nebrodensis* subsp. *nebrodensis* (II), *Helianthemum cinereum* (II), *Knautia calycina* (II), *Avenula cincinnata* (I), *Sideritis sicula* (I), *Viola nebrodensis* (I), *Sesleria nitida* subsp. *sicula* (I), *Pimpinella tragium* subsp. *glauca* (I).

Char. order: *Erysimum bonannianum* (V), *Polycarpon tetraphyllum* subsp. *polycarpoides* (IV), *Galium lucidum* subsp. *venustum* (III), *Dianthus arrostii* (II), *Allium cupanii* (I), *Asperula aristata* subsp. *scabra* (I), *Helianthemum croceum* (I), *Jurinea bocconei* (I), *Trisetum splendens* (I), *Pilosella hoppeana* s.l. (I).

Char. class: *Cerastium tomentosum* (V), *Petrorhagia saxifraga* subsp. *gasparrinii* (V), *Clinopodium alpinum* subsp. *meridionalis* (IV), *Phleum hirsutum* subsp. *ambiguum* (IV), *Silene italica* subsp. *sicula* (IV), *Centaurea parlatoris* (IV), *Bunium petraeum* (III), *Valeriana tuberosa* (III), *Tragopogon crocifolius* subsp. *nebrodensis* (II), *Carlina nebrodensis* (II), *Arabis rosea* (II).

Other species: *Anisantha tectorum* (V), *Festuca cirummediterranea* (V), *Alyssum siculum* (IV), *Dactylis glomerata* (IV), *Petrosedum tenuifolium* (IV), *Rosa sicula* (I).

Geographical distribution: This association occurs only in the Madonie massif (Raimondo, 1980; Brullo, 1984a; Brullo et al., 2005).

Structure and ecology: The flat or gently sloped surfaces with quite deep soils and slightly humid until the beginning of summer, between 1400 and 1900 m a.s.l., are colonized by a mesophilous and nitrophilous community dominated by *Prangos ferulacea*. This vegetation, named *Prangetum ferulaceae*, is linked to overgrazing places. It has quite high coverage values and characterizes the landscape of some areas during the flowering time in June. Among the species of higher rank, *Euphorbia myrsinites*, *Astragalus nebrodensis*, *Cerastium tomentosum*, *Pentanema montanum*, *Erysimum bonannianum*, *Polycarpon tetraphyllum* subsp. *polycarpoides* and *Galium lucidum* subsp. *venustum* are very frequent.

Syndynamism: The primary stands of this vegetation are rocky and karstic habitats, with very primitive soils. However, it is now mainly found in secondary habitats represented by heavily grazed areas.

Habitat reference: See order.

37.2.1.4. ***Carduncello pinnati-Thymetum spinulosi*** Brullo & Marcenò in Brullo 1984

Prostrate vegetation with Sicily thyme and Sicilian safflower of eroded soils with a clay component.

Holotypus: rel. 8, tab. 12, Brullo (1984a).

Characteristic and differential species: *Carthamus pinnatus* Desf., *Scorzonera villosa* Scop. subsp. *columnae* (Guss.) Nyman, *Teucrium chamedrys* L., *Thymus spinulosus* Ten.

Phytosociological table: From Brullo (1984a), tab. 12, 20 rel. (subass. *typicum*).

Char. association: *Thymus spinulosus* (V), *Scorzonera villosa* subsp. *columnae* (V), *Carthamus pinnatus* (IV), *Teucrium chamedrys* (III).

Char. alliance: *Helianthemum cinereum* (V), *Avenula cincinnata* (V), *Sesleria nitida* subsp. *sicula* (IV), *Pentanema montanum* (III), *Prangos ferulacea* (II), *Astragalus nebrodensis* (I), *Euphorbia myrsinites* (I), *Sideritis sicula* (I).

Char. order: *Asperula aristata* subsp. *scabra* (IV), *Koeleria splendens* subsp. *splendens* (IV), *Dianthus arrostii* (IV), *Erysimum bonannianum* (IV), *Helianthemum croceum* (II), *Galium lucidum* subsp. *venustum* (II), *Pilosella hoppeana* s.l. (I), *Lomelosia crenata* (I), *Polycarpon tetraphyllum* subsp. *polycarpoides* (II).

Char. class: *Silene italica* subsp. *sicula* (IV), *Centaurea parlatoris* (III), *Petrorhagia saxifraga* subsp. *gasparrinii* (II), *Clinopodium alpinum* subsp. *meridionalis* (II), *Cerastium tomentosum* (II), *Arabis rosea* (I), *Bunium petraeum* (I), *Carlina nebrodensis* (I), *Tragopogon crocifolius* subsp. *nebrodensis* (I).

Other species: *Anthyllis vulneraria* subsp. *maura* (IV), *Festuca cirummediterranea* (IV), *Dactylis glomerata* (III), *Sinapis pubescens* (II), *Sixalix atropurpurea* (II), *Sedum album* (II), *Eryngium campestre* (II), *Hypochoeris laevigata* (II).

Geographical distribution: This vegetation occurs in Madonie, Sicani and Nebrodi mountains (Brullo, 1984a; Brullo et al., 2005).

Structure and ecology: The *Carduncello pinnati-Thymetum spinulosi* is a very peculiar vegetation dominated by prostrate chamaephytes, 20-35 cm high, sometimes with low coverage values, occurring in the meso- and supramediterranean belt (1100-1400 m a.s.l.). It dwells eroded soils with a relevant percentage of silt and clay, preferring consolidated debris and windy gently-sloping summits with various substrata, including dolomites, limestones and flaky clays (Brullo et al., 2005). The key species are *Carthamus pinnatus*, *Scorzonera villosa* subsp. *columnae*, *Teucrium chamedrys* and *Thymus spinulosus*, growing together with some species of higher rank, among them *Helianthemum cinereum*, *Avenula cincinnata*, *Sesleria nitida* subsp. *sicula Asperula aristata* subsp. *scabra*, *Koeleria splendens* subsp. *splendens*, *Dianthus arrostii* and *Erysimum bonannianum* are very frequent. The subass. *plantaginetosum cupanii* is a very floristically poor aspect, which occurs in the flysch outcrops of Nebrodi mountains and shows a high coverage of transgressive species belonging to *Plantaginion cupanii* (Brullo & Grillo, 1978; Brullo, 1984a).

Syndynamism: This community has a primary role in the windy summit areas and consolidated debris below 1400 m, but its further spread can be favored by deforestation and soil erosion.

Habitat reference: See order.

37.2.1.5. ***Sideritido siculae-Artemisietum albae*** (Raimondo 1980) Brullo & Giusso in Brullo et al. 2005

Orophilous vegetation with Sicily shepherd's tea and white sage of steep rocky slopes.

Synonyms: *Cachryetum ferulaceae* subass. *artemisietosum* Raimondo 1980; *Cerastio-Cachryetum ferulaceae* subass. *artemisietosum* Brullo & Marcenò 1984 (art. 22); *Cachryetum ferulaceae* subass. *vicietosum* Raimondo 1980.

Holotypus: rel. 2, tab. 5, Raimondo (1980).

Characteristic and differential species: *Artemisia alba* Turra, *Sternbergia exscapa* Guss., *Verbascum siculum* Tod. ex Lojac.

Phytosociological table: From Brullo et al. (2005), tab. 10, 25 rel. (subass. *artemisietosum albae*).

Char. association: *Artemisia alba* (V), *Verbascum siculum* (II), *Sternbergia exscapa* (I).

Char. alliance: *Sideritis sicula* (V), *Astragalus nebrodensis* (V), *Prangos ferulacea* (V), *Odontarrhena nebrodensis* (V), *Euphorbia myrsinites* (V), *Pentanema montanum* (III), *Helianthemum cinereum* (III), *Knautia calycina* (III), *Avenula cincinnata* (III), *Sesleria nitida* subsp. *sicula* (II), *Viola nebrodensis* (II), *Pimpinella tragium* subsp. *glauca* (I).

Char. order: *Erysimum bonannianum* (V), *Polycarpon tetraphyllum* subsp. *polycarpoides* (IV), *Galium lucidum* subsp. *venustum* (IV), *Asperula aristata* subsp. *scabra* (IV), *Dianthus arrostii* (II), *Koeleria splendens* subsp. *splendens* (II), *Jurinea bocconei* (II), *Allium cupanii* (I), *Minuartia verna* subsp. *grandiflora* (I).

Char. class: *Clinopodium alpinum* subsp. *meridionalis* (V), *Cerastium tomentosum* (V), *Phleum hirsutum* subsp. *ambiguum* (V), *Silene italica* subsp. *sicula* (V), *Petrorhagia saxifraga* subsp. *gasparrinii* (V), *Centaurea parlatoris* (III), *Carlina nebrodensis* (III), *Bunium petraeum* (III), *Valeriana tuberosa* (II), *Arabis rosea* (II), *Tragopogon crocifolius* subsp. *nebrodensis* (I).

Other species: *Festuca cirummediterranea* (V), *Dactylis glomerata* (V), *Petrosedum tenuifolium* (III), *Lactuca viminea* (III), *Sedum album* (III), *Arrhenatherum elatius* subsp. *nebrodense* (III).

From Brullo et al. (2005), tab. 10, 8 rel. (subass. *vicietosum glaucae*).

Char. association: *Artemisia alba* (III), *Verbascum siculum* (II).

Char. subass.: *Vicia glauca* (V).

Char. alliance: *Sideritis sicula* (V), *Astragalus nebrodensis* (V), *Prangos ferulacea* (V), *Odontarrhena nebrodensis* (IV), *Euphorbia myrsinites* (IV), *Pentanema montanum* (IV), *Viola nebrodensis* (IV), *Helianthemum cinereum* (III), *Avenula cincinnata* (III), *Sesleria nitida* subsp. *sicula* (III), *Pimpinella tragium* subsp. *glauca* (I).

Char. order: *Erysimum bonannianum* (IV), *Polycarpon tetraphyllum* subsp. *polycarpoides* (IV), *Galium lucidum* subsp. *venustum* (IV), *Asperula aristata* subsp. *scabra* (I), *Dianthus arrostii* (II), *Helianthemum croceum* (II), *Jurinea bocconei* (I), *Minuartia verna* subsp. *grandiflora* (I), *Lomelosia crenata* (I), *Pilosella hoppeana* s.l. (I).

Char. class: *Clinopodium alpinum* subsp. *meridionalis* (V), *Cerastium tomentosum* (V), *Phleum hirsutum* subsp. *ambiguum* (V), *Silene italica* subsp. *sicula* (IV), *Petrorhagia saxifraga* subsp. *gasparrinii* (III), *Centaurea parlatoris* (III), *Carlina nebrodensis* (I), *Bunium petraeum* (I), *Valeriana tuberosa* (III), *Arabis rosea* (II), *Tragopogon crocifolius* subsp. *nebrodensis* (I).

Other species: *Festuca cirummediterranea* (V), *Dactylis glomerata* (V), *Arrhenatherum elatius* subsp. *nebrodense* (III), *Galium verticillatum* (III), *Lactuca viminea* (III).

Geographical distribution: This vegetation is restricted to Madonie mountains (Raimondo, 1980; Brullo, 1984a; Brullo et al., 2005).

Structure and ecology: The steep and windy slopes with carbonatic outcrops, between 1000 and 1700 m a.s.l., are colonized by an orophilous community dominated by *Artemisia alba*. According to Brullo et al. (2006), this vegetation, which was originally described by Raimondo (1980) as *Cachryetum ferulaceae* subass. *artemisietosum*, may be ascribed to a different syntaxon named *Sideritido siculae-Artemisietum albae*. The physiognomy of the typical community (subass. *artemisietosum albae* (Raimondo 1980) Brullo & Giusso in Brullo et al. 2005) is given by some chamaephytes and caespitose hemicriptophytes, such as *Verbascum siculum*, *Sideritis sicula*, *Astragalus nebrodensis*, *Prangos ferulacea*, *Alyssum nebrodense*, *Euphorbia myrsinites*, *Erysimum bonannianum*, *Polycarpon tetraphyllum* subsp. *polycarpoides*, etc. A very peculiar aspect (subass. *vicietosum glaucae* (Raimondo 1980) Brullo & Giusso in Brullo et al. 2005) occurs on screes and karstic crests, being characterized by lower coverage values and the clear dominance of hemicryptophytes, including the rare orophyte *Vicia glauca*, whose occurrence gives a floristic differentiation to this subassociation.

Syndynamism: The vegetation at issue replaces the *Prangetum ferulaceae* in the more inclined surfaces with a lower grazing pressure, where has its primary stands.

Habitat reference: See order.

37.2.1.6. ***Seslerio siculae-Melicetum cupanii*** Brullo & Giusso in Brullo et al. 2005

Orophilous vegetation with Sicily nest moor grass and Cupani melic of very steep rocky slopes.

Holotypus: rel. 4, tab. 11, Brullo et al. (2005).

Characteristic and differential species: *Melica cupanii* Guss.

Phytosociological table: From Brullo et al. (2005), tab. 11, 7 rel.

Char. association: *Melica cupanii* (V).

Char. alliance: *Sesleria nitida* subsp. *sicula* (V), *Sideritis sicula* (V), *Astragalus nebrodensis* (V), *Avenula cincinnata* (V), *Prangos ferulacea* (V), *Euphorbia myrsinites* (V), *Odontarrhena nebrodensis* subsp. *nebrodensis* (V), *Helianthemum nebrodense* (V), *Viola nebrodensis* (IV), *Pentanema montanum* (IV), *Pimpinella tragium* subsp. *glauca* (III), *Helianthemum cinereum* (II).

Char. order: *Galium lucidum* subsp. *venustum* (V), *Minuartia verna* subsp. *grandiflora* (V), *Polycarpon tetraphyllum* subsp. *polycarpoides* (IV), *Erysimum bonannianum* (III), *Asperula aristata* subsp. *scabra* (III), *Allium cupanii* (II), *Bunium petraeum* (I),

Char. class: *Clinopodium alpinum* subsp. *meridionalis* (V), *Cerastium tomentosum* (V), *Silene italica* subsp. *sicula* (V), *Petrorhagia saxifraga* subsp. *gasparrinii* (V), *Valeriana tuberosa* (V), *Arabis rosea* (V), *Carlina nebrodensis* (II), *Phleum hirsutum* subsp. *ambiguum* (II).

Other species: *Anthyllis vulneraria* subsp. *busambarensis* (V), *Dactylis glomerata* (V), *Festuca cirummediterranea* (V), *Helianthemum nummularium* subsp. *tomentosum* (V), *Sedum album* (V), *Lactuca viminea* (IV).

Geographical distribution: This vegetation seems confined to Pizzo Carbonara in the Madonie range (Brullo et al., 2005).

Structure and ecology: The *Seslerio siculae-Melicetum cupanii* colonizes the very steep slopes with rocky outcrops and windy ridges within the oromediterranean belt (1800-1900 m a.s.l.). From the floristic point of view, it is well characterized by the occurrence of the endemic *Melica cupanii*, which together with others caespitose hemicryptophytes, such as *Sesleria nitida* subsp. *sicula* and *Avenula cincinnata*, gives a characteristic physiognomy to this vegetation (Brullo et al., 2005).

Syndynamism: This community represents the summital vegetation of calcareous mountains belonging to Madonie range, being replaced by the *Sideritido siculae-Artemisietum albae* in less steep surfaces, often located at lower altitudes.

Habitat reference: See order.

37.2.1.7. ***Peucedanetum nebrodensis*** Brullo & Giusso in Brullo et al. 2005

Orophilous vegetation with Sicily parsley of dolines with northern exposure

Holotypus: rel. 8, tab. 12, Brullo et al. (2005).

Characteristic and differential species: *Siculosciadium nebrodense* (Guss.) C. Brullo et al. (= *Peucedanum nebrodense* (Guss.) Nyman).

Phytosociological table: From Brullo et al. (2005), tab. 12, 9 rel.

Char. association: *Siculosciadium nebrodense* (V).

Char. alliance: *Prangos ferulacea* (V), *Euphorbia myrsinites* (V), *Astragalus nebrodensis* (III), *Helianthemum cinereum* (III).

Char. order: *Allium cupanii* (IV), *Erysimum bonannianum* (IV), *Galium lucidum* subsp. *venustum* (IV), *Polycarpon tetraphyllum* subsp. *polycarpoides* (IV), *Minuartia verna* subsp. *grandiflora* (III).

Char. class: *Petrorhagia saxifraga* subsp. *gasparrinii* (V), *Cerastium tomentosum* (V), *Centaurea parlatoris* (V), *Bunium petraeum* (V), *Herniaria glabra* subsp. *nebrodensis* (IV), *Clinopodium alpinum* subsp. *meridionalis* (III), *Valeriana tuberosa* (III), *Silene italica* subsp. *sicula* (II), *Arabis rosea* (II), *Tragopogon crocifolius* subsp. *nebrodensis* (II).

Other species: *Dactylis glomerata* (V), *Festuca cirummediterranea* (V), *Hypochaeris cretensis* (V), *Crepis vesicaria* (V), *Trifolium pratense* subsp. *semipurpureum* (V), *Sedum hispanicum* (V), *Trifolium repens* (V).

Geographical distribution: This rare community occurs only in the dolines near Pizzo Carbonara (Madonie), which are known as ”Fosse di San Gandolfo”.

Structure and ecology: The bottoms and the inner slopes of dolines with northern exposure, at an altitude of 1800-1900 m, is colonized by a very peculiar vegetation named *Siculosciadietum nebrodensis*. This community is linked to quite deep soils with a good amount of organic matter and fine particles, where the snow persists longer than in adjacent surfaces, providing a certain degree of humidity until the late summer (Brullo et al., 2005). It forms a dense layer, mainly constituted by some hemicryptophytes, as *Prangos ferulacea*, *Euphorbia myrsinites*, *Erysimum bonannianum*, *Petrorhagia saxifraga* subsp. *gasparrinii*, *Cerastium tomentosum*, *Bunium petraeum*, *Herniaria glabra* subsp. *nebrodensis*, etc. The occurrence of *Siculosciadium nebrodense*, belonging to an endemic monotypic genus, gives a significant phytogeographic value to this association.

Syndynamism: During the last years, the primary stands of this community are subject to a strong increase in grazing by wild boars and fallow deers, which determines its progressive floristic impoverishment and threatens the survival of this vegetation.

Habitat reference: See order.

37.2.1.8. ***Seslerio siculae-Helictotrichetum convolutae*** Brullo & Cormaci in Brullo et al. 2005

Mountain grassland with Sicily nest moor grass and Sicily oat of eroded calcareous soils.

Holotypus: rel. 5, tab. 13, Brullo et al. (2005).

Characteristic and differential species: *Helictotrichon convolutum* (C. Presl) Henrard.

Phytosociological table: From Brullo et al. (2005), tab. 13, 15 rel.

Char. association: *Helictotrichon convolutum* (V).

Char. alliance: *Pentanema montanum* (V), *Avenula cincinnata* (V), *Sesleria nitida* subsp. *sicula* (V), *Prangos ferulacea* (III), *Helianthemum cinereum* (II).

Char. order: *Erysimum bonannianum* (V), *Dianthus arrostii* (V), *Allium cupanii* (IV), *Galium lucidum* subsp. *venustum* (IV), *Asperula aristata* subsp. *scabra* (IV), *Koeleria splendens* subsp. *splendens* (I), *Trisetum splendens* (I).

Char. class: *Silene italica* subsp. *sicula* (V), *Centaurea parlatoris* (V), *Clinopodium alpinum* subsp. *meridionalis* (IV), *Arabis rosea* (IV), *Petrorhagia saxifraga* subsp. *gasparrinii* (IV), *Valeriana tuberosa* (IV).

Other species: *Festuca cirummediterranea* (V), *Poa bulbosa* (V), *Sedum album* (V), *Thapsia asclepium* (V), *Anthyllis vulneraria* subsp. *busambarensis* (V), *Scorzonera villosa* (IV).

Geographical distribution: This community was surveyed by Brullo et al. (2005) in the Sicani mountains (Western Sicily).

Structure and ecology: The strongly eroded soils derived from carbonatic rocks, within the supramediterranean belt (1300-1570 m a.s.l.), are covered by a discontinuous vegetation dominated by *Helictotrichon convolutum*. It is the *Seslerio siculae-Helictotrichetum convolutae*, which is clearly referable to *Rumici-Astragaletea siculi* for the occurrence of many taxa belonging to this class and lower syntaxa, among which *Pentanema montanum*, *Avenula cincinnata*, *Sesleria nitida* subsp. *sicula*, *Erysimum bonannianum*, *Dianthus arrostii*, *Allium cupanii*, *Silene italica* subsp. *sicula*, *Centaurea parlatoris*, *Clinopodium alpinum* subsp. *meridionalis*, etc.

Syndynamism: This vegetation is linked to secondary habitats, which are originated from the degradation of woodlands, due to fires, grazing and deforestation. Generally, below 1300 m it progressively shifts towards the *Ampelodesmos mauritanica* dry grasslands.

Habitat reference: See order.

37.2.1.9. ***Festuco rubrae-Seslerietum siculae*** Brullo & Cormaci in Brullo et al. 2005

Mountain grassland with red fescue and Sicily nest moor grass of windy calcareous ridges.

Holotypus: rel. 2, tab. 14, Brullo et al. (2005).

Characteristic and differential species: *Festuca rubra* L.

Phytosociological table: From Brullo et al. (2005), tab. 14, 10 rel.

Char. association: *Festuca rubra* (V).

Char. alliance: *Avenula cincinnata* (V), *Sesleria nitida* subsp. *sicula* (V), *Prangos ferulacea* (IV), *Helianthemum cinereum* (II), *Pentanema montanum* (II).

Char. order: *Erysimum bonannianum* (V), *Galium lucidum* subsp. *venustum* (V), *Dianthus arrostii* (IV), *Asperula aristata* subsp. *scabra* (III), *Allium cupanii* (II), *Koeleria splendens* subsp. *splendens* (I).

Char. class: *Clinopodium alpinum* subsp. *meridionalis* (V), *Silene italica* subsp. *sicula* (V), *Centaurea parlatoris* (IV), *Arabis rosea* (III), *Petrorhagia saxifraga* subsp. *gasparrinii* (I), *Valeriana tuberosa* (I).

Other species: *Thymus spinulosus* (V), *Anthyllis vulneraria* subsp. *maura* (V), *Hypochoeris laevigata* (IV), *Silene vulgaris* (IV), *Festuca cirummediterranea* (IV), *Picris hieracioides* (IV), *Thapsia asclepium* (III), *Selinum silaifolium* (III).

Geographical distribution: This community is restricted to the Sicani mountains (Brullo et al., 2005).

Structure and ecology: The *Festuco rubrae-Seslerietum siculae* occurs on calcareous windy ridges, within the supramediterranean belt (1300-1570 m a.s.l.). It is dominated by caespitose hemicryptophytes, such as *Festuca rubra*, *Sesleria nitida* subsp. *sicula* and *Avenula cincinnata*, which form a dense layer, 15-25 cm high (Brullo et al., 2005). Among the species of higher rank, *Prangos ferulacea*, *Erysimum bonannianum*, *Galium lucidum* subsp. *venustum*, *Dianthus arrostii*, *Clinopodium alpinum* subsp. *meridionalis*, *Silene italica* subsp. *sicula* and *Centaurea parlatoris* show a high coverage.

Syndynamism: The community at issue replaces the previous one in more exposed and windy environments, representing an ecological vicariant. On screes, this association turns progressively into glareicolous vegetation of *Linarion purpureae* (*Scrophulario-Helichrysetea italici* class).

Habitat reference: See order.

37.2.1.10. ***Helichryso italici-Onosmetum canescentis*** Brullo & Guarino in Brullo et al. 2005

Orophilous vegetation with Italian strawflower and hairy vipers bugloss of carbonatic screes and steep stony surfaces.

Holotypus: rel. 4, tab. 15, Brullo et al. (2005).

Characteristic and differential species: *Festuca rubra* L. subsp. *microphylla* St.-Yves, *Helichrysum italicum* (Roth) G. Don, *Onosma canescens* J. Presl & C. Presl.

Phytosociological table: From Brullo et al. (2005), tab. 15, 11 rel.

Char. association: *Helichrysum italicum* (V), *Onosma canescens* (V), *Festuca rubra* subsp. *microphylla* (IV).

Char. alliance: *Pimpinella tragium* subsp. *glauca* (V), *Euphorbia myrsinites* (V), *Avenula cincinnata* (IV).

Char. order: *Dianthus arrostii* (IV), *Galium lucidum* subsp. *venustum* (III), *Lomelosia crenata* (III), *Minuartia verna* subsp. *grandiflora* (III), *Helianthemum croceum* (I).

Char. class: *Clinopodium alpinum* subsp. *meridionalis* (V), *Centaurea parlatoris* (V), *Cerastium tomentosum* (V), *Petrorhagia saxifraga* subsp. *gasparrinii* (IV), *Bunium petraeum* (III), *Arabis rosea* (III), *Silene italica* subsp. *sicula* (II).

Other species: *Helianthemum oelandicum* subsp. *incanum* (V), *Anthyllis vulneraria* subsp. *busambarensis* (V), *Dactylis hispanica* (V), *Carlina hispanica* subsp. *globosa* (V), *Hyoseris radiata* (V), *Micromeria graeca* (V), *Sinapis pubescens* (V), *Origanum vulgare* subsp. *viridulum* (V), *Reichardia picroides* (V).

Geographical distribution: This community was described by Brullo et al. (2005) from Monte Scuderi (Peloritani range), representing the easternmost association of the *Erysimo-Jurineetalia bocconei* order.

Structure and ecology: The association at issue represents the local vicariant of the *Lino-Seslerietum nitidae* in the Peloritani mountains. It is a hemicrypto-chamaephytic vegetation with a sparse coverage, occurring on carbonatic screes and steep rocky places, between 980 and 1140 m a.s.l. It is linked to a supramediterranean bioclimate with lower humid ombrotype. From the floristic point of view, this vegetation lacks of many orophytes, due to the low altitude of Monte Scuderi, while the occurrence of *Helichrysum italicum* emphasizes the relatively xerophilous character of this association. In addition to the above mentioned species, also *Onosma canescens* and *Festuca rubra* subsp. *microphylla* can be considered as differential species. According to Brullo et al. (2005), can be recognized two facies within this association: the first one grows in rocky stands and is characterized by *Lomelosia crenata*; the second one occurs on screes and is differentiated by the high presence of *Pimpinella tragium* var. *glauca*, *Euphorbia myrsinites* and *Galium lucidum* subsp. *venustum*.

Syndynamism: This community is restricted to primary stands.

Habitat reference: See order.

37.2.1.11. ***Plantagini humilis-Asperuletum peloritanae*** Brullo & Guarino in Brullo et al. 2005 corr.

Pulvinate vegetation with prostrate plantain and Peloritani woodruff of windy summital areas with calcareous rocks.

Synonyms: *Plantagini humilis-Asperuletum gussonei* Brullo & Guarino in Brullo et al. 2005.

Holotypus: rel. 2, tab. 16, Brullo et al. (2005).

Characteristic and differential species: *Asperula peloritana* C. Brullo, Brullo, Giusso & Scuderi, *Plantago humilis* Guss.

Phytosociological table: From Brullo et al. (2005), tab. 16, 17 rel.

Char. association: *Asperula peloritana* (IV), *Plantago humilis* (III).

Char. alliance: *Euphorbia myrsinites* (V), *Pimpinella tragium* subsp. *glauca* (III), *Linum punctatum* (II), *Avenula cincinnata* (I), *Onosma canescens* (I), *Prangos ferulacea* (I).

Char. order: *Galium lucidum* subsp. *venustum* (V), *Minuartia verna* subsp. *grandiflora* (IV), *Lomelosia crenata* (III), *Dianthus arrostii* (II).

Char. class: *Cerastium tomentosum* (V), *Petrorhagia saxifraga* subsp. *gasparrinii* (V), *Clinopodium alpinum* subsp. *meridionalis* (IV), *Centaurea parlatoris* (IV), *Silene italica* subsp. *sicula* (IV).

Other species: *Helianthemum oelandicum* subsp. *incanum* (V), *Thymus longicaulis* (IV), *Festuca circummediterranea* (IV), *Hypochoeris cretensis* (IV), *Lolium perenne* (IV), *Anthemis arvensis* subsp. *sphacelata* (IV).

Geographical distribution: As highlighted by Brullo et al. (2005), this community is localized on the summit of Monte Scuderi (Peloritani range).

Structure and ecology: This community is found on flat or inclined calcareous outcrops, between 1100 and 1253 m a.s.l., within the supramediterranean bioclimatic belt with lower humid ombrotype (Brullo et al., 2005). It is a pulvinate hemicrypto-chamaephytic vegetation with a dense coverage, 5-15 cm high, having its phenological optimum at the beginning of June. The key species are *Asperula peloritana*, a local endemism strictly related to *Asperula gussonei* (C. Brullo et al., 2009), and *Plantago humilis*, which is usually found on siliceous substrates. The floristic set includes several calciphilous species, among them *Euphorbia myrsinites*, *Pimpinella tragium* subsp. *glauca*, *Linum punctatum*, *Avenula cincinnata*, *Onosma canescens*, *Galium lucidum* subsp. *venustum*, *Minuartia verna* subsp. *grandiflora*, *Lomelosia crenata*, *Dianthus arrostii*, etc.

Syndynamism: This association is a permanent edaphic vegetation.

Habitat reference: See order.

37.2.2. Alliance: ***Armerion nebrodensis*** Brullo 1984

Oromediterranean xeric pulvinate scrub of siliceous substrates.

Synonyms: *Trifolion humilis* Pignatti & Nimis in Pignatti et al. 1980, non Quézel 1957.

Holotypus: *Plantagini-Armerietum nebrodensis* Pignatti & Nimis in Pignatti et al. 1980

Characteristic and differential species: *Armeria nebrodensis* (Guss.) Boiss., *Avenella flexuosa* (L.) Drejer, *Festuca pignattiorum* Markgr., *Genista cupanii* Guss.

Geographical distribution: This alliance occurs only in the siliceous reliefs of Madonie mountains (Brullo, 1984; Brullo et al., 2005).

Structure and ecology: The alliance at issue groups the silicicolous communities occurring on quartzites and quartzarenites substrates, within the supra- and oromediterranean bioclimatic belt. This vegetation is characterized by the dominance of endemic pulvinate species, as *Armeria nenrodensis*, *Plantago humilis* and *Genista cupanii*. Some authors (Mucina et al., 2016; Guarino et al., 2017) prefer to treat this alliance within the *Rumici-Astragaletalia siculi* order, basing only on its acidophilous requirements, despite the floristic set of this vegetation clearly belongs to *Erysimo-Jurineetalia bocconei*.

Syndynamism: See class.

Habitat reference: See order.

37.2.2.1. ***Genistetum cupanii*** Pignatti & Nimis in Pignatti et al. 1980

Pulvinate vegetation with Cupani broom of quartzitic sunny slopes.

Synonyms: *Carlino nebrodensis-Genistetum cupanii* Gianguzzi, Cusimano, Ilardi & Romano 2015 (syntax. syn.).

Holotypus: rel. 100, tab. 11, Pignatti et al. (1980).

Characteristic and differential species: *Tolpis virgata* (Desf.) Bertol. subsp. *sexaristata* (Biv.) Giardina & Raimondo.

Phytosociological table: From Brullo (1984a), tab. 18, 10 rel.

Char. association: *Tolpis virgata* subsp. *sexaristata* (V).

Char. alliance: *Genista cupanii* (V), *Avenella flexuosa* (V), *Armeria nebrodensis* (II).

Char. order: *Pilosella hoppeana* s.l. (V), *Helianthemum croceum* (IV), *Allium cupanii* (III), *Trisetum splendens* (II), *Erysimum bonannianum* (I), *Asperula aristata* subsp. *scabra* (I), *Dianthus arrostii* (I), *Polycarpon tetraphyllum* subsp. *polycarpoides* (I), *Jurinea bocconei* (I), *Koeleria splendens* subsp. *splendens* (I), *Galium lucidum* subsp. *venustum* (I).

Char. class: *Clinopodium alpinum* subsp. *meridionalis* (IV), *Arabis rosea* (IV), *Petrorhagia saxifraga* subsp. *gasparrinii* (IV), *Carlina nebrodensis* (III), *Silene italica* subsp. *sicula* (III), *Phleum hirsutum* subsp. *ambiguum* (III), *Bunium petraeum* (I), *Cerastium tomentosum* (I), *Centaurea parlatoris* (I), *Rumex multifidus* (I).

Other species: *Anthoxanthum odoratum* (V), *Aira caryophyllea* (V), *Festuca circummediterranea* (IV), *Plantago cupanii* (IV), *Petrosedum tenuifolium* (IV), *Carex flacca subsp. erythrostachys* (IV), *Crataegus laciniata* (IV), *Jasione montana* (IV), *Asphodelus ramosus* (IV).

Geographical distribution: See alliance.

Structure and ecology: The association at issue is linked to quartzitic sunny slopes with poorly evolved acidic soils, between (800)1100 and 1700 m a.s.l., within the supramediterranean bioclimatic belt. It is characterized by the dominance of the big and dense pulvines of *Genista cupanii*, which can measure up to 1 m in diameter (Brullo et al., 2005). The only characteristic species is *Tolpis virgata* subsp. *sexaristata*, while the alliance is represented also by *Avenella flexuosa* and *Armeria nebrodensis*. Among the species belonging to *Erysimo-Jurineetalia bocconei* order, *Pilosella hoppeana* s.l., *Helianthemum croceum* and *Allium cupanii* are frequent. Gianguzzi et al. (2015) considered the community surveyed by Pignatti et al. (1980) and Brullo (1984a) as a depleted aspect of secondary habitats, observing a remarkable enrichment of nanophanerophytic and chamaephytic thermophilous species in the intact cacuminal stands. Consequently, they proposed a new association, named *Carlino nebrodensis-Genistetum cupanii*, referring it to *Cisto-Lavanduletea* Br.-Bl. in Br.Bl., Molinier & Wagner 1940 class.

Syndynamism: The primary stands of this association are found in very primitive soils, where pedogenetic processes are hindered (Brullo et al., 2005). However, the *Genistetum cupanii* often occurs in secondary habitats, representing an early stage in the *Anemono apenninae-Fagetum* and *Ilici aquifolii-Quercetum austrothyrrenicae* dynamic series. In fact, the degradation of these woods initially favours the secondary shrublands of *Crataego-Prunetea spinosae*, which turns in the *Genistetum cupanii* following soil erosion and grazing pressure. In particular, livestock favors the dispersal of *Genista cupanii* seeds and at the same time rarely eat its seedlings (Marino et al., 2012).

Habitat reference: See order.

37.2.2.2. ***Plantagini humilis-Armenietum nebrodensis*** Pignatti & Nimis in Pignatti et al. 1980

Pulvinate vegetation with prostrate plantain and Nebrodi thrift of windy ridges and stony slopes with acidic soils.

Holotypus: rel. 92, tab. 10, Pignatti et al. (1980).

Characteristic and differential species: *Bellardiochloa variegata* (Lam.) Kerguélen, *Minuartia recurva* (All.) Schinz & Thell subsp. *condensata* (C. Presl) Greuter & Burdet, *Plantago humilis* Guss., *Scleranthus annuus* L.

Phytosociological table: From Brullo (1984a), tab. 16, 15 rel.

Char. association: *Plantago humilis* (V), *Minuartia recurva* subsp. *condensata* (IV), *Scleranthus annuus* (III), *Bellardiochloa variegata* (III).

Char. alliance: *Armeria nebrodensis* (V), *Genista cupanii* (II), *Avenella flexuosa* (II).

Char. order: *Pilosella hoppeana* s.l. (V), *Polycarpon tetraphyllum* subsp. *polycarpoides* (IV), *Jurinea bocconei* (III), *Dianthus arrostii* (III), *Valeriana tuberosa* (III), *Asperula aristata* subsp. *scabra* (II), *Koeleria splendens* subsp. *splendens* (II), *Erysimum bonannianum* (II), *Galium lucidum* subsp. *venustum* (I), *Allium cupanii* (I), *Lomelosia crenata* (I).

Char. class: *Petrorhagia saxifraga* subsp. *gasparrinii* (V), *Herniaria glabra* subsp. *nebrodensis* (IV), *Clinopodium alpinum* subsp. *meridionalis* (III), *Arabis rosea* (III), *Bunium petraeum* (I), *Silene italica* subsp. *sicula* (III), *Rumex multifidus* (III), *Bellardiochloa variegata* subsp. *nebrodensis* (III), *Carlina nebrodensis* (II), *Phleum hirsutum* subsp. *ambiguum* (II), *Cerastium tomentosum* (I), *Centaurea parlatoris* (I).

Other species: *Anthemis cretica* (V), *Festuca circummediterranea* (IV), *Petrosedum tenuifolium* (IV), *Aira caryophyllea* (IV), *Saxifraga granulata* (IV), *Erophila verna* (IV), *Minuartia verna* (III), *Silene conica* (III), *Cerastium semidecandrum* (III).

Geographical distribution: See alliance.

Structure and ecology: It is an orophilous vegetation dominated by small pulvinate species, as *Armeria nebrodensis*, *Plantago humilis*, *Dianthus arrostii* and *Minuartia recurva* subsp. *condensata*, growing on strongly eroded soils of windy ridges and stony plateaux between 1700 and 1900 m a.s.l. (Brullo et al., 2005). This community is strictly linked to Numidian flysch substrate with a very acidic soil (pH: 5,4-6), whose pedogenetic evolution is slowed by cryoturbation and aeolic erosion (Pignatti et al., 1980). The floristic set includes several species of order and class, such as *Pilosella hoppeana* s.l., *Polycarpon tetraphyllum* subsp. *polycarpoides*, *Jurinea bocconei*, *Petrorhagia saxifraga* subsp. *gasparrinii*, *Herniaria glabra* subsp. *nebrodensis*, etc.

Syndynamism: Generally, this vegetation represents an edaphic climax, though sometimes it can colonize also secondary habitats derived from the beech tree degradation, but only in very exposed and windy stands (Brullo, 1984a).

Habitat reference: See order.

38. Class: ***Cisto-Lavanduletea stoechadis*** Br.-Bl. in Br.-Bl., Molinier & Wagner 1940

Western mediterranean scrub and garrigue of eroded siliceous soils.

Synonyms: *Cisto-Lavanduletea* Br-Rl. 1940, excl. *Helianthemetea* Br-Rl. (1940) 1952; *Cisto-Lovanduletea* (Br.-Bl. 1940) Rivas Goday 1964 pp.; *Carici-Genistetea lobelii* Klein 1972 (syntax. syn.) p.p.; *Carlinetea macrocephalae* Gamisans 1977 (art. 29) p.p.

Lectotypus: *Lavanduletalia stoechadis* Br.-Bl. 1940 em. Rivas-Martínez 1968.

Characteristic and differential species: *Cistus monspeliensis* L.*, Cistus salvifolius* L., *Cytinus hypocistis* (L.) L. subsp. *hypocistis, Cytinus hypocistis* (L.) L. subsp. *clusii* Nyman, *Genista monspessulana* (L.) L.A.S. Johnson, *Lavandula stoechas* L.*, Pulicaria odora* (L.) Rchb.

Geographical distribution: This class is mainly distributed in the Western Mediterranean area, having its greater diversity in the Iberian Peninsula and North Africa (Rivas-Martinez, 1979; Biondi, 1997; Rivas-Martinez et al., 2011; Costa et al., 2012; Loidi, 2017).

Structure and ecology: According to Rivas-Martinez (1979), the xerophilous chamaephytic and nanophanerophytic vegetation of eroded siliceous soils is ascribed to *Cisto-Lavanduletea stoechadis*. Generally, the communities of this class appear as a dense and low scrub or garrigue dominated by various species of *Cistus* and *Genista* genera, as well as by some taxa belonging to *Lamiaceae* family. This class shows a very depleted floristic set in Sicily, lacking most of the typical acidophilous species occurring in the Iberian Peninsula and North Africa. From the syntaxonomic point of view, Mucina et al. (2016) proposed to included here also the Eastern Mediterranean alliances of siliceous substrates, formerly classified in the *Cisto-Micromerietea*, considering this class superfluous and recognizing the geographical criterion only at order rank, despite the clear floristic differentiation between the Western and the Eastern Mediterranean communities.

Syndynamism: This vegetation has a secondary role, replacing the thermophilous woods and maquis of *Quercetea ilicis* on degraded stands with very primitive soils. Its settlement is often favored by fires, grazing and the consequent leaching of soil.

Habitat reference: F6.1b Western acidopholous garrigue.

38.1. Order: ***Lavanduletalia stoechadis*** Br.-Bl. in Br.-Bl., Molinier & Wagner 1940

Western Mediterranean garrigue and other scrub on hard acidic siliceous and ultramafic bedrocks.

Synonyms: *Lavanduletalia stoechadis* Br.-Bl. 1931 (art. 2b)*; Stoechado-Lavanduletalia* Rothmaler 1943 (orig.form) (art. 10); *Ulici-Cistetalia* Br.-Bl. et al. 1964 (syntax.syn.); *Teucrio-*

Santolinetalia Arrigoni 1986 (syntax.syn.); *Myrto communis-Ericetalia scopariae* Paradis & Pozzo di Borgo 2005 (syntax.syn.).

Lectotypus: *Cistion laurifolii* Rivas Goday in Rivas Goday, Borja, Monasterio, Galiano & Rivas-Martínez 1960.

Characteristic and differential species: See class.

Geographical distribution: See class.

Structure and ecology: The order at issue gathers the scrub communities of siliceous cohesive soils, with a loamy, sandy or coarse texture (Costa et al., 2012).

Syndynamism: See class.

Habitat reference: See class.

38.1.1. Alliance: ***Calicotomo villosae–Genistion tyrrhenae*** Biondi 1997

Thermomediterranean acidophilous coastal garrigue of the southwestern Tyrrhenian seaboards**.**

Holotypus: *Erico multiflorae-Genistetum tyrrhenae* Biondi 2000

Characteristic and differential species: *Cytisus villosus* Pourr., *Micromeria consentina* (Ten.) N. Terracc., *Trifolium bivonae* Guss.

Geographical distribution: This alliance is endemic of the south-western Tyrrhenian area (Biondi, 1997; Gianguzzi et al., 2015).

Structure and ecology: This alliance groups the acidophilous and thermophilous garrigues dominated by local endemic species of *Genista*, which colonizes various kinds of siliceous substrates in the infra- and thermomediterranean belt. Within this syntaxon, Gianguzzi et al. (2015) recognized also the subass. *Genisto aristatae–Calicotomenion infestae*, which includes some mesophilous communities with primary stands in rocky ridges and very stony surfaces in the meso- and supra-mediterranean belts.

Syndynamism: See class.

Habitat reference: See class.

38.1.1.1. ***Cistus salvifolii-Genistetum madoniensis*** Marino et al. 2012

Thermophilous garrigue with sage-leaved rock-rose and Madonie broom of Numidian flysch substrates.

Holotypus: rel. 1, tab. 5, Marino et al. (2012).

Characteristic and differential species: *Genista madoniensis* Raimondo.

Phytosociological table: From Marino et al. (2012), tab. 5, 15 rel.

Char. association: *Genista madoniensis* (V).

Char. alliance, order and class: *Cistus salvifolius* (V), *Lavandula stoechas* (V), *Cytinus hypocistis* subsp. *hypocistis* (IV), *Cytisus villosus* (III), *Cistus monspeliensis* (III), *Pulicaria odora* (I), *Trifolium bivonae* (I).

Other species: *Erica arborea* (V), *Quercus suber* (V), *Calicotome infesta* (V), *Briza maxima* (V), *Eryngium tricuspidatum* subsp. *bocconei* (V), *Cistus creticus* subsp. *creticus* (IV), *Arbutus unedo* (IV), *Rubia peregrina* (III).

Geographical distribution: This vegetation is restricted to the low northern slopes of Madonie mountains, namely in the localities of Gratteri, Lascari, Pollina, Cefalu` and San Mauro Castelverde (Marino et al., 2012; Gianguzzi et al., 2015).

Structure and ecology: This community is a thermophilous garrigue dominated by the endemic *Genista madoniensis*, growing together with others shrubby species, as *Lavandula stoechas*, *Cistus salvifolius*, *C. monspeliensis*, *C. creticus* subsp. *creticus* and *Erica arborea*. It is found on siliceous substrates belonging to Numidic Flysch, at altitudes between 200 m and 600(700) m a.s.l. From the bioclimatic point of view, this community is linked to the upper thermomediterranean and low mesomediterranean belts with upper subhumid ombrotype (Marino et al., 2012).

Syndynamism: The *Cistus salvifolii-Genistetum madoniensis* is connected with the dynamic series of thermophilous cork oak woods, having a pioneer role in secondary stands affected by quite frequent fires. As regards *Genista madoniensis*, it has a primary habitat in the small rocky outcrops, where constitutes almost pure monospecific populations (Marino et al., 2012).

Habitat reference: See class.

38.1.1.2. ***Genisto aristatae–Cistetum salvifolii*** Gianguzzi, Cusimano, Ilardi & Romano 2015

Mesophilous garrigue with Nebrodi broom and sage-leaved rock-rose of acidic soils.

Holotypus: rel. 1, tab. SVII, Gianguzzi et al. (2015).

Characteristic and differential species: *Genista demarcoi* Brullo, Scelsi & Siracusa, *Helichrysum nebrodense* Heldr., *Matthiola fruticulosa* (L.) Maire subsp. *fruticulosa*.

Phytosociological table: From Gianguzzi et al. (2015), tab. SIV, 16 rel.

Char. association: *Genista aristata* (V).

Char. alliance, order and class: *Cistus salvifolius* (V), *Tolpis virgata* subsp. *gussonei* (V), *Pulicaria odora* (IV), *Trifolium bivonae* (IV), *Eryngium tricuspidatum* subsp. *bocconei* (III), *Cytinus hypocistis* (I),

Other species: *Cytisus infestus* (V), *Erica multiflora* (V), *Micromeria graeca* subsp. *consentina* (IV), *Ampelodesmos mauritanicus* (III), *Erica arborea* (III), *Cistus monspeliensis* (II), etc.

Geographical distribution: This community occurs in the Tyrrhenian side of Madonie and Nebrodi mountains (Gianguzzi et al., 2015).

Structure and ecology: The community at issue colonizes acidic soils, generally belonging to Numidian flysch, at an altitude between 500 and 800 m a.s.l., within the lower mesomediterranean bioclimatic belt with upper subhumid ombrotype (Gianguzzi et al., 2015). Its physiognomy is given by *Cistus salvifolius* and *Genista aristata*, which are associated with *Cistus creticus* subsp. *creticus*, *Calicotome infesta* subsp. *infesta*,*Micromeria graeca* subsp. *consentina*, *Trifolium bivonae* and *Eryngium tricuspidatum* var. *bocconii*.

Syndynamism: It is a secondary stage that is dynamically linked to the degradation of mesic cork oak woods belonging to *Genisto aristatae-Quercetum suberis*.

Habitat reference: See class.

39. Class: ***Cisto-Micromerietea*** Oberd. 1954

Thermophilous garrigues and phrygana of Central and Eastern Mediterranean areas.

Synonyms: *Erico-Cistetea Trinajstič 1978 (phantom)*; *Erico-Cistetea* Trinajstič 1985 (art. 5), *Ononido-Rosmarinetea* Br.-Bl. in A. Bolòs y Vayreda 1950 sensu Mucina et al. 2016 (p.p.).

Holotypus: *Cisto-Micromerietalia* Oberd. 1954

Characteristic and differential species: *Cistus creticus* subsp. *creticus* L., *C. salvifolius* L., *Coridothymus capiatatus* (L.) Reichenb., *Cytinus hypocistis* (L.) L., *Cytisus laniger* DC., *Dorycnium hirsutum* (L.) Ser., *Fumana arabica* (L.) Spach, *F. laevipes* (L.) Spach, *F. thymifolia* (L.) Webb., *Globularia alypum* L., *Micromeria graeca* (L.) Rechb., *M. nervosa* (Desf.) Bentham, *Phagnalon rupestre* (L.) DC., *Teucrium capitatum* L.

Geographical distribution: This class occurs in the Central (South Tyrrhenian and Adriatic coasts) and Eastern Mediterranean areas (Oberdorfer, 1954; Barbero & Quezel, 1989; Brullo et al., 1997).

Structure and ecology: The class at issue includes the thermophilous shrub vegetation dominated by chamaephytes and nano-phanerophytes, often with a thorny-pulvinate habitus, which occurs both on calcareous and acidic soils (limestones, marls, clays, vulcanites, sands, granites, schists, etc.) In fact, as highlighted by several authors (Oberdorfer, 1954; Horvatic, 1963; Raus, 1979, Biondi et al., 1994; Brullo et al., 1997), in the eastern Mediterranean area the floristic set of garrigues and phryganas tends to be fairly constant regardless of the kind of substrate and clearly differentiated from that of similar western communities. For this reason the proposal by Mucina et al. (2016) to include all the calciophilous garrigues of the Mediterranean in the *Ononido-Rosmarinetea* class cannot be accepted and at the same time it should be preferable to not distinguish from the syntaxonomic point of view the eastern communities on the basis of the substrata (unlike the Western area). Therefore, the *Cisto-Micromerietea* class should be considered an eastern vicariant of both *Cisto-Lavanduletea* and *Ononido-Rosmarinetea*.

Syndynamism: The garrigues belonging to this class represent a primary aspect only on dry outcrops and rocky ridges, although more frequently their settlement derives from the degradation of the forest and maquis communities due to anthropogenic disturbance and the consequent erosion of denuded slopes (Gianguzzi et al., 2015). In particular, many frequent species of garrigues show specific adaptations to overgrazing, thanks to the presence of ethereal oils, and are able to have a rapid recovery after repeated fires (Guarino et al., 2005).

Habitat reference: F6.2 Eastern garrigue**;** F7.3 Eastern Mediterranean spiny heath (phrygana).

39.1. Order: ***Cisto-Ericetalia*** Horvatic 1958

Thermophilous garrigues and phrygana of South Tyrrhenian and Adriatic areas.

Synonyms: *Cisto-Micromerietalia* Oberd. 1954 (p.p.).

Holotypus: *Cisto-Ericion* Horvatic 1958

Characteristic and differential species: *Cistus creticus* L. subsp. *eriocephalus* (Viv.) Greuter & Burdet, *Coris monspeliensis* L., *Coronilla valentina* L., *Erica multiflora* L., *Helictotrichon convolutum* (Presl) Henrard, *Ononis minutissima* L., *Rosmarinus officinalis* L.

Geographical distribution: This order occurs only in the Central Mediterranean area (Tyrrhenian and Adriatic territories).

Structure and ecology: Originally, Oberdorfer (1954) described only one order within the *Cisto-Micromerietea* class, named *Cisto-Micromerietalia*. According to Brullo et al. (1997), it should be framed in two syntaxa based on a geographical criterion: the eastern alliances are included in the *Sarcopoterietalia spinosi* Eig 1939, while the central ones are classified in the

Cisto-Ericetalia. The latter includes the more or less thermophilous garrigues occurring from the coast to low mountains on various kinds of soil.

Syndynamism: See class.

Habitat reference: See class.

39.1.1. Alliance: ***Cisto eriocephali–Ericion multiflorae*** Biondi 1997

Thermo-xerophilous, coastal and subcoastal garrigues of the Tyrrhenian sector of the Italian peninsula

Synonyms: *Cisto-Ericion* Horvatic sensu Brullo et al. 1997; *Polygalo preslii-Ericion multiflorae* Guarino & Pasta 2017.

Holotypus: *Rosmarino officinalis-Thymetum capitati* Furnari 1965

Characteristic and differential species: See order.

Geographical distribution: This alliance is endemic of the central and southern Tyrrhenian area of Italy (Biondi, 1997).

Structure and ecology: The alliance at issue includes the low shrub communities occuring from the coastal to low mountain areas on various types of soil. In the new syntaxonomical framework of *Ononido-Romarinetea* class proposed by Mucina et al. (2016), Guarino & Pasta (2017) proposed to classify the endemite-rich garrigues of North-Western Sicily in a proper alliance named *Polygalo preslii-Ericion multiflorae*.

Syndynamism: See class.

Habitat reference: See class.

39.1.1.1. ***Rosmarino officinalis-Coridothymetum capitati*** Furnari 1965

Thermophilous garrigue with common rosemary and shrubby thyme of clay and marly soils.

Holotypus: rel. 8, tab. 3, Furnari (1965).

Characteristic and differential species: *Coridothymus capitatus* (L.) Rchb. f.

Phytosociological table: From Giusso del Galdo et al. (2008), tab. 15, 6 rel.
Char. association: *Coridothymus capitatus* (V).

Char. alliance, order and class: *Rosmarinus officinalis* (V), *Phagnalon rupestre* subsp. *annoticum* (V), *Cistus creticus* (V), *Erica multiflora* (V), *Teucrium capitatum* (V), *Cistus monspeliensis* (IV), *Fumana thymifolia* (IV), *Cistus salvifolius* (III), *Fumana laevipes* (III), *Avenula cincinnata* (III), *Fumana arabica* (II), *Fumana ericoides* (II), *Micromeria graeca* (II).

Other species: *Ampelodesmos mauritanicus* (V), *Cytisus infestus* (V), *Dactylis hispanica* (V), *Anthyllis vulneraria* subsp. *maura* (V), *Chamaerops humilis* (V), *Charybdis pancration* (V), *Asphodelus ramosus* (V), *Foeniculum vulgare* subsp. *piperitum* (V), *Hyparrhenia hirta* (V), etc.

Geographical distribution: This association occurs mainly in central and southern Sicily, particularly from the Hyblean area to the Agrigento district (Furnari, 1965; Bartolo et al., 1982; Giusso et al., 2008; Cusimano et al., 2014). Besides, it occurs also in Pantelleria island (Brullo et al., 1977).

Structure and ecology: The dry inner stands and less frequently also the coastal ones are colonized by a thermo-xerophilous garrigue dominated by *Rosmarinus officinalis* and *Coridothymus capitatus*. It is the *Rosmarino officinalis-Coridothymetum capitati*, which is found mainly on marls, clays, calcarenites and sometimes also on chalks and sands (Bartolo et al., 1982). From the structural point of view, this vegetation may appear to be an almost monospecific community dominated by *Rosmarinus officinalis*, particularly on very rocky surfaces, or on the contrary it can be constituted by various shrub species, such as *Phagnalon rupestre* subsp. *annoticum*, *Cistus creticus*, *Erica multiflora*, *Teucrium capitatum*, *Cistus salvifolius*, etc.

Syndynamism: Probably, this association has a primary role only on the calcarenitic and marly outcrops of very arid coastal areas, while in most cases it is a secondary community that grows after the fire of maquis and forest vegetation. In particular, it belongs to the dynamic series of *Coridothymo-Pinetum halepensis* (in the marly soils of coastal areas), *Pistacio lentisci-Quercetum ilicis* (in the inner stands) and *Calicotomo-Juniperetum turbinatae* (in the coastal calcarenitic stands).

Habitat reference: See class.

39.1.1.2. ***Erico multiflorae-Micromerietum fruticulosae*** Brullo & Marcenò 1983

Thermophilous garrigue with sea micromeria and mediterranean heath of coastal areas with calcareous soils.

Synonyms: *Brachypodio ramosi-Micromerietum fruticulosae* Gianguzzi & La Mantia 2008.

Holotypus: rel. 10, tab. 3, Brullo & Marcenò (1983b).

Characteristic and differential species: *Micromeria fruticulosa* (Bertol.) Grande

Phytosociological table: From Brullo & Marcenò (1983), tab. 3, 15 rel.

Char. association: *Micromeria fruticulosa* (V).

Char. alliance, order and class: *Rosmarinus officinalis* (V), *Cistus creticus* subsp. *eriocephalus* (V), *Erica multiflora* (V), *Globularia alypum* (V), *Coronilla valentina* (IV), *Fumana thymifolia* (IV), *Ononis minutissima* (III), *Fumana laevipes* (III), *Cistus salvifolius* (II), *Cistus monspeliensis* (II), *Cytinus hypocistis* (I), *Coridothymus capitatus* (I).

Other species: *Pistacia lentiscus* (V), *Ruta chalepensis* (IV), *Dactylis hispanica* (IV), *Phagnalon saxatile* (IV), *Euphorbia dendroides* (III), *Daphne gnidium* (III). *Helichrysum panormitanum* (III), etc.

Geographical distribution: This community was originally described by Brullo & Marcenò (1983b) from Marettimo islands (Aegadian Islands), but occurs also in many coastal places of North-Western Sicily (Gianguzzi et al., 1993).

Structure and ecology: The *Erico multiflorae-Micromerietum fruticulosae* is a very dense garrigue, whose physiognomy is given by *Erica multiflora*, usually associated with the endemic *Micromeria fruticulosa* and other chamaephytes and nano-phanerophytes, among them *Cistus creticus* subsp. *eriocephalus*, *Globularia alypum*, *Coronilla valentina*, *Fumana thymifolia*, *Rosmarinus officinalis*, etc. This vegetation is found from the sea level until 400 m (always in coastal areas) and grows on more or less eroded limestone substrata.

Syndynamism: This association represents a secondary stage of holm oak woods belonging to *Rhamno-Quercetum ilicis* (NW Sicily) and *Pistacio lentisci-Quercetum ilicis* subass. *daphnetosum sericeae* (Marettimo). The primary stands are perhaps represented by small clearings inside the wood (Brullo & Marcenò, 1983b).

Habitat reference: See class.

39.1.1.3. ***Erico multiflorae-Polygaletum preslii*** Marcenò & Colombo 1982

Calciophilous and mesic garrigue with Presl milkwort and Mediterranean heath of inner stands.

Holotypus: rel. 15, tab. 1, Marcenò & Colombo (1982).

Characteristic and differential species: *Hippocrepis glauca* Ten., *Ononis pusilla* L., *Rhaponticum coniferum* (L.) Greuter, *Polygala preslii* Spreng., *Silene kemoniana* C. Brullo et al., *Viola ucriana* Raimondo & Erben.

Phytosociological table: From Marcenò & Colombo (1982), tab. 1, 15 rel.

Char. association: *Polygala preslii* (V), *Rhaponticum coniferum* (V), *Hippocrepis glauca* (III).

Char. alliance, order and class: *Erica multiflora* (V), *Fumana thymifolia* (V), *Cistus salvifolius* (IV), *Coridothymus capitatus* (III), *Cistus creticus* subsp. *eriocephalus* (III), *Coris monspeliensis* (II), *Rosmarinus officinalis* (I), *Fumana laevipes* (I),

Other species: *Spartium junceum* (I), etc.

Geographical distribution: This vegetation is restricted to Palermo and Sicani mountains, in the North-Western part of Sicily (Marcenò & Colombo, 1982; Bazan & Marino, 2005).

Structure and ecology: Above 300-400 m a.s.l., the thermophilous garrigue of *Erico multiflorae-Micromerietum fruticulosae* is replaced by a more mesic vegetation dominated by *Erica multiflora*, which was described by Marcenò & Colombo (1982) as *Erico multiflorae-Polygaletum preslii*. It prefers the more or less inclined calcareous slopes, often with abundant outcropping of rocks and very rich in debris material. Under the floristic profile, it is characterized by the occurrence of the endemic *Polygala preslii* and some other rare or endemic species, as *Rhaponticum conifera*, *Coris monspeliensis*, *Hippocrepis glauca*, *Viola ucriana*, *Silene kemoniana* and *Ononis pusilla*.

Syndynamism: This vegetation has a secondary role, growing after deforestation and overgrazing of *Quercus virgiliana* and *Q. ilex* woods belonging to *Oleo-Quercetum virgilianae* and *Ampelodesmo mauritanici-Quercetum ilicis*. In the most eroded surfaces and in areas subject to repeated fires, the garrigues are replaced by dry grasslands with *Ampelodesmos mauritanicus*.

Habitat reference: See class.

39.1.1.4. ***Coridothymo capitati-Helichrysetum stoechadis*** Barbagallo 1983

Thermo-xerophilous garrigue with shrubby thyme and shrubby everlasting of sandy soils.

Holotypus: rel. 5, tab. 1, Barbagallo (1983).

Characteristic and differential species: *Gagea trinervia* (Viv.) Greuter, *Helichrysum stoechas* (L.) Moench, *Stachys arenaria* Vahl, *Stipa gussonei* Moraldo.

Phytosociological table: From Barbagallo (1983b), tab. 1, 15 rel.

Char. association: *Helichrysum stoechas* (V), *Stachys arenaria* (II), *Stipa gussonei* (II), *Gagea trinervia* (I).

Char. alliance, order and class: *Rosmarinus officinalis* (V), *Fumana thymifolia* (V), *Cistus creticus* (V), *Coridothymus capitatus* (V), *Cistus salvifolius* (V), *Teucrium capitatum* (V), *Erica multiflora* (IV), *Cistus monspeliensis* (III), *Micromeria nervosa* (II).

Geographical distribution: This vegetation occurs only in southern Sicily, particularly near Caltagirone, Niscemi and Gela (Barbagallo, 1983b; Minissale & Sciandrello, 2005).

Structure and ecology: In the inner stands with sandy soils the *Rosmarino officinalis-Coridothymetum capitati* is vicaried by a psammophilous garrigue, which is characterized by the occurrence of *Helichrysum stoechas* and some very rare species, as *Gagea trinervia*, *Stipa gussonei* and *Stachys arenaria* (Barbagallo, 1983b). It is the *Coridothymo capitati-Helichrysetum stoechadis*, whose floristic set includes also some species of higher rank, among them *Rosmarinus officinalis*, *Fumana thymifolia*, *Cistus creticus*, *Coridothymus capitatus*, *Cistus salvifolius*, *Teucrium capitatum*, *Erica multiflora*, etc.

Syndynamism: The settlement of this association derives from the degradation of the cork woods belonging to *Stipo bromoidis-Quercetum suberis* (Minissale & Sciandrello, 2005).

Habitat reference: See class.

39.1.1.5. ***Coridothymo capitati-Pinetum halepensis*** De Marco & Caneva 1985

Thermophilous garrigue with shrubby thyme and a sparse canopy of Aleppo pine.

Synonyms: *Rosmarino-Thymetum capitati* Bartolo et al. 1978, non Furnari 1965

Holotypus: rel. 10, single tab., Bartolo et al. (1978).

Characteristic and differential species: *Pinus halepensis* Mill.

Phytosociological table: From Bartolo et al. (1978), single tab., 16 rel. (subass. *globularietosum*).

Char. association: *Pinus halepensis* (V).

Char. subass.: *Globularia alypum* (IV).

Char. alliance, order and class: *Rosmarinus officinalis* (V), *Coridothymus capitatus* (V), *Cistus monspeliensis* (V), *Fumana thymifolia* (IV), *Cistus creticus* (IV), *Cytisus infestus* (IV), *Cistus salvifolius* (IV), *Phagnalon rupestre* (III), *Erica multiflora* (III), *Teucrium capitatum* (III), *Cytinus hypocistis* (II), *Lotus hirsutus* (I), *Coronilla valentina* (I), *Fumana laevipes* (I).

Other species: *Pistacia lentiscus* (V), *Teucrium fruticans* (V), *Asparagus acutifolius* (IV), *Coronilla scorpioides* (IV), *Serapias vomeracea* (IV), *Hedysarum spinosissimum* (IV), *Asphodelus ramosus* (IV), etc.

From Bartolo et al. (1986), tab. 1, 15 rel. (subass. *sarcopoterietosum*).

Char. association: *Pinus halepensis* (V).

Char. subass.: *Sarcopoterium spinosum* (V).

Char. alliance, order and class: *Rosmarinus officinalis* (V), *Cistus creticus* (V), *Cistus salvifolius* (V), *Cytinus hypocistis* (V), *Erica multiflora* (V), *Cistus monspeliensis* (V), *Lotus hirsutus* (IV), *Coridothymus capitatus* (IV), *Teucrium capitatum* (III), *Fumana thymifolia* (III), *Phagnalon rupestre* (II), *Fumana ericoides* (II), *Micromeria nervosa* (II), *Ononis pusilla* (II), *Fumana arabica* (I).

Other species: *Pistacia lentiscus* (V), *Ampelodesmos mauritanicus* (V), *Teucrium fruticans* (IV), *Asparagus acutifolius* (IV), *Quercus ilex* (III), *Olea europaea* (III), *Phyllirea latifolia* (III), etc.

Geographical distribution: This community occurs in south-eastern Sicily and Apulia, near Taranto (Bartolo et al., 1978, 1986; Brullo et al., 1997).

Structure and ecology: In the dry stands, the pine forest of *Pistacio-Pinetum halepensis* is vicaried by a very peculiar vegetation, where some taxa of *Cisto-Micromerietea*, as *Rosmarinus officinalis*, *Cistus monspeliensis*, *Fumana thymifolia*, *Cistus creticus*, *Erica multiflora* and *Coridothymus capitatus*, constitute a dense and intricate garrigue with a scattered covering of *Pinus halepensis*. This association is found in very arid marly or calcarenitic substrata within the upper thermomediterranean belt, from the sea level until 400 m a.s.l. According to Bartolo et al. (1986), two aspects can be distinguished within this syntaxon based on a geographical criterion: the subass. *globularietosum*, spread in the Ippari valley and characterized by the high coverage of *Globularia alypum*; the subass. *sarcopoterietosum*, restricted to the area of Tellaro river and characterized by the occurrence of *Sarcopoterium spinosum*.

Syndynamism: Usually, this community represents an edaphic climax, that is linked to Messinian and Pleistocenic marls and calcarenites occurring in areas with a long period of dryness from the late spring to early autumn (Bartolo et al., 1986). It can take catenal contacts with other woody communities, as the *Junipero-Quercetum calliprini* on sands, *Oleo-Quercetum virgilianae* on more evolved substrata and *Doronico-Quercetum ilicis* in the most humid and cool slopes. The frequent fires can determine the degradation of the *Coridothymo capitati-Pinetum halepensis,* favoring the settlement of secondary garrigues belonging to *Rosmarino-Coridothymetum capitati* and *Cistetum salvifolio-clusii*.

Habitat reference: See class.

39.1.1.6. ***Cistetum salvifolio-clusii*** Bartolo, Giardina, Minissale & Spampinato 1987

Thermophilous garrigue with Clusius rockrose of calcarenitic-sandy soils.

Holotypus: rel. 11, tab. 1, Bartolo et al. (1987).

Characteristic and differential species: *Cistus clusii* Dunal.

Phytosociological table: From Bartolo et al. (1987), tab. 1, 15 rel.

Char. association: *Cistus clusii* (V).

Char. alliance, order and class: *Rosmarinus officinalis* (V), *Fumana thymifolia* (V), *Cistus creticus* (V), *Cistus salvifolius* (V), *Globularia alypum* (V), *Cistus monspeliensis* (IV), *Coridothymus capitatus* (IV), *Teucrium capitatum* (IV), *Erica multiflora* (II), *Coronilla valentina* (II), *Micromeria nervosa* (I).

Other species: *Pinus halepensis* (III), *Hyparrhenia hirta* (III), *Asphodelus ramosus* (III), *Hedysarum spinosissimum* (III), etc.

Geographical distribution: This association is found only in the Ippari valley near Vittoria (Bartolo et al., 1987). Outside Sicily, it was surveyed also in Apulia near Lesina (Caniglia et al., 1976).

Structure and ecology: The very xeric stands with sunny exposure and sandy soils derived from calcarenitic rocks, are colonized by a peculiar shrubby community, where the thermophilous *Cistus clusii*, a south-western Mediterranean species, finds its only relict stations in Sicily. It is the *Cistetum salvifolio-clusii*, a sparse garrigue with an average height of 0.5-1 m, clearly attributable to the *Cisto-Micromerietea* for the occurrence of *Rosmarinus officinalis*, *Fumana thymifolia*, *Cistus creticus*, *Cistus salvifolius*, *Globularia alypum*, *Cistus monspeliensis*, etc.

Syndynamism: It is a pioneer vegetation linked to poorly evolved soils, which can represents an edaphic climax on soils where, due to their geological nature and very dry climatic conditions, the pedogenetic processes are very slow and often prevent a further evolution. Sometimes, it can be a secondary stage belonging to *Coridothymo-Pinetum halepensis* subass. *globularietosum* dynamic series, particularly on sandy and marly soils, where a normal evolution is possible (Bartolo et al., 1987).

Habitat reference: See class.

39.1.1.7. ***Hyparrhenio hirtae-Helianthemetum sessiliflori*** Brullo, Giardina, Minissale & Spampinato 1987

Psammophilous garrigue with twilled rock-rose of inner sands.

Holotypus: rel. 8, tab. 1, Brullo et al. (1987).

Characteristic and differential species: *Cachrys libanotis* L., *Helianthemum lippii* (L.) Dum. Cours., *Hyparrhenia hirta* (L.) Stapf.

Phytosociological table: From Brullo et al. (1987), tab. 1, rel. 14.

Char. association: *Helianthemum lippii* (V), *Hyparrhenia hirta* (V), *Cachrys libanotis* (V).

Char. alliance, order and class: *Fumana thymifolia* (V), *Coridothymus capitatus* (V), *Teucrium capitatum* (V), *Cistus salvifolius* (V), *Rosmarinus officinalis* (IV), *Cistus creticus* (IV), *Micromeria nervosa* (IV), *Phagnalon rupestre* (II),

Other species: *Dactylis hispanica* (V), *Cytisus infestus* (IV), *Launaea resedifolia* (IV), *Muscari gussonei* (IV), *Hedysarum spinosissimum* (III), etc.

Geographical distribution: This association occurs in Southern Sicily, particularly within the Camarino-Pachinense phytogeographical district. Besides, it was surveyed by Gianguzzi & Cusimano (2014) also in the western part of the island, near Partinico.

Structure and ecology: This xerophilous vegetation occurs in the sandy soils of old dune systems, generally quite far from the sea. From the structural point of view, it is an intermediate community between the dry grassland and the garrigue, since it is characterized by the high coverage of *Hyparrhenia hirta* and the thermo-xeric species *Helianthemum lippii* (=*Helianthemum sessiliflorum*). The other differential species is *Cachrys libanotis*, which is strictly linked to this community. Besides also some shrubby species of *Cisto-Micromerietea*, as *Fumana thymifolia*, *Coridothymus capitatus*, *Teucrium capitatum*, *Cistus salvifolius* and *Rosmarinus officinalis* play a relevant physiognomic role, determining a more or less sparse garrigue mixed with the clumps of *Hyparrhenia hirta*.

Syndynamism: This community can be considered as a secondary stage derived from the degradation of the psammophilous maquis belonging to *Junipero-Quercetum calliprini*, which is now very rare in the area and limited to small surfaces due to human activities. In the stands subject to an even more intense disturbance, the *Hyparrhenio hirtae-Helianthemetum sessiliflori* it is in turn replaced by the therophytic vegetation of *Vulpio-Leopoldietum gussonei* (Brullo et al., 1987).

Habitat reference: See class.

39.1.1.8. ***Coridothymo capitati-Cistetum parviflori*** Bartolo, Brullo, Minissale & Spampinato 1990 corr.

Thermophilous garrigue with small-flowered rock-rose of shallow calcareous soils.

Synonyms: *Thymo-Cistetum parviflori* Bartolo et al. 1990

Holotypus: rel. 1, tab. 3, Bartolo et al. (1990).

Characteristic and differential species: *Cistus parviflorus* Lam.

Phytosociological table: From Bartolo et al. (1990), tab. 3, 3 rel.

Char. association: *Cistus parviflorus* (3).

Char. alliance, order and class: *Coridothymus capitatus* (3), *Fumana thymifolia* (3), *Phagnalon rupestre* (3), *Fumana laevipes* (2).

Other species: *Teucrium fruticans* (3), *Hypericum aegyptiacum* (3), *Lotus cytisoides* (3), *Asphodelus ramosus* (3), *Chiliadenus lopadusanum* (3), etc.

Geographical distribution: This very rare community is restricted to Lampedusa islands (Bartolo et al., 1990a), where it has sufferend a significant degradation due to human

activities, so much so that it is now relegated to a few small valleys, as Vallone Madonna and Vallone Imbriacole.

Structure and ecology: The community at issue colonizes the bottom of small dry valleys with calcareous shallow soils, whitin the inframediterranean bioclimatic belt. From the floristic point of view, it is differentiated by *Cistus parviflorus*, an eastern Mediterranean species that occurs only on Lampedusa island in Italy. Besides, the structure of this garrigue is given also by *Rosmarinus officinalis* and *Coridothymus capitatus*, while other species once frequent according to Gussone (1839), as *Globularia alypum*, *Erica multiflora* and *Daphne gnidium*, have now disappeared (Bartolo et al., 1990a).

Syndynamism: This community has a primary role only on very dry rocky surfaces, but it often derive from the degradation of *Periploco-Juniperetum turbinatae*. However, today is frequently replaced by impoverished and degraded garrigues with scattered and twisted shrubs of *Coridothymus capitatus*.

Habitat reference: See class.

39.1.1.9. ***Helichryso archimedei-Ericetum multiflorae*** Brullo, Minissale, Scelsi & Spampinato 1993 corr.

Semi-rupicolous garrigue with Archimede strawflower and Mediterranean heather of limestone substrata.

Synonyms: *Helichryso scandentis-Ericetum multiflorae* Brullo, Minissale, Scelsi & Spampinato 1993 (orig. form).

Holotypus: rel. 3, tab. 4, Brullo et al. (1993).

Characteristic and differential species: *Helichrysum archimedeum* C.Brullo & Brullo

Phytosociological table: From Brullo et al. (1993), tab. 4, 6 rel.

Char. association: *Helichrysum archimedeum* (V).

Char. alliance, order and class: *Rosmarinus officinalis* (V), *Erica multiflora* (V), *Cistus creticus* (V), *Coronilla valentina* (V), *Micromeria nervosa* (IV), *Cistus salvifolius* (III), *Phagnalon rupestre* (I).

Other species: *Emerus major* (V), *Anthyllis vulneraria* subsp. *maura* (V), *Ampelodemos mauritanicus* (V), *Euphorbia dendroides* (IV), *Lobularia maritima* (III), *Pistacia lentiscus* (III), *Lonicera implexa* (II), *Daphne gnidium* (II), *Arisarum vulgare* (I), etc.

Geographical distribution: This vegetation was described from the Anapo valley, Hyblaean area (Brullo et al., 1993; Minissale et al., 2007).

Structure and ecology: The sunny stands of the narrow valleys, known as «cave» in the Hyblaean mountains, are frequently colonized by a low garrigue characterized by the endemic *Helichrysum archimedeum*. It is the *Helichryso archimedei-Ericetum multiflorae*, which is found on calcareous rocky stands, at an altitude from 200 to 500 m a.s.l., within the thermomediterranean bioclimatic belt with a humid-subhumid ombrotype. The physiognomy of this garrigue is given by some species of *Cisto-Micromerietea*, as *Rosmarinus officinalis*, *Erica multiflora*, *Cistus creticus* and *Coronilla valentina* (Brullo et al., 1993).

Syndynamism: It is an edaphophilous vegetation, strictly linked to semi-rupestrian stands, but sometimes its settlement is favored by degradation of thermophilous holm oak woods belonging to *Pistacio-Quercetum ilicis* or maquis of *Oleo-Euphorbietum dendroidis* (Minissale et al., 2007).

Habitat reference: See class.

39.1.1.10. ***Thymelaeo hirsutae-Rosmarinetum officinalis*** Brullo, Minissale & Spampinato 1997

Coastal garrigue with shaggy sparrow-wort and rosemary of marly substrates.

Holotypus: single rel., p. 43, Brullo et al. (1997).

Characteristic and differential species: *Thymelaea hirsuta* (L.) Endl.

Phytosociological table: From Brullo et al. (1997), tab. 8, ass. 14, 5 rel.

Char. association: *Thymelaea hirsuta* (V).

Char. alliance, order and class: *Rosmarinus officinalis* (V), *Fumana thymifolia* (V), *Fumana arabica* (V), *Cistus salvifolius* (V), *Coridotymus capitatus* (V), *Teucrium capitatum* (V), *Phagnalon rupestre* (IV), *Cistus creticus* (III).

Geographical distribution: This vegetation occurs only in southern Calabria and South-Western Sicily (Brullo et al., 1997).

Structure and ecology: The community at issue colonizes the xeric coastal stands with marly soils, within the thermomediterranean belt. It is characterized by the high coverage of *Thymelaea hirsuta*, usually associated with *Rosmarinus officinalis*, *Fumana thymifolia*, *F. arabica*, *Cistus salvifolius*, *Coridothymus capitatus* and *Teucrium capitatum*.

Syndynamism: This association represents an edaphic climax in rocky stands along the coast, taking catenal contacts with the halophilous communities of *Crithmo-Limonietea* closer to the sea, while it is replaced by the *Rosmarino-Coridothymetum capitati* inward.

Habitat reference: See class.

39.1.1.11. ***Sileno siculae-Helichrysetum hyblaei*** Brullo et al. 1998

Mesophilous garrigue with Sicilian campion and Hyblaean strawflower of basaltic substrata

Holotypus: rel. 1, tab. 6, Brullo et al. (1998).

Characteristic and differential species: *Helichrysum hyblaeum* Brullo, *Silene italica* (L.) Pers. subsp. *sicula* (Ucria) Jeanm.

Phytosociological table: From Brullo et al. (1998), tab. 6, 5 rel.

Char. association: *Helichrysum hyblaeum* (V), *Silene italica* subsp. *sicula* (V).

Char. alliance, order and class: *Coridotymus capitatus* (V), T*eucrium capitatum* (V), *Micromeria graeca* (V), *Phagnalon rupestre* (V), *Teucrium flavum* (V).

Other species: *Ononis natrix* subsp. *ramosissima* (V), *Helictotrichon convolutum* (V), *Avenula cincinnata* (V), *Gypsophila arrostii* (V), *Reseda alba* (V), *Daucus carota* (V), *Bituminaria bituminosa* (V), *Galium lucidum* (V), *Anthyllis vulneraria* subsp. *maura* (V), *Dactylis hispanica* (V), *Pallenis spinosa* (V), *Kundmannia sicula* (V), *Sixalix atropurpurea* (V), *Medicago lupulina* (V), *Arabis collina* (V), etc.

Geographical distribution: This vegetation was described by Brullo et al. (1998) from Monte Lauro, in the Hyblaean area.

Structure and ecology: The community at issue colonizes the slightly inclined volcanic surfaces, at an altitude of 600-900 m a.s.l., within the mesomediterranean belt. Physiognomically, it is dominated by *Coridothymus capitatus*, which occurs with other species of *Cisto-Micromerietea*, among them *Teucrium capitatum*, *Micromeria graeca*, *Phagnalon rupestre* and *Teucrium flavum* (Brullo et al., 1998). From the floristic point of view, it is characterized by *Silene italica* subsp. *sicula* and *Helichrysum hyblaeum*, an endemic species that is found only in this kind of vegetation.

Syndynamism: This association is a secondary stage dynamically linked to the mesophilous deciduous oak woods of *Mespilo germanicae-Quercetum virgilianae*. The intensification of the degradation processes leads to the settlement of the grasslands belonging to *Arrhenathero-Helictotrichetum convoluti* and finally to the annual meadows of *Echinarietum todaroanae* (Brullo et al. 1998).

Habitat reference: See class.

39.1.1.12. ***Diplotaxio crassifoliae-Reamurietum vermiculatae*** Brullo, Guarino & Ronsisvalle 2000

Thermo-xerophilous garrigue with succulent wall-rocket and reaumuria of marly-calcarenitic slopes near the sea.

Holotypus: rel. 4, tab. 15, Brullo et al. (2000).

Characteristic and differential species: *Diplotaxis crassifolia* (Raf.) DC, *Reaumuria vermiculata* L.

Phytosociological table: From Brullo et al. (2000), tab. 15, 10 rel.

Char. association: *Diplotaxis crassifolia* (V), *Reaumuria vermiculata* (V).

Char. alliance, order and class: *Coridotymus capitatus* (V), *Phagnalon rupestre* (V), *Thymelaea hirsuta* (V), *Teucrium capitatum* (V).

Other species: *Reichardia picroides* (V), *Asparagus stipularis* (V), *Lygeum spartum* (IV), *Hyparrhenia hirta* (IV), *Asparagus acutifolius* (IV), *Salsola oppositifolia* (III), *Capparis spinosa* (III), *Asphodelus ramosus* (III), *Crithmum maritimum* (II), etc.

Geographical distribution: It is a very rare and localized vegetation, which is currently known only in the locality of Torre Manfria, near Gela (Brullo et al., 2000).

Structure and ecology: This community is strictly linked to strongly inclined surfaces near the sea, constituted by marls, calcarenites and chalks, within the lower thermomediterranean bioclimatic belt with upper semi-arid ombrotype. It is a scattered vegetation dominated by small chamaephytes, as the endemic *Diplotaxis crassifolia* and the rare North African species *Reaumuria vermiculata*. The syntaxa of higher rank are represented by few species, as *Coridotymus capitatus*, *Phagnalon rupestre*, *Thymelaea hirsuta* and *Teucrium capitatum*.

Syndynamism: This association represents and edaphic climax on the small rocky outcrops near the sea, where the kind of substrate and dry climate determine extreme ecological conditions, preventing a further evolution. It is often in catenal contact withe the dry grasslands of *Phagnalo annotici-Lygetum sparti*, which occur in the layers of clay nterspersed with calcarenitic outcrops (Brullo et al., 2000).

Habitat reference: See class.

39.1.1.13. ***Coronillo valentinae-Coridothymetum capitati*** Brullo, Guarino & Ronsisvalle 2000

Coastal garrigue with shrubby scorpion vetch and shrubby thyme of calcareous surfaces near the sea.

Holotypus: rel. 6, tab. 16, Brullo et al. (2000).

Characteristic and differential species: *Asperula aristata* L. f., *Coronilla valentina* L.

Phytosociological table: From Brullo et al. (2000), tab. 16, 6 rel.

Char. association: *Coronilla valentina* (V), *Asperula aristata* (V).

Char. alliance, order and class: *Coridotymus capitatus* (V), *Fumana arabica* (V), *Erica multiflora* (V), *Fumana thymifolia* (V), *Phagnalon rupestre* (V), *Teucrium flavum* (V), *Teucrium capitatum* (III), *Micromeria nervosa* (III).

Other species: *Petrosedum sediforme* (V), *Hyparrhenia hirta* (V), *Capparis spinosa* (V), *Reichardia picroides* (V), *Crithmum maritimum* (III), *Anthyllis vulneraria* subsp. *maura* (III), *Thymelaea hirsuta* (III).

Geographical distribution: This vegetation was described by Brullo et al. (2000) from Torre Manfria, near Gela.

Structure and ecology: The association at issue replaces the previous one in more or less inclined calcareous slopes not directly subjected to sea agents. It is a garrigue with an open and sparse structure, which is dominated by *Coridothymus capitatus* and *Coronilla valentina*. Besides, the floristic set is completed by the differential species *Asperula aristata* and some taxa of higher rank, as *Fumana arabica*, *Erica multiflora*, *Fumana thymifolia*, *Phagnalon rupestre*, etc.

Syndynamism: This community has a piooner character, being linked to eroded slopes with shallow soils, whose further evolution is slowed by meteoric leaching and winds. However, this vegetation can potentially evolve towards the maquis of *Ephedro fragilis-Pistacietum lentisci* (Brullo et al., 2000).

Habitat reference: See class.

39.1.1.14. ***Genistetum tyrrhenae*** Brullo, Di Martino & Marcenò 1977 corr. Brullo 1994

Thermophilous garrigue with tyrrhenian broom of volcanic soils.

Synonyms: "comunità con *G. ephedroides*" Ferro & Furnari 1970; *Genistetum ephedroides* Brullo et al. 1977 (art. 45).

Holotypus: rel. 5, tab. 12, Ferro & Furnari (1970).

Characteristic and differential species: *Genista tyrrhena* Vals. subsp. *tyrrhena*, *Centaurea aeolica* Guss. ex Lojac**.**

Phytosociological table: From Gianguzzi et al. (2015), tab. SII, 5 rel.

Char. association: *Genista tyrrhena* subsp. *tyrrhena* (V), *Centaurea aeolica* (I).

Char. alliance, order and class: *Cytisus laniger* (V), *Micromeria graeca* (IV), *Cistus creticus* subsp. *eriocephalus* (IV), *Cistus salvifolius* (IV), *Spartium junceum* (II), *Phagnalon saxatile* (II),

Other species: *Pistacia lentiscus* (V), *Brachypodium retusum* (V), *Erica arborea* (IV), *Lonicera implexa* (III), *Euphorbia dendroides* (II), etc.

Geographical distribution: This community is restricted to Aeolian Archipelago, where it is widespread in all the islands (Brullo et al., 1977; Gianguzzi et al., 2015).

Structure and ecology: Large surfaces of Aeolian islands are covered with a dense maquis-garrigue, 1-2.5 m high, dominated by *Genista tyrrhena* subsp. *tyrrhena* (Brullo & Furnari, 1994). It occurs on more or less flat or inclined slopes and also on volcanic outcrops, from 100 to almost 900 m a.s.l. From the bioclimatic point of view, it is linked to a thermomediterranean thermotype with upper dry-lower subhumid ombrotype (Gianguzzi et al., 2015). The floristic composition of this community is characterized by some species of *Cisto-Micromerietea*, as *Cistus salvifolius*, *C. monspeliensis*, *C. creticus* subsp. *eriocephalus*, *Micromeria graeca* and *Spartium junceum*. In particularly humid and poorly disturbed places, this vegetation is enriched by some transgressive species of acidophilous maquis, as *Erica arborea* and *Arbutus unedo*. In addition to the typical aspect (subass. *genistetosum*), Brullo et al. (1977) described also the subass. *cytisetosum aeolici*, which is a pioneer community dominated by the aeolian endemic *Cytisus aeolicus*, colonizing cliffs and steep volcanic sands of Stromboli and Alicudi.

Syndynamism: This vegetation has a primary role only on rocky ridges, while it is often of secondary origin, arising from the degradation of maquis belonging to *Myrto-Pistacietum* or *Erico-Arbutetum unedonis*. The frequent fires lead to the establishment of floristically poor garrigues dominated by many species of *Cistus*, which are today widespread in the islands in place of *Genistetum tyrrhenae*.

Habitat reference: See class.

39.1.1.15. ***Genisto aspalathoidis-Rosmarinetum officinalis*** Gianguzzi 1999

Thermophilous garrigue with Pantelleria broom and rosemary of basaltic basic substrates.

Synonyms: *Pino pinastri–Genistetum aspalathoidis* subass. *ericetosum multiflorae* Brullo, Di Martino & Marceno` 1977 (p.p.).

Holotypus: rel. 5, tab. 7, Gianguzzi (1999).

Characteristic and differential species: *Genista aspalathoides* Lam.

Phytosociological table: From Gianguzzi (1999), tab. 7, 12 rel.

Char. association: *Genista aspalathoides* (V).

Char. alliance, order and class: *Rosmarinus officinalis* (V), *Erica multiflora* (V), *Cistus salvifolius* (V), *Cistus monspeliensis* (V), *Cytisus laniger* (V), *Cytinus hypocistis* (V), *Fumana*

thymifolia (IV), *Lotus hirsutus* (III), *Cistus creticus* subsp. *eriocephalus* (III), *Phagnalon saxatile* (III), *Fumana laevipes* (II), *Coris monspeliensis* (I), *Micromeria graeca* (I), *Coridothymus capitatus* (I).

Other species: *Lavandula stoechas* (V), *Erica arborea* (IV), *Myrtus communis* (III), *Arbutus unedo* (III), *Genista monspessulana* (II), *Cytinus ruber* (II), etc.

Geographical distribution: This community occurs only in the southern part of Pantelleria island (Gianguzzi, 1999b; Gianguzzi et al., 2015).

Structure and ecology: This syntaxon was previously indicated by Brullo et al. (1977) as *Pino pinastri–Genistetum aspalathoidis* subass. *ericetosum multiflorae* and later redefined as autonomous association (Gianguzzi 1999b). It is a garrigue or low maquis dominated by *Rosmarinus officinalis*, which grows together with *Genista aspalathoides*, *Erica multiflora* and *Cistus creticus* subsp. *eriocephalus*. Besides, its floristic set is completed by some other species of *Cisto-Micromerietea* and ingressive acidophilous species belonging to *Cisto-Lavanduletea* class, as *Lavandula stoechas*, *Erica arborea*, *Arbutus unedo* and *Genista monspessulana*. This unusual composition is given by the occurrence of this vegetation in basaltic basic substrates that are sorrounded by acidophilous volcanites (ignimbrites), Therefore, as highlighted by Gianguzzi et al. (2015), the contemporary presence of basophilous and acidophilous species respectively belonging to *Ononido-Rosmarinetea* and *Cisto-Lavanduletea* has led to some difficulties in its syntaxonomical framework. However, at the moment it seems preferable to refer also this association to *Cisto-Micromerietea*, whereas its physiognomy is given by some typical species of this class which are indifferent to the type of substrate. From the bioclimatic point of view, this community grows in xeric areas with a inframediterranean-lower thermomediterranean thermotype and upper semiarid-lower dry ombrotype (Gianguzzi et al., 2015).

Syndynamism: This vegetation is linked to the degradation of thermophilous pine woods of *Pistacio lentisci–Pinetum halepensis*, having a primary role only on small rocky surfaces. Besides, it can have catenal contacts with the *Genisto aspalathoidis-Pinetum hamiltonii*, which occurs at higher altitudes (above 400-500 m a.s.l.).

Habitat reference: See class.

39.1.1.16. ***Genistetum gasparrinii*** Gianguzzi, Cusimano, Ilardi & Romano 2015

Semi-rupestrian garrigue with Gasparrini's broom of calcareous rocky ridges.

Holotypus: rel. 5, tab. SVI, Gianguzzi et al. (2015).

Characteristic and differential species: *Genista gasparrini* (Guss.) C. Presl., *Helminthotheca aculeata* (Vahl) Lack, *Klasea flavescens* (L.) Holub. subsp. *mucronata* (Desf.) Cantó & Rivas Martinez

Phytosociological table: From Gianguzzi et al. (2015), tab. SVI, 12 rel.

Char. association: *Genista gasparrini* (V), *Helminthotheca aculeata* (III), *Klasea flavescens* subsp. *mucronata* (III).

Char. alliance, order and class: *Micromeria fruticulosa* (V), *Erica multiflora* (V), *Cistus creticus* subsp. *creticus* (IV), *Fumana laevipes* (III), *Fumana thymifolia* (III), *Phagnalon rupestre* subsp. *illyricum* (III), *Cytisus infestus* (I), *Micromeria graeca* (I), *Coridotyhmus capitatus* (I).

Other species: *Teucrium fruticans* (V), *Teucrium flavum* (IV), *Pistacia lentiscus* (IV), *Lonicera implexa* (III), *Asparagus acutifolius* (III), *Smilax aspera* (II), *Euphorbia dendroides* (II), *Olea europaea* (II), *Arisarum vulgare* (I), *Prasium majus* (I), etc.

Geographical distribution: This rare vegetation is found only in Capo Gallo, near Palermo (Gianguzzi et al., 2015).

Structure and ecology: The *Genistetum gasparrinii* is a basiphilous garrigue dominated by the narrow endemic *Genista gasparrini*, which is linked to calcareous and calcareous-dolomite rocky ridges with very eroded and shallow soils. It occurs from 50 to 400 m a.s.l., within the upper-lower thermomediterranean belt with lower subhumid ombrotype (Gianguzzi et al., 2015). The floristic set includes several species of higher rank, as *Micromeria fruticulosa*, *Erica multiflora*, *Cistus creticus* subsp. *creticus*, *Fumana laevipes*, *F. thymifolia* and *Phagnalon rupestre*, while *Helminthotheca aculeata* and *Klasea flavescens* subsp. *mucronata* represent differential species of this community. Despite Gianguzzi et al. (2015) place this association within the *Ononido-Rosmarinetea* class, considering its strictly basophilic character, even in this case it seems more appropriate to classify it inside the *Cisto-Micromerietea* class, detecting a low presence of *Ononido-Rosmarinetea* species, which are mostly restricted to the Western Mediterranean area.

Syndynamism: This vegetation has a primary character only on semi-rupestrian habitats, while is possible to find secondary expressions along the consolidated rubble at the base of steep cliffs, which are linked to the degradation of holm oak woods belonging to *Rhamno alaterni-Quercetum ilicis* subass. *pistacietosum terebinthi*. Sometimes, the vegetation at issue is mixed with *Ampelodesmos mauritanicus* grassland of *Helictotricho convoluti–Ampelodesmetum mauritanici* (Gianguzzi et al.,1996, 2015).

Habitat reference: See class.

39.1.1.17. ***Genistetum demarcoi*** Gianguzzi, Cusimano, Ilardi & Romano 2015

Basophilous garrigue with De Marco's broom of rocky surfaces.

Holotypus: rel. 4, tab. SVII, Gianguzzi et al. (2015).

Characteristic and differential species: *Genista demarcoi* Brullo, Scelsi & Siracusa, *Helichrysum nebrodense* Heldr., *Matthiola fruticulosa* (L.) Maire subsp. *fruticulosa*.

Phytosociological table: From Gianguzzi et al. (2015), tab. SVII, 10 rel.

Char. association: *Genista demarcoi* (V), *Helichrysum nebrodense* (V), *Matthiola fruticulosa* subsp. *fruticulosa* (V).

Char. alliance, order and class: *Erica multiflora* (V), *Micromeria graeca* (V), *Fumana thymifolia* (IV), *Coronilla valentina* (III), *Cistus creticus* subsp. *creticus* (III), *Phagnalon rupestre* subsp. *illyricum* (III), *Cytisus infestus* (II), *Fumana laevipes* (I),

Other species: *Ampelodesmos mauritanicus* (V), *Euphorbia rigida* (III), *Teucrium montanum* (II), *Eryngium tricuspidatum* subsp. *bocconei* (I), *Phyllirea latifolia* (I), *Teucrium flavum* (I), *Euphorbia dendroides* (I), *Olea europaea* (I),

Geographical distribution: This community is restricted to the lower Madonie mountains, particularly in the south-eastern slopes of Pizzo di Pilo, near Isnello (Gianguzzi et al., 2015).

Structure and ecology: This shrubby vegetation appears as a dense garrigue dominated by the narrow endemic *Genista demarcoi*, colonizing rocky ridges, ledges and sub-rupicolous stands with Mesozoic calcareous and dolomitic substrates. It occurs between 400 and 850 (900) m a.s.l., within the lower mesomediterranean bioclimatic belt with upper subhumid ombrotype. Under the floristic profile, its structure is given by some chamaephytes and nanophanerophytes belonging to *Cisto-Micromerietea*, as *Erica multiflora*, *Micromeria graeca*, *Fumana thymifolia* and *Coronilla valentina*. Besides, its floristic set is characterized by the occurrence of some endemic and rare species, among them *Helichrysum nebrodense*, *Onosma canescens*, *Matthiola fruticulosa* subsp. *fruticulosa* and *Centaurea parlatoris*.

Syndynamism: This vegetation represents an edaphic climax of very eroded and fractured surfaces, whose pedological processes are strongly hindered.

Habitat reference: See class.

40. Class: ***Cytisetea scopario-striati*** Rivas-Martínez 1974

Mediterranean and (sub)atlantic temperate broomy scrub (retamal, piornal, escobonal). seral to forests on acidic substrates.

Holotypus: *Cytisetalia scopario-striati* Rivas-Martinez 1974

Characteristic and differential species: *Cytisus scoparius* (L.) Link, *Erica arborea* L., *Orobanche rapum-genistae* Thuill. subsp. *rapum-genistae, Pteridium aquilinum* (L.) Kuhn.

Geographical distribution: The distribution of this class is centered in the Atlantic territories of Iberian peninsula with a markedly oceanic climate, but is also present in the mountains of the western Mediterranean area (Rivas-Martinez 1974; Costa et al., 2003; Pinto-Gomes et al., 2012; De Foucault, 2013; Loidi et al., 2017).

Structure and ecology: The scrublands of retamoid species, which are plants with strongly reduced leaves and photosynthesising branches belonging to *Genista*, *Cytisus*, *Adenocarpus* and *Retama* genera, are framed within the *Cytisetea scopario-striati* class (Haveman et al., 2017). In the Mediterranean area this vegetation is linked to mountain stands with oceanic conditions, constituting the forest mantle of *Quercetalia robori-petraeae* and *Quercetalia ilicis* communities, within the thermo-, meso- and supra-mediterranean bioclimatic belts. Generally, they prefer siliceous and (meso-)oligotrophic soils with humus mull and without temporal hydromorphy (Costa et al., 2003; Gavilàn et al., 2011).

Syndynamism: Usually, these communities represent the first serial stage of deciduous and sclerophyllous forests, but sometimes they can be a permanent edapho-xerophilous vegetation (Costa et al., 2003; Loidi et al., 2017).

Habitat reference: F3.1c Lowland to montane temperate and submediterraneangenistoid scrub.

40.1. Order: ***Cytisetalia scopario-striati*** Rivas-Martínez 1974

Western and Central Mediterranean thermo- to supramediterranean and submediterranean broomy cytisoid scrub.

Synonyms: *Cytisetalia scopario-striati* Rivas-Martinez 1974 (art. 3f); *Retametalia sphaerocarpae* Rivas Goday 1980 (syntax.syn.); *Genistetalia haenselero-ramosissimae* Pérez Latorre & Cabezudo in Pérez Latorre et al. 2004 (syntax.syn.).

Holotypus: *Genistion floridae* Rivas-Martínez 1974

Characteristic and differential species: See class.

Geographical distribution: This order occurs in the Central and Western Mediterranean area (Mucina et al., 2016).

Structure and ecology: This order groups the seral large-sized plant communities, occurring from thermo to supramediterranean dry to hyperhumid bioclimate (Costa et al., 2003).

Syndynamism: See class.

Habitat reference: See class.

40.1.1. Alliance: ***Violo messanensis-Adenocarpion brutii*** Mucina in Mucina et al. 2016 corr. Guarino & Pasta 2017

Siculo-Calabrian meso-supramediterranean broom heath.

Synonyms: *Violion messanensis* Barbagallo, Brullo, Furnari & Signorello 1982 (art. 29b); *Violo messanensis-Adenocarpion brutii* Mucina in Mucina et al. 2016 (art. 2b).

Holotypus: *Centaureo-Adenocarpetum intermedii* S. Brullo & Furnari in Barbagallo et al. 1982

Characteristic and differential species: *Adenocarpus commutatus* Guss., *Helianthemum nummularium* (L.) Mill. subsp. *obscurum* (Čelak.) Holub., *Thymus longicaulis* C. Presl, *Viola messanensis* (W.Becker) Brullo.

Geographical distribution: This alliance is endemic of Calabria and North-eastern Sicily, where it is actually known only for the Peloritani mountains (Barbagallo et al., 1982; Bartolo et al., 1994a).

Structure and ecology: This vegetation is linked to mountain stands with a particularly fresh and humid microclimate, within the (meso-)supra-mediterranean bioclimatic belt (Barbagallo et al., 1982). It colonizes shallow and siliceous soils with rocky outcrops, represented by granites, schists and gneisses. From the floristic point of view, this alliance is well differentiated from the other ones belonging to *Cytisetalia scopario-striati* by some rare endemic species, as *Adenocarpus commutatus*, *A. brutius*, *Anthemis calabrica*, *Thymus longicaulis* and *Viola messanensis*.

Syndynamism: This association covers small rocky surfaces with very eroded soils, representing a permanent edapho-xerophilous vegetation within the zonal belt occupied by the mesic woods belonging to *Querco-Fagetea*.

Habitat reference: See class.

40.1.1.1. ***Calicotomo infestae-Adenocarpetum commutati*** Bartolo, Brullo & Pulvirenti 1994

Orophilous thickets with Hairy thorny broom and Messina silver broom of cacuminal stands with metamorphic rocks.

Synonyms: *Cytiso infesti-Adenocarpetum commutati* Bartolo, Brullo & Pulvirenti 1994 corr. Guarino & Pasta 2017.

Holotypus: rel. 8, tab. 1, Bartolo et al. (1994a).

Characteristic and differential species: *Anthemis messanensis* Brullo, *Cytisus infestus* (C. Presl) Guss., *Hypochaeris cretensis* (L.) Bory & Chaub., *Luzula multiflora* (Ehrh.) Lej.

Phytosociological table: From Bartolo et al. (1994a), tab. 1, 20 rel.

Char. association: *Cytisus infestus* (V), *Hypochaeris cretensis* (IV), *Luzula multiflora* (III), *Anthemis messanensis* (I).

Char. alliance: *Adenocarpus commutatus* (V), *Viola messanensis* (V), *Thymus longicaulis* (V), *Helianthemum nummularium* subsp. *obscurum* (V).

Char. order and class: *Erica arborea* (V), *Pteridium aquilinum* (V), *Cytisus scoparius* (IV).

Other species: *Micromeria graeca* (V), *Cistus salvifolius* (V), *Petrosedum sedifolium* (V), *Anthoxanthum odoratum* (V), *Dactylis glomerata* (V), *Silene italica* subsp. *sicula* (V), *Festuca* sp. (V), *Hypochoeris laevigata* (V), *Hyoseris radiata* (IV), etc.

Geographical distribution: This community is endemic of Peloritani Mountains, NE Sicily, where is restricted to the higher belt (Bartolo et al., 1994a).

Structure and ecology: The windy and exposed cacuminal stands with metamorphic substrates, between 850 and 1200 m a.s.l., are colonized by a mesic vegetation dominated by the pulvinate shrubs of the endemic *Adenocarpus commutatus*. It is the *Cytiso infesti-Adenocarpetum commutati*, which clearly belongs to *Violo messanensis-Adenocarpion brutii* for the occurrence of *Viola messanensis*, *Thymus longicaulis* and *Helianthemum nummularium* subsp. *obscurum*. Besides, should be noted the presence of the differential species *Luzula multiflora* and *Anthemis messanensis*, as well as the high coverage of some taxa belonging to *Cytisetea scopario-striati*, as *Erica arborea*, *Pteridium aquilinum* and *Cytisus scoparius*. The occurrence of this association is strictly linked to the very humid climate of the higher Peloritani mountains, which are characterized by a considerable amount of rainfall (1000-1250 mm per year), frequent fogs and snowfall during the winter.

Syndynamism: This vegetation has a primary role on semi-rupicolous rocky ridges with very eroded soils, being well adapted to strong winds and other extremes climatic conditions. However, it is possible to find this vegetation also in non-cacuminal stands, where it represents a secondary stage deriving from degradation of deciduous woods belonging to *Erico arboreae-Quercetum virgilianae.*

Habitat reference: See class.

41. Class: ***Crataego-Prunetea spinosae*** R. Tx. 1962

Scrub and mantle vegetation seral or marginal to broad-leaved forests.

Synonyms: *Rhamno-Prunetea* Rivas Goday et Borja Carbonell 1961 (art. 3b); *Rhamno-Prunetea* Rivas Goday et Borja Carbonell ex R. Tx. 1962 (art. 3b); *Sambucetea* Doing 1962 (syntax.syn.).

Holotypus: *Prunetalia spinosae* R. Tx. 1952.

Characteristic and differential species: *Convolvulus silvaticus* Kit., *Clematis flammula* L., *Clematis cirrhosa* L., *Clematis vitalba* L., *Cornus sanguinea* L., *Crataegus monogyna* Jacq., *Ligustrum vulgare* L., *Prunus spinosa* L., *Pyrus spinosa* Forssk., *Rhamnus catharticus* L., *Rosa canina* L., *Rubus canescens* DC., *Rubus hirtus* Waldst. & Kit., *Sambucus nigra* L.

Geographical distribution: This class has a wide Eurosiberian and Mediterranean distribution (Poldini et al., 2002; Rivas- Martinez et al., 2002; Costa et al., 2012; Mucina et al., 2016).

Structure and ecology: The deciduous shrubby communities that constitute the mantle and seral stages of the broad-leaved forests belonging to *Querco-Fagetea* and *Alno glutinosae-Populetea albae* are framed within the *Crataego-Prunetea spinosae* class. This vegetation is constituted by thorny and spikey scrambling shrubs, mainly nanophanerophytes and microphanerophytes of *Rosaceae* family, which form scrubs with a very dense structure. It grows in rich nutrient humic soils at forest edges or in river-banks, from the (thermo)meso-mediterranean to oro-mediterranean bioclimatic belts with subhumid to humid ombrotype (Costa et al., 2012).

Syndynamism: Generally, the communities of *Crataego-Prunetea* represent a secondary stage of mesophilous forests, but sometimes they can be a permanent edapho-xerophilous vegetation, particularly in orophilous semi-rupestrian habitats and sub-xeric riverbanks. However, human activities, such as deforestation, fires and grazing, have greatly favored the extension of this vegetation at the expense of the more evolved woody communities.

Habitat reference: F3.1e Temperate and submediterranean thorn scrub.

41.1. Order: ***Prunetalia spinosae*** R.Tx. 1952

Scrub and mantel vegetation seral or marginal to deciduous forests.

Synonyms: *Corylo-Prunetalia* R. Tx. in P. Fukarek 1968 (art. 2b); *Prunetalia fruticosae* P. Fukarek 1968 (art. 2b); *Urtico-Crataegetalia* Passarge in Passarge & G. Hofmann 1968 (syntax.syn.); *Coryletalia avellanae* P. Fukarek 1969 (art. 2b); *Pruno-Rubetalia* Weber 1974 (syntax.syn.); *Berberido-Prunetalia* (R. Tx. 1952) Passarge 1978 (art. 29c); *Amygdaletalia*

nanae Golub 1990 (art. 5); *Berberidetalia vulgaris de* Foucault & Julve in Julve 1993 (art. 3b);*Tamo communis-Rubetalia inermis* de Foucault & Julve in Julve 1993 (art. 3b); *Betulo pendulae-Populetalia tremulae* Rivas-Martinez & M. Costa 1998 (art. 2b); *Berberidetalia vulgaris* de Foucault & Julve 2001 (art. 5, 8); *Tamo communis-Rubetalia ulmifolii* de Foucault & Julve 2001 (art. 5,8).

Lectotypus: *Rhamno alpini-Berberidion vulgaris* Br.-Bl. ex Rivas-Martínez 2011

Characteristic and differential species: *Dioscorea communis* (L.) Caddick & Wilkin, *Euonymus europaeus* L., *Rosa pouzinii* Tratt., *Rubia peregrina* L. subsp. *peregrina*, *Rubus ulmifolius* Schott., *Smilax aspera* L.

Geographical distribution: See class.

Structure and ecology: The order at issue groups the shrubby communities that are dominated by thorn and prickle scrub, constituting the edges or seral mantle of deciduous forests.

Syndynamism: See class.

Habitat reference: See class.

41.1.1. Alliance: ***Berberido aetnensis-Crataegion laciniatae*** Gianguzzi et al. 2011

Orophilous mantle vegetation of Northern Sicily.

Synonyms: *Ilici-Crataegion laciniatae* Ubaldi 2011 (art. 2b).

Holotypus: *Crataegetum laciniatae* Brullo 1984.

Characteristic and differential species: *Amelanchier ovalis* Medik. subsp. *cretica* (Willd.) Maire & Petitm, *Berberis aetnensis* C. Presl, *Cotoneaster nebrodensis* (Guss.) K. Koch, *Crataegus laciniata* Ucria*, Prunus cocomilia* Ten.*, Prunus cupaniana* Guss.*, Rhamnus saxatilis* Jacq. subsp. *infectorius* (L.) P. Fourn, *Ribes uva-crispa* L. subsp. *austro-europaeum* (Bornm.) Bech., *Rosa heckeliana* Tratt., *Rosa montana* Chaix, *Sorbus graeca* (Spach) Lodd. ex S. Schauer.

Geographical distribution: Actually, this alliance is known only for northern and western Sicily (Nebrodi, Madonie, Rocca Busambra and Sicani mountains), but it occurs probably also in other areas of the southern Tyrrhenian (Ubaldi, 2011, Gianguzzi et al., 2011; Guarino & Pasta, 2017).

Structure and ecology: It is a shrubby vegetation dominated by spiny and creeping nanophanerophytes (partly endemic), which is found at forest edges of mountain belt, within

the meso- and supra-mediterranean bioclimatic belts with sub-humid-humid ombrotypes (Gianguzzi et al., 2011). This vegetation grows on on forest soils of different nature, often with a rich rocky texture. From the syntaxonomical point of view, as highlighted by Guarino & Pasta (2017), the framing of *Berberido aetnensis-Crataegion laciniatae* in the *Paliuretalia* Trinajstič proposed by Mucina et al. (2016) should be rejected, since the diagnostic species typical of the pseudo-maquis communities of south-eastern Europe are totally absent in the vegetation at issue.

Syndynamism: These communities have a secondary role, being linked to the degradation processes of deciduous forests belonging to the class *Querco-Fagetea*, but sometimes they have a pioneer and adaphic character on detritic slopes, screes, sub-rupestrian habitats and ledges (Gianguzzi et al., 2011).

Habitat reference: See class.

41.1.1.1. ***Crataegetum laciniatae*** Brullo & Marcenò in Brullo 1984

Orophilous scrubs with oriental thorn.

Holotypus: rel. 5, tab. 19, Brullo (1984).

Characteristic and differential species: *Crataegus laciniata* Ucria

Phytosociological table: From Brullo (1984), tab. 19, 8 rel.

Char. association and alliance: *Crataegus laciniata* (V).

Char. order and class: *Rubus ulmifolius* (V), *Rhamnus catharticus* (V), *Euonymus europaeus* (V), *Prunus spinosa* (V), *Rosa canina* (V), *Clematis vitalba* (V), *Crataegus monogyna* (V), *Dioscorea communis* (IV), *Pyrus spinosa* (IV), *Sambucus nigra* (II), *Rubus canescens* (II).

Other species: *Acer campestre* (V), *Ilex aquifolium* (V), *Ruscus aculeatus* (V), *Brachypodium sylvaticum* (V), *Daphne laureola* (V), *Lonicera etrusca* (V), *Lamium flexuosum* (IV), *Primula vulgaris* (IV), *Viola alba* subsp. *dehnhardtii* (IV), etc.

Geographical distribution: This community is restricted to Sicani, Rocca Busambra, Madonie and Nebrodi mountains (Brullo, 1984; Gianguzzi et al., 2001, 2007, 2011, 2016; Cambria et al., 2015).

Structure and ecology: This shrubby community has an orophilous character, being linked to the forest mantle of stands with a meso-supramediterranean bioclimate and subhumid-humid ombrotypes (Giaguzzi et al., 2011). It occurs above 900-1000 m a.s.l., preferably on calcareous lithotypes with quite deep soils and northern exposures (Gianguzzi et al., 2016). Its physiognomy is given by *Crataegus laciniata*, occurring together with some species of higher rank, as *Rubus ulmifolius*, *Rhamnus catharticus*, *Euonymus europaeus*, *Prunus spinosa*, *Rosa canina*, *Clematis vitalba*, *Crataegus monogyna*, etc.

Syndynamism: This vegetation represents a seral stage of mesophilous forests of *Querco-Fagetea*, in particular deciduous oak and beech woods, as *Luzulo-Fagetum sylvaticae*, *Anemono apeninninae-Fagetum*, *Sorbo torminalis-Quercetum virgilianae*, etc.

Habitat reference: See class.

41.1.1.2. ***Clematido vitalbae-Prunetum cupanianae*** Raimondo, Marino & Schicchi 2010

Pioneer vegetation with old man's beard and Cupani's mahaleb cherry of unstable calcareous screes.

Holotypus: rel. 2, tab. 1, Raimondo et al. (2010).

Characteristic and differential species: *Prunus cupaniana* Guss.

Phytosociological table: From Raimondo et al. (2010), tab. 1, 11 rel.

Char. association: *Prunus cupaniana* (V).

Char. alliance: *Sorbus graeca* (II), *Crataegus laciniata* (I), *Amelanchier ovalis* subsp. *cretica* (I), *Berberis aetnensis* (I), *Rosa montana* (I), *Rosa heckeliana* (I), *Rosa sicula* (I), *Rhamnus saxatilis* subsp. *infectorius* (I).

Char. order and class: *Clematis vitalba* (IV), *Prunus spinosa* (II), *Rhamnus catharticus* (II), *Rubus canescens* (II), *Rosa canina* (I), *Euonymus europaeus* (I), *Pyrus spinosa* (I), *Crataegus monogyna* (V), *Dioscorea communis* (IV), *Pyrus spinosa* (IV), *Sambucus nigra* (II).

Other species: *Cerastium tomentosum* (IV), *Lonicera etrusca* (III), *Melica cupanii* (III), *Acer campestre* (II), *Lamium flexuosum* (II), etc.

Geographical distribution: This vegetation was described by Raimondo et all (2010) for the Madonie mountains, in particular for the northern and western sides of Carbonara mount.

Structure and ecology: The unstable calcareous screes between 1250 and 1850 m a.s.l., preferably with northern exposure, are colonized by a low shrubby vegetation dominated by *Prunus cupaniana*. This community, named *Clematido vitalbae-Prunetum cupanianae*, should be referred to the *Berberido aetnensis-Crataegion laciniatae* for the occurrence of *Sorbus graeca*, *Crataegus laciniata*, *Amelanchier ovalis* subsp. *cretica*, *Berberis aetnensis*, *Rosa montana*, *Rosa heckeliana*, *Rosa sicula*, *Rhamnus saxatilis* subsp. *infectorius*, despite their scattered and low coverage.

Syndynamism: This vegetation has a piooner role on poorly evolved substrates due to their peculiar geomorphological characteristics, favoring the stabilization of the slopes and starting the dynamic processes that lead to the establishment of more mature communities, as the basophilous beech woods of *Luzulo siculae-Fagetum sylvaticae*.

Habitat reference: See class.

41.1.1.3. ***Junipero hemisphaericae-Prunetum cupanianae*** Raimondo, Marino & Schicchi 2010 corr. Guarino et al. 2017

Shrubby vegetation with hemispheric juniper and Cupani's mahaleb cherry of stabilized dolomitic screes.

Synonyms: *Pruno cupanianae-Juniperetum hemisphaericae* Raimondo et al. 2010 (orig. form).

Holotypus: rel. 3, tab. 2, Raimondo et al. (2010).

Characteristic and differential species: *Daphne oleoides* Schreb., *Juniperus communis* L. subsp. *hemispaherica* (C. Presl) Nyman, *Prunus cupaniana* Guss., *Scutellaria rubicunda* Hornem. subsp. *linneana* (Cornel) Reichinger f.

Phytosociological table: From Raimondo et al. (2010), tab. 2, 7 rel.

Char. association: *Prunus cupaniana* (V), *Juniperus communis* subsp. *hemispaherica* (V), *Daphne oleoides* (V), *Scutellaria rubicunda* Hornem. subsp. *linneana* (III).

Char. alliance: *Rosa sicula* (IV), *Berberis aetnensis* (IV), *Sorbus graeca* (IV), *Amelanchier ovalis* subsp. *cretica* (III), *Crataegus laciniata* (I).

Char. order and class: *Rubus canescens* (IV), *Rosa pouzinii* (III), *Rhamnus catharticus* (I).

Other species: *Cerastium tomentosum* (IV), *Helianthemum croceum* (IV), *Asphodeline lutea* (III), *Origanum vulgare* (III), *Sesleria nitida* subsp. *sicula* (III), etc.

Geographical distribution: This vegetation occurs only in the Madonie mountains (Raimondo et al., 2010).

Structure and ecology: This vegetation replaces the previous one on more stabilized screes with dolomitic substrata, from 1300 to 1450 m a.s.l. Even this community is dominated by *Prunus cupaniana*, growing together with *Daphne oleoides*, *Scutellaria rubicunda* subsp. *linneana* and some species of higher rank, among them *Rosa sicula*, *Berberis aetnensis*, *Sorbus graeca*, *Amelanchier ovalis* subsp. *cretica* and *Rubus canescens*. Despite the high coverage of *Juniperus communis* subsp. *hemispaherica*, which probably led the authors of this association to report it to *Junipero sabinae-Pinetea sylvestris*, for its ecological and floristic characteristics it is better to refer this community to *Crataego-Prunetea* class and *Berberido aetnensis-Crataegion laciniatae* alliance.

Syndynamism: If compared to the *Cerastio-Juniperetum hemisphaericae* (*Rumici-Astragaletea* class), this community represents a more evolved stage, colonizing less rocky surfaces with deeper soils, within the belt of the mesophilous holm oak woods of *Acero-Quercetum ilicis*.

Habitat reference: See class.

41.1.1.4. ***Roso siculae-Prunetum spinosae*** Gianguzzi, Cuttonaro, Cusimano & Romano 2016

Orophilous vegetation with Sicily rose and blackthorn of forest edges.

Holotypus: rel. 3, tab. 19, Gianguzzi et al. (2016).

Characteristic and differential species: *Rosa sicula* Tratt., *Rosa glutinosa* Sm.

Phytosociological table: From Gianguzzi et al. (2016), tab. 19, 8 rel.
Char. association: *Rosa sicula* (V), *Rosa glutinosa* (V).
Char. alliance: *Crataegus laciniata* (V).
Char. order and class: *Prunus spinosa* (V), *Rosa canina* (V), *Rubus ulmifolius* (IV), *Pyrus spinosa* (III), *Clematis vitalba* (III), *Rubus canescens* (III).
Other species: *Daphne laureola* (V), *Brachypodium sylvaticum* (V), *Asparagus acutifolius* (III), *Hedera helix* (II), *Lonicera etrusca* (I), etc.

Geographical distribution: This vegetation was described by Gianguzzi et al. (2016) from the cacuminal belt of Sicani mountains.

Structure and ecology: It is an orophilous shrubby vegetation dominated by *Prunus spinosa*, occurring in the clearings of the holm oak community belonging to *Sorbo torminalis-Quercetum ilicis*. It grows above 800-900 m in the meso- and supra-mediterranean belts, on more or less eroded calcareous soils, forming a very dense and closed vegetation. From the floristic point of view, it is remarkable the presence of *Rosa sicula* and *R. glutinosa*, as well as of some species of higher rank, as *Crataegus laciniata*, *Rubus canescens*, *Rosa canina*, *Rubus ulmifolius*, *Pyrus spinosa*, etc.

Syndynamism: This community represents a seral stage of the mesophilous holm oak woods belonging to *Sorbo torminalis-Quercetum ilicis*.

Habitat reference: See class.

41.1.1.5. ***Lonicero xylostei-Prunetum cupaniani*** Gianguzzi, Caldarella, Cusimano & Romano 2011

Orophilous vegetation with honeysuckle and Cupani's mahaleb cherry of colluvial soils.

Holotypus: rel. 5, tab. 4, Gianguzzi et al. (2011).

Characteristic and differential species: *Lonicera xylosteum* L.

Phytosociological table: From Gianguzzi et al. (2011), tab. 4, rel. 8.
Char. association: *Lonicera xylosteum* (V).

Char. alliance: *Prunus cupaniana* (V), *Rosa sicula* (IV), *Sorbus graeca* (III), *Berberis aetnensis* (III), *Crataegus laciniata* (II), *Ribes uva-crispa* subsp. *austro-europaeum* (II), *Amelanchier ovalis* subsp. *cretica* (I), *Rhamnus saxatilis* subsp. *infectorius* (I), *Cotoneaster nebrodensis* (I), *Rosa montana* (I).

Char. order: *Rhamnus chatarticus* (V), *Rubus canescens* (III), *Euonymus europaeus* (II), *Rosa rubiginosa* (I).

Char. class: *Rosa canina* (V), *Clematis vitalba* (V), *Sambucus nigra* (II), *Prunus spinosa* (I).

Other species: *Hedera helix* (V), *Lamium flexuosum* (V), *Acer monspessulanum* (V), *Fraxinus ornus* (IV), *Ilex aquifolium* (III), *Acer campestre* (III), *Lonicera etrusca* (I), etc.

Geographical distribution: According to Gianguzzi et al. (2011), this association occurs only in the Madonie mountains (Carbonara, Quacella, Monte dei Cervi, etc.).

Structure and ecology: The detritic soils at the base of unstable slopes are colonized by a peculiar orophilous shrubby vegetation rich in endemic and rare taxa, as *Lonicera xylosteum*, *Berberis aetnensis*, *Rosa sicula*, *Amelanchier ovalis* subsp. *cretica*, *Cotoneaster nebrodensis*, *Prunus cupaniana*, *Rhamnus saxatilis* subsp. *infectorius* and *Ribes uva-crispa* subsp. *austro-europaeum*. It is the *Lonicero xylostei-Prunetum cupaniani*, which is found above 1350 m, in the upper supramediterranean bioclimatic belt with upper humid ombrotype. It grows in calcareous or dolomitic surfaces with northern exposure and more or less humified soils, located along the outer margins of steep debris cones (Gianguzzi et al., 2011).

Syndynamism: This plant community represents a dynamic stage in the colonization of the most stable and consolidated part of debris cones, forming the forest margin of *Sorbo graecae-Aceretum pseudoplatani*, while in the more central parts of screes and in subrupestral habitats it has an edaphic role. It takes contact with the climax woods of *Aceri campestris-Quercetum ilicis* and rarely also *Luzulo siculae-Fagetum* at higher elevations.

Habitat reference: See class.

41.2. Order: ***Pyro spinosae-Rubetalia ulmifolii*** Biondi, Blasi & Casavecchia in Biondi et al. 2014

Spiny bramble scrub with elmleaf blackberry of nutrient-rich soils.

Holotypus: *Pruno spinosae-Rubion ulmifolii* O. Bolòs 1954

Characteristic and differential species: *Pyrus spinoa* Forssk., *Rubus ulmifolius* Schott, *Lonicera etrusca* Santi, *Rosa sempervirens* L.

Geographical distribution: This order is widespread in Atlantic (including Macaronesian Archipelago) and Mediterranean areas (Mucina et al., 2016).

Structure and ecology: This syntaxon groups together the shrubby communities growing on deep and wet soils with a with a high percentage of clay or pelites components. From the bioclimatic point of view, it is found in a wide range of thermotypes, from humid mesomediterranean to submediterranean (Biondi et al., 2014).

Syndynamism: See class.

Habitat reference: See class.

41.2.1. Alliance: ***Pruno spinosae-Rubion ulmifolii*** O. Bolòs 1954

Spiny bramble scrub of the winter-mild Atlantic seaboards and the Western Mediterranean.

Synonyms: *Pruno spinosae-Rubion inermis* O. de Bolòs 1954 nom. mut. propos. (sensu Julve 1993) (mut. superfl.); *Ligustro-Rubion ulmifolii* Gèhu et Delelis in Delelis 1973 (art. 3b).

Holotypus: *Coriarietum myrtifoliae* O. Bolòs 1954

Characteristic and differential species: *Asparagus acutifolius* L.*, Clematis cirrhosa* L.*, Crataegus monogyna* Jacq.*, Cytisus infestus* (C. Presl) Guss., *Dioscorea communis* (L.) Caddick & Wilkin, *Euphorbia characias* L.*, Origanum vulgare* L.*, Pyrus pyraster* Burgsd*, Rosa canina* L.*, Rubia peregrina* L.*, Smilax aspera* L.*, Spartium junceum* L.

Geographical distribution: This alliance is widely distributed in the central-western Mediterranean area, as well as in the Atlantic seaboards from France to the Iberian peninsula (Costa et al., 2012; Biondi et al., 2014; Mucina et al., 2016).

Structure and ecology: This alliance includes some types of shrubby and lianoid vegetation, as mantle communities and bushes, which in their most evolved aspect are characterized by a two-layered structure with scattered small and medium sized trees and a dense shrubby layer. This vegetation is not strictly linked to a precise kind of substrate, growing on limestones, marls, flysch or sandstones, but it is found only on quite humid, deep and oligo-mesotrophic soils. It occurs from the thermomediterranean to lower supramediterranean belts with dry to humid ombrotypes. From the floristic point of view, the Italian communities are quite diferrent from those ones of Iberian peninsula and are distinct within the *Pruno-Rubenion* suballiance (Blasi et al., 2002), which is characterized by the abundance of transgressive species belonging to *Quercetea ilicis* and *Pistacio-Rhamnetalia*, often with a SE-European chorotype (Ubaldi, 2011; Biond et al., 2014).

Syndynamism: These communities represent a secondary vegetation of different types of mesophilous deciduous or persistent forests, often constituting their mantle or one of the first replacement stages (Costa et al., 2012).

Habitat reference: See class.

41.2.1.1. ***Rubo ulmifolii-Tametum communis*** R. Tx. in R. Tx. & Oberd. 1958

Meso-hygrophilous scrub with elmleaf blackberry and black bryony of humid stands.

Lectotypus: Not designated.

Characteristic and differential species: *Dioscorea communis* (L.) Caddick & Wilkin

Phytosociological table:-

Geographical distribution: This community occurs mainly in the Atlantic territories of Iberian Peninsula (Arnaiz & Loidi, 1981), being more rare in the Mediterranean area (Brullo et al., 2001). As regards Sicily, it is a rare and scattered vegetation that is restricted to few places in the North-eastern part of the island.

Structure and ecology: The association at issue is linked to oceanic conditions, occurring in humid valleys near streams, where constitutes dense scrubs dominated by climbing species, as *Rubus ulmifolius*, *Dioscorea communis*, *Clematis vitalba* and *Hedera helix*. From the syntaxonomical point of view, the Sicilian aspect should be referred to the subass. *ccalystegietosum sylvaticae*, described by Brullo et al. (2001) from southern Calabria.

Syndynamism: This community is a replacement stage of hygrophilous forests belonging to *Populion albae*.

Habitat reference: See class.

41.2.1.2. ***Rubo ulmifolii-Crataegetum monogynae*** O. Bolòs 1962 corr. Rivas-Martinez 2011

Deciduous scrub with elmleaf blackberry and common hawthorn of humid depressions.

Synonyms: *Rubo ulmifolii-Crataegetum brevispinae* O. Bolòs 1962 (orig. form).

Lectotypus: Not designated.

Characteristic and differential species: *Crataegus monogyna* Jacq

Phytosociological table: From Minissale & Spampinato (1985), tab. 9, 4 rel.

Char. association and alliance: *Crataegus monogyna* (4), *Rubus ulmifolius* (4), *Rosa canina* (4).

Char. order and class: *Prunus spinosa* (4), *Rosa pouzinii* (III).

Other species: *Agropyron repens* (4), *Phalaris coerulescens* (4), *Galium debile* (3), *Rumex crispus* (3), *Plantago lanceolata* (1), *Gaudinia fragilis* (1), *Poa trivialis* (1), etc.

Geographical distribution: This association, originally described from Spain (Bòlos, 1962), was surveyed in the Hyblaean area and Gurrida lake (Minissale & Spampinato, 1985; Brullo et al., 1996; Minissale, 2007).

Structure and ecology: The slightly raised stands of humid valley floor, sometimes subject to a short flooding period during the winter, are colonized by the *Rubo ulmifolii-Crataegetum monogynae*. It is a dense scrub dominated by *Crataegus monogyna* and *Rubus ulmifolius*, growing together with *Rosa canina*, *Prunus spinosa*, *Rosa pouzinii* and some lianoid species, as *Clematis vitalba* and *Smilax aspera*. This vegetation occurs both on calcareous and siliceous soils within the mesomediterranean bioclimatic belt.

Syndynamism: Generally, this vegetation constitutes the deciduous mantle of mesophilous holm-oak woods belonging to *Doronico-Quercetum ilicis* and *Ostryo-Quercetum ilicis* (Minissale, 2007).

Habitat reference: See class.

41.2.1.3. ***Roso sempervirentis-Rubetum ulmifolii*** Blasi, Di Pietro & Fortini 2000

Mesophilous scrub with evergreen rose and elmleaf blackberry of wet and deep soils.

Holotypus: rel. 3, tab. 2, Blasi et al. (2000).

Characteristic and differential species: *Rubus ulmifolius* Schott, *Rosa sempervirens* L.

Phytosociological table: From Sciandrello et al. (2013), tab. 6, 10 rel.

Char. association and alliance: *Rubus ulmifolius* (V), *Rubia peregrina* (V), *Rosa sempervirens* (III), *Dioscorea communis* (II).

Char. order and class: *Clematis vitalba* (V), *Spartium junceum* (III)

Other species: *Hypericum hircinum* subsp. *majus* (V), *Calystegia sylvatica* (V), *Bupleurum fruticosum* (II), *Ficus carica* (II), etc.

Geographical distribution: This association was described by Blasi et al. (2000) from Central Italy and later reported from Taormina area by Sciandrello et al. (2013).

Structure and ecology: The vegetation at issue occurs in the depressions with moist and nitrate-rich soils within the mesomediterranean bioclimatic belts. It is a dense and impenetrable scrub dominated by a mixture of shrubby and lianoid species, both evergreen and deciduous, among them *Rosa sempervirens*, *Rubus ulmifolius*, *Smilax aspera*, *Rubia*

peregrina, *Rosa canina*, *Crataegus monogyna*, *Asparagus acutifolius*, *Dioscorea communis* and *Clematis cirrhosa*.

Syndynamism: This community represents a secondary stage of mesophilous woodlands and in particular of *Bupleuro fruticosi-Quercetum ilicis* and *Erico arboreae-Quercetum virgilianae*.

Habitat reference: See class.

41.2.1.4. ***Scutellario rubicundae-Urticetum rupestris*** Brullo, Minissale, Scelsi & Spampinato 1993

Sciaphilous vegetation with Sicilian skullcaps and rock nettle of humid calcareous soils.

Synonyms: *Scutellario-Urticetum rupestris* Bartolo et al. 1989 (nom. nud.).

Holotypus: rel. 6, tab. 5, Brullo et al. (1993).

Characteristic and differential species: *Scutellaria rubicunda* Hornem., *Urtica rupestris* Guss.

Phytosociological table: From Brullo et al. (1993), tab. 5, 13 rel.

Char. association: *Urtica rupestris* (V), *Scutellaria rubicunda* (V).

Char. alliance and order: *Rubus ulmifolius* (V), *Dioscorea communis* (V), *Rubia peregrina* (V), *Smilax aspera* (IV), *Clematis cirrhosa* (IV), *Crataegus monogyna* (III).

Char. class: *Clematis vitalba* (III).

Other species: *Hedera helix* (V), *Dryopteris pallida* (IV), *Arabis alpina* (IV), *Umbilicus horizontalis* (IV), *Geranium purpureum* (IV), *Allium subhirsutum* (III), *Parietaria lusitanica* (II), etc.

Geographical distribution: This vegetation is restricted to the Hyblaean area, where is linked to the bottom of narrow valleys locally known as «cave» (Brullo et al., 1993).

Structure and ecology: It is a nemoral vegetation, often occurring in the undergrowth of holm oak forest (*Doronico-Quercetum ilicis*) with calcareous outcrops and very humid and cool conditions, which represent the only relictual stands of the rare Hyblaean endemic *Urtica rupestris*. Under the floristic profile, this species characterizes the association at issue together with the other Sicilian endemism *Scutellaria rubicunda*, while the floristic set is completed by some species of alliance and order, as *Rubus ulmifolius*, *Dioscorea communis*, *Rubia peregrina*, *Smilax aspera*, *Clematis cirrhosa* and *Crataegus monogyna*.

Syndynamism: This community has an edaphic role, occurring only within the holm oak forests, whose degradation leads to its rarefaction and disappearance.

Habitat reference: See class.

41.2.1.5. ***Rubo ulmifolii-Aristolochietum altissimae*** Brullo, Minissale, Scelsi & Spampinato 1993

Lianoid vegetation with elmleaf blackberry and evergreen pipevine of humid valley floors.

Holotypus: rel. 5, tab. 6, Brullo et al. (1993).

Characteristic and differential species: *Aristolochia altissima* Desf., *Ficus carica* L.

Phytosociological table: From Brullo et al. (1993), tab. 6, 12 rel.

Char. association: *Aristolochia altissima* (V), *Ficus carica* (IV).

Char. alliance and order: *Rubus ulmifolius* (V), *Dioscorea communis* (III), *Rubia peregrina* (III), *Smilax aspera* (III), *Asparagus acutifolius* (II), *Rosa sempervirens* (II).

Char. class: *Clematis vitalba* (V).

Other species: *Calystegia sepium* (IV), *Hedera helix* (IV), *Rhamnus alaternus* (I), *Pistacia terebinthus* (I), *Celtis australis* (I), *Pteridium aquilinum* (I), *Centranthus ruber* (I), etc.

Geographical distribution: This vegetation occurs only in the bottom of Hyblaean «cave» (Brullo et al., 1993; Minissale 2007).

Structure and ecology: In more open places, the previous association is replaced by another community, named *Rubo ulmifolii-Aristolochietum altissimae.* This phytocoenosis is linked to fresh and humid stands of valley floors, within the mesomediterranean belt, constituting a dense lianoid and shrubby vegetation dominated by *Rubus ulmifolius*, *Hedera helix*, *Calystegia sepium*, *Discorea communis*, *Rubia peregrina* and *Smilax aspera*. The occurrence of the rare sub-endemic *Aristolochia altissima* gives to this association a certain floristic peculiarity.

Syndynamism: This association takes catenal contacts with the hygrophilous forest dominated by *Platanus orientalis* and the mesophilous holm oak woods, sometimes constituting their mantle.

Habitat reference: See class.

41.2.1.6. ***Rubo ulmifolii-Dorycnietum recti*** Brullo, Minissale, Scelsi & Spampinato 1993

Meso-hygrophilous vegetation with elmleaf blackberry and greater badassi of riparian stands.

Synonyms: Aggr. a *Dorycnium rectum* e *Rubus ulmifolius* Brullo & Ronsisvalle 1975

Holotypus: rel. 2, tab. 7, Brullo et al. (1993).

Characteristic and differential species: *Lotus rectus* L.

Phytosociological table: From Brullo et al. (1993), tab. 7, 2 rel.

Char. association: *Lotus rectus* (2).

Char. alliance and order: *Rubus ulmifolius* (2), *Dioscorea communis* (2), *Rubia peregrina* (2), *Asparagus acutifolius* (2).

Other species: *Pteridium aquilinum* (2), *Eupatorium cannabinum* (2), *Cirsium creticum* subsp. *triumfettii* (2), *Acanthus mollis* (2), *Ficus carica* (1).

Geographical distribution: Actually, this vegetation is known for Hyblaean and Peloritani mountains, as well as for Western Sicily (Brullo & Ronsisvalle, 1975; Brullo et al., 1993; Guarino, 1997; Bazan & Marino, 2005; Pasta et al., 2008). Outside Sicily, it occurs also in Calabria, Sardinia and Campania.

Structure and ecology: The humid surfaces near streams or wet cliffs are colonized by a markedly hygrophilous community whose physiognomy is given by *Lotus rectus*. This species, usually linked to riparian stands or periodically submerged surfaces, is associated with some species of higher rank, as *Rubus ulmifolius*, *Dioscorea communis*, *Rubia peregrina* and *Asparagus acutifolius*. It is a dense and intricate vegetation, 1-1.5 m high, occurring within the thermo- and mesomediterranean bioclimatic belts with humid-subhumid ombrotypes.

Syndynamism: It is an edaphic vegetation, having catenal contact with the *Platanus orientalis* riparian forest (*Platano-Salicetum gussonei*) and sometimes also with the *Osmundo-Salicetum gussonei*. In the small streams and near springs it can be found in contact with the *Cirsio-Eupatorietum cannabini* and *Helosciadetum nodiflori*, while near humid cliffs it takes contact with *Adiantetea* communities (Guarino, 1997).

Habitat reference: See class.

41.2.1.7. ***Spartio juncei-Rubetum ulmifolii*** Pérez-Latorre & Cabezudo in Pérez-Latorre et al. 2008

Spiny scrub with spanish broom and elmleaf blackberry of disturbed stands.

Holotypus: rel. 6, tab. 9, Pérez-Latorre et al. (2008).

Characteristic and differential species: *Spartium junceum* L.

Phytosociological table: 5 unpublished rel. (2016), Gibilmanna (Palermo).

Char. association: *Spartium junceum* (V).

Char. alliance and order: *Rubus ulmifolius* (V), *Rubia peregrina* (IV), *Smilax aspera* (II).

Char. class.: *Prunus spinosa* (I), *Crataegus monogyna* (I), *Rosa canina* (I).

Other species: *Acanthus mollis* (III), *Ailanthus altissima* (III), *Quercus virgiliana* (II), *Bupleurum fruticosum* (I), *Fraxinus ornus* (I), etc.

Geographical distribution: This community, originally described by Pérez-Latorre et al. (2008) from southern Spain, it is widespread in Sicily.

Structure and ecology: This association occurs on shady and humid depressions, often with clay soils, colonizing abandoned crops, wood clearings and burned wooded areas. It is a thermophilous vegetation, which is usually found in the thermomediterranean bioclimatic belt. From the floristic point of view, it is dominated by *Spartium junceum* and some spiny shrubs, as *Rubus ulmifolius*, *Rosa canina* and *Crataegus monogyna*.

Syndynamism: It is a secondary stage of thermophilous deciduous oak forests (*Oleo-Quercetum virgilianae*) and more rarely also of holm oak woods. In some places, it can evolve towards the *Hippocrepido emeri-Bupleuretum fruticosi*.

Habitat reference: See class.

41.2.1.8. ***Clematido cirrhosae-Rubetum ulmifolii*** Gianguzzi & La Mantia 2008

Thermophilous scrub with virgin's bower and elmleaf blackberry of shady stands near calcareous cliffs.

Synonyms: Aggr. a *Rubus ulmifolius* e *Prunus spinosa* sensu Gianguzzi et al. 1993; Aggr. a *Rhus coriaria* sensu Gianguzzi et al. 1993.

Holotypus: rel. 3, tab. 15, Gianguzzi & La Mantia (2008).

Characteristic and differential species: *Clematis cirrhosa* L., *Euphorbia characias* L.

Phytosociological table: From Gianguzzi & La Mantia (2008), tab. 15, 5 rel. (subass. *calystegietosum sylvaticae*).

Char. association: *Clematis cirrhosa* (V), *Euphorbia characias* (IV).

Char. subass: *Calystegia sylvatica* (V).

Char. alliance and order: *Rubus ulmifolius* (V), *Smilax aspera* (V), *Asparagus acutifolius* (V), *Rubia peregrina* subsp. *longifolia* (V), *Rosa sempervirens* (V), *Dioscorea communis* (V).

Char. class: *Crataegus monogyna* (III), *Pyrus spinosa* (II), *Lonicera implexa* (II), *Rosa canina* (I).

Other species: *Pistacia terebinthus* (V), *Rhamnus alaternus* (V), *Hedera helix* (IV), *Teucrium flavum* (III), *Fraxinus ornus* (II), etc.

From Gianguzzi & La Mantia (2008), tab. 15, 7 rel. (subass. *rhoetosum coriariae*).

Char. association: *Clematis cirrhosa* (III), *Euphorbia characias* (III).

Char. subass: *Rhus coriaria* (V).

Char. alliance and order: *Rubus ulmifolius* (V), *Smilax aspera* (V), *Asparagus acutifolius* (V), *Rubia peregrina* subsp. *longifolia* (V), *Rosa sempervirens* (IV), *Dioscorea communis* (I).

Char. class: *Crataegus monogyna* (V), *Pyrus spinosa* (I), *Lonicera implexa* (I), *Rosa canina* (I).

Other species: *Teucrium flavum* (V), *Oxalis pes-caprae* (V), *Rhamnus alaternus* (IV), *Pistacia terebinthus* (III), *Hedera helix* (III), *Fraxinus ornus* (III), etc.

Geographical distribution: This community occurs in the North-Western part of Sicily, in the coastal and hilly belts from Trapani to Palermo (Gianguzzi et al., 1993; Gianguzzi & La Mantia, 2008).

Structure and ecology: The humid and shady surfaces located at the base of limestone cliffs are covered by a dense shrubby vegetation dominated by *Rubus ulmifolius*. It is the *Clematido cirrhosae-Rubetum ulmifolii*, a thermophilous vicariant of *Roso sempervirentis-Rubetum ulmifolii*, from which it is well differentiated under the floristic profile for the high coverage of *Clematis cirrhosa* and *Euphorbia characias*. Gianguzzi & La Mantia (2008) distinguished a typical aspect (subass. *calystegietosum sylvaticae*) and a peculiar phytocoenosis dominated by *Rhus coriaria* (subass. *rhoetosum coriariae*). The latter is a species that has been widely cultivated in the past and is now widespread in abandoned crops, arid slopes, screes, hedges, forming more or less monotypical populations. From the bioclimatic point of view, this vegetation occurs in the more mesic areas of the thermo-mediterranean belt and sometimes also in the lower meso-mediterranean belt.

Syndynamism: This association is linked to the dynamic series of thermophilous deciduous oak and holm oak woods belonging to *Oleo-Quercetum virgilianae*, *Rhamno alaterni-Quercetum ilicis* and *Pistacio lentisci-Quercetum ilicis*. The subass. *rhoetosum coriariae* shows a more markedly pioneer character, colonizing soil-poor surfaces with abundant coarse debris.

Habitat reference: See class.

41.2.1.9. ***Calicotomo infestae-Pyretum spinosae*** Gianguzzi & La Mantia 2008

Thermophilous garrigue with hairy thorny broom and almond-leaved pear of disturbed stands.

Synonyms: *Cytiso infesti-Pyretum spinosae* Gianguzzi & La Mantia 2008 corr. Pasta & Guarino 2017.

Holotypus: rel. 6, tab. 12, Gianguzzi & La Mantia (2008).

Characteristic and differential species: *Cytisus infestus* (C. Presl) Guss., *Ruta chalepensis* L.

Phytosociological table: From Gianguzzi & La Mantia (2008), tab. 12, 8 rel.

Char. association: *Cytisus infestus* (V), *Ruta chalepensis* (V).

Char. alliance and order: *Rubus ulmifolius* (IV), *Rubia peregrina* subsp. *longifolia* (IV), *Asparagus acutifolius* (IV), *Rosa sempervirens* (I), *Smilax aspera* (I).

Char. class: *Pyrus spinosa* (V), *Crataegus monogyna* (IV).

Other species: *Asparagus albus* (IV), *Arisarum vulgare* (IV), *Brachypodium ramosum* (IV), *Charybdis pancration* (IV), *Dactylis hispanica* (III), etc.

Geographical distribution: This community was described by Gianguzzi & La Mantia (2008) from North-Western Sicily.

Structure and ecology: The uncultivated lands and the burnt surfaces are colonized by a piooner garrigue with *Cytisus infestus*, which forms a very intricate vegetation together with few other species as *Pyrus spinosa*, *Rubus ulmifolius* and *Ruta chalepensis*. This community, named *Cytiso infesti-Pyretum spinosae*, occurs in the slightly inclined calcareous surfaces, within the thermomediterranean belt. According to Gaurino et al. (2017), this syntaxon should be framed in the *Pyro spinosae-Rubetalia ulmifolii* order for its floristic composition, rather than within the *Pistacio-Rhamnetalia alaterni*, as proposed by Gianguzzi & La Mantia (2008).

Syndynamism: This association represents one of the first stages in the dynamic succession leading to the settlement of *Pistacio-Quercetum ilicis*.

Habitat reference: See class.

41.2.1.10. ***Euphorbio meuselii-Rubetum ulmifolii*** Vicente Orellana, Galán de Mera & Gianguzzi 2018

Holm oak forest mantle with wood spurge and elmleaf blackberry of mesic stands.

Synonyms: *Roso corymbiferae-Rubetum ulmifolii* Gianguzzi et al. 2016 nom. inval. (art. 32d).

Holotypus: rel. 3, tab. 17, Gianguzzi et al. (2016).

Characteristic and differential species: *Euphorbia meuselii* Raimondo & Mazzola, *Paeonia mascula* (L.) Mill. subsp. *russoi* (Biv.) Cullen & Heywood, *Rosa corymbifera* Borkh.

Phytosociological table: From Gianguzzi et al. (2016), tab. 17, 8 rel.

Char. association: *Rosa corymbifera* (V), *Euphorbia meuselii* (V), *Paeonia mascula* subsp. *russoi* (IV).

Char. alliance and order: *Rubus ulmifolius* (V), *Asparagus acutifolius* (V), *Rubia peregrina* subsp. *longifolia* (IV), *Dioscorea communis* (V), *Smilax aspera* (III), *Rosa sempervirens* (I).

Char. class: *Prunus spinosa* (V), *Crataegus monogyna* (V), *Rosa canina* (V), *Pyrus spinosa* (V), *Rosa micrantha* (I), *Crataegus laciniata* (I), *Rosa balsamica* (I).

Other species: *Hedera helix* (V), *Ruscus aculeatus* (V), *Brachypodium sylvaticum* (V), *Achillea ligustica* (III), *Ampelodesmos mauritanicus* (III), etc.

Geographical distribution: This vegetation occurs only in the submountainous belt of Sicani mountains (Gianguzzi et al., 2016).

Structure and ecology: It is a spiny scrub with a closed structure, which is dominated by some species belonging to Rosaceae family, among them *Rubus ulmifolius*, *Rosa corymbifera*, *Prunus spinosa*, *Crataegus monogyna* and *Rosa canina* are very frequent. The floristic set is completed by *Euphorbia meuselii* and *Paeonia mascula* subsp. *russoi*, which represent the characteristic species, as well as by some lianas, as *Smilax aspera*, *Rubia peregrina*, *Discorea communis* and *Clematis vitalba*. Generally, this community forms the forest margin of mesic holm oak woodlands on slightly inclined clayey surfaces, within the humid-subhumid mesomediterranean belt.

Syndynamism: It is a secondary stage of vegetation series belonging to mesic deciduous and persistent woods (e.g. *Ampelodesmo mauritanici-Quercetum ilicis*).

Habitat reference: See class.

41.2.1.11. ***Euphorbio characias-Prunetum spinosae*** Gianguzzi, Cuttonaro, Cusimano & Romano 2016

Thorny scrub with Mediterranean spurge and blackthorn of eroded slopes.

Holotypus: rel. 3, tab. 18, Gianguzzi et al. (2016).

Characteristic and differential species: *Euphorbia characias* L., *Rosa corymbifera* Borkh.

Phytosociological table: From Gianguzzi et al. (2016), tab. 18, 10 rel.

Char. association: *Euphorbia characias* (V), *Rosa corymbifera* (IV).

Char. alliance and order: *Rubus ulmifolius* (V), *Asparagus acutifolius* (IV), *Rubia peregrina* subsp. *longifolia* (IV), *Rosa sempervirens* (II), *Dioscorea communis* (I), *Smilax aspera* (I).

Char. class: *Prunus spinosa* (V), *Crataegus monogyna* (V), *Rosa canina* (V), *Pyrus spinosa* (IV), *Lonicera etrusca* (II), *Crataegus laevigata* (I), *Clematis vitalba* (I).

Other species: *Hedera helix* (IV), *Ruscus aculeatus* (IV), *Arisarum vulgare* (IV), *Brachypodium sylvaticum* (III), *Ampelodesmos mauritanicus* (III), *Osyris alba* (II), *Daphne laureola* (I), etc.

Geographical distribution: This community was described by Gianguzzi et al. (2016) from Sicani mountains.

Structure and ecology: This shrubby vegetation colonizes the rocky and steep slopes with more or less eroded calcareous soils, within the humid-subhumid mesomediterranean belt. Its structure is given by some thorny shrubs and lianas, as *Prunus spinosa*, *Rosa corymbifera*, *R. sempervirens*, *R. canina*, *Crataegus monogyna*, *Rubus ulmifolius*, *Asparagus acutifolius*, *Smilax aspera*, etc. Besides, its floristic set is characterized by the occurrence of *Euphorbia characias* and some species of higher rank.

Syndynamism: This community belongs to the dynamic series of mesophilous holm oak woods, such as *Ampelodesmo mauritanici-Quercetum ilicis* and *Sorbo torminalis-Quercetum ilicis*.

Habitat reference: See class.

41.3. Order: ***Lauro nobilis-Sambucetalia nigrae*** Biondi, Blasi, Casavecchia, Galdenzi & Gasparri 2014 in Biondi et al. 2014

Mesic scrubs of shady and nutrient-rich soils.

Holotypus: *Lauro nobilis-Sambucion nigrae* Biondi, Blasi, Casavecchia, Galdenzi et Gasparri in Biondi et al. 2014

Characteristic and differential species: *Laurus nobilis* L., *Sambucus nigra* L., *Ulmus minor* Mill.

Geographical distribution: The syntaxon at issue is distributed in the Central Mediterranean area, being a geographical vicariant of the *Clematido vitalbae-Sambucetum nigrae* O. Bòlos 1978, which occurs in the Iberian Peninsula (Biondi et al., 2014).

Structure and ecology: The nitrophilous and sciaphilous micro-forests dominated by *Sambucus nigra*, occurring on soils rich in organic matter within the meso-Mediterranean thermotype, are framed within the *Lauro nobilis-Sambucetalia nigrae* order.

Syndynamism: Generally, it is an edaphic vegetation growing on the slightly raised surfaces of wet depressions and valley floors, often near rivers and streams. It has catenal contacts with the nitro-sciaphilous communities of *Artemisietea vulgaris* and hygrophilous forest of *Alno-Populetea*, which occupies the belt closest to the waterway.

Habitat reference: See class.

41.3.1. Alliance: ***Lauro nobilis-Sambucion nigrae*** Biondi, Blasi, Casavecchia, Galdenzi et Gasparri in Biondi et al. 2014

Micro-forests with elderberry of shady and humid stands.

Holotypus: *Symphyto bulbosi-Sambucetum nigrae* Biondi & Allegrezza 2004

Characteristic and differential species: See order.

Geographical distribution: See order.

Structure and ecology: See order.

Syndynamism: See order.

Habitat reference: See class.

41.3.1.1. ***Hyperico majoris-Rubetum ulmifolii*** Gianguzzi, Cuttonaro, Cusimano & Romano 2016

Mesic scrub with stinking tutsan and elmleaf blackberry of fresh and humid soils.

Holotypus: rel. 2, tab. 16, Gianguzzi et al. (2016).

Characteristic and differential species: *Calystegia sylvatica* (Kit.) Griseb., *Hypericum hircinum* L. subsp. *majus* (Aiton) N. Robson.

Phytosociological table: From Gianguzzi et al. (2016), tab. 16, 8 rel.

Char. association: *Hypericum hircinum* subsp. *majus* (V), *Calystegia sylvatica* (IV).

Char. alliance and order: *Sambucus nigra* (V), *Ulmus minor* (IV), *Laurus nobilis* (II).

Char. class: *Rubus ulmifolius* (V), *Clematis vitalba* (V), *Rubia peregrina* subsp. *longifolia* (V), *Euphorbia characias* (V), *Asparagus acutifolius* (V), *Dioscorea communis* (V), *Rosa canina* (IV), *Prunus spinosa* (III), *Crataegus monogyna* (II), *Smilax aspera* (II), *Lonicera etrusca* (I), *Rosa sempervirens* (I), *Rosa corymbifera* (I).

Other species: *Hedera helix* (V), *Acanthus mollis* (IV), *Allium triquetrum* (III), *Arum italicum* (III), *Urtica dioica* (III), *Allium subhirsutum* (III), *Ficus carica* (III), etc.

Geographical distribution: This vegetation occurs in the Sicani mountains, being rare and scattered along impluvi and banks of torrents (Gianguzzi et al., 2016).

Structure and ecology: The shady stands with more or less deep and evolved soils, often near impluvi, river-banks and nitrophilous glades, are colonized by the *Hyperico majoris-Rubetum ulmifolii*. It is a dense and intricate shrubby vegetation dominated by *Rubus ulmifolius* and *Clematis vitalba*, growing togheter with *Hypericum hircinum* subsp. *majus* and some species of alliance and order, as *Sambucus nigra*, *Ulmus minor* and *Laurus nobilis*. Besides, the physiognomy of this vegetation is characterized by the abundance of lianas, as

Hedera helix, *Smilax aspera*, *Calystegia sylvatica* and *Dioscorea communis*, and thorny shrubs, among them *Rosa* sp. pl., *Prunus spinosa* and *Crategus monogyna*. From the bioclimatic point of view, it is tied to the sub-humid mesomediterranean thermotype at an altitude from 600 to 1100 m a.s.l. (Gianguzzi et al., 2016).

Syndynamism: This association belongs to hygrophilous and ombrophilous series, within the climactic belt of the class *Quercetea ilicis*.

Habitat reference: See class.

42. Class: ***Nerio-Tamaricetea*** Br.-Bl. & O.Bolòs 1958

Circummediterranean and Macaronesian riparian scrub and thickets.

Synonyms: *Nerio-Tamaricetea gallicae* (O. de Bolòs 1956) Br.-Bl. et O. de Bolòs 1957 (sensu Julve 1993) (phantom); *Tamaricetea* Drossos 1992 (art. 2b, 5).

Holotypus: *Tamaricetalia africanae* Br.-Bl. & O. Bolòs 1958

Characteristic and differential species: *Nerium oleander* L., *Tamarix africana* Poir., *Tamarix gallica* L., *Vitex agnus-castus* L.

Geographical distribution: This class is distributed through the Mediterranean, Saharo-North Arabian and Iranic-Turanian territories (Rivas-Martinez et al., 1997; Costa et al., 2012).

Structure and ecology: This class groups the riparian vegetation formed by microphanerophytes, nanophanerophytes and tall grasses, growing on alluvial soils, often slightly saline and with an abundant gravelly and silty component. These communities occur along rivers and streams with extremely irregular flooding seasonal pattern and temporary severe drought, as well as on the banks of coastal salty lagoons, from the infra- to supra-mediterranean bioclimatic belts (Costa et al., 2012). Their physiognomy is given by some sub-halophilous tall shrubs, as *Tamarix* sp. pl., *Nerium oleander* and *Vitex agnus-castus*.

Syndynamism: These riparian thickets with tamarisks represent an edaphic vegetation, which is tied to the physical dynamics of torrential streams or coastal marshes affected by summer drying and an increased salinity. Consequently, this vegetation has a durable character, whose dynamic evolution is prevented by peculiar edaphic conditions. Its degredation, due to anthropic disturbance, leads to their replacement with the subnitrophilous grasslands of *Bromo-Oryzopsion*. From the catenal point of view, it can be in contact with the hygrophilous herbaceous communities of *Scirpetalia compacti* and *Juncetalia maritimi*, as well as with the glareicolous aspects dominated by *Helichrysum italicum*, located

on the alluvial terraces most frequently affected by winter floods (Asensi & Dìez-Garretas, 2011; Biondi et al., 2014).

Habitat reference: F9.3 Mediterranean riparian scrub.

42.1. Order: ***Tamaricetalia africanae*** Br.-Bl. & O.Bolòs 1958

Thermophilous and sub-halophilous riparian scrubs of Mediterranean area

Synonyms: *Nerio-Tamaricetalia* Br.-Bl. et Bolòs (orig.form) (sensu Lovrić sine dato) (phantom); *Tamaricetalia africanae* Br.-Bl. et O. de Bolòs 1957 (sensu Julve 1993) (phantom); *Viticetalia agni-casti* Lakušić 1972 (phantom); *Viticetalia agni-casti* Lakušić 1973 (art. 2b); *Nerio oleandri-Viticetalia agni-casti* de Foucault et al. 2012 (syntax.syn.).

Holotypus: *Tamaricion africanae* Br.-Bl. & O. Bolòs 1958

Characteristic and differential species: See class.

Geographical distribution: It is the single order of the Mediterranean area (Costa et al., 2012).

Structure and ecology: See class.

Syndynamism: See class.

Habitat reference: See class.

42.1.1. Alliance: ***Tamaricion africanae*** Br.-Bl. & O.Bolòs 1958

Infra- to supramediterranean tamarisk riparian scrub in temporarily flooded freshwater habitats of the Western Mediterranean**.**

Synonyms: *Tamaricion africanae* Br.-Bl. et O. de Bolòs 1957 (phantom).

Holotypus: *Tamaricetum canariensis* Br.-Bl. & O. Bolòs 1958 corr. O. Bolòs & Vigo 1984

Characteristic and differential species: *Glycyrrhiza glabra* L., *Tamarix arborea* Ehrenb. ex Bunge.

Geographical distribution: This alliance is restricted to the Western Mediterranean area (Costa et al., 2012). In Sicily it is mainly linked to the more dry areas with evaporitic rocks of the Central-Southern part.

Structure and ecology: This alliance includes the thermophilous communities dominated by several species of *Tamarix*, occurring on river, streams and lagoon with freshwater or brackish waters and subject to severe drought and high water fluctuations, undergoing periods of high aridity and high temperatures. These communities occur from the infra- to meso-mediterranean thermorypes.

Syndynamism: See class.

Habitat reference: See class.

42.1.1.1. ***Tamaricetum gallico-africanae*** ass. nov. provv.

Riparian thickets with French and African tamarisk of river-banks with brackish waters.

Synonyms: *Tamaricetum gallicae* auct. sic. non Br.-Bl. & O.Bolòs 1958.

Holotypus: rel. 4, tab. 14, Brullo & Spampinato (1990).

Characteristic and differential species: *Tamarix gallica* L.

Phytosociological table: From Brullo & Spampinato (1990), tab. 14, 7 rel.
Char. association and alliance: *Tamarix gallica* (V), *Glycyrrhiza glabra* (II).
Char. order and class: *Tamarix africana* (V), *Nerium oleander* (II).
Other species: *Salix alba* (IV), *Salix purpurea* (IV), *Phragmites australis* (IV), *Calystegia sylvatica* (V), *Dittrichia viscosa* (IV), *Artemisia arborescens* (V), *Festuca arundinacea* (IV), *Salix gussonei* (III), *Populus nigra* (II), etc.

Geographical distribution: This community occurs in the rivers and streams of Southern and Eastern Sicily (Brullo et al., 1988; Brullo & Spampinato, 1990; Sciandrello, 2016).

Structure and ecology: The less disturbed stands of the lower part of rivers and streams with slightly salty waters are covered by a floristically poor vegetation dominated by *Tamarix gallica* and *T. africana*. It is the *Tamaricetum gallico-africanae*, a dense and intricate scrub, growing in the dry banks subject to seasonal flooding and sometimes also in the shores of coastal marshes and artificial basins. The floristic set is characterized by the sporadic occurrence of *Nerium oleander* and *Glycyrrhiza glabra*, as well as of some transgressive hygrophilous species, as *Salix alba*, *S. purpurea*, *S. gussonei*, *Phragmites australis*, *Populus nigra*, etc.

Syndynamism: This vegetation shows catenal contacts with the *Salicetea purpureae* communities , which are linked to more humid surfaces with a longer flooding period (Brullo & Spampinato, 1990).

Habitat reference: See class.

42.1.1.2. ***Tamaricetum africano-arboreae*** Brullo & Sciandrello 2006

Thermophilous thickets with arboreal tamarisk of lacustrine shores.

Holotypus: rel. 10, tab. 15, Brullo & Sciandrello (2006).

Characteristic and differential species: *Tamarix arborea* Ehrenb. ex Bunge.

Phytosociological table: From Brullo & Sciandrello (2006), tab. 15, 13 rel.
Char. association and alliance: *Tamarix arborea* (V).
Char. order and class: *Tamarix africana* (V), *Tamarix gallica* (IV).
Other species: *Arundo donax* (V), *Parietaria judaica* (V), *Galium aparine* (V), *Piptantherum miliaceum* (IV), *Picris hieracioides* (IV), *Urtica membranacea* (IV), *Mercurialis annua* (IV), etc.

Geographical distribution: This community was described by Brullo & Sciandrello (2006) from «Biviere di Gela» lake.

Structure and ecology: It is a more or less dense woodland dominated by *Tamarix africana* and *T. arborea*, a rare species with a south-eastern Mediterranean and Saharo-Arabian distribution. This vegetation is found on the shores of coastal salt marshes, near the entry point of rivers, where there is a deposition of sandy and silty matter. On the whole, this association is well differentiated from the others of the same alliance for its markedly thermo-xerophilous character and also because it is linked exclusively to lacustrine habitats with slightly salty soils. However, Guglielmo et al. (2012) described from the coastal salt-marshes of South-Eastern Sicily the *Limbardo crithmoidis-Tamaricetum africanae* (*nom. nudum*), an association with very similar ecological requirements but differing for the dominance of *T. africana* and the absence of *T. arborea*.

Syndynamism: This vegetation shows catenal contacts with a sub-hygrophilous community dominated by *Lotus rectum*, which colonizes the raised surfaces further from the river and with sporadic flooding.

Habitat reference: See class.

40.1.2. Alliance: ***Rubo ulmifolii-Nerion oleandri*** O.Bolòs 1985

Thermo- to supramediterranean oleander riparian scrub.

Holotypus: R*ubo ulmifolii-Nerietum oleandri* O. Bolòs 1955

Characteristic and differential species: *Nerium oleander* L., *Rubus ulmifolius* Schott.

Geographical distribution: This alliance occurs in the Western Mediterranean area and North Africa (Costa et al., 2012; Mucina et al. 2016).

Structure and ecology: The communities of this alliance differ from those one belonging to *Tamaricion africanae* for their more mesic and not halophilous requirements, growing only along rivers and streams with freshwaters. Their physiognomy derive from the high coverage of *Nerium oleander*, often associated with *Rubus ulmifolius* and *Vitex agnus-castus* (Brullo & Spampinato, 1990).

Syndynamism: See class.

Habitat reference: See class.

42.1.2.1. ***Tamarici africanae-Viticetum agni-casti*** Brullo & Spampinato 1997

Riparian scrub with african tamarisk and chaste tree of alluvial soils.

Holotypus: rel. 1, tab. 12, Brullo & Spampinato (1997).

Characteristic and differential species: *Tamarix africana* Ehrenb. ex Bunge.

Phytosociological table:-

Geographical distribution: This community occurs in the Ionian side of Calabria (Brullo & Spampinato, 1997; Brullo et al., 2001), in South-Western Sardinia (Bacchetta et al., 2005) and in the North-Eastern part of Sicily (Licandro et al., 2011).

Structure and ecology: The large terminal part of the river-beds known as «fiumare» is colonized by a shrubby vegetation dominated by *Vitex agnus-castus,* usually associated with *Tamarix africana*, *Nerium oleander* and *Rubus ulmifolius*. It is the *Tamarici africanae-Viticetum agni-casti*, a thermophilous community growing on wet alluvial soils with a rich silty component that maintain a certain degree of humidity even in summer (Brullo et al., 2001). This vegetation was surveyed also on the shores of coastal salt-marshes by Licandro et al. (2011).

Syndynamism: See class.

Habitat reference: See class.

42.1.2.2. ***Spartio juncei-Nerietum oleandri*** Brullo & Spampinato 1990

Thermophilous scrub with spanish broom and wild oleander of alluvial soils.

Holotypus: rel. 2, tab. 13, Brullo & Spampinato (1990).

Characteristic and differential species: *Cytisus infestus* (C. Presl) Guss., *Spartium junceum* L.

Phytosociological table: From Brullo & Spampinato (1990), tab. 13, 10 rel.

Char. association: *Spartium junceum* (V), *Cytisus infestus* (V).

Char. alliance, order and class: *Nerium oleander* (V), *Tamarix africana* (IV), *Rubus ulmifolius* (IV).

Other species: *Helichrysum italicum* (V), *Micromeria graeca* (V), *Foeniculum vulgare* subsp. *piperitum* (IV), *Avena barbata* (III), *Briza maxima* (III), *Trifolium campestre* (III), *Clinopodium nepeta* (III), etc.

Geographical distribution: This community is widely distributed in Sicily, particularly in the rivers of the Northern and Eastern sides, including Madonie, Nebrodi and Peloritani (Brullo & Spampinato, 1990). It was surveyed also in southern Calabria by Brullo et al. (2001).

Structure and ecology: This community grows on alluvial soils with a rich gravelly and sandy component, preferring the narrow stretches of river-bed subject to sporadic floodings during the winter and dry in summer. Its structure is given by *Spartium junceum* and *Nerium oleander*, which gives a peculiar appareance to this vegetation during the summer flowering. Besides, the floristic set is characterized by the occurrence of *Cytisus infestus* and some species of higher rank, such as *Tamarix africana* and *Rubus ulmifolius*.

Syndynamism: This association shows catenal contact with the glareicolous vegetation of *Euphorbion rigidae*, which occurs on less evolved soils subject to more frequent flooding.

Habitat reference: See class.

42.1.2.3. ***Rubo ulmifolii-Nerietum oleandri*** O. Bolòs 1956

Riparian scrub with elmleaf blackberry and oleander.

Holotypus: Not designated.

Characteristic and differential species: *Nerium oleander* L.

Phytosociological table: From Sciandrello et al. (2013), tab. 6, 3 rel. (subass. *hypericetosum maioris*).

Char. association: *Nerium oleander* (3).

Char. subass.: *Hypericum hircinum* subsp. *majus* (3).

Char. alliance, order and class: *Rubus ulmifolius* (3).

Other species: *Platanus orientalis* (3), *Ficus carica* (3), *Smilax aspera* (3), *Spartium junceum* (3), *Fraxinus ornus* (2), *Salix gussonei* (2), *Equisetum telmateja* (2), etc.

Geographical distribution: This Western-Mediterranean association is known only from Taormina area in Sicily (Sciandrello et al., 2013).

Structure and ecology: This community replaces the previous one on more inclined river-beds with rocky outcrops and subject to frequent winter flooding, where *Spartium junceum* and *Cytisus infestus* are absent. Its physiognomy derives from the high coverage of *Nerium oleander*, normally associated with *Rubus ulmifolius* and *Tamarix africana*. Sciandrello et al. (2013) distinguished the subass. *hypericetosum maioris*, growing on steep beds of modest streams. Under the floristic profile, this aspect is characterized by the frequency of *Hypericum hircinum* subp. *majus*.

Syndynamism: See class.

Habitat reference: See class.

43. Class: ***Junipero-Pinetea sylvestris*** Rivas-Martinez 1965 nom. inv. propos. Rivas- Martínez et al. 2002

Relict oromediterranean and submediterranean orotemperate dry pine forests, juniper woods and related scrub of the Mediterranean.

Synonyms: *Pino-Juniperetea* Rivas-Martinez 1965 (art. 42); *Junipero sabinae-Pinetea ibericae* Rivas-Martinez 1965 nom. mut. propos. et nom. invers. propos. (Rec. 10C, mut.superfl.).

Holotypus: *Junipero-Pinetalia sylvestris* Rivas-Martinez 1965 nom. invers. propos.

Characteristic and differential species: *Cotoneaster nebrodensis* (Guss.) C. Koch, *Daphne oleoides* Schreb., *Juniperus communis* L. subsp*. hemisphaerica* (J. & C. Presl) Arcang.*, Rosa sicula* Tratt.

Geographical distribution: This class occurs in the whole Mediterranean area, including Sicily, where it is resticted to the main mountain ranges and in particular to Etna and Madonie (Rivas-Martinez 1965; Brullo et al., 2001).

Structure and ecology: It is a mesophilous and orophilous woody vegetation dominated by conifers (mainly *Juniperus* spp., *Abies* spp. and *Pinus* spp.), forming a bistratified structure, with an open and spaced tree layer (sometimes absent) and a thick and prostrate shrubby layer. This vegetation grows on lithosoils or entisoils poor in humus, both on calcareous and siliceous substrates, enduring the very harsh ecological conditions of the supra- and oro-mediterranean bioblimatic belts. As reported by many authors (see Brullo et al., 2001), these woodlands have a relictual significance, showing a scattered distribution in the Mediterranean mountains, as result of the progressive spread of angiosperms after the Tertiary age.

Syndynamism: It is a permanent climactic vegetation, having catenal contacts with the mesophilous woods of *Querco-Fagetea* class.

Habitat reference: F3.1a Lowland to montane temperate and submediterranean *Juniperus* scrub.; G3.1c Mediterranean mountain *Abies* woodland; G3.4c Mediterranean montane *Pinus sylvestris-Pinus nigra* woodland.

43.1. Order: ***Berberido creticae-Juniperetalia excelsae*** Mucina in Mucina et al. 2016

Relict submediterranean supramediterranean dry pine forests and juniper woods of the Central and Eastern Mediterranean.

Holotypus: *Juniperion excelso-foetidissimae* Matevski et al. 2010.

Characteristic and differential species: *Allium nebrodense* Guss., *Berberis aetnensis* C. Presl, *Pinus nigra* Arnold subsp. *calabrica* (Loud.) A.E. Murray.

Geographical distribution: This order represents the Central-Eastern Mediterranean vicariant of *Pino sylvestris-Juniperetalia sabinae* Rivas-Martinez 1965, occurring in the Western territories. It is distributed from the Tyrrhenian islands of Corsica and Sardinia as far east as Cyprus and Middle East (Mucina et al., 2016).

Structure and ecology: It groups open-woodlands and dwarf shurblands with a very localized distribution in the supra- and oromediterranean belts. From the floristic point of view, these communities show a remarkable differentiation from the analogous occurring in the Western Mediterranean area.

Syndynamism: See class.

Habitat reference: See class.

43.1.1. Alliance: ***Berberido aetnensis-Pinion laricionis*** (Brullo, Giusso & Guarino 2001) Mucina & Theurilllat 2016

Acidophilous dry pine forests in the supra-mediterranean belt of Corsica, Sardinia, Sicily and Calabria.

Synonyms: *Pinion laricionis* Mayer 1984 (phantom); *Pinion nigrae-laricionis* Mayer 1984 (art. 2b); *Pinion calabricae* S. Brullo & Spampinato 1999 (art. 1); *Berberidion aetnensis* S. Brullo et al. 2001 (art. 29b); *Pinion calabricae* S. Brullo & Spampinato in S. Brullo et al. 2001 (art. 3b).

Holotypus: *Junipero hemisphaericae-Pinetum calabricae* Brullo & Siracusa in Brullo et al. 2001

Characteristic and differential species: See order

Geographical distribution: This alliance occurs in Corsica, Sardinia, Sicily and Calabria (Brullo et al., 2001).

Structure and ecology: It comprises orophilous coniferous forests and dwarf shrublands, having a pioneer character. They are characterized by a low number of characteristic and differential species, but often endemic and with a high biogeographical and ecological significance (Brullo et al., 2001).

Syndynamism: See class.

Habitat reference: See class.

43.1.1.1. ***Cerastio tomentosi-Juniperetum hemisphaericae*** Pignatti & Nimis in Pignatti et al. 1980

Prostrate shrublands with snow-in-summer and dwarf juniper.

Synonyms: *Lino punctati-Seslieretum siculae* subass. *juniperetosum* Brullo 1984 (synt. syn.)

Holotypus: rel. 82, tab. 9, Pignatti et al. (1980).

Characteristic and differential species: *Allium nebrodense* Guss., *Cerastium tomentosum* L.

Phytosociological table: From Pignatti et al. (1980), tab. 9, 6 rel.

Char. association: *Cerastium tomentosum* (V), *Allium nebrodense* (I).

Char. alliance, order and class: *Juniperus communis* subsp. *hemisphaerica* (V), *Rosa sicula* (IV), *Daphne oleoides* (III), *Berberis aetnensis* (II).

Other species: *Aethionema saxatile* (IV), *Festuca circummediterranea* (III), *Helianthemum cinereum* (III), *Hypochoeris laevigata* (II), *Dianthus arrostii* (I), etc.

Geographical distribution: This community is restricted to Madonie mountains (Pignatti et al., 1980).

Structure and ecology: This shrubland is characterized by a monostratified structure dominated by prostrate shrubs of *Juniperus communis* subsp. *hemisphaerica*, which are associated with few other species of higher rank, as *Rosa sicula*, *Daphne oleoides* and *Berberis aetnensis*. Moreover, its floristic autonomy is is guaranteed by *Cerastium tomentosum* and *Allium nebrodense*. This vegetation dwells sunny and windy stands between 1300 and 1900 m, on limestones, dolomites and quartzites, preferring shallow and scarcely evolved soils. It is possible to find a calcicole and silicicole facies of this association, characterized respectively by *Sesleria nitida* subsp. *sicula* and *Genista cupanii* (Brullo et al., 2001).

Syndynamism: This edaphophilous community has catenal contacts with the orophilous pulvinate vegetation of *Rumici-Astragaletea* and sometimes replaces the mesic broad-leaved woods of *Ilici aquifolii-Quercetum austrothyrrenicae* and *Luzulo siculae-Fagetum sylvaticae* in secondary stands.

Habitat reference: F3.1a Lowland to montane temperate and submediterranean *Juniperus* scrub.

43.1.1.2. ***Junipero hemisphaericae-Abietetum nebrodensis*** Brullo & Giusso in Brullo et al. 2001

Relict orophilous woodlands with dwarf juniper and Madonie fir.

Holotypus: rel. 4, tab. 2, Brullo et al. (2001).

Characteristic and differential species: *Abies nebrodensis* (Lojac.) Mattei., *Rosa heckeliana* Walp.

Phytosociological table: From Brullo et al. (2001), tab. 2, 4 rel.

Char. association: *Abies nebrodensis* (4), *Rosa heckeliana* (3).

Char. alliance, order and class: *Juniperus communis* subsp. *hemisphaerica* (4), *Pinus nigra* subsp. *calabrica* (3), *Rosa sicula* (1).

Other species: *Silene italica* subsp. *sicula* (4), *Plantago subulata* subsp. *humilis* (4), *Sorbus graeca* (3), *Galium lucidum* subsp*. venustum* (3), *Armeria nebrodensis* (3), *Bunium petraeum* (3), etc.

Geographical distribution: It is a very localized association, which is restricted to a small valley in the Madonie mountains (Brullo et al., 2001).

Structure and ecology: *Abies nebrodensis* is a rare endemic species of Sicily, that in the Tertiary age probably constituted extensive woodland formations in the mountains of Sicily, but following the beechwood expansion during the ice ages and the intense anthropic exploitation it is now confined to a small area (Bertolani-Marchetti et al., 1984). Currently, this species characterizes a peculiar bistratified community, named *Junipero hemisphaericae-Abietetum nebrodensis*, with scattered trees and a shrubby layer dominated by *Juniperus communis* subsp. *hemisphaerica*. It occurs on initial soils derived by quartzites, colonizing slightly inclined slopes subject to frequent fogs, between 1400 and 1600 m a.s.l.

Syndynamism: The survival of this relict vegetation is allowed by very peculiar ecological conditions that insist on the only stand of *Abies nebrodensis*, such as the frequent fogs and high rainfall, as well as the poorly evolved soil that does not allow the establishment of beech.

It shows catenal contacts with the *Rumici-Astragaletea* vegetation and the *Anemono appeninae-Fagetum sylvaticae*.

Habitat reference: G3.1c Mediterranean mountain *Abies* woodland.

43.1.1.3. ***Bellardiochloa aetnensis-Juniperetum hemisphaericae*** Brullo & Siracusa in Brullo et al. 2001

Orophilous scrubland with Etna bluegrass and dwarf juniper on volcanic substrata.

Holotypus: rel. 7, tab. 4, Brullo et al. (2001).

Characteristic and differential species: *Bellardiochloa variegata* (Lam.) Kerguélen subsp. *aetnensis* (C. Presl) Giardina & Raimondo

Phytosociological table: From Brullo et al. (2001), tab. 4, 10 rel.

Char. association: *Bellardiochloa variegata subsp. aetnensis* (V).

Char. alliance, order and class: *Berberis aetnensis* (V), *Juniperus communis* subsp. *hemisphaerica* (V), *Pinus nigra* subsp. *calabrica* (I).

Other species: *Festuca circummediterranea* (V), *Secale strictum* (V), *Astragalus siculus* (V), *Silene italica* subsp. *sicula* (V), *Galium aetnicum* (V), *Carlina nebrodensis* (IV), *Linaria purpurea* (IV), *Clinopodium alpinum* subsp. *meridionale* (IV), *Viola aetnensis* (IV), *Erysimum aetnense* (IV), *Petrorhagia saxifraga* (III), etc.

Geographical distribution: This community occurs in the supramediterranean belt of Etna mountain, representing an edaphic and geographical vicariant of *Cerastio tomentosi-Juniperetum hemisphaericae* (Brullo et al., 2001).

Structure and ecology: It is a shrubby vegetation with a marked pioneer character, colonizing the poorly evolved volcanic soils between 1800 and 2000 m a.s.l.. Its structure is given by *Juniperus communis* subsp. *hemisphaerica*, growing together with *Bellardiochloa variegata* subsp. *aetnensis* and *Berberis aetnensis*.

Syndynamism: In the less mature soils is replaced by the pulvinate vegetation of *Astragaletum siculi*, while in the more evolved substrates it tends to be substituted by the orophilous forests.

Habitat reference: F3.1a Lowland to montane temperate and submediterranean *Juniperus* scrub.

43.1.1.4. ***Junipero hemisphaericae-Pinetum calabricae*** Brullo & Siracusa in Brullo et al. 2001

Orophilous open woodlands with Calabrian black-pine and dwarf juniper.

Holotypus: rel. 8, tab. 3, Brullo et al. (2001).

Characteristic and differential species: *Pinus nigra* Arnold subsp. *calabrica* (Land.) E. Murray, *Rosa montana* Chaix.

Phytosociological table: From Brullo et al. (2001), tab. 3, 10 rel.

Char. association: *Pinus nigra subsp. calabrica* (V), *Rosa montana* (V).

Char. alliance, order and class: *Berberis aetnensis* (V), *Juniperus communis* subsp. *hemisphaerica* (V).

Other species: *Silene italica* subsp. *sicula* (V), *Calamagrostis epigejos* (V), *Crepis leontodontoides* (V), *Brachypodium sylvaticum* (V), *Secale strictum* (IV), *Festuca circummediterranea* (IV), *Pteridium aquilinum* (IV), *Lathyrus pratensis* (IV), etc.

Geographical distribution: This association is widespread in the supramediterranean belt of Etna volcano (Brullo et al., 2001).

Structure and ecology: This open pine-wood dominated by *Pinus nigra* subsp. *calabrica* replaces the previous association on more mature volcanic soils with rocky outcrops, within the supramediterranean belt from 1600 to 1900 m a.s.l. Even this community is characterized by a dense shrubby undergrowth with *Juniperus communis* subsp. *hemisphaerica*. As suggested by Brullo et al. (2001), it is very probable that during the Tertiary this vegetation was well represented on the siliceous mountains of north-eastern Sicily (Peloritani and Nebrodi), where it is now completely absent, and only during the Quaternary it colonizes the suitable habitats of Etna. Under the structural and ecological profile, the vegetation at issue is well differentiated from the close pine-woods of *Daphno laureolae-Pinetum calabricae*, which occurs at lower altitudes.

Syndynamism: This association represents the climax of an edaphoxerophilous series linked to initial volcanic substrates. The beech-forests replaces it on more evolved and ticker soils, despite they are not very frequent in the Etna due to the volcanic activity that hamperes the normal evolution of dynamic series.

Habitat reference: G3.4c Mediterranean montane *Pinus sylvestris-Pinus nigra* woodland.

44. Class: ***Salicetea purpureae*** Moor 1958

Willow scrub and low open forests of riparian habitats.

Synonyms: *Rubo-Salicetea purpureae* (Moor 1958) Passarge in Passarge & G. Hofmann

1968 (29c); *Salici purpureae-Populetea nigrae* (Rivas-Martinez et Cantò ex Rivas-Martinez et al. 1991) Rivas-Martinez et Canto in Rivas-Martinez et al. 2002 p.p. (art. 29b).

Holotypus: *Salicetalia purpureae* Moor 1958

Characteristic and differential species: *Salix purpurea* L. subsp. *lambertiana* (Sm.) Macreight

Geographical distribution: This class is widely distributed in temperate to arctic zones of Europe (Mucina et al., 2016). In Sicily this vegetation shows a low diversification and a marked floristic poverty (Brullo & Spampinato, 1990).

Structure and ecology: The medium and low course of rivers and streams, where the bed is wide and with little slope, is colonized by a pioneer vegetation constituted by arboreous and shrubby willows. These communities should be referred to *Salicetea purpureae*, a syntaxon clearly differentiated from the *Alno-Populetea* hygrophilous forests for its floristic and structural characteristics. Infact, the class at issue includes scrubs and low open riparian forests with an heliophilous and thermophilous character, where the typical species of *Alno-Populetea* class are rare or totally missing. The occurrence of this poorly evolved vegetation is linked to some physical features of river-beds, as regular floodings, slow currents, rapid sedimentation of fine materials and xeric conditions (Rivas-Martinez et al., 1997). The soils are generally little evolved and are represented by sandy-gravelly substrates in Northern Sicily and by silty-clayey alluvia in the Central-Southern part of the island (Brullo & Spampinato, 1990).

Syndynamism: This edaphic permanent vegetation can have catenal contact with the riparian forests of *Alno-Populetea*, of which sometimes it can be a secondary stage.

Habitat reference: G1.3 Mediterranean and Macaronesian riparian woodland.

44.1. Order: ***Salicetalia purpureae*** Moor 1958

Riparian, forest, floodway vegetation dominated by tall willows and pioneer willow shrubs, regularly inundated by seasonal floods.

Synonyms: *Salicetalia albae* T.Mùller & Gòrs 1958 (art. 3b); *Ranunculo-Salicetalia albae* Passarge 1968 (syntax.syn.); *Rubo-Salicetalia purpureae* (Moor 1958) Passarge & G. Hofmann 1968 (art. 29c)

Holotypus: *Salicion albae* Soò 1951

Characteristic and differential species: See class.

Geographical distribution: See class.

Structure and ecology: It is the only order within the *Salicetea purpureae* class.

Syndynamism: See class.

Habitat reference: See class.

44.1.1. Alliance: ***Salicion albae*** Soò 1951

Willow and poplar low open forests of lowland to submontane river alluvia.

Synonyms: *Salicion albae* Soò 1930 (art.2b); *Populion albae* R. Tx. 1931 (art. 3f); *Populion albae* Szafer 1935 (art. 2b); *Saliceto-Populion albae* Klika 1943 (orig.form) (phantom); *Saliceto-Populion albae* Klika in Klika & Hadać 1944 (orig.form) (art. 2b); *Salicion albae* R. Tx. 1955 (art. 31); *Salicion albae* T.Mùller & Gòrs 1958 (art. 31); *Salicion eleagni* T.Mùller & Gòrs 1958 (phantom); *Salicion purpureae* Moor 1958 (phantom); *Irido-Salicion albae* Passarge & G. Hofmann 1968 (syntax.syn.); *Salici fragilis-Alnion* Passarge 1968 (phantom); *Salici fragilis-Alnion* Passarge et G. Hofmann 1968 (syntax.syn.); *Salicion purpureae* Ellenberg et Kl€otzli 1974 (syntax. syn.); *Salicion purpureae* Lakušić et al. 1975 (phantom); *Salicion purpureae* Lakušić et al. 1979 (art. 2b, 5); *Rubo caesiae-Populion nigrae* Passarge 1985 (syntax.syn.); *Populion nigrae* Schnitzler 1988; *Populion nigrae* Rameau in Rameau et al. 1993 (art. 2b, 3b); *Asparago officinalis-Salicion albae* Golub 2001 (syntax. syn.).

Lectotypus: Not designated.

Characteristic and differential species: *Populus nigra* L., *Salix alba* L., *Saponaria officinalis* L.

Geographical distribution: This alliance is widely distributed in Central-Eastern Europe and in the Mediterranean area (Mucina et al., 2016).

Structure and ecology: This alliance comprises open willow and willow-poplar riparian forests dominated by arborescent or shrubby specimens of *Salix alba* and *Populus nigra*. The unusual habitus of these species is due to quite xero-thermophilous conditions, if compared to the typical *Alno-Populetea* habitat, where they find a more suitable environment.

Syndynamism: See class.

Habitat reference: See class.

44.1.1.1. ***Salicetum albo-purpureae*** (I. & V. Karpati 1961) Barbagallo, Brullo & Fagotto 1979

Riparian scrub with purple and white willow of gravelly-sandy alluvia.

Synonyms: *Salicetum albae-fragilis albanicum* I. Karpati & V. Karpati 1961 (nom. inval.).

Lectotypus: Not designated.

Characteristic and differential species: *Salix purpurea* L.

Phytosociological table: From Brullo & Spampinato (1990), tab. 5, 9 rel. (subass. *typicum*).
Char. association: *Salix purpurea* (V).
Char. alliance, order and class: *Salix alba* (V), *Populus nigra* (III), *Saponaria officinalis* (II).
Other species: *Rubus ulmifolius* (III), *Brachypodium sylvaticum* (III), *Tamarix africana* (III), *Rosa canina* (III), *Spartium junceum* (II), *Prunus spinosa* (II), *Silene dioica* (II), etc.

From Brullo & Spampinato (1990), tab. 5, 10 rel. (subass. *salicetosum gussonei*).
Char. association: *Salix purpurea* (V).
Char. subassociation: *Salix gussonei* (V).
Char. alliance, order and class: *Salix alba* (V), *Populus nigra* (III).
Other species: *Rubus ulmifolius* (III), *Eupatorium cannabinum* (III), *Hypericum hircinum* (II), *Fraxinus angustifolia* (II), *Platanus orientalis* (II), *Brachypodium sylvaticum* (II), *Spartium junceum* (II), etc.

Geographical distribution: This community was originally described from the Balkanic peninsula and later surveyed also in Sicily, where it is quite frequent in the north-eastern part (Etna and Peloritani) up to altitudes of about 800 m a.s.l. (Barbagallo et al., 1979; Brullo & Sparnpinato, 1990; Gianguzzi & D'Amico, 2006).

Structure and ecology: It is a riparian shrubby vegetation dominated by *Salix purpurea* and *S. alba*, occurring on alluvial lowlands with metamorphic rocks. Generally, this community is found in incoherent soils with a rich gravelly and sandy component, within the subhumid mesomediterranean belt, preferring the stands subject to a marked erosion and sedimentation due to strong currents. This quite extreme habitat determines the low height of this vegetation, usually below 2-3 m. The typical aspect is linked to the wider areas of river-bed, while the subass. *salicetosum gussonei*, a transitional aspect towards the *Platano-Salicetum gussonei*, occurs near the entrance of gorges or in any case in less large sections of the riverbed (Brullo & Spampinato, 1990).

Syndynamism: See class.

Habitat reference: See class.

44.1.2. Alliance: ***Salicion pedicellatae*** Rivas-Martinez et al. 1984

Riparian willow scrub on the alluvia of mineral-poor rivers.

Synonyms: *Salicion pedicellatae* Galàn de Mera, Pèrez Latorre & Cabezudo in Pèrez Latorre et al. 1999 (art. 31); *Salicion pedicellatae* (Ubaldi 2003) Poldini et al. 2011 (art. 31).

Lectotypus: Not designated.

Characteristic and differential species: *Salix pedicellata* Desf.

Geographical distribution: This alliance occurs in the Southern Iberian, Maghrebinian and Calabro-Sicilian territories (Mucina et al., 2016).

Structure and ecology: This alliance groups the riparian scrub or low forests dominated by *Salix pedicellata*, occurring from the thermo- to mesomediterranean bioclimatic belt. Generally, this vegetation is found in the margins of rivers with mineral-poor waters and silty-clay soils, showing a more thermophilous character than *Salicion albae*.

Syndynamism: See class.

Habitat reference: See class.

44.1.2.1. ***Salicetum albo-pedicellatae*** Brullo & Spampinato 1990

Riparian scrub or woodlands with white and mediterranean willow of marly-clayey alluvia.

Holotypus: rel. 5, tab. 6, Brullo & Spampinato (1990).

Characteristic and differential species: *Salix pedicellata* Desf.

Phytosociological table: From Brullo & Spampinato (1990), tab. 6, rel. 19.
Char. association and alliance: *Salix pedicellata* (V).
Char. order and class: *Salix alba* (V), *Salix purpurea* (I), *Saponaria officinalis* (I).
Other species: *Rubus ulmifolius* (V), *Calystegia sylvatica* (IV), *Phragmites australis* (IV), *Mentha suaveolens* (III), *Tamarix africana* (III), *Brachypodium sylvaticum* (III), *Populus nigra* (II), etc.

Geographical distribution: This association occurs mainly in Central and South-Western Sicily, while is more sporadic in the Eastern part of the island (Brullo & Spampinato, 1990; Gianguzzi & La Mantia, 2004; Minissale et al., 2007).

Structure and ecology: This community dwells river banks with silty-clay or marly soils, generally in quite large and open valleys, having a pioneer role in the colonization of the wet alluvia deposited by floods. It is an high scrub (up to 8 m) with a marked floristic poverty, being dominated by *Salix pedicellata* and *Salix alba* with few other species, including some

transgressive taxa of *Alno-Populetea* class, among them *Populus nigra*, *Equisetum telmateja*, *Solanum dulcamara*, *Ulmus minor* and *Hypericum hircinum*.

Syndynamism: Actually, this vegetation results very scattered and fragmented, due to the strong human impact on river ecosystem, being often replaced by nitrophilous communities. In the Hyblaean area the degradation of *Platano-Salicetum pedicellatae* can promote the settlement of *Salicetum albo-pedicellatae* (Minissale et al., 2007).

45. Class: ***Alno glutinosae-Populetea albae*** P. Fukarek & Fabijanic 1968

Meso-hygrophilous, riparian, deciduous forests of azonal type, localized along water courses and alluvial plains in the Eurosiberian and Mediterranean regions.

Synonyms: *Populetea albae* Br.-Bl. 1962 (art. 2b); *Alno-Populetea* P. Fukarek 1964 (art. 2b); *Populetea albae* Br.-Bl. 1964 nom. nud.; *Tamarici-Platanetea orientalis* I. Kárpáti et V. Kárpáti 1962; *Fraxino excelsioris-Quercetea roboris* Gillet 1986; *Tamarici-Platanetea orientalis* Buzo 2000 (art. 2b); *Salici purpureae-Populetea nigrae* (Rivas-Martinez et Canto ex Rivas-Martinez et al. 1991) Rivas-Martinez et Canto in Rivas Martinez et al. 2002 p.p. (art. 29b); *Salici purpureae-Populetea albae* (Rivas-Martinez et Canto in Rivas-Martinez et al. 2002) Belmonte Lopez 2008 (art. 29a).

Holotypus: *Populetalia albae* Br.-Bl. ex Tchou 1949 nom. conserv. propos.

Characteristic and differential species: *Alliaria petiolata* (Bieb.) Cavara & Grande, *Alnus glutinosa* (L) Gaertner, *Arum italicum* Miller subsp. *italicum*, *Bryonia dioica* Jacq., *Carex pendula* Hudson, *Carex remota* L., *Clematis vitalba* L., *Equisetum telmateia* Herh., *Fraxinus oxycarpa* M.Bieb ex Willd., *Hypericum androsaemum* L., *Hypericum hircinum* L. subsp. *majus* (Aiton) N. Robson, *Juglans regia* L., *Polystichum setiferum* (Forssk.) T. Moore ex Woyn., *Populus alba* L., *Populus nigra* L., *Salix alba* L., *Sambucus nigra* L., *Stachys sylvatica* L., *Symphytum bulbosum* C. Schimper, *Vinca minor* L., *Vitis vinifera* L. subsp. *sylvestris* (Gmelin) Hegi.

Geographical distribution: It is distributed in Eurosiberian and Mediterranean territories.

Structure and ecology: Meso-hygrophilous riparian, deciduous forests that grow along water courses and alluvial plains, linked to submerged or humid soils and dominated by *Salix* sp. pl., *Populus* sp. pl. *Fraxinus* sp. pl., *Alnus glutinosa*, *Ulmus* sp. pl., etc. Formerly, most of these woodlands were attributed from the syntaxonomical viewpoint to the class *Querco-Fagetea sylvaticae*, but for its very peculiar ecological requirements and floristical set their arrangement in an autonomous class is more appropriate (Mucina et al., 2016).

Syndynamism: The forests belonging to this class can be considered as azonal plant communities, representing the most mature stages of edapho-hygrophilous series.

Habitat reference: G1.2a Alnus woodland on riparian and upland soils; G1.3 Mediterranean and Macaronesian riparian woodland.

45.1. Order: ***Populetalia albae*** Br.-Bl. ex Tchou 1949 nom. conserv. propos.

Mediterranean and Mediterranean-Atlantic, riparian, deciduous, hygrophilous forests, localized on fluviosoils, periodically inondated, of fluvial valleys or plains.

Synonyms: *Populetalia albae* Br.-Bl. 1931 (art. 2b); *Populetalia albae* Br.-Bl. & R. Tx. 1943 (art. 2b); *Platanetalia orientalis* Knapp 1959 (art. 2b); *Platanetalia orientalis* Knapp ex I. Karpati & V. Karpati 1961; *Platanetalia orientalis* I. Karpati in P. Fukarek 1968 (art. 2b); *Tamarici-Platanetalia* P. Fukarek 1968 (art. 2b); *Rhododendro pontici-Prunetalia lusitanicae* Pèrez Latorre et al. 1999; *Rhododendretalia pontici* Pèrez Latorre, Galan de Mera & Cabezudo in Cabezudo & Pèrez Latorre 2001 (29a); *Rubio peregrinae-Ulmetalia minoris* Biondi, Casavecchia, Gasparri & Pesaresi in Biondi et al. 2015.

Holotypus: *Populion albae* Br.-Bl. ex Tchou 1949

Characteristic and differential species: see class.

Geographical distribution: This order occurs in the Mediterranean and thermo-Atlantic territories. In Sicily it is well represented in the mountain ranges of Peloritani, Nebrodi, Madonie, as well as in the Hyblaean and Palermo areas (Brullo & Spampinato, 1990).

Structure and ecology: Deciduous, riparian meso-hygrophilous gallery forests, localized on alluvial terraces of fluvial valleys or plains. They are widespread from sea level to the mountais, but in Sicily are more frequent in the mesomediterranean belt. They prefers quite deep and narrow valleys, where the riverbed is quite sloped, favoring the occurrence of a strong current, whose erosion activity determines the creation of gorges. The high humidity and the shady conditions of these environments allow the settlement of the hygrophilous riparian forests.

Syndynamism: This order groups azonal woodlands, representing mature stages of edapho-hygrophilous series.

Habitat reference: See class.

45.1.1. Alliance: ***Populion albae*** Br.-Bl. ex Tchou 1949

Riparian forests dominated by deciduous hygrophilous trees, rich in poplars and willows distributed within the Mediterranean bioclimatic belt.

Synonyms: *Populion albae* Br.-Bl. 1931 (art. 2b); *Populion albae* de Bannes-Puygiron 1933 (art. 2b); *Populion albae* Br.-Bl. & R. Tx. 1943 (art. 2b); *Fraxino-Quercion pyrenaicae* Rivas Goday 1964; *Fraxino angustifoliae-Populion albae* P. Fukarek 1978 (art. 2b, 3b); *Fraxino*

angustifoliae-Populion albae Julve 1993 (orig. form) (art. 2b); *Clematido cirrhosae-Populion albae* Bensettiti 1999; *Saponario officinalis-Populion albae* (Br.-Bl. ex Tchou 1949) Bensettiti 1999 (art. 29).

Holotypus: *Populetum albae* Br.-Bl. ex Tchou 1948

Characteristic and differential species: *Ficus carica* L., *Iris foetidissima* (L.) Medik., *Ranunculus ficaria* L. subsp. *calthifolius* (Rchb.) Arcang., *Rumex conglomeratus* Murray, *S. pedicellata* Desf., *Solanum dulcamara* L., *Symphytum tuberosum* L., *Ulmus canescens* Melville, *Ulmus minor* Mill., *Viola odorata* L.

Geographical distribution: The associations of this alliance are widespread in the central and western Mediterranean territories, with some penetrations in the Balkanic peninsula (Bolos, 1967; Pedrotti 1970, Horvat et al., 1974).

Structure and ecology: This alliance groups deciduous riparian woodlands with the canopy dominated *Salix* sp. pl. and *Populus* sp. pl. linked to stands characterized by a very shallow water table, subject to periodic flooding. They are localized along the watercourses on alluvional soils, usually in the bottom of valleys with constant water regime, usually above 700-800 m a.s.l., within the meso and supra-mediterranean bioclimatic belt.

Syndynamism: They are azonal riparian forests developing along the riverbeds and represent mature edapho-hygrophilous stages within fluvial geosigmeta. In Sicily this vegetation is replaced by *Nerio-Tamaricetea* communities at lower altitudes.

Habitat reference: G1.3 Mediterranean and Macaronesian riparian woodland.

45.1.1.1. ***Ulmo canescentis-Salicetum pedicellatae*** Brullo & Spampinato 1990

Mesophilous riparian forest dominated by Mediterranean willow and rich in grey elm, occurring within the thermo and mesomediterranean belt.

Holotypus: Rel 2, tab. 1, Brullo & Spampinato (1990).

Characteristic and differential species: *Salix pedicellata* Desf., *Ulmus canescens* Melville.

Phytosociological table: From Brullo & Spampinato (1990), tab. 1, 8 rel.

Char. association: *Ulmus canescens* (V).

Char. alliance: *Salix pedicellata* (V), *Solanum dulcamara* (III), *Ficus carica* (I), *Ulmus minor* (I).

Char. order and class: *Carex pendula* (V), *Equisetum telmateia* (V), *Fraxinus oxycarpa* (V), *Symphytum bulbosum* (IV), *Salix alba* (IV), *Clematis vitalba* (III), *Populus alba* (III), *Populus nigra* (III), *Hypericum hircinum* subsp. *majus* (II), *Arum italicum* subsp. *italicum* (II), *Sambucus nigra* (I).

Other species: *Dioscorea communis* (V), *Rubus ulmifolius* (V), *Brachypodium sylvaticum* (V), *Hedera helix* (V), *Dorycnium rectum* (V), *Phragmites australis* (V), *Rosa canina* (V), *Equisetum*

ramosissimum (V), *Rubia peregrina* (IV), *Agrimonia eupatoria* (III), *Euphorbia meuselii* (III), *Acanthus mollis* (III), *Calystegia sylvatica* (III), *Laurus nobilis* (III).

Geographical distribution: The association occurs in several fluvial localities of the northen and central Sicily, where it is quoted by Brullo & Spampinato (1990), Gianguzzi (2002), Gianguzzi & La Mantia (2004a, 2004c), Gianguzzi et al. (2007), Cambria et al. (2015), etc. .

Structure and ecology: Riparian gallery woodland exclusive of rivers edges localized at the bottom of narrow valleys, on alluvial carbonatic substrata. The canopy of this vegetation, which can reach a height of 10-15 m., is dominated by *Salix pedicellata*, which is usually associated to *Salix alba*, *Populus alba*, *P. nigra*, *Fraxinus oxycarpa* and *Ulmus canescens*. It has its optimum at altitudes between 300 and 800 m, within the thermo and mesomediterranean belts. From the floristical and structural viewpoint, it shows some realation with the *Alno-Salicetum pedicellatae*, association described from North Tunisia by Braun-Blanquet (1953). The proposal by Guarino et al. (2017) to include this association in the *Salicion pedicellatae* alliance (*Salicetea purpureae*) cannot be followed, since for its physiognomic features and floristic set it is better framed in *Populion albae* and *Alno-Populetea*.

Syndynamism: It is an azonal vegetation distributed within belts potentially occupied by climatophilous woodlands of the *Quercetea ilicis*, representing mature edapho-hygrophilous stages of fluvial geosigmeta.

Habitat reference: See alliance.

45.1.1.2. ***Agropyro-Salicetum pedicellatae*** Brullo & Spampinato 1990

Orophilous riparian forest, linked to carbonatic substrata, dominated by Mediterranean willow and rich in Palermo couch-grass, occurring within the supramediterranean belt.

Holotypus: Rel. 3, tab. 1a, Brullo & Spampinato (1990).

Characteristic and differential species: *Agropyron panormitanum* Parl., *Salix pedicellata* Desf., *Ulmus glabra* Hudson.

Phytosociological table: From Brullo & Spampinato (1990), tab. 1a, 5 rel.

Char. association: *Agropyron panormitanum* (V), *Ulmus glabra* (V).

Char. alliance: *Salix pedicellata* (V), *Solanum dulcamara* (IV).

Char. order and class: *Carex pendula* (V), *Clematis vitalba* (V), *Hypericum hircinum* subsp. *majus* (IV), *Hypericum androsaemum* (IV), *Salix alba* (IV), *Populus nigra* (II).

Other species: *Ilex aquifolium* (V), *Tussilago farfara* (V), *Heracleum cordatum* (V), *Brachypodium sylvaticum* (V), *Hedera helix* (V), *Potentilla reptans* (V), *Euphorbia meuselii* (V), *Geranium versicolor* (V), *Equisetum arvense* (V), *Rubus canescens* (V), *Rosa canina* (IV), *Sanicula europaea* (IV), *Lamium flexuosum* (IV), *Acer campestre* (IV).

Geographical distribution: This vegetation is found only in the Madonie massif (Brullo & Spampinato, 1990).

Structure and ecology: The small streams above 1000 m a.s.l. with calcareous or dolomitic substrates are colonized by a peculiar riparian vegetation with an orophilous character. This vegetation, named *Agropyro-Salicetum pedicellatae*, occurs in gorges and very narrow valleys, forming dense and intricate woods dominated by *Salix pedicellata*, growing together with *Populus nigra*, *Ulmus glabra*, *Salix alba*, *Ilex aquifolium*, *Hypericum hircinum* and some herbaceous species, as *Heracleum cordatum*, *Agropyron panormitanum*, *Carex pendula*, etc. Besided, also some lianas are quite frequent, among them *Clematis vitalba*, *Hedera helix* and *Solanum dulcamara*.

Syndynamism: This association constitutes the more evolved stages of an edapho-hygrophilous series, occurring within the climactic area of basiphilous hom-oak woods belonging to *Aceri campestris-Quercetum ilicis*.

Habitat reference: See alliance.

45.1.1.3. ***Fraxino angustifoliae-Salicetum nebrodensis*** Brullo & Cambria ass. nov. provv.

Orophilous riparian forest, linked to siliceous substrata, dominated by Sicilian willow and occurring within the supramediterranean belt.

Holotypus: Rel. here published.

Char. association: *Salix nebrodensis* (3).
Char. alliance: *Salix pedicellata* (2), *Rumex conglomeratus* (+).
Char. order and class: *Clematis vitalba* (2), *Fraxinus oxycarpa* (2), *Sambucus nigra* (2), *Carex remota* (1).
Other species: *Rosa canina* (2), *Geranium purpureum* (2), *Ilex aquifolium* (2), *Rubus ulmifolius* (2), *Pteridium aquilinum* (2), *Allium ursinum* (2), *Cherophyllum temulum* (1), *Lamium flexuosum* (1), *Poa nemoralis* (1), *Circaea lutetiana* (1), *Ruscus aculeatus* (1), *Acer campestre* (1), *Rubus glandulosus* (1), *Mycelis muralis* (1), *Brachypodium sylvaticum* (1), *Hedera helix* (1), *Galium aparine* (+), *Crataegus monogyna* (+).

Geographical distribution: This association is restricted to Nebrodi mountains (NE Sicily), where it is quite rare and localized.

Structure and ecology: This orophilous riparian community is linked to small streams with siliceous substrates of Numidian Flysch, within the supramediterranean belt (1000-1600 m a.s.l.). Generally, it occurs in shady places inside mesophilous oak woods and beech woods, forming a low arboreal-shrubby vegetation. From the floristic point of view, it is characterized by the occurrence of the rare endemic *Salix nebrodensis*, associated with few species of higher

rank, as *S. pedicellata*, *Rumex conglomeratus*, *Clematis vitalba*, *Fraxinus oxycarpa*, *Sambucus nigra* and *Carex remota*.

Syndynamism: This community represents a mature edapho-hygrophilous stage within the belt occupied by mesic woods of *Anemono-Fagetum sylvaticae* and *Ilici aquifolii-Quercetum cerridis*.

Habitat reference: See alliance.

45.1.1.4. ***Roso sempervirentis-Populetum nigrae*** Pedrotti & Gafta 1992

Pioneer riparian forest dominated by black poplar occurring within the mesomediterranean belt.

Holotypus: Rel. , tab. , Pedrotti & Gafta (1992).

Characteristic and differential species: *Rosa sempervirens* L.

Phytosociological table: From Costanzo et al. (2005), tab. 5, 4 rel.

Char. association: *Rosa sempervirens* (4).

Char. alliance and order: *Populus nigra* (4), *Arum italicum* (4), *Salix pedicellata* (4), *Salix alba* (4), *Sambucus nigra* (3), *Solanum dulcamara* (1), *Populus alba* (1), *Equisetum telmateia* (1).

Char. class: *Ulmus canescens* (4), *Clematis vitalba* (2).

Other species: *Rubus ulmifolius* (4), *Acanthus mollis* (4), *Brachypodium sylvaticum* (3), *Rubia peregrina* (3), *Euphorbia characias* (3), *Arundo pliniana* (3), *Hedera helix* (2), etc.

Geographical distribution: This association is distributed in southern Italy (Pedrotti & Gafta, 1992, 1996) and Sicily (Tomaselli, 2004; Costanzo et al. 2005), where it is known for the Central and Eastern part.

Structure and ecology: If compared to the previous communities, this association occurs at lower altitudes (400-800 m a.s.l.), showing a pioneer character in colonizing narrow valleys with clay soils subject to irregular floodings. Its structure is given by *Populus nigra*, associated with some shrubs of *Salix alba*, *S. pedicellata*, *Rosa sempervirens* and *Sambucus nigra*.

Syndynamism: This association represents a mature stage of an edapho-hygrophilous series, within the lower mesomediterranean belt. The more degradated facies show a remarkable presence of *Rubus ulmifolius*.

Habitat reference: See alliance.

45.1.2. Alliance: ***Platanion orientalis*** I. Karpati et V. Karpati 1961

Mesophilous riparian gallery forests dominated by oriental plane, spread in the astern Mediterranean territories, whitin the thermo-mediterranean belt.

Synonyms: *Platanion orientalis* I. Karpati & V. Karpati 1962.

Holotypus: *Nerio-Platanetum orientalis* I. Karpati et V. Karpati 1961

Characteristic and differential species: *Daucus carota* L. subsp. *major* (Vis.) Arcan., *Nerium oleander* L., *Melissa officinalis* L. subsp. *altissima* (Sm.) Arcang., *Platanus orientalis* L.

Geographical distribution: The communities of *Platanion orientalis* are widespread in South-Eastern Europe (Balkans and Aegean territories), as well as in southern Italy (Caruso et al., 2008) and Sicily (Barbagallo et al., 1979; Brullo & Spampinato, 1990; Minissale et al., 2007), where are mainly restricted to Peloritani and Hyblaean areas. An isolated stand occurs also along the Oreto river near Palermo (Gianguzzi et al., 1995; Traina & Marcenò, 2001).

Structure and ecology: The riparian communities dominated by *Platanus orientalis* are linked to perennial water courses inside narrow valley and gorges. They occurs at altitudes less than 500 m a.s.l., within the thermomediterranean thermotype and are found on a wide range of alluvial, hydromorphic soils, with sandy to pebbly textures.

Syndynamism: These forests are mature stages of edapho-hygrophilous series.

Habitat reference: G1.3 Mediterranean and Macaronesian riparian woodland.

45.1.2.1. ***Platano-Salicetum pedicellatae*** Barbagallo, Brullo & Fagotto 1979.

Mesophilous riparian forest dominated by Mediterranean willow and oriental plane, occurring within the thermo and mesomediterranean belts.

Holotypus: Rel. 5, tab. 1 ,Barbagallo et al. (1979).

Characteristic and differential species: *Lamium pubescens* Sibth. ex Bentham, *Salix pedicellata* Desf., *Tamarixa gallica* L.

Phytosociological table: From Brullo & Spampinato (1990), table 2, 21 releves.

Char. association: *Salix pedicellata* (V), *Lamium pubescens* (III), *Tamarix gallica* (III).

Char. alliance: *Platanus orientalis* (V), *Nerium oleander* (III), *Daucus carota* subsp. *major* (III), *Melissa officinalis* subsp. *altissima* (III).

Char. order and class: *Ulmus canescens* (V), *Salix alba* (V), *Clematis vitalba* (V), *Carex pendula* (IV), *Hypericum hircinum* subsp. *majus* (IV), *Populus nigra* (III), *Ficus carica* (III), *Arum italicum* subsp. *italicum* (III), *Carex remota* (III), *Equisetum telmateia* (III), *Fraxinus oxycarpa* (III), *Symphytum bulbosum* (III), *Solanum dulcamara* (II), *Vinca minor* (II), *Alliaria petiolata* (II), *Sambucus nigra* (II), *Populus alba* (II), *Vitis vinifera subsp. sylvestris* (II).

Other species: *Hedera helix* (IV), *Dioscorea communis* (III), *Rubus ulmifolius* (V), *Brachypodium sylvaticum* (V), *Dorycnium rectum* (III), *Crataegus monogyna* (III), *Eupatorium*

cannabinum (III), *Equisetum ramosissimum* (III), *Rubia peregrina* (III), *Pteridium aquilinum* (III), *Euphorbia meuselii* (III), *Calystegia sylvatica* (III).

Geographical distribution: This association occurs in the valleys («cave») of Hyblaean area (Barbagallo et al., 1979; Brullo & Spampinato, 1990; Minissale et al., 2007) and also near Palermo (Gianguzzi et al., 1995).

Structure and ecology: This association occurs along the banks of perennial rivers flowing in the bottom of narrow valleys, forming a riparian forest up to 15 m high. It colonizes pebbly-loamy soils derived from calcareous or siliceous rocks, which remain moist also during the summer. Its appearance is defined by *Platanus orientalis*, growing together with *Salix alba*, *S. pedicellata* and *Populus nigra*. The shrubby layer is represented by *Nerium oleander*, *Hypericum hircinum*, *Myrtus communis* and *Tamarix gallica*, while among the lianas, *Vitis vinifera* subsp. *sylvestris*, *Clematis vitalba* and *Hedera helix* are frequent.

Syndynamism: This association is the most mature stage of an edapho-hygrophilous series within the thermomediterranean belt. In the broadest stretches of river-bed, characterized by more thermo-xeric conditions, it is replaced by the *Nerio-Tamaricetea* communities.

Habitat reference: See alliance.

45.1.2.2. ***Platano-Salicetum gussonei*** Brullo & Spampinato 1990.

Mesophilous riparian forest dominated by Sicilian willow and oriental plane, occurring within the thermo and mesomediterranean belts

Holotypus: Rel. 6, table 3, Brullo & Spampinato (1990).

Characteristic and differential species: *Salix gussonei* Brullo & Spampinato.

Phytosociological table: From Brullo & Spampinato (1990), table 3, 18 releves.

Char. association: *Salix gussonei* (V).

Char. alliance: *Platanus orientalis* (V), *Nerium oleander* (IV), *Daucus carota subsp. major* (II).

Char. order and class: *Alnus glutinosa* (III), *Hypericum hircinum* subsp. *majus* (III), *Populus nigra* (II), *Ficus carica* (II), *Equisetum telmateia* (II), *Fraxinus oxycarpa* (I), *Solanum dulcamara* (I), *Arum italicum* subsp. *italicum* (I), *Carex pendula* (I), *Clematis vitalba* (I), *Salix alba* (I),*Vitis vinifera subsp. sylvestris* (I), *Ulmus minor* (I).

Other species: *Rubus ulmifolius* (V), *Phragmites australis* (V), *Brachypodium sylvaticum* (IV), *Euphorbia characias* (IV), *Equisetum ramosissimum* (III), *Rubia peregrina* (III), *Dioscorea communis* (III), *Spartium junceum* (III), *Hedera helix* (II), *Dorycnium rectum* (II).

Geographical distribution: This association occurs only in the North-Eastern part of Sicily, from the south-eastern side of Nebrodi to Peloritani and marginally also Etna (Brullo & Spampinato, 1990).

Structure and ecology: The most narrow and recessed sections of «fiumare» are characterized by a peculiar riparian vegetation dominated by *Platanus orientalis* and the endemic *Salix gussonei*. It is the *Platano-Salicetum gussonei*, an hygrophilous forest with a more mesic character than the previous one, growing on gravelly soils derived from metamorphic rocks (rarely also volcanites). Brullo & Spampinato (1990) distinguished two subassociations: the subass. *platanetosum* represent the typical aspect and is linked to low altitudes (100-350 m), preferring watercourses with a greater scope and slow water flow; the subass. *alnetosum* shows a more mesophilous character (above 350-400 m) and is dominated by *Alnus glutinosa*, a rare species in Sicily. Finally, Sciandrello et al. (2013) identified a further aspect, named subass. *fraxinetosum orni*, which is tied to less hygrophilous stands.

Syndynamism: This vegetation represents the most structured stage of edapho-hygrophilous series, having catenal contacts with the acidophilous oak woods of *Erico-Quercetum virgilianae* and *Festuco heterophyllae-Quercetum congestae*.

Habitat reference: See alliance.

45.1.3. Alliance: ***Osmundo-Alnion glutinosae*** (Br.-Bl. et al. 1956) Dierschke et Rivas-Martinez in Rivas-Martinez 1975

Alnus-dominated riparian communities that grow on acidic substrates in the western Mediterranean.

Synonyms: *Alnion lusitanicum* Br.-Bl. et al. 1956 (art. 34a); *Caricion microcarpae* Gamisans 1975 (syntax. syn.); *Osmundo-Alnion* (Br.-Bl. et al. 1956) Dierschke & Rivas Martinez in Rivas-Martinez 1975 (art. 2b); *Caricion microcarpae* Gamisans 1977 (art. 31); *Rhododendro-Alnenion* Rivas Goday & Rivas- Martínez in Rivas-Martínez 1965 (corresp. name), *Rhododendro pontici-Prunion lusitanicae* A.V. Pérez, Galán & Cabezudo in A.V. Pérez, Galán, P. Navas, D. Navas, Y. Gil & Cabezudo 1999 (syntax. syn.).

Holotypus: *Scrophulario scorodoniae-Alnetum glutinosae* Br.-Bl., P. Silva & Rozeira 1955

Characteristic and differential species: *Athyrium filix-femina* (L.) Roth Tent., *Ilex aquifolium* L., *Osmunda regalis* L., *Pteridium aquilinum* (L.) Kuhn.

Geographical distribution: This alliance was described from Corsica and Iberian peninsula (Dierschke, 1975, 1984) and later reported also for Sicily by Brullo & Spampinato (1990).

Structure and ecology: The communities of *Osmundo-Alnion* dwells very mesic and humid places with acidic soils, within the meso- and supra-mediterranean belts. The floristic set of the Sicilian aspects is quite impoverished and missing of some characteristic species like *Alnus glutinosa*.

Syndynamism: It is an edapho-hygrophilous vegetation, replacing the *Populion albae* on siliceous soils.

Habitat reference: G1.2a Alnus woodland on riparian and upland soils.

45.1.3.1. ***Osmundo-Salicetum pedicellatae*** Brullo & Spampinato 1990

Orophilous riparian forest, linked to siliceous substrata, dominated by Mediterranean willow and rich in royal fern, occurring within the supramediterranean belt.

Holotypus: Rel. 1, tab. 4, Brullo & Spampinato (1990).

Characteristic and differential species: *Osmunda regalis* L., *Salix pedicellata* Desf.

Phytosociological table: From Brullo & Spampinato (1990), table 4, 10 releves.

Char. association: *Salix pedicellata* (V).

Char. alliance: *Osmunda regalis* (V), *Athyrium filix-foemina* (V), *Ilex aquifolium* (V).

Char. order and class: *Carex pendula* (V), *Carex remota* (IV), *Hypericum hircinum subsp. majus* (II), *Salix alba* (II).

Other species: *Dioscorea communis* (V), *Rubus ulmifolius* (V), *Rubus canescens* (V), *Brachypodium sylvaticum* (V), *Eupatorium cannabinum* (V), *Geranium versicolor* (V), *Rosa canina* (V), *Blechnum spicant* (IV), *Lamium flexuosum* (IV), *Daphne laureola* (IV), *Arrhenatherum elatius* (IV), *Mentha aquatica* (IV), *Holcus lanatus* (IV), *Asperula laevigata* (III), *Galium elongatum* (III).

Geographical distribution: This rare community occurs only in Madonie mountains (Brullo & Spampinato, 1990).

Structure and ecology: The mountain stands above 1000 m with very humid acidic soils are colonized by a sciaphilous and hygrophilous vegetation dominated by low shrubby specimens of *Salix pedicellata*. This community, named *Osmundo-Salicetum pedicellatae*, constitutes dense and impenetrable riparian scrubs, whose physiognomy is characterized by the occurrence of some rare big-sizen ferns, as *Osmunda regalis* and *Athyrium filix-femina.* Moreover, the alliance is represented also by *Ilex aquifolium* and *Pteridium aquilinum*.

Syndynamism: This permanent edaphic vegetation shows catenal contacts with mesic broad-leaved woods of *Ilici-Quercetum petraeae* and *Anemono-Fagetum sylvaticae*.

Habitat reference: See alliance.

46. Class: ***Querco roboris-Fagetea sylvaticae*** Br.-Bl. & Vlieger in Vlieger 1937

Mesophilous forest and woods characterized by deciduous phaenerophytes and conifers, having their optimum within the infra-orotemperate and meso-supramediterranean

subhumid-hyperhumid bioclimate of the Euro-Siberian and Mediterranean regions, sometimes extending in the Mediterranean oceanic bioclimate.

Synonyms: *Querco-Fagetales* Br.-Bl. & Vlieger in Vlieger 1937 (original name, art. 41b); *Quercetea robori-sessiliflorae* Br.- Bl. & R. Tx. 1943 (art. 8); *Quercetea robori-sessiliflorae* Br.-Bl. & R. Tx. ex Br.-Bl. 1950 (syntax. syn.); *Quercetea robori-petraeae* Br.-Bl. & R. Tx. ex Oberd. 1957 (art. 31); *Quercetea pubescentis Doing 1955* (art. 8); *Quercetea pubescenti-petraeae* Jakucs 1960 (syntax. syn.); *Carpino-Fagetea sylvaticae* Jakucs ex Passarge 1968 (syntax. syn.); *Geranio-Fraxinetea excelsioris* Passarge 1968; *Peucedano-Quercetea* Oberd. et Doing ex Passarge 1968; *Fraxino-Fagetea sylvaticae* Moor 1976 (syntax. syn.); *Tilietea platyphylli* Moor 1977; *Fagetea* Lakusic et al. 1979; *Quercetea pubescentis* Doing ex Scamoni & Passarge 1959 (syntax. syn.).

Holotypus: *Fagetalia* Pawłowski 1928.

Characteristic and differential species: *Aremonia agrimoniodes* (L.) DC.*, Brachypodium sylvaticum* (Huds.) P. Beauv.*, Clematis vitalba* L.*, Clinopodium vulgare* L. subsp. *orientale* Bothmer, *Crepis leontodontoides* All., *Daphne laureola* L., *Epipactis microphylla* (Ehrh.) Sw., *Euonymus europaeus* L. *Fagus sylvatica* L.*, Drymochloa drymeja* (Mert. & W.D.J. Koch) Holub subsp. *exaltata* (C. Presl) Foggi & Signorini, *Festuca heterophylla* Lam.*, Geum urbanum* L.*, Hedera helix* L.*, Ilex aquifolium* L.*, Lathraea squamaria* L.*, Lathyrus venetus* (Mill.) Wohlf.*, Latrhyrus pratensis* L.*, Lathyrus sylvestris* L.*, Luzula forsteri* (Sm.) DC.*, Mercurialis perennis* L.*, Milium vernale* Bieb. subsp. *montianum* (Parl.) Jahand. et Maire *, Mycelis muralis* (L.) Dumort., *Oxalis acetosella* L.. *Poa sylvicola* Guss.*, Polystichum aculeatum* (L.) Roth*, Primula vulgaris* Huds.*, Rosa canina* L.*, Rubus glandulosus* Bellardi*, Sanicula europaea* L.*, Taxus baccata* L.*, Viola reichenbachiana* Jord. ex Boreau.

Geographical distribution: This class has an Euro-Siberian and Mediterranean distribution, extending also in the Middle East. In Sicily, these woody communities are widespread in the northern and north-eastern districts of the island, occurring on the highest mountains (Madonie, Nebrodi, Peloritani, and Etna).

Structure and ecology: The *Querco-Fagetea sylvaticae* class gathers together the mesophilous deciduous forest communities, represented by beech woods, deciduous oak woods or mixed forests with deciduous trees and conifers having their optimum within the infra-orotemperate, and meso-supramediterranean subhumid-hyperhumid bioclimates (Dierschke 1997; Brullo et al. 1999, 2012; Di Pietro et al. 2004, 2007; Abbate et al. 2005; Di Pietro 2010; Biondi et al. 2012). As emphasized by Brullo et al. (2012), the Sicilian communities represent a very interesting example of boreo-temperate vegetation in a southern Mediterranean territory, having a floristically-rich pool of euro-Siberian species and also some endemic taxa, whose distribution is circumscribed to the mountains of Southern Italy and Sicily. The origin of the temperate floristic elements arises from the late glacial period, during which these species reached the southernmost mediterranean area, coming into contact with the pre-existent mediterranean flora. The co-existence of these two floristic elements with a very different origin determined the remarkable floristic and stuctural

peculiarity of the *Querco-Fagetea* communities occurring in Sicily,, many of which endemic to the island.

Syndynamism: The forests belonging to this this class are represented usually by climatophilous plant communities, that can be considered as the potential final stage of a natural series not affected by human activities. Apart from the communities which have a really or virtually meso-climax function, there are also the permanent woodlands referable to edaphophilous series.

Habitat reference: G1.6a *Fagus* woodland on non-acid soils; G1.6b *Fagus* woodland on acid soils; G1.7b Mediterranean thermophilous deciduous woodland; G1.8 Acidophilous *Quercus* woodland; G1.9b Mediterranean mountain *Betula* and *Populus tremula* woodland on mineral soils; G1.Aa *Carpinus* and *Quercus* mesic deciduous woodland**;** G2.1 Mediterranean evergreen *Quercus* woodland; G2.6 *Ilex aquifolium* woodland; G3.4c Mediterranean montane *Pinus sylvestris-Pinus nigra* woodland; G3.9a *Taxus baccata* woodland.

46.1. Order: ***Fagetalia sylvaticae*** Pawłowski 1928

Mesophilous deciduous forests, often mixt, that usually occurs in the supratemperate bioclimate, as well as in cool sites where the soil is deep and moist in the mesotemperate one, as well as in the montane belt of the submediterranean regions of temperate Europe.

Synonyms: *Querco-Fagetalia sylvaticae* Vanden Berghen 1957 (syntax.syn.); *Carpino-Fagetalia sylvaticae* Scamoni & Passarge 1959 (syntax.syn.); *Fraxinetalia* Scamoni & Passarge 1959 (syntax.syn.); *Aegopodio-Fagetalia sylvaticae* Passarge 1968 (art. 29c); *Aegopodio-Fagetalia sylvaticae* Passarge & G. Hofmann 1968 (art. 31); *Asperulo-Fagetalia sylvaticae* Passarge 1968 (art. 3d); *Asperulo-Fagetalia sylvaticae* Passarge in Passarge & G. Hofmann 1968 (art. 3d); *Mercuriali-Fagetalia sylvaticae* Passarge 1968 (art. 3d); *Mercuriali-Fagetalia sylvaticae* Passarge in Passarge & G. Hofmann 1968 (art. 3d); *Dentario-Fagetalia sylvaticae* P. Fukarek 1969 (syntax.syn.); *Aremonio-Fagetalia sylvaticae* Gentile 1970 (art. 3b); *Aremonio-Fagetalia sylvaticae* Gentile ex Feoli & Lagonegro 1982 (art. 5); *Abieti albae-Fagetalia sylvaticae* Gillet 1986 (art. 1).

Holotypus: *Fagion sylvaticae* Pawłowski 1928

Characteristic and differential species: *Acer campestre* L.*, Acer pseudoplatanus* L., *Allium ursinun* L.*, Anthriscus nemorosa* (Bieb.) Spreng.*, Arum cylindraceum* Gasparr.*, Conopodium capillifolium* (Guss.) Boiss., *Dryopteris filix-mas* (L.) Schott*, Epilobium montanum* L.*, Epipactis helleborine* (L.) Crantz*, Galanthus reginae-olgae* Orph. subsp. *vernalis* Kamari*, Galium odoratum* (L.) Scop.*, Galium rotundifolium* L. subsp. *rotundifolium Geranium robertianum* L.*, Ilex aquifolium* L.*, Malus sylvestris* (L.) Mill.*, Melica uniflora* Retz.*, Melittis albida* Guss., *Milium effusum* L.*, Monotropa hypopytis* L.*, Moehringia trinervia* (L.) Clairv.*, Neottia nidus-avis* (L.) Rich.*, Orthilia secunda* (L.) House*, Platanthera chlorantha* (Custer) Rchb., *Polygonatum multiflorum* (L.) All.*, Polystichum setiferum* (Forssk.) T. Moore ex Woynar.*, Potentilla micrantha* Ramond ex DC., *Quercus cerris* L., *Rubus canescens* DC., *Rubus hirtus* Waldst. & Kit.*,*

Saxifraga rotundifolia L., *Scilla bifolia* L.*, Dioscorea communis* (L.) Caddick & Wilkin*, Ulmus glabra* Huds.*, Veronica officinalis* L.

Geographical distribution: Atlantic and central Europe (up to the Caucasian region), as well as North Mediterranean region.

Structure and ecology: Mesophilous forests with deciduous broadleaved trees often mixed with conifers, not having specific substrate requirements. From the bioclimatic viewpoint, the associations of this order occurs within the thermo-orotemperate and the supramediterranean bioclimatic belts. For the complex nomenclature of the name *Fagetalia sylvaticae* see Willner et al. (2015).

Syndynamism: The plant communities of this order represent usually final mature stages of climatophilous or, sometimes, edaphophilous series.

Habitat reference: See class.

46.1.1. Alliance: ***Geranio versicoloris-Fagion sylvaticae*** Gentile 1970, nom. mut. prop. by Di Pietro et al. 2004

Mesophilous deciduous forest dominated by European beech or deciduous oaks, sometimes mixed with conifers, distributed in central-southern Apennines, Sicily and southwestern Balkans, within the supratemperate sub mediterranean belt.

Synonyms: *Geranio striati-Fagion sylvaticae* Gentile 1970; *Aquifolio-Fagion* Corbetta & Ubaldi in Ubaldi et al. 1986 (art. 5); *Doronico orientalis-Fagenion sylvaticae* Ubaldi et al. 1990 ex Ubaldi 1995; *Fagion mediterraneo-montanum* Br.-Bl. & A. Hofmann in A. Hofmann 1960 (art. 2b); *Campanulo trichocalycinae-Fagion* Corbetta & Ubaldi in Ubaldi et al. 1986 (art. 5); *Doronico orientalis-Fagion sylvaticae* Ubaldi et al. 1990 (art. 5); *Doronico orientalis-Fagion sylvaticae* Ubaldi et al. ex Ubaldi 1995; *Campanulo trichocalycinae-Fagion* Ubaldi ex S. Brullo et al. 2001.

Lectotypus: *Asyneumo-Fagetum sylvaticae* Gentile 1970.

Characteristic and differential species: *Acer lobelii* Ten., *Allium pendulinum* Ten.*, Anemone apennina* Ten., *Aquilegia sicula* (Strobl) Nardi, *Asyneuma trichocalycinum* (Ten.) K. Malý*, Corydalis densiflora* C. Presl.*, Doronicum orientale* Hoffm.*, Euphorbia meuselii* Geltman., *Galium rotundifolium* L. subsp. *hirsutum* (Ten.) Brullo & al., *Geranium versicolor* L.*, Lamium flexuosum* Ten.*, Lamium garganicum* L. subsp. *laevigatum* (Ces., Pass. & Gibelli) Arcang., *Luzula sicula* Parl.*, Polygonatum gussonei* Parl.*, Ranunculus lanuginosus* L.*, Ranunculus umbrosus* Ten. & Guss., *R. velutinus* Ten.*, Senecio nemorensis* L. subsp. *stabianus* (Lacaita) Pignatti., *Symphytum gussonei* F. W. Schultz.

Geographical distribution: The plant communities of this alliance occur in central and southern Italy, Sicily and the southwestern Balkans. The territories interested by this sintaxon represent the main refugium area of the European beech forests here localized (Magri et al.2006; Willner et al. 2009, Mucina et al. 2016).

Structure and ecology: Thermophilous beech and mesophilous oak forests, sometimes mixed with conifers, which are localized in the warmest and driest sites of the mountain belt. They represent mesic mountain woods with a remarkable mediterranean character, which occur at an altitude of 1000-2000 m, in territories with a submediterranean or supramediterranean thermotypes and humid-hyperhumid ombrotypes. In Sicily, this alliance includes forests dominated by *Fagus sylvatica*, *Taxus baccata*, deciduous oak, and more rarely by *Quercus ilex*., localizing on various substrata, such as limestones, dolomites, quartzarenites, volcanites, flysch, gneiss, etc. These forestal communities are very rich in endemic species of central-southern Apennines and Sicily or occurring also in the western Balkans.

Syndynamism: Most of plant communities belonging to this alliance shows an evident climatophilous role, representing orophilous forests often reaching the timberline. In fact, they are upward in contact with pulvinate shrub vegetation of the *Rumici-Astragaletea siculi* class or sometimes with dwarf woods with conifer of *Junipero-Pinetea sylvestris* class, while they downward are replaced by mesophilous woodlands of *Quercetea ilicis*.

Habitat reference: See class.

46.1.1.1. ***Anemono apenninae-Fagetum sylvaticae*** (Gentile 1970) Brullo 1984

Mesophilous acidophilous beech forests, dominated by European beech and rich in European holly and blue anemone, linked to siliceous substrata within the supramediterranean and supratemperate submediterranean belts.

Synonyms: *Anthrisco siculae-Fagetum* Hofmann 1960, nom. inval.; *Aquifolio-Fagetum* Gentile 1970 nom. illeg., non *Ilici-Fagetum* Br.-Bl. 1967.

Lectotypus: rel. 9, tab. 3, Gentile (1970).

Characteristic and differential species: *Anemone apennina* Ten., *Anthriscus nemorosa* (Bieb.) Spreng., *Ilex aquifolium* L., *Ranunculus umbrosus* Ten. & Guss..

Phytosociological table: **Phytosociological table:** From Brullo et al. (1999), tab. 1, 10 rel.

Char. association: *Ilex aquifolium* (V), *Anemone apennina* (IV), *Anthriscus nemorosa* (II), *Ranunculus umbrosus* (II).

Char. alliance: *Allium pendulinum* (IV), *Euphorbia meuselii* (IV), *Lamium flexuosum* (IV), *Doronicum orientale* (III), *Geranium versicolor* (III), *Luzula sicula* (III), *Ranunculus lanuginosus* (II), *Symphytum gussonei* (II), *Aquilegia sicula* (I).

Char. order and class: *Fagus sylvatica* (V), *Daphne laureola* (V), *Sanicula europaea* (IV), *Viola reichenbachiana* (IV), *Hedera helix* (IV), *Lathyrus venetus* (IV), *Mycelis muralis* (III), *Aremonia agrimoniodes* (III), *Primula vulgaris* (III), *Brachypodium sylvaticum* (III), *Drymochloa drymeja subsp. exaltata* (II), *Geum urbanum* (II), *Poa sylvicola* (II), *Rosa canina* (II), *Festuca heterophylla* (I), *Clematis vitalba* (I).

Other species: *Pteridium aquilinum* (III), *Silene sicula* (II), *Cyclamen hederifolium* (II), *Crataegus monogyna* (II), *Hypochoeris laevigata* (II), *Fragaria vesca* (II), *Ruscus aculeatus* (II).

Geographical distribution: This association is widespead along the Nebrodi range and Madonie in Northern Sicily, as well as in the southern Appennines (Hofmann 1960, Gentile 1970, Brullo et al. 1999, 2001, 2012, Di Pietro et al.2004).

Structure and ecology: Acidophilous beech forests localized in the mountain belt at 1400-1800 m of altitude, on siliceous substrata within the supramediterranean and supratemperate submediterranean bioclimatic belts. Floristically, it is characterized by the occurrence of *Ilex aquifolium*, which emphasizes the oceanic character of this association. In fact, this community is localized on stands subject to fog regime due to the condensation of humid streams coming from the Tyrrhenian Sea.

Syndynamism: Due to degradation processes, this beech forest is normally replaced on schistose substrata by mesophilous meadows belonging to the alliance *Plantaginion cupanii*, while under more xeric conditions, such as on quartz sandstones, this is dinamically in contact with the pulvinate orophilous communities of *Armerion nebrodensis,* acidophilic alliance of the *Rumici-Astragaletea siculi.*

Habitat reference: G1.6b *Fagus* woodland on acid soils.

46.1.1.2. ***Melitto albidae-Fagetum sylvaticae*** Ubaldi et al. ex Ubaldi 1995

Thermo-acidophilous beech forests, dominated by European beech and rich in Italian maple and bastard balm, linked to siliceous substrata within the supramediterranean subhumid belts.

Synonyms: *Melitto albidae-Fagetum* Ubaldi et al. 1990, nom. inval.; *Anemono apenninae-Fagetum melittetosum albidae* (Ubaldi 1995) Brullo et al. 1999; *Aquifolio-Fagetum* Ronsisvalle & Signorello 1977, non Gentile 1970.

Lectotypus: rel. 19, tab.1, Ronsisvalle & Signorello (1977).

Characteristic and differential species: *Acer obtusatum* Waldst. & Kit. ex Willd. subsp. *aetnense* (Tineo ex Strobl) C.Brullo & Brullo, *Melittis albida* Guss., *Polygonatum multiflorum* (L.) All., *Saxifraga rotundifolia* L., *Symphytum gussonei* F.W. Schultz.

Phytosociological table: From Brullo et al. (1999), tab. 1, 10 rel.

Char. association: *Melittis albida* (V), *Acer obtusatum* subsp. *obtusatum* (IV), *Polygonatum multiflorum* (IV), *Saxifraga rotundifolia* (IV), *Symphytum gussonei* (IV).

Char. alliance: *Geranium versicolor* (V), *Euphorbia meuselii* (V), *Doronicum orientale* (IV), *Lamium flexuosum* (IV), *Luzula sicula* (III), *Allium pendulinum* (II), *Anemone apennina* (II), *Aquilegia sicula* (II), *Galium rotundifolium* subsp. *hirsutum* (II), *Ranunculus lanuginosus* (I).

Char. order: *Melica uniflora* (V), *Rubus hirtus* (V), *Neottia nidus-avis* (IV), *Polystichum setiferum* (IV), *Epipactis helleborine* (IV), *Dioscorea communis* (IV), *Conopodium capillifolium* (III), *Geranium robertianum* (III), *Ilex aquifolium* (III), *Milium effusum* (III), *Monotropa hypopytis* (II), *Quercus cerris* (II), *Acer pseudoplatanus* (II), *Anthriscus nemorosa* (I), *Arum cylindraceum* (I).

Char. class: *Fagus sylvatica* (V), *Hedera helix* (V), *Daphne laureola* (V), *Lathyrus venetus* (V), *Sanicula europaea* (V), *Aremonia agrimoniodes* (IV), *Limodorum abortivum* (IV), *Epipactis microphylla* (III), *Mycelis muralis* (III), *Viola reichenbachiana* (III), *Drymochloa drymeja* subsp. *exaltata* (III), *Festuca heterophylla* (III), *Geum urbanum* (II), *Brachypodium sylvaticum* (II), *Poa sylvicola* (II), *Rosa canina* (I), *Lathyrus pratensis* (I), *Clematis vitalba* (I).

Other species: *Pteridium aquilinum* (IV), *Viola alba* subsp. *dehnhardtii* (III), *Paeonia mascula* subsp. *russii* (II), *Chaerophyllum temulum* (II).

Geographical distribution: This association is exclusive of Malabotta, locality near Roccella Valdemone in the Northern Peloritani (Ronsisvalle & Signorello 1977, Ubaldi 1995, Ubaldi et al. 1990, Brullo et al. 1999).

Structure and ecology: This thermophilous beech forest occurs on siliceous substrata of the submontane belt, at 1000-1300 m of altitude within the supramediterranean subhumid belt. It can be considered an extrazonal community linked to the marked humid microclimatic conditions, localizing mainly on the north-facing slopes of the valleys, while on sunny and exposed stands this association is replaced by the *Arrhenathero nebrodensis-Quercetum cerridis*, climatic woodland widespread within this altitudinal belt.

Syndynamism: This beech forest belongs to an edaphophilous series linked to very fresh habitats, showing catenal contact with the *Quercus cerris* woodlands. As result of degradation processes, the association is usually replaced by the mesophilous meadows of the *Plantaginion cupanii*.

Habitat reference: G1.6b *Fagus* woodland on acid soils.

46.1.1.3. ***Luzulo siculae-Fagetum sylvaticae*** Brullo, Guarino, Minissale, Siracusa, Spampinato 1999

Basiphilous beech forests, dominated by European beech and rich in red and white helleborine, linked to carbonatic substrata within the humid supramediterranean belt.

Synonyms: *Fagetum* s.l. Raimondo (1980).

Holotypus: rel. 22, tab. 1, Brullo et al. (1999)

Characteristic and differential species: *Cephalanthera damasonium* (Mill.) Druce, *Cephalanthera rubra* (L.) Rich., *Luzula sicula* Parl.

Phytosociological table: From Brullo et al. (1999), tab. 1, 6 rel.

Char. association: *Luzula sicula* (V), *Cephalanthera damasonium* (V), *Cephalanthera rubra* (V).

Char. alliance: *Anemone apennina* (V), *Doronicum orientale* (V), *Euphorbia meuselii* (V), *Galium rotundifolium* subsp. *hirsutum* (V), *Lamium flexuosum* (V).

Char. order: *Neottia nidus-avis* (V), *Melica uniflora* (V), *Monotropa hypopytis* (IV), *Rubus hirtus* (IV), *Acer pseudoplatanus* (III), *Conopodium capillifolium* (III), *Acer campestre* (II), *Polystichum setiferum* (I).

Char. class: *Fagus sylvatica* (V), *Festuca heterophylla* (V), *Epipactis microphylla* (V), *Viola reichenbachiana* (V), *Aremonia agrimoniodes* (II), *Brachypodium sylvaticum* (II), *Lathyrus venetus* (II), *Primula vulgaris* (II), *Rosa canina* (I), *Limodorum abortivum* (I).

Other species: *Silene sicula* (V), *Hypochoeris laevigata* (V), *Silene vulgaris* (IV), *Ruscus aculeatus* (IV), *Dactylis glomerata* (IV), *Cyclamen repandum* (III).

Geographical distribution: This association is restricted to the Madonie massif (Brullo et al., 1999).

Structure and ecology: This association represents a basiphilous beech forest occurring on dolomites and limestone at an altitude of 1500-1900 m, within a humid supramediterranean belt. This beech wood, differentiated by *Cephalanthera damasonium* and *Cephanlanthera rubra,* shows close floristical and ecological relation with the *Carici albae-Fagetum* Moor 1952 (=*Chephalanthero-Fagetum* Oberd. 1957), a calcicolous association widely spread in central Europe, of which it can be considered a geographical vicariant.

Syndynamism: It is a climatophilous forest in contact with the *Aceri campestris-Quercetum ilicis* at lower altitudes, while after disturbance, it is replaced by orophilous pulvinate plant communities of *Cerastio-Astragalion nebrodensis.*

Habitat reference: G1.6a *Fagus* woodland on non-acid soils.

46.1.1.4. ***Hieracio madoniensis-Fagetum sylvaticae*** C. Brullo, Brullo, Giusso, Guarino, Siracusa & Sciandrello 2012

Basiphilous sciaphilous beech forests, dominated European beech and rich in Greek whitebeam and Madonie hawkweed, localized on carbonatic rocks of gorges linked to humid microclimatic condition of the supramediterranean belt.

Holotypus: rel. 1, tab. 2, Brullo et al. (2012).

Characteristic and differential species: *Adenostylis hybrida* DC., *Hieracium madoniense* Raimondo & Di Crist., *Hieracium pignattianum* Raimondo & Di Crist., *Physospermum verticillatum* (Waldst. & Kit.) Vis., *Sorbus graeca* (Spach) Schauer.

Phytosociological table: From Brullo et al. (2012), tab. 2, 3 rel.

Char. association: *Sorbus graeca* (3), *Hieracium madoniense* (3), *Hieracium pignattianum* (3), *Physospermum verticillatum* (3), *Adenostyles hybrida* (1).

Char. alliance: *Lamium flexuosum* (3), *Luzula sicula* (3), *Doronicum orientale* (3), *Euphorbia meuselii* (3), *Geranium versicolor* (3), *Ranunculus umbrosus* (1), *Galium rotundifolium* subsp. *hirsutum* (1), *Allium pendulinum* (1).

Char. order: *Acer pseudoplatanus* (3), *Anthriscus nemorosa* (3), *Ilex aquifolium* (3), *Polystichum setiferum* (2), *Geranium robertianum* (1).

Char. class: *Fagus sylvatica* (3), *Brachypodium sylvaticum* (3), *Crepis leontodontoides* (3), *Daphne laureola* (3), *Viola reichenbachiana* (3), *Festuca heterophylla* (3), *Rubus glandulosus* (3), *Lathyrus venetus* (3), *Mycelis muralis* (2), *Clematis vitalba* (2), *Sanicula europaea* (2), *Poa sylvicola* (1).

Other species: *Sesleria nitida* subsp. *sicula* (3), *Odontites bocconei* (3), *Sorbus aucuparia* (2), *Hypochoeris laevigata* (2), *Laserpitium siculum* (2).

Geographical distribution: The association is endemic to the Madonie massif (N Sicily), where it is very rare (Brullo et al. 2012).

Structure and ecology: This beech forest occurs exclusively in some gorges of the mountain belt at an altitude of 1350-1500 m, where it is localized on dolomitic rocky places. On the whole, it is can be considered a strictly subrupestrian vegetation, linked to habitat with a microclimate characterized by a high degree of atmospheric moisture. From the floristic point of view, it is remarkable the occurrence of endemic and rare species, as *Hieracium madoniense*, *Hieracium pignattianum*, *Physospermum verticillatum* and *Adenostylis hybrida*.

Syndynamism: This association replaces in the rupestrian stands of narrow and deep gorges the *Luzulo siculae-Fagetum sylvaticae*, widespread on the surrounding open surfaces, showing also catenal contacts with the chasmophytic plant communities belonging to *Saxifragion australis* (*Potentilletalia caulescentis*).

Habitat reference: G1.6a *Fagus* woodland on non-acid soils.

46.1.1.5. ***Ilici aquifolii-Taxetum baccatae*** Brullo, Minissale, Signorello & Spampinato 1996

Acidophilous woodland, dominated by European yew and rich in common holly, with oceanic requirement and localized on siliceous substrata within the supramediterranean belts.

Holotypus: rel. 5, tab. 1, Brullo et al. (1996).

Characteristic and differential species: *Fraxinus excelsior* L. subsp. *siciliensis* Ilardi & Raimondo, *Ilex aquifolium* L., *Taxus baccata* L., *Ulmus glabra* Hudson.

Phytosociological table: From Brullo et al. (1996), tab. 1, 5 rel. and 1 unpublished releve.

Char. association: *Taxus baccata* (V), *Ilex aquifolium* (V), *Ulmus glabra* (IV), *Fraxinus excelsior* subsp. *siciliensis* (I).

Char. alliance: *Euphorbia meuselii* (V), *Galium rotundifolium* subsp. *hirsutum* (V), *Geranium versicolor* (V), *Lamium flexuosum* (V), *Doronicum orientale* (IV), *Ranunculus lanuginosus* (IV).

Char. order: *Acer campestre* (V), *Acer pseudoplatanus* (V), *Rubus canescens* (V), *Allium ursinun* (V), *Melica uniflora* (V), *Epipactis helleborine* (III), *Arum cylindraceum* (II), *Neottia nidus-avis* (I),

Char. class: *Brachypodium sylvaticum* (V), *Daphne laureola* (V), *Fagus sylvatica* (V), *Lathyrus venetus* (V), *Lathyrus pratensis* (IV), *Mercurialis perennis* (V), *Poa sylvicola* (V), *Primula vulgaris* (V), *Sanicula europaea* (V), *Viola reichenbachiana* (IV), *Mycelis muralis* (IV), *Geum urbanum* (III).

Other species: *Asperula laevigata* (V), *Crataegus laciniata* (II), *Cyclamen repandum* (II).

Geographical distribution: It occurs on the northern slopes of the Nebrodi ridge, where it is very rare and circumscribed to very small areas. It has been also reported from southern Calabria (Brullo et al., 2001).

Structure and ecology: Forests dominated by *Taxus baccata* are extremely rare in Sicily, and they replace the beech forests of the *Anemono apenninae-Fagetum sylvaticae* in stands characterized by colder and more humid microclimatic conditions. In fact, these arcaic forest of conifers are localized in slopes exposed most of the year to a fog regime, giving to these areas marked oceanic characteristics. This association, clearly acidophilous, occurs on siliceous substrata, represented mainly by schists, granites and gneiss, at an altitude of about 1400 m a.s.l. Within thias association Gianguzzi & La Mantia (2004c) recognized a new subassociation proposed as *ruscetosum aculeati*, which was surveyed in a small gorge of Nebrodi at lower altitudes, where the *Taxus baccata* woodlands take contact with holm oak woods.

Syndynamism: This association, belonging to a clearly edaphophilous series,is in catenal contact with the *Anemono apenninae-Fagetum sylvaticae*, beech forest widespread in this mountain territory.

Habitat reference: G2.6 *Ilex aquifolium* woodland; G3.9a *Taxus baccata* woodland.

46.1.1.6. ***Arrhenathero nebrodensis-Quercetum cerridis*** Brullo, Minissale, Signorello & Spampinato 1996

Acidophilous deciduous woodland, dominated by Turkey oak and rich in Sicilian oatgrass, localized on siliceous substrata within the subhumid supramediterranean belt.

Holotypus: rel. 1, tab. 2, Brullo et al. (1996).

Characteristic and differential species: *Quercus cerris* L., *Aristolochia clusii* Lojac., *Aristolochia sicula* Tineo, *Arrhenatherum nebrodensis* Brullo, Minissale & Spampinato, *Conopodium capillifolium* (Guss.) Boiss.

Phytosociological table: From Brullo et al. (1996), tab. 2, 12 rel.

Char. association: *Quercus cerris* (V), *Aristolochia sicula* (V), *Arrhenatherum nebrodensis* (V), *Conopodium capillifolium* (V), *Aristolochia clusii* (III).

Char. alliance: *Doronicum orientale* (V), *Symphytum gussonei* (V), *Ranunculus umbrosus* (V), *Allium pendulinum* (IV), *Euphorbia meuselii* (IV), *Geranium versicolor* (IV), *Lamium flexuosum* (IV), *Luzula sicula* (IV).

Char. order: *Melittis albida* (V), *Milium effusum* (IV), *Rubus canescens* (IV), *Scilla bifolia* (III), *Acer campestre* (III), *Geranium robertianum* (III), *Potentilla micrantha* (III), *Malus sylvestris* (II), *Polystichum setiferum* (I).

Char. class: *Brachypodium sylvaticum* (V), *Crepis leontodontoides* (V), *Daphne laureola* (V), *Lathyrus venetus* (V), *Poa sylvicola* (V), *Primula vulgaris* (V), *Rosa canina* (V), *Aremonia agrimoniodes* (IV), *Clinopodium vulgare* subsp. *orientale* (IV), *Geum urbanum* (III), *Viola reichenbachiana* (III), *Lathyrus pratensis* (III), *Epipactis microphylla* (II).

Other species: *Cyclamen repandum* (V), *Genista aristata* (V), *Viola alba* subsp. *dehnhardtii* (V), *Hypochoeris laevigata* (V), *Sanguisorba minor* (V), *Anthoxanthum odoratum* (V), *Festuca rubra* (V), *Silene vulgaris* subsp. *angustifolia* (IV), *Quercus dalechampii* (IV), *Silene sicula* (IV), *Fragaria vesca* (IV), *Crataegus monogyna* (IV), *Bellis perennis* (IV), *Pteridium aquilinum* (III).

Geographical distribution: It is widespread on the Nebrodi ridge, especially along the northern slopes.

Structure and ecology: This *Quercus cerris* woodland is distributed within a belt between 1100 and 1400 mm belt of altitude, on siliceous bedrock rich in clay. It is a forestal vegetation rich in endemic and rare geophytes, such as *Arrhenatherum nebrodensis*, *Aristolochia sicula*, *A. clusii*, *Conopodium capillifolium*, which is distributed within the subhumid supramediterranean belt. It is can be considered a southern vicariant of other Turkey oak woods forests described from various territories of central and southern Apennines (see Ubaldi et al. 1990, Blasi et al. 2004).

Syndynamism: The association represents the more mature stage of a climatophilous series, showing spatial contact with the *Anemono apenninae-Fagetum sylvaticae* at elevations higher than 1400 m, while at lower altitudes it is replaced by thermophilic woods of the *Erico*

arboreae-Quercion ilicis. The degradation processes usually lead to the replacement of this woodland with mesophilous meadows of the *Plantaginion cupani*.

Habitat reference: G1.8 Acidophilous *Quercus* woodland.

46.1.1.7. ***Ilici aquifolii-Quercetum cerridis*** Raimondo, Schicchi & Bazan 2009

Acidophilous deciduous woodland, dominated by Turkey oak and rich in European yew, with oceanic requirement and localized on siliceous substrata within the subhumid meso-supramediterranean belts.

Holotypus: rel. 4, tab. 1, Raimondo et al. (2009).

Characteristic and differential species: *Ilex aquifolium* L., *Euonymus europaeus* L., *Scutellaria rubicunda* Hornem.

Phytosociological table: From Brullo et al. (1999), tab. 1, 21 rel..

Char. association: *Quercus cerris* (V), *Ilex aquifolium* (V), *Euonymus europaeus* (V), *Scutellaria rubicunda* (V).

Char. alliance: *Geranium versicolor* (V), *Lamium flexuosum* (III), *Luzula sicula* (III), *Polygonatum gussonei* (II), *Euphorbia meuselii* (II), *Galium rotundifolium* subsp. *hirsutum* (I), *Ranunculus umbrosus* (I), *Doronicum orientale* (I).

Char. order: *Acer campestre* (V), *Malus sylvestris* (IV), *Melica uniflora* (IV), *Polystichum setiferum* (IV), *Rubus canescens* (IV), *Geranium robertianum* (III), *Dioscorea communis* (III), *Melittis albida* (II), *Anthriscus nemorosa* (II), *Rubus hirtus* (I), *Saxifraga rotundifolia* (I), *Acer pseudoplatanus* (I), *Allium ursinun* (I).

Char. class: *Daphne laureola* (V), *Lathyrus venetus* (V), *Viola reichenbachiana* (IV), *Drymochloa drymeja* subsp. *exaltata* (IV), *Hedera helix* (IV), *Geum urbanum* (III), *Brachypodium sylvaticum* (III), *Clematis vitalba* (III), *Poa sylvicola* (III), *Clinopodium vulgare* subsp. *orientale* (II), *Mercurialis perennis* (II), *Aremonia agrimoniodes* (II), *Fagus sylvatica* (I), *Primula vulgaris* (I), *Sanicula europaea* (I).

Other species: *Ruscus aculeatus* (V), *Silene sicula* (V), *Crataegus monogyna* (V), *Pteridium aquilinum* (V), *Prunus spinosa* (IV), *Oenanthe pimpinelloides* (IV), *Dactylis glomerata* (III), *Hypochoeris laevigata* (III), *Arrhenatherum nebrodense* (II).

Geographical distribution: It shows a scattered distribution in the north-facing slopes of Nebrodi ridge.

Structure and ecology: This association dominated by *Quercus cerris* is localizzed on flysch between 800 and 1300 m of altitude, within the mesomediterranean and supramediterranean belts with subhumid ombrotype. It is linked to oceanic microclimatic conditions, favored especially during the winter by an almost constant regime of fogs. Species differential of this association is *Ilex aquifolium*, which usually reaching very high cover values, as well as

Euonymus europaeus and *Scutellaria rubicunda*.

Syndynamism: It is an edaphophilous woodland linked to habitas with very humid microclimatic conditions, which is in contact with *Arrhenathero nebrodensis-Quercetum cerridis*, replacing it under more xeric environmental characterics. The destruction of the canopy leads to its replacement with a shrubby community of *Pruno-Rubion ulmifolii*, while a heavier anthropic impact favors the settlement of mesophilous meadows of *Plantaginion cupanii*.

Habitat reference: G1.8 Acidophilous *Quercus* woodland; G2.6 *Ilex aquifolium* woodland.

46.1.1.8. ***Ilici aquifolii-Quercetum austrothyrrenicae*** Brullo & Marcenò in Brullo 1984, corr. Brullo et al. 2002

Acidophilous deciduous woodland, dominated by Sicilian Sessile oak and rich in European yew, with oceanic requirement and localized on siliceous substrata within the supramediterranean belts.

Synonyms: *Ilici aquifolii-Quercetum petraeae* Brullo & Marcenò in Brullo 1984

Holotypus: rel. 7, tab. 22, Brullo (1984).

Characteristic and differential species: *Quercus petraea* (Mattuschka) Liebl. subsp. *austrotyrrhenica* Brullo et al.; *Ilex aquifolium* L., *Aquilegia sicula* (Strobl) E. Nardi.

Phytosociological table: From Brullo (1984), tab. 22, 12 rel.

Char. association: *Quercus petraea* subsp. *austrotyrrhenica* (V), *Ilex aquifolium* (V), *Aquilegia sicula* (III).

Char. alliance: *Geranium versicolor* (V), *Lamium flexuosum* V), *Euphorbia meuselii* (II), *Myosotis gussonei* (II), *Anemone apennina* (II), *Allium pendulinum* (I), *Ranunculus umbrosus* (I), *Doronicum orientale* (I), *Luzula sicula* (I).

Char. order: *Melica uniflora* (V), *Polystichum setiferum* (V), *Rubus canescens* (V), *Potentilla micrantha* (III), *Dioscorea communis* (III), *Geranium robertianum* (III), *Acer campestre* (II), *Malus sylvestris* (I), *Milium effusum* (I).

Char. class: *Daphne laureola* (V), *Rosa canina* (V), *Luzula forsteri* (V), *Lathyrus venetus* (IV), *Clinopodium vulgare* subsp. *orientale* (III), *Latrhyrus pratensis* (III), *Fagus sylvatica* (III), *Primula vulgaris* (III), *Viola reichenbachiana* (II), *Aremonia agrimoniodes* (II), *Brachypodium sylvaticum* (II), *Geum urbanum* (II), *Hedera helix* (II), *Euonymus europaeus* (I), *Mycelis muralis* (I), *Clematis vitalba* (I).

Other species: *Ruscus aculeatus* (IV), *Teucrium siculum* (III), *Cyclamen hederifolium* (III), *Pteridium aquilinum* (III).

Geographical distribution: It occurs on the massif of Madonie (Pomieri) and more rarely on the Nebrodi ridge, near Portella dell'Obolo (Capizzi).

Structure and ecology: In Sicily, these woodlands with *Quercus petraea* subsp. *austrotyrrhenica* grows on quartz sandstones and flysch at an altitude of 1400-1600 m a.s.l., under supramediterranean humid bioclimatic conditions. Usually, this vegetation is localized on deep valleys under oceanic microclimatic conditions, characterized almost all the year by a fog regime, as highlighted by the dense shrubby layer with *Ilex aquifolium*.

Syndynamism: This association can be considered an extrazonal forest developping within the climatophilous belt of the *Anemono apenninae-Fagetum sylvaticae*, which is widespread in more open and sunny sites. The degradation processes lead to the replacement of this woodland with shrubby vegetation of *Pruno-Rubion ulmifolii*.

Habitat reference: G1.8 Acidophilous *Quercus* woodland; G2.6 *Ilex aquifolium* woodland.

46.1.1.9. ***Geranio versicoloris-Quercetum ilicis*** Maniscalco & Raimondo 2003

Acidophilous evergreen woodland, dominated by holm oak and rich in pencilled geranium, with oceanic requirement and localized on siliceous substrata within the humid supramediterranean belt.

Holotypus: rel. 10, tab. 2, Maniscalco & Raimondo (2003).

Characteristic and differential species: *Quercus ilex* L., *Aremonia agrimonioides* (L.), *Ilex aquifolium* L., *Melittis albida* Guss., *Silene sicula* Ucria.

Phytosociological table: From Maniscalco & Raimondo (2003), tab. 2, 16 rel..

Char. association: *Quercus ilex* (V), *Ilex aquifolium* (V), *Silene sicula* (V), *Aremonia agrimonioides* (IV), *Melittis albida* (IV).

Char. alliance: *Lamium flexuosum* (IV), *Euphorbia meuselii* (IV), *Allium pendulinum* (III), *Geranium versicolor* (III), *Galium rotundifolium* subsp. *hirsutum* (II), *Ranunculus velutinus* (II), *Anemone apennina* (II), *Symphytum gussonei* (II), *Luzula sicula* (I).

Char. order: *Dioscorea communis* (IV), *Potentilla micrantha* (IV), *Geranium robertianum* (IV), *Melica uniflora* (IV), *Polystichum setiferum* (III), *Acer campestre* (III), *Quercus cerris* (III), *Rubus hirtus* (III), *Anthriscus nemorosa* (II), *Malus sylvestris* (II), *Scilla bifolia* (I), *Galium odoratum* (I), *Neottia nidus-avis* (I).

Char. class: *Hedera helix* (V), *Crepis leontodontoides* (IV), *Lathyrus venetus* (IV), *Luzula forsteri* (IV), *Poa sylvicola* (III), *Clinopodium vulgare* subsp. *orientale* (III), *Daphne laureola* (III), *Primula vulgaris* (II), *Rosa canina* (II), *Viola reichenbachiana* (II), *Sanicula europaea* (I), *Brachypodium sylvaticum* (I), *Mycelis muralis* (I), *Fagus sylvatica* (I), *Drymochloa drymeja* subsp. *exaltata* (I), *Festuca heterophylla* (I), *Geum urbanum* (I), *Clematis vitalba* (I).

Other species: *Cyclamen repandum* (V), *Viola alba* subsp. *dehnhardtii* (V), *Quercus congesta* (IV), *Prunus mahaleb* (IV), *Bellis perennis* (IV), *Ruscus aculeatus* (IV), *Cyclamen hederifolium* (III), *Rubia peregrina* (III), *Pteridium aquilinum* (III), *Hypochoeris laevigata* (III), *Crataegus monogyna* (III).

Geographical distribution: This association is widespread in the mountain of northern Sicily

(Madonie, Nebrodi and Peloritani).

Structure and ecology: It is a markedly mesophilous holm oak woodland localized on flysch characterized by slightly acidic and well humified soils, within the lower supramediterranean humid belt at an altitude of 900-1200 m. This association differs from the other associations more thermophilous dominated by *Quercus ilex*, for the occurrence in the underwood of several species of the *Querco-Fagetea sylvaticae*, while the elements of the *Quercetea ilicis* are on the whole much less frequent. This association was initially included by Maniscalco & Raimondo (2003) into the *Pino-Quercion congestae*, but for its floristic set it is more correct to attribute it to *Geranio versicoloris-Fagion sylvestris*.

Syndynamism: The association can be considered an ecological vicariant on the siliceous substrata of the *Acero-campestris-Quercetum ilicis*, linked to carbonatic rocks. Following the degradation processes it is usually replaced by a community of *Pruno-Rubion ulmifolii*.

Habitat reference: G2.1 Mediterranean evergreen *Quercus* woodland.

46.1.1.10. ***Sorbo graecae-Aceretum pseudoplatani*** Gianguzzi & La Mantia 2004

Basiphilous deciduous woodland, dominated by sycamore and rich in Greek whitebeam, localized on carbonatic substrata within the humid low supramediterranean belt.

Holotypus: rel. 4, tab. 3, Gianguzzi & La Mantia (2004a).

Characteristic and differential species: *Acer pseudoplatanus* L., *Agropyron panormitanum* Parl,, *Prunus cupaniana* Guss., *Sorbus aria* (Spach) M. Roem.

Phytosociological table: From Brullo et al. (1999), tab. 1, 10 rel.

Char. association: *Acer pseudoplatanus* (V), *Aria graeca* (IV), *Agropyron panormitanum* (IV), *Prunus cupaniana* (III).

Char. alliance: *Lamium flexuosum* subsp*. pubescens* (V)*.*

Char. order: *Anthriscus nemorosa* (V)*, Dioscorea communis* (V)*, Polystichum setiferum* (III)*, Rubus canescens* (III), *Scilla bifolia* (III)*, Acer campestre* (III)*, Ilex aquifolium* (I)*, Malus sylvestris* (I)*.*

Char. class: *Clematis vitalba* (V)*, Hedera helix* (V)*, Poa sylvicola* (V)*, Rosa canina* (V)*, Daphne laureola* (IV), *Drymochloa drymeja* subsp. *exaltata* (IV), *Geum urbanum* (III)*, Clinopodium vulgare* subsp. *orientale* (II), *Primula vulgaris* (I)*.*

Other species: *Fraxinus ornus* (V), *Rubus ulmifolius* (V), *Arrhenatherum sardoum* (IV), *Arabis caucasica* (IV), *Secale strictum* (IV), *Cyclamen repandum* (III), *Quercus ilex* (III), *Festuca circummediterranea* (III).

Geographical distribution: It is a very rare association occurring in the Madonie and Rocca Busambra.

Structure and ecology: This peculiar woodland is localized on stable screes at the bottom of north-facing rocky walls. It grows on carbonate substrates (limestones and dolomitic rocks) at 1000-1500 m of altitude., within the lower supramediterranean belt with humid ombrotype. From the floristic viewpoint, it is characterized by a canopy with *Acer pseudoplatanus*, *Fraxiunus ornus* and *Sorbus aria*. In particular, Gianguzzi & La Mantia (2004) referred it to the order *Quercetalia pubescenti-petraeae*, while Brullo et al. (2012) considered more appropriate its attribution to the *Fagetalia sylvaticae* order.

Syndynamism: It is an edapho-xerophilous plant community scattered within the area potentially occupied by the *Aceri campestris-Quercetum ilicis*, which has its optimum on stands characterized by very immature soils rich in coarse clastic material. This community is dynamically connected with the shrubland of *Pruno-Rubion ulmifolii* and with the scree vegetation of *Scrophulario-Helichrysetea italici*.

Habitat reference: G1.7b Mediterranean thermophilous deciduous woodland.

46.1.1.11. ***Ilici aquifolii-Quercetum leptobalani*** Maniscalco & Raimondo 2009

Mesophilous deciduous woodland with acidophilous exsigences, dominated by Madonie downy oak and rich in European yew, localized on siliceous substrata within the lower humid supramediterranean belt.

Holotypus: Rel 4, tab.1, Maniscalco & Raimondo (2009).

Characteristic and differential species: *Quercus leptobalanos* Guss., *Quercus congesta* C. Presl, *Quercus dalechampii* Ten., *Ilex aquifolium* L.

Phytosociological table: From Maniscalco & Raimondo (2009), tab. 1, 8 rel.

Char. association: *Quercus leptobalanus* (V), *Quercus congesta* (V), *Quercus dalechampii (*V), *Ilex aquifolium* (V).

Char. alliance: *Lamium flexuosum* (IV), *Anemone apennina* (IV), *Symphytum gussonei* (IV), *Luzula sicula* (IV), *Geranium versicolor* (IV), *Galium rotundifolium* subsp. *hirsutum* (II), *Allium pendulinum* (II), *Doronicum orientale* (II), *Euphorbia meuselii* (I).

Char. order: *Dioscorea communis* (V), *Melittis albida* (V), *Melica uniflora* (IV), *Rubus hirtus* (IV), *Polystichum setiferum* (IV), *Anthriscus nemorosa* (III), *Neottia nidus-avis* (III), *Potentilla micrantha* (III), *Acer campestre* (II), *Allium ursinum* (I), *Malus sylvestris* (I), *Rubus canescens* (I),

Char. class: *Hedera helix* (V), *Daphne laureola* (IV), *Poa sylvicola* (IV), *Lathyrus venetus* (IV), *Primula vulgaris* (III), *Aremonia agrimonioides* (III), *Clinopodium vulgare* subsp. *orientale* (II), *Sanicula europaea* (II), *Brachypodium sylvaticum* (II), *Geum urbanum* (II), *Crepis leontodontoides* (I), *Luzula forsteri* (I), *Euonymus europaeus* (I).

Trangr. *Quercetalia pubescenti-petraeae*: *Oenenthe pimpinelloides* (III), *Lonicera etrusca* (II), *Asperula laevigata* (II), *Teucrium scorodonia* subsp. *crenatifolium* (I), *Buglossoides purpureocaerulea* (I), *Echinops ritro* subsp. *siculum* (I) *Fraxinus ornus* (I), *Acer monspessulanum* (I), *Sorbus torminalis* (I).

Other species: *Quercus ilex* (V), *Rubia peregrina* (V), *Pteridium aquilinum* (V), *Ruscus aculeatus* (V), *Thalictrum calabricum* (V), *Viola alba* subsp. *dehnhardtii* (V), *Cyclamen repandum* (IV), *Oenanthe pimpinelloides* (III), *Ranunculus bulbosus* subsp. *alea* (III), *Crataegus monogyna* (II).

Geographical distribution: The association is localized in some places of the Madonie Massif.

Structure and ecology: This markedly mesophilous deciduous wood was surveyed on the cooler slopes between 1,000 and 1,250 m, occasionally also at lower altitudes under favourable conditions. The canopy is dominated by deciduous oaks, such as *Quercus leptobalanos*, *Q. congesta* and *Q. dalechampii*, which grow on deep and mature soils of various Flyschoid substrates. The underwood of this vegetation is very rich in mesic elements of *Fagetalia* due to the particularly oceanic microclimatic conditions of the growth habitat, which is strongly affected by humid currents coming from the Tyrrhenian Sea. As concerns the bioclimate, it is linked to the supramediterranean belt with lower humid ombrotype. Previously, this forest was attributed by Maniscalco & Raimondo (2009) to *Pino calabricae-Quercion congestae*, alliance of *Quercetalia pubescenti-petraeae*, but the floristic contingent of these two sintaxa is scarcely represented in the association at issue, while it is rich in species of the *Geranio versicoloris-Fagion sylvaticae*, as well as of the *Fagetalia sylvaticae*, therefore it must be attributed to this last alliance.

Syndynamism: In the stands with mature and deep soils, this association replaces the *Geranio versicoloris-Quercetum ilicis*, which is linked instead to rocky substrata. Usually, it is localized in a belt interposed between the acidophilous woodland of *Teucrio siculi-Quercetum ilicis* and the beech forests of *Anemono apenninae-Fagetum sylvaticae*. Because of the degradation processes, it is replaced by shrublands of *Rhamno-Prunetea*.

Habitat reference: G1.8 Acidophilous *Quercus* woodland.

46.1.1.12. ***Conopodio capillifolii-Quercetum congestae*** Maniscalco & Raimondo 2009

Mesophilous deciduous woodland, dominated by Sicilian downy oak and rich in filiform pignut, localized on metamorphic substrata within the upper humid supramediterranean belt.

Holotypus: Rel 1, tab. 2, Maniscalco & Raimondo (2009).

Characteristic and differential species: *Quercus congesta* C.Presl, *Conopodium capillifolium* (Guss.) Boiss.

Phytosociological table: From Maniscalco & Raimondo (2009), tab. 2, 6 rel.

Char. association: *Quercus congesta* (V), *Conopodium capillifolium* (V).

Char. alliance: *Galium rotundifolium* subsp. *hirsutum* (V), *Euphorbia meuselii* (III), *Geranium versicolor* (III), *Doronicum orientale* (II), *Allium pendulinum* (II), *Polygonatum gussonei* (I), *Lamium flexuosum* (I), *Luzula sicula* (I).

Char. order: *Malus sylvestris* (III), *Ilex aquifolium* (III), *Polystichum setiferum* (II), *Dioscorea*

communis (I), *Potentilla micrantha* (I).

Char. class: *Hedera helix* (V), *Daphne laureola* (IV), *Poa sylvicola* (IV), *Lathyrus venetus* (IV), *Primula vulgaris* (III), *Aremonia agrimonioides* (III), *Clinopodium vulgare* subsp. *orientale* (II), *Sanicula europaea* (II), *Brachypodium sylvaticum* (II), *Geum urbanum* (II), *Crepis leontodontoides* (I), *Luzula forsteri* (I), *Euonymus europaeus* (I).

Trangr. *Quercetalia pubescenti-petraeae*: *Castanea sativa* (II), *Fraxinus ornus* (II), *Asperula laevigata* (II), *Teucrium scorodonia* subsp. *crenatifolium* (I), *Lonicera etrusca* (I), *Acer obtusatum* (I), *Ostrya carpinifolia* (I).

Other species: *Quercus ilex* (V), *Erica arborea* (V), *Thalictrum calabricum* (V), *Silene sicula* (V), *Cyclamen repandum* (V), *Viola alba subsp. dehnhardtii* (V), *Ranunculus bulbosus subsp. alea* (V), *Pteridium aquilinum* (V), *Hypochoeris laevigata* (V), *Crataegus monogyna* (V), *Dactylis hispanica* (III).

Geographical distribution: This deciduous woodland occurs in some localities of the Peloritani range.

Structure and ecology: The association as the previous one shows marked acidophilous requirements developping on cooler slopes of mountain peaks at 1000-1150 m of altitude. It is linked to various kinds of metamorphic substrata, characterized by quite permeable soils, generally having at least on the surface a certain xericity. From the bioclimate viewpoint, this vegetation is localized within the supramediterranean belt with upper humid ombrotype, since its growth territories are effected by very humid winds coming from sea. The canopy of this deciduous woodland is dominated by *Quercus congesta*, acidophilous species growing together with a rich pool of mesophilous elements of the *Geranio versicoloris-Fagion sylvaticae* and of higher rank. Even this association as the previous one was attributed by Maniscalco & Raimondo (2009) to the *Pino calabricae-Quercion congestae*, but for the same reasons it falls instead into the *Geranio versicoloris-Fagion sylvaticae*.

Syndynamism: It can be considered a climatophilous woodland of cacuminal stands with humid and cool conditions, limitedly to siliceous mountains. Usually, the degradation processes lead to its replacment with acidophilos shrubby communities characterized by *Erica arborea* and *Pteridium aquilinum*, belonging to *Cytisetea scopario-striati*, a class with oceanic requirements.

Habitat reference: G1.8 Acidophilous *Quercus* woodland.

46.2. Order: ***Quercetalia pubescenti-petraeae*** Klika 1933

Mixed forests of mesophilous deciduous trees with the canopy caracterized mainly by species of the genus *Quercus*, *Acer*, *Fraxinus*, *Carpinus*, etc. widespread within the mesotemperate belt of the central and southern Europe, including also the relic supramediterranean fir-pine and oak forests of the Mediterranean area.

Synonyms: *Quercetalia pubescentis* Br.-Bl. 1931 (art. 2b); *Quercetalia pubescentis* R. Tx. 1931 (art. 2b); *Quercetalia pubescenti-sessiliflorae* Quantin 1935 (31); *Fraxino orni-Ostryetalia* Jakucs 1959 (3b); *Quercetalia pubescentis medioeuropeae* Horvat 1959 (art. 2b); *Fraxino orni-Cotinetalia* Jakucs 1960 (art. 29c); *Quercetalia petraeae-pubescentis* Jakucs 1960 (art. 31); *Brachypodio-Quercetalia petraeae* Passarge 1968 (29c); *Brachypodio-Quercetalia petraeae* Hofmann in Passarge & G. Hofmann 1968 (art. 31); *Festuco-Quercetalia robori-petraeae* Passarge 1968 (art. 34c); *Festuco-Quercetalia robori-petraeae* Passarge & G. Hofmann 1968 (art. 34c); *Quercetalia robori-pubescentis* Fòrster 1979 (art. 29c); *Ostryo-Carpinetalia orientalis* Lakùsić et al. 1982 (art. 2b, 5); *Carpino-Melicetalia uniflorae* Ubaldi et al. 1986 (art. 2b); *Sorbo ariae-Quercetalia lanuginosae* Gillet 1986 (art. 1); *Lathyro nigri-Quercetalia cerridis* Ubaldi 1988 (art. 2b, 5); *Lathyro veneti-Carpinetalia* Ubaldi et al. 1990 (syntax.syn.); *Sorbo ariae-Quercetalia lanuginosae* Gillet ex Julve 1991 (sensu Julve 1993) (orig.form) (art. 2b, mut.superfl.); *Quercetalia cerridis* Borhidi in Borhidi & Kevey 1996 (syntax.syn.).

Holotypus: *Quercion pubescenti-petraeae* Br.-Bl. 1932

Characteristic and differential species: *Acer monspessulanum* L., *A. campestre* L., *Agropyron panormitanum* Parl., *Buglossoides purpureocaerulea* (L.) I.M. Johnst., *Castanea sativa* Mill., *Cephalanthera longifolia* (L.) Fritsch,, *Cnidium silaifolium* (Jacq.) Simonk., *Fraxinus ornus* L., *Limodorum abortivum* (L,) Sw., *Lonicera etrusca* Santi, *Ostrya carpinifolia* Scop., *Populus tremula* L., *Quercus cerris* L., *Q. pubescens* Willd., *Teucrium siculum* (Raf,) Guss., *Vicia cassubica* L.

Geographical distribution: This order is widespread in the Euro-Siberian and Mediterranean regions with plant communities occurring on both acidic and calcareous substrates. It shows a high etherogenity that from the syntaxonomic point justifies the large number of alliances currently recognized within it.

Structure and ecology: According to literature (Mucina et al. 2016), the order includes deciduous forests dominated by several species of *Quercus* (*Q. pubescens*, *Q. cerris*, *Q. petraea*, *Q. frainetto*, *Q. faginea* and others), often mixed with *Carpinus* sp. pl., *Acer* sp. pl., *Ostrya carpinifolia*, *Fraxinus ornus*, etc. or more rarely with conifers. These mesophilous woodlands occur both on carbonatic and siliceous substrates, in territories characterized by thermo-supratemperate and meso-supramediterranean bioclimates.

Syndynamism: The woodlands belonging to this order represent usually final mature stages of climatophilous or, sometimes, edaphophilous series.

46.2.1. Alliance: ***Pino calabricae-Quercion congestae*** Brullo, Scelsi, Siracusa & Spampinato 1999

Submediterranean mesophilous Siculo-Calabrian pine-oak woodlands, dominated by deciduous and semideciduous trees, as well as conifers, occurring in the meso-mediterranean and supra-mediterranean belt.

Holotypus: *Vicio cassubicae-Quercetum cerridis* Brullo & Marcenò 1985.

Characteristic and differential species: *Acer obtusatum* Willd. subsp. *aetnense* (Tineo) C. Brullo & Brullo, *Betula aetnensis* Raf., *Epipactis meridionalis* H.Baumann & R.Lorenz, *Pinus nigra* J.F.Arnold subsp. *calabrica* (Loud.) A.E. Murray, *Quercus congesta* C. Presl, *Q. dalechampii* Ten., *Rubus aetnicus* Torn.

Geographical distribution: It occurs in Southern Calabria and Sicily, where it seems to be restricted to Mt. Etna. This alliance has been recently recorded by Bacchetta et al. (2004) also in Sardinia, where they recognize a special suballiance (*Paeonio morisii-Quercenion ichnusae*), grouping the Sardinian associations. According to Brullo et al. (2012) and Guarino et al. (2015), it is preferable to treat this suballiance to the rank of alliance: *Paeonio morisii-Quercion ichnusae* (Bacchetta et al., 2004) Brullo et al. 2012.

Structure and ecology: This alliance includes mesophilous woodlands growing on siliceous substrates, within the supramediterranean bioclimatic belt. These communities are physiognomically characterized by the dominance of *Fagus sylvatica* or deciduous mesophilous oaks, as *Quercus congesta* and *Q. dalechampii*, or by other endemic trees, among them *Pinus nigra* subsp. *calabrica*, *Betula aetnensis* and *Acer obtusatum* subsp. *aetnense*.

Syndynamism: This syntaxon gathers climatophilos and edapho-xerophilous forests distributed within the supramediterranean belt.

46.2.1.1. ***Epipactido meridionalis-Fagetum sylvaticae*** Brullo, Guarino, Minissale, Siracusa & Spampinato 1999

Acidophilous beech forests, dominated European beech and rich in southern helleborine, localized on basalts within the upper supramediterranean belt with humid ombrotype.

Holotypus: rel, 27, tab. 1, Brullo et al. (1999).

Characteristic and differential species: *Fagus sylvatica* L., *Epipactis meridionalis* H.Baumann & R. Lorenz, *Cephalanthera longifolia* (L.) Fritsch.

Phytosociological table: From Brullo et al. (1999), tab. 1, 18 rel..

Char. association: *Fagus sylvatica* (V), *Epipactis meridionalis* (V), *Cephalanthera longifolia* (II).

Char. alliance and order: *Quercus congesta* (II), *Pinus nigra* subsp. *calabrica* (I), *Acer obtusatum* subsp. *aetnense* (I), *Rubus aetnicus* (I).

Char. class: *Festuca heterophylla* (V), *Neottia nidus-avis* (IV), *Brachypodium sylvaticum* (IV), *Luzula forsteri* (IV), *Lathyrus venetus* (III), *Crepis leontodontoides* (III), *Lathyrus pratensis* (III), *Rubus glandulosus* (III), *Aremonia agrimonioides* (II), *Rosa canina* (II), *Viola reichenbachiana* (II), *Lathraea squamaria* (I), *Daphne laureola* (I), *Ilex aquifolium* (I), *Clinopodium vulgare* subsp. *orientale* (I), *Poa sylvicola* (I).

Other species: *Pteridium aquilinum* (V), *Festuca circummediterranea* (III), *Silene sicula* (III), *Fragaria vesca* (II).

Geographical distribution: This association is endemic of Mt. Etna.

Structure and ecology: It is a pioneer beach forest occurring between 1400 m and 2000 m of altitude, within the upper supramediterranean humid bioclimatic belt. This association is linked to volcanic substrata, localizing on deep and humified soils, with a quite deep layer of organic matter. Potentially it should tend to form a quite continuous belt around the volcano, but due to the frequent lava flows it is fragmented in several patches of different size, locally called "dagala". This vegetation, dominated by *Fagus sylvatica*, shows a very poor floristic underwood probably for the marked sterility of the substratum. A peculiar connotation of this association is given by the occurrence of two orchids, as *Epipactis meridionalis* and *Cephalanthera longifolia*. Previously, this association was referred by Brullo et al. (1999) to the alliance *Geranio versicoloris-Fagion sylvaticae*.

Syndynamism: This association represents represents the more mature stage of a supramountain climatophilous series of a volcanic habitat. Usually, it is replaced is on compact rocky substrates without humified soil, by orophilous pine woods represented by *Junipero hemisphaericae-Pinetum calabricae*, while on sandy volcanic soils is vicaried by the Cephalanthero longifoliae-Betuletum aetnensis. At higher altitudes, the *Epipactido meridionalis-Fagetum sylvaticae* comes in contact with orophilous pulvinate shrubby communities, chiefly represented by *Bellardiochloo aetnensis-Juniperetum hemisphaericae* or *Astragaletum siculi*.

Habitat reference: G1.6b *Fagus* woodland on acid soils.

46.2.1.2. ***Rubo aetnici-Fagetum sylvaticae*** Brullo, Guarino, Minissale, Siracusa & Spampinato 1999

Sciaphilous beech forests, dominated European beech and rich in Etna dewberry, localized on basalts within the upper supramediterranean belt with humid ombrotype.

Holotypus: rel. 32, tab. 1, Brullo et al. (1999).

Characteristic and differential species: *Fagus sylvatica* L., *Rubus aetnicus* Torn.

Phytosociological table: From Brullo & Marcenò (1985), tab. 1, 5 rel..

Char. association: *Fagus sylvatica* (V), *Rubus aetnicus* (V).

Char. alliance: *Acer obtusatum* subsp. *aetnense* (V), *Quercus dalechampii* (IV), *Pinus nigra* subsp. *calabrica* (III),

Char. order: *Quercus cerris* (V), *Vicia cassubica* (V), *Agropyron panormitanum* (II).

Char. class: *Festuca heterophylla* (V), *Viola reichenbachiana* (V), *Lathyrus venetus* (V), *Brachypodium sylvaticum* (V), *Lamium flexuosum* (IV), *Anemone apennina* (IV), *Lathyrus pratensis* (III), *Geum urbanum* (I).

Other species: *Pteridium aquilinum* (V), *Sanguisorba minor* (V), *Silene sicula* (IV), *Trifolium semipurpureum* (III).

Geographical distribution: This association occurs only on the eastern slopes of Mt. Etna.

Structure and ecology: This peculiar beech woodland is localized in the sheltered and shady valleys. Actually, this plant community, as well as the *Epipactido meridionalis-Fagetum sylvaticae*, occurs on volcanic substrata, but it is linked to more mesic microclimatic conditions In fact, it is exclusive of small valleys characterized by fresher soils and high air humidity and seems to have its optimum within the lower supramediterranean subhumid bioclimatic belt, between 1200-1600 m of altitude. Floristically, this association is characterized by the occurrence of two endemics, *Rubus aetnicus* and *Acer obtusatum* subsp. *aetnense*, while the marked mesophilous requirements confirm the ecological role by it played.

Syndynamism: This association can be considered as an heterotopic, extrazonal community, being localized within the belt potentially occupied by the *Vicio cassubicae-Quercetum cerridis* and the pine woods with *Pinus nigra* subsp. *calabrica*. Similarly to the *Epipactido meridionalis Fagetum sylvaticae*, it was formerly ascribed by Brullo et al. (1999) to *Geranio versicoloris-Fagion sylvaticae*, but for the floristic contingent its inclusion in the *Pino-Quercion congestae* is more suitable. as emphasized by Brullo et al (2012).

Habitat reference: G1.6b *Fagus* woodland on acid soils.

46.2.1.3. ***Hieracio criniti-Aceretum aetnensis*** Brullo & Siracusa in Brullo et al. 2012

Sciaphilous deciduous forests, dominated Etna maple and rich in maned hawkweed, localized on basalts within the upper supramediterranean belt with humid ombrotype.

Holotypus: Rel. 8, tab. 3, Brullo et al. (2012).

Characteristic and differential species: *Acer obtusatum* Willd. subsp. *aetnense* (Tineo) C. Brullo & Brullo, *Hieracium crinitum* Sibth & Sm., *Dryopteris pallida* (Bory) Maire & Petitm.

Phytosociological table: From Brullo et al. (2012), tab. 3, 2 rel..

Char. association: *Hieracium crinitum* (2), *Dryopteris pallida* (2).

Char. alliance: *Acer obtusatum* subsp. *aetnense* (2), *Pinus nigra* subsp. *calabrica* (2), *Quercus dalechampii* (2), *Rubus aetnicus* (2).

Char. order: *Agropyron panormitanum* (2), *Castanea sativa* (2).

Char. class: *Daphne laureola* (2), *Festuca heterophylla* (2), *Lathyrus pratensis* (2), *Brachypodium sylvaticum* (2), *Crepis leontodontoides* (2), *Luzula sicula* (2), *Galium rotundifolium* subsp. *rotundifolium* (2), *Rubus glandulosus* (2), *Lathyrus venetus* (1), *Viola reichenbachiana* (1).

Other species: *Pteridium aquilinum* (2), *Hypochoeris laevigata* (2), *Thalictrum minus* (2), *Stellaria media* (2), *Dactylis glomerata* (1), *Daucus carota* (1), *Vicia disperma* (1), *Fragaria vesca* (1).

Geographical distribution: This association is endemic of North-East slopes of Mt. Etna.

Structure and ecology: It is a very peculiar deciduous woodland occurring in the narrow and deep gorges and impluvia of volcanic substrata, at about 1400 m of altitude, within the supramediterranean humid belt. This association is floristically characterized by the dominance of *Acer obtusatum* subsp. *aetnense*, localizing in habitats charaterized by marked oceanic conditions, represented mainly by damp soils as a result of seasonal running off of rainwater and elevated atmospheric moisture, which gives to it a marked mesophily.

Syndynamism: For its ecological requirements, this woodland can be considered an orophilous vicariant of the *Aceri obtusati-Ostryetum carpinifoliae*, community of *Quercetea ilicis*, which occurs in the same territory but at lower altitudes (usually below 1000 m).

Habitat reference: G1.Aa *Carpinus* and *Quercus* mesic deciduous woodland**.**

46.2.1.4. ***Vicio cassubicae-Quercetum cerridis*** Brullo & Marcenò 1985

Mesophilous deciduous woodland, dominated Turkey oak and rich in Kashubian vetch, localized on basalts within the lower supramediterranean belt with humid ombrotype.

Holotypus: Rel. 4, tab. 16, Brullo & Marcenò (1985).

Characteristic and differential species: *Quercus cerris* L., *Vicia cassubica* L.

Phytosociological table: From Brullo & Marcenò (1985), tab. 2, 6 rel.

Char. association: *Quercus cerris* (V), *Vicia cassubica* (III).

Char. alliance: *Epipactis meridionalis* (V), *Quercus congesta* (V), *Quercus dalechampii* (V), *Rubus aetnicus* (IV), *Pinus nigra* subsp. *calabrica* (IV), *Betula aetnensis* (III).

Char. order: *Lonicera etrusca* (V), *Acer monspessulanum* (III), *Fraxinus ornus* (II).

Char. class: *Lathyrus pratensis* (V), *Crepis leontodontoides* (V), *Luzula sicula* (IV), *Festuca exaltata* (III).

Other species: *Pteridium aquilinum* (V), *Carex distachya* (V), *Silene sicula* (V), *Daucus carota* (V), *Genista aetnensis* (V), *Secale strictum* (V), *Festuca circummediterranea* (V), *Asplenium onopteris* (IV), *Juniperus hemisphaerica* (IV), *Anthoxanthum odoratum* (IV), *Cytisus villosus* (III), *Rhamnus alaternus* (III), *Asparagus acutifolius* (III).

Geographical distribution: This association is endemic of eastern slope of Mt. Etna.

Structure and ecology: This association is localized between 1200 and 1500 m of altitude on deep and mature soils, having a volcanic origin, within the lower supramediterranean belt with humid ombrotype. In the canopy of this woodland, apart from *Quercus cerris*, occur other

deciduous species, such as *Quercus congesta*, *Q. dalechampii*, *Fraxinus ornus*, *Castanea sativa*, *Acer obtusatum* subsp. *aetnense*, etc., constituting a well structured tree layer. This Turkey oak woods is floristically and ecologically rather differentiated from the *Arrhenathero nebrodensis-Quercetum cerridis* from nebrodi, since the latter association has its optimum on clayey soils with a high water capacity and further it is definitely richer of nemoral species.

Syndynamism: The association comes in contact with pine woods and birch woods at higher altitudes, while it is replaced by deciduous oak woods with *Quercus congesta* at lower altitudes.

Habitat reference: G1.8 Acidophilous *Quercus* woodland.

46.2.1.5. ***Agropyro panormitani-Quercetum congestae*** Brullo, Scelsi, Siracusa & Spampinato 1999

Mesophilous deciduous woodland, dominated by Sicilian downy oak and rich in Palermo couch-grass, localized on volcanic substrata within the humid lower supramediterranean humid belt.

Holotypus: rel. pag. 24, Brullo et al. (1999).

Characteristic and differential species: *Agropyron panormitanum* Parl., *Quercus congesta* C. Presl.

Phytosociological table: From Brullo et al. (1999), tab. 1, 23 rel.

Char. association: *Quercus congesta* (V), *Cnidium silaifolium* (III).

Char. alliance:, *Quercus dalechampii* (V), *Pinus nigra* subsp. *calabrica* (IV).

Char. order: *Conopodium capillifolium* (III), *Castanea sativa* (II), *Limodorum abortivum* (II).

Char. class: *Daphne laureola* (V), *Brachypodium sylvaticum* (V), *Crepis leontodontoides* (V), *Lathyrus pratensis* (V), *Festuca heterophylla* (IV), *Poa sylvicola* (IV), *Viola reichenbachiana* (III), *Lathyrus venetus* (III), *Milium vernale* subsp. *montianum* (III), *Luzula sicula* (III), *Galium rotundifolium* subsp. *hirsutum* (III), *Doronicum orientale* (III), *Epipactis micrphylla* (II), *Rubus glandulosus* (II), *Aremonia agrimonioides* (I).

Other species: *Trifolium semipurpureum* (V), *Dactylis glomerata* (V), *Pteridium aquilinum* (V), *Silene sicula* (V), *Anthoxanthum odoratum* (IV), *Bellis perennis* (IV), *Festuca circummediterranea* (IV), *Festuca rubra* (III), *Secale strictum* (III), *Carex distachya* (III).

Geographical distribution: The association is localized along the North-eastern slope of Mt. Etna.

Structure and ecology: This association represents a mesophilous plant community, dominated by *Quercus congesta*, a deciduous oak strictly linked to humid and cold environments limitedly to siliceous substrata. Actually, the most typical sites where this phytocoenosis has its optimum are represented by North-East facing slopes, whose soils are well developed and with a good accumulation of organic matter. From the bioclimatic point of

view, it fall within the lower supramediterranean belt with humid ombrotype, distributing an altitudinal of 1000-1500 m. The thermophilous species are absolutely lacking in this woodland, differentiating therefore quite from the thermophilous oak woods characterized by *Q. congesta* occurring in at lower altitudes always of the Etna.

Syndynamism: The association at higher altitudes is in contact with the beech woods of the *Epipactido meridionalis-Fagetum sylvaticae* or, in more xeric conditions, with the pine woods with *Pinus nigra* subsp. *calabrica*, whereas it is replaced at lower altitudes by the thermophilous deciduous woodlands of *Erico-Quercion ilicis*.

Habitat reference: G1.8 Acidophilous *Quercus* woodland.

46.2.1.6. ***Doronico orientalis-Castanetum sativae*** Brullo & Siracusa in Brullo et al. 2012

Acidophilous deciduous woodland, dominated by sweet chestnut and rich in Palermo couch-grass, localized on volcanic substrata within the supramediterranean belt with subhumid ombrotype.

Holotypus: rel. 3, tab. 3, Brullo et al (2012).

Characteristic and differential species: *Castanea sativa* Mill., *Doronicum orientale* Hofmm., *Lathyrus grandiflorus* Sibth. & Sm..

Phytosociological table: From Brullo et al. (2012), tab. 3, 7 rel..

Char. association: *Castanea sativa* (V), *Doronicum orientale* (V), *Lathyrus grandiflorus* (III).

Char. alliance: *Quercus dalechampii* (V), *Quercus congesta* (IV), *Pinus nigra* subsp. *calabrica* (I).

Char. order: *Agropyron panormitanum* (V), *Limodorum abortivum* (III), *Populus tremula* (III).

Char. class: *Brachypodium sylvaticum* (V), *Lathyrus pratensis* (V), *Luzula forsteri* (V), *Festuca heterophylla* (V), *Epipactys microphylla* (IV), *Rosa canina* (IV), *Daphne laureola* (IV), *Crepis leontodontoides* (IV), *Clinopodium vulgare* subsp. *orientale* (III), *Luzula sicula* (III), *Lamium flexuosum* (II), *Galium rotundifolium* subsp. *hirsutum* (II), *Viola reichenbachiana* (I), *Hedera helix* (I).

Other species: *Trifolium semipurpureum* (V), *Pteridium aquilinum* (V), *Bellis perennis* (V), *Tapsia garganica* (V), *Leopoldia comosa* (V), *Rubus ulmifolius* (IV), *Cytisus villosus* (IV), *Quercus ilex* (III), *Rubia peregrina* (III), *Daucus carota* (III), *Ruscus aculeatus* (II).

Geographical distribution: The association occurs on Mt. Etna.

Structure and ecology: This chestnut wood is widespread above 1000 m a.s.l., especially on the southern and eastern slopes of Mt. Etna, within the supramediterranean belt with subhumid ombrotype. As in many other Mediterranean territories, the chestnut has been widely cultivated and managed, but most of the etnean chestnut woods appear floristically and ecologically quite natural. Furthermore, the occurrence of several old individuals of *Castanea sativa* would confirm the native state of this species on Mt. Etna. This association

usually growing on deeper soils, with a canopy dominated by *Castanea sativa* and an underwood characterized by many nemoral species, such as *Doronicum orientale*, *Lathyrus pratensis*, *Daphne laureola*, *Lamium flexuosum*, *Viola reichenbachiana*, etc.

Syndynamism: This association comes in contact at lower altitudes with the thermophilous woods of the *Erico-Quercion ilicis*, while at higher altitudes it is replaced by more mesophilous woodlands, as those ones dominated by *Quercus cerris* or *Q. congesta*.

Habitat reference: G1.Aa *Carpinus* and *Quercus* mesic deciduous woodland**.**

46.2.1.7. ***Agropyro panormitani-Populetum tremulae*** Brullo & Siracusa in Brullo et al. 2012

Acidophilous deciduous woodland, dominated by common aspen and rich in Palermo couch-grass, localized on volcanic substrata within the supramediterranean belt with subhumid-humid ombrotype.

Holotypus: rel. 10, tab. 3, Brullo et al. (2012).

Characteristic and differential species: *Agropyron panormitanum* Parl., *Populus tremula* L.

Phytosociological table: From Brullo et al. (2012), tab. 3, 8 rel..
Char. association: *Populus tremula* (V).
Char. alliance: *Pinus nigra* subsp*. calabrica* (IV), *Quercus congesta* (IV)*, Quercus dalechampii* (IV), *Betula aetnensis* (II)*.*
Char. order: *Agropyron panormitanum* (V), *Quercus cerris* (II), *Castanea sativa* (II), *Vicia cassubica* (II).
Char. class: *Lathyrus pratensis* (V), *Brachypodium sylvaticum* (V)*, Galium rotundifolium* subsp. *hirsutum* (V), *Poa sylvicola* (V)*, Festuca heterophylla* (IV)*, Daphne laureola* (IV), *Crepis leontodontoides* (IV), *Luzula forsteri* (IV)*, Rosa canina* (III)*, Drymochloa drymeja subsp. exaltata* (II), *Fagus sylvatica* (II), *Lathyrus venetus* (II)*, Rubus glandulosus* (II), *Doronicum orientale* (I).
Other species: *Pteridium aquilinum* (V), *Dactylis glomerata* (IV), *Silene sicula* (IV), *Rubus ulmifolius* (III), *Quercus ilex* (I).

Geographical distribution: This association occur on Mt. Etna.

Structure and ecology: This peculiar woodland dominated by *Populus tremula* is rather common above 900 m of altitudes, where it is chiefly localized on small and narrow valleys characterized by a fairly good water availability. This tree is an euro-asiatic species, in Sicily occurring only on Mt. Etna, where it shows its optimum between 1200 m and 1600 of altitude, within the supramediterranean belt is an euro-asiatic species, but in Sicily it occurs only on mt. Etna, where it has its core area between 1200 m and 1600 a.s.l., within the supramediterranean belt, with subhumid-humid ombrotype. The occurrence of a rich pool of mesophilous taxa allows to ascribe this association to the *Pino calabricae-Quercion congestae*.

Syndynamism: This association is localized within the climatophilous belt dominated by mesophilous deciduous oak woods belonging to the *Agropyro panormitani-Quercetum congestae*, but at higher altitudes it comes in contact with the beech woods of the *Epipactido meridionalis-Fagetum sylvaticae*.

Habitat reference: G1.9b Mediterranean mountain *Betula* and *Populus tremula* woodland on mineral soils.

46.2.1.8. ***Daphno laureolae-Pinetum calabricae*** Brullo & Siracusa in Brullo et al. 2012

Orophilous pine forest, dominated by Calabrian black pine and rich in spurge-laurel, localized on volcanic substrata within the supramediterranean belt with humid ombrotype.

Holotypus: Rel. 5, tab. 4, Brullo et al. (2012).

Characteristic and differential species: *Pinus nigra* J.F.Arnold subsp. *calabrica* (Loud.) A.E. Murray, *Daphne laureola* L.

Phytosociological table: From Brullo et al. (2012), tab. 4, 7 rel..
Char. association: *Pinus nigra* subsp*. calabrica* (V), *Daphne laureola* (V).
Char. alliance: *Quercus dalechampii* (IV)*, Quercus congesta* (II)*, Rubus aetnicus* (II).
Char. order: *Agropyron panormitanum* (V), *Castanea sativa* (V), *Quercus cerris* (I).
Char. class: *Festuca heterophylla* (V)*, Lathyrus pratensis* (V)*, Brachypodium sylvaticum* (V)*, Galium rotundifolium* subsp. *rotundifolium* (V), *Crepis leontodontoides* (V), *Luzula sicula* (V), *Rubus glandulosus* (V), *Viola reichenbachiana* (III)*, Lathyrus venetus* (II)*, Poa sylvicola* (II)*.*
Other species: *Hypochoeris laevigata* (V), *Pteridium aquilinum* (V), *Trifolium semipurpureum* (IV), *Anthoxanthum odoratum* (III), *Silene sicula* (III).

Geographical distribution: This association is circumcribed to Mt. Etna.

Structure and ecology: It is a very peculiar orophilous pine wood localized along the North-eastern slopes of Mt. Etna. The canopy of this forest is dominated by *Pinus nigra* subsp. *calabrica*, conifer endemic to Calabria and Sicily, which reaches high cover values. This association shows some relation with another Etnean pine wood, such as *Junipero hemisphaericae-Pinetum calabricae*, from which it is well differentiated mainly for the lack of *Juniperus hemisphaerica* and *Berberis aetnensis*, shrubs of the class *Pino-Juniperetea*, as well as for its ecology. In fact, the *Daphno laureolae-Pinetum calabricae* is localizzed on rather flattened stands, usually with deep soils, rich in humus and fine particles, edaphic conditions that allow the settlement in the underwood of mesophilous nemoral species, such as *Daphne laureola*, *Poa sylvicola*, *Galium rotundifolium* subsp. *rotundifolium*, *Luzula sicula*, etc. Conversely, the *Junipero hemisphaericae-Pinetum calabricae* is linked to rocky and more or less steep surfaces with superficial and immature soils. In particolar, the association at issue grows at 1400-1600 m of altitude, within the supramediterranean belt with humid ombrotype. It can be considered as a geographic vicariant of the *Hypochaerido laevigatae-Pinetum calabricae* Bonin ex Brullo, Scelsi &. Spampinato 2001, occurring in Calabria.

Syndynamism: This association has its optimum within the belt of the deciduous oak woods regarding the *Agropyro panormitani Quercetum congestae*, while on rocky substrates it is replaced by the edapho-xerophilous vegetation of the *Junipero hemisphaericae-Pinetum calabricae*.

Habitat reference: G3.4c Mediterranean montane *Pinus sylvestris-Pinus nigra* woodland.

46.2.1.9. ***Cephalanthero longifoliae-Betuletum aetnensis*** Brullo & Siracusa in Brullo et al. 2012

Orophilous woodland, dominated by Etna birch and rich in narrow-leaved helleborine, localized on volcanic substrata within the upper supramediterranean belt with humid-hyperhumid ombrotype, with penetrations towards the oromediterranean one.

Holotypus: rel. 13, tab. 4, Brullo et al. (2012).

Characteristic and differential species: *Betula aetnensis* Raf., *Adenocarpus bivonae* (C.Presl) C.Presl, *Cephalanthera longifolia* (L.) Fritsch..

Phytosociological table: From Brullo et al. (2012), tab. 4, 10 rel.

Char. association: *Betula aetnensis* (V), *Adenocarpus bivonae* (V), *Cephalanthera longifolia* (V).

Char. alliance: *Pinus nigra* subsp. *calabrica* (V), *Quercus congesta* (III), *Quercus dalechampii* (II).

Char. order: *Agropyron panormitanum* (II), *Quercus cerris* (II), *Vicia cassubica* (I).

Char. class: *Crepis leontodontoides* (V), *Lathyrus pratensis* (II), *Brachypodium sylvaticum* (I).

Other species: *Festuca circummediterranea* (V), *Silene sicula* (V), *Pteridium aquilinum* (V), *Achillea ligustica* (V), *Genista aetnensis* (V), *Astragalus siculus* (IV), *Tanacetum siculum* (IV), *Carlina nebrodensis* (IV), *Secale strictum* (III), *Erysimum aetnense* (III), *Centaurea giardinae* (III), *Linaria purpurea* (III), *Festuca rubra* (III), *Trifolium semipurpureum* (III).

Geographical distribution: The association is exclusive of Mt. Etna.

Structure and ecology: This orophilous association characterizes the Etna volcanic landscape at 1400-2000 m of altitude. Physiognomically, it is dominated by *Betula aetnensis*, an Etnean endemic, constituting an open and extremely interesting woodland, growing on volcanic scoriae, where the soil evolution is definitely hampered by the severe climatic conditions and by the frequent volcanic events, such as ash rains and lava flows. It is a vegetation with marked pioneer characters and floristically quite poor, having its optimum within the upper supramediterranean belt with humid-hyperhumid ombrotype, with penetrations towards the oromediterranean one, limitedly to stands subject to long periods of snowmaking bioclimatic belt.

Syndynamism: This association represents an edaphoxerophilous stage, occurring within the area potentially occupied by Epipactido meridionalis-Fagetum sylvaticae. Above 1800 m a.s.l.,

this vegetation is in contact and interspersed with the Astragaletum siculi, thus forming a patchy vegetation pattern.

Habitat reference: G1.9b Mediterranean mountain *Betula* and *Populus tremula* woodland on mineral soils.

47. Class: ***Quercetea ilicis*** Br.-Bl. *ex* A. & O. Bolòs 1950

Thermophilous forest, woodlands and shrubby vegetation characterized by phaenerophytes, especially sclerophyll or deciduous trees, having its optimum in the Mediterranean and South-West Euro-Atlantic region.

Synonyms: *Quercetea ilicis* Br.-Bl. in Br.-Bl. et al. 1947 (art, 2b) ; *Quercetea ilicis* Br.-Bl. ex Br.-Bl. et al. 1952 (art. 31); *Quercetea calliprini* Zohary 1955; *Aceretea orientalis* Zohary et Orshan 1966 (art. 2b); *Euphorbietea dendroidis* Zohary & Orshan 1966 (art. 2b); *Pino halepensis-Quercetea ilicis* de Foucault & Julve 1991 (art.5, 8); *Pistacio lentisci-Rhamnetea alaterni* Julve 1993.

Holotypus: *Quercetalia ilicis* Br.-Bl. ex Molinier1934

Characteristic and differential species: *Arisarum vulgare* O. Targ.Tozz., *Asparagus acutifolius* L., *Carex halleriana* Asso, *Daphne gnidium* L., *Dryopteris pallida* (Bory) Maire & Petim. subsp. *pallida. Erica arborea* L., *Laurus nobilis* L., *Lonicera implexa* Aiton, *Melica arrecta* O. Kuntze, *Osyris alba* L., *Phillyrea latifolia* L., *Phillyrea media* L., *Pistacia terebinthus* L., *Pulicaria odora* (L.) Rchb., *Pyrus spinosa* Forssk., *Rhamnus alaternus* L., *Rubia peregrina* L. subsp. *peregrina, Rubia peregrina* L. subsp. *angustifolia* (L) Rouy, *Ruscus aculeatus* L., *Ruta chalepensis* L., *Smilax aspera* L., *Achnatherum bromoides* (L.) P. Beauv.

Geographical distribution: This class is widespred in the Mediterranean and southern EuroAtlantic territories (Rivas-Martınez et al., 2011).

Structure and ecology: The *Quercetea ilicis* class gathers the thermophilous to mesophilous and often orophilous woodlands linked to Mediterranean pluviseasonal oceanic bioclimate and occurring in thermo-Mediterranean to supra-Mediterranean belts. This syntaxon includes evergreen or semideciduous oak and relict laurel forests, pine-woods, maquis, scrublands, etc., usually constituting dense, intricate, multistratified arboreal or arborescent plant communities, rich in trees, lianas, shrubs hemicriptophytes and geophytes. The canopy is represented by few woody species, while in the underwood there are mostly nemoral or sciaphilous shrubs and herbs. In absence of anthropic pressure the tree vegetation, in relation to its ecological needs, it tends to cover large surfaces. In Sicily the *Quercetea ilicis* class is distributed from the sea level up to about 1500 m of elevation, with numerous associations

well differentiated from floristical and structural viewpoint. Although most of the island and neighboring islets are now devoid of the original forest cover, these plant communities are quite rich in endemic or rare species, which attest their ancient origin and marked geographical isolation (Brullo et al. 2008)

Syndynamism: The woody vegetation belonging to *Quercetea ilicis* is represented usually by climatophilous plant associations, that are considered the potential final stage of a natural succession not affected by human activities. Apart from the communities which have a really or virtually meso-climax function, there are also the permanent woodlands or maquis belongimg to edaphophilous series.

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral; F5.3 Submediterranean pseudomaquis; F5.5 Thermomediterranean scrub; G2.1 Mediterranean evergreen *Quercus* woodland; G2.2 Mainland laurophyllous woodland; G2.4 *Olea europaea-Ceratonia siliqua* woodland; G1.7b Mediterranean thermophilous deciduous woodland; G3.7 Mediterranean lowland to submontane *Pinus* woodland; G3.9b Mediterranean Cupressaceae woodland.

47.1. Order: ***Quercetalia ilicis*** Br.-Bl. *ex* Molinier 1934 em. Rivas-Martinez 1975

Evergreen and deciduous woodlands, mainly dominated by various termophilous or mesophilous oaks, distributed in the Mediterranean region, estending also in the South-West Euro-Atlantic territories within the thermomediterranean to supramediterranean belt.

Synonyms: *Quercetalia ilicis* Br.-Bl. 1931 (art. 2b) ; *Quercetalia ilicis* Horvatic 1934; *Quercetalia ilicis* Br.-Bl. ex Br.-Bl., Roussine & Negre 1952 (art. 31); *Quercetalia rotundifolio-ilicis* de Foucault & Julve 1991 (art. 5); *Quercetalia rotundifolio-ilicis* de Foucault & Julve in de Foucault et al. 2013 (art. 5).

Holotypus: *Quercion ilicis* Br.-Bl. ex Molinier 1935.

Characteristic and differential species: *Asperula laevigata* L.*,* *Aristolochia pallida* Willd., *A. rotunda* L.*, Carex distachya* Desf.*, Cyclamen hederifolium* Aiton*, Euphorbia characias* L.*, Fraxinus ornus* L.*, Laurus nobilis* L.*, Lonicera etrusca* Santi*, Loranthus europaeus* Jacq.*, Luzula forsteri* (Sm.) DC.*, Paeonia mascula* (L.) Mill.*, Pimpinella peregrina* L.*, Quercus ilex* L.*,* Ten., *Rosa sempervirens* L.*, Thalictrum calabricum* Spreng.*, Viburnum tinus* L.*, Paeonia mascula* (L.) Mill., *Paeonia russoi* Biv., *Viola alba* Besser subsp. *dehnhardtii* (Ten.) W. Becker, *Helleborus bocconei* Ten. subsp. *intermedius* (Guss.) Greuter & Burdet*, Huetia cynapioides* (Guss.) P.W. Ball *, Mespilus germanica* L.*, Physospermum verticillatum* (Waldst. & Kit.) Vis.

Geographical distribution: See class.

Structure and ecology: The order groups evergreen or semi-deciduous forests of the thermophile type, sometimes mixed, which are distributed in the more mesic territories sectors of the Mediterranean macrobioclimate and also in the sub-Mediterraneam variant of Temperate macroclimate, usually within the thermo to supramediterranean termotype with ombrotype subhumid to iperhumid.

Syndynamism: This syntaxon includes woody associations which are the final stages of climatophile series as well as of xero-edaphophilous series.

Habitat reference: G2.1 Mediterranean evergreen *Quercus* woodland; G2.2 Mainland laurophyllous woodland; G1.7b Mediterranean thermophilous deciduous woodland.

47.1.1. Alliance: ***Fraxino orni-Quercion ilicis*** Biondi, Casavecchia et Gigante in Biondi et al. 2013 em. Mucina et al. 2016

Evergreen and semideciduous basiphilous holm oak forests of the Central Mediterranean, distributed in thermo-supramediterranean mesic belt.

Synonyms: *Quercion ilicis* Br.-Bl. ex Horvatic 1934 (art. 31); *Quercion ilicis* auct. ital. non Br.-Bl. ex Molinier 1934; *Fraxino orni-Quercion ilicis* Biondi, Casavecchia & Gigante 2003*,* nom. inval. (art. 5).

Holotypus: *Cyclamino hederifolii-Quercetum ilicis* Biondi, Casavecchia & Gigante in Biondi et al. 2013.

Characteristic and differential species: *Cyclamen hederifolium* Aiton*, C. repandum* Sibth. & Sm.*, Emerus majus* Mill. subsp. *emeroides* (Boiss. & Spruner) Soldano & F. Conti*., Ostrya carpinifolia* Scop*., Dioscorea communis* L*., Quercus virgiliana* (Ten,) Ten., *Q. amplifolia* Guss*., Calicotome infesta* (C.Presl) Guss*., Phillyrea latifolia* L*., Fraxinus ornus* L.

Geographical distribution: The plant communities of this alliance occur in the European Central Mediterranean territories (Italian Penisula, Sicily, Sardinia, Corsica, Dalmatia). This alliance can be considered in this countries as a vicariant of *Quercion ilicis* Br.-Bl. ex Molinier 1934 em. Brullo et al.1977, distributed in the North-West Mediterranean.

Structure and ecology: Thermo-supramediterranean mesic evergreen holm oak forests on calcareous substrates, characterized in the mature stage by a quite clair stratification with arboreal, shrubby, lianose and erbaceous layer. This woody vegetation often affected by relevant disturbance fenomena which lead to its structural and floristic degradation towards scrublands or even tree pasture. The floristic composition is generally paucispecific, even in the arboreal layer, but rather variable given the remarkablen ecological breadth of the alliance. These forest communities fit well to conditions of marked summer aridity, which

favors the occurrence of thermo-xerophilous sclerophylls, and also to the winter cold, which makes the deciduous species more competitive. Usually, they are widwspread from sea level to 1500 m. of elevation.

Syndynamism: The association of this alliance represent the most mature final stages of basophilous dynamic series occurring in the central Mediterranean, whose most typical degradation aspects correspond to shrublands, garrigues, grasslands

Habitat reference: G2.1 Mediterranean evergreen *Quercus* woodland; G2.2 Mainland laurophyllous woodland; G1.7b Mediterranean thermophilous deciduous woodland.

47.1.1.1. ***Pistacio lentisci-Quercetum ilicis*** Brullo & Marcenò 1985

Thermo-xerophilous holm oak woodlands rich in mastic tree, linked to carbonatic substrates of the thermo-mediterranean belt.

Holotypus: Rel. 3, Tab. 2, Brullo & Marcenò (1985).

Characteristic and differential species: *Pistacia lentiscus* L.

Phytosociological table: From Brullo & Marcenò (1985), tab. 2, 6 rel.

Char. association: *Pistacia lentiscus* (V).

Differential association: *Prasium majus* (V), *Euphorbia dendroides* (I), *Ceratonia siliqua* (I), *Phillyrea angustifolia* (I).

Char. alliance: *Phillyrea latifolia* (III), *Thamus communis* (II), *Fraxinus ornus* (II), *Calicotome infesta* (I), *Cyclamen repandum* (I) .

Char. order and class: *Quercus ilex* (V), *Ruscus aculeatus* (V), *Asparagus acutifolius* (V), *Arisarum vulgare* (V), *Lonicera implexa* (V), *Carex halleriana* (III), *Rubia peregrina* subsp. *angustifolia* (III), *Osyris alba* (III), *Daphne gnidium* (II), *Carex distachya* (II), *Rosa sempervirens* (I), *Smilax aspera* (I), *Euphorbia characias* (I).

Other species: *Crataegus monogyna* (III), *Cistus creticus* (III), *Geranium purpureum* (III), *Polypodium australe* (III), *Acanthus mollis* (II), *Rubus ulmifolium* (II), *Erica multiflora* (II).

Geographical distribution: This association is spread mainly in Sicily, where it is frequent in southern and north-western part of the island (Furnari 1965, Brullo & Ronsisvalle 1975, Brullo & Marcenò 1985, Bartolo et al. 1990, Costanzo et al. 1998, Fichera et al 1998, Turrisi et al. 2002, Brullo et al. 2009).

Structure and ecology: It is forestal vegetation with the canopy dominated by *Quercus ilex* and the underwood characterized by termophilous sclerophylls of the *Quercetalia calliprini*, as in particular *Pistacia lentiscus*, while the mesophilic nemoral species are quite rare (Brullo & Marcenò, 1985). This woodland is localized on compact carbonatic substrata (limestones, marls, calcarenites, dolomites, etc.) with very superficial and undevelopped soils. As concerns

the bioclimte, it is linked to the thermomediterranean belt between the upper dry to lower subhumid, at an altitude of 50-700 m a.s.l. Currently, this association is very rare, examples can be observed on the bottom of fresh and shady valleys or on the northern slopes of hills. According to Brullo et al. (2009), within it four subassociation can be distinguished, which are floristically well differentiated and also with peculiar ecological requirements, they are: *typicum*, *daphnetosum sericeae* Brullo, Gianguzzi & La Mantia 2009, *arbutetosum unedonis* Brullo, Gianguzzi & La Mantia 2009 and *quercetosum suberis* Miniss., Musumarra & Sciandr. 2006.

Syndynamism: The association in its most mature and structured stage assumes a climatophile role, limitedly to stands with carbonatic rocks and characterized by xero-thermic climatic condition. Often it represents an edaphoxerophilous vegetation, havin catenal contact with more xeric woody communities of *Quercetalia calliprini* or with mesophilous woodlands of *Quercetalia ilicis.*

Habitat reference: G2.1 Mediterranean evergreen *Quercus* woodland.

47.1.1.2. ***Rhamno alaterni-Quercetum ilicis*** Brullo & Marcenò 1985

Thermo-oceanic holm oak woodlands rich in Italian buckthorn, linked to carbonatic substrates of the thermo-mediterranean belt.

Holotypus: Rel. 6, Tab. 1, Brullo & Marcenò (1985).

Characteristic and differential species: *Rhamnus alaternus* L. and *Viburnum tinus* L.

Phytosociological table: From Brullo & Marcenò (1985), tab. 1, 10 rel.

Char. association: *Rhamnus halaternus* (V), *Viburnum tinus* (V).

Char. alliance: *Fraxinus ornus* (V), *Dioscorea communis* (IV), *Cyclamen repandum* (III), *Phillyrea latifolia* (I).

Char. order and class: *Quercus ilex* (V), , *Asparagus acutifolius* (V), *Rubia peregrina* subsp. *angustifolia* (V), *Arisarum vulgare* (V), *Smilax aspera* (V), *Rosa sempervirens* (III), *Euphorbia characias* (III), *Carex halleriana* (III), *Ruta chalepensis* (III), *Prasium majus* (III), *Anagyris foetda* (III), *Euphorbia dendroides* (III), *Ruscus aculeatus* (II), *Lonicera etrusca* (II), *Clematis cirrhosa* (II), *Ceratonia siliqua* (II), *Lonicera implexa* (II), *Laurus nobilis* (II), *Pistacia terebinthus* (I), *Carex distachya* (I), *Dryopteris pallida* (I), *Pistacia lentiscus* (I), *Olea europaea* var *oleaster* (I), *Daphne gnidium* (I), *Pimpinella peregrina* (I).

Other species: *Teucrium flavum* (V), *Allium subhirsutum* (V), *Acanthus mollis* (V), *Rubus ulmifolium* (IV), *Geranium purpureum* (IV), *Anemone hortensis* (IV), *Ampelodesmos mauritanicus* (III), *Rhus coriaria* (III), *Inula conyza* (III).

Geographical distribution: The association is recorded only from the northern slopes of the coastal mountains of North-western Sicily (Brullo & Marcenò 1985, Gianguzzi et al. 1996,

Brullo et al. 2009, Marcenò et al. 2011).

Structure and ecology: This holm oak forest, differentiated by the occurrence and sometimes abundance in the undergrowth of *Rhamnus halaternus*, *Viburnum tinus*, *Fraxinus ornus* and *Laurus nobilis*, is linked to habitat with a certain edaphic freshness, within the lower Thermo-Mediterranean subhumid belt. It is grows mainly along the abrupt acclive northern slopes of coastal stands, where it colonizes the clastic deposits, localized at the base of cliffs and originated from erosive phenomena of limestone or dolomite (Brullo e Marcenò 1985, Gianguzzi et al. 1996). Apart from th subass. *typicum*, within this association have been described a subass. *pistacietosum lentisci* Brullo, Gianguzzi & La Mantia 2009 and a subass. *pistacietosum terebinthi* Gianguzzi, Ilardi & Raimondo 1996. The first can be considered as the most thermophilous aspect of the association and represent the term of passage towards the *Pistacio-Quercetum ilicis,* differentiated by the constant occurrence and abundance of thermoxerophilous species of *Quercetalia calliprini* and to be localized in fairly sunny places (Brullo et. al. 2009). The second sub-association differs from the typical aspect in its greater mesophily, which is attested by the high frequency of thermophilous deciduous trees, such as *Pistacia terebinthus*, *Celtis australis* and *Rhus coriaria* (Gianguzzi et. al. 1996).

Syndynamism: It represents the most mature stage of a climatophilous series linked to coastal slopes, in contact in semi-rupestrian stands with the *Euphorbietum dendroidis* and towards the coast with the maquis of *Chamaeropo humilis-Pistacetum lentisci* (Bartolo et al., 1990). The main degradation aspect of the subass. *typicum* of this association is the grassland of *Helictotricho-Ampelodesmetum mauritanici*. As regards the subass. *pistacietosum lentisci,* the degradation processes lead to its replacement with grasslands of the *Bothrioclhoo panormitanae-Hyparrhenietum hirtae,* while the subass*. pistacietosum terebinthi* differs from that typical one for its catenal contact, being interposed between the rupestrian communities of the *Dianthion rupicolae* and the maquis of the *Chamaeropo humilis-Quercetum calliprini* (La Mantia, 2003)

Habitat reference: G2.1 Mediterranean evergreen *Quercus* woodland.

47.1.1.3. ***Doronico orientalis-Quercetum ilicis*** Barbagallo, Brullo & Fagotto 1979

Mesophilous holm oak woodlands rich in Leopard's Bane, linked to carbonatic substrates of the thermo-mediterranean belt.

Holotypus: Rel. 2, Tab. 1, Barbagallo et al. (1979).

Characteristic and differential species: *Doronicum orientale* Hoffm., *Scutellaria rubicunda* Hornem., *Aristolochia clusii* Lojac.

Phytosociological table: From Barbagallo et al. (1979), tab. 1, 12 rel.

Char. association: *Doronicum orientale* (IV)*, Scutellaria rubicunda* (IV)*, Aristolochia clusii*

(III).

Char. alliance: *Quercus virgiliana* (V), *Dioscorea communis* (V), *Cyclamen repandum* (V), *Cyclamen hederifolium* (II), *Phillyrea latifolia* (I).

Char. order and class: *Quercus ilex* (V), *Asparagus acutifolius* (V), *Rubia peregrina* subsp. *angustifolia* (V), *Ruscus aculeatus* (V), *Carex distachya* (IV), *Smilax aspera* (IV), *Euphorbia characias* (IV), *Phillyrea angustifolia* (III), *Rosa sempervirens* (III), *Pistacia terebinthus* (III), *Asplenium onopteris* (III), *Dryopteris pallida* (III), *Pistacia lentiscus* (III), *Pimpinella peregrina* (III), *Rhamnus halaternus* (III), *Viola alba* subsp. *denhardhtii* (II), *Daphne gnidium* (II), *Arisarum vulgare* (II), *Lonicera etrusca* (I).

Other species: *Hedera helix* (IV), *Crataegus monogyna* (IV), *Allium subhirsutum* (III), *Acanthus mollis* (II), *Rubus ulmifolium* (II), *Teucrium flavum* (II).

Geographical distribution: The association is circumscribed to the eastern part of the Hyblaean territory (South Sicily), at an elevation of 300-700 m a.s.l. (Barbagallo et al. 1979, Brullo & Marcenò 1985, Costanzo et al.1998, Brullo et al. 1996, 2009).

Structure and ecology: Mesophilous forest dominated by *Quercus ilex*, with occurrence of deciduous trees, as *Quercus virgiliana*, as well as sciaphilous elements of *Querco-Fagetea sylvaticae*. This vegetation is localized on Miocene limestone of north facing slopes of valleys in territories affected by Mesomediterranean lower to upper sub-humid bioclimate, with annual precipitation of 700-1000 mm.

Syndynamism: The *Doronico orientalis-Quercetum ilicis* is an azonal vegetation of edaphoclimatophilous kind, exclusive of Hyblaean valleys. It constitutes the final stage of a special calcicolous series including very peculiar associations, rich in East Mediterranean elements, such as *Salvio fruticosae-Phlomidetum fruticosae* and *Chamaeropo humilis-Sarcopoterietum spinosi*. On the sunniest or most exposed places, this holm oak woodland is replaced by more thermophilous woody communities dominated by deciduous oak trees, like *Oleo-Quercetum virgilianae*, or evergreen oak trees, like *Pistacio lentisci-Quercetum ilics* (Bartolo et al., 1990, Brullo et al. 2009).

Habitat reference: G2.1 Mediterranean evergreen *Quercus* woodland.

47.1.1.4. ***Aceri campestri-Quercetum ilicis*** Brullo 1984

Mountain holm oak woodlands rich in hedge maple, linked to carbonatic substrates of the supra-mediterranean belt.

Synonyms: *Sorbo torminalis-Quercetum ilicis* Gianguzzi, Cuttonaro, Cusimano & Romano 2016, nom. illeg.

Holotypus: Ril. 2, Tab. 23, Brullo (1984).

Characteristic and differential species: *Acer campestre* L., *A. monspessulanum* L., *Ilex aquifolium* L., *Sorbus graeca* (Spach) Kotschy, *Ulmus glabra* Uds.

Phytosociological table: From Brullo (1984), tab. 23, 6 rel; Raimondo (1977), tab. 1, rel .3-4.

Char. association: *Acer campestre* (V), *A. monspessulanum* (V), *Ilex aquifolium*(V), *Sorbus graeca* (III), *Ulmus glabra* (II).

Char. alliance: *Dioscorea communis* (V), *Cyclamen repandum* (IV), *Fraxinus ornus* (II), *Cyclamen hederifolium* (I).

Char. order and class: *Quercus ilex* (V), *Thalictrum calabricum* (V), *Rubia peregrina* subsp. *angustifolia* (IV), *Ruscus aculeatus* (IV), *Carex distachya* (IV), *Euphorbia characias* (IV), *Viola alba* subsp. *denhardhtii* (IV), *Asplenium onopteris* (III), *Arbutus unedo* (III), *Lonicera etrusca* (III), *Paeonia mascula* (II), *Asperula laevigata* (II), *Emerus majus* subsp. *emeroides* (I), *Pyrus spinosa* (I).

Other species: *Brachypodium sylvaticum* (V), *Clematis vitalba* (V), *Prunus spinosa* (V), *Rosa canina* (V), *Daphne laureola* (V), *Hedera helix* (V), *Crataegus monogyna* (V), *Lamium flexuosum* (V), *Rubus canescens* (V), *Malus sylvestris* (V), *Chaerophyllum temulum* (IV), *Geum urbanum* (III), *Allium subhirsutum* (II).

Geographical distribution: The association is reported from North-western Sicily, and in particular from the Madonie (Brullo 1984, Brullo e Marcenò 1985, Marcenò & Ottonello 1991, Raimondo et al. 1994, Gianguzzi et al.1995, 2000, 2001, Guzzardo, 2002).

Structure and ecology: This is an orophilous holm oak forest distributed an elevation of 1000-1500 m a.s.l., rich in deciduous mesophilous trees, such as *Acer campestre*, *A. monspessulanum*, *Ulmus glabra*, etc. Besides, *Ilex aquifolium* is also quite frequent, highlighting a certain oceanic character of this association. It is widespread on calcareous and dolomitic slopes of mountain stands, colonizing mainly the stabilized clastic deposits, and is linked to meso-supramediterranean bioclimate, with upper subhumid to upper humid ombrotypes. Apart from the subass*. typicum* was described a subass. *helleboretosum intermedii* by Marcenò & Ottonello (1991), which manifests a greater thermophily as confirmed by a richer contingent of *Quercetea ilicis* species. It is localized at an altitudes of 800-1100 m a.s.l., always on dolomitic substrates and within of the lower humid Mesomediterranean belt. In particular, it should be highlighted that the association described by Gianguzzi et al. (2016) as *Sorbo torminalis-Quercetum ilicis*, for its floristic peculiarities and ecological requirements is quite similar to *Aceri campestri-Quercetum ilicis*, as already noted by the aforementioned authors. Therefore it seems appropriate to consider this syntaxon a simple nomenclatural synonym of the association in question.

Syndynamism: Usually**,** the association is localized in a belt in contact downwards with the *Oleo-Quercetum virgilianae*. while upwards it is replaced by the beech-tree of *Luzulo siculae-Fagetum sylavticae*. In consequence of degradation processes the surfaces left free by this

holm oak are occupied by the orophilous pulvinate communities of the *Cerastio-Astragalion nebrodensis* (Brullo, 1984; Bartolo et al., 1990).

Habitat reference: G2.1 Mediterranean evergreen *Quercus* woodland.

47.1.1.5. ***Ostryo carpinifoliae-Quercetum ilicis*** Lapraz 1975

Mixed mesophile forest with holm oak and hop hornbeam, linked to carbonatic substrates of the mesomediterranean belt.

Synonyms: *Roso sempervirentis-Quercetum ilicis* Biondi, Casavecchia e Gigante 2003,

Lectotypus: Ril. 15,Tab. (s.n.), Lapraz (1975 b), hoc loco.

Characteristic and differential species: *Ostrya carpinifolia* Scop.

Phytosociological table: From Bartolo et al. (1990), tab. 2, 5 rel.

Char. association: *Ostrya carpinifolia* (V).

Char. alliance: *Fraxinus ornus* (V), *Dioscorea communis* (II), *Phillyrea latifolia* (II),

Char. order and class: *Quercus ilex* (V), *Rhamnus alaternus* (V), *Asparagus acutifolius* (V), *Smilax aspera* (V), *Emerus majus* subsp. *emeroides* (IV), *Dryopteris pallida* (IV), *Rubia peregrina* subsp. *angustifolia* (V), *Ruscus aculeatus* (V), *Aristolochia clusii* (IV), *Rosa sempervirens* (III), *Asplenium onopteris* (III), *Pistacia lentiscus* (III), *Pistacia terebinthus* (II), *Osyris alba* (II), *Euphorbia characias* (II), *Arisarum vulgare* (I), *Clematis cirrhosa* (I), *Viola alba* subsp. *denhardhtii* (I), *Carex distachya* (I).

Other species: *Brachypodium sylvaticum* (IV), *Hedera helix* (IV), *Teucrium flavum* (III), *Acanthus mollis* (II).

Geographical distribution: The association is recorded from various localities of Italian Peninsula and Sicily, as well as in the Maritime Alps (France), where it was mentioned as *Ostryo carpinifoliae-Quercetum ilicis* (Horvatic 1958) Trinajstic 1977 (= *Orneto-Quercetum ilicis* Horvatić 1958 *ostryetosum* Horvatić 1958), *Ostryo carpinifoliae-Quercetum ilicis* Lapraz 1975 or *Roso sempervirentis-Quercetum ilicis* Biondi et al. 2003. According to Brullo et al. (2009), the *Ostryo carpinifoliae-Quercetum ilicis* Lapraz 1975 occurring in Italy is replaces in Croatia by the *Seslerio autumnalis-Quercetum ilicis* (Trinajstic 1977) Brullo, Gianguzzi, La Mantia e Siracusa 2009 (=*Ostryo carpinifoliae-Quercetum ilicis* (Horvatic 1958) Trinajstic 1977, nom. illeg.). In Sicily it occurs in the Hyblaean Mounts, Nebrodes Chain, Sicanian Mountains and Rifesi Woodland near Agrigento (Brullo et al. 1998, Bartolo et al.1990, Gianguzzi, 1999b, Gianguzzi et al. 2001, Venturella et al., 1991, Brullo et al. 2009).

Structure and ecology: Mesophilous woodland with the canopy dominated by *Quercus ilex* and *Ostrya carpinifolia*, linked to calcareous substrates. It is exclusive of stands with northen exposure, linked to quite shaded and fresh environmental conditions, characterized also by a

certain edaphic humidity. This association grows within the Mesomediterranean belt with subhumid to lower humid ombrotype.

Syndynamism: The association is the most structured stage of an edafo-climatophilous series, usually in catenal contact with various other forestal series always belonging to the *Quercetea ilicis* or sometimes of the *Querco-Fagetea sylvaticae*. Contact with hydro-hydrophitic or rupicolous microgeoseries has been also observed (Bartolo et al., 1990).

Habitat reference: G2.1 Mediterranean evergreen *Quercus* woodland.

47.1.1.6. ***Bupleuro fruticosi-Quercetum ilicis*** Sciandrello, D'Agostino & Minissale 2013

Rupestrian holm oak woodlands rich in shrubby hare's-ear, linked to calcareous rocky places of the subhumid mesomediterranean belt.

Holotypus: Rel. 4, tab. 1, Sciandrello et al. (2013)

Characteristic and differential species: *Bupleurum fruticosum* L.

Phytosociological table: From Sciandrello et al. (2013), tab. 1, 8 rel.

Char. association: *Bupleurum fruticosum* (V).

Char. alliance: *Calicotome infesta* (V), *Quercus virgiliana* (II), *Fraxinus ornus* (II), *Dioscorea communis* (II), *Cyclamen repandum* (I).

Char. order and class: *Asparagus acutifolius* (V), *Quercus ilex* (V), *Rhamnus alaternus* (V), *Pistacia terebinthus* (V), *Ruta chalepensis* (IV), *Emerus majus* subsp. *emeroides* (IV), *Euphorbia dendroides* (IV), *Olea europaea* subsp. *oleaster* (IV), *Ruscus aculeatus* (II), *Pistacia lentiscus* (II), *Rubia peregrina* subsp. *angustifolia* (II), *Smilax aspera* (II), *Teucrium fruticans* (II), *Arisarum vulgare* (I), *Prasium majus* (I)..

Other species: *Phlomis fruticosa* (V), *Dactylis hispanica* (V), *Ampelodesmos mauritanicus* (V), *Teucrium flavum* (IV), *Phagnalon saxatile* (IV), *Silene fruticosa* (IV), *Dianthus rupicola* (III), *Carlina hispanica* susp. *globosa* (II).

Geographical distribution: This association is recorded from Peloritani range, near Taormina, where it is quite discontinuous and localized on limited rupestrian stands.

Structure and ecology: It is a peculiar rupestrian holm oak woodland exclusive of limestone cliffs mostly with north-eastern exposure and sometymes also on the clastic deposits located at the base of the cliffs. This vegetation is caracterized by several trees showing a prevalently shrubby habit, such as *Quercus ilex, Fraxinus ornus, Rhamnus alaternus, Pistacia terebinthus,* etc. which are often mixed to chasmophytes. Quite significant it is the occurrence and abundance of *Bupleurum fruticosum*, shrub West Mediterranean with mesophilous requirement, which highlights the peculiarities of this vegetation linked to well exposed and

ventilated rocky outcrops at an elevation of 300-800 m a.s.l.. Fom the bioclimatic viewpoint, it is developped within the mesomediterranean belt, with upper subhumid ombrotype.

Syndynamism: This vegetation represents the most mature stage of a xeroedaphilous series linked to rocky outcrops, usually in contact with the rupestrian communities of the *Euphorbietum dendroidis* and the chasmophilous vegetation of the *Dianthion rupicolae.* The association is strongly affected by the humid winds coming from the Ionian Sea, which compensate for the remarkable edaphic dryness of the habitat in which it grows. For its ecological peculiarities, it is well guarded by the anthropic pressure, but any degradation processes effected its replacement with shrublands of *Oleo-Ceratonion* or grasslands of *Lygeo-Stipetea*.

Habitat reference: G2.1 Mediterranean evergreen *Quercus* woodland.

47.1.1.7. ***Ampelodesmo mauritanici-Quercetum ilicis*** Gianguzzi, Cuttonaro, Cusimano & Romano 2016

Mesophilous holm oak woodlands rich in deciduous tree as italian pubescent holm oak and manna ash, linked to clastic calcareous substrata of the upper subhumid mesomediterranean belt.

Holotypus: Rel, 4, tab. 9, Gianguzzi et al (2016).

Characteristic and differential species: *Quercus ilex* L., *Ampelodesmos mauritanicus* (Poir.) Dur. & Schinz, *Emerus majus* Mill. subsp. *emeroides* (Boiss. & Spruner) Soldano & F. Conti., *Viburnum tinus* L., *Arbutus unedo* L.

Phytosociological table: From Gianguzzi et al. (2016), tab. 9, 20 rel.

Char. Association: *Emerus major* subsp. *emeroides* (V), *Arbutus unedo* (IV), *Viburnum tinus* (III).

Char. alliance: *Quercus virgiliana* (V), *Cyclamen hederifolium* (V), *Fraxinus ornus* (IV), *Dioscorea communis* (IV), *Drymochloa drymeja* subsp. *exaltata* (IV), *Cyclamen repandum* (III).

Char. order and class: *Quercus ilex* (V), *Rubia peregrina* subsp. *angustifolia* (V), *Smilax aspera* (V), *Asparagus acutifolius* (V), *Ruscus aculeatus* (IV), *Lonicera implexa* (III), *Rosa sempervirens* (III), *Paeonia russi* (III), *Pistacia terebinthus* (II), *Euphorbia characias* (II), *Chamaerops humilis* (II), *Pulicaria odora* (II), *Lonicera etrusca* (II), *Pistacia lentiscus* (II), *Osyris alba* (II), *Arisarum vulgare* (I), *Daphne gnidium* (I), *Carex distachya* (I), *Viola alba* subsp. *denhardhtii* (I), *Myrtus communis* (I), *Prasium majus* (I).

Other species: *Ampelodesmos mauritanicus* (V), *Allim subhirsutum* (V), *Brachypodium sylvaticum* (IV), *Hedera helix* (IV), *Erica multiflora* (III), *Crataegus monogyna* (III), *Clematis vitalba* (III), *Rubus ulmifolius* (II), *Prunus spinosa* (II), *Teucrium flavum* (II), *Acanthus mollis* (II).

Geographical distribution: It is widely distributed in the Sicanian Mountains (North-western Sicily) and can be considered a geographic vicariant of *Rhamno alaterni-Quercetum ilicis*.

Structure and ecology: The dense tree layer of this woodland is dominated by *Quercus ilex*, which is usually associated with *Quercus virgiliana* and *Fraxinus ornus,* while the shrub layer consists of young trees and bushes, that constitute an intricate layer. This vegetation is widespread at an altitudes 350-1000 m a.s.l., localizing along the shady and humid mountain slopes, mainly with north or northwest exposure, on soils rich in clastic material, originated by erosion and landslides coming from the overhanging rock faces. As concerns the bioclimate, it is developped within the upper mesomediterranean belt, with upper subhumid ombrotype. Gianguzzi et al. (2016), apart from a subass. *typicum,* descrive also a subass. *viburnetosum tini*, but on the basis of the data provided by them they do not appear ecologically well differentiated.

Syndynamism: It is sciaphilous-mesophilous woodland with canopy characterized by occurrence of evergreen and deciduoud trees, which is localized on clastic carbonatic lithosols. It constitutes the most structured stage of an edapho-climatophilous series showing upward catenal contact with the *Aceri campestris-Quercetum ilicis*, while on the stands with deeper and mature soils it is replaces by the *Sorbo torminalis-Quercetum virgilianae.* When the degradation processes lead to the destruction of the tree layer, intricate spiny-shrubby plant communities belonging to the *Pruno spinosi-Rubion ulmifolii* tend to cover these surfaces and later the grasslands of the *Helictotricho convoluti-Ampelodesmetum mauritanici*

Habitat reference: G2.1 Mediterranean evergreen *Quercus* woodland.

47.1.1.7. ***Oleo oleaster-Quercetum virgilianae*** Brullo 1984

Thermophilous deciduous woodland dominated by italian pubescent holm oak rich in schlerophylls, edaphycally not specialized and distributed within the dry thermo-mediterranean to meso-mediterranean belt.

Holotypus: Rel. 3, tab. 24, Brullo (1984).

Characteristic and differential species: *Quercus virgiliana* (Ten.)Ten.*, Olea europaea* L. subsp. *oleaster* Brot.*, Pistacia lentiscus* L.*, Teucrium fruticans* L.*, Prasium majus* L., *Asparagus albus* L..

Phytosociological table: From Brullo & Marcenò (1985), tab. 3, 18 rel.

Char. association: *Quercus virgiliana* (V), *Olea europaea* subsp. *oleaster* (V),

Differ. association: *Pistacia lentiscus* (V), *Teucrium fruticans* (IV), *Prasium majus* (III), *Asparagus albus* (II) .

Char. alliance: *Quercus amplifolia* (V), *Calicotome infesta* (IV), *Cyclamen repandum* (II) .

Char. order and class: *Asparagus acutifolius* (V), *Rubia peregrina* subsp. *angustifolia* (V), *Osyris alba* (V), *Rosa sempervirens* (IV), *Quercus ilex* (IV), *Smilax aspera* (IV), *Euphorbia characias* (IV), *Rhamnus alaternus* (III), *Pyrus spinosa* (III), *Lonicera implexa* (III), *Euphorbia dendroides* (III), *Pistacia terebinthus* (II), *Chamaerops humilis* (II), *Phyllirea angustifolia* (II), *Carex distachya* (II), *Ruscus aculeatus* (II), *Lonicera etrusca* (I), *Ruta chalepensis* (I).

Other species: *Rubus ulmifolium* (V), *Ampelodesmos mauritanicus* (IV), *Crataegus monogyna* (III), *Acanthus mollis* (II), *Prunus spinosa* (II), *Hedera helix* (II).

Geographical distribution: This association is currently recorded from Sicily and southern Italy, where it occurs from the coastal places to the submontane zones. In Sicily it is widespread everywhere on the whole territory on different substrates, but always sporadical and fragmentary way, due to the strong anthropic pressure that acts heavily within its distribution range (see Brullo 1984, Brullo e Marcenò 1985, Furnari e Scelsi 1993, Raimondo et al. 1994, Siracusa 1996, Brullo et al. 1998, Guarino 1998,Tomaselli 1999, Gianguzzi1999b, Gianguzzi et al. 2000, 2001, Brullo et al 2009, etc.).

Structure and ecology: Peculiar Mediterranean woodland dominated by deciduous termophilous oaks (*Quercus virgiliana* and *Q. amplifolia*), differentiated by the occurrence of several sclerophylls of *Quercetalia calliprini*, indicative of a marked environmental xericity. The association grows on more or less deep and evolved soils, developping on various kinds of substrates (limestone, dolomite, marl, clay, basalt, calcarenite, schist, etc.). This tree vegetation occupies potentially a wide altimetric belt, extended from the coast up to 800-1000 m of altitude. It currently shows a discontinuous distribution, constituting usually small relict flaps, limited mainly to impervious and isolated areas. This is due to the fact that the range of this association coincides potentially with low altitude stations, which represent the most suitable areas for agricultural activities. From the bioclimatic viewpoint, it grows within the thermomediterranean to mesomediterranean belt with upper dry to lower sub-humid ombrotype.

Syndynamism: The association is the most structured stage of a climatophilous series having catenal contacts with other series belonging to the *Oleo-Ceratonion* or the *Orno-Quercion ilicis* communities, as well as with hygro-hydrophitic or rupicolous microgeoseries. The degradation processes normally lead to the settlement of *Cisto-Micromerietea* garigues which afterwards are replaced by *Ampelodesmos mauritanicus* grasslands.

Habitat reference: G1.7b Mediterranean thermophilous deciduous woodland.

47.1.1.8. ***Celtido aetnensis-Quercetum virgilianae*** Brullo & Marcenò 1985

Mesophilous deciduous woodland dominated by italian pubescent holm oak and sicilian hackberries , linked to volcanic rocks and distributed within the upper suhumid meso-

mediterranean belt.

Holotypus: Rel. 2, tab. 4, Brullo & Marcenò (1985).

Characteristic and differential species: *Quercus virgiliana* (Ten.) Ten,, *Celtis aetnensis* (Tornab.) Strobl..

Phytosociological table: From Brullo & Marcenò (1985), tab. 4, 8 rel.

Char. association: *Quercus virgiliana* (V), *Celtis aetnensis* (V).

Char. alliance: *Quercus amplifolia* (V).

Char. order and class: *Asparagus acutifolius* (V), *Rubia peregrina* subsp. *angustifolia* (V), *Arisarum vulgare* (V), *Carex distachya* (V), *Lonicera etrusca* (V), *Pistacia terebinthus* (V), *Euphorbia characias* (V), *Rosa sempervirens* (IV), *Quercus ilex* (IV), *Rhamnus alaternus* (III), *Olea europaea* subsp. *oleaster* (III), *Lonicera implexa* (III), *Ruscus aculeatus* (III), *Paeonia mascula* (III), *Dryopteris pallida* (II), *Asplenium onopteris* (II).

Other species: *Hedera helix* (IV), *Rubus ulmifolium* (IV), *Crataegus monogyna* (IV), *Geranium purpurem* (III), *Celtis australis* (III), *Hypericum perforatum* (III), *Aristolochia rotunda* (III), *Silene sicula* (II).

Geographical distribution: The association is spread along the south-western slope of Etna, limitedly to sub mountain belt (Brullo and Marcenò, 1985)

Structure and ecology: This association for the dominance of *Quercus virgiliana*, shows a certain affinity with the *Oleo-Quercetum virgilianae*, from which it differs primarily in the floristic and ecological point of view. In fact, the thermophilous elements of the *Quercetalia calliprini* are almost completely absent, while it is frequent and often abundant *Celtis aetnensis*, Sicilian endemism related to *Celtis tournefortii*. Therefore, it can be considered a mesophilous vicariant of the previous being localized at higher altitudes (700-900 m) on volcanic substrates with rocky outcrops, within the Mesomediterranean belt with upper subhumid ombrotype..

Syndynamism: It is a climatophilous association in contact upward with the acidophilos series of *Erico arboreae-Quercion ilicis* and downward with the thermophilous series of *Oleo-Quercetum virgilianae*. The degradation processes determine the settlement of shrub communities of *Pruno spinosae-Rubion ulmifolii* and successively to open shrublands of *Linarion purpureae*.

Habitat reference: G1.7b Mediterranean thermophilous deciduous woodland.

47.1.1.9. ***Sorbo torminalis-Quercetum virgilianae*** Brullo, Miniss., Signorello & Spamp. 1996

Orophilous deciduous woodland dominated by italian pubescent holm oak and checkertree, linked to limestones and distributed within the upper suhumid meso-mediterranean to supramediterranean belt.

Holotypus: ril. 6 di Tab. 3, Brullo et al. (1996).

Characteristic and differential species: *Sorbus torminalis* (L.) Crantz*, Physospermum verticillatum* (Waldst. & Kit.) Vis., *Geocaryum cynapioides* (Guss.) Engstrand.

Phytosociological table: From Brullo et al. (1996), tab. 3, 10 rel.

Char. association: *Sorbus torminalis* (V)*, Physospermum verticillatum* (V), *Geocaryum cynapioides* (V).

Char. alliance: *Quercus virgiliana* (V), *Quercus amplifolia* (V), *Dioscorea communis* (IV), *Fraxinus ornus* (II), *Phillyrea latifolia* (II), *Cyclamen hederifolium* (II), *Drymochloa drymeja* subsp. *exaltata* (II).

Char. order and class: *Quercus ilex* (V), *Thalictrum calabricum* (V), *Lonicera etrusca* (V), *Paeonia mascula* (V), *Clinopodium vulgare* subsp. *arundanum* (IV), *Aristolochia clusii* (IV), *Rosa sempervirens* (IV), *Ruscus aculeatus* (IV), *Viola alba* subsp. *denhardhtii* (II), *Rubia peregrina* subsp. *angustifolia* (II), *Arisarum vulgare* (II), *Carex distachya* (II), *Asparagus acutifolius* (I).

Other species: *Brachypodium sylvaticum* (V), *Acer campestre* (V), *Silene sicula* (V), *Cnidium silaefolium* (V), *Rubus hirtus* (V), *Allium subhirsutum* (V), *Poa sylvicola* (V), *Clematis vitalba* (V), *Teucrium flavum* (IV), *Geranium lucidum* (IV), *Hedera helix* (III), *Prunus spinosa* (III), *Anthriscus nemorosa* (III).

Geographical distribution: The association is circumscribed to the calcareous complex of Sicanian Mountains in North-West Sicily, where it is recorded by several authors (Gianguzzi et al. 1995, 2001, Brullo et al. 1996, Guzzardo, 2002, Marino et al., 2005, Brullo et al. 2009).

Structure and ecology: Orophilous marked mesophilous forest, which differs from other associations dominated by *Quercus virgiliana* for the occurrence of *Sorbus torminalis* and a rich herbaceous contingent caracterized by some rare umbellifers, among which in particular *Physospermum verticillatum*, *Geocaryum cynapioides*, *Cnidium silaefolium*, etc. It is linked to deep calcareous soils locating mainly on the fresh and shady northern slopes at altitudes between 800-1400 m a.s.l. From the bioclimatic viewpoint, it is localized from the mesomediterranean to the supramediterranean belt with upper subhumid ombrotype.

Syndynamism: It represents a climatophilous association, mainly spread in mountain cacuminal areas, having downward catenal contact, with the termophilous series of the *Oleo-Quercetum virgilianae*. As a result of degradation processes it is usually replaced by a dwarf scrubby vegetation referable to the *Carduncello-Thymetum spinulosi* orophilous community among the most thermophilous of the *Cerastio-Astragalion nebrodensis*.

Habitat reference: G1.7b Mediterranean thermophilous deciduous woodland.

47.1.1.10. ***Lauro nobilis-Quercetum virgilianae*** Brullo, Costanzo & Tomaselli 2001

Mesophilous deciduous woodland dominated by italian pubescent holm oak and laurel tree, linked to vulcanites or sometimes growing also on marls and distributed within the mesomediterranean belt with lower subhumid to humid ombrotype.

Holotypus: Rel. 4, tab. 2, Brullo et al. (2001).

Characteristic and differential species: *Quercus virgiliana* (Ten.) Ten., *Laurus nobilis* L., *Doronicum orientale* Hoffm.

Phytosociological table: From Brullo et al. (2001), tab. 2, 13 rel.

Char. association: *Laurus nobilis* (V)*, Doronicum orientale.* (III).

Char. alliance: *Quercus virgiliana* (V), *Cyclamen hederifolium* (V), *Cyclamen repandum* (IV), *Quercus amplifolia* (IV), *Dioscorea communis* (II), *Fraxinus ornus* (II).

Char. order and class: *Dryopteris pallida* (V), *Ruscus aculeatus* (V), *Rubia peregrina* subsp. *angustifolia* (V), *Asparagus acutifolius* (IV), *Rosa sempervirens* (IV), *Clematis cirrhosa* (III), *Viola alba* subsp. *denhardhtii* (II), *Osyris alba* (II), *Carex distachya* (II), *Emerus majus* subsp. *emeroides* (II), *Quercus ilex* (I), *Arisarum vulgare* (I).

Other species: *Hedera helix* (V), *Lamium flexuosum* (V), *Rubus ulmifolius* (V), *Ulmus minor* (IV), *Arum italicum* (IV), *Brachypodium sylvaticum* (III), *Acanthus mollis* (III), *Crataegus monogyna* (III), *Clematis vitalba* (III), *Rosa canina* (III), *Geranium lucidum* (III), *Prunus spinosa* (II).

Geographical distribution: The association was descrive from Hyblaean Mountains near Buscemi and northern slope of Monte Lauro by Brullo et al. (2001). Besides, it can be attributed to this association also the rel. carried out by Marcenò and Traina (2001) along the Valle del fiume Oreto (Palermo).

Structure and ecology: It is a mesophilous woodland with the canopy dominated by deciduous tree of *Quercus virgiliana* and *Q. amplifolia*, growing together with *Laurus nobilis*. It occurs on Tertiary volcanic substrata or sometimes on marly rocks, usually on slopes affected by particularly humid and fresh environmental conditions, at an altitudes of 650-850 m a.s.l., within the Mesomediterranean belt with subumid to lower humid ombrtype. According to Brullo et al. (2001), two subassociations can be distinguished, indicated as subass. *lauretosum*, coincident with the type, and subass. *mespiletosum,* which represents the transition aspect towards the *Mespilo-Quercetum virgilianae* linked to more dry edaphic condition.

Syndynamism: The association constitutes an edaphoseries within the area potentially occupied by *Mespilo-Quercetum virgilianae*. In fact, it replaces this latter climatophilous woodland in the stands characterized by marked edaphic moisture, sometimes with a

rather superficial water tab..

Habitat reference: G2.2 Mainland laurophyllous woodland

47.1.1. Alliance: ***Erico arboreae-Quercion ilicis*** Brullo, Di Martino & Marcenò 1977

Evergreen and deciduous acidophilous oak forests of the Central and East Mediterranean, distributed in thermo-supramediterranean belt.

Holotypus: *Asplenio onopteris-Quercetum ilicis* (Br.-Bl. 1936) Rivas-Martinez 1975.

Characteristic and differential species: *Erica arborea* L.*, Arbutus unedo* L., *Pulicaria odora* (L.) Rchb., *Cytisus villosus* Pourret *, Teline monspessulana* (L.) Koch, *Melica arrecta* Kuntze*, Teucrium siculum* Guss.*, Poa sylvicola* Guss.*, Clinopodium vulgare* L. subsp. *arundanum* (Boiss.) Nyman

Geographical distribution: The alliance shows its maximum spread in the Tyrrhenian territories (Southern France, Italian Peninsula, Corsica, Sardinia, Sicily) also penetrating into the Balkan Peninsula and Egean area. (Brullo & Marcenò 1985, Brullo et al., 2004, 2009).

Structure and ecology: The alliance gathers acidophilous forests and woodlands dominated by evergreen (*Quercus ilex* and *Q. suber*) and deciduous (*Q. virgiliana, Q. dalechampii, Q. congesta, Q. leptobalanos, Q. gussonei*) oaks, spread from sea level up to about 1500 m a.s.l. Floristically, these tree communities are differentiated by the occurrence of a rich set of calcifugous species linked to siliceous or strongly leached soils. According to literature data (Brullo et al. 1977, Brullo 1984, Brullo & Marcenò 1985, Brullo et al. 2009, Mucina et al. 2016, etc.), the *Erico arborae-Quercion ilicis* can be considered as the acidophilous vicariant of the *Quercion ilicis* Br.-Bl. ex Molinier 1934, em.Brullo et al. 1977 and *Fraxino orni-Quercion ilicis* Biondi et al. 2013 em. Mucina et al. 2016, both including basifilous associations. The plant communities of this alliance are mainly spread in the mesomediterranean to supramediterranean belt with subhumid to humid ombrotype, penetrating marginally in the thermomediterranean one.

Syndynamism: The associations belonging to this alliance show a climatophilous or edaphophilous role limitedly to siliceous substrata or more rarely to strongly leached limestones. Their degradation leads to the settlement of shrublands of the *Ericion arboreae* or garrigues of the *Cisto-Ericion*, which often in extreme conditions are replaced by ephemeral meadows of *Tuberarietea guttatae*.

Habitat reference: G2.1 Mediterranean evergreen *Quercus* woodland; G1.7b Mediterranean thermophilous deciduous woodland.

47.1.1.1. Suballiance: ***Erico arboreae-Quercenion ilicis*** Brullo, Di Martino & Marcenò 1977

Evergreen and deciduous acidophilous oak forests of the Central and East Mediterranean, with more termophilous requirements, distributed in thermo-mesomediterranean belt.

Holotypus: *Asplenio onopteris-Quercetum ilicis* (Br.-Bl. 1936) Rivas-Martinez 1975.

Characteristic and differential species: See alliance.

Geographical distribution: See alleance.

Structure and ecology: This syntaxon groups acidophilous woodlands with thermophilous requirements, represented by holm oaks, deciduous oaks and cork oaks, occurring mainly in coastal and hill stands, on siliceous substrata (volcanites, sands, granites, scists, etc.), limitedly to thermo-mesomediterranean subumid belt. The floristic set of the associations is often rich in thermophilous elements of the *Quercetalia calliprini*.

Syndynamism: See alliance..

47.1.1.1.1. ***Erico arboreae-Quercetum ilicis*** Brullo, Di Martino & Marcenò 1977

Evergreen acidophilous holm oak woodland with termophilous requirements, distributed in thermo-mesomediterranean belt.

Synonyms: *Erico arborae-Quercetum ilicis* Barbero & Quezel 1980, nom. inval. (art. 5).

Holotypus: Ril.11, tab. 1, Brullo *et al.* (1977).

Characteristic and differential species: *Pistacia lentiscus* L., *Calicotome villosa* (Poir.) Link, *Phillyrea angustifolia* L.

Phytosociological table: From Brullo et al. (2009), tab. 7(1-4), 22 rel.

Diff. association: *Pistacia lentiscus* (V), *Calicotome villosa* (III), *Phillyrea angustifolia* (II).

Char. alliance: *Erica arborea* (V)*, Arbutus unedo* (V), *Cytisus villosus* (II)*, Teline monspessulana* (II), *Melica arrecta* (II)*.*

Char. order and class: *Quercus ilex* (V), *Daphne gnidium* (IV), *Asplenium onopteris* (IV), *Asparagus acutifolius* (IV), *Rubia peregrina* subsp. *angustifolia* (III), *Smilax aspera* (III), *Carex distachya* (II), *Dioscorea communis* (II), *Arisarum vulgare* (II), *Lonicera implexa* (II), *Rhamnus alaternus* (I), *Prasium majus* (I), *Fraxinus ornus* (I), *Euphorbia dendroides* (I), *Ruta chalepensis* (I), *Phillyrea latifolia* (I), *Myrtus communis* (I).

Other species: *Cistus eriocephalus* (II), *Geranium purpureum* (II), *Allium subhirsutum* (II), *Pteridium aquilinum* (II), *Cistus salvifolius* (II), *Rubus ulmifolium* (II).

Geographical distribution: The association is recorded in Sicily from Pantelleria island, Aeolian archipelago (Brullo and Furnari, 1994), as well as from the Hyblaean volcanites (Brullo et al. 1977, 2009, Brullo & Marcenò 1985, Brullo & Furnari 1994). It occurs also in other Mediterranean territories as South France, Italian Peninsula, Corsica, Sardinia and Balkan Peninsula (Barbero & Quezel 1980, Brullo et al . 2009).

Structure and ecology: Acidophilous evergreen woodland with thermophilous requirement, physiognomically dominated by *Quercus ilex*. It is linked to siliceous substrates (volcanites, granites, schists, gneiss, etc.), at an altitude of 10-1000 m a.s.l. It is differentiante floristically by the occurrence of *Erica arborea* and *Arbutus unedo*, as well as by some sclerophylls of *Quercetalia calliprini*. It is often localized in island areas characterized by a maritime climate with marked occult precipitations, mainly represented by dew or persistent fog, but also in coastal and continental stands, limited to the more fresh and humid slopes. Examples of this association are localized in the thermomediterranean to mesomediterranean belt, with lower dry to lower subhumid ombrotype. According to Brullo et al (1977), within this association can be distiguished three subassociation, such as subass. *quercetosum ilicis,* subass. *juniperetosum turbinatae* and subass. *pinetosum hamiltonii,* which are linked to different ecological conditions, especially of edaphic and altitudinal kind.

Syndynamism: The association is the most structured stage of a climatophilous series, with marked thermo acidophilous requirement and occurring on siliceous substrates with more or less rocky soils. The degradation of this woodland usually leads to shrubland belonging to *Ericion arboreae* or *Cisto-Ericion* garrigues.

Habitat reference: G2.1 Mediterranean evergreen *Quercus* woodland.

47.1.1.1.2. ***Stipo bromoidis-Quercetum suberis*** Barbagallo 1983

Evergreen psammophilous cork oaks woodland with sharp-awned feathergrass, distributed in dry thermomediterranean belt.

Holotypus: Ril. 1, tab.1, Barbagallo (1983).

Characteristic and differential species: *Quercus suber* L., *Achnatherum bromoides* (L.) P. Beauv.(= *Stipa bromoides* (L.) Dorfl.)

Phytosociological table: From Barbagallo (1983), tab. 1, 24 rel.

Char. association: *Achnatherum bromoides* (V)

Char. alliance: *Quercus suber* (V), *Pulicaria odora* (III), *Melica arrecta* (II)*, Cytisus villosus* (I)*, Teline monspessulana* (I), *Arbutus unedo* (I).

Char. order and class: *Daphne gnidium* (V), *Asparagus acutifolius* (V), *Rubia peregrina* subsp. *angustifolia* (V), *Carex distachya* (V), *Calycotome infesta* (IV), *Osyris alba* (IV), *Euphorbia characias* (IV), *Smilax aspera* (III), *Lonicera implexa* (III), *Phillyrea angustifolia* (III), *Rosa*

sempervirens (III), *Teucrium fruticans* (III), *Chamaerops humilis* (III), *Ruscus aculeatus* (III), *Pistacia lentiscus* (III), *Dioscorea communis* (II), *Olea europaea* subsp, *oleaster* (II), *Quercus amplifolia* (II), *Luzula forsteri* (II), *Quercus ilex* (II), *Cyclamen repandum* (II), *Ceratonia siliqua* (I), *Quercus calliprinos* (I), *Myrtus communis* (I).

Other species: *Cistus salvifolius* (V), *Ampelodesmos mauritanicus* (IV), *Anthoxanthum odoratum* (IV), *Dactylis hispanixa* (IV), *Cistus creticus* (IV), *Carex serrulata* (III), *Crataegus monogyna* (III), *Oryzopsis miliacea* (III), *Briza maxima* (III), *Asphodelus ramosus* (III), *Allium subhirsutum* (III), *Sanguisorba minor* (III), *Rubus ulmifolium* (III).

Geographical distribution: It is limited to the hilly area of the Erei Mountains (South Sicily) and in particular in the territory of Niscemi, Mazzarino Caltagirone and Granieri (Furnari 1965, Barbagallo 1983, Costanzo et al. 1998, Brullo et al.1998, 2009)

Structure and ecology: Psammo-xerophilous woodland with canopy dominated by Quercus suber, showing a more or less open structure, diversified by the constant occurrence of *Achnatherum bromoides*. It is typical of incoherent substrates deriving from Pleistocenic yellow sands, in hilly areas characterized by average annual rainfall of 500-600 mm, with prolonged and marked summer dryness. It is localized in the upper dry thermomediterranean belt.

Syndynamism: This psammophilous woodland constitutes the final mature stage of a markedly xeric edaphophilous series, whose degradation leads to a garrigues of *Cisto-Ericion* represented by the *Thymo-Helichrysetum stoechadis*, which is later replaced by therophytic meadows of *Malcolmietalia* (Barbagallo, 1983). It has catenal contacts with the *Oleo-Quercetum virgilianae*, in the stands with deep non-sandy soils, or with the *Pistacio lentisci-Quercetum ilicis*, limitedly to calcareous rocky soils.

Habitat reference: G2.1 Mediterranean evergreen *Quercus* woodland

47.1.1.1.3. ***Mespilo germanicae-Quercetum virgilianae*** Brullo & Marcenò 1985

Mesophilous deciduous woodland dominated by italian pubescent holm oak and laurel tree, linked to vulcanites or sometimes growing also on marls and distributed within the mesomediterranean belt with lower subhumid to humid ombrotype.

Holotypus: Ril. 3 di Tab. 6, Brullo e Marcenò (1985).

Characteristic and differential species: *Mespilus germanica* L..

Phytosociological table: From Brullo & Marcenò (1985), tab. 6, 13 rel.
Char. association: *Mespilus germanica* (V).

Char. alliance: *Clinopodium vulgare* ssp. *arundanum* (V), *Teucrium siculum* (V), *Poa sylvicola* (V), *Pulicaria odora* (IV), *Cytisus villosus* (IV), *Melica arrecta* (II).

Char. order and class: *Quercus virgiliana* (V), *Quercus amplifolia* (V), *Asparagus acutifolius* (V), *Rubia peregrina* subsp. *angustifolia* (V), *Cyclamen hederifolium* (V), *Ruscus aculeatus* (V), *Rosa sempervirens* (V), *Quercus ilex* (IV), *Carex distachya* (IV), *Osyris alba* (IV), *Asplenium onopteris* (IV), *Lonicera etrusca* (IV), *Calycotome infesta* (IV), *Smilax aspera* (IV), *Viola alba* subsp*. dehnhardtii* (IV), *Rhamnus alaternus* (III), *Euphorbia characias* (III), *Lonicera implexa* (II), *Pistacia lentiscus* (II), *Dioscorea communis* (II), *Cyclamen repandum* (II), *Pimpinella peregrina* (II), *Dryopteris pallida* (II), *Fraxinus ornus* (II), *Clematis cirrhosa* (I), *Paeonia mascula* (I).

Other species: *Allium subhirsutum* (V), *Brachypodium sylvaticum* (IV), *Crepis leontodontoides* (IV), *Hedera helix* (IV), *Ranunculus neapolitanus* (IV), *Rubus ulmifolius* (IV), *Daucus carota* (IV), *Dactylis hispanica* (IV), *Achillea ligustica* (III), *Pteridium aquilinum* (II), *Geum urbanum* (II).

Geographical distribution: The association is spread in the highest area of the Iblei Mountains, particularly along the slopes of Monte Lauro, as well as in the territory of Ferla, Sortino, Vizzini and Monterosso Almo (Brullo & Marcenò, 1985, Fichera et al. 1998, Brullo et a. 2009)

Structure and ecology: Mesophilous woodland with acidophilous requirements dominated by deciduous oaks, such as *Quercus virgiliana* and *Q. amplifolia*, floristically differentiated by the occurrence of *Mespilus germanica*. It is linked to Tertiary basalts of submontain areas at altitudes between 600 and 900 m, affected by annual rainfall above 800 mm. It is localized within Mesomediterranean belt with upper subumid to humid ombrotype.

Syndynamism: The association is the most structured stage of a climatophilous series of calcifuge kind. Its degradation due to anthropic pressure causes a gradual replacement with thorny shrublands of the *Pruno spinosi-Rubion ulmifolilii*, while the intensification of these processes leads to peculiar endemic communities represented by suffruticose dwarf bushes referable to the *Sileno-Helichrysetum hyblaei*, by grasslands of the *Arrhenathero-Helictotrichetum convoluti* and finally to the therophytic meadows of the dell'*Echinarietum todaroanae* (Brullo et al., 1998).

Habitat reference: G1.7b Mediterranean thermophilous deciduous woodland

47.1.1.2. Suballiance: ***Quercenion dalechampii*** Brullo 1984

Evergreen and deciduous acidophilous oak forests of the Central and East Mediterranean, with mesophilous requirements, distributed in meso-supramediterranean belt.

Holotypus: *Genisto aristatae-Quercetum suberis* Brullo 1984**.**

Characteristic and differential species: *Quercus dalechampii* Ten.*, Q. congesta* C. Presl.*, Q. x fontanesii* Guss.*, Drymochloa drymeja* (Mert. & W.D.J. Koch) Holub subsp. *exaltata* (C. Presl) Foggi & Signorini*, Echinops siculus* Strobl*, Symphytum gussonei* F. W. Schultz*, Melittis albida* Guss.*, Silene viridiflora* L.*, Cnidium silaifolium* (Jacq.) Simonk.*, Allium siculum* Ucria.

Geographical distribution: The syntaxon is circumscribed to the southern Tyrrhenian territories (South Italy, Sardinia and Sicily).

Structure and ecology: It includes mesophilous associations with marked acidophilous requirements, distributed at altitudes between 500 and 1500 m, in stands characterized by annual rainfalls above 700 mm. These woodlands are dominated cork oaks, holm oaks or deciduous oaks, often constituent mixed communities of evergreen and deciduous trees, usually belonging to the genus *Quercus*. On the whole, this forest vegetation is well developped on siliceous substrates with rather mature soils, in which canopy, in addition to *Quercus ilex* and *Q. suber*, are frequent and often dominant various deciduous oaks, as *Quercus virgiliana, Q. dalechampii, Q. congesta, Q. leptobalanos, Q. gussonei.* It is distributed within the mesomediterranean to supramediterranean belt with lower subhumid to umid ombrotype.

Syndynamism: The sub-alliance gathers mainly climatophilous associations, only rarely they assume an edaphophilous role.

47.1.1.2.1. ***Genisto aristatae-Quercetum suberis*** Brullo 1984

Evergreen acidophilous cork oaks woodland with nebrodes broom, distributed in subhumid mesomediterranean belt.

Holotypus: Rel. 7, tab. 26, Brullo (1984).

Characteristic and differential species: *Trifolium bivonae*, *Eryngium bocconei, Genista aristata*.

Phytosociological table: From Brullo (1984), tab. 26, 19 rel.

Char. association: *Trifolium bivonae* (V), *Eryngium bocconei* (V), *Genista aristata* (IV).

Char. suballiance: *Quercus dalechampii* (V)*, Q. congesta* (V)*, Drymochloa drymeja* subsp. *exaltata* (V)*, Echinops siculus* (III)*, Symphytum gussonei* (II)*, Melittis albida* (I)*, Quercus gussonei* (II), *Silene viridiflora* (II), *Q. x fontanesii* (I).

Char. alliance: *Quercus suber* (V), *Erica arborea* (V)*, Pulicaria odora* (V), *Clinopodium vulgare* ssp. *arundanum* (IV), *Teucrium siculum* (IV), *Melica arrecta* (IV), *Poa sylvicola* (IV), *Cytisus villosus* (II), *Teline monspessulana* (II).

Char. order and class: *Asparagus acutifolius* (V), *Calycotome infesta* (V), *Ruscus aculeatus* (V), *Asperula laevigata* (V), *Rosa sempervirens* (V), *Carex distachya* (V), *Asplenium onopteris* (IV), *Osyris alba* (III), *Luzula forsteri* (III), *Quercus ilex* (III), *Thalictrum calabricum* (III), *Smilax aspera* (II), *Daphne gnidium* (II), *Viola alba* subsp*. dehnhardtii* (II), *Euphorbia characias* (II),

Fraxinus ornus (II), *Rubia peregrina* subsp. *angustifolia* (II), *Pyrus spinosa* (II), *Dioscorea communis* (II), *Cyclamen repandum* (I), *Phillyrea angustifolia* (I), *Cyclamen hederifolium* (I).

Other species: *Brachypodium sylvaticum* (V), *Prunus spinosa* (V), *Dactylis hispanica* (V), *Crataegus monogyna* (V), *Rubus ulmifolius* (V), *Oenanthe pimpinelloides* (V), *Anthoxanthum odoratum* (V), *Allium subhirsutum* (IV), *Cistus salvifolius* (III), *Carex serrulata* (III), *Hedera helix* (II), *Acer campestre* (II), *Malus silvestris* (II).

Geographical distribution: The association is widespread along the Tyrrhenian slopes of the northern Sicily and in particular in the hilly and submontain belt of the Madonie and Monti Nebrodi (Brullo and Marcenò, 1985).

Structure and ecology: It is a mesophilous *Quercus suber* woodland, usually rich in deciduous species of oaks, occurring on few coherent siliceous substrates, such as sandstones, quartzarenites, flysch, etc., at altitudes between sea level and 800 m. The subass. *typicum*, differentiated by the endemic *Genista aristata,* is linked to stands with annual rainfall of 750-850mm, spreads within the thermomediterranean to mesomediterranean belt with subhumid ombrotype (Brullo and Marcenò, 1985). As concerns the subass. *pistacietosum lentisci* Brullo, Gianguzzi & La Mantia 2009, it regards the most thermophilic aspects, which are widespread especially in low altitude stands, in markedly xeric edaphic conditions at altitudes not exceeding 600 m. From the floristic and physiognomic-structural point of view, it is differentiated by the absence of *Genista aristata*, and by the high frequency of thermophilous species of the *Quercetalia calliprini*.

Syndynamism: This forest vegetation constitutes the most structured stage of an edaphoclimatophilous series linked to siliceous substrates, which has catenal contacts with climatophilous series characterized by *Quercetalia ilicis* oak woods. The degradation of this association, due to anthropogenic causes, leads to the settlement of shrubby communities dominated by *Calicotome infesta*, as well as to garrigue of *Cistus* sp. pl.

Habitat reference: G2.1 Mediterranean evergreen *Quercus* woodland.

47.1.1.2.2. ***Doronico orientalis-Quercetum suberis*** Brullo, Miniss., Signorello & Spamp. 1996

Evergreen acidophilous cork oaks woodland rich in Leopard's Bane, distributed in the humid mesomediterranean belt.

Holotypus: Rel. 1 di Tab. 5, Brullo et al. (1996).

Characteristic and differential species: *Doronicum orientale* Hoffm.

Phytosociological table: From Brullo (1996), tab. 5, 7 rel.

Char. association: *Doronicum orientale* (V).

Char. suballiance: *Quercus dalechampii* (V)*, Drymochloa drymeja* subsp. *exaltata* (II)*, Melittis albida* (II)*, Quercus gussonei* (I), *Silene viridiflora* (I), *Allium siculum* (I).

Char. alliance: *Quercus suber* (V), *Cytisus villosus* (V), *Erica arborea* (IV)*, Arbutus unedo* (II), *Teucrium siculum* (II), *Poa sylvicola* (II), *Pulicaria odora* (I).

Char. order and class: *Asplenium onopteris* (V), *Rubia peregrina* subsp. *angustifolia* (V), *Asparagus acutifolius* (IV), *Carex distachya* (IV), *Dioscorea communis* (IV), *Luzula forsteri* (III), *Smilax aspera* (III), *Calycotome infesta* (II), *Ruscus aculeatus* (II), *Rosa sempervirens* (II), *Pyrus spinosa* (II), *Cyclamen repandum* (II), *Phillyrea angustifolia* (II), *Euphorbia characias* (II), *Fraxinus ornus* (II), *Viola alba* subsp*. dehnhardtii* (II), *Osyris alba* (II), *Thalictrum calabricum* (I), *Daphne gnidium* (I), *Clematis cirrhosa* (I), *Carex halleriana* (I), *Pimpinella peregrina* (I).

Other species: *Brachypodium sylvaticum* (V), *Rubus ulmifolius* (V), *Anthoxanthum odoratum* (IV), *Cistus salvifolius* (IV), *Hedera helix* (IV), *Prunus spinosa* (II), *Allium subhirsutum* (II).

Geographical distribution: Currently it is known exclusively for the northern side of the Nebrodi range, along the valley of Caronia and San Fratello, and for the Peloritani in the Camaro valley near Messina (Brullo et al., 1997, 2009).

Structure and ecology: Woodland dominated by *Quercus suber*, characterized by a certain meso-hygrophilous microclimate and linked to sandy or incoherent soils, differentiated by *Doronicum orientale*, a markedly mesophilous geophyte. This vegetation is localized on the bottom of fresh and humid valleys originated from erosion phenomena of Pliocene sandy deposits by watercourses, as well as on the most xeric slopes of the submontana belt interposed between the *Quercetum gussonei* and the *Arrhenathero-Quercetum cerridis*. It is distributed in lower humid mesomediterranean belt.

Syndynamism: This is an edaphophilous association localized within the belt potentially occupied by the *Quercetum gussonei* as conerns the Nebrodes territory, or in that one of the *Erico arboreae-Quercetum virgilianae* relatily to the Peloritani range. The degradation processes of this mesophilic cork oak wood favor the spread of shrubby communities mainly represented by garrigues with *Cistus* sp. pl.

Habitat reference: G2.1 Mediterranean evergreen *Quercus* woodland.

47.1.1.2.3. ***Teucrio siculi-Quercetum ilicis*** Gentile 1969 *em.* Brullo & Marcenò 1985

Evergreen acidophilous holm oak woodland, rich in sicilian germander, with mesophilous requirements, distributed in thermo-mesomediterranean belt

Synonyms: *Querco-Teucrietum siculi* Gentile 1969,

Holotypus: Rel. n. 4, tab.1, Gentile (1969).

Characteristic and differential species: *Teucrium siculum* Guss*.*

Phytosociological table: From Brullo & Marcenò (1985), tab. 8, 8 rel.

Char. association: *Teucrium siculum* (V).

Char. suballiance: *Quercus dalechampii* (V)*, Drymochloa drymeja* subsp. *exaltata* (II)*.*

Char. alliance: *Cytisus villosus* (V), *Erica arborea* (V)*, Clinopodium vulgare* subsp. *arundanum* (V), *Melica arrecta* (IV), *Pulicaria odora* (IV), *Arbutus unedo* (II), *Teline monspessulana* (I).

Char. order and class: *Quercus ilex* (V), *Asparagus acutifolius* (V), *Viola alba* subsp*. dehnhardtii* (V), *Carex distachya* (V), *Asplenium onopteris* (IV), *Cyclamen repandum* (IV), *Luzula forsteri* (IV), *Daphne gnidium* (IV), *Cyclamen hederifolium* (IV), *Calycotome infesta* (IV), *Ruscus aculeatus* (III), *Lonicera etrusca* (III), *Rosa sempervirens* (II), *Pyrus spinosa* (II), *Arisarum vulgare* (II), *Osyris alba* (II), *Lonicera implexa* (II), *Rubia peregrina* subsp. *angustifolia* (II), *Dioscorea communis* (II), *Pimpinella peregrina* (II), *Phillyrea angustifolia* (I), *Smilax aspera* (I), *Fraxinus ornus* (I), *Carex halleriana* (I).

Other species: *Rubus ulmifolius* (V), *Brachypodium sylvaticum* (IV), *Hedera helix* (IV), *Pteridium aquilinum* (IV), *Crepis leontodontoides* (IV), *Geranium purpureum* (IV), *Anthoxanthum odoratum* (III), *Rosa canina* (III), *Allium subhirsutum* (III), *Crataegus monogyna* (II).

Geographical distribution: This association is spread in South Italy and Sicily, where it was recorded from Etna, Peloritani, Nebrodes, Madonie, Ficuzza, etc. (Gianguzzi et al., 2000, Gentile 1969, Poli et al., 1979, Brullo and Marcenò 1985, Bartolo et al. 1990, Brullo et al. 2009).

Structure and ecology: Mesophilous woodland with the canopy dominated by *Quercus ilex*, showing marked acidophilous requirements, which is differentiated by several calcifugous species of the *Erico arboreae-Quercion ilicis*. It is linked to siliceous substrates (schists, gneiss, basalts, granites, etc.) or to leached soils. It is frequent from hilly places up to about 1200 m a.s.l., within the thermomedierranean to mesomediterranean belt with upper subhumid to humid ombrotype. Bartolo et a. (1990), a part from a typical aspect represented by the subass. *teucrietosum siculi,* recognized a subass. *polystichetosum setiferi* with markedly more fresh and humid edaphic requirements.

Syndynamism: In Sicily the association has a predominant edaphophilous behavior, occurring mainly at altitudes of 800-1200 m a.s.l., in stands with a more fresh and humid microclimate compared to the surrounding macroclimate, such as ravines, gorges, valleys and northern slopes of the mountains. Here it is localized within the climatic belt of deciduous oak woods, including the *Quercetum leptobalani* (Madonie and Ficuzza), the *Erico arborae-Quercetum virgilianae* (Nebrodi and Peloritani) and the *Arabido turritae-Quercetum congestae* or *Festuco heterophyllae-Quercetum congestae* (Etna). Only in the more humid slopes of the Tyrrhenian side of the Nebrodi and Madonie, limitedly to the siliceous substrates, the *Teucrio siculi-Quercetum ilicis* is the most evolved stage of a climatophilous series. Particularly on the Nebrodi it constitutes a belt interposed between the series of the *Quercetum gussonei* and that one of the *Arrhenatero nebrodensis-Quercetum cerridis*. On the Madonie instead it

occupies a belt between the *Erico arboreae-Quercetum virgilianae* and the *Anemono apenninae-Fagetum sylvaticae*.

Habitat reference: G2.1 Mediterranean evergreen *Quercus* woodland.

47.1.1.2.4. ***Sorbo graecae-Quercetum ilicis*** Brullo, Gianguzzi, La Mantia & Siracusa 2009

Evergreen acidophilous holm oak woodland, rich in Balkan whitebeam, with orophilous requirements, distributed in the supramediterranean belt.

Holotypus: Rel. 3, tab. 7c, Brullo et al. (2009).

Characteristic and differential species: *Sorbus graeca* (Spach) Schauer, *Acer obtusatum* Willd. subsp. *aetnense* (Tineo) C. Brullo & Brullo

Phytosociological table: From Brullo et a. (2009), tab. 7c, 9 rel.

Char. association: *Sorbus graeca* (V), *Acer obtusatum* subsp. *aetnense* (V).

Char. suballiance: *Quercus congesta* (V), *Quercus dalechampii* (IV), *Cnidium silaefolium* (II).

Char. alliance: *Teucrium siculum* (V).

Char. order and class: *Quercus ilex* (V), *Luzula forsteri* (V), *Carex distachya* (IV), *Rosa sempervirens* (V), *Lonicera etrusca* (V), *Cyclamen repandum* (II).

Other species: *Pteridium aquilinum* (V), *Silene sicula* (V), *Daphne laureola* (IV), *Brachypodium sylvaticum* (IV), *Festuca rubra* (IV), *Rubus glandulosus* (IV), *Hypochoeris laevigata* (IV), *Juniperus hemisphaerica* (IV), *Malus sylvestre* (III), *Prunus spinosa* (III), *Festuca eterophylla* (II), *Fragaria vesca* (II), *Viola reichenbachiana* (II).

Geographical distribution: Currently the association has been observed only in some stands on the north-western slope of Etna.

Structure and ecology: This orophilous *Quercus ilex* woodland observed at an altitude of 1200-1400 m a.s.l., is located on old lava flows characterized by a thick layer of basaltic block,s where the humus is accumulated among the interstices even at considerable depth. Significant here is the presence, a part from *Quercus ilex*, which is the dominant tree, also of *Acer obtusatum* subsp. *aetnense* and above all of *Sorbus graeca*, a species quite rare on Etna, which finds its optimum in this wood vegetation. Other tree are frequent are *Quercus congesta* and *Q. dalechampii*. The association in question shows a clear pioneer role and can be considered as a Etnean vicariant of the *Aceri campestris-Quercetum ilicis* from the mountains of North western Sicily. From the bioclimatic viewpoint, it is distributed within the subhumid supramediterranean belt.

Syndynamism: The association shows a clear edaphophilous role, since it is localized within the belt potentially occupied by the pinewoods at *Pinus nigra* ssp. *calabrica* in the rocky stands and by the beeches of *Epipactido meridionalis-Fagetum sylvaticae* in those ones with

very mature soils. In the colonization processes of these lava flows, the vegetation in question is preceded by shrub communities of the *Schrophulario-Helichrysetalia italici*.

Habitat reference: G2.1 Mediterranean evergreen *Quercus* woodland.

47.1.1.2.5. ***Erico arboreae-Quercetum virgilianae*** Brullo & Marcenò 1985

Acidophilous deciduous woodland dominated by italian pubescent holm oak and rich in tree heath , linked to siliceous substrata and distributed within the subhumid to humid mesomediterranean belt, sometimes in the supramediterranea that one.

Holotypus: Rel. 2, tab. 11, Brullo e Marcenò (1985).

Characteristic and differential species: *Erica arborea* L.*, Quercus virgiliana* (Ten.) Ten.

Phytosociological table: From Brullo & Marcenò (1985), tab. 11, 8 rel.

Char. association: *Quercus virgiliana* (V).

Char. suballiance: *Quercus dalechampii* (V)*, Drymochloa drymeja* subsp. *exaltata* (V).

Char. alliance: *Erica arborea* (V)*, Arbutus unedo* (V), *Cytisus villosus* (V), *Pulicaria odora* (V), *Clinopodium vulgare* subsp. *arundanum* (IV), *Melica arrecta* (IV), *Teline monspessulana* (III). *Cnidium silaefolium* (II), *Quercus suber* (II).

Char. order and class: *Asparagus acutifolius* (V), *Viola alba* subsp*. dehnhardtii* (V), *Carex distachya* (V), *Smilax aspera* (V), *Ruscus aculeatus* (V), *Rubia peregrina* subsp. *angustifolia* (V), *Asplenium onopteris* (V), *Cyclamen hederifolium* (V), *Luzula forsteri* (V), *Arisarum vulgare* (V), *Thalictrum calabricum* (IV), *Pimpinella peregrina* (IV), *Cyclamen repandum* (III), *Daphne gnidium* (III), *Rosa sempervirens* (III), *Dioscorea communis* (III), *Quercus ilex* (II), *Calycotome infesta* (II), *Dryopteris pallida* (I).

Other species: *Rubus ulmifolius* (V), *Doronicum orientale* (V), *Ranunculus neapolitanus* (V), *Ampelodesmos mauritanicus* (V), *Pteridium aquilinum* (V), *Crepis leontodontoides* (V), *Dactylis hispanica* (V), *Anthoxanthum odoratum* (IV), *Brachypodium sylvaticum* (IV), *Geranium purpureum* (IV), *Oenanthe pimpinelloides* (IV), *Asphodelus ramosus* (III), *Scutellaria gussonei* (III)*, Allium subhirsutum* (II), *Hedera helix* (II).

Geographical distribution: In Sicily the *Erico arborae-Quercetum virgilianae* is represented along the Peloritani range, Nebrodes, Madonie and Aeolien Islands (Brullo and Marcenò 1985, Brullo et al., 1995, 2009). The association is also recorded from Aspromonte in South Italy (Brullo et al., 2001)

Structure and ecology: Mesophilous woodland with marked acidophilous requirement, physiognomically dominated by *Quercus virgiliana*, often associated to *Q. dalechampii*. The undergrowth is rather dense and consists of numerous shrubs, among which are frequent *Erica arborea*, *Arbutus unedo* and *Cytisus villosus*, while the herbaceous layer is rich in nemoral species, among which in particular *Drymochloa drymeja* subsp. *exaltata*. The association is

linked to siliceous substrates with deep and fresh soils of submontain or mountain territories at altitudes of 500-1200 m, affected by annual rainfalls of 600-1000 mm. Usually it occurs within the subhumid to humid mesomediterranean belt, with penetrations sometimes in supramediterranean that one.

Syndynamism: It is a climatophilous association with marked acidophilous requirements, linked to soils of siliceous origin, which as a result of degradation processes is replaced by shrub communities of *Ericion arboreae* and later by *Pteridium aquilinum* population**.**

Habitat reference: G1.7b Mediterranean thermophilous deciduous woodland.

47.1.1.2.6. ***Arabido turritae-Quercetum congestae*** Brullo & Marcenò 1985

Mesophilous deciduous woodland dominated by Sicilian oak and rich in tower cress, linked to siliceous substrata, mainly volcanites, and distributed within the subhumid to humid mesomediterranean belt, sometimes in the supramediterranea that one.

Holotypus: Rel. 2, tab.12, Brullo & Marcenò (1985).

Characteristic and differential species: *Arabis turrita, Quercus congesta*.

Phytosociological table: From Brullo & Marcenò (1985), tab. 12, 5 rel.
Char. association: *Arabis turrita* (V), *Quercus congesta* (V).
Char. suballiance: *Quercus dalechampii* (V)*, Drymochloa drymeja* subsp. *exaltata* (V)*.*
Char. alliance: *Cytisus villosus* (V), *Teucrium siculum* (IV), *Clinopodium vulgare* subsp. *arundanum* (IV), *Poa sylvicola* (IV), *Erica arborea* (II)*.*
Char. order and class: *Quercus ilex* (V), *Calycotome infesta* (V), *Carex distachya* (V), *Arisarum vulgare* (V), *Aristolochia pallida* (V), *Fraxinus ornus* (IV), *Quercus amplifolia* (IV), *Asplenium onopteris* (IV), *Cyclamen hederifolium* (IV), *Luzula forsteri* (IV), *Rubia peregrina* subsp. *angustifolia* (III), *Euphorbia characias* (III), *Lonicera etrusca* (III), *Pyrus spinosa* (III), *Asparagus acutifolius* (III), *Rosa sempervirens* (II), *Rhamnus alaternus* (II), *Smilax aspera* (II), *Ruscus aculeatus* (II), *Thalictrum calabricum* (I).
Other species: *Rubus aetnicus* (V), *Daucus carota* (V), *Crepis leontodontoides* (V), *Pimpinella anisoides* (V), *Brachypodium sylvaticum* (V), *Pteridium aquilinum* (IV), *Hypericum perforatum* (IV), *Hedera helix* (IV), *Anthoxanthum odoratum* (III), *Ranunculus neapolitanus* (III), *Geranium purpureum* (III), *Asphodelus ramosus* (III), *Achillea ligustica* (III), *Dactylis glomerata* (II).

Geographical distribution: In Sicily the association is exclusive of the eastern slope of Etna, where it occupies a well defined altitudinal band (Brullo and Marcenò, 1985). Examples of this association are also recorded from Calabria, where occurs in the southern part of the Aspromonte (Brullo et al., 2001).

Structure and ecology: Calcifugous and mesophilous woodland, physiognomically dominated by *Quercus congesta*, which is usually associated with *Quercus dalechampii* and *Q. ilex*. Floristically it is differentiated by the occurrence in the herbaceous layer of *Arabis turrita*, in Sicily exclusive of the stands occupied by this vegetation. It is an association linked to siliceous substrates (mainly volcanic), in an area characterized by annual rainfall above 1000 mm, at an altitude of 600-1100 m. It falls in a belt between the humid mesomediterranean and supramediterranean bioclimate.

Syndynamism: The association is the most structured stage of a climatophilous series in contact with other woodlands floristically and ecologically well distinct from it. In particular, the *Oleo-Quercetum virgilianae* replaces it at lower altitudes, while upwards more mesophilous communities of the *Pino-Quercion congestae* vicaried it.

Habitat reference: G1.7b Mediterranean thermophilous deciduous woodland.

47.1.1.2.6. ***Festuco heterophyllae-Quercetum congestae*** Brullo & Marcenò 1985

Mesophilous deciduous woodland dominated by Sicilian oak and rich in variousleaf fescue, linked to siliceous substrata, and distributed within the subhumid to humid mesomediterranean belt, sometimes in the supramediterranean that one.

Holotypus: Rel. 3, tab. 14, Brullo & Marcenò (1985).

Characteristic and differential species: *Festuca heterophylla* Lam., *Conopodium capillifolium* (Guss,) Boiss., *Potentilla detommasii* Ten.

Phytosociological table: From Brullo & Marcenò (1985), tab. 14, 7 rel.

Char. association: *Festuca heterophylla* (V), *Conopodium capillifolium* (V), *Potentilla detommasii* (III).

Char. suballiance: *Quercus congesta* (V), *Quercus dalechampii* (V), *Drymochloa drymeja* subsp. *exaltata* (V).

Char. alliance: *Teucrium siculum* (V), *Clinopodium vulgare* subsp. *arundanum* (V), *Cnidium silaeifolium* (IV), *Melica arrecta* (III), *Cytisus villosus* (III).

Char. order and class: *Carex distachya* (V), *Quercus ilex* (IV), *Cyclamen hederifolium* (IV), *Luzula forsteri* (IV), *Asparagus acutifolius* (IV), *Rosa sempervirens* (IV), *Asplenium onopteris* (IV), *Thalictrum calabricum* (IV), *Ruscus aculeatus* (IV), *Rubia peregrina* subsp. *angustifolia* (III), *Euphorbia characias* (III), *Lonicera etrusca* (III), *Aristolochia pallida* (III), *Quercus amplifolia* (III), *Peonia mascula* (III), *Rhamnus alaternus* (II), *Pimpinella peregrina* (II).

Other species: *Hedera helix* (V), *Pimpinella anisoides* (V), *Brachypodium sylvaticum* (V), *Pteridium aquilinum* (V), *Crepis leontodontoides* (IV), *Anthoxanthum odoratum* (IV), *Dactylis glomerata* (IV), *Rubus ulmifolius* (III), *Daucus carota* (III), *Ranunculus neapolitanus* (III), *Asplenium trichomanes* (III), *Trifolium ochroleucum* (III).

Geographical distribution: In Sicily the *Festuco heterophyllae-Quercetum congestae* is localizeded in the West and South-western slopes of Etna and on the South slopes of the Nebrodi chain (Brullo & Marcenò 1985, Brullo et al. 2009). The association was also found in Calabria, along the Tyrrhenian side of the Aspromonte (Brullo et al., 2001)

Structure and ecology: Mesophilous forest vegetation with marked acidophilus requirements, characterized in the canopy by the dominance of *Quercus congesta*, usually associated with *Q. dalechampii* and *Q. ilex*. The herbaceous layer is characterized by the occurrence of mesophilous nemoral species of the *Querco-Fagetea sylvaticae,* among which *Festuca heterophylla* is particularly abundant, mixed with more thermophilous species of the *Quercetea ilicis*. The association is mainly linked to mountain stands at an altitudes of 800-1300 m a.s.l., on siliceous substrata. It falls within the mesomediterranean to supramediterranean belt with upper humid ombrotype.

Syndynamisms: It is a climatophilous vegetation, upward in contact with the *Junipero hemisphaericae-Pinetum calabricae* as concerns the Etna area, or with the *Arrenathero nebrodensis-Quercetum cerridis* limited to the Nebrodi territory.

Habitat reference: G1.7b Mediterranean thermophilous deciduous woodland.

47.1.1.2.7. ***Aceri aetnensis-Ostryetum carpinifoliae*** Brullo & Marcenò 1985

Sciaphilous deciduous woodland dominated by hop-hornbeam and rich in Sicilian maple, linked impluvia and gorges on siliceous substrata, affected by marked mesophilous microclimatic conditions.

Holotypus: Rel. 2, tab13, Brullo & Marcenò (1985).

Characteristic and differential species: *Ostrya carpinifolia* Scop*., Acer obtusatum* Willd. subsp. *aetnense.* (Tineo ex Strobl) C. Brullo & Brullo.

Phytosociological table: from Brullo & Marcenò (1985), tab. 13, 6 rel. (subass. *quercetosum congestae*).

Char. Association: *Ostrya carpinifolia* (V), *Acer obtusatum* subsp. *aetnense* (V).

Char. suballiance: *Quercus congesta* (V), *Quercus dalechampii* (V)*, Drymochloa drymeja* subsp. *exaltata* (V), *Silene viridiflora* (V)*.*

Char. alliance: *Teucrium siculum* (V), *Clinopodium vulgare* subsp. *arundanum* (V), *Poa sylvicola* (V), *Cytisus villosus* (V)*.*

Char. order and class: *Quercus ilex* (V), *Quercus amplifolia* (V), *Fraxinus ornus* (V), *Cyclamen hederifolium* (V), *Carex distachya* (V), *Asparagus acutifolius* (V), *Asplenium onopteris* (V), *Ruscus aculeatus* (V), *Rubia peregrina* subsp. *angustifolia* (V), *Euphorbia characias* (V), *Lonicera etrusca* (V), *Rhamnus alaternus* (IV), *Thalictrum calabricum* (IV), *Luzula forsteri* (III), *Smilax aspera* (III), *Dioscorea communis* (III), *Rosa sempervirens* (I), *Pyrus spinosa* (I).

Other species: *Brachypodium sylvaticum* (V), *Pteridium aquilinum* (V), *Achillea ligustica* (V),*Crepis leontodontoides* (V), *Anthoxanthum odoratum* (),*Asplenium trichomanes* (V), *Trifolium ochroleucum* (V), *Rubus aetnicus* (V), *Hypericum perforatum* (V), *Pinus nigra* ssp. *calabrica* (IV), *Acer psedoplatanus* (III), *Castanea sativa* (III), *Daucus carota* (III), *Geranium purpureum* (III), *Spartium junceum* (III), *Polypodium cambricum* (III), *Hedera helix* (II), *Dactylis glomerata* (II).

Phytosociological table: from Bartolo et al. (1990), tab. 8, 5 rel. (subass. *tilietosum*).

Char. Association: *Ostrya carpinifolia* (V), *Acer obtusatum* subsp. *aetnense* (V) *Tilia platyplyllos* subsp. *platyphyllos* (V), *Laurus nobilis* (V).

Char. suballiance: *Quercus dalechampii* (V).

Char. alliance: *Erica arborea* (V), *Melica arrecta* (V), *Cytisus villosus* (V).

Char. order and class: *Quercus ilex* (V), *Luzula forsteri* (V), *Rosa sempervirens* (V), *Thalictrum calabricum* (V), *Viola alba* subsp*. dehnhardtii* (V), *Ruscus aculeatus* (V), *Rubia peregrina* subsp. *angustifolia* (IV), *Cyclamen repandum* (IV), *Carex distachya* (IV), *Calicotome infesta* (III), *Lonicera etrusca* (III), *Dioscorea communis* (III), *Asplenium onopteris* (III), *Peonia mascula* (III), *Rhamnus alaternus* (III), *Pyrus spinosa* (III), *Bupleurum fruticosum* (III), *Fraxinus ornus* (II), *Quercus amplifolia* (II), *Smilax aspera* (II), *Cyclamen hederifolium* (II), *Euphorbia characias* (II), *Lonicera implexa* (I).

Other species: *Hedera helix* (V), *Brachypodium sylvaticum* (V*), Polysticum setiferum* (V), *Hypericum perforatum* (V), *Crepis leontodontoides* (III).

Geographical distribution: The subass. *quercetosum congestae* is circumscribed to some places on the eastern scope of Etna (Brullo and Marcenò 1985, Brullo et al. 2009), while the subass. *ostrietosum* and subass. *tilietosum* are known only for few stands of the Peloritani chain(Bartolo et al. 1990, Brullo et al 2009).

Structure and ecology: Mesophilous woodland dominated by *Acer obtusatum* subsp. *aetnense* and *Ostrya carpinifolia*, which grow together with several deciduous oaks (*Quercus dalechampii, Q. congesta, Q. amplifolia*) and evergreens (*Q. ilex*). It is linked to siliceous substrata, localizing exclusively along impluvia and gorges, characterized by a markedly humid and fresh microclimate. According Bartolo et al. (1990), this association ir represented by three subassociations: a) subass *quercetosum congestae*, corrisponding to typical aspect, is floristically differentiated by the abundance of *Quercus congesta* and occurs in inpluvia on volcanic substrates at an altitude of 600-900 m a.s.l.; b) subass. *ostrietosum carpinifoliae* linked to deep gorges, where it occupies the highest parts in more exposed and sunny conditions, on compact siliceous substrates with outcropping rock and superficial soils, physiognomically differentiating for the dominance of *Ostrya carpinifolia*; c) subass. *tilietosum platyphylli* that compared to the subass. *ostrietosum* grows on the bottom of deep and narrow gorges, affected by considerable shading and a marked environmental humidity, where it grows on siliceous rock faces, usually very inclined and sometimes almost vertical, covered by compact moss carpets , differentiating mainly for the presence of two very peculiar species, such as *Tilia platyphyllos* subsp. *platyphyllos* and *Laurus nobilis*.

Syndynamism: On the whole, the association shows a clearly edaphophilious role, since it is linked to very peculiar microclimatic conditions. In particular in the Etna territory, the subass. *quercetosum congestae* is localized within the climatophilous belt of the *Arabido-Quercetum congestae*, while the other two subassociations limited to the Peloritani chain grow within that one of the *Erico arborae-Quercetum virgilianae.*

Habitat reference: G1.7b Mediterranean thermophilous deciduous woodland.

47.1.1.2.8. ***Quercetum leptobalanae*** Brullo 1984

Mesophilous deciduous woodland dominated by Madonie downy oak and rich in other deciduos oaks and holm oak , linked to siliceous substrata, and distributed within the upper subumid to humid mesomediterranean belt, sometimes in the supramediterranean that one.

Holotypus: Ril. 3 di Tab. 25, Brullo (1984).

Characteristic and differential species: *Quercus leptobalanos.*

Phytosociological table: From Brullo & Marcenò (1985), tab. 9, 17 rel.

Char. association: *Quercus leptobalanos* (V).

Char. suballiance: *Quercus dalechampii* (V), *Quercus congesta* (IV), *Drymochloa drymeja* subsp. *exaltata* (V), *Echynops siculus* (IV), *Quercus gussonei* (III), *Symphytum gussonei* (III), *Melittis albida* (II), *Allium siculum* (II).

Char. alliance: *Cytisus villosus* (IV), *Teucrium siculum* (IV), *Poa sylvicola* (IV), *Clinopodium vulgare* subsp. *arundanum* (IV), *Melica arrecta* (III), *Erica arborea* (III), *Pulicaria odora* (III),

Arbutus unedo (II).

Char. order and class: *Quercus ilex* (V), *Luzula forsteri* (V), *Asparagus acutifolius* (V), *Rosa sempervirens* (V), *Thalictrum calabricum* (V), *Ruscus aculeatus* (V), *Rubia peregrina* subsp. *angustifolia* (V), *Viola alba* subsp. *dehnhardtii* (V), *Asperula laevigata* (V), *Cyclamen repandum* (IV), *Carex distachya* (IV), *Lonicera etrusca* (III), *Asplenium onopteris* (III), *Pyrus spinosa* (III), *Peonia mascula* (III), *Calicotome infesta* (III), *Dioscorea communis* (III), *Quercus amplifolia* (II), *Fraxinus ornus* (II), *Smilax aspera* (II), *Daphne gnidium* (II), *Cyclamen hederifolium* (II), *Euphorbia characias* (II), *Lonicera implexa* (I), *Phillyrea media* (I).

Other species: *Hedera helix* (V), *Brachypodium sylvaticum* (V), *Acer campestre* (V), *Rubus ulmifolius* (V), *Oenanthe pimpinelloides* (V), *Buglossoides purpureo-coerulea* (IV), *Crepis leontodontoides* (IV), *Carex serrulata* (IV), *Dactylis glomerata* (IV), *Euphorbia amygdaloides* ssp. *arbuscula* (IV), *Pimpinella anisoides* (III), *Malus sylvestris* (III), *Asphodelus ramosus* (III), *Allium subhirsutum* (III), *Silene sicula* (III), *Trifolium ochroleucum* (III), *Tolpis virgata* (III).

Geographical distribution: It is an endemic association recorded from the Tyrrhenian slopes of North-western Sicily. In particular it occurs on the Madonie and also at Ficuzza (Brullo & Marcenò 1985, Brullo et al 2009).

Structure and ecology: Acidophilus mixed woodland dominated by *Quercus leptobalanos,* endemism of North-western Sicily, generally associated with various other deciduous and evergreen oaks, such as *Quercus dalechampii*, *Q. congesta*, *Q. amplifolia* and *Q. ilex*. It is linked to submontain and mountain stands characterized by deep and well-developed soils, originating from siliceous substrates (schists, quartzarenites, silty clays, flysch, etc.), and by annual rains higher than 800 mm. This mesophilous association occupies a wide altitudinal belt, between 700 and 1400 m, within the mesomediterranean to supramediterranean belt with upper subumid to humid ombrotype.

Syndynamism: The association is the most structured stage of a climatophilous series, which downward is in catenal contacts with the *Genisto aristatae-Quercetum suberis*, while upwards it is replaced by the acidophilus beech woods of the *Anemone apenninae-Fagetum sylvaticae*. The most common aspect of degradation is represented by a spiny shrub vegetation referable to the *Crataegetum laciniatae*, which, that for further soil erosion, is progressively replaced by the mesophilous pastures of the *Plantaginion cupanii*.

Habitat reference: G1.7b Mediterranean thermophilous deciduous woodland.

47.1.1.2.9. ***Quercetum gussonei*** Brullo & Marcenò 1985

Mesophilous deciduous woodland dominated by Gussone Turkey oak, linked to siliceous sandy soils, and distributed within upper subumid mesomediterranean belt..

Holotypus: Rel. 6 di Tab. 16, Brullo e Marcenò (1985).

Characteristic and differential species: *Quercus gussonei* (Borzì) Brullo, *Iris foetidissima* L.

Phytosociological table: From Brullo & Marcenò (1985), tab. 16, 9 rel.

Char. association: *Quercus gussonei* (V), *Iris foetidissima* (III).

Char. suballiance: *Drymochloa drymeja* subsp. *exaltata* (V), *Quercus dalechampii* (IV), *Quercus congesta* (IV), *Echynops siculus* (IV), *Quercus x fontanesii* (IV), *Melittis albida* (IV), *Symphytum gussonei* (III), *Silene viridiflora* (II), *Allium siculum* (II).

Char. alliance: *Cytisus villosus* (V), *Poa sylvicola* (V), *Pulicaria odora* (V), *Clinopodium vulgare* subsp. *arundanum* (V), *Teucrium siculum* (IV), *Erica arborea* (IV), *Quercus suber* (IV), *Cnidium silaifolium* (III).

Char. order and class: *Rosa sempervirens* (V), *Ruscus aculeatus* (V), *Viola alba* subsp. *dehnhardtii* (V), *Asperula laevigata* (V), *Carex distachya* (V), *Lonicera etrusca* (V), *Asplenium onopteris* (IV), *Peonia mascula* (IV), *Luzula forsteri* (IV), *Asparagus acutifolius* (IV), *Rubia peregrina* subsp. *angustifolia* (IV), *Calicotome infesta* (III), *Dioscorea communis* (III), *Fraxinus ornus* (III), *Cyclamen hederifolium* (III), *Thalictrum calabricum* (II), *Pyrus spinosa* (II), *Aristolochia pallida* (II).

Other species: *Hedera helix* (V), *Brachypodium sylvaticum* (V), *Rubus ulmifolius* (V), *Oenanthe pimpinelloides* (V), *Agrimonia eupatoria* (V), *Crepis leontodontoides* (IV), *Daphne laureola* (V), *Dactylis glomerata* (V), *Euphorbia amygdaloides* subsp. *arbuscula* (IV), *Pimpinella anisoides* (IV), *Ranunculus neapolitanus* (IV). *Pteridium aquilinum* (IV), *Trifolium ochroleucum* (IV), *Tolpis virgata* (IV), *Geum urbanum* (III), *Scutellaria gussonei* (III), *Asphodelus ramosus* (III), *Anthoxanthum odoratum* (III), *Buglossoides purpureo-coerulea* (III), *Allium subhirsutum* (III),

Geographical distribution: The association is spread on the northern slopes of the Nebrodi chain and in the Ficuzza territory (Brullo and Marcenò 1985, Gianguzzi 1999, Gianguzzi et al. 2000, Brullo et al 2009)

Structure and ecology: Mesophilous woodland with marked acidophilous requirements, physiognomically dominated by *Quercus gussonei*, endemism of central-western Sicily belonging to the cycle of *Q. cerris*, which differs from the latter morphologically and also for its markedly thermophily. This association likes deep and mature soils, originating from siliceous substrates, such as flysh and schists, rich in sandy component. It localized in the submontain stands at altitudes of 500-800 m, with annual precipitation of 800-1100 mm. From the bioclimatic viewpoint, it is linked to upper subumid mesomediterranean belt.

Syndynamism: It is a climatophilous tree community, linked to well-drained and mature soils, mainly spread along the northern slopes of siliceous mountain ranges. Downwards normally it is in contact with the cork oaks of the *Genistis aristatae-Quercetum suberis,* while upwards it is replaced by the *Arrhenathero nebrodensis-Quercetum cerridis* in more mesic environmental conditions or from the *Quercetum leptobalani*, in more xeric stands.

Habitat reference: G1.7b Mediterranean thermophilous deciduous woodland.

47.1.1.2.10. ***Vicio elegantis-Quercetum congestae*** Brullo & Marcenò 1985

Mesophilous deciduous woodland dominated by Sicilian oak and rich in fine leaved vetch, linked to siliceous substrata, and distributed within the humid mesomediterranean belt.

Holotypus: rel. 2, tab. 15, Brullo & Marcenò (1985).

Characteristic and differential species: *Quercus congesta* C. Presl, *Vicia elegans* Guss.

Phytosociological table: From Brullo & Marcenò (1985), tab. 15, 5 rel.

Char. association: *Vicia elegans* (V).

Char. suballiance: *Quercus congesta* (V), *Quercus dalechampii* (V), *Drymochloa drymeja* subsp. *exaltata* (III).

Char. alliance: *Cytisus villosus* (V), *Poa sylvicola* (V), *Teucrium siculum* (IV), *Clinopodium vulgare* subsp. *arundanum* (III).

Char. order and class: *Ruscus aculeatus* (V), *Calicotome infesta* (V), *Rosa sempervirens* (IV), *Luzula forsteri* (IV), *Asparagus acutifolius* (IV), *Lonicera etrusca* (IV), *Rubia peregrina* subsp. *angustifolia* (IV), *Viola alba* subsp. *dehnhardtii* (III), *Osyris alba* (III), *Lonicera implexa* (III), *Peonia russii* (III), *Rhamnus alaternus* (III), *Pyrus spinosa* (III), *Thalictrum calabricum* (II).

Other species: *Brachypodium sylvaticum* (V), *Rubus ulmifolius* (V), *Geranium purpureum* (V), *Crepis leontodontoides* (V), *Pimpinella anisoides* (V), *Spartium junceum* (IV), *Dactylis glomerata* (IV), *Cistus salvifolius* (IV), *Anthoxanthum odoratum* (IV), *Achillea ligustica* (IV), *Carex serrulata* (IV), *Crataegus monogina* (III), *Silene sicula* (III), *Tolpis virgata* (III), *Castanea sativa* (III), *Hedera helix* (III).

Geographical distribution: It is a very rare association occurring in southern slopes of the Nebrodi chain near Capizzi (Brullo & Marcenò 1985)

Structure and ecology: Markedly mesophilous woodland with acidophilous requirements, with the canopy dominated by *Quercus congesta*, showing relations with *Festuco heterophyllae-Quercetum congestae*, from which differs for its more pronounced mesophily and mainly for the occurrence in the in the undergrowth of *Vicia elegans*, rare Sicilian endemism belonging to the cycle of *V.tenuifolia* Roth. In particular, this association is localized at an altitude of 850-1000 m on deep and mature soils, originating from siliceous substrates, mostly flysh. From the bioclimatic viewpoint, it is distributed within the humid mesomediterranean belt.

Syndynamism: It is a climatophilous vegetation, interposed between other two climatophilous series, represented upwards by the *Arrenathero nebrodensis-Quercetum cerridis* and downward by the *Erico arboreae- Quercetum virgilianae*.

Habitat reference: G1.7b Mediterranean thermophilous deciduous woodland.

47.2. ***Quercetalia calliprini*** Zohary 1955

Thermophilous and mesophilous maquis, schrublands and thermophilous conifer forests, rich in sclerophylls, distributed in the all Mediterranean region, estending also in the South-West Euro-Atlantic territories. within the thermomediterranean to mesomediterranean belt, sometimes with penetration into supramediterranean one.

Synonyms: *Pistacio-lentisci-Rhamnetalia alaterni* Rivas Martinez 1975 nom illeg.

Holotypus: *Quercion calliprini* Zohary 1955.

Characteristic and differential species: *Anagyris foetida* L.*, Asparagus albus* L., *Asparagus aphyllus* L.*, Bupleurum fruticosum* L.*, Ceratonia siliqua* L.*, Clematis cirrhosa* L.*, Ephedra fragilis* Desf.*, Emerus major* Mill. subsp. *emeroides* (Boiss. & Spruner) Soldano & F. Conti*, Jasminum fruticans* L.*, Myrtus communis* L.*, Olea europaea* L. subsp. *oleaster* (Hoffmanns. & Link) Negodi*, Phillyrea angustifolia* L.*, Pinus halepensis* Mill.*, Pistacia lentiscus* L., *Prasium majus* L.*, Quercus calliprinos* Webb., *Rhamnus oleoides* L.*, Teucrium fruticans* L.

Geographical distribution: This syntaxon is widespread in the Mediterranean and Iberian-Atlantic territories. In agreement with Brullo et al. (2004), the name *Pistacio lentisci-Rhamnetalia alaterni* proposed by Rivas-Martinez (1975), must be considered illegitimate since it is a nomenclatural synonymous of *Quercetalia calliprini* Zohary 1955.In fact under the nomenclatural aspect, this order has been correctly described by Zohary (1955) including into it alliances and associations distributed in the eastern Mediterranean. Overall, the *Quercetalia calliprini* order in the original description appears to have the same floristic, ecological and structural characterization of the *Pistacio lentisci-Rhamnetalia alaterni.* Recently, Mucina et al. (2016) treat the *Quercetalia calliprini* as an order distinct from the *Pistacio lentisci-Rhamnetalia alaterni*, probably because they have not been well documented on this question, surely they have not had the opportunity to consult the original paper of Zohary (1955).

Structure and ecology: It gathers shrub or shrub-tree communities dominate by sclerophylls or deciduous-summer woody species and also by thermophilous conifers. This vegetation, well adapted even to long periods of summer dryness, is linked to a usually markedly arid bioclimate between the infra and thermomediterranean with lower dry to lower subhumid ombrotipe, sometimes with penetration also in the mesomediterranean or more rarely in the supramediterranean.

Syndynamism: Climatophilous, edaphophilous association and also secondary degradation communities belong to this syntaxon.

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral; F5.3 Submediterranean pseudomaquis; F5.5 Thermomediterranean scrub; G2.4 *Olea europaea-Ceratonia siliqua* woodland; G3.9b Mediterranean Cupressaceae woodland.

47.2.1. ***Oleo sylvestris-Ceratonion siliquae*** Br.-Bl. ex Guinochet in Guinochet & Drouineau 1944

Thermophilous maquis, schrublands and thermophilous conifer communities, rich in sclerophylls, distributed in the Central Mediterranean region, within the thermomediterranean to mesomediterranean belt.

Synonyms: *Oleo-Ceratonion* Br.-Bl. 1936 (2b); *Myrtion communis* Allier & Lacoste 1980

Holotypus: *Euphorbietum dendroidis* Guinochet in Guinochet & Droineau 1945.

Characteristic and differential species: *Euphorbia dendroides* L., *Chamaerops humilis* L., *Teucrium flavum* L., *Asparagus horridus* L., *Artemisia arborescens* (Vaill.) L., *Ziziphus lotus* (L.) Lam. subsp. *lotus.*

Geographical distribution: This syntaxon is widespread in the Central Mediterranean and in particolar in the Tyrrhenian and Amphiadriatic territories.

Structure and ecology: It groups thermo-xerophilous shrub communities, represented mainly by maquis rich in sclerophylls and deciduos summer species. They are localized within the dry to sub-humid thermomediterranean belt.

Syndynamism: Climatophilous, edaphophilous and sometimes substitution associations are part of this alliance.

47.2.1.1. ***Euphorbietum dendroidis*** Guinochet in Guinochet & Drounieau 1944

Thermo-xerophilous maquis rich in tree spurge, linked to rochy places with lithosoils, within the thermomediterranean belt.

Synonyms: *Oleo-Lentiscetum* subass. *euphorbietosum* Molinier 1954; *Oleo-Euphorbietum dendroidis* Trinajstic 1974; *Oleo-Euphorbietum dendroidis* Trinajstic 1975; *Rhamno alaterni-Euphorbietum dendroidis* Gèhu & Biondi 1997.

Holotypus: Ril. pag. 26, Guinochet & Drounieau (1944).

Characteristic and differential species: *Euphorbia dendroides* L., *Olea europaea* L. subsp. *oleaster* (Hoffmanns. & Link) Negodi.

Phytosociological table: From Brullo & Marcenò (1985), tab. 19, 20 rel.
Char. association: *Euphorbia dendroides* (V), *Olea europaea* subsp. *oleaster* (IV).
Char. alliance: *Chamaerops humilis* (III), *Teucrium flavum* (II), *Artemisia arborescens* (II).

Char. order: *Prasium majus* (IV), *Teucrium fruticans* (IV), *Pistacia lentiscus* (III), *Ceratonia siliqua* (III), *Myrtus communis* (II), *Anagyris foetida* (I), *Asparagus albus* (I).

Char. class: *Asparagus acutifolius* (IV), *Calicotome infesta* (IV), *Daphne gnidium* (II), *Smilax aspera* (II), *Rhamnus alaternus* (II), *Arisarum vulgare* (II), *Rubia peregrina* subsp. *angustifolia* (II), *Osyris alba* (I), *Lonicera implexa* (I), *Ruta chalepensis* (I), *Thamus communis* (I), *Fraxinus ornus* (I), *Cyclamen repandum* (I).

Other species: *Hyparrhenia hirta* (V), *Ampelodesmos mauritanicus* (IV), *Charybdis pancratium* (III), *Bituminaria bituminosa* (III), *Dactylis hispanica* (III).

Geographical distribution: In Sicily it is spread almost everywhere throughout the territory, starting from the coast to the submountain stands (Brullo et al. 1965,2009). A part from the Sicily, it is recorded in the Tyrrhenian area (South Italy, Sardinia, Corsica, Liguria, Provence and Balearic Islands), where it is represented by several subassociations to consider as geographic vicariants (Trinajstic 1974, 1975 a, b, 1984; Trinajstic and Sugar 1977; Gèhu and Biondi, 1997, Brullo et al. 2009, Gianguzzi et al. 2016). They are: a) subass. *typicum* (= *Clematis flammulae-Euphorbietum dendroidis* Gèhu & Biondi 1997; *Oleo-Lentiscetum* subass. *euphorbietosum* Molinier 1954) from Liguria, Provence and Sicily; b) subass. *clematidetosum balearicae* (= *Oleo-Euphorbietum dendroidis* subass. *clematidetosum cirrhosae* Trinajstic 1974; *Clematido balearicae-Euphorbietum dendroidis* Gèhu & Biondi 1997) circumscribed to Balearic Islands; c) subass. *ericetosum arboreae* (= *Erico arboreae-Euphorbietum dendroidis* Gèhu & Biondi 1994) from Corsica and Sicily; d) subass. *rhamnetosum alaterni* (= *Rhamno alaterni-Euphorbietum dendroidis* Gèhu & Biondi 1997, p.p.) distributed in Sardinia and Tyrrhenian slopes of South Italy. Other associations related to *Euphorbietum dendroidis* are *Coronillo emeroidis-Euphorbietum dendroidis* Gèhu & Biondi 1997 (= *Oleo-Euphorbietum dendroidis coronilletosum emeroidis* Trinajstic 1974) with Amphiadriatic distribution, *Periploco angustifoliae-Euphorbietum dendroidis* Brullo, Di Martino & Marcenò 1977 from islands of the Sicily Channel, *Rubio tenuifoliae-Euphorbietum dendroidis* Gèhu, Costa & Uslu 1988 from South-eastern Aegean islands, *Phlomido fruticosae-Euphorbietum dendroidis* Brullo, Guarino, Minissale, Scelsi & Spampinato 2004 from central and southern Aegean territories, *Daphno gnidiodis-Euphorbietum dendroidis* Brullo, Guarino, Minissale, Scelsi & Spampinato 2004 from Eastern and Central Aegean area.

Structure and ecology: Thermo-xerophile maquis linked to rocky places, often of semi-rupestrian type, growing usually on lithosoils represented by compact rocky substrates of various kinds (limestone, calcarenites, gypsum, schists, basalts, etc.). Physiognomically it is differentiated by the dominance of *Euphorbia dendroides*, which is associated with several sclerophylls, such as *Rhamnus alternus*, *Olea europaea* subsp. *oleaster*, *Pistacia lentiscus*, *Prasium majus*, etc. This vegetation, showing its vegetative optimum during the spring-winter period, is distributed within the thermomediterranean with upper dry to lower subumid ombrotype, penetrating also in mesomediterranean one. The vegetation is representated in Sicily by various local subassociations, such as: a) subass. *typicum,* widespread in the Island on various substrata in coastal and hilly places; b) subass. *phlomidetosum fruticosae* Brullo e Marcenò 1985 replaces the subass. *typicum* on gypsium substrata and is distributed in the Agrigento territory; c) subass. *rhamnetosum oleoidis* Brullo e Marcenò 1985 linked to rocky

coastal places with marly, calcarenitic or calcareous substrates affected by a marked edaphic xericity and observed in the Egadi Islands and Agrigento; d) subass. *euphorbietosum bivonae* Gianguzzi, Ilardi e Raimondo 1996 replaces the type on rocky limestone-dolomitic cliffs where it is in contact with the casmophilous communities of the *Dianthion rupicolae*, frequent in the coastal calcareous cliffs near Palermo, Trapani and Sciacca; e) subass. *celtidetosum asperrimae* Marcenò, Romano e Ottonello 2002 corr. with weak xerophilic requirements, linked to calcareous submountain places, occurring in Sicani Mounts; f) subass. *brassicetosum incanae* Castellano & Bazan 2009 linked to submontane semirupestrian calcareous habitats placed at 600-750 m of altitude and showing a more pronounced mesophily compared to the other subassociations, it is rare and localized on the Sicani Mounts.

Syndynamism: It is a thermo-xerophilous maquis showing an essentially edaphophilous role, representing the most mature stage of xerophilous and pioneer series, which are localized on the windy and sunny rocky places. However, it can also have a secondary role colonizing the old abandoned fields or surfaces damaged by landslides or erosion processes.

Habitat reference: F5.5 Thermomediterranean scrub.

47.2.1.2. ***Pistacio lentisci-Chamaeropetum humilis*** Brullo & Marcenò 1985

Thermo-xerophilous coastal maquis dominated by the Mediterranean dwarf palm and rich in mastic, distributed in the thermomediterranean belt.

Synonyms: *Ceratonietum* Molinier & Molinier 1955 p.p.

Holotypus: rel.12, tab. 22, Brullo & Marcenò (1985).

Characteristic and differential species: *Chamaerops humilis* L., *Pistacia lentiscus* L..

Phytosociological table: From Brullo & Marcenò (1985), tab. 22, 20 rel.

Char. association: *Chamaerops humilis* (V), *Pistacia lentiscus* (V).

Char. alliance: *Euphorbia dendroides* (I), *Artemisia arborescens* (I).

Char. order: *Teucrium fruticans* (IV). *Asparagus albus* (III), *Olea europaea* subsp. *oleaster* (III), *Prasium majus* (III), *Ceratonia siliqua* (II), *Phillyrea angustifolia* (I), *Rhamnus oleoides* (I),

Char. class: *Calicotome infesta* (V), *Asparagus acutifolius* (IV), *Rubia peregrina* subsp. *angustifolia* (III), *Smilax aspera* (III), *Rhamnus alaternus* (II), *Arisarum vulgare* (II), *Daphne gnidium* (I).

Other species: *Asphodelus ramosus* (III), *Dactylis hispanica* (III), *Charybdis pancratium* (III), *Cistus salvifolius* (II), *Brachypodium ramosum* (II).

Geographical distribution: The association is recorded mainly from several coastal places of North-western Sicily (Sortino & Giaccone 1968, Brullo & Di Martino 1974. Barbagallo et al. 1979, Brullo & Marcenò 1985, Gianguzzi et al., 1996, Brullo et al 2009), while it is sporadic in the rest of the Island.

Structure and ecology: Shrubby xerophilous maquis, with subalophilous requirements, dominated by *Chamaerops humilis,* linked to rocky coastal environments with carbonatic and calcarenitic substrata. It occurs within the thermomediterranean belt with upper dry to lower subumid ombrotype.

Syndynamism: It is a climatophilous association showing an intermediate position between the halophilous communities of the *Crithmo-Limonion* near the shoreline and the woodland of the *Fraxino orni-Quercion ilicis* towards the inland. Its main aspect of degradation is represented by ephemeral meadows of the *Plantagini-Catapodion balearici* (Barbagallo et al. 1979).

Habitat reference: F5.5 Thermomediterranean scrub.

47.2.1.3. ***Chamaeropo humilis-Sarcopoterietum spinosi*** Barbagallo, Brullo & Fagotto 1979

Thermo-xerophilous coastal maquis dominated by the Mediterranean dwarf palm and rich in thorny burnet, distributed in the thermomediterranean belt

Holotypus: rel. 7, tab. 3, Barbagallo et al. (1979).

Characteristic and differential species: *Chamaerops humilis* L., *Sarcopoterium spinosum* (L.) Spach*, Thymbra capitata* (L.) Cav.

Phytosociological table: From Barbagallo et al. (1979), tab. 3, 22 rel.

Char. association: *Sarcopoterium spinosum* (V), *Thymbra capitata* (V)*.*

Char. alliance: *Chamaerops humilis* (V), *Asparagus horridus* (I).

Char. order: *Pistacia lentiscus* (V), *Prasium majus* (IV), *Asparagus albus* (IV), *Teucrium fruticans* (IV), *Olea europaea* subsp. *oleaster* (II), *Myrtus communis* (II), *Ceratonia siliqua* (I),

Char. class: *Asparagus acutifolius* (V), *Calicotome infesta* (V), *Arisarum vulgare* (IV), *Euphorbia characias* (III), *Pistacia terebinthus* (III), *Daphne gnidium* (I), *Smilax aspera* (I), *Rubia peregrina* subsp. *angustifolia* (I).

Other species: *Asphodelus ramosus* (IV), *Dactylis hispanica* (IV), *Ononis ramosissima* (III), *Reichardia picrodes* (III).

Geographical distribution: The association is circumscribed to the coastal stands of South-eastern Sicily, between Capo Passero and Augusta, occurring also in the inland of the eastern part of the Hyblaean Plateau (Barbagallo et al. 1979, Bartolo et al. 1982; Brullo et al. 1998, Raimondo et al. 1990).

Structure and ecology: It is a dwarf shrubland dominated by small pulvines of *Sarcopoterium spinosum* and *Thymbra capitata*, usually associated to *Chamaerops humilis*. It is spread along

the shoreline on calcareous substrates in arid rock places, where it shows its optimum vegetative. Sometimes it occurs also in the inland, often on Tertiary basalts, where it represents a degradation stage of the bushland or woodlands. This vegetation is distributed within the themomedierranean belt with lower dry to lower subhumid ombrotype..

Syndynamism: Nelle stazioni costiere questa formazione assume un ruolo edafofilo a carattere permanente occupando una fascia intermedia tra il *Crithmo-Limonion* e la macchia alta climatofila, come ad esempio il *Myrto communis-Pistacietum lentisci*. In zone interne l'associazione svolge invece un ruolo prevalentemente secondario, quale aspetto di sostituzione della macchia.

Habitat reference: F5.5 Thermomediterranean scrub.

47.2.1.4. ***Asparago pastoriani-Chamaeropetum humilis*** Raimondo & Bazan 2008

Thermo-xerophilous coastal maquis dominated by the Mediterranean dwarf palm and rich in Pastor asparagus, distributed in the thermomediterranean belt.

Holotypus: rel. 1, tab. 1, Raimondo & Bazan (2008).

Characteristic and differential species: *Chamaerops humilis* L.*:, Asparagus pastorianus* Webb. & Berth.

Phytosociological table: From Raimondo & Bazan (2008), tab. 1, 12 rel.

Char. association: *Asparagus pastorianus* (V).

Char. alliance: *Chamaerops humilis* (V).

Char. order: *Prasium majus* (V), *Teucrium fruticans* (V), *Olea europaea* subsp. *oleaster* (I), *Pistacia lentiscus* (I).

Char. class: *Asparagus acutifolius* (V), *Arisarum vulgare* (V), *Calicotome infesta* (III), *Rubia peregrina* subsp. *angustifolia* (II).

Other species: *Oxalis pes-caprae* (V), *Lotus biflorus* (V), *Ampelodesmos mauritanicus* (V), *Carlina sicula* (V), *Hyparrhenia hirta* (V), *Thapsia garganica* (V), *Asphodelus ramosus* (V).

Geographical distribution: This vegetation occurs along the coast of southern Sicily, in particular between Selinunte and the mouth of the river Verdura.

Structure and ecology: It is a very peculiar dwarf maquis characterized by *Chamaerops humilis* associated to *Asparagus pastorianus*. This association with remarkable thermo-xerophilous requirement is localized on coastal stands constitutes by calcarenites and sandy clays of Pleistocene origin. Currently, due to anthropic pressure it shows a fragmented distribution within the dray thermomedietrranean belt.

Syndynamism: Similarly to other coastal associations physiognomically dominated by

Chamaerops humilis occurring in Sicily, as *Pistacio lentisci-Chamaeropetum humilis* and *Chamaeropo humilis-Sarcopoterietum spinosi*, this one also plays a climatophilous role localizing a belt interposed between the halophilous communities of *Crithmo-Limonietea* typical of the rocky shoreline and the thermophilous woods of *Quecetalia ilicis* of the inland. Its main aspect of degradation is represented by ephemeral meadows of the Plantagini-Catapodion balearici

Habitat reference: F5.5 Thermomediterranean scrub.

47.2.1.5. ***Myrto communis-Pistacetum lentisci*** (Molinier 1954) Rivas-Martínez 1975

Thermophilous coastal maquis dominated by the common myrtle and mastic, distributed in the thermomediterranean belt

Synonyms: *Oleo-Lentiscetum provinciale* Molinier 1954; *Myrto-Lentiscetum* (Molinier 1954 em. O. Bolòs 1962) Rivas-Martinez 1975.

Lectotypus: rel. 22, tab. 1, Molinier (1954).

Characteristic and differential species: *Myrtus communis* L., *Pistacia lentiscus* L.

Phytosociological table: From Bartolo et al (1982), tab. 25, 13 rel.

Char. association: *Myrtus communis* (V).

Char. alliance: *Chamaerops humilis* (V), *Asparagus horridus* (II).

Char. order: *Pistacia lentiscus* (V), *Prasium majus* (IV), *Olea europaea* subsp. *oleaster* (IV). *Phillyrea angustifolia* (IV), *Ceratonia siliqua* (I).

Char. class: Asparagus acutifolius (V), Rubia peregrina subsp. angustifolia (V), Smilax aspera (V), *Lonicera implexa* (III), *Calicotome infesta* (III), *Daphne gnidium* (II), *Phillyrea latifolia* (II), *Arisarum vulgare* (II).

Other species: *Thymbra capitata* (V), *Thymelaea hirsuta* (V), *Teucrium capitatum* (IV), *Dactylis hispanica* (IV), *Phagnalon rupestre* (IV), *Cistus monspeliensis* (III), *Daucus carota* (III), *Fumana thymifolia* (III).

Geographical distribution: The association shows a typical Tyrrhenian distribution, with its greater diffusion along the Catalan-Provençal coasts. In Sicily it occurs in the Hyblaean coasts (Bartolo et al., 1982, Turrisi et al., 2002, Raimondo et al., 1990, Brullo et al., 1998) and Tyrrhenian slope (Gianguzzi 1999b, Traina and Marcenò, 2001).

Structure and ecology: High-shrubby maquis (up to 4-5 m), often very dense and impenetrable due to the richness of lianas and sclerophylls, localized on marly or calcareous substrates mainly in coastal stands. It is characterized by a certain mesophily, if compared with the other associations of this alliance, as evidenced by the occurrence and abundance of *Myrtus communis*, tendentially subhygrophilous shrub. This vegetation is spread within the

thermomediterranean belt with lower dry to upper subhumid ombrotype. For the Ionic slope of South Sicily, Costanzo & Tomaselli (1998) describe a subass. *arbutetosum unedonis*, differentiated from the more xeric subass, *typicum* by *Arbutus unedo*. This maquis occurs on marly substrata of valleys potentially occupied by the pinewoods of *Thymo capitati-Pinetum halepensis*, where it tends to localize in stands with edaphic conditions more mesic than the surrounding surfaces.

Syndynamism: Climatophilous maquis widespread on windy coastal environments, affected by sea aerosol, showing catenal contact with garrigues and halophilous community of *Crithmo-Limonietea*. In the inland places it often assumes an edapho-xerophilous role localizing in habitats with more mesic microclimates.

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral.

47.2.1.6. ***Teucrio fruticantis-Rhamnetum alaterni*** Brullo, Minissale, Scelsi & Spampinato 1993

Thermo-xerophilous maquis with secondary origin, dominated by the shrubby germander and Italian buckthorn, distributed in the thermomediterranean belt.

Holotypus: rel. 1, tab. 2, Brullo *et al.*(1993).

Characteristic and differential species: *Teucrium fruticans* L.*, Rhamnus alaternus* L.

Phytosociological table: From Brullo et al. (1993), tab. 2, 6 rel.

Char. association: *Teucrium fruticans* (V), *Rhamnus alaternus* (V).

Char. alliance: *Teucrium flavum* (V), *Chamaerops humilis* (IV).

Char. order: *Prasium majus* (V), *Ceratonia siliqua* (V), *Olea europaea* subsp. *oleaster* (V), *Myrtus communis* (V).

Char. class: *Calicotome infesta* (V), *Euphorbia characias* (V), *Asparagus acutifolius* (IV), *Melica arrecta* (IV), *Rubia peregrina* subsp. *angustifolia* (IV), *Daphne gnidium* (IV), *Rosa sempervirens* (II).

Other species: *Ampelodesmos mauritanicus* (V), *Acanthus mollis* (V), *Hypericum perfoliatum* (V), *Asphodelus ramosus* (III), *Cistus creticus* (III).

Geographical distribution: Very rare association known only for few localities of the Hyblaean territory in southern Sicily (Brullo et al., 1993; Turrisi et al., 2002)

Structure and ecology: High-shrub maquis of pre-forestal kind, dominated by *Rhamnus alaternus*, *Teucrium fruticans* and *Pistacia lentiscus*, occurring on calcareous outcrops facing north, limitedly to rather rocky and not very sunny stands. It is locale within the upper dry thermomediterranean belt.

Syndynamism: This is an secondary vegetation mainly linked to the degradation of the holm oak of the *Pistacio lentisci-Quercetum ilicis*.

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral.

47.2.1.7. ***Rhamno oleoidis-Pistacietum lentisci*** Minissale, Musumarra & Sciandrello 2006

Calcicolous thermo-xerophilous maquis with secondary origin, dominated by mastic and rich in black buckthorn, distributed in the upper thermomediterranean belt with upper dry ombrotype.

Holotypus: rel.6, tab.2, Minissale et al. (2006).

Characteristic and differential species: *Rhamnus oleoides* L., *Pistacia lentiscus* L.

Phytosociological table: From Minissale et al. (2006), tab. 2, 20 rel.

Char. association: *Rhamnus oleoides* (IV).

Char. alliance: *Chamaerops humilis* (IV), *Teucrium flavum* (III).

Char. order: *Pistacia lentiscus* (V), *Teucrium fruticans* (V), *Prasium majus* (III), *Olea europaea* subsp. *oleaster* (III), *Phillyrea angustifolia* (II), *Anagyris foetida* (I),

Char. class: *Asparagus acutifolius* (V), *Phillyrea latifolia* (V), *Daphne gnidium* (IV), *Lonicera implexa* (IV), *Rubia peregrina* subsp. *angustifolia* (III), *Smilax aspera* (II), *Arisarum vulgare* (II), *Euphorbia characias* (I), *Quercus suber* (I).

Other species: *Ampelodesmos mauritanicus* (V), *Cistus creticus* (IV), *Thymbra capitata* (IV), *Micromeria graeca* (IV), *Phagnalon saxatilis* (IV), *Charybdis pancratium* (IV), *Cistus monspeliensis* (IV), *Erica multiflora* (IV).

Geographical distribution: This maquis is recorded from some localities of central-southern Sicily, such as near Caltagirone, Castelvetrano and Mazzarino (Minissale et al. 2006; Bazan et al 2006; Pasta et al. 2008).

Structure and ecology: Thermo-xerophilous shrubland occurring on calcareous outcrops of hilly stands, where it likes not very sloping surfaces. It is characterized by the dominance of *Pistacia lentiscus*, usually associated to *Rhamnus oleoides* and several other schlerophylls, localizing within the upper thermomediterranean belt with upper dry ombrotype.

Syndynamism: This association can be considered as a secondary vegetation linked to degradation processes of the *Pistacio lentisci-Quercetum ilicis*.

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral.

47.2.1.8. ***Ephedro fragilis-Lycetum europaei*** Brullo & Marcenò 1985

Thermo-subnitrophilous maquis with secondary origin, dominated by the box-thorn and joint pine,, distributed in the thermomediterranean belt.

Holotypus: rel. 4, tab. 24, Brullo e Marcenò (1985).

Characteristic and differential species: *Ephedra fragilis* Desf.*, Lycium europaeum* L.

Phytosociological table: From Brullo & Marcenò (1985), tab. 24, 6 rel.
Char. association: *Ephedra fragilis* (V), *Lycium europaeum* (V).
Char. alliance: *Chamaerops humilis* (IV).
Char. order: *Teucrium fruticans* (V), *Prasium majus* (IV), *Asparagus albus* (IV), *Pistacia lentiscus* (IV), *Olea europaea* subsp. *oleaster* (III), *Myrtus communis* (II).
Char. class: *Asparagus acutifolius* (V), *Arisarum vulgare* (V), *Smilax aspera* (V), *Rubia peregrina* subsp. *angustifolia* (V), *Calicotome infesta* (IV), *Calicotome infesta* (IV), *Osyris alba* (III), *Daphne gnidium* (II).
Other species: *Dittrichia viscosa* (V), *Oryzopsis miliacea* (IV), *Ferula communis* (IV), *Salsola oppositifolia* (III), *Micromeria graeca* (III), *Rosmarinus officinalis* (III), *Cistus salvifolius* (III).

Geographical distribution: It is recorded from the territory of Caltagirone, in particular in stands near Santo Pietro (Brullo and Marcenò, 1985; Brullo, Minissale and Siracusa, 1998), where due to the remarkable anthropization of thia area, it is quite rare.

Structure and ecology: Sub-nitrophilous shrubby vegetation dominated by *Ephedra fragilis, Chamaerops humilis* and *Lycium europaeum*, linked to marly-clayey substrates, usually slightly inclined. It occurs within the Upper dry thermomediterranean belt.

Vegetazione arbustiva a carattere sub-nitrofilo a dominanza di *Ephedra fragilis, Chamaerops humilis* e *Lycium europaeum*, tipica di substrati marnoso-argillosi, in stazioni a scarsa pendenza. Termomediterraneo secco superiore.

Syndynamism: It constitutes a secondary vegetation linked to the processes of colonization of the calanchive areas in correspondence of little inclined surfaces.

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral.

47.2.1.9. ***Asparago acutifolii-Ziziphetum loti*** Gianguzzi, Ilardi & Raimondo 1996

Thermo-subhalophilous maquis, dominated by jujube, distributed in the thermomediterranean belt.

Holotypus: rel. 4, tab. 4, Gianguzzi *et al.* (1996).

Characteristic and differential species: *Ziziphus lotus* (L.) Lam. subsp*. lotus*.

Phytosociological table: From Gianguzzi et al. (1996), tab. 4, 6 rel.
Char. association: *Ziziphus lotus* subsp. *lotus* (V).
Char. alliance: *Artemisia arborescens* (II).
Char. order: *Olea europaea* subsp. *oleaster* (II), *Asparagus albus* (I).
Char. class: *Arisarum vulgare* (V), *Asparagus acutifolius* (IV), *Rubia peregrina* subsp. *angustifolia* (IV), *Smilax aspera* (II), *Osyris alba* (I), *Rhamnus alaternus* (I), *Pistacia terebinthus* (I). *Ruta chalepensis* (I).
Other species: *Silene vulgaris* subsp. *angustifolia* (V), *Carlina sicula* (V), *Sixalis maritima* (IV), *Convolvulus altheoides* (IV), *Dactylis hispanica* (IV), *Parietaria judaica* (III).

Geographical distribution: It is a rare vegetation restricted to a small coastal area between l'Addaura and l'Arenella (Palermo) where it is very localized (Gianguzzi *et al.* 1996).

Structure and ecology: This shrubby vegetation is dominated by *Ziziphus lotus,* a rare thermo-xerophilous species with a North-African, Iberian and Middle East distribution. This community shows subnitrophilous requirements, occurring on calcareous flat surfaces near the sea, at altitudes between 5 and 75 m a.s.l., within the thermomediterranean belt with lower sub-humid ombrotype.

Syndynamism: This vegetation belongs to a subhalophilous series, having catenal contact towards the sea with the *Crithmo-Limonietea* communities and inwards with the holm oak woods of *Quercion ilicis*.

Habitat reference: F5.5 Thermomediterranean scrub.

47.2.1.10. ***Chamaeropo humilis-Quercetum calliprini*** Brullo & Marcenò 1985

Thermo-xerophilous woodland, dominated by Palestine oak and Mediterranean dwarf palm, distributed in the thermomediterranean belt.

Synonyms: Aggr. a *Quercus calliprinos* Brullo & Ronsisvalle 1975; *Calicotomo infestae-Quercetum calliprini* Minissale & Sciandrello 2013 subass. *typicum*.

Holotypus: rel. 3, tab.23, Brullo & Marcenò (1985).

Characteristic and differential species: *Quercus calliprinos* Webb, *Chamaerops humilis* L., *Galium litorale* Guss*.*

Phytosociological table: From Brullo & Marcenò (1985), tab. 23, 16 rel.
Char. association: *Quercus calliprinos* (V), *Galium litorale* (III).
Char. alliance: *Chamaerops humilis* (V), *Teucrium flavum* (I).

Char. order: *Pistacia lentiscus* (V), *Rhamnus oleoides* (V), *Teucrium fruticans* (V), *Prasium majus* (V), *Olea europaea* subsp. *oleaster* (III), *Asparagus albus* (III), *Anagyris foetida* (I), *Phillyrea angustifolia* (I), *Clematis cirrhosa* (I).

Char. class: *Asparagus acutifolius* (IV), *Rubia peregrina* subsp. *angustifolia* (III), *Calicotome infesta* (III), *Phillyrea latifolia* (III), *Osyris alba* (III), *Daphne gnidium* (II), *Smilax aspera* (II), *Quercus ilex* (II), *Arisarum vulgare* (I), *Carex distachya* (I), *Lonicera implexa* (I).

Other species: *Cistus creticus* (IV), *Dactylis hispanica* (IV), *Charybdis pancration* (IV), *Brachypodium retusum* (IV), *Thymbra capitata* (III), *Micromeria graeca* (III), *Ampelodesmos mauritanicus* (III), *Eryngium bocconei* (III).

Geographical distribution: Western and southern Sicily, where it occurs in a very fragmentary way. In particular, it is recorded from Monte Catalfano (Marcenò & Raimondo, 1972) Capo Rama (La Mantia & Gianguzzi, 1999), between Trapani and Selinunte (Brullo and Ronsisvalle, 1975; Brullo and Marcenò, 1985; Ottonello et al., 1991), Capo Passero (La Mantia & Gianguzzi, 2002) and Acate (Minissale & Sciandrello 2013, sub *Calicotomo infestae-Quercetum calliprini typicum*).

Structure and ecology: It is a woodland with canopy dominated by *Quercus calliprinos*, which is usually associated with *Chamaerops umilis*. It is frequent in markedly xeric habitats, occurring along the coastal stands, often penetrating considerably towards the inland. It likes calcarenitic or calcareous substrates, within the lower sub-humid Mediterranean belt.

Syndynamism: It represents a well-structured and evolved climatophilous vegetation, that occupies a belt between the coast and the 250-300 m of altitude. In fresher and shady habitats it tends to be replaced by holm oak woodlands.

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral

47.2.1.11. ***Pyro amygdaliformis-Calicotometum infestae*** Gianguzzi & La Mantia 2008

Thermo-xerophilous maquis, dominated by almond-leaf pear and hairy thorny broom, distributed in the thermomediterranean belt.

Holotypus: rel. 6, tab. 3, Gianguzzi & La Mantia (2008),

Characteristic and differential species: *Pyrus spinosa* Forssk. (=*Pyrus amygdaliformis* Vill.)*, Calicotome infesta* (C.Presl) Guss..

Phytosociological table: From Gianguzzi & La Mantia (2008), tab. 3, 8 rel.

Char. association: *Pyrus spinosa* (V), *Calicotome infesta* (V).

Char. alliance: *Euphorbia dendroides* (III), *Chamaerops humilis* (I).

Char. order: *Asparagus albus* (IV), *Prasium majus* (III), *Olea europaea* subsp. *oleaster* (I), *Pistacia lentiscus* (I), *Teucrium fruticans* (I).

Char. class: *Ruta chalepensis* (V), *Asparagus acutifolius* (IV), *Arisarum vulgare* (IV), *Rubia peregrina* subsp. *angustifolia* (IV), *Daphne gnidium* (II), *Smilax aspera* (II), *Rosa sempervirens* (I),.

Other species: *Brachypodium ramosum* (IV), *Charybdis pancratium* (IV), *Dactylis hispanica* (III), *Aphodeline lutea* (III), *Foeniculum piperitum* (II).

Geographical distribution: The association is quite widespread especially along the coastal and hilly slopes of the western Sicily (Gianguzzi & La Mantia 2008, Brullo et al. 2009).

Structure and ecology: Shrubby vegetation dominated by *Calicotome infesta*, linked to calcareous-dolomitic substrates, very steep and rocky with superficial soils, due to the erosion processes. It is localized within the dry lowe and upper thermomediterraneo belt.

Syndynamism: It constitutes a secondary commmunity within the area potentially occupied by the thermophilous woodlands of the *Fraxino orni-Quercion ilicis*, such as *Pistacio-Quercetum ilicis* and *Oleo-Quercetum virgilianae*, mainly on very degraded substrates due to an intense and prolonged anthropic pressure.

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral.

47.2.1.12. ***Salvio fruticosae-Phlomidetum fruticosae*** Barbagallo, Brullo & Fagotto 1979

Thermophilous shrubland, dominated by Greek sage and Jerusalem sage, distributed in the thermomediterranean belt.

Holotypus: rel. 6, tab. 2, Barbagallo *et al.* (1979).

Characteristic and differential species: *Salvia fruticosa* Mill., *Phlomis fruticosa* L.

Phytosociological table: From Brullo & Marcenò (1985), tab. 2, 12 rel.

Char. association: *Salvia fruticosa* (V), *Phlomis fruticosa* (V).

Char. alliance: *Euphorbia dendroides* (V), *Teucrium flavum* (III), *Chamaerops humilis* (II).

Char. order: *Prasium majus* (V), *Teucrium fruticans* (V), *Pistacia lentiscus* (IV), *Olea europaea* subsp. *oleaster* (IV), *Ceratonia siliqua* (III), *Asparagus albus* (III), *Phillyrea angustifolia* (I), *Clematis cirrhosa* (I).

Char. class: *Asparagus acutifolius* (V), *Ruta chalepensis* (V), *Calicotome infesta* (V), *Osyris alba* (IV), *Rhamnus alaternus* (IV), *Pistacia terebinthus* (IV), *Daphne gnidium* (IV), *Rubia peregrina* subsp. *angustifolia* (III), *Smilax aspera* (II), *Pyrus spinosa* (II), *Euphorbia characias* (I), *Phillyrea latifolia* (I), *Pulicaria odora* (I), *Carex halleriana* (I), *Cyclamen hederifolium* (I).

Other species: *Dactylis hispanica* (IV), *Micromeria graeca* (III), *Asphodelus ramosus* (III), *Galium corrudifolium* (III), *Daucus carota* (III), *Phagnalon saxatile* (III), *Sarcopoterium spinosum* (II).

Geographical distribution: It is mainly distributed in the Hyblaean area (South Sicily) in hill stands of inland (Barbagallo et al. 1979, Brullo & Marcenò 1985, Fichera et al. 1998, Brullo et al. 1993, Brullo et al. 1998).

Structure and ecology: Shrubby vegetation dominated by *Salvia fruticosa* and *Phlomis fruticosa*, East Mediterranean species, which is linked to calcareous substrata. It occurs mainly in quite fresh and not very sunny stands, within lower subhumid thermomediterranean belt.

Syndynamism: It is mainly a secondary association linked to the degradation processes of the woodlands of the *Doronico orientalis-Quercetum ilicis* or the *Oleo-Quercetum virgilianae.* The typical aspect corresponds to the subass. euphorbietosum dendroidis, while the semirupestrian was referred by Barbagallo et al. (1979) to the subass. *thymetosum capitati* represents a garigue that can be ascribed to *Cisto-Micromerietea* rather than *Oleo-Ceratonion*.

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral.

47.2.1.13. ***Calicotomo infestae-Juniperetum turbinatae*** Brullo, Gianguzzi & La Mantia 2009

Thermo-xerophilous maquis, dominated by Phoenician juniper rich in hairy thorny broom, distributed in the thermomediterranean belt.

Synonyms: *Calicotomo infestae-Quercetum calliprini* Minissale & Sciandrello 2013 subass. *juniperetosum turbinatae* Minissale & Sciandrello 2013.

Holotypus: rel. 7, tab. 3d, Brullo et al. (2009).

Characteristic and differential species: *Juniperus turbinata* Guss., *Calicotome infesta* (C.Presl) Guss.

Phytosociological table: From Brullo et al. (2009), tab. 3d, 7 rel.

Char. association: *Juniperus turbinata* (V), *Calicotome infesta* (IV).

Char. alliance: *Chamaerops humilis* (III), *Euphorbia dendroides* (III).

Char. order: *Pistacia lentiscus* (V), *Olea europaea* subsp. *oleaster* (IV), *Ephedra fragilis* (III), *Teucrium fruticans* (II), *Prasium majus* (II), *Asparagus albus* (I), *Myrtus communis* (I), *Ceratonia siliqua* (I).

Char. class: *Asparagus acutifolius* (IV), *Phillyrea latifolia* (III), *Rubia peregrina* subsp. *angustifolia* (II), *Dioscorea communis* (I), *Lonicera implexa* (I), *Rhamnus alaternus* (I).

Other species: *Salsola oppositifolia* (III), *Thymelaea hirsuta* (III), *Thymbra capitata* (III), *Capparis spinosa* (III), *Ampelodesmos mauritanicus* (III).

Geographical distribution: The association can be considered as a central-southern Mediterranean vicariant of the *Oleo-Juniperetum turbinatae*, described sub *Oleo-Juniperetum phoeniceae* by Arrigoni et al. (1989) from Sardinia. This maquis is currently very fragmented

and reduced to small relict flaps along the coastal stands of western and southern Sicily. Examples of this vegetation, previously attributed to *Oleo-Juniperetum turbinatae*, were recorded from Alcamo Marina, Capo Bianco and Torresalsa, Cava Randello (Turrisi et al. 2002, La Mantia, 2003, Giusso et al. 2008), as well as those ones described as *Calicotomo infestae-Quercetum calliprini* subass. *juniperetosum turbinatae* by Minissale & Sciandrello 2013 from Acate. Basing on the rel. published by Mercurio & Spampinato (1999) and Brullo et al. (2001), it occurs also in Calabria.

Structure and ecology: It is a thermophilous maquis dominated by *Juniperus turbinata*, linked to more or less rocky substrata, which are represented by mainly calcarenites or calcareous-marls. It is mainly localized on hilly stands near the coast, within the dry lower to upper thermomediterranean belt.

Syndynamism: It can be considered an edaphophilous vegetation linked to poorly evolved soils, mainly due to the nature of the substrate and their marked acclivity.

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral.

47.2.1.14. ***Hippocrepido emeri-Bupleuretum fruticosi*** Brullo, Miniss., Scelsi & Spamp. 1993

Mesophilous semi-rupestrian shrubland, dominated by shrubby hare's-ear and rich in scorpion senna., distributed in the thermomediterranean to mesomediterranean belt with upper subhumid to humid ombrotype.

Synonyms: *Spartio juncei-Bupleuretum fruticosi* Raimondo & Ilardi 2009.

Holotypus: rel. 2, tab. 1, Brullo et al. (1993).

Characteristic and differential species: *Bupleurum fruticosum* L. *, Emerus major* Mill. subsp. *major* (=*Hippocrepis emerus*(L.) Lassen subsp. *emerus*).

Phytosociological table: From Brullo et al. (1993), tab. 1, 6 rel.

Char. association: *Bupleurum fruticosum* (V)*, Emerus major* subsp. *major* (V).

Char. alliance: *Teucrium flavum* (V)*, Chamaerops humilis* (I).

Char. order: *Prasium majus* (V), *Anagyris foetida* (I).

Char. class: *Ruscus aculeatus* (V), *Asparagus acutifolius* (V), *Osyris alba* (V), *Smilax aspera* (V), *Euphorbia characias* (V), *Dioscorea communis* (V), *Melica arrecta* (IV), *Rhamnus alaternus* (IV), *Pistacia terebinthus* (III), *Aplenium onopteris* (III), *Rosa sempervirens* (III), *Quercus ilex* (II), *Fraxinus ornus* (II), *Lonicera etrusca* (II), *Rubia peregrina* subsp. *angustifolia* (I), *Phillyrea latifolia* (I), *Lonicera implexa* (I).

Other species: *Acanthus mollis* (V), *Rubus ulmifolius* (V), *Hedera helix* (V), *Pteridium*

aquilinum (V), *Silene italica* (V), *Arum italicum* (IV).

Geographical distribution: This vegetation was recorded along some Hyblaean valleys by Brullo et al. (1993, 1998), as well as on the Tyrrhenian slopes of the Nebrodi and Peloritan mountains (Brullo et al. 2009). In this association must be included the *Spartio junceiBupleuretum fruticosi* described by Raimondo & Ilardi (2009) from northern Sicily.

Structure and ecology: Sciaphilous mesophilous shrubland, physiognomically dominated by *Bupleurum fruticosum* and *Emerus major* subsp. *major*, typical of fresh and shady semi-rupestrian stands. It is usually spread along the steep slopes of the rivers or on sides facing north, from sea level to about 900 m of elevation, where is localizzed on various rocky substrata. As concerns the bioclimate, it occurs within the thermomediterranean to mesomediterranean belt with upper subhumid to humid ombrotype.

Syndynamism: In primary habitats it assumes the role of permanent community, localizing into climatophilous evergreen oak woods.

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral.

47.2.1.15. ***Calicotomo villosae-Artemisietum arborescentis*** Ferro 2005

Thermo-xerophilous shrubland, dominated by tree wormwood and hairy thorny broom, distributed in the thermomediterranean belt.

Holotypus: rel. 10, tab. 1, Ferro (2005).
Characteristic and differential species: *Artemisia arborescens* L., *Calicotome villosa* (Poir.) Link

Phytosociological table: From Ferro (2005), tab. 1, 10 rel.
Char. association: *Calicotome villosa* (IV).
Char. alliance: *Artemisia arborescens* (V), *Euphorbia dendroides* (I).
Char. order: *Pistacia lentiscus* (III).
Char. class: *Asparagus acutifolius* (IV), *Daphne gnidium* (II).
Other species: *Spartium junceum* (IV), *Dactylis glomerata* (III), *Hyparrhenia hirta* (III), *Brachypodium ramosum* (III), *Ferula communis* (III), *Cistus salvifolius* (II), *Teline monspessulana* (I), *Cistus eriocephalus* (I), *Rubus ulmifolium* (I), *Genista tyrrhena* subsp. *tyrrhena* (I).

Geographical distribution: This vegetation is described from the Aeolian Islands in northern Sicily (Ferro 2005).

Structure and ecology: Shrubby vegetation with markedly pioneer characters, which colonizes the abandoned fields and of very steep slopes with incoherent little evolved soils,

spread from the sea level up to 400-500 m of altitude in arid stands. Exemples of this community can be observed in the terraced areas previously cultivated and now abandoned for many years. It occurs also in primary habitats characterized by a considerable acclivity, where the evolutionary processes are blocked . From the physiognomic point of view, it is differentiated by the dominance of *Artemisia arborescens* and *Calicotome villosa*, which are generally accompanied by a rather poor set of small shrubs. It seems developped mainly within the upper dry thermomediterranean belt

Syndynamism: It usually constitutes an intermediate stage between the grasslands with *Brachypodium ramosum* and the holm oaks of the *Erico arboreae-Quercetum ilicis*. This vegetation is often in contact with the shrublands of the Genistetum tyrrheniae, association of the *Cisto-Micromerietea* (Bartolo et al. 1990).

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral.

47.2.1.16. ***Asparago albi-Artemisietum arborescentis*** Gianguzzi, Cuttonaro, Cusimano & Romano 2016

Thermo-xerophilous subnitrophilous shrubland, dominated by tree wormwood and white asparagus, distributed in the thermomediterranean belt.

Holotypus: rel. 2, tab. 6, Gianguzzi et al. (2016)

Characteristic and differential species: *Artemisia arborescens* L., *Asparagus albus* L.

Phytosociological table: From Gianguzzi et al. (2016), tab. 6, 8 rel.
Char. association: *Artemisia arborescens* (V), *Asparagus albus* (V).
Char. alliance: *Euphorbia dendroides* (IV), *Chamaerops humilis* (I).
Char. order: *Prasium majus* (III), *Anagyris foetida* (I).
Char. class: *Ruta chalepensis* (IV), *Asparagus acutifolius* (II), *Osyris alba* (II), *Rubia peregrina* subsp. *angustifolia* (I), *Rosa sempervirens* (I).
Other species: *Oryzopsis miliacea* (V), *Bituminaria bituminosa* (IV), *Ferula communis (*IV), *Asphodelus ramosus* (IV), *Foeniculum piperitum* (IV), *Mercurialis annua* (IV), *Dactylis hispenica* (III), *Ampelodesmos mauritanicus* (II).

Geographical distribution: It occurs in some places of the central-southern part of Sicily (Gianguzzi et al. 2016).

Structure and ecology: Sub-nitrophilous shrubland dominated by *Artemisia arborescens*, linked to xeric habitats affected by anthropic pressure. Usually, it colonizes the rocky outcrops, represented by limestones, marls or calcarenites, mainly on the slopes charaterized by rather incoherent and rich in debris. It is distributed within the thermo-mesomediterranean belt with dry to subhumid ombrotype.

Syndynamism: This vegetation with marked pioneer characters plays a secondary role since closely correlated to degradation processes of the termophilous woodlands of *Quercetea ilicis*. It shows catenal contact with xeric geoseries linked to rocky habitats.

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral.

47.2.1.17. ***Ampelodesmo mauritanici-Juniperetum turbinatae*** Gianguzzi, Ilardi, Caldarella, Cusimano, Cuttonaro & Romano 2012

Rupestrian juniper woods with basiphilous requirements, dominated by Phoenicean juniper and rich in Mauritania vinereed , distributed in the thermomediterranean belt.

Synonyms: *Oleo-Juniperetum turbinatae* Caneva et al. 2004 non Arrigoni, Bruno, De Marco & Veri 1985 in De Marco et al., 1985 corr. Biondi & Mossa 1992.

Holotypus: rel. 15, tab. 1, Caneva et al. (2004).

Characteristic and differential species: *Juniperus turbinata* Guss., *Ampelodemos mauritanicus* (Poir.) T.Durand & Schinz, *Emerus major* subsp. *emeroides* (Boiss. & Spruner) Soldano & F. Conti.

Phytosociological table: From Gianguzzi et al. (2012), tab. 7, 9 rel.

Char. association: *Juniperus turbinata* (V), *Ampelodemos mauritanicus* (V) *Emerus major* subsp. *emeroides* (I).

Char. alliance: *Teucrium flavum* (III)*, Euphorbia dendroides* (II).

Char. order: *Pistacia lentiscus* (V), *Prasium majus* (IV), *Olea europaea* subsp. *oleaster* (IV).

Char. class: *Phillyrea latifolia* (V), *Asparagus acutifolius* (IV), *Arbutus unedo* (III), *Cyclamen hederifolium* (II), *Lonicera implexa* (I), *Rubia peregrina* subsp. *angustifolia* (I), *Quercus ilex* (I), *Pistacia terebinthus* (I),

Other species: *Charybdis pancration* (V), *Cistus creticus* (V), *Fumana laevipes* (V), *Micromeria graeca* (V), *Erica multiflora* (V), *Sedum sediforme* (IV), *Asphodelus ramosus* (IV), *Hyparrhenia hirta* (III) *Allium subhirsutum* (III).

Geographical distribution: In Sicily it occurs in the Sicanian Mounts and in particular along the Sosio River (Gianguzzi et al. 2012).

Structure and ecology: Maquis dominated by *Juniperus turbinata* occurring exclusively on the top of high calcareous outcrops, where colonize the southern faces at an altitude of 300-400 m a.s.l. In this rupestrian association are frequent several shrubs mixed to some chasmophytes of *Asplenitea trichomanis*. Because of the extremely steep conditions of the surfaces, a possible evolution towards denser and more mature communities is clearly precluded. It is a vegetation very rare localized within the thermomediterranean belt with subhumid ombrotype. According to Gianguzzi et al. (2012), this association is represented by

a subass. *myrtetosum communis* and a subass. *cistetosum cretici*, which can be considered as two geographic vicariants. The first one is distributed in the Tyrrhenian coasts of Basilicata and Calabria, while the second one is exclusive of Sicily.

Syndynamism: It is an edapho-xerophilous maquis linked to calcareos rocky places in serial contact with a rupestrian geosigmetum of the *Dianthion rupicolae*.

Habitat reference: G3.9b Mediterranean Cupressaceae woodland.

47.2.1.18. ***Cisto salviifolii-Calicotometum infestae*** Sciandrello, D'Agostino & Minissale 2013

Thermo-acidophilous shrubland, dominated by hairy thorny broom, distributed in the mesomediterranean belt.

Holotypus: rel. 4, tab. 2, Sciandrello et al. (2013)

Characteristic and differential species: *Calicotome infesta* (C. Presl) Guss., *Cistus salvifolius* L.

Phytosociological table: From Sciandrello et al. (2013), tab. 2, 15 rel.

Char. association: *Cistus salvifolius* (V), *Calicotome infesta* (V).

Char. alliance: *Euphorbia dendroides* (II).

Char. order: *Olea europaea* subsp. *oleaster* (III), *Prasium majus* (II), *Asparagus albus* (I), *Bupleurum fruticosum* (I).

Char. class: *Erica arborea* (III), *Rhamnus alaternus* (III), *Asparagus acutifolius* (III), *Arisarum vulgare* (II), *Euphorbia characias* (II), *Quercus ilex* (II), *Ruta chalepensis* (I), *Rubia peregrina* subsp. *angustifolia* (I), *Pyrus spinosa* (I), *Daphne gnidium* (I), *Pistacia terebinthus* (I), *Quercus congesta* (I), *Quercus virgiliana* (I), *Fraxinus ornus* (I), *Cyclamen hederifolium* (I).

Other species: *Ampelodesmos mauritanicus* (V), *Micromeria graeca* subsp. *consentina* (V), *Dactylis hispanica* (V), *Ferula communis* (IV), *Carlina hispanica* subsp. *globosa* (IV), *Phagnalon saxatile* (IV).

Geographical distribution: It is recorded from Taormina territory in the Peloritani range (Sciandrello et al. 2013).

Structure and ecology: Dense shrubby vegetation characterized by the dominance of *Calicotome infesta*, growing on metamorphic substrata mainly on very steep scope. It occurs at an altitude of 100-750 m, within the subhumid mesomediterranean belt. This association shows some relations with the *Pyro amydaliformis-Calicotometum infestae* described by Gianguzzi & La Mantia (2008) from West Sicily, where is localized on calcareous outcrops.

Syndynamism: This is a secondary community dynamically connected with the degradation

processes of the woodlands belonging to *Erico arboreae-Quercetum virgilianae*, as highlighted by the occurrence of isolated individuals of *Erica arborea, Quercus virgiliana* and *Q. congesta*.

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral.

47.2.1.19. ***Micromerio consentinae-Phlomidetum fruticosae*** Sciandr., D'Agostino & Miniss. 2013

Thermo-basiphilous shrubland, dominated by Jerusalem sage rich in Cosentini micromeria, distributed in the subhumid mesomediterranean belt.

Holotypus: Rel 17, tab. 2, Sciandrello et al. (2013).

Characteristic and differential species: *Phlomis fruticosa* L.*, Micromeria graeca* (L.) Benth. ex Rchb. subsp*. consentina* (Ten.) Guinea*.*

Phytosociological table: From Sciandrello et al. (2013), tab. 2, 10 rel.

Char. association: *Phlomis fruticosa* (V)*, Micromeria graeca* subsp. *consentina* (V).

Char. alliance: *Teucrium flavum* (III)*.*

Char. order: *Teucrium fruticans* (III). *Prasium majus* (II), *Asparagus albus* (II), *Bupleurum fruticosum* (II), *Emerus major* subsp. *emeroides* (I), *Ceratonia siliqua* (I), *Pistacia lentiscus* (I).

Char. class: *Quercus ilex* (II), *Ruscus aculeatus* (I), *Rhamnus alaternus* (II), *Asparagus acutifolius* (IV), *Arisarum vulgare* (I), *Ruta chalepensis* (II), *Calicotome infesta* (V), *Euphorbia characias* (I).

Other species: *Dactylis hispanica* (IV), *Ampelodesmos mauritanicus* (III), *Bituminaria bituminosa* (III), *Phagnalon saxatile* (III), *Odontites bocconei* subsp*. bocconei* (II), *Ferula communis* (II), *Carlina hispanica* subsp. *globosa* (II),

Geographical distribution: It is recorded from Taormina territory in the Peloritani range (Sciandrello et al. 2013).

Structure and ecology: This vegetation with sub-chasmophilous requirements occurs at an altitude of 300-1000 m a.s.l. on carbonatic outcrops and is characterized by the dominance of *Phlomis fruticosa*. It is developed within the subhumid mesomediterranean belt. A part from the subass. *typicum*, it was descrived also the subass. *odontidetosum bocconei,* which shows more marked rupestrian characters.

Syndynamism: From the dynamic viewpoint, this shrubland represents a secondary community, linked to the degradation processes of evergreen oaks woods ascribed to *Bupleuro fruticosi-Quercetum ilicis.*

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral.

47.2.1.20. ***Pistacio terebinthi-Celtidetum aetnensis*** Gianguzzi, Cusimano & Romano 2014

Thermo-mesophilous maquis, dominated by Etnean hackberries and rich in terebinth, distributed in the thermomediterranean belt.

Holotypus: rel. 2, tab. 2, Gianguzzi et al. (2014).

Characteristic and differential species: *Celtis aetnensis* (Tornab.) Strobl s.l., *Pistacia terebinthus* L.

Phytosociological table: From Gianguzzi et al. (2014), tab. 2, 18 rel.

Char. association: *Celtis aetnensis* (V), *Pistacia terebinthus* (IV).

Char. alliance: *Euphorbia dendroides* (II), *Chamaerops humilis* (I), *Teucrium flavum* (I), *Artemisia arborescens* (I).

Char. order: *Clematis cirrhosa* (IV), *Prasium majus* (II), *Asparagus albus* (II), *Olea europaea* subsp. *oleaster* (I), *Anagyris foetida* (I).

Char. class: *Asparagus acutifolius* (V), *Euphorbia characias* (V), *Arisarum vulgare* (IV), *Cyclamen hederifolium* (IV), *Ruta chalepensis* (III), *Rubia peregrina* subsp. *angustifolia* (III), *Smilax aspera* (III), *Dioscorea communis* (II), *Cyclamen repandum* (II), *Quercus virgiliana* (I), *Achnatherum bromoides* (I), *Thalictrum calabricum* (I), *Quercus ilex* (I), *Lonicera etrusca* (I), *Phillyrea latifolia* (I), *Rhamnus halternus* (I), *Ruscus aculeatus* (I), *Calicotome infesta* (I), *Pyrus spinosa* (I), *Rosa sempervirens* (I).

Other species: *Allium subhirsutum* (IV), *Geranium purpureum* (III), *Rubus ulmifolium* (III), *Arum italicum* (III), *Smyrnium olusatrum* (II), *Galium aparine* (II), *Phlomis fruticosa* (II), *Hedera helix* (II).

Geographical distribution: On the basis of the current knowledge, this vegetation occurs in varous localities of northen Sicily, such as Sicanian Mountains, Rocca Busambra, Madonie, Nebrodi and Etna.

Structure and ecology: This very peculiar and interesting maquis, which sometimes reach the height of 4-8 m can be considered as micro-woods, are differentiated by the dominance of *Celtis aetnensis*, species closely releted to *Celtis tournefortii*. It occurs usually on screes and clastic rocky stands, constituted by various kinds of substrata, as basalts, schists, flysch, limestones dolomites, etc., at an altitude of 350-1000 m a.s.l. This vegetation, very poor in woody species, likes immature or poorly evolved soils, within upper thermomediterranean to mesomediterranean belt with upper dray to lower subhumid ombrotype. In relation to the nature of the substrate and the altitude, several subassociations can be distinguished: a) subass. *typicum,* exclusive of carbonatic rocks and located at rather high altitudes, within the climatophilous series of the *Acer campestris-Quercetum ilicis*; b) subass. *phlomidetosum fruticosae*, always linked to carbonate rocks but at relatively lower altitudes or in more xeric microclimatic conditions, within the climatophilous series of the *Rhamno alaterni-Quercetum ilicis* or *Oleo-Quercetum virgilianae*; c) subass. *artemisietosum arborescentis*, occurring on

large quartzarenitic blocks mainly with southern exposure, within of climatophilou series of the *Teucrio siculi-Querco ilicis* or *Festuco heterophyllae-Quercetum congestae*; e) subass. *rhamnetosum alaterni,* localized on volcanic rocks characterized by flat or sonny surfaces, in catenal contact with various deciduous e evergreen acidophious oaks of climatophilous kind.

Syndynamism: This association consists of a well structured woody vegetation showing an edapho-xerophilous role with a markedly pioneer, having catenal contact with different climatophilous or edaphophilous series spread on hilly and submountain stands.

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral.

47.2.1.21. ***Euphorbio characiae-Anagyridetum foetidae*** Gianguzzi, Cuttonaro, Cusimano & Romano 2016

Thermo-basiphilous shrubland, dominated by bean trefoil rich in Mediterranean spurge, distributed in the thermo-mesomediterranean belt.

Holotypus: rel. 2, tab. 7, Gianguzzi et al. (2016).

Characteristic and differential species: *Anagyris foetida* L., *Euphorbia characias* L., *Asparagus albus* L.

Phytosociological table: From Brullo & Marcenò (1985), tab. 7, 10 rel.

Char. association: *Anagyris foetida* (V) , *Euphorbia characias* (V), *Asparagus albus* (IV),

Char. alliance: *Chamaerops humilis* (I).

Char. order: *Prasium majus* (III), *Olea europaea* subsp. *oleaster* (I).

Char. class: *Asparagus acutifolius* (V), *Arisarum vulgare* (V), *Ruta chalepensis* (IV), *Rhamnus alaternus* (IV), *Rubia peregrina* subsp. *angustifolia* (III), *Osyris alba* (III), *Rosa sempervirens* (III), *Lonicera implexa* (II), *Smilax aspera* (II), *Pirus spinosa* (I), *Ruscus aculeatus* (I), *Pistacia terebinthus* (I), *Cyclamen hederifolium* (I).

Other species: *Asphodelus ramosus* (V), *Allium subhirsutum* (IV), *Foeniculum vulgare* (III), *Ferula communis* (II), *Phlomis fruticosa* (II), *Melica ciliata* (II).

Geographical distribution: This vegetation occurs in Sicanian mountains (central-western Sicily)

Structure and ecology: It is a thermo-subnitrophilous shrubland linked to sunny stands with south/south-western exposure, where is localized on carbonatic outcrops, limitedly to the surfaces characterized by clayey soil, some-times mixed with red soil and debris. It is distruted within the thermo-mesomediterranean belt with dry-subhumid ombrotype. According to Gianguzzi et al. (2016), this association is represented by two subassociation indicated as subass. *asparagetosum albae* and subass. *loniceretosum implexae.*

Syndynamism: This association shows an edapho-xerophilous role circumscribed to carbonatic outcrop, having catenal contact with the holm oak climatophilous serie of the *Sorbo torminalis-Quercetum ilicis.*

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral.

47.2.1.22. ***Calicotomo infestae-Paliuretum spinae christi*** Casavecchia, Biscotti, Pesaresi & Biondi 2015

Thermo-basiphilous shrubland, dominated by Christ's thorn rich in hairy thorny broom, distributed in the thermomediterranean belt.

Synonyms: *Pyro amygdaliformis-Paliuretum spinae-christi* sensu Costanzo & Tomaselli (1998) and Brullo, not O. Bolòs 1962.

Holotypus: rel. 13, tab. 1, Costanzo & Tomaselli (1998)

Characteristic and differential species: *Paliurus spina-christi* Mill., *Calicotome infesta* (C.Presl) Guss., *Aristolochia clusii* Lojac..

Phytosociological table: From Costanzo & Tomaselli (1998), tab. 1, 14 rel.

Char. association: *Paliurus spina-christi* (V), *Calicotome infesta* (V), *Aristolochia clusii* (II).

Char. order: *Prasium majus* (II), *Olea europaea* subsp. *oleaster* (IV), *Asparagus albus* (III), *Clematis cirrhosa* (I), *Pistacia lentiscus* (II).

Char. class: *Asparagus acutifolius* (V), *Pyrus spinosa* (V), *Rubia peregrina* subsp. *angustifolia* (V), *Quercus suber* (IV), *Osyris alba* (IV), *Smilax aspera* (IV), *Rhamnus alaternus* (IV), *Rosa sempervirens* (III), *Quercus virgiliana* (III), *Phillyrea latifolia* (I).

Other species: *Crataegus monogyna* (V), *Dactylis hispanica* (V), *Asphodelus ramosus* (V), *Hordeum bulbosum* (IV), *Rubus ulmifolium* (IV), *Carlina corymbosa* (IV).

Geographical distribution: This association is localized in the Hyblaean territory near Francofonte in South-Eastern Sicily (Costanzo & Tomaselli 1998, Biondi et al 2014).

Structure and ecology: It is a thermophilous maquis characterized by the dominance of thorny shrubs as *Paliurus spina-christi*, *Pyrus spinosa* and *Calicotome infesta*, that constitute a dense and intricate vegetation. This vegetation occurs on calcareous rocky stands with well mature soil only in the deep pockets scattered on the outcrops. Usually, they are spread in the abandoned pastures or former olive groves, within the subhumid thermomediterranean belt.

Syndynamism: This shrubland represents a secondary community, linked to the degradation processes of evergreen oaks woods.

Habitat reference: F5.3 Submediterranean pseudomaquis.

47.2.2. ***Periplocion angustifoliae*** Rivas-Martinez 1975

Thermo-xerophilous maquis, schrublands and conifer communities, rich in sclerophylls, distributed in the Mediterranean region, within the dry inframediterranean and thermomediterranean belt.

Holotypus: *Mayteno-Periplocietum angustifoliae* Rivas Goday & Esteve in Rivas Goday 1959

Characteristic and differential species: *Periploca angustifolia* Labill.*, Lycium intricatum* Boiss.*, Searsia pentaphylla* (Jacq.) FA.Barkley **(=***Rhus pentaphylla* (Jacq.) Desf.)*, Searsia tripartita* (Ucria) Moffett (=*Rhus tripartita* (Ucria) Grande).

Geographical distribution: Western part of the Euro-Mediterranean Region (Spain, Sicily) and North-Africa (Rivas-Martinez, 1975)as well as in the islands south of Crete (Brullo and Guarino 2000). In Sicily it is widespread in the islands of the Sicilian Channel (Egadi, Pelagie, Pantelleria) and in the extreme southern part of the island (Brullo et al., 1977; Brullo and Marcenò, 1985, Brullo et al. 2009 etc.).

Structure and ecology: It gathers markedly thermo-xerophilous maquis dominated by sclerophylls and deciduous summer shrubs, mainly linked to coastal rocky stands or sometimes to sands. These communities aredistributed within thbetween the inframediterranean and thermomediterranean belt, with dry ombrotype.

Syndynamism: Climatophilous and edaphophilous associations are part of this alliance.

Habitat reference: F5.5 Thermomediterranean scrub.

47.2.2.1. ***Periploco angustifoliae-Euphorbietum dendroidis*** Brullo, Di Martino & Marcenò 1977

Thermo-xerophilous maquis, dominated by wolfbanetree and tree spurge, distributed in the dry inframediterranean and thermomediterranean belt.

Holotypus: rel. 5, tab. 2, Brullo et al. (1977).

Characteristic and differential species: *Euphorbia dendroides* L.*, Periploca angustifolia* Labill.

Phytosociological table: from Brullo et al.(1977), tab. 2, 14 rel., Brullo et al. (2009), tab. 1a, 21 rel. and tab. 1b, 14 rel. (subass. *typicum*).

Char. association: *Euphorbia dendroides* (V),

Char. alliance: *Periploca angustifolia* (V)*, Lycium intricatum* (I).

Char. order: *Pistacia lentiscus* (V), *Prasium majus* (IV), *Teucrium fruticans* (III), *Olea europaea* subsp. *oleaster* (II), *Phillyrea angustifolia* (II), *Asparagus albus* (I), *Clematis cirrhosa* (I), *Ephedra fragilis* (I), *Myrtus communis* (I), *Rhamnus oleoides* (I), *Chamaerops humilis* (I), *Artemisia arborescens* (I), *Ceratonia siliqua* (I).

Char. class: *Asparagus acutifolius* (V), *Ruta chalepensis* (III), *Rubia peregrina* subsp. *angustifolia* (II), *Smilax aspera* (II), *Arisarum vulgare* (I), *Lonicera implexa* (I), *Daphne gnidium* (I), *Phillyrea latifolia* (I), *Cyclamen hederifolium* (I), *Cyclamen repandum* (I).

Other species: *Hyparrhenia hirta* (IV), *Asphodelus ramosus* (III), *Phagnalon saxatile* (III), *Bituminaria bituminosa* (III), *Dactylis hispanica* (III), *Erica multiflora* (III).

Phytosociological table: from Brullo et al.(2009), tab. 1c, 12 rel. (subass. *euphorbietosum papillaris*).

Char. association: *Euphorbia dendroides* (V).

Char. subassociation: *Euphorbia papillaris* (V).

Char. alliance: *Periploca angustifolia* (V).

Char. order: *Pistacia lentiscus* (V), *Teucrium fruticans* (V), *Prasium majus* (IV), *Olea europaea* subsp. *oleaster* (III), *Asparagus albus* (III), *Rhamnus oleoides* (III), *Asparagus horridus* (II), *Chamaerops humilis* (I), *Teucrium flavum* (I), *Clematis cirrhosa* (I), *Ceratonia siliqua* (I).

Char. class: *Asparagus acutifolius* (V), *Arisarum vulgare* (III), *Ruta chalepensis* (III), *Phillyrea latifolia* (III), *Lonicera implexa* (I), *Rubia peregrina* subsp. *angustifolia* (I), *Rhamnus alaternus* (I), *Smilax aspera* (I).

Other species: *Asphodelus ramosus* (V), *Hyparrhenia hirta* (V), *Bituminaria bituminosa* (IV), *Phagnalon saxatile* (III), *Coronilla valentina* (III), *Dactylis hispanca* (III), *Erica multiflora* (II).

Geographical distribution: Islands of Levanzo, Favignana, Marettimo (Brullo & Marcenò 1983, Brullo et al. 2009), Linosa (Brullo & Siracusa, 1996), Lampedusa (Bartolo et al., 1988), Pantelleria (Brullo et al., 1977; Gianguzzi, 1999a) and Malta (Brullo and Marcenò, 1985).

Structure and ecology: Marked xerophilous vegetation characterized by deciduous summer shrubs with dominance of *Periploca angustifolia* and *Euphorbia dendroides*, which is linked to coastal habitats where it occurs on various rocky substrata (limestone, dolomites, basalts, calcarenites, etc.). It falls within the belt between the upper semiarid inframediterranean and the lower dry Mediterranean bioclimate. In addition to a subass. *typicum*, Brullo et al (2009) identified a subass *euphorbietosum papillaris* localized in rupestrian environments in contact with the casmofilous communities of the *Dianthion rupicolae*, which is differentiated by the endemic *Euphorbia papillaris*.

Syndynamism: Climatophilous maquis localized on rocky stands, sometimes of semirupestrian kind, occurring usually along the coast. The subass. *euphorbietosus papillaris* assume an edaphophilous role, showing catenal contact with chasmophilous association of the *Dianthion rupicolae*.

Habitat reference: F5.5 Thermomediterranean scrub.

47.2.2.2. ***Periploco angustifoliae-Juniperetum turbinatae*** Bartolo, Brullo, Miniss. & Spamp. 1990

Thermo-xerophilous juniper woods, dominated by Phoenicean juniper and rich in wolfbane, distributed in the rocky coastal stands, within the dry semiarid inframediterranean belt.

Holotypus: rel. 1, tab. 1, Bartolo et al. (1990).

Characteristic and differential species: *Juniperus turbinata* Guss., *Periploca angustifolia* Labill.,

Phytosociological table: From Bartolo et al. (1990), tab. 1, 8 rel.

Char. association: *Juniperus turbinata* (V),

Char. alliance: *Periploca angustifolia* (IV), *Lycium intricatum* (II).

Char. order: *Prasium majus* (V), *Pistacia lentiscus* (V), *Teucrium fruticans* (V), *Olea europaea* subsp. *oleaster* (V), *Asparagus aphyllus* (V), *Phillyrea angustifolia* (II), *Ceratonia siliqua* (II),*Clematis cirrhosa* (II).

Char. class: *Asparagus acutifolius* (V), *Rubia peregrina* subsp. *angustifolia* (V), *Melica arrecta* (IV), *Phillyrea latifolia* (III), *Smilax aspera* (II), *Arisarum vulgare* (II).

Other species: *Foeniculum piperitum* (V), *Thymbra capitata* (III), *Lotus cytisoides* (III), *Asphodelus ramosus* (III), *Smyrnium olusatrum* (III), *Magydaris pastinacea* (III).

Geographical distribution: It occurs in some islands Sicilian Channel as Lampedusa (Bartolo et al., 1990), Linosa (La Mantia, 2003) and Pantelleria (Gianguzzi, 1999 c). Basing on literature data, is recorded from Khrisi, a small island south of Crete (Brullo & Guarino, 2000) and Tunisia (Brullo et al. 2009)

Structure and ecology: Markedly thermo-xerophilous maquis dominated by *Juniperus turbinata*, with high frequency of *Periploca angustifolia*, typical of coastal environments, where it is localized on calcareous or basaltic outcrops, with soil present only in the interstices and in the pockets between the rocks. It is linked to the upper dry semiarid inframediterranean belt. According to Gianguzzi (1999) and Brullo et al. (2009), a part from a subass. *typicum* it is possible to distinguish a subass. *brassicetosum insularis*, which can be considered as a chasmofilous vicariante of edaphophilous kind, occurring exclusively on some cliffs of Pantelleria.

Syndynamism: It represent the most structured and mature association of a thermo-xerophilous climatophilous series linked to extremely arid coastal habitats.

Habitat reference: F5.5 Thermomediterranean scrub.

47.2.2.3. ***Calicotomo infestae-Rhoetum tripartitae*** Bartolo, Brullo e Marcenò 1982

Basiphilous thermo-xerophilous thorny maquis dominated by lac sumach and rich in hairy thorny broom, distributed in the rocky coastal stands, within the dry thermomediterranean belt.

Holotypus: rel. 6, tab. 30, Bartolo et al. (1982).

Characteristic and differential species: *Calicotome infesta* (C.Presl) Guss. *Searsia pentaphylla* (Jacq.) FA.Barkley*, Searsia tripartita* (Ucria) Moffett.

Phytosociological table: From Brullo & Marcenò (1985), tab. 30, 7 rel.

Char. association: *Calicotome infesta* (V), *Searsia pentaphylla* (II).

Char. alliance: *Searsia tripartita* (V)*, Lycium intricatum* (II).

Char. order: *Prasium majus* (V), *Teucrium fruticans* (V), *Chamaerops humilis* (V), *Ceratonia siliqua* (V), *Pistacia lentiscus* (IV), *Olea europaea* subsp. *oleaster* (III), *Asparagus horridus* (III), *Phillyrea angustifolia* (I).

Char. class: *Asparagus acutifolius* (V), *Arisarum vulgare* (V), *Rubia peregrina* subsp. *angustifolia* (III).

Other species: *Thymbra capitata* (V), *Oxalis pes-caprae* (V), *Hyparrhenia hirta* (V), *Kundmannia sicula* (V), *Stipella capensis* (V), *Andropogon distachyos* (V), *Asphodelus ramosus* (IV).

Geographical distribution: This association is exclusive of South Sicily in the coastal stands between Marina di Ragusa and Pozzallo (Bartolo et al. 1982; Brullo et al. 1998, 2009).

Structure and ecology: Maquis physiognomically dominated by thorny deciduous summer shrubs, such as *Searsia tripartita*, Calicotome infesta, Lycium intricatum and more rarely *Searsia pentaphylla*. It occurs on Miocene limestone, in coastal rock places with superficial red Mediterranean soil and characterized by considerable edaphic aridity. This vegetation is spread within the lower thermomediterranean belt with lower dry ombrotype.

Syndynamism: It is the most structured and mature association of a thermo-xerophilous climatophilous series linked to limestones of strongly windy and arid coastal environmental.

Habitat reference: F5.5 Thermomediterranean scrub.

47.2.2.4. ***Periploco angustifoliae-Rhoetum tripartitae*** Brullo, Gianguzzi, La Mantia & Siracusa 2009

Acidophilous thermo-xerophilous thorny maquis dominated by lac sumach and rich in wolfban, distributed in the rocky coastal stands, within the dry thermomediterranean belt

Holotypus: rel. 1, tab. 1d, Brullo et al. (2009).

Characteristic and differential species: *Searsia tripartita* (Ucria) Moffett, *Periploca angustifolia* Labill.

Phytosociological table: From Brullo et al. (2009), tab. 1d, 4 rel.
Char. association: *Searsia tripartita* (4).
Char. alliance: *Periploca angustifolia* (4), *Lycium intricatum* (4).
Char. order: *Pistacia lentiscus* (4), *Euphorbia dendroides* (2).
Other species: *Phagnalon saxatile* (4), *Lobularia maritima* (3), *Euphorbia terracina* (2).

Geographical distribution: It was recorded from the island of Linosa, where it is quite rare and localized on the slopes of Montagna Rossa (Brullo et al. 2009).

Structure and ecology: Thermo-xerophilous shrub vegetation, with marked pioneer requirements, which is floristically very poor and dominated by summer deciduous trees, sometimes thorny, such as *Searsia tripartita, Periploca angustifolia* and *Lycium intricatum*. It is linked to incoherent substrates represented by volcanic slag, within the upper semiarid Inframediterranean belt.

Syndynamism: This association, well differentiated from the floristic-structural viewpoint, represents a edaphophilous maquis replacing the *Periploco angustifoliae-Euphorbietum dendroidis*, linked to compact rocky substrates, in steep slopes constituted by deposits of volcanic slag.

Habitat reference: F5.5 Thermomediterranean scrub.

47.2.2.5. ***Lycio intricati-Pistacietum lentisci*** (Brullo, Guarino & Ronsisvalle 2000) Brullo nom. nov.

Thermo-xerophilous maquis dominated by joint pine and mastic rich in boxthorn, distributed in the rocky coastal stands, within the dry thermomediterranean belt.

Synonyms: *Ephedro fragilis-Pistacietum lentisci* Brullo, Guarino & Ronsisvalle 2000, non Géhu & Sadki 1996.

Holotypus: rel. 2, tab. 18, Brullo et al. (2000).

Characteristic and differential species: *Pistacia lentiscus* L., *Ephedra fragilis* Desf., *Lycium intricatum* Boiss.

Phytosociological table: From Brullo et al. (2000), tab. 18, 5 rel.
Char. association: *Ephedra fragilis* (V).
Char. alliance: *Lycium intricatum* (V).
Char. order: *Pistacia lentiscus* (V), *Teucrium fruticans* (V), *Prasium majus* (V), *Chamaerops humilis* (V), *Asparagus aphyllus* (V), *Teucrium flavum* (IV), *Euphorbia dendroides* (IV),

Asparagus horridus (V), *Phillyrea angustifolia* (V).

Char. class: *Phillyrea latifolia* (V), *Asparagus acutifolius* (IV), *Lonicera implexa* (IV), *Rubia peregrina* subsp. *angustifolia* (III), *Osyris alba* (III), *Calicotome infesta* (III).

Other species: *Salsola oppositifolia* (V), *Coronilla valentina* (III), *Capparis spinosa* (III), *Thymbra capitata* (III).

Geographical distribution: This association is recorded from the coastal stands of South Sicily, between Palma di Montechiaro and Scoglitti (Brullo et al. 2000, 2009; Turrisi *et al.* 2002). Previously, Brullo et al. (2000) named it as *Ephedro fragilis-Pistacietum lentisci*, but it must be rejected (art.44) since a later homonym of a syntaxon described from Algeria by Gehu & Sadki (1996) and quoted also by and therefore a new name is proposed.

Structure and ecology: Xerophilous maquis characterized by *Pistacia lentiscus*, *Ephedra fragilis* and *Lycium intricatum*, occurring on calcarenitic rocky substrates, characterized by a remarkable edaphic dryness. It is localized in the lower dry thermomediterranean belt.

Syndynamism: It is a climatophilous vegetation localized in coastal and hilly stands, which is replaced in semi-rupestrian habitats by the *Euphorbietum dendroidis,* usually edaphophilous association.

Habitat reference: F5.5 Thermomediterranean scrub.

47.2.2.6. ***Asparago stipularis-Retametum gussonei*** Brullo, Guarino e Ronsisvalle ex Brullo, Giusso, Siracusa & Spampinato 2001

Psamophilous shrubland with marked thermo-xerophilous requirements, dominated by Gussonei white broom and rich in grey asparagus, linked to retrodunal stands within to lower dry thermomediterranean belt.

Synonyms: *Asparago stipularis-Retametum gussonei* Brullo, Guarino e Ronsisvalle 2000, nom inval. (art. 5); *Asparago horridi-Retametum gussonei* Brullo, Guarino e Ronsisvalle ex Brullo, Giusso, Siracusa & Spampinato 2001, corr. Brullo et al. 2009.

Holotypus: rel. 2, tab. 17, Brullo *et al.* (2000).

Characteristic and differential species: *Retama raetam* (Forssk.) Webb subsp. *gussonei* (Webb) Greuter*, Asparagus horridus.*

Phytosociological table: From Brullo *et al.* (2000), tab. 17, 8 rel.

Char: *Retama raetam* subsp. *gussonei* (V), *Asparagus horridus* (V).

Char. alliance: *Lycium intricatum* (V).

Char. order: *Ephedra fragilis* (V), *Prasium majus* (III), *Pistacia lentiscus* (III), *Asparagus aphyllus* (III).

Char. class: *Arisarum vulgare* (V), *Asparagus acutifolius* (IV), *Rubia peregrina* subsp. *angustifolia* (III).

Other species: *Daucus carota* (V), *Centaurea spherocephala* (V), *Ononis ramosissma* (V), *Euphorbia terracina* (V), *Echinophora spinosa* (IV).

Geographical distribution: The association is circumscribed to southern Sicily, where it is frequent on the sandy coast between Gela and Punta Braccetto (Brullo et al. 2000, 2001, 2009).

Structure and ecology: High-shrub vegetation linked to inland and consolidated dunes, dominated by *Retama raetam* subsp. *gussonei*, strictly psammophilous Sicilian endemism. It localized within the lower dry thermomediterranean belt.

Syndynamism: It is part of a edafo-xerophilous series of psammophilous kind, which is vicaried in less arid environmental condition by the maquis of the *Ephedro fragilis-Juniperetum macrocarpae*.

Habitat reference: F5.5 Thermomediterranean scrub.

47.2.3. ***Juniperion turbinatae*** Rivas-Martínez 1975 corr. Rivas-Martínez 1987

Psammophilous thermo-xerophilous maquis and schrublands, rich in junipers, distributed in the Mediterranean region, within the thermomediterranean belt.

Synonyms: *Juniperion liciae* Rivas-Martinez 1975.

Holotypus: *Rhamno oleoidis-Juniperetum macrocarpae* Rivas-Martinez 1965D

Characteristic and differential species: *Juniperus macrocarpa* Sm.*, J. turbinata* Guss.

Geographical distribution: Associations belonging to this alliance are widespread along the sandy coasts of the all Mediterranean. In Sicily they are currently quite scattered and locazized, junst some examples of this very peculiar vegetation are still observable mainly near Alcamo, between Gela and Donnalucata, Vendicari, while in the rest of the island they are now almost completely destroyed by anthropic activities (Di Martino & Sortino 1970; Maugeri & Leonardi 1974; Bartolo et al. 1982, 1987; Raimondo et al. 1990; Brullo et al. 2001, 2009).

Structure and ecology: It gathers permanent woody communities represented mainly by dense maquis with *Juniperus* sp. pl., linked to sandy coasts, such as retro-dune sistems and paleodunes cords. They are widespread in the thermomediterranean belt with dry or subhumid ombrotype.

Syndynamism: The associations of this syntaxon are usually edaphophilous of thermo-xerophilous kinds, wich are part of psammophilous series.

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral; G3.9b Mediterranean Cupressaceae woodland.

47.2.3.1. ***Ephedro fragilis-Juniperetum macrocarpae*** Bartolo, Brullo & Marcenò 1982

Thermo-psammophilous maquis dominate by large-fruited juniper and rich in joint pine, linked to retrodunal stands within to dry thermomediterranean belt.

Synonyms: *Ephedro fragilis-Juniperetum macrocarpae* Géhu & Géhu-Franck 1986

Holotypus: rel. 4, tab. 31, Bartolo et al. (1982).

Characteristic and differential species: *Ephedra fragilis* Desf.*, Juniperus macrocarpa* Sm.

Phytosociological table: From Bartolo et al. (1982), tab. 31, 15 rel.
Char. association: *Ephedra fragilis* (V).
Char. alliance: *Juniperus macrocarpa* (V).
Char. order: *Pistacia lentiscus* (V), *Prasium majus* (II), *Phillyrea angustifolia* (II), *Clematis cirrhosa* (I), *Ceratonia siliqua* (I), *Lycium intricatum* (I).
Char. class: *Rubia peregrina* subsp. *angustifolia* (III), *Asparagus acutifolius* (II), *Smilax aspera* (II), *Daphne gnidium* (II), *Phillyrea latifolia* (I).
Other species: *Ononis ramosissima* (IV), *Pancratium maritimum* (IV), *Launea resedifolia* (III), *Seseli tortuosum* subsp. *maritimum* (III), *Centaurea sphaerocephala* (III).

Geographical distribution: The association is recorded from the coast of southern Sicily (Bartolo et al 1982, Brullo et al., 2001, 2009), Tunisia (Géhu & Géhu-Frank 1986; Gèhu et al., 1990) and Algeria (Aimé et al 1983; Géhu et al., 1992, 1994; Khelifi et al., 2014; Meddour et al., 2017). In Sicily, due to the anthropic pressure of the shoreline, it is now limited to some stretches of the south-eastern part of the island, as along the coast between Gela and Donnalucata, as well as Vendicari, near Noto (Maugeri and Leonardi 1974; Bartolo et al. 1982; Brullo and Marcenò 1985; Brullo et al. 1980, 1998, 2001, 2009).

Structure and ecology: It is a coastal psammophilous maquis, physiognomically caracterized by *Juniperus macrocarpa*, linked to retrodunal sandy systems. This vegetation compared to other Mediterranean communities dominated by this juniper (Géhu et al. 1990; Brullo et al. 1994, 2004; Dìez-Garretas & Asensi 2014). shows more marked thermo-xerophilous requirements. It is spread within the lower dry thermomediterranean belt.

Syndynamism: It is the most evolved stage of an edafo-climatophilous series that plays an important role in the stabilization processes of coastal dunes colonized by permanent communities of the *Euphorbio paraliae-Ammophiletea australis* class.

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral.

47.2.3.2. ***Junipero turbinatae-Quercetum calliprini*** Bartolo, Brullo & Marcenò 1982

Thermo-psammophilous maquis dominate by Phoenicean juniper and Palestine oak, linked to inland paleodunes, within to dry thermomediterranean belt.

Holotypus: rel. 7, tab. 32, Bartolo et al. (1982).

Characteristic and differential species: *Junuperus turbinata* Guss., *Quercus calliprinos* Webb.

Phytosociological table: From Bartolo et al. (1982), tab. 32, 8 rel.

Char. association: *Quercus calliprinos* (V).

Char. alliance: *Juniperus turbinata* (V), *Juniperus macrocarpa* (II).

Char. order: *Prasium majus* (V), *Ephedra fragilis* (V), *Pistacia lentiscus* (V), *Teucrium fruticans* (V), *Chamaerops humilis* (V), *Olea europaea* subsp. *oleaster* (IV), *Phillyrea angustifolia* (IV), *Ceratonia siliqua* (I).

Char. class: *Asparagus acutifolius* (V), *Phillyrea latifolia* (V), *Arisarum vulgare* (IV), *Rubia peregrina* subsp. *angustifolia* (IV), *Calicotome infesta* (IV), *Rhamnus alaternus* (III), *Lonicera implexa* (III), *Smilax aspera* (III), *Euphorbia characias* (II), *Quercus ilex* (II), *Daphne gnidium* (II).

Other species: *Dactylis hispanica* (IV), *Oryzopsis miliacea* (IV), *Charybdis pancratium* (IV), *Rosmarinus officinalis* (III).

Geographical distribution: The association in Sicily is surveyed in the southern part and partularly in the territory of Niscemi, Caltagirone, Vittoria, Acate and Scoglitti (Furnari 1965; Bartolo et al. 1982, 1987, 1988; Raimondo et al. 1990; Brullo et al. 1993, 2001, 2009; Minissale & Sciandrello 2013). It was also recorded from south-western Sardinia (Agostini & Sanfilippo 1970, Mossa 1989, 1990, Bartolo et al., 1992).

Structure and ecology: High maquis characterized by *Quercus calliprinos* and *Juniperus turbinata*, linked to sandy substrates of fossil dunes often very far from the sea. It occurs within the thermomediterranean belt, with a lower dry to upper dry ombrotype.

Syndynamism: This vegetation is placed in a very large belt, constituting the best structured stand of an edapho-xerophilous geoseries interposed between the maquis of *Ephedro fragilis-Juniperetum macrocarpae* and the cork woods of *Stipo bromoidis-Quercetum suberis*.

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral.

47.2.3.2. ***Piptathero caerulescens-Juniperetum turbinatae*** Minissale & Sciandrello 2013

Thermo-psammophilous maquis dominate by Phoenicean juniper and rich in *Piptatherum caerulescens*, linked to inland paleodunes, within to dry thermomediterranean belt.

Holotypus: rel. 2, tab. 2, Minissale & Sciandrello (2013).

Characteristic and differential species: *Juniperus turbinata* Guss.. *Piptatherum caerulescens* (Desf.) P. Beauv, *Euphorbia dendroides* L.

Phytosociological table: From Brullo & Marcenò (1985), tab. 2, 21 rel.

Char. association: *Piptatherum caerulescens* (V).

Char. alliance: *Juniperus turbinata* (V).

Char. order: *Euphorbia dendroides* (V), *Ephedra fragilis* (V), *Pistacia lentiscus* (V), *Olea europaea* subsp. *oleaster* (V), *Teucrium fruticans* (V), *Prasium majus* (IV), *Ceratonia siliqua* (II), *Asparagus albus* (II), *Clematis cirrhosa* (I), *Chamaerops humilis* (I).

Char. class: *Asparagus acutifolius* (V), *Phillyrea latifolia* (V), *Arisarum vulgare* (IV), *Calicotome infesta* (IV), *Rhamnus alaternus* (II), *Quercus ilex* (I), *Dioscorea communis* (I).

Other species: *Rosmarinus officinalis* (V), *Asphodelus ramosus* (V), *Charybdis pancration* (IV), *Cistus creticus* (III), *Dactylis hispanica* (III), *Helianthemum lippii* (III), *Ampelodesmos mauritanicus* (II).

Geographical distribution: This association is recorded only from a hilly stend near Acate in South Sicily (Minissale & Sciandrello 2013).

Structure and ecology: This woody vegetation occurs on paleodunes very distant from the sea, colonizing the more or less sloped surfaces usually with southern exposure, within to the dry thermomediterranean belt. Physiognomically, it is characterized by the dominance of *Juniperus turbinata*, often represented by old-growth individuals, and by high frequency of *Piptatherum caerulescens* and *Euphorbia dendroides.*

Syndynamism: It is a quite mature maquis belonging to a edapho-xerophilous geoseries replacing the *Junipero turbinatae-Quercetun calliprini* in more xeric environmrntal conditions.

Habitat reference: G3.9b Mediterranean Cupressaceae woodland

47.2.4. Alliance: ***Ericion arboreae*** (Rivas-Martinez ex Rivas-Martinez, Costa e Izco 1985) Rivas-Martinez 1987

Acidophilous shrublands with mesic requirements rich in tree heath and strawberry tree, distributed in the Mediterranean-Atlantic territories, within the thermomediterranean and mesomediterranean belts.

Synomyms: *Ericenion arboreae* Rivas-Martinez 1975, nom. inval. (art.3b); *Ericenion arboreae* Rivas-Martinez ex Rivas-Martinez, Costa e Izco 1985.

Holotypus: *Phillyreo-Arbutetum unedonis* Rivas-Goday e Galiano 1959.

Characteristic and differential species: *Erica arborea* L.*, Arbutus unedo* L.

Geographical distribution: This alliance is spread in the Mediterranean-Atlantic territories, especially in environments affected by oceanic climatic condition. Associations belonging to this syntaxon are recorded from the western Mediterranean, especially in the Iberian Peninsula, South France, Corsica and the Tyrrhenian side of the Italian Peninsula islands included (Sardinia and Sicily).

Structure and ecology: It ranges shrubby acidophilous communities, represented by preforestal mantles, matorrals and garrigues, localized usually on siliceous substrata with with more or less acid soils. Physiognomically this vegetation is dominated by woody mesic species, as mainly *Erica arborea* and *Arbutus unedo*. It is distributed within the thermomediterranean and mesomediterranean belts with subhumid to humid ombrotype.

Syndynamism: The association of this alliance constitute secondary shrublands arising from degradation processes of acidophilous oak woodland caracterized mainly *Quercus ilex*, *Q. suber* or *Q. virgiliana*, occurring in the hilly and submountain belts.

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral

47.2.4.1. ***Erico arboreae-Arbutetum unedonis*** Molinier 1937

Acidophilous schrublands with mesophilous requirements rich in tree heath and strawberry tree, localized within the thermomediterranean with dry to upper subhumid ombrotype.

Holotypus: rel. pag. 110, Molinier (1937).

Characteristic and differential species: *Erica arborea* L.*, Arbutus unedo* L.

Phytosociological table: From Brullo et al. (2009), tab. 4a, 6 rel.

Char. association and alliance: *Erica arborea* (V)*, Arbutus unedo* (V).

Char. order: *Myrtus communis* (II), *Olea europaea* subsp. *oleaster* (I), *Pistacia lentiscus* (I).

Char. class: *Calicotome infesta* (V), *Quercus suber* (V), *Pulicaria odora* (IV), *Teline monspessulana* (IV), *Rubia peregrina* subsp. *angustifolia* (IV), *Quercus virgiliana* (III), *Arisarum vulgare* (III),), *Daphne gnidium* (II), *Smilax aspera* (I), *Asparagus acutifolius* (I).

Other species: *Ampelodesmos mauritanicus* (V), *Cistus monspeliensis* (V), *Pteridium aquilinum* (III), *Rubus ulmifolium* (III), *Allium subhirsutum* (III).

Geographical distribution: In Sicily it was surveyed along the coastal slopes of the Madonie, Nebrodi, Peloritani, as well as at Filicudi in the Aeolian Islands and Pantelleria Island (Longhitano 1982, Guarino 1998, Gianguzzi 1999, Brullo et al. 2009). This association is also

reported from Sardinia (Biondi et al., 2001), Corsica (Allier & Lacoste, 1980), Provence (Molinier, 1937), Algeria (Meddour et al. 2017).

Structure and ecology: High shrubby vegetation with mesophilous requirements, which is characterized by the dominance of *Erica arborea* and *Arbutus unedo*, which forms preforestal mantles on siliceous substrates (flysch, quartzarenites, vulcanites, etc.). It is developped within the thermomediterranean belt with upper sub-humid ombrotype.

Syndynamism: In Sicily it represents a degradation stage of the acidophilous woods, as particularly the *Erico arboreae-Quercetum virgilianae*, the *Teucrio siculi-Quercetum ilicis* or the *Pino pinastri-Genistetum aspalathoidis*, playing a secondary role within these climatophilous series. Its spread is usually favored by processes of deforestation and fire.

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral.

47.2.4.2. ***Erico arboreae-Myrtetum communis*** Quezel, Barbero, Benabid, Loisel e Rivas-Martinez 1988

Acidophilous schrublands with mesic requirements rich in tree heath and common myrtle, localized within the thermomediterranean belt with dry to upper subhumid ombrotype.

Holotypus: Ril. 2, tab. 1, Quezel et al. (1988).

Characteristic and differential species: *Myrtus communis* L. *Erica arborea* L.

Phytosociological table: From Brullo et al. (1996), tab. 6, 4 rel.
Char. association: *Myrtus communis* (4).
Char. alliance: *Erica arborea* (4).
Char. order: *Pistacia lentiscus* (4).
Char. class: *Asparagus acutifolius* (4), *Calicotome infesta* (4), *Rubia peregrina* subsp. *angustifolia* (4), *Rosa sempervirens* (4), *Phillyrea latifolia* (4), *Pulicaria odora* (4), *Arisarum vulgare* (3), *Melica arrecta* (3), *Ruscus aculeatus* (3), *Smilax aspera* (1).
Other species: *Sorbus aucuparia* (4), *Cistus monspeliensis* (4), *Spartium junceum* (3).

Geographical distribution: The association, described by Quezel et al. (1989) for northern Morocco, is represented in Sicily according to Brullo et al. (1996) by the subass. *calicotometosum infestae*, which differs from the subass. *typicum* in the absence of some Ibero-Mauritanian species and in the occurrence of *Calicotome infesta*. It was recorded from some stands of the Nebrodi chain, as Torrente Buzza near Caronia (Brullo et al., 1996), but it is also observed along the coastal belt between Cefalù and Capo Tindari. It has also been reported for the Tyrrhenian coast of the Aspromonte by Brullo et al. (2001), as well as for the Algeria by Khelifi & Sadki (1995), Hadjadi-Aoul & Loisel (1999) and Meddour et al. (2017)

Structure and ecology: Pre-forestal shrub vegetation characterized by *Erica arborea* and *Myrtus communis* typical of acidophilous substrates (flysch, quartzarenites, etc.). Compared to the previous association, it manifests more thermophilous requirements,
which finds confirmation in its localization in usually coastal habitats. It occurs within the thermomediterranean belt with dry to subhumid ombrotype.

Syndynamism: This shrublands constitute a degradation stage of *Quercus suber* woodland and in particular of the *Genisto aristatae-Quercetum suberis*.

Habitat reference: F5.1 Mediterranean maquis and arborescent matorral.

47.2.5. Alliance: ***Asparago acutifolii-Laurion nobilis*** Gianguzzi, Cuttonaro, Cusimano & Romano 2016

Meso-hygrophilous schrublands with shady requirements, rich in bay laurel, distributed in the Mediterranean-Tyrrhenian territories, within the thermo- mesomediterranean belts with dry to subhumid ombrotype.

Synonyms: *Arbuto unedonis-Laurion nobilis* Brullo et al. 2001 non Rivas-Martínez, Fernandez-Gonzalez & Loidi 1999.

Holotypus: *Acantho mollis-Lauretum nobilis* Gianguzzi, D'Amico & Romano in Gianguzzi et al., 2010

Characteristic and differential species: *Laurus nobilis* L.*, Ficus carica* L.*, Celtis australis* L.*, Clematis vitalba* L.*, Acanthus mollis* L., *Ulmus minor* Miller, *Orobanche hederae* Duby*.*

Geographical distribution: The alliance is spread in the Tyrrhenian territories (Central Mediterranean), where some communities dominated by *Laurus nobilis* occurs, which are recorded from Sicily (Brullo et al. 2001; Gianguzzi et al. 2010, 2016; Marino et al. 2014), Sardinia (Bacchetta et al. 2007; Biondi et al. 2009) and Lazio (Bianco et al., 2002).

Structure and ecology: This syntaxon gathers shrublands and woodlands dominated by *Laurus nobilis,* occurring along valley, streams or shady and fresh slopes in hilly and sub mountain stands. These plant communities like well humified soils, rich in coarse rocky matrix, with substrata of various origin, often at the edge of sources or in areas with shallow groundwater. They are spread within the thermo-mesomediterranean belt, with dry to subhumid ombrotype

Syndynamism: The laurisilvas of this alliance usually characterize very peculiar and relict edapho-hygrophilous series, showing catenal contact with climactic communities of the class *Quercetea ilicis*.

Habitat reference: G2.2 Mainland laurophyllous woodland.

47.2.5.1 ***Acantho mollis-Lauretum nobilis*** Gianguzzi, D'Amico & Romano 2010

Meso-hygrophilous laurisilva dominated by bay laurel and rich in bear's breeches, occurring within the thermo-mesomediterranean belt with subhumid ombrotype.

Synonyms: *Hedero helicis-Lauretum nobilis* Brullo et al., 2001 non Bueno & Prieto 1991

Holotypus: rel. 14, tab. 3, Gianguzzi et al. (2010).

Characteristic and differential species: *Laurus nobilis* L.*, Acanthus mollis* L.*, Hedera helix* L. subsp. *helix.*

Phytosociological table: From Gianguzzi et al. (2010), tab. 3, 18 rel.

Char. association: *Acanthus mollis* (V)*, Hedera helix* subsp. *helix* (V).

Char. alliance: *Laurus nobilis* (V)*, Clematis vitalba* (IV)*, Ficus carica* (III)*, Orobanche hederae* (II), *Ulmus minor* (II)*, Celtis australis* (I).

Char. order: *Chamaerops humilis* (I), *Rhamnus oleoides* (I).

Char. class: *Asparagus acutifolius* (V), *Cyclamen hederifolium* (V), *Arisarum vulgare* (V), *Rubia peregrina* subsp. *angustifolia* (V), *Dioscorea communis* (IV), *Smilax aspera* (IV), *Rhamnus alaternus* (III), *Osyris alba* (III), *Euphorbia characias* (III), *Pistacia terebinthus* (III), *Quercus virgiliana* (II), *Carex distachya* (II), *Rosa sempervirens* (II), *Fraxinus ornus* (II), *Viburnum tinus* (I), *Quercus ilex* (I), *Asplenium onopteris* (I), *Ruscus aculeatus* (I).

Other species: *Rubus ulmifolium* (V), *Allium subhirsutum* (V), *Smyrnium olusatrum* (IV), *Arum italicum* (IV).

Geographical distribution: Association with a relict character surveyed in several and scattered stands of Sicily, where it can be considered a vicariant of other Mediterranean communities caracterized by *Laurus nobilis* (Gianguzzi et al., 2010). Previously, this vegetation was referred by Brullo et al. to *Hedero helicis-Lauretum nobilis*, association descrived by Bueno & Prieto (1991) from Iberian Peninsula. In Sicily, it is currently reported from several localities of the Sicani Mountains, as Sambuca di Sicilia, Bivona, Palazzo Adriano, Bisacquino and Castronovo di Sicilia, as well as from various places near Palermo, Trapani, Sciacca, Agrigento and Buccheri (Brullo et al, 2001, Gianguzzi et al. 2010).

Structure and ecology: The *Acantho mollis-Lauretum nobili* is a woody vegetation, which constitutes a dense forest often characterized by very old individuals of *Laurus nobilis* up to 15 m tall, with a very dark and closed undergrowth rich in markedly sciaphilous species, as *Acanthus mollis*, *Cyclamen hederifolium*, *Arum italicum*, *Smyrnium olusatrum*, etc. The lianose layer is very intricate and is represented by *Smilax aspera*, *Rubia peregrina* var. *angustifolia*, *Asparagus acutifolius*, *Dioscorea communis*, *Clematis vitalba*, *Calystegia sylvatica* and *Rubus ulmifolius*. This very pecuiliar vegetation is usually localized in mesic habitats of valley floor

(wet depressions, banks of streams and gorge), on various substrata (limestones, clays, flysh, volcanites, etc.) covered by brown soils or andosoils, rather humid and rich in coarse detritic skeleton. As concerns the bioclimate, it occurs within the thermo-mesomediterranean belt with subhumid ombrotype. The examples of this association currently observable in the Island must to be considered as the last relict fragments of laurisilve, formerly much more widespread in habitats characterized by particularly humid and fresh microclimatic conditions.

Syndynamism: For its very peculiar ecological requirements, this forestal community represents the most mature and evolved stage of an edapho-hygrophilous series, in catenal contact with climactic woodlands of the class *Quercetea ilicis.*

47.2.5.2 ***Rhamno lojaconoi-Lauretum nobilis*** Marino, Castiglia, Bazan, Domina & Guarino 2014

Mesophilous woody vegetation characterized by the abundance of bay laurel and by the sporadic occurrence of Lojacono buckthorn, localized within the mesomediterranean belt, with subhumid to humid ombrotype.

Holotypus: rel. 2, tab. 1, Marino et al. (2014).

Characteristic and differential species: *Laurus nobilis* L., *Rhamnus lojaconoi* Raimondo, *Vitis vinifera* L. subsp. *sylvestris*

Phytosociological table: From Brullo & Marcenò (1985), tab. 3, 18 rel.

Char. association: *Vitis vinifera* subsp. *sylvestris* (II), *Rhamnus lojaconoi* (I).

Char. alliance: *Laurus nobilis* (V)*, Clematis vitalba* (V)*, Hedera helix* subsp. *helix* (V), *Acanthus mollis* (III)*, Ficus carica* (II)*.*

Char. order and class: *Rubia peregrina* subsp. *angustifolia* (V), *Asplenium adiantum-nigrum* (V), *Ruscus aculeatus* (V), *Quercus ilex* (IV), *Quercus virgiliana* (IV), *Smilax aspera* (IV), *Asparagus acutifolius* (IV), *Phyllirea latifolia* (IV), *Cyclamen hederifolium* (III), *Erica arborea* (III), *Rosa sempervirens* (III), *Dioscorea communis* (III), *Rhamnus alaternus* (II), *Arbutus unedo* (II), *Euphorbia characias* (I), *Carex distachya* (I), *Calicotome infesta* (I).

Other species: *Polysticum setiferum* (V), *Rubus ulmifolium* (V), *Euonymus europaeus* (III), *Lamium flexuosum* (III), *Daphne laureola* (III), *Crataegus monogyna* (III), *Geranium robertianum* (III), *Asplenium trichomanes subsp. quadrivalens* (III), *Arum italicum* (III).

Geographical distribution: The association is exclusive of the Tyrrhenian slopes of the Madonie Mountains (North Sicily), where was recorded by Marino et al (2014).

Structure and ecology: It is a thermo-mesophilous woodland characterized by the dominance of *Laurus nobilis*, which grows togheter with isolated trees of *Quercus ilex*, *Q.*

virgiliana, *Rhamnus alaternus* and *Phillyrea latifolia*, as well as several lianas that make up an intricate undergrowth, including *Rubia peregrina* subsp. *angustifolia*, *Clematis vitalba, Hedera helix, Smilax aspera*, *Asparagus acutifolius*, *Rosa sempervirens*, *Dioscorea communis*, *Rubus ulmifolium*, etc. It is also quite significant the occurrence, even if sporadic, of the rare endemic *Rhamnus lojaconoi* and *Vitis vinifera* subsp. *sylvestris*. These set of species confers to the vegetation an oceanic-atlantic connotation and a markedly relict character, which justifies its localization in stands characterized by extremely peculiar microclimatic conditions (Raimondo 1979). This association showing a very dense canopy with a tree layer that can reach 12 m in height, likes the bottom of the ravines and valleys or sometimes the open north-facing slopes at an elevation of 300-560 m, on soils rich in debris of quarzarenitic and calcareous rocks. These stands are they are directly affected throughout the year by winds loads of humidity coming from the Tyrrhenian Sea. From the bioclimate viewpoint, the vegetation is distribuite within the lower to upper mesomediterranean belt with subhumid to humid ombrotype

Syndynamism: For its very peculiar ecological requirements, this forestal community represents the most mature and evolved stage of an edapho-hygrophilous series, in catenal contact with climactic woodlands of the class *Quercetea ilicis.*

70.3. Order: ***Pinetalia halepensis*** Biondi, Blasi, Galdenzi, Pesaresi & Vagge in Biondi et al. 2014

Thermophilous open pinewoods, dominated by Aleppo pine, rich in shrubs of *Quercetea ilicis*, *Rosmarinetea officinalis* and *Cisto cretici-Micromerietea julianae*, which are distributed in the Mediterranean territories, within the inframediterranean to lower mesomediterranean belts.

Holotypus: *Pistacio lentisci-Pinion halepensis* Biondi,Galdenzi, Pesaresi & Vagge in Biondi et al. 2014

Characteristic and differential species: *Pinus halepensis* Mill. s.l., *Pinus brutia* Ten., *Pinus pinea* L., *Juniperus oxycedrus* L., *Juniperus turbinata* Guss., *Pistacia lentiscus* L., *Myrtus communis* L., *Rosmarinus officinalis* L.

Geographical distribution: Associations referable to this order are widespread in all Mediterranean area, mainly in the coastal and hilly places (Biondi et al. 2014a, 2014b, Pesaresi et al. 2017).

Structure and ecology: Native thermo-xerophilous forests dominate by *Pinus halepensis* (subspecies, varieties and ecotypes), including long-established plantations present within its natural growth area. These coniferous forests shows a quite open canopy with an underwood very rich in sclerophyll shrubs of the *Quercetea ilicis*, as well as of *Rosmarinetea officinalis* and *Cisto cretici-Micromerietea julianae*. These pinewoods occur on various substrata (marls, limestones, volcanites, schists, serpetinites, sands, calcarenites, etc.), usually in coastal or hilly

places and also in inland stands. They are localized within the inframediterranean to lower mesomediterranean belt with dry to subhumid

Syndynamism: The associations of this order constitute the most mature stages of edafo-xerophilous series linked prevalently to rocky habitats or stands characterized by lithosoils of various geological origin.

Habitat reference: G3.7 Mediterranean lowland to submontane *Pinus* woodland.

70.3.1. ***Pistacio lentisci-Pinion halepensis*** Biondi, Blasi, Galdenzi, Pesaresi & Vagge in Biondi et al. 2014

Thermo-xerophilous open pinewoods, dominated by Aleppo pine, rich in shrubs of *Quercetea ilicis*, *Rosmarinetea officinalis* and *Cisto cretici-Micromerietea julianae*, which are distributed in the western and central Mediterranean territories, within the upper thermomediterranean to upper mesomediterranean belts with lower dry to lower humid ombrotype.

Synonyms: *Pinion halepensis occidentalis* De Marco & Caneva 1985, nom. nud.; *Pistacio lentisci-Pinion halepensis* Rivas-Martìnez, Soriano, Costa 2011; *Rosmarino officinalis-Pinion halepensis* Biondi & Pesaresi in Pesaresi et al. 2017.

Holotypus: *Pistacio lentisci-Pinetum halepensis* De Marco, Veri & Caneva 1985.

Characteristic and differential species: see order.

Geographical distribution: It gathers pinewoods dominated by *Pinus halepensis* occurring in the western and central Mediterranean territories (Biondi et al. 2014a, 2014b, Pesaresi et al. 2017).

Structure and ecology: This alliance regards the thermophilous and open *Pinus halepensis* forests very rich in sclerophyll shrubs. They are plant communities localized on various substrata, limitedly to rocky stands characterized by lithosoils, within the upper thermomediterranean to upper mesomediterranean belts with lower dry to lower humid ombrotype.

Syndynamism: See order.

Habitat reference:

47.3.1.1. ***Pistacio lentisci-Pinetum halepensis*** De Marco & Caneva 1985

Thermophilous pine-wood with basiphilous requirements, dominated by Aleppo pine and rich in mastic, distributed in the thermomediterranean belt.

Synonyms: *Pino-Genistetum aspalathoidis pinetosum halepensis* Brullo, Di Martino e Marcenò (1977); *Erico multiflorae-Pinetum halepensis* (Brullo, Di Martino & Marcenò 1977) Biondi & Pesaresi in Biondi et al. (2017)

Holotypus: rel. 17, tab. 4, De Marco *et al.* (1984).

Characteristic and differential species: *Pinus halepensis* Mill., *Pistacia lentiscus* L., *Globularia halypum* L., *Dorycnium hirsutum* (L.) Ser.

Phytosociological table: From Brullo et al. (1977), tab. 3 (rel. 28-35), Gianguzzi 1999, tab. 6, Brullo et al. 2009, tab.,3e (rel.4-5), 15 rel.

Char. association: *Dorycnium hirsutum* (IV), *Globularia alypum* (II).

Char. alliance and order: *Pinus halepensis* (V), *Rosmarinus officinalis* (V), *Pistacia lentiscus* (V), *Myrtus communis* (II).

Char. class: *Phillyrea latifolia* (IV), *Asparagus acutifolius* (III), *Daphne gnidium* (III), *Prasium majus* (II), *Rubia peregrina* subsp. *angustifolia* (II), *Arbutus unedo* (II), *Phillyrea angustifolia* (II), *Olea europaea* subsp. *oleaster* (I), *Carex halleriana* (I), *Arisarum vulgare* (I), *Smilax aspera* (I), *Euphorbia dendroides* (I), *Lonicera implexa* (I), *Pinus pinaster* (I), *Erica arborea* (I).

Other species: *Erica multiflora* (V), *Cistus salvifolius* (V), *Phagnalon saxatile* (IV), *Lavandula stoechas* (III), *Genista aspalathoides* (III), *Fumana laevipes* (II), *Calicotome villosa* (II), *Cistus monspeliensis* (II), *Fumana thymifolia* (II).

Geographical distribution: In Sicily the association was reported for the island of Pantelleria (Brullo et al., 1977; Gianguzzi, 1999 b), the Island of Marettimo (Brullo and Marcenò, 1983) and Hyblaean territory, where it occurs along the basin of Ippari River (Bartolo et al., 1978). Outside of Sicily, ìt is known from Apulian in the Island of S. Domino (Tremiti Islands), as well as from Sardinia near Porto Pino (De Marco and Caneva 1985, Bartolo et al. 1992).

Structure and ecology: These basiphilous pine woods with *Pinus halepensis* are linked to marly and calcareous substrates, sometimes also basalts, of stands affected by a marked edaphophilous dryness. This vegetation occurs in coastal and hilly habitats, where the aridity is mainly determined by the climatic conditions, and often is influenced also by the rocky substratum. Floristically, it is differentiated by the abundance in the undergrowth of *Pistacia lentiscus*. As concerns the bioclimate, this community is distributed within the thermomediterranean belt with lower to upper dry ombrotype.

Syndynamism: Edaphophilous vegetation linked to poorly evolved soils of stands, that gives a certain edaphic dryness. In more mature edaphic condition it is normally replaced by holm oak woods. Usually, the degradation processes determine the establishment of garrigues belonging to *Cisto cretici-Micromerietea julianae,* often with sparse individuals of *Pinus halepensis* (Bartolo et al. 1978, 1986, Brullo et al. 2009).

47.3.1.2. ***Thymo capitati-Pinetum halepensis*** De Marco & Caneva 1985

Thermo-xerophilous pine-wood with basiphilous requirements, dominated by Aleppo pine and rich in Mediterranean thyme, distributed in the thermomediterranean belt with dry ombrotype..

Synonyms:.*Rosmarino officinalis-Thymetum capitati* Bartolo, Brullo, Lo Cicero, Marcenò & Piccione 1978, non Furnari 1965.

Holotypus: rel. 10, tab. s.n., Bartolo et al. (1978).

Characteristic and differential species: *Pinus halepensis* Mill., *Thymbra capitata* (L.) Cav., *Erica multiflora* L., *Globularia alypum* L., *Calicotome infesta* (C.Presl.) Guss.

Phytosociological table: From Bartolo et al. (1978), tab.. s.n., 16 rel.

Char. association: *Thymbra capitata* (V), *Globularia alypum* (IV), *Calicotome infesta* (IV), *Erica multiflora* (III).

Char. alliance and order: *Pinus halepensis* (V), *Rosmarinus officinalis* (V), *Pistacia lentiscus* (V).

Char. class: *Teucrium fruticans* (V), *Asparagus acutifolius* (IV), *Chamaerops humilis* (III), *Quercus calliprinos* (III), *Prasium majus* (III), *Olea europaea* subsp. *oleaster* (III), *Ephedra fragilis* (II), *Arisarum vulgare* (II), *Ceratonia siliqua* (II), *Rubia peregrina* subsp. *angustifolia* (II), *Phillyrea angustifolia* (II), *Teucrium flavum* (II), *Quercus ilex* (II), *Osyris alba* (I), *Daphne gnidium* (I), *Rhamnus alaternus* (I), *Lonicera implexa* (I), *Euphorbia characias* (I), *Juniperus turbinata* (I), *Phillyrea latifolia* (I), *Arbutus unedo* (I).

Other species: *Cistus creticus* (V), *Cistus monspeliensis* (V), *Fumana thymifolia* (IV), *Cistus salvifolius* (IV), *Phagnalon rupestre* (IV), *Asphodelus ramosus* (IV), *Ampelodesmos mauritanicus* (III), *Teucrium capitatum* (III).

Geographical distribution: The association is reported in Siciliy from Hyblaean territory, where it occurs along the basin of Tellaro River, Ippari River and Dirillo River (Bartolo et al., 1978; Bartolo et al., 1986; Bazan et al. 2010). Here it is represented by subass. *pinetosum halepensis* De Marco & Caneva 1985 (= subass. *globularietosum* Bartolo et al. 1986) and by the subss. *sarcopoterietosum spinosi* Bartolo et al. 1986, the latter only from Tellaro River. Outside of Sicily, it is known also from Apulian near Taranto (Agostini 1967, De Marco and Caneva 1985, Bartolo et al. 1986, Pesaresi et al. 2017).

Structure and ecology: These basiphilous pinewoods with *Pinus halepensis* are linked to marly substrates of stands with very superficial soils and characterized by a marked edaphilous dryness. This vegetation, occurring usually in inland habitats at an elevation not exceeding 600 m, is differentiated by the occurrence of several schlerophylls of the *Cisto cretici-Micromerietea julianae,* such as *Thymbra capitata*, *Erica multiflora*, *Globularia alypum*, *Rosmarinus officinalis*, *Cistus* sp. pl., *Sarcopoterium spinosum*, etc. It is localized within the upper thermomediterranean belt with dry ombrotype.

Syndynamism: Edaphophilous vegetation linked to poorly evolved soils of stands characterized by a marked edaphic dryness. In more mature edaphic condition it is normally replaced by holm oak woods, belonging to *Pistacio lentisci-Quercetum ilicis*. Its degradation, due to fires and cutting of the tree layer, leads to garrigues of the *Cisto-Micromerietea* (Bartolo et al. 1978, 1986).

47.3.1.3. ***Genisto tyrrhenae-Pinetum halepensis*** Biondi & Pesaresi in Biondi et al. 2017

Thermophilous pine-wood with acidophilous requirements, dominated by Aleppo pine and rich in Tyrrhenian broom, distributed in the lower thermomediterranean belt with subhumid ombrotype.

Synonyms: *Erico arboreae-Pinetum halepensis* Brullo, Gianguzzi, La Mantia & Siracusa 2009, non De Marco & Caneva 1985.

Holotypus: rel. 1, tab. 3e, Brullo et al. (2009).

Characteristic and differential species: *Pinus halepensis* Mill., *Genista tyrrhena* Vals. subsp. *tyrrhena*, *Erica arborea* L., *Arbutus unedo* L, *Spartium junceum* L.

Phytosociological table: From Brullo et al. (2009), tab. 3e (rel.1-3), 3 rel.

Char. association: *Genista tyrrhena* subsp. *tyrrhena* (3), *Erica arborea* (3), *Spartium junceum* (3), *Arbutus unedo* (2).

Char. alliance and order: *Pinus halepensis* (3), *Pistacia lentiscus* (3).

Char. class: *Arisarum vulgare* (3), *Asparagus acutifolius* (2), *Olea europaea* subsp. *oleaster* (2), *Lonicera implexa* (2), *Rubia peregrina* subsp. *angustifolia* (2), *Daphne gnidium* (2), *Carex distachya* (1), *Smilax aspera* (1), *Osyris alba* (1), *Quercus virgiliana* (1), *Calicotome infesta* (1), *Clematis flammula* (1), *Prasium majus* (1), *Euphorbia dendroides* (1), *Artemisia arborescens* (1).

Other species: *Brachypodium ramosum* (3), *Micromeria graeca* (3), *Cistus eryocephalus* (3), *Asphoderus ramosus* (3), *Charybdis* sp. (3), *Cistus salvifolius* (2), *Calicotome villosa* (2), *Jacobea bicolor* (2).

Geographical distribution: The association is known only from Aeolian Islands, where was described by Biondi et al. (2017) on relevés published by Brullo et al. (2009). The last authors similarly to Bartolo et al. (1986) and Brullo & Furnari (1994) attributed this plant community to *Erico arboreae-Pinetum halepensis* De Marco & Caneva 1985, pinewood currently occurring in Sardinia.

Structure and ecology: It is an open thermophilous pinewood dominated by *Pinus halepensis,* showing marked acidophilous requirements. In fact, this forest is linked to basaltic substrata with very rocky soils, floristically differentiated by *Genista tyrrhena* subsp. *tyrrhena*, endemic to Aeolian Islands, as w ell as by *Erica arborea* and *Arbutus unedo,* all silicicolous

species. Usually, it is localized on coastal slopes of islands, where it is affected to marine aerosol, within the lower thermomediterranean belt with subhumid ombrotype.

Syndynamism: Potentially, it represents an edapho-xerophilous vegetation circumscribed to rocky places of volcanic islands, where it is replaced on stands with more mature soils by maquis of the *Oleo- Ceratonion* siliquea and in more mesic conditions by acidophilous woodlands of the *Erico arborae-Quercion ilicis*.

47.3.1.4. ***Genisto aspalathoidis-Pinetum hamiltonii*** Brullo, Di Martino & Marcenò 1977 corr. Gianguzzi 2009

Thermophilous pine-wood with acidophilous requirements, dominated by maritime pine and rich in Pantelleria broom, distributed in the thermomediterranean to mesomediterranean belts.

Synonyms: *Pino pinastri-Genistetum aspalathoidis* Brullo, Di Martino & Marcenò 1977, *pinetosum pinastri*; *Genisto aspalathoidis-Pinetum escarenae* Biondi & Vagge 2015, nom. nud.

Holotypus: rel. 26, tab. 3, Brullo et al. (1977).

Characteristic and differential species: *Pinus pinaster* Aiton subsp. *escarena* (Risso) K. Richt. (=*P. pinaster* subsp. *hamiltonii* (Ten.) Villar), *Genista aspalathoides* Boiss., *Carex illegittima* Cesati.

Phytosociological table: From Brullo et al. (1977), tab. 3 (rel. 22-27), Gianguzzi (1999), tab. 8, 11 rel.

Char. association: *Pinus pinaster* subsp. *escarena* (V), *Genista aspalathoides* (V), *Carex illegitima* (IV).

Char. alliance and order: *Pinus halepensis* (III), *Pistacia lentiscus* (V), *Myrtus communis* (V), *Rosmarinus officinalis* (III).

Char. class: *Erica arborea* (V), *Daphne gnidium* (V), *Lonicera implexa* (V), *Arbutus unedo* (IV), *Phillyrea latifolia* (IV), *Teline monspessulana* (III), *Asparagus acutifolius* (II), *Smilax aspera* (II), *Rubia peregrina* subsp. *angustifolia* (I), *Melica arrecta* (I), *Quercus ilex* (I), *Phillyrea angustifolia* (I), *Prasium majus* (I).

Other species: *Lavandula stoechas* (V), *Cistus salvifolius* (V), *Ampelodesmos mauritanicus* (IV), *Cistus monspeliensis* (IV), *Cytinus hypocistis* (IV), *Erica multiflora* (IV), *Calicotome villosa* (III), *Centaurium erythraea* (III).

Geographical distribution: This association is known exclusively from the Island of Pantelleria (Brullo et al. 1977; Gianguzzi 1999).

Structure and ecology: It is an open thermomophilous pinewood, with the canopy characterized by the dominance of *Pinus pinaster* subsp. *escarena*, sometimes associated with

P. halepensis, showing acidophilous requirements. In fact, this forest is linked to basaltic substrata with quite mature andosoils, floristically differentiated by *Genista aspalathoides* and *Carex illegittima*, which grow together with some silicicolos species, as *Erica arborea* and *Arbutus unedo*. This vegetation occurs on coastal slopes affected to marine aerosol at an elevation of 300-800 m, within the belts between the upper dry thermomediterranean and subhumid mesomediterranean.

Syndynamism: This pinewood represents the most mature stage of very peculiar climatophilous series, linked to volcanic substrata and strongly affected by a fog regime together with a marine aerosol. It is in catenal contact upward with the acidophilous woodlands of the *Erico arboreae-Quercetum ilicis* having a more mesic requirements, while at lower altitudes it is in contact with the xerophilous maquis of *Periplocion angustifoliae*. Their degradation leads to the settlement of dense garigues of the *Cisto cretici-Micromerietea julianae*, such as the *Genisto aspalathoidis-Rosmarinetum officinalis* Gianguzzi 1999.

70.3.2. ***Pinion pineae*** Feinbrun 1959

Thermophilous open pinewoods, dominated by stone pine, rich in shrubs of *Quercetea ilicis* and *Cisto-Lavanduletea* with psammo-acidophilous requirements, distributed in the central and eastern Mediterranean territories, within the mesomediterranean belts with upper subhumid to humid ombrotype.

Holotypus: *Cisto eriocephali-Pinetum pineae* (Feinbrun 1959) Brullo et al. 2002.

Characteristic and differential species: *Pinus pinea*, *Cistus creticus*, *C. crispus, C. eriocephalus, Lavandula stoechas.*

Geographical distribution: It gathers pinewoods dominated by *Pinus pinea* occurring in the central and eastern Mediterranean territories (Feibrun 1959, Brullo et al 2002, Mucina et al. 2016).

Structure and ecology: This alliance regards the thermophilous and open *Pinus pinea* forests very rich in sclerophyll shrubs. The natural plant communities belonging to this sintaxon are localized usually on sandy soils and occurring along the coasts in the retodunal places as well as inland on paleodunes. They are localized within the mesomediterranean belt with upper subhumid to humid ombrotype. Previously this vegetation was included by Bartolo et al. (1994) and Brullo et al. (2002) into the *Cisto-Lavanduletea* class:

Syndynamism: The pinewoods of *Pinion pineae* represent the most mature stage of very peculiar xero-climatophilous series, linked to quite mature sandy soils. Usually, the degradation processes determine the establishment of garrigues belonging to *Cisto cretici-Micromerietea julianae,* often with sparse individuals of *Pinus pinea*.

47.3.1.1. ***Cisto crispi-Pinetum pineae*** Bartolo, Brullo & Pulvirenti 1994

Psammophilous pine-wood with acidophilous requirements, dominated by stone pine and rich in wrinkle-leaved rockrose, distributed within mesomediterranean belt with upper subhumid to humid ombrotype.

Holotypus: rel. 9, tab. 1, Bartolo et al. (1994).

Characteristic and differential species: *Pinus pinea* L.., *Cistus crispus* L., *Calicotome infesta* (C.Presl) Guss., *Tuberaria lignosa* (Sweet) Samp.

Phytosociological table: From Bartolo et al. (1994), tab. 1, 16 rel.
Char. association: *Cistus crispus* (V), *Calicotome infesta* (V), *Tuberaria lignosa* IV).
Char. alliance: *Pinus pinea* (V).
Char. order: *Erica arborea* (V), *Pistacia lentiscus* (II).
Char. class: *Pulicaria odora* (V), *Daphne gnidium* (IV), *Arbutus unedo* (III), *Cytisus villosus* (III), *Carex distachya* (II), *Quercus virgiliana* (I), *Quercus ilex* (I).
Other species: *Cistus salvifolius* (V), *Ampelodesmos mauritanicus* (V), *Pteridium aquilinum* (V), *Micromeria graeca* (V), *Sonchus bulbosus* (V), *Anthoxanthum odoratum* (V), *Dorycnium hirsutum* (IV), *Cytinus hypocistis* (III), *Dactylis glomerata* (III), *Brachypodium retusum* (III), *Daucus carota* (III), *Cistus monspeliensis* (II).

Geographical distribution: This association is circumscribed to the more or less stepp slopes of the sandy hills around Messina in North-East Sicily, (Bartolo et al. 1994).

Structure and ecology: It is a marked acidophlous pine wood with the canopy dominated by *Pinus pinea,* which is linked to mature sandy soils of quite sloped surfaces. Floristically, it is differentiated by *Cistus crispus*, *C. salvifolius*, *Tuberaria lignosa* and *Calicotome infesta*, that constitute a dwarf and dense shrub layer. This vegetation occurs from sea level up to 700 m of elevation and is affected by very moist climatic conditions, due to annual rainfall of 700 up to over 1000 mm and from a persistent fog regime during most of the year. From the bioclimatic viewpoint, it is spreads within the mesomediterranean belt with upper subhumid to humid ombrotype.

Syndynamism: It is can be considered more mature edapho-climatophilous stand of a very peculiar acidophilous series linked to quite sandy evolved soils. In more mature edaphic condition it is normally replaced by deciduous oak woods represented by the *Erico arboreae-Quercetum virgilianae*. The degradation processes determine the establishment of ephemeral meadows belonging to *Tuberarietea guttatae*, as the *Tolpidetum grandiflorae* (Bartolo et al. 1994).

47.3.1.2. ***Cisto creticae-Pinetum pineae*** Brullo, Minissale, Siracusa, Scelsi & Spampinato 2002

Thermophilous pine-wood with acidophilous requirements, dominated by stone pine and rich in Cretan rockrose, distributed within subhumid mesomediterranean belt.

Holotypus: rel. 6, tab. 1, Brullo et al. (2002).

Characteristic and differential species: *Pinus pinea* L., *Cistus creticus* L., *Eryngium bocconi* Lam.

Phytosociological table: From Brullo et al. (2002), tab. 1, 22 rel.

Char. association: *Cistus creticus* (V), *Eryngium bocconei* (IV).

Char. alliance: *Pinus pinea* (V), *Lavandula stoechas* (IV).

Char. order: *Erica arborea* (III), *Pistacia lentiscus* (I), *Myrtus communis* (I).

Char. class: *Calicotome infesta* (V), *Asparagus acutifolius* (IV), *Quercus suber* (IV), *Pulicaria odora* (III), *Quercus virgiliana* (III), *Olea europaea* subsp. *oleaster* (II), *Osyris alba* (II), *Achnatherum bromoides* (II), *Arbutus unedo* (II), *Lonicera implexa* (II), *Fraxinus ornus* (I), *Smilax aspera* (I), *Teucrium fruticans* (I), *Prasium majus* (I), *Pyrus spinosa* (I), *Asplenium onopteris* (I), *Rosa sempervirens* (I), *Teucrium siculum* (I), *Rubia peregrina* subsp. *angustifolia* (I), *Asparagus orridus* (I), *Euphorbia characias* (I), *Lonicera etrusca* (I), *Quercus ilex* (I).

Other species: *Cistus salvifolius* (V), *Cytinus hypocistis* (IV), *Ampelodesmos mauritanicus* (IV), *Micromeria graeca* (III), *Anthoxanthum odoratum* (III), *Dactylis glomerata* (III), *Cistus monspeliensis* (II).

Geographical distribution: This association occurs exclusively in Sicily, where it was surveyed in some localities of Nebrodi and Madonie, as well as near Piazza Armerina (Brullo et al. 2002).

Structure and ecology: It is an acidophlous pinewood physiognomically dominated by *Pinus pinea,* conifer having a more or less thinned coverage, which is associated with to dwarfs and compact bushes represented mainly by *Cistus creticus*, *C. salvifolius*, *C. monspeliensis* and *Lavandula stoechas*. This vegetation is linked to incoherent substrata, such as quartz-arenites and paleo-dunes, localizing at an elevation of 200-700 m in stands affected by annual rainfall not exceeding 700 mm. Usually it occurs within the mesomediterranean belt with subhumid ombrotype.

Syndynamism: This pinewood represents the more mature edapho-climatophilous association belonging to an acidophilous series linked to quite incoherent substrata. In the more mesic and fresh stands it is replaced by deciduous oak woods represented by the *Erico arboreae-Quercetum virgilianae* or limitedly to more mature and deep soils by cork oak woods of the *Genisto aristatae- Quercetum suberis.*

CONCLUSIONS

This investigation on all the types of the Sicilian vegetation allows to identify 47 classes, 83 orders, 164 alliances and 738 associations, giving a total of 1032 syntaxa. According to our investigation, the classes with the greatest diversification on the island are: *Chenopodietea* (6 orders, 12 alliances and 96 associations), *Quercetea ilicis* (3 orders, 10 alliances and 71 associations), *Lygeo-Stipetea tenacissimae* (2 orders, 7 alliances and 51 associations) and *Helianthemetea guttati* (2 orders, 4 alliances and 43 associations in Sicily). Several new combinations and arrangements from the class to association rank have been proposed, based on nomenclatural, ecological and floristic considerations. Moreover, during the field activity 23 probably new communities have been surveyed and provisionally discussed, although later they will be subject of more detailed studies in order to verify, also with support of numerical analysis, their proper syntaxonomical treatment. It is our intention that the realization of this thesis may lead to the publication of a monographic volume on the vegetation of Sicily, making the work easily accessible to a wider public interested to this subject.

ACKNOWLEDGMENTS

I'd like to thank prof. S. Brullo and prof. G. Giusso del Galdo for their fundamental help and support. Besides, i want to thank also my friends Michele Aleo, Gianleonardo Allasia, Vicente Avola, Cristina Blandino, Christian Brullo, Giuseppe Di Gregorio, Antoine Giardina, Bernardo Inghilleri, Giuseppe Ippolito, Fabio Luchino and Michele Torrisi for their useful suggestions and pleasant company during field activities, as well as my family for their patience and cooperation.

REFERENCES

AA.VV. Piano di Gestione "Rupe di Marianopoli e Lago Sfondato".

ABATE B., INCANDELA A., NIGRO F. & RENDA P., 1998 - Plio-Pleistocene strike-slip tectonics in the Trapani Mts. (NW Sicily). Boll. Soc. Geol. It., 117: 555-567.

ABBATE, G., PIRONE, G., CIASCHETTI, G., BONACQUISTI, S., GIOVI, E., LUZZI, D., SCASSELLATI, E., 2003 - Considerazioni preliminari sui boschi a Fagus sylvatica L. e Taxus baccata L. dell'Italia peninsulare e della Sicilia. Fitosociologia 40, 97-108.

ACOSTA A., BLASI C., ESPOSITO S. & STANISCI A., 2000 - Analisi della vegetazione delle dune costiere del Lazio centro-meridionale. Inf. Bot. Ital. 32, suppl. 1: 5-10.

ACOSTA A., STANISCI A., ERCOLE S. & BLASI C. 2003 - Sandy coastal landscape of the Lazio region (Central Italy). Phytocoenologia 33(4): 715-726.

ACUNTO S., MALTAGLIATI F., RINDI F., ROSSI F. & CINELLI F., 1995 - Indagine su una prateria di *Halophila stipulacea* (Forssk.) Aschers. (Hydrocharitaceae) nel mar Tirreno Meridionale. Atti Soc. Tosc. Sci. Nat., Mem., Serie B 102: 19-22.

ADAM P., 1993 - Saltmarsh Ecology. Cambridge University Press, 461 pp.

AGNESI V., 2004 - Sicily in the last one million years. Bocconea 17: 23-32.

AGOSTINI R. 1967 - Osservazioni fitosociologiche sulle pinete a Pinus halepensis Mill. del territorio di Taranto. Arch. Bot. Biogeograf. Ital. 43: 373-401.

AGOSTINI R. & SANFILIPPO E. 1970 - Ricerche storiche, fitosociologiche e dendrometriche sulla pineta naturale di Pino d'Aleppo a Porto Pino (Sardegna sud-occidentale). Ann. Acc. It. Sc. Forest. 29: 177-208.

AIMÉ S., AINAD-TABET L., HADJADJ-AOUL S. & SEBAA E.D. 1983 - Recherches phytoécologiques en Oranie. Premiers résultats. Mém. Soc. Hist. Nat. Afr. Nord N.S. 13: 17-31.

ALBO G., 1959 - La flora e la vegetazione delle isole intorno ai Capo Pachino. Boll. Ist. Bot. Univ. Catania,ser. 2(1): 88-108.

ALBO G., 1961 - La vita delle piante vascolari nella Sicilia Meridionale-Orientale. I. Ambiente e vegetazio-ne dei Piani e Colli Iblei. Delpinoa, n. ser, 2:193-390.

ALEFFI M. & CORTINI PEDROTTI C., 1996 - Variazioni temporali dell'associazione *Ricciocarpetum natantis* nel Piano di Colfiorito (Marche, Italia centrale). Coll. Phytosoc., XXIV: 601-608.

ALLIER C. & LACOSTE A. 1980 - Maquis et groupements végétaux de la série du chene vert dans le bassin du Fango (Corse). Ecol. Medit., 5: 59-82.

ALLORGE P., 1921 - Les associations vegetales du Vexin francais. Rev. Gen. Bot. 33: 598-605.

ALLORGE P., 1947 - Essai de bryogéographie de la Péninsule Ibérique. Encycl. Biogeogr. et Ecol. 1: 1-114.

ALONGI G., CORMACI M &, PIZZUTO F.. 1993 - La macroflora epifita delle foglie di Halophila stipulacea (Forssk.) Aschers. del porto di Catania. Biol. Mar. S.I.B.M., supp. 1: 287-288.

ANGIOLINI C., BACCHETTA G., BRULLO S., CASTI M., GIUSSO DEL GALDO G. & GUARINO R., 2005 - The vegetation of the mining dumps in SW-Sardinia. Feddes Repertorium 116(3-4): 243-276.

ANGIOLINI C., LANDI M., BODDI M. & FRIGNANI F., 2005 - La vegetazione dell'alveo fluviale del sito d'importanza regionale Torrente Trasubbie (Grosseto, Toscana meridionale). Atti Soc. tosc. Sci. nat., Mem., Serie B, 112: 127-151.

ANZALONE B. & CAPUTO, G., 1976 - Flora e vegetazione delle Isole Ponziane (Golfo di Gaeta). Delpinoa, n.s. 16-17:3-184.

ARÉNES J., 1929 – Les associations végétales de la basse Provence. George Chassel, Mirecourt.

ARNÁIZ C. & LOIDI J., 1981 - Estadio fítosociológíco de los zarzales del País Vasco (*Rubo ulmifoiíí-Tametum communís*). Lazaroa, 3: 63-73.

ASENSI A. & DÌEZ-GARRETAS B., 2011 - The *Tamaricetalia* order in the Western Mediterranean region. Plant Biosystems 145 suppl.1: 123-131.

AUBERT G. & LOISEL R., 1971 - Etude des groupements des Isoeto-Nanojuncetea et des Helianthemetea annua dans le sud-est Méditerranéen Français. Ann. Fac. Sci. Mars. 45: 203-241.

AUGIER H., 1982 - Inventaire et classification des biocénoses marines benthiques de la Méditerranée. Conseil de l'Europe Collection sauvegarde de la nature 29, 59 pp.

AUGIER H. & BOUDOURESQUE C. F., 1970 - Vègètation marine de l'ile de Port-Cros (parc national). Bull. Mus. Hist. Nat. Marseille XXX: 145-164.

AVERNA V., 1953 - Contributo alla conoscenza delle terre rosse siciliane. Nota III. Annali della Sperimentazione Agraria, n. s., 7(4): 1259-1266.

BACCARINI P., 1901 - Appunti Sulla Vegetazione Di Alcune Parti Della Sicilia Orientale: osservazioni. Firenze, 46 pp.

BACCHETTA G., BIONDI E., FARRIS E., FILIGHEDDU R. & MOSSA L. 2004 - A phytosociological study of the deciduous oak woods of Sardinia (Italy). Fitosociologia 41(1):53-65.

BACCHETTA G., BRULLO S., GUARINO G. & SCIANDRELLO S., 2012 - Studi tassonomici sulle popolazioni italiane di *Halocnemum strobilaceum* (Amaranthaceae). Pp. 29-30 in: Peccenini, S., Domina, G. & Salmeri, C. (eds.), Flora vascolare d'Italia: studi biosistematici, taxa endemici e loci classici. Palermo.

BACCHETTA G., CASTI M. & ZAVATTERO L., 2007 - Analisi della vegetazione del distretto minerario di Montevecchio (Sardegna sud-occidentale). Fitosociologia 44(2): 83-108.

BACCHETTA G., FARRIS E., FENU G., FILIGHEDDU R., MATTANA E. & MULE P., 2007 - Contributo alla conoscenza dei boschi a Laurus nobilis L. della Sardegna, habitat prioritario ai sensi della Direttiva 92/43/CEE. Fitosociologia 44 (2): 239-244.

BACCHETTA G., ORRÙ M., SERRA G. & VACCA A., 2005 - studio pedologico-forestale dei boschi e delle boscaglie ripariali del Sulcis (Sardegna sud-occidentale). Bollettino della Società Italiana della Scienza del Suolo 54 (1-2): 16-24

BAGELLA S., CARIA M.C., FARRIS E. & FILIGHEDDU R., 2007 - Issues related to the classification of Mediterranean temporary wet habitats according with the European Union Habitats Directive. Fitosociologia, 44 (2) suppl.1: 245-249.

BALDONI M. & BIONDI E., 1993 - La vegetazione del medio e basso corso del fiume Esino (Marche- Italia centrale). Stud. Bot. 11: 209-257.

BARBAGALLO C., 1983a - Vegetazione di alcuni boschi di Sughera (*Quercus suber* L.) della Sicilia meridionale-orientale. Boll. Acc. Gioenia Sci. Nat. Catania 16: 289-296.

BARBAGALLO C., 1983b - Segnalazione di *Helichrysum stoechas* (L.) Moench in Sicilia e osservazioni fitosociologiche. Pubbl. Ist. Bot. Univ. Catania, pp. 6.

BARBAGALLO C., BRULLO S., FAGOTTO F., 1979° - Boschi di *Quercus ilex* L. del territorio di Siracusa e principali aspetti di degradazione. Pubbl. Ist. Bot. Univ. Catania, pp. 21.

BARBAGALLO C., BRULLO S., FAGOTTO F., 1979b - Vegetazione a Platanus orientalis L. e altri aspetti igrofili dei fiumi iblei (Sicilia meridionale). Pubbl. Ist. Bot. Univ. Catania, pp. 28.

BARBAGALLO C., BRULLO S., FURNARI F., 1979c - Su alcuni aspetti di vegetazione igrofila di Serra del Re (Monti Nebrodi). Pubbl. Ist. Bot. Univ. Catania.

BARBAGALLO C., BRULLO S., FURNARI F., 1979d - Osservazioni fitosociologiche sulla vegetazione del Fiume Ciane (Sicilia orientale). Pubbl. Ist. Bot. Univ. Catania, pp. 13.

BARBAGALLO C., BRULLO S., FURNARI F., 1990 - La vegetazione alofila palustre della Tunisia. Boll. Acc. Gioenia Sci. Nat. Catania 23(336): 581-652.

BARBAGALLO C., BRULLO S., FURNARI F., LONGHITANO N. & SIGNORELLLO P., 1982 - Studio fitosociologico e cartografi a della vegetazione (1:25.000) del territorio di Serra S. Bruno (Calabria). CNR AQ/1/227.

BARBAGALLO C., BRULLO S., GUGLIELMO A. 1979e - Lineamenti della vegetazione di Monte Cofano (Sicilia occidentale). Pubbl. Ist. Bot. Univ. Catania. pp. 15

BARBAGALLO C., BRULLO S., SIGNORELLO P., 1983 - Note fitosociologiche sulla vegetazione delle Isole Eolie. Boll. Acc. Gioenia Sci. Nat. Catania 16: 7-16.

BARBAGALLO C., FAGOTTO F. & ZIZZA A., 1977 - Osservazioni sulla vegetazione della penisola della Maddalena. Boll. Sed. Acc. Gioenia Sci. Nat. 13: 24-42.

BARBERO M. & QUEZEL P., 1989 - Contribution à l'étude phytosociologique des mattorals de Méditerranée orientale. Lazaroa 11: 37-60.

BARDAT J., BIORET F., BOTINEAU M., BOULLET V., DELPECH R., GÉHU J.-M., HAURY J., LACOSTE A., RAMEAU J.-C., ROYER J.-M.. ROUX G. & TOUFFET J., 2004 - Prodrome des végétations de France. Muséum National d'Histoire Naturelle, Paris, 142 pp.

BARDAT J. & HAUGUEL J.-C., 2002 - Synopsis bryosociologique pour la France. Cryptogamie, Bryologie 23(4): 279-343.

BARINOVA S. & ROMANOV R., 2015 - Charophyte Communities in the Ein Afeq Natural Reserve, Israel. Natural Resources and Conservation 3(2): 31-44.

BARRAT-SEGRETAIN M.-H. & BORNETTE G., 2000 - Regeneration and colonization abilities of aquatic plant fragments: effect of disturbance seasonality. Hydrobiologia 421: 31–39.

BARTOLO G., BRULLO S., 1986 - La classe *Parietarieta judaicae* in Sicilia. Arch. Bot. Biogeogr. It. 62: 31-50.

BARTOLO G., BRULLO S., 1993 - La classe *Crithmo-Limonietea* in Sicilia. Boll. Acc. Gioenia Sci. Nat. Catania 26(342): 5-47.

BARTOLO G., BRULLO S., DE MARCO G., DINELLI A., SIGNORELLO P. & SPAMPINATO G., 1992- Studio fitosociologico sulla vegetazione psammofila della Sardegna meridione. Coll. Phytosoc. 19:251-273

BARTOLO G., BRULLO S., FAGOTTO F., GRILLO M., 1983 - La vegetazione segetale della Sicilia sud-orientale. Boll. Acc. Gioenia Sci. Nat. Catania 15(320): 307-321.

BARTOLO G., BRULLO S., GIARDINA G., MINISSALE P. & SPAMPINATO G. 1987 - Considerazioni fitosociologiche sulle garighe a "*Cistus clusii*" della Sicilia meridionale. Boll. Acc. Gioenia Sci. Nat. Catania, 20 (330): 141-148.

BARTOLO G., BRULLO S., LO CICERO E., MARCENÒ C. & PICCIONE V. 1978 - Osservazioni fitosociologiche sulla pineta a *Pinus halepensis* di Vittoria (Sicilia meridionale). Arch. Bot. Biogeogr. Ital., 54 (3/4): 137-154.

BARTOLO G., BRULLO S., MARCENÓ C., 1982 - La vegetazione costiera della Sicilia sud-orientale. Contributo alla interpretazione delle fasce di vegetazione delle coste mediterranee. C.N.R. AQ/1/226, pp. 49.

BARTOLO G., BRULLO S., MINISSALE P., SPAMPINATO G., 1985 - Osservazioni fitosociologiche sulle pinete a *Pinus halepensis* Miller del bacino del Fiume Tellaro (Sicilia sud-orientale). Boll. Acc. Gioenia Sci. Nat. Catania 18(325): 255-270.

BARTOLO G., BRULLO S., MINISSALE P., SPAMPINATO G., 1990 - Flora e vegetazione dell'Isola di Lampedusa. Boll. Acc. Gioenia Sci. Nat. Catania 21(334): 119-255.

BARTOLO G., BRULLO S., MINISSALE P. & SPAMPINATO G., 1990b - Contributo alla conoscenza dei boschi a *Quercus ilex* della Sicilia. Acta Bot. Malac. 15: 203-215.

BARTOLO G., BRULLO S., PULVIRENTI S. 1994a - Su una nuova associazione della classe *Cytisetea striato-scoparii* in Sicilia. Boll. Acc. Gioenia Sci. Nat. Catania 27(346): 399-407.

BARTOLO G., BRULLO S., PULVIRENTI S. 1994b - Considerazioni fitosociologiche sulla vegetazione a *Cistus crispus* del territorio di Messina (Sicilia nord-orientale). Boll. Acc. Gioenia Sci. Nat. Catania 27 (346): 409-414.

BARTOLO G., BRULLO S., SIGNORELLO P., 1992 - La classe *Crithmo-Limonietea* nella penisola italiana. Coll. Phytosoc. 19: 55-81.

BARTOLO G., MINISSALE P., SORBELLO R., SPAMPINATO G., 1988- Su alcuni aspetti di vegetazione nitrofila della valle del Fiumedinisi (Sicilia orientale) Boll. Acc. Gioenia Sci. Nat. Catania 21(334): 5-18.

BARTOLUCCI F. & COAUTHORES, 2018 - An updated checklist of the vascular flora native to Italy. Plant Biosystems 152(2): 179-303.

BAZAN G., BRULLO S., RAIMONDO F.M. & SCHICCHI R., 2010 - Le serie di vegetazione della Regione Sicilia. In: Blasi C. (ed.), La vegetazione d'Italia: 429-470. Palombi & Partner S.r.l., Roma.

BAZAN G., ILARDI V., MINISSALE P. & SCIANDRELLO S., 2006b - La biodiversità vegetale di Monte Gibliscemi (Mazzarino, Sicilia). Quad. Bot. Amb. Appl., 17(2): 121-140.

BAZAN G., ILARDI V. & RAIMONDO F. M., 2006 - La vegetazione della Gola della Tardara (Sicilia sud-occidentale). Nat. Sicil. s.4, 30:379-392.

BAZAN G. & MARINO P., 2005 - Carta del paesaggio e della biodiversità vegetale dei Monti Sicani Sud-Orientali(Sicilia centro-occidentale). Quaderni di Botanica Ambientale e Applicata 16:3-60.

BAZAN G., MARINO P., GUARINO R., DOMINA G. & SCHICCHI S. 2015 - Bioclimatology and Vegetation Series in Sicily: A geostatistical approach. Ann. Bot. Fennici 52(1-2): 1-18.

BAZZICHELLI G. & ABDELAHAD N., 2009 - Alghe d'acqua dolce d'Italia. Flora analitica delle Caroficee. Roma: Sapienza, Università di Roma, 73 pp.

BECCARISI L., BIONDI E., CASAVECCHIA S., ERNANDES P., MEDAGLI P. & ZUCCARELLO V., 2010 - La quercia da sughero (*Quercus suber* L.) nel Salento: analisi diacronica e sinfitosociologica (Adriatico meridionale, Italia). Fitosociologia 47(2): 3-16.

BEEFTINK W.G., 1965 - Die zoutvegetatties van ZW-Nederland beschoud in Europees verband. Thesis, Wagenigen.

BEEFTINK W.G., 1968 - Die Systematik des europaischen Salzpflanzengesellschaften. Pflanzensoziologische Sistematik, 239-263.

BELONOVSKA E.A., MUCINA L. & THEURILLAT J.P. - Syntaxonomic and nomenclatural notes on the scree vegetation of Caucasus. Hacquetia 13(2): 279-284.

BELTRANDO M., COMPAGNONI R. & LOMBARDO B., 2010 - (Ultra-) High-pressure metamorphism and orogenesis: An Alpine perspective. Gondwana Research 18: 147-166.

BERG C., DENGLER J., ABDANK A. & ISERMANN M. (eds), 2004 - Die Pflanzengesellschaften Mecklenburg-Vorpommernsund ihre Gefährdung. Textband. Weissdorn-Verlag, Jena.

BERTACCHI A, LOMBARDI T. & BOCCI G., 2009 - Il paesaggio vegetale dell'ambiente dunale di Calambrone nel litorale pisano (Toscana settentrionale). Inf. Bot. Ital. 41(2): 281-292.

BERTOLANI-MARCHETTI D., ACCORSI C., AROBBA D., BANDINI MAZZANTI M., BERTOLANI M., BIONDI E., BRAGGIO G., CIUFFI G., DE CUNZO T., DELLA RAGIONE ., FORLANI L., GUIDO M. A., LOLLI F., MONTANARI C., PAOLI P., RAIMONDO F.M., ROSSITTO M. & TREVISAN-GRANDI G., 1984 - Recerches géobotaniques sur le Monts Madonie (Sicilie du Nord). Webbia 38: 329-348.

BERTOLANI-MARCHETTI D. & CITA M.B., 1975 - VII: Palynological investigations on Late Messinian sediments recorded at DSDP Site 132 (Tyrrhenian Basin) and their bearing on the deep basin desiccation model. Riv. It. Paleont. Strat., 81:281–308.

BERTOLDI R., RIO D. & THUNELL R., 1989 - Pliocene-pleistocene vegetational and climatic evolution of the south-central mediterranean Palaeogeography, Palaeoclimatology, Palaeoecology 72: 263-275.

BEST E. P. H. & VAN DER WERF A. K., 1986 - Respiration inrelation to reserve substances in the submerged macrophyte *Ceratophyllum demersum* L.. Aquatic Bot. 26: 235-246.

BESSEDIK M., GUINET P. & SUC J.P., 1984 - Données paléofloristiques en Méditerranée nord-occidentale depuis l'Aquitanien. Revue de Paleobiologie Volume spécial: 25-3.

BIANCO P.M., FANELLI G. & DE LILLIS M. 2002 - Flora e vegetazione di Castel Fusano (Roma). Quad. Bot. Amb. Appl. 13: 125-181.

BILIOTTI M. & ABDELAHAD N., 1990 - *Halophila stipulacea* (Forssk.) Aschers. (Hydrocharitaceae): espèce nouvelle pour l'Italie. Posidonia newsletter 3 (2): 23-26.

BIONDI E., 1988 - Aspetti di vegetazione alo-nitrofila sulle coste del Gargano e delle isole Tremiti. Arch Bot Biogeogr Ital 64: 19–33.

BIONDI E., 1992 - Studio fitosociologico dell'arcipelago de La Maddalena. 1. La vegetazione costiera. Coll. Phytosoc. 19: 183-224.

BIONDI E., 1997 - Sintaxonomy of the Mediterranean chamaephytic and nanophanerophytic vegetation in Italy. Colloques Phytosociologiques, 27, 123-145.

BIONDI E., 1999 - La vegetazione del monte Conero (con carta della vegetazione alla scala 1:10.000). Ancona

BIONDI E., 1999 - Diversità fitocenotica degli ambienti costieri italiani. In Bon M., Sburlino G., Zuccarello V. (eds.). Aspetti ecologici e naturalistici dei sistemi lagunari e costieri. Arsenale ed.

BIONDI E., 2007 - Thoughts on the ecology and syntaxonomy of same vegetation typologies of the Mediterranean coast. Fitosociologia 44 (1): 3-10.

BIONDI E., 2011- Phytosociology today: Methodological and conceptual evolution. Plant Biosystems 145 suppl. 1: 19-29.

BIONDI E., ALLEGREZZA M., CASAVECCHIA S., GALDENZI D., GIGANTE D., PESARESI S., 2013 - Validation of some syntaxa of Italian vegetation. Plant Biosystems 147(1): 186-207.

BIONDI E., ALLEGREZZA M., CASAVECCHIA S., GALDENZI D., GASPARRI R., PESARESI S., SORIANO P., TESEI G. & BLASI C., 2015 - New insight on Mediterranean and sub-Mediterranean syntaxa included in the Vegetation Prodrome of Italy. Fl. Medit. 25 (Special Issue): 77-102. 2015.

BIONDI E., ALLEGREZZA M., CASAVECCHIA S., GALDENZI D., GASPARRI R., PESARESI S., VAGGE I. & BLASI C., 2014b - New and validated syntaxa for the checklist of Italian vegetation. Plant Biosyst. 148(1):318-332.

BIONDI E. & BAGELLA S., 2005 - Vegetazione e paesaggio vegetale dell'arcipelago di La Maddalena (Sardegna nord-orientale). Fitosociologia 42 (2) suppl. 1: 3- 99.

BIONDI E., BALLELLI S., ALLEGREZZA M., TAFFETANI F. & FRANCALANCIA C., 1994 - La vegetazione delle fiumare del versante ionico lucano-calabro. Fitosociologia 27: 51-66.

BIONDI E., BALLELLI S., ALLEGREZZA M., TAFFETANI F., FRATTAROLI A.R., GUITIAN J., ZUCCARELLO V., 1999 - La vegetazione Campo Imperatore (Gran Sasso d'Italia). Braun-Blanquetia, 16: 53-115.

BIONDI E., BALLELLI S. & TAFFETANI F., 1992 - La vegetazione di alcuni territori calanchivi in Basilicata (Italia meridionale). Doc. Phytosoc., n.s., 14:489-498.

BIONDI E. & BLASI C. (eds.), 2015 - Prodromo della vegetazione d'Italia. Check-list sintassonomica aggiornata di classi, ordini e alleanze presenti in Italia. Società Botanica Italiana Onlus. Website adress: http://www.prodromo-vegetazione-italia.org.

BIONDI E., BLASI C., ALLEGREZZA M., ANZELOTTI I., AZZELLA M.M., CARLI E., CASAVECCHIA S., COPIZ R., DEL VICO E., FACIONI L., GALDENZI D., GASPARRI R., LASEN C., PESARESI S., POLDINI L., SBURLINO G., TAFFETANI F., VAGGE I., ZITTI S. & ZIVKOVIC L., 2014° - Plant communities of Italy: The Vegetation Prodrome. Plant Biosystems 148(4): 728-814.

BIONDI E., BLASI C., BRUGIAPAGLIA E., FOGU M.C. & MOSSA L. 1994 - La vegetazione nitrofila della città di Cagliari (Sardegna). Allionia 32: 303–323.

BIONDI E., BLASI C., BURRASCANO S., CASAVECCHIA S., COPIZ R., DEL VICO E., GALDENZI D., GIGANTE D., LASEN C., SPAMPINATO G., VENANZONI R., ZIVKOVIS L., 2010 - Manuale italiano di interpretazione degli habitat (Direttiva 92/43/CEE). Ministero dell'Ambiente e della Tutela del Territorio e del Mare, Direzione per la Protezione della Natura. Sito internet: http://vnr.unipg.it/habitat/index.jsp

BIONDI, E., BURRASCANO, S., CASAVECCHIA, S., COPIZ, R., DEL VICO, E., GALDENZI, D., GIGANTE, D., LASEN, C., SPAMPINATO, G., VENANZONI, R., ZIVKOVIC, L., BLASI, C., 2012 - Diagnosis and syntaxonomic interpretation of Annex I Habitats (Dir. 92/43/EEC) in Italy at the alliance level. Plant Sociology 49, 5-37.

BIONDI E., CASAVECCHIA S., ESTRELLES E. & SORIANO P., 2013 - *Halocnemum* M. Bieb. vegetation in the Mediterranean Basin. Plant Biosystems 147(3): 536-547.

BIONDI E., CASAVECCHIA S. & GIGANTE D., 2003 - Contribution to the syntaxonomic knowledge of the *Quercus ilex* L. woods of the Central European Mediterranean Basin. Fitosociologia 40(1): 129-156

BIONDI E., CASAVECCHIA S., PESARESI S., GANGALE C. & UZUNIOV D., 2014 - New syntaxa for the prodrome of Italian vegetation. Plant Biosystems 148 (3-4): 723-727.

BIONDI E., CASAVECCHIA S. & ZUCCARELLO V., 1997 - The *Potentilletalia caulescentis* Br.-Bl. in Br.-Bl. & Jenny 1926 order in Italy. Colloques Phytosociologiques 27: 105-122.

BIONDI E., FILIGHEDDU R. & FARRIS E., 2001 - Il paesaggio vegetale della Nurra. Fitosociologia 38 (2) suppl. 2: 3-105.

BIONDI E. & GALDENZI D., 2014 - Syntaxonomic considerations of the Mediterranean vegetation dominated by perennial psammophilous graminaceous plants. Plant Sociology 51 Suppl. 1: 25-32.

BIONDI E., IZCO J., BALLELLI S. & FORMICA E., 1997 - La vegetazione dell'ordine *Thero-Brachypodietea* Br.-Bl. 1936 nell'Appennino centrale (Italia). Fitosociologia 32: 273-287.

BIONDI E. & MOSSA L., 1992 - Studio fitosociologico del promontorio di Capo S.Elia e dei Colli di Cagliari (Sardegna). Doc. Phytosoc. 14: 1-44.

BIONDI E., PESARESI S., GALDENZI D., GASPARRI R., BISCOTTI N., DEL VISCIO G. & CASAVECCHIA S., 2016 - Post-abandonment dynamic on Mediterranean and sub-Mediterranean perennial grasslands: the edge vegetation of the new class *Charybdido pancratii-Asphodeletea ramosi.* Plant Sociology 53(2): 3-18.

BIONDI E. & VAGGE N. 2015 - The forest of *Pinus pinaster* Aiton subsp. *pinaster* of the NW Italian Tyrrenian sector. Acta Bot. Gallica: Botany Letters 162(3):239-246.

BIORET F., GAUDILLAT V. & ROYER J.M., 2013 - The Prodrome of French vegetation: a national synsystem for phytosociological knowledge and management issues. Plant Sociology, 50 (1): 17–21.

BISCULM M., COLOMBAROLI D., VESCOVI E., VAN LEEUWEN J., HENNE P. D., ROTHEN J., PROCACCI J., PASTA S., LA MANTIA T. & TINNER W., 2012 - Holocene vegetation and fire dynamics in the supra-mediterranean belt of the Nebrodi Mountains (Sicily, Italy). Journal of Quaternary Science 27(7):687-698.

BLASI C. (ed.), 2010 - La vegetazione d'Italia, Carta delle Serie di Vegetazione, scala 1:500 000. Palombi & Partner S.r.l. Roma.

BLASI C., CUTINI M., DI PIETRO R. & FORTINI P., 2002 - Contributo alla conoscenza della sub-alleanza *Pruno-Rubenion ulmifolii* in Italia. Fitosociologia 39 (1)-Suppl. 2: 129-143.

BLASI C., DI PIETRO R. & FILESI L. 2004 - Syntaxonomical revision of *Quercetalia pubescenti-petraeae* in the Italian peninsula. Fitosociologia 41(1): 87-164.

BLASI C., DI PIETRO R. & FORTINI P., 2000 - Aphytosociological analysis of abandoned terraced olive grove in the Tyrrhenian district of Central Italy. Plant Biosystems 134 (3): 305-331.

BLASI C., FASCETTI S., VERI L., BRUNO F., 1983 - Coastal plant communities along the seashore between Scalea and Amantea (Western Calabria-Southern Italy). Ann. Bot. (Roma) 41: 197-209.

BLOM C.W.P.M. 1976 - Effects of trampling and soil compaction on the occurrence of some Plantago species in coastal sand dunes. I. Soil compaction, soil moisture and seedling emergence. Orcol. Plant. 11: 225-241.

BOCQUET G., WIDLER B. & KIEFER H., 1978 - The Messinian Model: A new outlook for the floristics and systematics of the Mediterranean area. Candollea 33(2): 269-287.

BOGENRIEDER A. & ESCHENBACH C., 1996 - Ökologische Untersuchungen an Moosen aus Quellfluren kaltstenothermer Quellen des Hochschwarzwaldes. Crunoecia 5: 109–118.

BOLÒS, O. de, 1956 - De vegetatione notulae II. Collect. Bot. (Barcelona) 5(1): 195-268.

BOLÓS, 0. de, 1957 - De vegetatione valentina I. Collect. Bot. (Barcelona)5(2): 527–596.

BOLÓS, 0. de, 1962 - El paisaje vegetal barcelonés. Fac. Fil. Letras. Univ. Barcelona, Barcelona.

BOLÓS, 0. de, 1967 - Comunidades vegetales de la Comarcas proxima al litoral situados entre los Rios llobregat y Segura. Mem. Real Acad. Cienc. Art. Barcellona 28(1):, 1-280.

BOLÒS O. DE, 1970 - A propos de quelques groupements végétaux observés entre Monaco et Gênes. Vegetatio 21: 49-73.

BOLÒS O. DE, 1975 - Contribution à l'étude du *Bromo-Oryziopsion miliaceae*. Phytocoenologia 2: 141-145.

BOLÓS, 0. de, 1996 - La vegetació de les Illes Balears: comunitats de plantes. Inst Estud Catalans 114:1-267.

BOLÒS, A. de & BOLÒS, O. de, 1950 - Vegetacion de la comarcas barcelonesas. Inst. Esp. De Est. Medit. Barcelona. 1-579.

BOLÓS O. de & MASCLANS F., 1955 - La vegetaciòn de los arrozales en la región mediterránea. Collect. Bot. (Barcelona) 4 (3): 1-32.

BOLÓS O. de & MOLINIER R., 1958 - Recherches phytosociologiques dans l'ile de Minorque. Collect. Bot. 5(3): 699-865.

BOLÒS O. de & VIGO J., 1972 - Contribution à la géobotanique de l'ile de Majorque. Rapp. Comm. Int. Mer Médit. 21(3): 81-82

BONANNO G., 2008 - La vegetazione della foce del fiume Salso (Sicilia meridionale). Webbia 63(1):109-133.

BONANNO G., 2014 - Vegetazione di foce a rischio in ambienti urbani. Il caso del fiume Imera Meridionale. Bollettino Accademia Gioenia Sci. Nat. 47:92-102.

BONANNO G. & LO GIUDICE R., 2009 - Vegetation of Aquicella stream, urban water course of Catania (Sicily, South Italy). Webbia 64(2): 213-234.

BONANOMI G. & ALLEGREZZA M., 2004 - Effetto della colonizzazione di *Brachypodium rupestre* (Host) Roemer et Schultes sulla diversità vegetale in un settore dell'Appennino umbro-marchigiano. Fitosociologia 41 (2): 51-69.

BONANOMI G., CAPORASO S. & ALLEGREZZA M., 2006 - Short-term effect of nitrogen enrichment, litter removal and cutting on a Mediterranean grassland. Acta Oecol. 30: 419-425.

BONIS A., LEPART J. & GRILLAS P., 1995 - Seed bank dynamics and coexistence of annual macrophytes in a temporary and variable habitat. Oikos 74: 81–92.

BORGESEN F., 1905 - The algae vegetation of the Faeröes coasts, with remarks on the phytogeography. Bot. Faeröes, 2 : 683-734.

BORUM J. & GREVE T.M., 2004 - The four European seagrass species. In: Borum J., Duarte C.M., Krause-Jensen D. and Greve T.M., Eds., European Seagrasses: An Introduction to Monitoring and Management, EU Project Monitoring and Managing of European Seagrasses (M&MS), 88. http://www.seagrasses.org

BOULOS L., 2005 - Flora of Egypt, Volume 4: Monocotyledons (Alismataceae-Orchidaceae). Al Hadara Publishing, Cairo, 617 pp.

BRANCA F., BRULLO S., GUARINO R., GUGLIELMO A., MASCARA R.,MINISSALE P., MULÈ N., PETRALIA A., RONSISVALLE F., RUSSO C. & SCIANDRELLO S. 2010 - Il litorale di Manfria (Gela) natura e storia da proteggere. Capur-Ciber,Roma, 127pp.

BRANDES D., 1991 - Soziologie und Ökologie von *Oxalis pes-caprae* L. im Mittelmeergebiet unter besonderer Berücksichtigung von Malta. Phytocoenologia 19(3):285-306.

BRANDES D., 1996 - Vegetation der Straßenränder Korfus. Braunschweiger Geobotanische Arbeiten, 5: 247-262.

BRAUN-BLANQUET J., 1931 - Aperçu des groupements végétaux du Bas Languedoc. Comm. SIGMA 9: 35-36.

BRAUN-BLANQUET J., 1933 - Prodrome des groupements végétaux, 1: Ammophiletalia et Salicornietalia médit. Montpellier, 23 pp.

BRAUN-BLANQUET J., 1949 - Premier aperçu phytosociologique du Sahara Tunisien. Mem. Hors-Serie Soc. Hist. Nat. Afrique du Nord 2: 39-50.

BRAUN-BLANQUET J., 1952 - Les groupements vegetaux de la France méditerranéenne. CNRS, Montpellier, 297 pp.

BRAUN-BLANQUET, J., 1953 - Irradiations europeennes dans la végétation de la Krumirie. Vegetatio 4(3): 182-194.

BRAUN-BLANQUET J., 1964 - Pflanzensoziologie, Grundzüge der Vegetationskunde. 3rd Edition, Springer-Verlag, Berlin, 631 pp.

BRAUN-BLANQUET J., 1966 - Vegetationsskizzen aus dem baskenland mit ausblicken auf das weitere ibero-atlantikum. I. Teil. Vegetatio, 13(3): 117-147.

BRAUN-BLANQUET J., 1967 - Vegetationsskizzen aus dem Baskenland mit Ausblicken auf das weitere Ibero-atlantikum. II. Teil. Vegetatio 14: 1–126.

BRAUN-BLANQUET J. & BOLÓS O. de, 1958 - Les groupements vegetaux du bassin moyen de l'Ebre et leur dynamisme. Anales de la Estacion Experimental de Aula Dei. Consejo Superior de Investigaciones Cientifica 5: 1-5.

BRAUN-BLANQUET J., GAJEWSKI W., WRABER M. & WALAS J., 1936 - Classe des *Rudereto-Secalinietales*. Prodrome des groupements végétaux, 3. Montpellier, 37 pp.

BRAUN-BLANQUET J., ROUSSINE N. & NÈGRE R., 1952 - *Les groupements végétaux de la France Méditerranéenne*. C.N.R.S., Montpellier.

BRAUN-BLANQUET J. & R. TÜXEN, 1943 - Ubersicht der hoheren vegetationseinheiten Mitteleuropas. Commun. Stat. Int. Geobot. Medit. Montpellier 84.

BRAUN-BLANQUET J. & R. TÜXEN, 1952 - Irische Pflanzengesellschaften Vcröff. Geobot. Inst. Rübel 25: 224–415.

BRENAC P., 1984 - Végétation et climat de la Campanie du Sud (Italie) au Pliocène final d'après l'analyse pollinique des dépôts de Camerota. Ecol. Medit., 10, 3-4: 207-216.

BROQUET P., 2016 - Sicily in its Mediterranean geological frame. Boletín Geológico y Minero, 127 (2-3): 547-562.

BROUWER E., BOBBINK R. & ROELOFS J. G. M., 2002- Restoration of aquatic macrophyte vegetation in acidified and eutrophied softwater lakes: an overview. Aquatic Bot. 73: 405–431.

BRULLO C. & BRULLO S., 2013 - Note tassonomiche su *Helichrysum panormitanum* (Asteraceae), endemismo siculo. In: Peccenini S. & Domina G. (Eds.). Contributi alla ricerca floristica in Italia. SBI, Firenze, pp. 43–44.

BRULLO C., BRULLO S., CAMBRIA S., GIUSSO DEL GALDO G. & ILARDI V., 2016 - *Limonium cophanense* (Plumbaginaceae), a new species from Sicily. Phytotaxa 255 (2): 153-159.

BRULLO C., BRULLO S., GASKIN J., GIUSSO DEL GALDO G., HRUSA G. & SALMERI C., 2015 - A new species of *Kali* (Salsoloideae, Chenopodiaceae) from Sicily, supported by molecular analysis. Phytotaxa 201(4):256-277.

BRULLO C., BRULLO S. & GIUSSO DEL GALDO G., 2013 - *Solenopsis mothiana* (Campanulaceae), a new species from Sicily. Phytotaxa 145 (1): 15–26.

BRULLO C., BRULLO S., GIUSSO DEL GALDO G., GUARINO R., MINISSALE P., SCUDERI L., SIRACUSA G., SCIANDRELLO S., SPAMPINATO G., 2010 - The *Lygeo-Stipetea* class in Sicily. Ann. Bot. Roma, 4, 0: 57-84.

BRULLO C., BRULLO S., GIUSSO DEL GALDO G., GUARINO R., SIRACUSA G., SCIANDRELLO S., 2012 -The class *Querco-Fagetea sylvaticae* in Sicily: an example of boreo-temperate

vegetation in the central mediterranean region. Annali di Botanica, (Ser. IV), vol. 2, 19-38.

BRULLO C., BRULLO S., GIUSSO DEL GALDO G., MINISSALE P. & SCIANDRELLO S., 2011 - *Astragalus raphaelis* (Fabaceae), a critical species from Sicily and taxonomic remarks on A. sect. Sesamei. Nordic Journal of Botany 29: 518-533.

BRULLO C., BRULLO S., GIUSSO DEL GALDO G. & SCUDERI L., 2009 - Taxonomical notes on the Sicilian populations of *Asperula gussonei* (Rubiaceae): *A. peloritana* sp. nov. Anales Jard. Bot. Madrid 6: 85-92.

BRULLO C., BRULLO S., GIUSSO DEL GALDO G., TOMASELLI V., 2006 - Contributo alla conoscenza delle praterie a *Brachypodium retusum* del Mediterraneo centro-orientale. Quad. Bot. Amb. Appl. 17(2): 49-64.

BRULLO S., 1975 - Aspetti di vegetazione tero-xerofitica del territorio ibleo (Sicilia meridionale-orientale). Boll. Sed. Acc. Gioenia Sc. Nat. Catania, 12 (7-8): 5-16.

BRULLO S., 1978 - La vegetazione palustre di Capo Feto. Un ambiente da salvare. Atti II° **Conv**.Sic.Ecol., Ambienti umidi costieri Noto 1977: 41-45.

BRULLO S., 1980 - La classe *Polygono-Poetea annuae* in Sicilia. Not.Fitosoc. 15: 117-123.

BRULLO S., 1983a - L'*Hordeion leporini* in Sicilia. Arch. Bot. e Biogeogr. Ital. 58(1-2): 55-88.

BRULLO S., 1983b - Le associazioni subnitrofile dell'*Echio-Galactition tomentosae* in Sicilia. Boll. Acc. Gioenia Sci. Nat. Catania 15: 405-452.

BRULLO S., 1984a - Contributo alla conoscenza della vegetazione delle Madonie (Sicilia settentrionale). Boll. Acc. Gioenia Sci. Nat. Catania 16: 351-420.

BRULLO S., 1984b - L'Alleanza *Bromo-Oryzopsion miliaceae* in Sicilia. Boll. Acc. Gioenia Sci. Nat. 17: 239-258.

BRULLO S., 1985 - Sur la syntaxonomie des pelouses therophytiques des territoires steppiques de l'Europe sud-occidentale. Doc. Phytosoc. n.s. 9: 1-24.

BRULLO S., 1986 - Le associazioni della classe *Frankenietea pulverulentae* nel Mediterraneo centrale. VI Journades Fitosoc. Veg. Nitrof. Barcellona: 29-31.

BRULLO S., 1988 - Le associazioni della classe *Frankenietea pulverulentae* nel Mediterraneo centrale. Acta Bot. Barc. 37: 45-57.

BRULLO S., 1988b - Miscellaneous Notes on the Genus *Limonium* (Plumbaginaceae). Acta Bot. Barc. 37: 45-57. Willdenowia 17(1/2): 11-18.

BRULLO S., BRULLO C., CAMBRIA S. & GIUSSO DEL GALDO, 2020 - The vegetation of the Maltese Islands (Central Mediterranean). Springer, 402 pp.

BRULLO S., BRULLO C., CAMBRIA S., GIUSSO DEL GALDO G. & MINISSALE P., 2017 - Phytosociological investigation on the class *Crithmo maritimi-Limonietea* in Greece. Plant Sociology 54(1): 3-57.

BRULLO S., CORMACI A., GIUSSO DEL GALDO G., GUARINO R., MINISSALE P., SIRACUSA G., 2005 - A syntaxonomical survey of the Sicilian dwarf shrub vegetation belonging to the class *Rumici-Astragaletea siculi*. Annali di Botanica, 5, 103-149.

BRULLO S., CORMACI A., GUARINO R., MUSARELLA C.M., 2007 - Syntaxonomical survey of *Geranio Cardaminetalia hirsutae*: semi-natural therophytic vegetation of the Mediterranean Region. Ann. Bot. VII: 183-216.

BRULLO S., COSTANZO E. & TOMASELLI V., 2001 - Étude phytosociologique sur les peuplements à *Laurus nobilis* dans les Monts Iblei (Sicile sud-orientale). Phytocoenologia 31(2): 249-270.

BRULLO S. & DE MARCO G., 1989 - *Anthyllidion barbae-jovis* alleanza nuova dei *Crithmo-Limonietea*. Arch. Bot. Biogeogr. Ital., 65 (1-2): 109-120.

BRULLO S., DE MARCO G. & SIGNORELLO P., 1990 - Studio fitosociologico delle praterie a *Lygeum spartum* dell'Italia meridionale. Boll. Acc. Gioenia Sci. Nat. 23(336): 561-579.

BRULLO S. & DI MARTINO A., 1974 - Vegetazione dell'Isola Grande dello Stagnone (Marsala). Boll. Studi Inform. Giard. Bot. Palermo 26: 15-62.

BRULLO S., DI MARTINO A. & MARCENÓ C., 1974 - Osservazioni sulla vegetazione psammofila di Capo Granitola e Selinunte (Sicilia occidentale). Bollettino di Studi e Informazioni del Giardino Coloniale di Palermo 26: 103-110.

BRULLO S., DI MARTINO A. & MARCENÓ C., 1977 - La vegetazione di Pantelleria. Pubbl. Ist. Bot. Univ. Catania. 110 pp.

BRULLO S, DE SANTIS C., FURNARI F., LONGHITANO N. & RONSISVALLE G., 1988 - La vegetazione dell'Oasi della Foce del Simeto (Sicilia orientale). Braun-Blanquetia 2: 165-188.

BRULLO S., FAGOTTO F. & MARCENÓ C., 1980 - Carta della vegetazione di Vendicari, Sicilia. Quaderni C.N.R., AQ/1/38: 25-41.

BRULLO S. & FURNARI F., 1970 - Vegetazione psammofila presso il Capo Isola delle Correnti (Sicilia sud-orientale). Pubbl. Ist. Bot. Univ. Catania, 8 pp.

BRULLO S. & FURNARI F., 1971 - Vegetazione dei pantani litoranei della Sicilia sud-orientale e problema della conservazione dell'ambiente. Pubblicazioni dell'Istituto do Botanica dell'Università di Catania.

BRULLO S. & FURNARI F., 1976 - Le associazioni vegetali degli ambienti palustri costieri della Sicilia. Not. Fitosoc. 11: 1-43.

BRULLO S. & FURNARI F., 1981 - Phytogeographical considerations on the coastal vegetation of Cyrenaica. Actas III Congr. ÓPTIMA. Anales Jard. Bot. Madrid 37 (2): 765-772.

BRULLO S. & FURNARI F., 1988 - La vegetazione costiera della Cirenaica. Boll. Acc. Gioenia Sci. Nat., 21: 37-117.

BRULLO S. & FURNARI F. 1990 - Considerazioni sulla flora e vegetazione delle Isole Eolie. In Piccione, V., & Antonelli, C. (a cura di), Parchi naturali e aree protette. 2° Workshop Progetto strategico Clima Ambiente e territorio nel Mezzogiorno. S.M. Salina (Isole Eolie), 28–30 maggio 1990, 379–392.

BRULLO S. & FURNARI F., 1994 - *Considerazioni sulla flora e vegetazione delle Isole Eolie*. 2° Workshop Progetto Strategico: 379-392.

BRULLO S., FURNARI F. & SCELSI F., 1993b - Considerazioni fitosociologiche sulla vegetazione di Cava d'Ispica (Sicilia meridionale). Boll. Acc. Gioenia Sci.Nat., 26(341): 49-83.

BRULLO S., GANGALE C. & UZUNOV D., 2004 - The orophilous cushion-like vegetation of the Sila Massif (S. Italy). Bot. Jahrb. Syst. 125: 453-488.

BRULLO, S., GIANGUZZI, L., LA MANTIA, A., & SIRACUSA, G., 2008 - La classe *Quercetea ilicis* in Sicilia. Bollettino dell'Accademia Gioenia di Scienze Naturali in Catania, 41(369), F1-F77.

BRULLO S., GIARDINA G. & SIRACUSA G., 1994 - Considerazioni fitogeografiche su *Leontodon muelleri* (C. A. Schultz) Ball (Asteraceae), specie rara della flora italiana. Giorn. Bot. Ital., 128 (1): 375.

BRULLO S. & GIUSSO DEL GALDO G., 2003 - La classe *Saginetea maritimae* in Italia. Fitosociologia 40 (2): 29-41.

BRULLO S., GIUSSO DEL GALDO G. & GUARINO R., 2001 - The orophilous communities of the *Pino-Juniperetea* class in the Central and Eastern Mediterranean area. Feddes Repertorium 112(3-4): 261-308.

BRULLO S., GIUSSO DEL GALDO G. & GUARINO R., 2002 - Phytosociological notes on the *Lygeum spartum* grassland from Crete. Lazaroa 23: 65-72.

BRULLO S., GIUSSO DEL GALDO G. & GUARINO R., 2001 - The orophilous communities of the *Pino-Juniperetea* class in the Central and Eastern Mediterranean area. Feddes Repert. 112: 261-308.

BRULLO S., GIUSSO DEL GALDO G, GUARINO R, MINISSALE P, SPAMPINATO G., 2007 - A survey of weedy communities of Sicily. Annali di botanica 7: 127-161.

BRULLO S., GIUSSO DEL GALDO G., GUARINO R., MINISSALE P., SCIANDRELLO S. & SPAMPINATO G., 2012 - Syntaxonomic survey of the class *Pegano harmalae-Salsoletea vermiculatae* Br.-Bl. & O. Bolos 1958 in Italy. Plant Biosystems; 161(1): 1–26.

BRULLO S., GIUSSO DEL GALDO G., MINISSALE P., SIRACUSA G., SPAMPINATO G., 2002 - Considerazioni sintassonomiche e fitogeografiche sulla vegetazione della Sicilia. Boll. Accad. Gioenia Sci. Nat., 35(361): 325-359.

BRULLO S., GIUSSO DEL GALDO G., MINISSALE P. & SPAMPINATO G. 2002 - Considerazioni sintassonomiche e fitogeografiche sulla vegetazione della Sicilia. Boll. Acc. Gioenia Sci. Nat. 35 (361): 325-359.

BRULLO S., GIUSSO DEL GALDO G., MINISSALE P. & SPAMPINATO G. 2003 - Considerazioni tassonomiche sui generi *Catapodium* Link., *Desmazeria* Dumort. e *Castellia* Tineo (Poaceae) in Italia. Inform. Bot. Ital. 35(1): 158-170.

BRULLO S., GIUSSO DEL GALDO G., SIRACUSA G. & SPAMPINATO G., 2001- Considerazioni fitogeografiche sulla vegetazione psammofila dei litorali italiani. Biogeographia 22: 93-137.

BRULLO S. & GRILLO M., 1978 - Ricerche fitosociologiche sui pascoli dei Monti Nebrodi (Sicilia settentrionale). Not. Fitosoc. 13:26-61.

BRULLO S. & GRILLO M., 1985 - Le associazioni psammofile effimere dei *Malcolmietalia* rinvenute in Sicilia. Boll. Acc. Gioenia Sci. Nat. Catania 18: 271-282.

BRULLO S., GRILLO M. & SCALIA C. 1980 - Su una nuova associazione dei *Pegano-Salsoletea* osservata presso Porto Empedocle (Agrigento). Giorn Bot Ital 114: 43-52.

BRULLO S., GRILLO M. & TERRASI M. C., 1976 - Ricerche fitosociologiche sui pascoli di Monte Lauro (Sicilia meridionale). Boll. Acc. Gioenia Sci. Nat. Catania s.4, 12(9-10): 84-104.

BRULLO S. & GUARINO R., 1998 - Syntaxonomy of the *Parietarietea judaicae* class in Europe. Ann. Bot. 56 (1): 109-146.

BRULLO S. & GUARINO R. 2000 - Contribution to the knowledge of flora and vegetation of Khrisi islet (Crete, SE Mediterranean sea). Fl. Medit. 10: 265-282.

BRULLO S. & GUARINO R., 2002 - La classe *Parietarietea judaicae* in Italia. Fitosociologia 39(1):5-27.

BRULLO S. & GUARINO R., 2007 - The Mediterranean weedy vegetation and its origin. Annali di Botanica 7: 101-110.

BRULLO S., GUARINO R. & MINISSALE P., 2000- Taxonomic and phytogeographical remarks on *Trifolium savianum* Guss., a misappreciated species of the Italian flora. Bot. Jahrb. Syst. 122(4): 469-480.

BRULLO S., GUARINO R., MINISSALE P., SCELSI F. & SPAMPINATO G., 2004 - Indagine fitosociologica sulla vegetazione forestale dell'Egeo meridionale. Coll. Phytosoc. 28: 401–466.

BRULLO S., GUARINO R., MINISSALE P., SIRACUSA G. & SPAMPINATO G., 1999 - Syntaxonomical analysis of the beech forests from Sicily. Ann. Bot. 57: 121-132.

BRULLO S., GUARINO R. & RONSISVALLE G., 2000 - La vegetazione del litorale di Manfria, presso Gela (Sicilia), area soggetta a vincolo archeologico. Arch. Geobot. 4: 91-107.

BRULLO S., GUGLIELMO A. & PAVONE P., 1985 - La classe *Pegano-Salsoletea* in Sicilia. Boll. Acc. Gioenia Sci. Nat. Catania 18: 247-254.

BRULLO S., LO GIUDICE R. & PRIVITERA M., 1989 - La classe *Adiantetea* in Sicilia. Arch. Bot. e Biogeogr. Ital. 65 (1-2): 81-99.

BRULLO S. & MARCENÓ C., 1973 - *Crucianella rupestris* Guss. in Sicilia. Lavori Ist. Bot. e Giard. Col. di Palermo 25:133-141.

BRULLO S. & MARCENÓ C., 1974° - *Vulpio-Leopoldietum gussonei* ass.nov. dell'*Alkanneto-Malcolmion* nella Sicilia meridionale. Not.Fitosoc. 8: 75-85.

BRULLO S. & MARCENÓ C., 1974b - *La vegetazione estiva dei bacini artificiali siciliani*. Lav. Ist. Bot. e Giard. Col. Palermo. 25: 184-194.

BRULLO S. & MARCENÓ C., 1976 - Osservazioni su una microassociazione a cariofillacee annue rilevata in Sicilia. Boll. Acc. Gioenia Sci. Nat. Catania s.4,12 (9-10): 105-108.

BRULLO S. & MARCENÓ C., 1979 - *Dianthion rupicolae* nouvelle alliance sud-tyrrhenienne des *Asplenietalia glandulosi*. Doc. Phytosoc. n.s. 4: 131-146.

BRULLO S. & MARCENÓ C., 1980 - Il *Diplotaxion erucoidis* in Sicilia, con considerazioni sulla sintassonomia e distribuzione. Not. Fitosoc. 15: 27-44.

BRULLO S. & MARCENÓ C., 1983° - Contributo alla conoscenza della vegetazione nitrofila della Sicilia. Coll. Phytosoc. 12: 23-148.

BRULLO S. & MARCENÓ C., 1983b - Osservazioni fitosociologiche sull'isola di Marettimo (Arcipelago delle Egadi). Boll. Acc. Gioenia Sci. Nat. Catania 15(320): 201-228.

BRULLO S. & MARCENÓ C., 1985 - Contributo alla conoscenza della classe *Quercetea ilicis* in Sicilia. Not. Fitosoc. 19(1): 183-229.

BRULLO S., MARCENÓ C., MINISSALE P. & SPAMPINATO G., 1989 - Su una nuova associazione del *Sedo-Ctenopsion gypsophilae* rinvenuta in Sicilia. Archivio Botanico Italiano 65: 100-108.

BRULLO S., MARCENÓ C. & ROMANO S., 1996 - *Limonium melancholicum* Brullo, Marcenó et Romano (Plumbaginaceae), a new species from Sicily. Candollea 51 (1): 99-102.

BRULLO S., MARCENÓ C. & SIRACUSA G., 2004 - La classe *Asplenietea trichomanis* in Sicilia. Coll. Phytosoc. 28: 467-538.

BRULLO S. & MINISSALE P., 1997 - Su alcune associazioni dell'alleanza *Anthyllidion barbae-jovis* del Mediterraneo occidentale. Fitosociologia 32: 161-169.

BRULLO S. & MINISSALE P., 1998 - Considerazioni sintassonomiche sulla classe *Isoeto-Nanojuncetea*. Itinera Geobot. 11: 263-290.

BRULLO S., MINISSALE P., SCELSI F. & SPAMPINATO G., 1993 - Note fitosociologiche miscellanee sul territorio ibleo (Sicilia sud-orientale). Boll. Acc. Gioenia Sci. Nat. Catania, 26 (341):19-48.

BRULLO S., MINISSALE P., SIGNORELLO P., SPAMPINATO G. 1996 - Contributo alla conoscenza della vegetazione forestale della Sicilia. Coll. Phytosoc. 24: 636-647.

BRULLO S., MINISSALE P. & SIRACUSA G., 1996 - Quadro sintassonomico della vegetazione iblea. Boll. Acc. Gioenia Sci. Nat. 29 (352): 113-150.

BRULLO S., MINISSALE P., SIRACUSA G., SCELSI F. & SPAMPINATO G. 2002- Indagine fitosociologia sui pineti a *Pinus pinea* della Sicilia. Quad. Bot. Ambientale Appl. 13: 117-124.

BRULLO S., MINISSALE P., SIRACUSA G. & SPAMPINATO G., 1997 - Taxonomic and phytogeographical considerations on *Hyoseris taurina* (Compositae) a S. Tyrrhenian element. Bocconea 5(2): 707-716.

BRULLO S., MINISSALE P. & SPAMPINATO G. 1994 - Studio fitosociologico della vegetazione lacustre dei Monti Nebrodi (Sicilia settentrionale). Fitosociologia 27: 5-50.

BRULLO S., MINISSALE P. & SPAMPINATO G. 1995 - Considerazioni fitogeografiche sulla flora della Sicilia. Ecologia Mediterranea 21: 99–117.

BRULLO S., MINISSALE P. & SPAMPINATO G., 1997 - La classe *Cisto-Micromerietea* nel Mediterraneo centrale e orientale. Fitosociologia 32: 29-60.

BRULLO S. & PAVONE P., 1981 - Chromosome numbers in the Sicilian species of *Limonium* Miller (Plumbaginaceae). Acta III Congr. OPTIMA, Anal. Jard. Bot. Madrid.

BRULLO S., PICCIONE V., 1980 - Esempi di cartografia della vegetazione di alcune aree della Sicilia. Carta della vegetazione di Linosa. C.N.R. AQ/1/40: 53-66.

BRULLO S, PRIVITERA M. & PUGLISI M., 1993c - *Thamnobryo alopecuri-Phyllitidetum scolopendrium* nuova associazione centro-mediterranea della classe *Adiantetea*. Arc. Bot. Ital. 68: 35-43.

BRULLO S. & RONSISVALLE G.A. 1973 - Vegetazione delle saline megaresi (Sicilia orientale). Primo contributo. Inform. Bot. Ital. 5(1): 89-90.

BRULLO S. & RONSISVALLE G.A. 1975 - La vegetazione dei Gorghi Tondi e del Lago Preola, presso Mazara del Vallo (Sicilia occidentale). Not. Fitosoc. 10: 45-67.

BRULLO S. & SCELSI F. 1998 - Contributo alla vegetazione terofitica del territorio ibleo. Boll. Acc. Gioenia Sci. Nat. 29(352): 151-168.

BRULLO S., SCELSI F. & SIRACUSA G., 1994 - Contributo alla conoscenza della vegetazione terofitica della Sicilia occidentale. Boll. Acc. Gioenia Sci. Nat. 27(346): 341-365.

BRULLO S., SCELSI F., SIRACUSA G. & SPAMPINATO G., 1996 - Caratteristiche bioclimatiche della Sicilia. Giornale Botanico Italiano 130: 177–185.

BRULLO S., SCELSI F., SIRACUSA G. & SPAMPINATO G., 1999 - Considerazioni sintassonomiche e corologiche sui querceti caducifogli della Sicilia e della Calabria. Monti e Boschi 1: 16-29.

BRULLO S., SCELSI F., SIRACUSA G. & TOMASELLI V. 1998c - Note fitosociologiche sulla vegetazione di Monte Lauro (Sicilia sud-orientale). Boll. Acc. Gioenia Sci. Nat. 29(352): 169-184.

BRULLO S., SCELSI F. & SPAMPINATO G., 1997 - *Aristido caerulescentis-Hyparrhenion hirtae*, alleanza nuova della classe *Lygeo-Stipetea* a distribuzione sud- mediterraneo-macaronesica. Fitosociologia 32: 189-206.

BRULLO S., SCELSI F. & SPAMPINATO G., 1998b - Considerazioni sintassonomiche sulla vegetazione perenne pioniera dei substrati incoerenti dell'Italia meridionale e Sicilia. Itinera Geobot. 11: 403-424.

BRULLO S., SCELSI F., SPAMPINATO G., 2001 - La vegetazione dell'Aspromonte. Studio fitosociologico. Laruffa Editore, 368 pp.

BRULLO S. & SCIANDRELLO S., 2006° - La vegetazione del bacino lacustre “Biviere di Gela” (Sicilia meridionale). Fitosociologia. 43(2):21-40.

BRULLO S. & SCIANDRELLO B., 2006b - *Cyperus alopecuroides* Rothb. (Cyperaceae): typification and first record for Sicily. Candollea 61(2): 365-372.

BRULLO S. & SIRACUSA G., 1996 - Studio fitosociologico dell'Isola di Linosa. Doc. Phytosoc. 16: 123-174.

BRULLO S. & SIRACUSA G., 2000 - Indagine fitosociologica su un'area umida del versante sud-occidentale dell'Etna di notevole interesse naturalistico. Arch. Geobot. 4: 71-90.

BRULLO S. & SPAMPINATO G., 1986 - *Fedio-Convolvulion cupaniani*, nuova alleanza sicula dei *Brometalia rubenti-tectori*. Not. Fitosoc. 21: 71-80.

BRULLO S., SPAMPINATO G. 1990 - La vegetazione dei corsi d'acqua della Sicilia. Boll. Acc. Gioenia 23 (336): 119-252.

BRULLO S. & SPAMPINATO G. 1997 - Indagine fitosociologica sulle ripisilve della Calabria (Italia meridionale). Lazaroa 18: 1-50.

BRULLO S. & SPAMPINATO G., 2003 - La Classe *Asplenietea trichomanis* in Calabria (Italia meridionale). Fitosociologia 40(1): 5-22.

BRZEG A. & WOJTERSKA M., 2001 - Zespoły roslinne Wielkopolski, ich stan poznania i zagrozenie. W: Szata roslinna Wielkopolski i Pojezierza Południowopomorskiego. Red. M. Wojterska. Przewodnik sesji terenowych 52. Zjazdu PTB, 24-28 wrzesnia 2001. Bogucki Wydawinctwo Naukowe, Poznán: 39-110.

BUCHWALD R., GAMPER U., SBURLINO G., & ZUCCARELLO V., 2000 - Sintassonomia delle comunità a *Potamogeton coloratus* dell'Europa centro-meridionale. Fitosociologia, 37(1): 61-68.

BUENO A., 1997- Flora y vegetaciòn de los estuarios asturianos. Quadernos de Medio Ambiente Naturaleza, Oviedo 3: 1-334.

BUENO SANCHEZ A. & FERNANDEZ PRIETO J.A., 1991 - Acebuchales y lauredales de la costa cantabrica. Lazaroa 12: 273-301

BUROLLET P. A., 1927 – Le Sahel de Sousse monographie phytogéographique. Société Anonyme de l'Imprimerie Rapide de Tunis, 278 pp.

BUTCHER R. W., 1941 - The distribution of Zostera (eelgrass, wigeon grass) and other seashore plants in relation to the migrations of wildfowl. International Waterfowl Inquiry 1:35.

CAFFREY J.M., DUTARTRE A., HAURY J., MURPHY K.J. & WADE P.M., 2006 - Macrophytes in Aquatic Ecosystems: from Biology to Management. Springer, 262 pp.

ÇAKAN H., YILMAZ K. T., ALPHAN H., ÜNLÜKAPLAN Y., 2011 - The classification and assessment of vegetation for monitoring coastal sand dune succession: the case of Tuzla in Adana, Turkey. Turk. J. Bot. 35: 697-711.

CALDARELLA O., 2012 - Variazioni floristico-fitocenotiche nel Gorgo del Drago (R.N.O. Bosco Ficuzza, Palermo), a seguito di un prolungato periodo di prosciugamento. Naturalista Siciliano S, IV, XXXVI: 495-532.

CALDARELLA O., LA ROSA A., CUSIMANO D., ROMANO S., GIANGUZZI L., 2013 - Distribution, ecology and conservation survey on *Trifolium michelianum* Savi (Fabaceae) in Sicily (Italy). Plant Biosystems, 147 (4): 979-990.

CALÒ C., HENNE P.D., BRANDON C., MAGNY M., VESCOVI E., LA MANTIA T., PASTA S., VANNIÈRE B. & TINNER W., 2012 - Spatio-temporal patterns of Holocene environmental change in southern Sicily. Palaeogeography Palaeoclimatology Palaeoecology 323–325:110–122.

CALVO S., FRADA ORESTANO C. & TOMASELLO A., 1995 - Distribution, structure and phenology of *Posidonia oceanica* meadows along Sicilian coasts. Giornale Botanico Italiano, 129(1): 351-356.

CALVO S., GIANGUZZI L., 2000 - Aspetti naturalistici ed ecologici del Lago Specchio di Venere nell'Isola di Pantelleria. Giornate di studio sul "Progressivo interramento dello Specchio di Venere", Pantelleria, 28-29 ottobre 1999. GEAM (Geoengineering Environment and Mining) 37 (1): 25-32.

CALVO S., DI MAIDA G., ORESTANO C., PIRROTTA M. & TOMASELLO A., 2009 - The Stagnone of Marsala lagoon. In: Flora and Vegetation of the Italian Transitional Water System, E. Cecere, A. Petrocelli, G. Izzo and A. Sfriso, eds., CORILA, 247-265.

CALVO S., MARCENÓ C., OTTONELLO D., FRADÁ ORESTANO C., ROMANO S. & LONGO A., 1995 - Osservazioni naturalistiche ed ecologiche intorno al lago Pergusa. Naturalista sicil., S. IV, 19 (1-2): 63-84.

CAMBRIA S., BAZAN G. & MARINO P., 2015 - Flora e vegetazione della valle di Castro e Monte Barraù (Sicilia centro-occidentale). 49° Congresso SISV, 24-26 settembre 2015, Ancona.

CAMBRIA S. & PUGLISI M., 2018 - Nuovi dati sulla classe *Adiantetea capilli-veneris* Br.-Bl. in Br.-Bl., Roussine & Négre 1952 a Creta. 52° Congress. of Italian Society of Vegetation Science, Catania, 5-7 April 2018.: 27.

CANCELLIERI L., 2008 - Studio delle serie di vegetazione nel complesso dei Monti Lattari (Campania). Tesi di Dottorato in Ecologia Vegetale, Roma Tre, 294 pp.

CANCEMI G., BUIA M. C. & MAZZELLA L., 2002 - Structure and growth dynamics of Cymodocea nodosa meadows. Sci. Mar. 66 (4): 365-373.

CANCEMI G., TERLIZZI A., SCIPIONE M.B. & MAZZELLA L., 1994 - Il prato ad *Halophila stipulacea* (Forssk.) Aschers. di Giardini Naxos (Sicilia): caratteristiche della pianta e del popolamentoa fauna vagile. Biol. Mar. Medit. 1 (1): 401-402.

CANEVA G., DE MARCO G., DINELLI A., VINCI M., 1995 - Le classi *Parietarietea diffusae* (Rivas Martinez 1964) Oberd. 1977 e *Adiantetea* Br-Bl. 1977 nelle aree archeologiche romane. Fitosociologia 29: 165-179.

CANIGLIA G., BORELLA S., CURIEL D., NASCIMBENI P., PALOSCHI A. F., RISMONDO A., SCARTON F., TAGLIAPIETRA D. & ZANELLA L., 1992 - Distribuzione delle fanerogame marine (*Zostera marina* L., *Zostera noltii* Hornem, *Cymodocea nodosa* (Ucria) Asch.) in laguna di Venezia. Soc. Ven. Sci. Nat. 17: 137-150.

CANIGLIA G., CHIESURA LORENZONI F., CURTI L., LORENZONI GG. & MARCHIORI S., 1976 - Inquadramento fitosociologico della cenosi a *Cistus clusii* Dunal di Lesina (Foggia). Arch. Bot. Ital. 52: 135-152.

CANIGLIA G., CHIESURA LORENZONI F., CURTI L., LORENZONI GG., MARCHIORI S., RAZZARA S. & TORNADORE MARCHIORI N., 1984 - Contributo allo studio fitosociologico del salento meridionale (Puglia - Italia meridionale). Archivio Botanico e Biogeografico italiano 60(1-2): 1-40.

CANO E., LADERO M., GARCIÁ-FUENTES A., PINTO-GOMES C.J. & CANO-ORTIZ A., 2007 - Estado actual de la clase *Poetea bulbosae* en la Península Ibérica. Phytocoenologia 37(3-4):645-661.

CAPELO J., COSTA J.C., LOUSÀ M., FONTINHA S., JARDIM R., SEQUEIRA M. & RIVAS-MARTINEZ S., 2000 - Vegetacào da Madeira (Portugal). I – Aproximacào à tipologia fitossocilògica. Silva Lusitana 7: 257– 282.

ČARNI A. & MUCINA L., 1998 - Vegetation of trampled soils dominated by C4 plants in Europe. J. Veg. Sci., 9(1): 45-56.

CARTABELLOTTA D., DRAGO A., LO BIANCO B., LOMBARDO M., 1998 - Climatologia della Sicilia. Regione Siciliana, Assessorato Agricoltura e Foreste, Palermo.

CARUSO G., GANGALE C., UZUNOV D., PIGNOTTI L. 2008 - Chorology of *Platanus orientalis* (Platanaceae) in Calabria (S Italy). Phytologia Balcanica, 14 (1): 51-56.

CASAVECCHIA S., BISCOTTI N., PESARESI S., & BIONDI E., 2015 - The *Paliurus spina-christi* dominated vegetation in Europe. Biologia 70(7): 879—892.

CASPER S. J. & KRAUSCH H.-D., 1981 - Süßwasserflora von Mitteleuropa. Band 24. Pteridophyta und Anthophyta. Teil 2. Gustav Fischer Verlag, Stuttgart & New York.

CASTELLANO, G., & BAZAN, G., 2009 - Aspetti distributivi e fitosociologici di *Brassica incana* (Brassicaceae, Magnoliophyta) in Sicilia. Quaderni di Botanica ambientale e applicata, 20(1), 263-268.

CASTROVIEJO S. & PORTA J., 1976 - Apport à l'écologie de la végétation des zones salées des rives de la Gigüela (Ciudad Real - Espagne). Coll. Phytosoc. 4:115-139.

CATALANO, R., 2004 - Geology of Sicily: an introduction. Bocconea, 17: 33-46.

CAYE G. & MEINESZ A., 1986 - Experimental study of seed germination in the seagrass *Cymodocea nodosa* (Ucria) Aschers. Aquat. Bot., 26: 79-87.

ČERNOHOUS F. & HUSÁK Š., 1986 - Macrophyte vegetation of eastern and northeastern Bohemia. Folia Geobot. Phytotax. 21: 113–161.

CESCHIN S., CUTINI M. & CANEVA G., 2003- La vegetazione ruderale dell'area archeologica del Palatino (Roma). Fitosociologia 40(1):73-96.

CESCHIN S. & SALERNO G., 2008 - La vegetazione del basso corso del fiume Tevere e dei suoi affluenti (Lazio, Italia). Fitosociologia 45(1): 39-74.

CHEPINOGA V., BERGMEIER E., ROSBAKH A. & FLECKENSTEIN K. M., 2013 - Classification of aquatic vegetation (Potametea) in Baikal Siberia, Russia, and its diversity in a northern Eurasian context. Phytocoenologia 43(1-2): 127–167.

CHEPINOGA V., IRKUTSK E., BERGMEIER S., ROSBAKH K. & FLECKENSTEIN M., 2013 - Classifi cation of aquatic vegetation (*Potametea*) in Baikal Siberia, Russia, and its diversity in a northern Eurasian context. Phytocoenologia 43(1-2): 127–167.

CHRISTIA C., TZIORTZIS I., FYTTIS G., KASHTA L. & PAPASTERGIADOU E., 2011 - A survey of the benthic aquatic flora in transitional water systems of Greece and Cyprus (Mediterranean Sea). Botanica marina 54(2): 169-178.

CHRISTIANSEN W., 1934 - Das pflanzengeographische und soziologische Verhalten der Salzpflanzen mit besonderer Berücksichtigung von Schleswig-Holstein. Beitr. Biol. Pflanzen 22: 139-154.

CHRISTIANSEN W., 1955 - *Salicornietum*. Mitt. Flor.-Soziol. Arbeitsgem., N. F. 5: 64–65.

CHYTRÝ M., DANIHELKA J., KAPLAN Z. & PYŠEK P., 2017 - Flora and Vegetation of the Czech Republic. Springer, 465 pp.

CHYTRÝ M., PEŜOUT P. & ANENKHONOV 0., 1993 - Syntaxonomy of vegetation of Svjatoj Nos Peninsula, Lake Baikal 1. Non forest communities. Folia Geobotanica 28(4):337-383.

CHYTRÝ J. A., 2004 - Estimated loss of salt marsh and freshwater wetlands within the Oregon coastal Coho Esu. Oregon Natural Heritage Information Center, Oregon State University, 7 pp.

CHYTRÝ M. (ed.), 2007-2013 - Vegetation of the Czech Republic, 4 vol. Academia, Praha,

CIRUJANO S., 1980 - Las lagunas manchegas y su vegetación. I. Anales Jard. Bot. Madrid 37: 155–192.

CIRUJANO S. & GARCIA-MURILLO P., 1990 - Ruppiaceae. Fontqueria 28: 159–165.

CIRUJANO S., PASCUAL P. & VELAYOS M., 1986 - Aportacìon al conocimiento de *Ranunculus peltatus* Schrank subsp. *saniculifolius* (Viv.) C. D. Trab. Dep. Botànica Madrid 13: 99-110.

CIRUJANO S., VELAYOS M., & GARCIA MURILLO P., 1993 - *Rielletea helicophyllae* una nueva clase fitosociológica de plantas acuáticas. Bot. Complutensis 18: 203-211.

CORBETTA F., 1970 - Lineamenti della vegetazione macrofitica dei Laghi di Lesina e di Varano. Nuovo Giorn. Bot. Ital., N.S., 104 (3): 165-191.

CORBETTA F., ABBATE G., FRATTAROLI A.R. & PIRONE G.F., 1998 - S.O.S. Verde! Vegetazioni e specie da conservare: 71-80. Edagricole, Bologna.

CORBETTA F. & LORENZONI G., 1973 - Proposta di costituzione del parco naturale degli Stagni di Oristono (Sardegna occidentale). Atti III Simposio naz. cons. natura 2: 437-461.

CORBETTA F., PAVONE P., SPAMPINATO G., TOMASELLI V. & TRIGILIA A., 2002 - Studio della vegetazione dell'area archeologica della Neapolis (Siracusa, Sicilia) finalizzato alla conservazione dei manufatti architettonici. Fitosociologia 39(2):3-24.

CORMACI M., FURNARI G. & ALONGI G., 2014 - Flora marina bentonica del Mediterraneo: Chlorophyta. Bollettino dell'Accademia Gioenia di Scienze Naturali di Catania 47: 11-436.

COSTA J.C., ARSÉNO P., MONTEIRO-HENRIQUES T., NETO C., PEREIRA E., ALMEIDA T. & IZCO J., 2009 - Finding the Boundary between Eurosiberian and Mediterranean Salt Marshes. Journal of Coastal Research 56: 1340-1344.

COSTA J.C., CAPELO J.H., AGUIAR C., NETO C., LOUSA M. & ESPIRITO-SANTO MD., 2000 - An overview of the Pegano-Salsoletea vermiculatae vegetation class in continental Portugal. Coll Phytosoc. 27: 81-93.

COSTA J.C., LOUSÃ M., CAPELO J., ESPÍRITO SANTO M. D., SEVILLANO J.I. & ARSÉNIO P., 2000 - The coastal vegetation of the portoguese divisory sector: dunes cliffs and low-scrub communities. Finisterra 35: 69-93.

COSTA M. & MANSANET J., 1981- Los ecosistemas dunares levantinos: La Dehesa de La Albufera. Anales Jard. Bot. Madrid 37: 277–299.

COSTA J.C., NETO C., AGUIAR C., CAPELO J., ESPÍRITO SANTO M. D., HONRADO J., PINTO-GOMES C., MONTEIRO-HENRIQUES T., SEQUEIRA M. & LOUSÃ M., 2012 - Syantoxonomical checklist of vascular plants communities in Portugal (Continental, the Azores and Madeira). Global Geobotany 2: 1-180.

COSTANZO E. & TOMASELLI V., 1998 - Osservazioni su alcuni esempi di macchia ad *Arbutus unedo* L. in territorio di Testa dell'Acqua (Siracusa, Sicilia sud-orientale). Boll. Acc. Gioenia Sci. Nat. Catania, 30: 351-359.

COSTANZO E. & TOMASELLI V. 1998b - Segnalazione di *Paliurus spina-christi* Miller per il territorio ibleo (Sicilia sud-orientale) con osservazioni sulla vegetazione. Boll. Accad. Gioenia di Sci. Nat. 30: 341–349.

COSTANZO E, PAVONE P, SPAMPINATO G, TOMASELLI V., 2005 - Analisi floristico-vegetazionale della R.N.O. ''Vallone Piano della Corte'' (Agira, Sicilia) finalizzata alla pianificazione ambientale. Quad. Bot. Amb. Appl. 16: 127–158.

COSTANZO E. & TOMASELLI V., 1998b - Segnalazione di *Paliurus spina-christi* Miller per il territorio ibleo (Sicilia sud-orientale) con osservazioni sulla vegetazione. Boll. Acc. Gioenia Sci. Nat. Catania 30: 341-349.

COUPLAND G.T. & MC DONALD J.I., 2008 - Extraordinarily high earthworm abundance in deposit of marine macrodetritus along two semi-arid beaches. Mar. Ecol. Prog. Ser., 361: 181-189.

CUSIMANO D., GUARINO R. & ILARDI V., 2014 - Aspetti del *Rosmarino-Thymetum capitati* Furnari, 1965 presso la torre di Monterosso (Sicilia centro-meridionale). Il Natural. Sic. n.s. 38(1): 43-50.

CUTINI M., AGOSTINELLI E., ACOSTA T. R. A. & MOLINA J. A., 2010 - Coastal salt-marsh zonation in Tyrrhenian central Italy and its relationship with other Mediterranean wetlands. Plant Biosystems 144(1): 1–11.

DE FOUCAULT B., 1999 - Nouvelle contribution à une synsystématique des pelouses sèches à thérophytes. Doc. Phytosoc. N.S. XIX: 47-105.

DE FOUCAULT B., 2013 - Les journées de l'association tunisienne de physiologie et de biosurveillance de l'environnement. Compte rendu phytosociologique des herborisations (12-15 mai 2012). Rev Ecol Env 9:1-15.

DE FOUCAULT B. & BIORET F., 2010 - Contribution au prodrome des végétations de France: les Saginetea maritimae Westhoff et al. 1962. J. Bot. Soc. Bot. France 50: 59-83.

DEIL U., 1996 - Zur Kenntnis der Klasse Adiantetea des Mittelmeerraumes und angrenzender Gebiete-mit allgemeinen Überlegungen zur ökologischen Skalierung

ihrer Standorte und zur Sättigung von Pflanzengesellschaften. Phytocoenologia 26: 481-536.

DEIL U., 1998 - The class *Adiantetea* in the Mediterranean area- a state of knowledge report. Annali di Botanica LVI(1): 73-78.

DEIL U., 2000 - Halophytic vegetation along the Arabian coast: Azonal or linked to climatic zones? Phytocoenologia 30(3–4): 591–611.

DEIL U., 2005 - A review on habitats, plant traits and vegetation of ephemeral wetlands – a global perspective. Phytocoenologia 35: 533–706.

DEL ARCO AGUILAR M. J. & DELGADO O. R., 2018 - Vegetation of the Canary Islands. Springer, 429 pp.

DELCOIGNE A. & THÉBAUD G., 2018 - Contribution au prodrome des végétations de France : les *Phragmito– Magnocaricetea* Klika in Klika & Novák 1941 nom. conserv. Doc. Phytosoc., sér. 3, 7: 87-178.

DE LA FUENTE V., RUFO L., RODRÍGUEZ N., SÁNCHEZ-MATA D., FRANCO A. & AMILS R., 2016 - A study of *Sarcocornia* A.J. Scott (Chenopodiaceae) from Western Mediterranean Europe. Plant Biosystems 150(2): 343-356.

DELLA BELLA V, BAZZANTI M. & CHIAROTTI F., 2005 - Macroinvertebrate diversity and conservation status of Mediterranean ponds in Italy: water permanence and mesohabitat influence. Aquatic Conservation: Marine and Freshwater Ecosystems 15: 583-600.

DE MARCO G. & CANEVA G. 1985 - Analisi sin tassonomica e fitogeografica comparata di alcune significative cenosi a *Pinus halepensis* Mill. in Italia. Not. Fitosoc.19(1): 155-176.

DE MARCO G. & MOSSA L., 1980 - Analisi fitosociologica e cartografica della vegetazione (1:25000) dell'Isola di S. Pietro (Sardegna sud-occidentale). Quad. CNR AQ/1/24. Roma.

DE MARCO G., VERI L. & CANEVA G., 1984 - Analisi fitosociologica, cartografia della vegetazione e trasformazioni ambientali nel periodo 1955-1981 delle Isole Tremiti (Adriatico centro-meridionale). Ann. Bot. 42(suppl. 2):17-47.

DE MARTIS G. & SERRI G., 2009 - L'analisi fitosociologica della vegetazione per il monitoraggio degli Habitat nel Parco Naturale Regionale Molentargius-Saline (Sardegna meridionale). Primi risultati. Inform. Bot. Ital. 41(2): 293-301.

DENGLER J., EISENBERG M. & SCHRÖDER J., 2007 - Die grundwasserfernen Saumgesellschaften Nordostniedersachsens im europäischen Kontext – Teil II: Säume nährstoffreicher Standorte (*Artemisietea vulgaris*) und vergleichende Betrachtung der Saumgesellschaften insgesamt. Tuexenia 27: 91–136.

DEN HARTOG C., 1970 - The sea-grasses of the world. Verh. K. Ned. Acad. Wet. Afd. Natuurk Reeks 2, 59: 1-275.

DEN HARTOG C., 2003 - Phytosociological classification of seagrass communities. Phytocoenologia 33: 203–229.

DEN HARTOG C. & SEGAL S., 1964 - A new classification of the water-plant communities. Acta Bot. Neerl. 13: 367-393.

DEN HARTOG C. & VAN DER VELDE G., 1988 - Structural Aspects of Aquatic Plant Communities. In: SYMOENS J.-J., Vegetation of inland waters, pp. 113-153.

DENK T., FROTZLER N. & DAVITASHVILI N. 2001 - Vegetational patterns and distribution of relict taxa in humid temperate forests and wetlands of Georgia (Transcaucasia). Biological Journal of the Linnean Society 72: 287-332.

DE PIETRO R. & DE PIETRO R., 2012 - I pantani di Lentini e di Gelsari (Sicilia orientale) stato di conoscenze sull'avifauna e strategie per la conservazione della biodiversità. Natural. Sic.. s. IV, 36: 533-544.

DIAZ GONZÁLEZ T. E., 1989 - Biogeografia y sintaxonomia de comunidades rupicolas. Proceedings Intern. Congr. "Nove jornadas intercionales de fitosociologia" Univ. de Alcala de Henares: 1-45.

DIAZ GONZÁLEZ T. E. & PRIETO F., 1994 - La vegetaciòn de Asturias. Itin. Geobot. 8: 243-528.

DÍAZ-MORENO A., BARBERI G.. COCINA O., KOULAKOV I., SCARFÌ L., ZUCCARELLO L., PRUDENCIO J., GARCÍA-YEGUAS A., I. ÁLVAREZ I., GARCÍA L. & IBÁÑEZ J.M., 2018 - New Insights on Mt. Etna's Crust and Relationship with the Regional Tectonic Framework from Joint Active and Passive P-Wave Seismic Tomography. Surveys in Geophysics 39(1): 57–97.

DIERßEN K. & DIERßEN B., 1996 - Vegetation Nordeuropas. Eugen Ulmer Verlag, Stuttgart, DE., 838 pp.

DIERSCHKE H., 1975 - Die Schwarzerlen (*Alnus glutinosa*-) Uferwalder Korsikos. Phytocoenologia 2: 229-243.

DIERSCHKE H., 1984 - Zur Syntaxonomischen stellung und gliderung der uferund auenwalder sudeuropas. Coll. Phytosoc. 9: 115-129.

DIERSCHKE H., 1997 - Syntaxomomical survey of European beech forests: some general conclusions. Annali di Botanica 45: 17-26.

DÍEZ-GARRETAS B. & ASENSI A., 1999 - Syntaxonomic analysis of the *Andropogon*-rich grasslands (*Hyparrhenietalia hirtae*) in the Western Mediterranean region. Folia Geobot. 34: 307-320.

DÌEZ-GARRETAS B. & ASENSI A. 2014 - The coastal plant communities of *Juniperus macrocarpa* in the Mediterranean region. Plant Biosystems 148 (3): 429-438.

DI MARTINO A., 1963 - Flora e vegetazione dell'Isola di Pantelleria. Lav. Ist. Bot. Giardino Colon. Palermo 19: 87-243.

DI MARTINO A. & RAIMONDO F.M., 1976 - Le infestanti delle colture di frumento della Sicilia occidentale. Not. Fitosoc. 11: 45-74.

DI MARTINO V., 2001 - Vegetali marini tropicali in Calabria e Sicilia. Distribuzione ed ecologia. In: Gravez V., Ruitton S., Boudouresque C.F., Le Direac'h L., Meinesz A.,

Scabbia G., Verlaque M. (eds). Fourth International Workshop on *Caulerpa taxifolia*. GIS Posidonie publ., Fr: 395-402.

DIMOPOULOS P., SÝKORA K., GILISSEN C., WIECHERINK D. & GEORGIADIS T., 2005 - Vegetation ecology of Kalodiki Fen (NW Greece). Biologia 60: 69–82.

DI PIETRO R. 2010 - Observations on the beech woodlands of the Apennines (peninsular Italy): an intricate biogeographical and syntaxonomical issue. Lazaroa 30: 89-97.

DI PIETRO R., CACCIANIGA M., VERDE S., 2007 - Distribuzione e corrispondenza fitosociologica degli habitat di faggeta nella Penisola Italiana. Fitosociologia 44, 279-283.

DI PIETRO R., IZCO J. & BLASI C. 2004 - Contribute to the nomenclatural knowledge of the beech-woodland communities of southern Italy. Plant Biosystems 138 (1):27-52.

DI PIETRO R., TERZI M. & FORTINI P., 2017 - A revision of the high-altitude acidophilous and chionophilous grasslands of the Apennines (Peninsular Italy), a long-lasting intricate syntaxonomic issue. Phytocoenologia Band 47(3): 261-304.

DI PIETRO R., THEURILLAT J.-P., CAPELO J., FERNÁNDEZ GONZÁLEZ F., TERZI M., ČARNI A. & MUCINA L., 2015 - Nomenclature and syntaxonomic notes on some high rank syntaxa of the European grassland vegetation. Lazaroa 36: 79-106.

DOLL R., 1991 - Die Pflanzengesellschaften der stehender Gewässer in Mecklenburg-Vorpommern. Teil I. 3. Potamogetonetea Tx. et Prsg. 42. Laichkrautgesellschaften. Feddes Repert. 102: 217–317.

DRAGO A., 2005 - Atlante climatologico della Sicilia – seconda edizione. Rivista Italiana di Agrometeorologia 2: 67-83.

DRAGO A., CARTABELLOTTA D., LO BIANCO B., LOMBARDO M., 2000 - Atlante climatologico della Sicilia. Regione Siciliana, Assessorato Agricoltura e Foreste, Palermo.

DUBYNA D. V., 2006 - Višča vodna roslynnist'. Instytut botaniky im. M. G. Holodnogo NAN Ukraïny, Kyïv.

DUBYNA D. V. & NEUHAUSLOVA Z., 2000 - Salt meadows of the Birjucij Island Spit, Azov Sea. Classes *Juncetea maritimi* and *Bolboschoenetea maritimi*. Acta Bot. Croat. 59(1): 167-178.

DURO A., PICCIONE V., SCALIA C., ZAMPINO D., 1996 - Precipitazioni e temperature medie mensiliin Sicilia relative al sessantennio 1926-85. Atti del 5° Workshop del P. S. Clima, Ambientee Territorio nel Mezzogiorno.Amalfi 28-30 Aprile 1993. CNR - Roma, I Tomo: 17-103.

ESTEVE CHUECA, F. 1973 - Vegetación y flora de las regiones central y meridional de la provincia de Murcia. Centro Edaf. Aplicada del Segura. Murcia, 451 pp.

EVERARD M., JONES L. & WATTS B., 2010 - Have we neglected the societal importance of sand dunes? An ecosystem services perspective. Aquatic Conserv. 20 (4): 476–487.

FAIR P. & MEEKE L., 1983 - Seasonal variations in the patternof photosynthesis and possible adaptive response to varyinglight flux regimes in Ceratophyllum demersum L. Aquatic Bot. 15: 81-90.

FANELLI G., DE SANCTIS M., GJETA E., MULLAJ A. & ATTORE F., 2015 - The Vegetation of the Buna River Protected Landscape (Albania). Hacquetia 14(2): 129-174.

FANELLI G., LUCCHESE F., 1998 - The status of *Brometalia rubenti-tectorum* communities from the Mediterranean area in different syntaxonomical schemes. Rend. Fis. Acc. Lincei, 9: 241-255

FARRIS E., SECCHI Z. & FILIGHEDDU R., 2007 - Caratterizzazione fitosociologica dell'habitat prioritario 6220*- "Percorsi substeppici di graminacee e piante annue dei *Thero-Brachypodietea*": caso di studio della Sardegna settentrionale. Fitosociologia 44(2) suppl. 1: 271-278.ù

FEINBRUN N., 1959 - Spontaneous Pineta in the Lebanon. Bull. Res. Cuoncil Israel 7D:132-153.

FELZINES J. C., 1983 - Les groupments du "*Potamion*" des etanges du centre de la France: aspects phytosociologiques et ecologiques. Coll. Phytosoc. 10: 149-170.

FELZINES J. C., 2012 - Contribution au prodrome des végétations de France: les *Lemnetea minoris* Tüxen ex O. Bolòs & Masclans 1955. J. Bot. Soc. Bot. France 59 : 189-240.

FELZINES J.C. & LAMBERT E., 2012 - Contribution au prodrome des végétations de France: les *Charetea fragilis* F. Fukarek 1961. J. Bot. Soc. Bot. France 59 : 133-188.

FERREZ Y., BAILLY G., FERNEZ T., GUYONNEAU J., ROYER J.-M., SCHMITT A. & VUILLEMENOT M., 2009 - Connaissance des habitats naturels et semi-naturels de Franche-Comté. Synopsis des groupements végétaux de Franche-Comté. Version provisoire avril 2009. Conservatoire botanique national de Franche-Comté, Besançon.

FERRO G., 1980 - La vegetazione di Butera (Sicilia meridionale) Atti Ist. Bot. Critt. Univ. Pavia 13: 51-118.

FERRO G., 1988 - Nuovi dati sulla vegetazione segetale della Sicilia e considerazioni sull'all. *Secalion*. Acta Bot. Barc. 37: 185-200.

FERRO G., 1990 - Revisione della vegetazione segetale mediterranea ed europea dell'ordine *Secaletalia*. Braun-Blanquetia 6. Camerino, pp. 59.

FERRO G., 2005a - Nuovi dati sulla flora e sulla vegetazione dei coltivi e degli incolti di Lipari (Isole Eolie). Quad. Bot. Amb. Appl. 15: 21-39.

FERRO G., 2005 - Caratteri biologici, corologici, ecologici e fitosociologici di *Artemisia arborescens* L. Quad. Bot. Amb. Appl., 16: 233-242.

FERRO G. & FURNARI F., 1968 - Flora e vegetazione di Stromboli (Isole Eolie). Arch. Bot. e Biogeogr. Ital. 44, s.4, 12, (1,2,3): 1-52.

FERRO G. & FURNARI F., 1970 - Flora e vegetazione di Vulcano (Isole Eolie). Pubbl. Ist. Bot. Univ. Catania. pp. 52.

FERRO G., LADERO-ALVAREZ M., 1999 - Osservazioni fitosociologiche sulle praterie a *Brachypodium retusum* delle isole Eolie (Sicilia). Quad. Bot. Amb. Appl., 7:99-105

FERRO G. & PRIVITERA G. D., 2010 - Su una nuova associazione dell'*Echio plantaginei-Galactition tomentosae* in Sicilia. Quad. Bot. Amb. Appl., 21: 119-125.

FICHERA G., FURNARI F. & SCELSI F., 1988 - Contributo alla conoscenza della vegetazione dei Monti Climiti (Siracusa). Boll. Acc. Gioenia Sci. Nat. Catania 21: 319-350.

FICI S. & GIANGUZZI L., 2011 - Aspetti vegetazionali e paesaggistici di Settefrati (Cefalù, Sicilia settentrionale), biotopo meritevole di conservazione. Naturalista Siciliano, 35(2): 233-255.

FIEROTTI G., DAZZI C. & RAIMONDI S., 1988 - Commento alla carta dei suoli della Sicilia. Ass. TT.AA., Reg. Siciliana, Palermo.

FOUCAULT B. DE, 1988 - Les végétations herbacées basses amphibies: systémique, structuralisme, synsystématique. Diss. Bot. 121: 1–150.

FOUCAULT B. DE, 1999 - Nouvelle contribution à une synsystématique des pelouses sèches à thérophytes. Doc. Phytosoc. N.S. XIX: 47-105.

FOUCAULT B. DE, 2013b - Les journées de l'association tunisienne de physiologie et de biosurveillance 930 de l'environnement. Compte rendu phytosociologique des herborisations (12-15 mai 2012). Rev. Ecol. Env. 9:1–15.

FOUCAULT B. DE & BIORET F., 2010 - Contribution au prodrome des végétations de France: les *Saginetea maritimae* Westhoff et al. 1962. Journal de Botanique de la Société Botanique de France 50: 59-83

FRANCOUR P., BOUDOURESQUE C.F., HARMELIN J.G. & HARMELIN-VIVIEN M.L., 1994 - Are the Mediterranean waters becoming warmer? Information from biological indicators. Mar. Poll. Bull. 28 (9): 523-526.

FREI M., 1937 - Studi fitosociologici su alcune associazioni litorali in Sicilia (*Ammophiletalia* e *Salicornietalia*). Nuov. Giorn. Bot. Ital. n.s. 44: 273-294.

FREI M., 1940 - Die pflanzen-assoziationen der alpinen stufe des Äetna. Ber. Geob. Forsc. Inst. Rübel Zürich 1939: 86-92.

FRENKEL R. 1970 - Ruderal vegetation along some California roadsides. Univ. Calif. Grogr. 20: 1-163.

FRITSCH C., 1895 - Uber die Auffindung einer marinen Hydrocharidae im Mittelmeer. Verh. Zool. Bot. Ges. Wien 45, 104–106.

FRONDONI R. & IBERITE M., 2002 - The halophile vegetation of the sedimentary coast of Lazio (central Tyrrhenian district, Italy). Plant Biosystems 136(1): 49-67.

FUKAREK P. & FABIJANIĆ B., 1968 - Versuch einer Pflanzensoziologische Gliederung der Wald- und Sibljak-Gesellschaften Bosniens und der Hercegovina. In: Tüxen, R. (ed.), Pflanzensoziologische Systematik, pp. 112–123. Dr W. Junk, Den Haag, NL.

FURNARI F., 1965 - Boschi di *Quercus suber* L. e di *Quercus ilex* L. e garighe del *Rosmarino-Ericion* in territorio di Santo Pietro (Sicilia meridionale). Boll. Ist. Bot. Univ. Catania. s.3, 5: 1-31.

FURNARI F. & RONSISVALLE G. A., 1971 - Osservazioni sulla vegetazione presso la foce del S. Leonardo (Sicilia Orientale). Boll. Acc. Gioenia Sc. Nat. Catania, s. IV, 10: 703-718.

FURNARI F. & SCELSI F. 1993 - Osservazioni su alcuni aspetti di vegetazione naturale del versante meridionale dell'Etna. Boll. Acc. Gioenia Sci. Nat. Catania 26(341): 5-17.

GALÁN DE MERA A., SÁNCHEZ GARCÍA I. & VICENTEORELLANA J. A., 1997 - Coastal plant communities of the sothwestern Iberian Peninsula, Spain and Portugal. Phytocoenologia 27:313–352.

GALÁN DE MERA A., MORALES ALONZO R. & VICENTE ORELLANA J. A., 2000 - Pasture communities linked to ovine stock. A synthesis of the Poetea bulbosae class in the western Mediterranean Region. Phytocoenologia 30(2): 223-267.

GALBANY-CASALS M., SAEZ L. & BENEDÌ C., 2006 - A taxonomic revision of *Helichrysum* Mill. sect. Stoechadina (DC.) Gren. & Godr. (Asteraceae, Ganaphalieae). Canad. J. Bot. 84(8):1202-1232.

GAMS H., 1927 - Von den Follateres zur Dent de Morcler. Beitr. Geobot. Landesaufn. d. Schwez. 15: 1-760. H. Huber, Bern.

GARFÌ G. & BUORD S., 2012 - Relict species and the challenges for conservation: the emblematic case of *Zelkova sicula* Di Pasquale, Garfì et Quézel and the efforts to save it from extinction. Biodiversity Journal 3(4): 281-296.

GAVILÁN R.G., VILCHES DE LA SERNA B. & FERNÁNDEZ-GONZÁLEZ, F., 2011 - Syntaxonomical review of *Cytisetea scopario-striati* communities in central Spain.. Lazaroa 32: 29–72

GIARDINA G., RAIMONDO F.M. & SPADARO V., 2007 - A catalogue of plants growing in Sicily. Bocconea 20: 5-582.

GÉHU J.-M., 1961 - Les groupements végétaux du bassin de la Sambre française. Vegetatio 10: 69–372.

GÉHU J.-M., 1975 - Essai systématique et chorologique sur les principales associations végétales du littoral atlantique français. An. R. Acad. Farm. 41: 207–227.

GÉHU J.-M., 1976 - Approche phytosociologique synthétique de la végétation des vases salées du littoral atlantique français (synsystématique et synchorologie). Coll. Phytosoc.. 4 : 395-462.

GÉHU J-M, 1979 - Pour une approche nouvelle des paysages végétaux: la symphytosociologie. Bull. Soc. Bot. France 126(2): 213-224.

GÉHU J.M., 1986 - Qu'est-ce que l'*Agropyretum mediterraneum* Braun-Blanquet (1931) 1933? Lazaroa 9: 343-354.

GÉHU J.M., 1987 - Reflexions et observations sur le classement des végétations halophiles européennes. In: Huiskes et al. (Eds.), Vegetation between land and sea, Geobotany Springer, pp: 134-145.

GÉHU J-M, 1988 - L'analyse symphytosociologique et geosymphytosociologique de l'espace. Theorie et methodologie.Coll. Phytosoc. 27: 11-46

GÉHU J.-M., 1992 - Reflexions sur les fondements syntaxonomiques necessaires a une synthèse des vegetations à l'èchelle du continent europèen et esqisse d'un

synsystème dans l'optique de la phytosociologie Braun-Blanqueto-Tüxennienne. Ebauche de synsystème pour la France. Ann. Bot. (Roma) 50: 131-151.

GÉHU J.M., 1998 - Schéma synsystématique des principales classes de végétations littorals sédimentaires européennes avec références à d'autres territoires holarctiques. Ann. Bot. (Roma) 56 (1): 5-51.

GÉHU, J.-M., 1999 - Considérations sur les végétations charnières en position d'ourlet et leur classification phytosociologique. Bull. Soc. Bot. Centre-Ouest, N.S., 30 : 35-46.

GÉHU J.-M., 2006 - Dictionnaire de sociologie et synécologie végétales. J. Cramer, Berlin-Stuttgart, 899 pp.

GÉHU J.M., APOSTOLIDES N., GÉHU-FRANCKJ., ARNOLD K., 1992 - Premières données sur la végétation littorale des îles de Rodhos et de Karpathos (Grèce). Coll. Phytosoc., 19: 545-582.

GÉHU J. M. & BIONDI E., 1988 - Données sur la vegetation des ceintures d'atterrissement des Lacs Alimini (Salento, Italie). Doc. Phytosoc., 11: 353-381. Sur les formations méditerraneénnes à *Artemisia arborescens*. VI Jornades de fitosociologia. Vegetaciò nitròfila. Barcelona: 77–78.

GÉHU J. M. & BIONDI E., 1988 - Données sur la vegetation des ceintures d'atterrissement des Lacs Alimini (Salento, Italie). Doc. Phytosoc., 11: 353-381.

GÉHU J.M. & BIONDI E., 1994 - La végétation du littoral de la Corse. Essai de synthése phytosociologique. Braun-Blanquetia 13: 3-149.

GÉHU J.M. & BIONDI E., 1999 - La végétation du littoral de la Corse. Essai de synthése phytosociologique. Braun-Blanquetia 13: 3-149.

GÉHU J. M., BIONDI E. & GÈHU-FRANCK J., 1988 - Les végétations nitro-alofiles des falaises de Bonifacio (Corse). Acta Bot. Barc. 37: 237-243.

GÈHU J.M., COSTA M. & BIONDI E., 1990 - Les *Junipereta macrocarpae* sur sable. Acta Bot. Malacit. 15: 303-309.

GÉHU J.M., COSTA M., BIONDI E., PERIS J.B., ARNOLD N., 1984b - Données sur la végétation maritime des côtes méridionales de l'île de Chypre (plages, dunes, lacs salés et falaises). Doc. Phytosoc., n.s., 8: 343-363.

GÉHU J.M., COSTA M., SCOPPOLA A., BIONDI E., MARCHIORI S., PERIS J.B., FRANCK J., CANIGLIA G. & VERI L., 1984° - Essay synsystématique et synchorologique sur les végétations littorales italiennes dans un but conservatoire. Doc. Phytosoc. 8: 393-474.

GÉHU J.M., COSTA M. & USLU T., 1990 - Analyse phytosociologiques de la végétation littorale de la partie turque de l'île de Chypre, dans un souci conservatoire. Doc. Phytosoc. 12: 203-234.

GÉHU J.M. & GÈHU-FRANCK J., 1984 - Schéma synsystématique et synchorologique des végétations phanérogamiques halophiles françaises. Doc. Phytosoc., 8: 51-70.

GÉHU J.M. & GÈHU-FRANCK J., 1986 - Données synsystématiques et Synchorologiques sur la végétation du littoral tunisien de Bizerte à Gabès. I. La végétation psammophile. Doc. Phytosoc., 10 (2): 127-155.

GÉHU J.M. & GÈHU-FRANCK J., 1988 - Variations floristiques et Synchorologie des Ammophilaies européoafricaines. Homenaje a P. Montserrat, Jaca y Huesca: 561-570.

GÉHU J.M., GÈHU-FRANCK J. & CARON B. 1978 - Les *Salicornietum emerici* et *ramosissimae* du littoral mediterraneen Français. Acta Bot. Malac. 4: 79-88.

GÉHU, J.M., KAABÈCHE, M. & GHARZOULI, R. 1992 - Observations phytosociologiques sur le littoral Kabyle, de Béjaia à Jijel. Doc. Phytosoc. N.S. 14: 305-322.

GÉHU J.M., KAABÈCHE M. & GHARZOULI R. 1994 - Observations phytosociologiques dans le Nord-est de l'Algérie. Phytocoenologia 24: 369-382.

GÉHU J. M. & PEDROTTI F., 1992 - *Lemnetalia*-gesellshaften mitteleuropas. Doc. Phytosoc., n.s., 14: 367-385.

GEHU J.M. & RIVAS-MARTINEZ S., 1981 - Notions fondamentales de pytosociologie. Berichte der Internationalen Symposien der Internationalen Vereinigung für Vegetationnskunde 980: 5-33.

GÉHU J.M. & SADKI N. 1996 - Remarques de phytosociologie et de synchorologie comparée sur le littoral algérois. Doc. Phytosoc. N.S. 15: 341-357

GÉHU J.M., USLU T., COSTAM., 1989 - Apport à la connaissance phytosociologique du littor al sud de la Turquie mediterranéenne. Coll. Phytosoc., 19: 591-622.

GENTILE S., 1958 - *Ricerche sui pascoli e sui boschi del territorio di Nicosia (Sicilia nebrodense).* Boll. Ist. Bot. Univ. Catania. s.2 2: 87-130.

GENTILE S., 1962a - Frammenti di macchia particolarmente con *Quercus calliprinos* Webb. nel territorio diRagusa (Sicilia Meridionale-Orientale). Delpinoa n. ser., 4: 127-144.

GENTILE S., 1969a - Sui faggeti dell'Italia meridionale. Atti Ist. Bot. Lab. Critt. Univ. Pavia s.6, 5: 207-306.

GENTILE S., 1969b - Remarques sur le chênaies de l'Appennin méridional et de la Sicile. Vegetatio 17: 214-231.

GENTILE S., 1970 - Sui faggeti dell'Italia meridionale (beech woodlands of southern Apennines). Atti dell'istituto Botanico dell'Università di Pavia, ser. 6, 5: 207-306.

GENTILE S. & DI BENEDETTO G., 1961 - Su alcune praterie a *Lygeum spartum* L. e su alcuni aspetti di vegetazione di terreni argillosi della Sicilia orientale e Calabria meridionale. Delpinoa n.s. 3: 67-151.

GIACCONE G., 1968 - Contributo allo studio fitosociologico dei popolamenti algali del Mediterraneo orientale. Giorn. Bot. Ital.102: 485-506.

GIACCONE G., ALONGI G., PIZZUTO F., COSSU A. V. L., 1994 - La vegetazione marina bentonica fotofila del Mediterraneo: 2.: Infralitorale e Circalitorale: proposte di aggiornamento. Bollettino dell'Accademia Gioenia di scienze naturali 27:111-157.

GIACCONE G. & DI MARTINO V., 1995 - La vegetazione a *Caulerpa racemosa* (Forskkäl) J. Agardh nella baia di S. Panagia (Sicilia Sud-Orientale). Boll. Acc. Gioenia Sci. Nat. 28: 59-73.

GIACCONE G. & PIGNATTI S., 1967 - Studi sulla produttività primaria del fitobenthos nel Golfo di Trieste. II. La vegetazione nel Golfo di Trieste. Nova Thalassia 3(2): 1–28.

GIANGUZZI L., 1999a - Flora e vegetazione dei Nebrodi. Itinerari didattici. Regione Siciliana, Sezioni Operative per l'Assistenza Tecnica nn° 5, 7, 8,10, 11, pp. 232. Arti Grafiche Zuccarello, S. Agata di Militello (ME).

GIANGUZZI L. 1999b- Vegetazione e bioclimatologia dell'isola di Pantalleria. Braun-Blanquetia 22: 1-70.

GIANGUZZI L., 2002 - Osservazioni sulla conservazione in situ del popolamento di *Petagnaea gussonei* (Spreng.) Rauschert, paleoendemita esclusivo dei Monti Nebrodi (Sicilia nord-orientale). Inform. Bot. Ital. 34 (1): 63-69.

GIANGUZZI L., 2008 - Il paesaggio vegetale della Riserva Naturale Orientata "Bosco della Ficuzza, Rocca Busambra, Bosco del Cappeliere, Gorgo del Drago". Collana Sicilia Foreste 22, 159 pp.

GIANGUZZI L., CALDARELLA O., CUSIMANO D., ROMANO S., 2011 - *Berberido aetnensis-Crataegion laciniatae*, new orophilous pre-forestal alliance of the class *Rhamno-Prunetea*. Phytocoenologia, 41 (3): 183-199.

GIANGUZZI L., CALDARELLA O. & DI PIETRO R., 2018 - A phytosociological analysis of the *Brachypodium rupestre* (Host) Roem. & Schult. communities of Sicily. Plant Sociology 55(1): 65-88.

GIANGUZZI, L. & CUSIMANO D., 2014 - Il paesaggio vegetale del tratto meandriforme del Fiume Jato (Sicilia nord-occidentale), interessante biotopo meritevole di tutela. AttI del 48° Congresso Scienza della Vegetazione e monitoraggio della Biodiversità, Sapienza Università di Roma 17-19 settembre 2014.

GIANGUZZI, L., CUSIMANO D., ILARDI V., & ROMANO S., 2014 - Distribution, ecology, vegetation and conservation survey on the relictual population of *Carex panormitana* Guss. (Cyperaceae) in Sicily (Italy). Webbia: Journal of Plant Taxonomy and Geography, 68(2), 159-175.

GIANGUZZI L., CUSIMANO D., ILARDI V. & ROMANO S., 2015 - Phytosociological analysis of the Genista sp. pl. garrigues of the *Cisto-Lavanduletea* and *Rosmarinetea officinalis* classes in the South-Tyrrhenian area (Mediterranean Region). Plant Biosystems 149(3): 574-588.

GIANGUZZI L., CUSIMANO D. & ROMANO S., 2014 - Phytosociological characterization of the *Celtis tournefortii* subsp. *aetnensis* microwoods in Sicily. Plant sociology, 51(2): 17-28.

GIANGUZZI L., CUTTONARO P., CUSIMANO D. & ROMANO S., 2016 - Contribution to the phytosociological characterization of the forest vegetation of the Sicani Mountains (inland of north-western Sicily). Plant Sociology 53(1): 5-43.

GIANGUZZI L., D'AMICO A. & CALDARELLA O., 2007 - Habitat e specie vegetali d'interesse prioritario nel SIC Rocche di Entella (Sicilia occidentale). Fitosociologia 44(2) suppl.1: 201-205.

GIANGUZZI L., D'AMICO A., CALDARELLA O., OTTONELLO D. & ROMANO S., 2009 - la flora vascolare e lichenica della riserva naturale Grotta Conza (Sicilia Nord-Occidentale). Naturalista sicil., S. IV, 33 (1-2): 33-68.

GIANGUZZI L., D'AMICO A., CALDARELLA O., & ROMANO S., 2011 - La flora vascolare delle Rocche di Entella (entroterra della Sicilia occidentale). Naturalista sicil., S. IV, 35(3-4): 363-405.

GIANGUZZI L., D'AMICO A., ROMANO S., 2010 - Phytosociological remarks on residual woodlands of *Laurus nobilis* in Sicily. Lazaroa, 31, 67-84.

GIANGUZZI L., ILARDI V., CALDARELLA O., CUSIMANO D., CUTTONARO P., ROMANO S., 2012 - Phytosociological characterization of the *Juniperus phoenicea* L. subsp. *turbinata* (Guss.) Nyman formations in the Italo-Tyrrhenian Province (Mediterranean Region). Plant Sociology, 49(2), 3-28.

GIANGUZZI L., ILARDI V. & RAIMONDO F.M., 1995 - The vegetation of Mount Carcaci natural reserve (NW Sicily). Giorn. Bot. Ital., 129 (2): 273.

GIANGUZZI L., ILARDI V. & RAIMONDO F.M. 1996 - La vegetazione del promontorio di Monte Pellegrino (Palermo). Quad. Bot. Amb. Appl. 4: 79-137.

GIANGUZZI L. & LA MANTIA A. 2000 - Il paesaggio vegetale. In: Gianguzzi L., Ottonello P. (eds.), La riserva di Monte Cofano. Sic. Forest. 8: 37-66.

GIANGUZZI L. & LA MANTIA A. 2004a - Le serie di vegetazione della riserva naturale Orientata "Bosco Ficuzza, Rocca Busambra, Bosco del Cappelliere e Gorgo del Drago" con allegata carta della vegetazione (Scala 1:20000). Naturalista Siciliano, 28(1): 205-242.

GIANGUZZI L. & LA MANTIA A. 2004b - Osservazioni fitosociologiche, sinecologiche e sincorologiche sulla vegetazione relittuale a *Petagnaea gussonei* (Galio-Urticetea) nell'area dei Monti Nebrodi (Sicilia nord-orientale). Fitosociologia 41 (1):165-180.

GIANGUZZI L. & LA MANTIA A., 2004c - Considerazioni su aspetti termofili di vegetazione a Taxus baccata L. nella fascia submontana dei Nebrodi (Sicilia nord-orientale). Coll. Phytosoc. 28: 882-893.

GIANGUZZI L. & LA MANTIA A., 2008 - Contributo alla conoscenza della vegetazione e del paesaggio vegetale della Riserva Naturale "Monte Cofano" (Sicilia occidentale) con allegata carta sinfitosociologica della vegetazione, scala 1:20.000). Fitosociologia 45 (1 suppl. 1): 1-55.

GIANGUZZI L., LA MANTIA A., OTTONELLO D. & ROMANO S., 2005 - La flora vascolare della riserva naturale Monte Cofano (Sicilia Occidentale). Naturalista sicil., S. IV, 29 (3-4): 107-152.

GIANGUZZI L., PAPINI F., & CUSIMANO D., 2016 - Phytosociological survey vegetation map of Sicily (Mediterranean region). Journal of Maps 12(5), 845-851.

GIANGUZZI L., RAIMONDO F.M. & RIGGIO S., 1995 - Relics of riverine *Platanus orientalis* forest in the Oreto Valley, Palermo. Giornale Botanico Italiano 129(2): 274.

GIANGUZZI L., SCUDERI L. & PASTA S., 2006 - La flora vascolare dell'isola di Marettimo (Arcipelago delle Egadi, Sicilia occidentale): analisi fitogeografica ed aggiornamento. Webbia 61(2): 359-402.

GIANGUZZI L., SPENNATI B. & LA MANTIA A., 2007 - La vegetazione di Monte Carcaci, Sito d'Interesse Comunitario dei Monti Sicani (Sicilia occidentale). Fitosociologia 44(2) suppl. 1: 195-199.

GIARDINA G., 2001 - Segnalazioni floristiche italiane 1046. Informatore Botanico Italiano 34(1): 138.

GIL J. A. & RUIZ P., 1985 - The aquatic basophilous bryophytic communities of South East Spain. Herzogia, 7: 211-228.

GIL J. & VARO J., 1981 - Estudio briosociologico de las comunidades reofilas de Sierra Nevada (Espana). Cryptogamie, Bryol. Lichénol., 2(4): 423-440.

GILLI A., 1943 - Die Vegetationverhältnisse der subalpinen und alpinen stufe des Ätna. Beih. Botan. Centralblatt 62: 43-67.

GIUSSO DEL GALDO G., MARCENO' C., MUSARELLA C. M., SCIANDRELLO S., 2008 - La vegetazione costiera della R.N.O. "Torre Salsa" (Siculiana - AG). Informatore Botanico Italiano: 40 (1) 73-89.

GOLUB V.B, LOSEV G.A., MIRKIN B.M., 1991 - Aquatic and hygrophytic vegetation of the Lover Volga valley. Phytocoenologia 20(1): 1-63.

GOOR A.C.J. VAN, 1921- Die Zostera-Association des holländischen Wattenmeeres. Rec. Trav. Bot. Neerl., 18: 103-123.

GRADSTEIN S. R. & SMITTENBERG J. H., 1977 - The hygrophilous vegetation of western Crete. Vegetatio 34: 65–86.

GRABHERR G. & MUCINA L. (eds), 1993 - Die Pflanzengesellschaften Österreichs. Teil II. Natürliche waldfreie Vegetation. Gustav Fischer Verlag, Jena/Stuttgart/New York.

GRAMMATICO F. 2011 - Aggiornamenti sulla distribuzione e status di conservazione di *Calendula maritima* Guss. (Asteraceae). Naturalista Sic. S. 4, 35(1): 43-49.

GRECHUSHKINA N.A., SOROKIN A.N. & GOLUB V.B., 2011- The plant communities with domination of *Phragmites australis* and *Bolboschoenus glaucus* in the territory of Russian coast of the Azov Sea. Nauchnyje Soobschchestva 20(2): 105-115.

GRILLAS P., GAUTHIER P., YAVERCOVSKI N. & PERENNOU C., 2004 - Les mares temporaires méditerranéennes. Station biologique de la Tour du Valat, Arles, 130 pp.

GRILLO M., 1975 - La vegetazione ad *Euphorbia rigida* Bieb. sul versante nord-occidentale dell'Etna. Boll. Acc. Gioenia Sc. Nat. Catania, se. 4, 12 (7-8). 61-75.

GUARINO R., 1997 - La vegetazione dei Monti Peloritani (Sicilia nord-orientale). Tesi di dottorato. Dipartimento di Botanica, Università degli Studi di Catania, pp. 301.

GUARINO R., 2006 - Origin and evolution of the Mediterranean dry grasslands. Berichte der Reinhold Tüxen Gesellschaft, 18: 195–206.

GUARINO R., BAZAN G. & PAURA B. 2015 - Downy-Oak Woods of Italy: Phytogeographical Remarks on a Controversial Taxonomic and Ecologic Issue. In: Box, E. & Fujiwara, K. (eds), Warm-temperate Deciduous Forests around the Northern Hemisphere. – Geobot. Stud. 8: 139-152

GUARINO R., GIUSSO DEL GALDO G. & PIGNATTI S., 2006 - The Mediterranean dwarf shrubs: originand adaptive radiation. Ann. Bot., Roma, n. s., 5: 93-101.

GUARINO R., LO CASCIO P., MUSTICA C. & PASTA S., 2018 - A new naturalized alien plant in Sicily: Cotula australis (Sieber ex Spreng.) Hook. f. (Asteraceae) on the acropolis of Lipari Island (Aeolian Archipelago). Naturalista sicil., S. IV, 42 (1): 125-135.

GUARINO R., MINISSALE P. & SCIANDRELLO S., 2008 - La biodiversità vegetale e relativa cartografia del S.I.C."Torre Manfria" (Gela – CL). Quad. Bot. Amb. Appl. 19: 37-66.

GUARINO R. & PASTA S., 2017 - Botanical excursions in Central and Western Sicily. Field guide for the 60th IAVS Symposium Palermo, 20-24 June 2017. Palermo University Press, 604 pp.

GUARINO R. & PASTA S., 2018 - Sicily: the island that didn't know to be an archipelago. Berichte der Reinhold-Tüxen-Gesellschaft 30: 133-148.

GUELI, L. & LO GIUDICE,R., 2007 - La vegetazione briofitica e vascolare dell'area urbana e territorio extraurbano di Militello in Val di Catania (Sicilia orientale). Quad. Bot. Amb. Appl., 18: 259-302.

GUGLIELMO A., PAVONE P. & TOMASELLI V., 2006 - Studio della vegetazione infestante e del verde ornamentale nel Parco Archeologico di Akrai (Palazzolo Acreide, SR) finalizzato alla conservazione ed alla valorizzazione dei manufatti architettonici. Fitosociologia 43 (1): 39-53.

GUGLIELMO A., SCIANDRELLO S., SPAMPINATO G.. 2012 - La vegetazione dei pantani salmastri della Sicilia sud–orientale. 47° Congresso SISV, Perugia.

GUGLIELMO A., SPAMPINATO G. & SCIANDRELLO S. (eds.), 2007 - I Pantani della Sicilia Sud-Orientale un ponte tra l'Europa e l'Africa. Monforte Editore, 174 pp.

GUINOCHET M., 1951 - Contribution à l'étude phytosociologique du Sud Tunisien. Bull. Soc. Hist. Nat. Afrique du Nord: 42(6-8): 131-153.

GUIRY M.D. & GUIRY, G.M., 2017 - AlgaeBase. World-wide electronic publication, National University of Ireland, Galway. http://www.algaebase.org; searched on 21 January 2017.

GUSSONE J., 1839 - Notizie sulle isole di Linosa, Lampione e Lampedusa e descrizione di una nuova specie di "Stapelia" che trovasi in questa ultima. Atti Reale Acc. delle Scienze, Sez. della Reale Soc. Borbonica 4: 74-97.

HADAČ E., 1983 - A survey of plant communities of springs and moutain brooks in Czechoslovakia. Folia Geobot. Phytotax. 18: 339–361.

HADJADJ-AOUL S. & LOISEL R., 1999 - Syntaxonomie des peuplements algériens du Thuya de Berbérie (*Tetraclinis articulata* (Vahl) Masters). Les peuplements forestiers et préforestiers. Doc. Phytosoc., n.s., 19: 229-285.

HARITONIDIS S. & DIAPOULIS A., 1990 - Evolution of Greek marine phanerogam meadows over the last 20 years. Posidonia Newsletter, 3(2): 5-10.

HARMELIN J.G., 1969 - Contribution à l'étude de l'endofaune de prairies d'*Halophila stipulacea* de Méditerranée orientale. Rec. Trav. Sta. mar. Endoume, 45 (61) : 305-316.

HARMSEN G.W., 1936 - Systematische Beobachtungen der Nordwesteuropäischen Seegrasformen. Ned. Kruidk. Arch., 46: 852-877.

HASLAM S.M., 1978 - River Plants. Cambridge University Press, Cambridge, 396 pp.

HAVEMAN R., DE RONDE I. & SCHAMINÉE JOOP H.J., 2017 - Retamoid scrubs of the *Cytisetea scopario-striati* in the Netherlands: a new approach to classify marginal associations. Tuexenia 37: 143–161.

HÉBRARD J.P., 1973 - Etude de bryassociations du Sud-est de la France et leur context écologique. Thése Doct. Etat., Marseille.

HEJNÝ S., 1997 - Charakteristika vybraných společenstev svazu Bidention tripartitae v jižních Čechách. Zprávy České Bot. Společn., Mater. 15: 205–215.

HENNE P.D., ELKIN C.M., FRANKE J., COLOMBAROLI D., CALÒ C., LA MANTIA T., PASTA S., CONEDERA M., DERMODY O. & TINNER W., 2015 - Reviving extinct Mediterranean forests increases ecosystem potential in a warmer future. Frontiers in Ecology and the Environment 13(7):356-362.

HERNÁNDEZ I., BERMEJO R., PÈREZ-LLORÈNS J.L. & VERGARA J.J., 2010 - Contribución al conocimiento de los macrófitos marinos del saco interno y caños adyacentes de la Bahía de Cádiz. ALGAS. Boletín de la Sociedad Española de Ficología 43: 11-16,

HERTEL E., 1974 - Epilitische Moose und Moosgesellschaften im nordostlichen Bayern. Beih. Ber. Naturwiss. Ges. Bayreuth, l : 1- 489.

HILBIG W., 1995 - Vegetation of Mongolia. SPB Academic Publishing, Amsterdam.

HILBIG W., 2000 - Kommentierte Übersicht über die Pflanzengesellschaften und ihre höheren Syntaxa in der Mongolei. Feddes Repert. 111: 75–120.

HINTERLANG D., 1992 - Vegetationsökologie der Weichwasserquellgesellschaften zentraleuropäisch -er Mittelgebirge. Crunoecia 1: 1–122.

HOCQUETTE M., 1927 - Étude sur la végétation et la flore du littoral de la Mer du Nord de Nieuport à Sangatte. Arch. Bot. 1/4: 1–178.

HOFMANN A. 1960 - Il Faggio in Sicilia. Flora et Vegetatio Italica 2:1-235.

HOLUB J., HEJNY S., MORAVEC J. & NEUHÄUSL R., 1967 - Übersicht der höheren Vegetationseinheiten der Tschechoslowakei. Rozpr. Čs. Acad. Sci. Praga: 77(3): 1-75.

HORVAT I., 1962 - Vegetacija Planina zapadne Hrvatske. Acta Biologica 2: 1-179.

HORVAT I., GLAVAC V. & ELLENBERG H., 1974 - Vegetatio Sudosteuropas. Geobot. Selecta, 4. Stuttgart.

HORVATIĊ S., 1963 - Vegetacijska karta otoka Paga s opicum pregledon vegetacijskih jedinica hrvatskog promorja. Acta Biol. 4, Zagreb.

HRIVNÁK R., OTÁHEL'OVÁ H., KOCHJAROVÁ J., BLANÁR D. & USÁK S., 2005 - Plant communities of the class *Charetea fragilis* FUKAREK ex KRAUSCH 1964 in Slovakia: new information on their distribution and ecology. Thaiszia Journal of Botany 15(2):117-128.

HROUDOVA Z., ZÁKRAVSKÝ P., DUCHÁČEK M. & MARHOLD K., 2007 - Taxonomy, distribution and ecology of *Bolboschoenus* in Europe. Ann. Bot. Fenn. 44(2),: 81-102.

HSÜ K.J., RYAN W. & CITA M. B., 1973 - Late Miocene Desiccation of the Mediterranean. Nature 242:240-244.

HÜBSCHMANN, A. von, 1953 - Einige hydro- und hygrophile Moosgesellschaften Norddeutschlands.. Mitteilungen der Floristisch-soziologischen Arbeitsgemeinschaft, N. F. 4: 15-24.

HÜBSCHMANN A. von, 1957 - Zur Systematik der Wassermoosgesellschaften. Mitt. fior. soz. Arb. Gem. N. F., 6n: 147-151.

HÜBSCHMANN A. von, 1986 - Prodromus der Moosgesellschaften Zentraleuropas. Bryophyt. Biblioth. 32: 1-413.

HULTÉN E. & FRIES M., 1986 - Atlas of North European vascular plants north of the Tropic of Cancer. Koeltz, Königstein, 1172 pp.

IAKUSHENKO D. & BORYSOVA O., 2012 - Plant communities of the class *Charetea* Fukarek ex Krausch 1964 in Ukraine: an overview. Biodiv. Res. Conserv. 25:75-82.

IAMONICO D., GUARINO R., ILARDI V. & PIGNATTI S., 2016 - A revision of *Helichrysum panormitanum* s.l. (Asteraceae) in the Italian and Maltese floras. Phytotaxa 286(3): 207-210.

IBERITE M., PALOZZI A.M. & RESINI A.M., 1995 - La vegetazione del Lago di Bolsena (Viterbo, Italia centrale). Fitosociologia 29: 151-164.

IZCO J., AMIGO J. & GARCÍA-SAN LEÓN D., 2000 - Análisis y clasificación de la vegetación de Galicia (España), II. La vegetación herbácea. Lazaroa 21: 25–50.

IZCO J. & GÉHU J.-M., 1978 - Un exemple de végetation macrohemitherophytique phytonitrophile: le *Smyrnietum olusatri* du littoral de la Manche occidentale. Coll. Phytosoc. 6: 263-267.

IZCO J., OHBA T. & TÜXEN R., 1977 – *Asplenietea rupestria*, *Parietarietea muralis*. Bibliograf. Phytosoz. Syntaxonom. 27: 1-173.

JAMALOV S. M., MARTYNENKO V. B., GOLUB V. B. & BAIŠEVA E. Z., 2004 - Prodromus rastitel'nych soobščestv respubliki Baškortostan. Izdatel'stvo Gilem, Ufa.

JAROLÍMEK I., ZALIBEROVÁ M., MUCINA L. & MOCHNACKÝ S., 1997 - Rastlinné spoločenstvá Slovenska 2. Synantropná vegetácia. Veda, Bratislava.

JASPRICA N., MILOVIĆ M. & ROMIĆ M., 2015 - Fitocenologija in ekologija vrste Cressa cretica L. (Convolvulaceae) na vzhodni jadranski obali. Hacquetia 14(2): 265–276.

JULVE, P., 1993 - Synopsis phytosociologique de la France (communautés de plantes vasculaires). Lejeunia 140 : 1-160.

JULVE, P., 2010 - eVeg: une base de données pour les végétations d'Europe. https://e-veg.net/accueil.

JURKO A. & PECIAR V., 1963 - Pflanzengesellschaften an Schattigen felsen in den Westkarphaten. Vegetatio 11(4): 199-209.

KADEREIT G., MUCINA L. & FREITAG H., 2007 - Phylogeny of Salicornioideae (Chenopodiaceae): diversification, biogeography, and evolutionarytrends in leaf and flower morphology. Taxon 55(3): 617–642.

KADID Y., THÉBAUD G., PÈTEL G. & ABDELKRIM H., 2013 - Les communautés végétales aquatiques de la classe des *Potametea* du lac Tonga, El-Kala, Algérie. Acta Bot. Gallica, 2007, 154 (4), 597-618.

KAISER K., 1969 - The climates of Europe during the Quaternary Ice Age. In: Wright H.E. (ed) Quaternary Geology and Climate (Washington DC): 10-37.

KALINKA A., MIFSUD S., POPIELA A., ACHREM M., 2014 - Chromosome number of *Elatine gussonei* (Sommier) Brullo (Elatinaceae) and its distribution on the Maltese islands. Acta Bot. Croat. 73,: 267–273.

KHELIFI H. & SADKI N., 1995 - Esquisse géobotanique des régions de Collo, Skikda, et Annaba (Nord-Est Algérien). Coll. Phytos. 23: 593-615.

KHELIFI H., SIAB-FARSI B. & KHADID Y. 2014 - Essai de synthèse phytosociologique sur les groupements psammophiles du littoral en Algérie. Doc. Phytos., Sér. 3, 1: 247-257.

KLOSOWSKI S., TOMASZEWICZ G.H. & TOMASZEWICZ H., 2006 - The expansion and decline of charophyte communities in lakes within the Sejny Lake District (north-eastern Poland) and changes in water chemistry. Limnologica - Ecology and Management of Inland Waters 36(4): 234–240.

KNAPP R. & STOFFER A.L., 1962 - Uber doe vegetation von Gewassern und Ufern im mittleren Hessen und Untersuchungen uber den Einflu von Pflanzen auf Sauerstoffgehalt, Wasserstoff-Ionem-Konzantration und die Lebensmiglichkeit anderer Gewaschse. Ber. Oberhess. Ges. Natur. Heilk., Geien, S. 90-171.

KOCH W., 1926 - Die Vegetationseinheiten der Linthebene unter Berücksichtigung der Verhältnisse in der Nordostschweiz. Jahrb. St. Gallischen Naturwissen Schaftlichen Geselschaft 61(2): 1–144.

KONTULA T. & FÜRHAPTER K., 2012 - Documentation of the checklist and distribution data for Baltic Sea macrophyte species. Baltic Sea Environment Proceedings No. 130. pp. 1-203. (Kontula, T. & Haldin, J. Eds), pp. 9-11. Helsinki: Helsinki Commission.

KOROTKOV K. O., MOROZOVA O. V. & BELONOVSKAYA E. A., 1991 - The USSR vegetation syntaxa prodromus. G. E. Vilchek, Moscow.

KRAJINA V., 1933 - Die Pflanzengesellschaften des Mlynica-Tales in den Vysoké Tatry (Hohe Tatra). Bot. Centralb. 51: 1-224.

KRAUSE W., 1997 - Charales (Charophyceae). Süßwasserflora von Mitteleuropa. Ettl H., Gärtner G., Heynig H. & Mollenhauer D.(eds) 18. 202 p.

KRZYWANSKI D., 1974 - Monogr. Bot. 43. Warszawa.

KVĚT J., JENÍK J. & SOUKUPOVÁ L., 2002 - Freshwater wetlands and their sustainable future. A case study of the Třeboň Basin Biosphere Reserve, Czech Republic. UNESCO, Paris & Parthenon Publishing Group, Boca Raton.

LADERO M., BIONDI E., MOSSA L. & AMOR A., 1992 - Los pastizales mediterra´neos presididos por *Trifolium subterraneum* L. en la isla de Cerdena (Italia). Doc. Phytosoc. 16: 45-64.

LADERO M., SOCORRO O., MOLERO J., LOPEZ GUADALUPE M., ZAFRA L., MARIN G., HURTADO J. & RAYA F.P., 1981 - Algunas consideraciones sobre las comunidades nitrofilas de Granada (Espana). Actas III Congr. Optima, Anales Jard. Bot. Madrid, 37: 737-764.

LAKUŠIĆ D., BLAŽENČIĆ J., RANĐELOVIĆ B., BUTORAC B., VUKOJIČIĆ S., ZLATKOVIĆ B., JOVANOVIĆ S., ŠINŽAR-SEKULIĆ J., ŽUKOVEC D., ĆALIĆ I. & PAVIĆEVIĆ D., 2005 - Staništa Srbije. Priručnika sa opisima i osnovnim podacima. Ministarstvo nauke i zaštite životne sredine & Institut za botaniku i botanička bašta "Jevremovac", Biologiški fakultet, Univerzitet u Beogradu, Beograd.

LA MANTIA A., 2003 - Su alcune specie relitte della macchia costiera siciliana di possibile utilizzazione nella forestazione ecologica e nelle progettazioni ambientali: *Quercus calliprinos* Webb, *Juniperus turbinata* Guss. e *Juniperus macrocarpa* S. et Sm. Tesi di dottorato. D.A.C.P.A., Università degli Studi di Catania, pp. 134.

LA MANTIA T., PASTA S., RÜHL J., 2009 - Quadro conoscitivo e proposte gestionali relative agli aspetti floristici, vegetazionali e agro-forestali. Piano di Gestione "Isole Pelagie" SIC ITA040002 "Isole di Lampedusa e Lampione" e ZPS ITA040013 "Arcipelago delle Pelagie. Area marina e terrestre".

LAMPE M. von, 1996 - Wuchsform, Wuchsrhythmus und Verbreitung der Arten der Zwergbinsengesellschaften. Diss. Bot. 266: 1–353.

LANCIONI A. & TAFFETANI F., 2012 - Vegetation of mowed and trampled habitats of a rural hilly area (Marche Region - central Italy. Plant Sociology 49(1): 55-80.

LANDOLT E., 1986 - The family of *Lemnaceae* – a monographic study. 1. Veröff. Geobot. Inst. ETH. Stift. Rübel 71, 566 pp.

LANDOLT E. & KANDELER, R., 1987 - The family of *Lemnaceae* –a monographic study. 2. Veröff. Geobot. Inst. ETH. Stift. Rübel 95.

LANDUCCI F., GIGANTE D. & VENANZONI R., 2011 - An application of the Cocktail method for the classification of the hydrophytic vegetation at Lake Trasimeno (Central Italy). Fitosociologia 48 (2): 3-22.

LANDUCCI F., GIGANTE D., VENANZONI R. & HYTRÝ M. C., 2013 - Wetland vegetation of the class *Phragmito-Magno-Caricetea* in central Italy. Phytocoenologia 43(1-2): 67-100.

LASTRUCCI L., LANDI M. & ANGIOLINI C., 2010 - Vegetation analysis on wetlands in a Tuscan agricultural landscape (central Italy). Biologia 65: 54–68.

LASTRUCCI L., PACI F. & RAFFAELLI M., 2010 - The wetland vegetation of the Natural Reserves and neighbouring stretches of the Arno river in the Arezzo province (Tuscany, Central Italy). Fitosociologia 47 (1): 31-61.

LASTRUCCI L., VALENTINI E., DELL'OLMO L., VIETINA B. & FOGGI B., 2015 - Hygrophilous vegetation and habitats of conservation interest in the area of the Lake Porta (Tuscany, Central Italy). Atti Soc. Tosc. Sci. Nat., Mem., Serie B, 122: 131-146.

LEDOYER M., 1966 - Ecologie de la faune vagile des biotopes méditerranéens accessibles en scaphandre autonome. II. Données analytiques sur les herbiers de phanérogames. Rec. Trav. St. mar. Endoume, 57 (41) : 135-164.

LENTINI F. & CARBONE S., 2014 - Geologia della Sicilia. Memorie Descrittive della Carta Geologica d'Italia 95, 409 pp.

LEUSCHNER C. & ELLENBERG H., 2017 - Ecology of Central European Non-Forest Vegetation: Coastal to Alpine, Natural to Man-Made Habitats. Springer, 1092 pp.

LIBBERT V., 1932 - Die Vegetationseinheiten der neumärkischen Staubeckenelandschaft unter Berücksicktigung der angrenzenden Landschaften 1.Teil. Verhandlungen Botanischen vereins der Provinz Brandenburg: 10-93.

LICANDRO G., MARINO P. & RAIMONDO F.M., 2011 - Flora e vegetazione della Riserva Naturale Orientata "Laghetti di Marinello" (Sicilia nord-orientale). Informatore Botanico Italiano 43(2): 333-351.

LICITRA G., 2011 - Flora e vegetazione delle riserve naturali orientate di Rossomanno-Grottascura-Bellia e di Monte Altesina (EN). Tesi di Dottorato di ricerca in Scienze Ambientali-I Fitogeografia dei territori mediterranei, XXIII ciclo, Università degli studi di Catania.

LO CICERO E. & PICCIONE V., 1977 - Osservazioni sulla vegetazione infestante le colture di grano nella provincia di Caltanissetta. Boll. Accad. Gioenia Sc. Nat. Catania 13 (1-2): 121-136.

LO GIUDICE R. & PRIVITERA M., 1984 - Sulla flora e vegetazione briologica del fiume Alcantara (Sicilia orientale) Boll. Acc. Gioenia Sci. Nat. Catania, 17 (323): 135-145.

LO GIUDICE R., PRIVITERA M. & PUGLISI M., 1993 - Sulla classe *Tortulo-Homalothecietea sericei* Hertel 1974 in Sicilia. Arch. Bot. It. 68: 153-172.

LOIDI A. J., 2017 - The Vegetation of the Iberian Peninsula, Volume 1. Springer, 676 pp.

LOIDI A. J., BIURRUN G. I. & HERRERA G. M., 1995 - La vegetación del centro-septentrional de España. Itinera Geobotanica 9: 161- 618.

LOIDI A. J., HERRERA M., BIURRUN I. & GARCÍA-MIJANGOS I, 1999 - Relationships between syntaxonomy of *Thero-Salicornietea* and taxonomy of the genera *Salicornia* and *Suaeda* in the Iberian Peninsula. Folia Geobotanica 34(1): 97-114.

LOISEL R., 1970 - Contribution à l'etude des groupements rupicoles calcifuges. Anal. Inst. Bot. Cavanilles 26: 167-196.

LONGHITANO N., 1983 - Carta della vegetazione dell'Isola di Filicudi (Isole Eolie). Arch. Bot. e Biogeogr. Ital. 58: 89-105.

LOPRIORE G., 1900 - Studi comparativi sulla flora lacustre delle Sicilia. Ed. Monaco & Mollica. 116 pp.

LORENZONI G.G. 1964 - Vegetazioni infestanti e ruderali della provincia di Vicenza. Lavor. Bor. 27: 1-46.

LÚDI W. VON, 1956 - *Bemerkungen zur gliederung der vegetation in der Baumlosen höhenstufe des Ätna (Sizilien).* Ber. Geobot. Forsch. Inst. Rübel in Zürich 1955 : 103-108.

LUDWIG G. & SCHNITTLER M., 1996 - Rote Liste gefährdeter Pflanzen Deutschlands. Schriftenreihe für Vegetationskunde 28: 1-744.

LUKÁCS B. A. & TÓTHMÉRÉSZ B., 2009 - Aquatic macrophytes as bioindicators of water chemistry in nutrient rich backwaters along the Upper-Tisza river (in Hungary). Phytocoenologia 39(3): 287-293.

MAGRI D., VENDRAMIN G.G., COMPS B., DUPANLOUP I., GEBUREK T., GOMORY D., LATAŁOWA M., LITT T., PAULE L., (...) & DE BEAULIEU J.-L. 2006 - A new scenario for the Quaternary history of European beech populations: palaeobotanical evidence and genetic consequences. New Phytologist 171:199–221.

MAIORCA G., SPAMPINATO G., CRISAFULLI A. & CAMERIERE P., 2007 - Flora vascolare e vegetazione della Riserva Naturale Regionale "Foce del Fiume Crati" (Calabria, Italia meridionale). Webbia 62(2): 121-174.

MAIRE R., 1963 - Flore de l'Afrique du nord. vol. 10. Encyclopédie biologique 62, Paris.

MALATO-BELIZ L., TÜXEN J. & TÜXEN R., 1960 - Zur Systematik der Unkrautgesellschaften der west- und mitteleuropäischen Wintergetriede-Felder. Mitt. Florist.-Soziol. Arbeitsgem., N.F. 8: 145-147.

MAMCZARZ H., 1978 - Bryoflora i zbiorowiska mszakow beskidu sadeckiego. Cz. II. Zbiiorowiska mszakow. Monog. Bot. 56: 1-94.

MANISCALCO M. & RAIMONDO F.M. 2003 - Ecology and optimal and heterotopical distribution of Ilex aquifolium (Aquifoliaceae) in Sicily. Bocconea 16(2): 905-917.

MANISCALCO M., RAIMONDO F.M., 2009 - Phytosociological study of the acidophilous deciduous oak woods with Ilex aquifolium of Sicily. Fitosociologia, 46(2), 67-80.

MARBÁ N., CEBRIAN J., ENRIQUEZ S. & DUARTE C.M., 1996 - Growth patterns of Western Mediterranean seagrasses: species- specific responses to seasonal forcing. Mar. Ecol. Prog. Ser. 133(1-3): 203-215.

MARCENÒ CORRADO, GUARINO R., LOIDI J., HERRERA M., ISERMANN M., KNOLLOVÁ I., TICHÝ1 L., TZONEV R.T., ACOSTA A. T. R., FITZPATRICK U., IAKUSHENKO D., JANSSEN J. A. M., JIMÉNEZ-ALFARO B., KĄCKI Z., KEIZER-SEDLÁKOVÁ I., KOLOMIYCHUK V., RODWELL J.S., SCHAMINÉE J. H. J., ŠILC1 U. & CHYTRÝ M., 2018 - Classification of European and Mediterranean coastal dune vegetation. Applied Vegetation Science, 21(3): 533-559.

MARCENÓ CORRADO & ROMANO S., 2010 - La vegetazione psammofila della Sicilia settentrionale. Inf. Bot. Ital. 42(1): 91-98.

MARCENÓ C. & COLOMBO P., 1982 - Su alcuni esempi di vegetazione ad *Erica multiflora* L. (*Erico-Polygaletum preslii* dei *Cisto-Ericetalia*) sui monti di Palermo (Sicilia). Biol.-Ecol. Médit 9: 85-94.

MARCENÓ C., COLOMBO P. & PRINCIOTTA R., 1978 - Nuovo contributo allo studio della vegetazione lacustre in Sicilia. Atti Accad. Sci., Lett. e Arti di Palermo 4, 36(1): 55-66.

MARCENÓ C., FALCI A. & PASTA S., 2011- Su alcuni lembi di vegetazione pre-forestale e forestale della provincia di Enna (Sicilia Centrale). Naturalista Siciliano S. IV, 35(2): 295-312.

MARCENÒ C., OTTONELLO D. & ROMANO S. 2002- Inquadramento fitosociologico dei popolamenti a *Celtis tournefortii* Lam. di Caltabellotta (Sicilia sud-occidentale). Fitosociologia 39 (1): 109-113.

MARCENÓ C. & RAIMONDO F.M., 1977 - Osservazioni su alcuni aspetti di vegetazione lacustre nella Sicilia centrale. Giorn. Bot. Ital. 111 (1-2): 13-26.

MARCENÓ C. & TRAPANI S., 1976 - L'*Isöetetum duriaei* (*Isöetion*) nella Piana dei Greci (Sicilia occidentale). Atti Acc. Sc. Lett. Arti Palermo, s. 4, 35 (1): 395-399.

MARCHIORI S. & SBURLINO G., 1997 - Present vegetation of the Venetian Plain. Allionia 34 (1996): 165-180.

MARINO P., CASTELLANO G., BAZAN G. & SCHICCHI R., 2005 - Carta del paesaggio e della biodiversità vegetale dei monti Sicani sud-orientali (Sicilia centro-occidentale. Quad. Bot. Amb. Appl., 16: 3-60.

MARINO, P., CASTIGLIA, G., BAZAN, G., DOMINA, G., & GUARINO, R., 2013 - Tertiary relict laurophyll vegetation in the Madonie mountains (Sicily). Acta Botanica Gallica, 161(1): 47-61.

MARINO, P., GUARINO, R., & BAZAN, G., 2012 - The Sicilian taxa of Genista sect. Voglera and their phytosociological framework. Flora Mediterranea, 22, 169-190.

MARINO P., RAIMONDO F. M., CASTELLANO G. & BAZAN G., 2013 - Aspetti di vegetazione ad euforbia arborescente e ciliegio canino dei monti Nebrodi (Sicilia). 108° Congresso Nazionale della Società Botanica Italiana, 18-20 settembre 2013, Trento, riassunti: 191.

MARSTALLER R., 1987 - Die Moosgesellschaften der Klasse Platyhypnidio-Fontinaletea antipyreticae Philippi 1956. 30. Beitrag zur Moosvegetation Thüringens. Phytocoenologia 15:85-138.

MARSTALLER R., 2006 - Syntaxonomischer Konspekt der Moosgesellschaften Europas und angrenzender Gebiete. Haussknechtia 13: 1-192.

MATUSZKIEWICZ W., 2007 - Przewodnik do oznaczania zbiorovisk roślinnych Polski. Ed. 3. Wydawnictwo Naukowe PWN, Warszawa.

MAUGERI G., 1975 - Una nuova associazione dell'*Echio-Galactition* nei prati di Sulla della piana di Catania. Arch. Bot. Biogeogr. Ital. 20(3): 83-113.

MAUGERI G., 1980 - La vegetazione infestante gli agrumeti dell'Etna. Not. Fitosoc. 15: 45-54.

MAUGERI G. & LEONARDI S., 1974 - Esempio di macchia a Ginepro e Lentisco nella Sicilia meridionale. Arch. Bot. Biogeogr. Ital. Forlì, 50: 51-59.

MEDAGLI P., MELE C., SCIANDRELLO S., DI PIETRO R., WAGENSOMMER R., URBANO M. & TOMASELLI V., 2013 - Analisi della biodiversita' vegetale e cartografia della vegetazione, degli habitat e dell'uso del suolo della Riserva Naturale Statale "Le Cesine" (Lecce - Puglia). Quad. Bot. Amb. Appl., 24: 55-76.

MEDDOUR R., MEDDOUR-SAHAR O., ZERAIA L. & MUCINA L., 2017 - Syntaxonomic synopsis of the forest and tall scrub vegetation of Northern Algeria. Lazaroa 38(2): 127-163

MEIER H. & BRAUN-BLANQUET J., 1934 – Prodrome des groupements végétaux. Fasc. 2 (Classe des *Asplenietales rupestres*- Groupements rupicoles. Mari-Lavitt, Montpellier, 47 pp.

MEINESZ A., BOUDOURESQUE C. F., FALCONEITI C., ASTRIER J. M., BAY D., BLANC J. J., BOURCIER M., CINELU F., CIRIK S., CRISTIANI G., DI GERONIMO I., GIACCONE G., lIARMELIN J. G., LAUBIERL., LOVRIC A. Z., MOUNIER R., SOVER J. & VAMVAKAS C., 1983 - NormalisatioN des symboles pour la représentation et lacartographie des biocénoses benthiques littorales de Méditerranée. Ann. Inst. Océanogr. 59 (2): 155-172.

MELENDO M., CANO E. & F. VALLE, 2003 - Synopsis of aquatic plant-communities of the class *Potametea* in the southern Iberian Peninsula. Acta Bot. Gallica, 150 (4), 429-444.

MERIAUX J. L., 1978 - Etude analitique et comparative de la vègètation aquatique d'etangs et de marais du Nord de la France (Vallèe de la Sensèe et Bassin houiller du Nord-pas-de-Calais. Documents Physociologiques (n. s.) 3: 1-278.

MERIAUX J. L., 1983 - La classe des *Phragmitetea* dans le nord-ouest de la France. Colloques Physociologiques 10: 139-147.

MEREU L., LASTRUCCI L. & VICIANI D., 2010- Contributo alla conoscenza della vegetazione del fiume Pesa (Toscana, Italia Centrale). Stud. bot. 29, 2010: 105-143.

MEUSEL H., JÄGER E. & WEINERT E. (eds), 1965 - Vergleichende Chorologie der zentraleuropäischen Flora. Gustav Fischer Verlag, Jena.

MICEV K., 1957 - Typologische Gliederung der Niederungwiesen und Sumpvegetation Mazedoniens. Folia Balcanica, Skopje, 6: 29-33.

MICEVSKI K., 1963 - Typologische untersuchungen der sumpfvegetation Mazenoniens. Ann. Fac. Sci. Univ. Skopje 14(5): 79-130.

MILCHAKOVA N.A., 2011 - Marine plants of the Black Sea. An illustrated field guide. pp. 1-144. Sevastopol: Digit Print Press.

MILNE R.I. & ABBOTT R.J., 2002 - The origin and evolution of Tertiary relict flora. Advances in Botanical Research 38:281-314

MINISSALE P., 1995 - Studio fitosociologico delle praterie ad *Ampelodesmos mauritanicus* della Sicilia. Coll. Phytosoc. 21: 615-652.

MINISSALE P., MOLINA J. A. & SCIANDRELLO S., 2017 - *Pilularia minuta* Durieu (Marsileaceae) discovered in south-eastern-Sicily: new insights on its ecology, distribution and conservation status. Botany Letters 164(3): 197–208.

MINISSALE P., MUSUMARRA G. & SCIANDRELLO S. 2006 - La vegetazione di Poggio Racineci (Caltagirone - Sicilia centro-meridionale), un biotopo da proporre come Sito di Interesse Comunitario. Boll. Acc. Gioenia Sci. Nat. Catania, 39 (366): 21-41.

MINISSALE P., SANTO A. & SCIANDRELLO S., 2011 - Analisi geobotanica del SIC "Capo Murro di Porco, Penisola della Maddalena e Grotta Pellegrino" (Siracusa, Sicilia). Fitosociologia 48(2): 77-98.

MINISSALE P. & SCIANDRELLO S., 2005 - La vegetazione di Piano Stella presso Gela (Sicilia meridionale), un biotopo meritevole di conservazione. Quad. Bot. Amb. Appl., 16: 129-142.

MINISSALE, P. & S. SCIANDRELLO. 2010 - Flora e vegetazione terrestre della Riserva Naturale di Vendicari (Sicilia sudorientale)."[Terrestrial flora and vegetation of the Natura reserve of Vendicari (south-easternSicily)] Ente Fauna Siciliana 12: 145–208.

MINISSALE P. & SCIANDRELLO S., 2013 - A relic wood of *Juniperus turbinata* Guss. (Cupressaceae) in Sicily: Structural and ecological features, conservation perspectives. Plant Biosystems 147(1): 145-157.

MINISSALE P. & SCIANDRELLO S., 2016 - Ecological features affect patterns of plant communities in Mediterranean temporary rock. Plant Biosystems 150(1): 171-179.

MINISSALE P. & SCIANDRELLO S., 2017a - Flora and habitats of Vendicari islet (isola di vendicari) in south east Sicily. Nat. Croat., 26(1): 1–16.

MINISSALE P. & SCIANDRELLO S., 2017b - The wild vascular flora of the Archaeological Park of Neapolis in Syracuse and surrounding areas (Sicily, Italy). Biodiversity Journal, 8 (1): 87–104.

MINISSALE P., SCIANDRELLO S., SCUDERI L. & SPAMPINATO G., 2010 - Gli ambienti costieri della Sicilia meridionale. Escursione della Società Italiana di Scienze della Vegetazione. Bonanno Editore, Catania, 74 pp.

MINISSALE P., SCIANDRELLO S. & SPAMPINATO G., 2005 - Analisi della biodiversità vegetale e relativa cartografia della Riserva Naturale Orientata Isola Bella e del territorio circostante (Taormina – ME – Sicilia). Quad. Bot. Amb. Appl., 16: 175-208.

MINISSALE P., SCIANDRELLO S. & SPAMPINATO G., 2007 - Analisi della biodiversità vegetale e relativa cartografia della Riserva Naturale Orientata "Pantalica, Valle dell'Anapo e Torrente Cava Grande " (Sicilia sud-orientale). Quad. Bot. Amb. Appl., 18: 145-207.

MINISSALE P., SPAMPINATO G., 1987 - Osservazioni fitosociologiche sul "Lago Gurrida" (Sicilia Nord-orientale). Giorn. Bot. Ital. 119(3-4): 197-225.

MINISSALE P. & SPAMPINATO G., 1990 - Osservazioni fitosociologiche sul "Pantano Gurna" presso Mascali (Sicilia orientale). Boll. Acc. Gioenia Sci. Nat. 23(336): 317-336.

MINISSALE P., SANTO A. & SCIANDRELLO S., 2011 - Analisi geobotanica del SIC "Capo Murro di Porco, Penisola della Maddalena e Grotta Pellegrino" (Siracusa, Sicilia). Fitosociologia vol. 48 (2): 77-98.

MIYAWAKI, A. & TUXEN, J. 1960 - Uber Lemnetea-Gesellschaften in Europa und Japan. Mitt. Flor.-Soziol Arbeits. N.F. 8: 127-135.

MOLINA J. A., 2005 - The vegetation of temporary ponds with Isoetes in the Iberian Peninsula. Phytocoenologia 35(2-3): 219-230.

MOLINA J.A. & MORENO P.S., 2003 - Diversity of the helophytic vegetation in Spain. Acta Bot. Gall. 150: 167–193.

MOLINIER R., 1934 - Etudes phytosociologiques et écologiques en. Provence occidentale. Ann. du Musée d'Hist. Nat. de Marseille 27: 1-274.

MOLINIER R. 1937 - Les Iles d'Hyeres. Etude phytosociologique. – Ann. Soc. Hist. Nat. Toulon et du Var, 21: 91-129.

MOLINIER R., 1954 - Observations sur la végétation de la zone littorale en Provence. Vegetatio 5-6: 257-267.

MOLINIER R., 1956 - La végetation de la Presq'ile du Cap Sicie (Var). Bull. Mus. Hist. Nat. Marseille 6: 1-23.

MOLINIER R., 1960 - Observations sur les Phanérogames marines méditerranéennes. Rapp. P.V. Réun. Commiss. internation. Explor. Sci. Médit., 15 (2): 165-170.

MOLINIER R. & MOLINIER R., 1955 - *Observations sur la végétation littorale de l'Italie occidentale et de la Sicilie*. Arch. Bot. Biogeogr. Ital. 31(3): 129-161.

MOLINIER R. & PICARD J., 1952 - Recherches sur les herbiers de Phanérogames marines du littoral méditerranéen français. Ann. Inst. océanogr. 27(3): 157-234.

MOLNÁR V.A., POPIELA A. & LUKÁCS B.A., 2014 - *Elatine gussonei* (Sommier) Brullo et al. (Elatinaceae) in Sicily. Plant Biosyst. 148(1): 27–30.

MOLNÁR V.A., TÓTH J.P., SRAMKÓ G., HORVÁTH O., POPIELA A., MESTERHÁZY A. & LUKÁCS B.A., 2015 - Flood induced phenotypic plasticity in amphibious genus *Elatine* (Elatinaceae). PeerJ 3: 1-23.

MORAVEC J., BALÁTOVÁ-TULÁČKOVÁ E., BLAŽKOVÁ D., HADAČ E., HEJNÝ S., HUSÁK Š., JENÍK J., KOLBEK J., KRAHULEC F., KROPÁČ Z., NEUHÄUSL R., RYBNÍČEK K., ŘEHOŘEK V. & VICHEREK J., 1995 - Rostlinná společenstva České republiky a jejich ohrožení. Ed. 2. Severočeskou Přír., Příl. 1995/1: 1–206.

MOSSA L., 1989 - Su alcuni aspetti della classe *Quercetea ilicis* della Sardegna meridionale. Not. Fitos., 22: 125-142.

MOSSA L. 1990 - La vegetazione forestale del Campo dunale di Buggerru-Potixeddu (Sardegna occidentale). Ann. Bot. (Studi sul Terrr.) 48 (suppl. 7): 291-306.

MOSSA L., ARU A., FOGU M.C., GUARINO R., ZAVATTERO L., 2005 - Studio Geobotanico del Parco Eolico di Ulassai. Edibo, Catania, 193 pp.

MUCINA L., 1993 - *Asplenietea trichomanis*. In: Grabherr, G. & Mucina, L. (Eds.). Die Pflanzengesellschaften Österreichs. Teil II. Gustav Fischer Verlag, Jena. pp. 241-275.

MUCINA L., GRABHERR G. & ELLMAUER T., 1993 - Die Pflanzengesellsschaften Österreichs. Teil 1: Anthropogene Vegetation. Fischer-Verlag, Jena, Stuttgart, New York.

MUCINA L. & THEURILLAT J.P., 2015 - Descriptions and validation of the names of some high-rank syntaxa in the European *Asplenietea trichomanis* and *Polypodietea*. Lazaroa 36: 75-78.

MUCINA L. ET AL., 2016 - Vegetation of Europe: hierarchical floristic classification system of vascular plant, bryophyte, lichen, and algal communities. Applied Vegetation Science 19(Suppl. 1): 3–264.

MÛLLER T., 1977 - Klasse: *Lemnetea* R. Tx. 1955 (*Lemnetea minoris*). In Oberdorfer E. (Ed.). Süddeutsche, pp: 67-77.

NIMIS P. & CROVELLO T.J., 1991- Quantitative approaches to phytogeography. Springer, 280 pp.

NINOT J.M., FONT X., MASALLES R.M. & VIGO J., 2011 - Syntaxonomic conspectus of the vegetation of Catalonia and Andorra. II: Ruderal communities Acta Bot. Barc. 53: 113-189.

NORDSTROM K. F., GAMPER U., FONTOLAN G., BEZZI A. & JACKSON N.L., 2009 - Characteristics of Coastal Dune Topography and Vegetation in Environments Recently Modified Using Beach Fill and Vegetation Plantings, Veneto, Italy.Environmental Management 44: 1121–1135.

NOTI R., VAN LEEUWEN J., COLOMBAROLI D., VESCOVI E., PASTA S., LA MANTIA T. & TINNER W., 2009 - Mid- and late-Holocene vegetation and fire history at Biviere di Gela, a coastal lake in southern Sicily, Italy. Veg. Hist. Archaeobot., 18: 371–387.

NOWAK A. & NOWAK S., 2007 - Interesujące zbiorowiska roślinne w dolinie Odry na Śląsku Opolskim. In: LIS J. A. & MAZUR M. A. (eds), Przyrodnicze wartości polsko-czeskiego pogranicza jako wspólne dziedzictwo Unii Europejskiej, Uniwersytet Opolski, Opole, pp. 59–83.

NOWAK A., NOWAK S. & NOBIS M., 2014 - Diversity and distribution of rush communities from the *Phragmito-Magnocaricetea* class in Pamir Alai mountains (Middle Asia: Tajikistan). Pak. J. Bot. 46(1): 27-64.

OBERDORFER E., 1954 - Nordaegaeische kraut und zwergstrauchfluren im vergleich mit den entsprechenden vegetationseinheiten des westlichen mittelmeergebietes. Vegetatio 5-6: 88-96.

OBERDORFER E., 1969 – Zur Soziologie der *Cymbalaria-Parietarietea* am Beispiel der Mauertepich-Geselfachten Italiens. Vegetatio 17: 207-213.

OBERDORFER E., 1975 - Die Mauerfugen-Vegetation Siziliens. Phytocoenologia 2: 146-153.

OBERDORFER E., 1977 - Suddeutsche pflanzegessellschaften. I. Stuttgart, 311 pp.

OBERDORFER E., GÖRS S., KORNECK D., LHOMEYER W., MÜLLER T., PHILIPPI G. & SEIBERT P., 1967 – Systematische Übersicht der westdeutschen Phanerogamen-und Gefäßkrycryptogamen-Geselschaften. Schriftenr. Vegetationsk. 2: 7-240.

ONNIS A., 1967 - Contributo alla conoscenza dell'areale e dell'ecologia di *Althenia filiformis* Petit in Sardegna. Atti Soc. Tosc. Sci. Nat. (Pisa), Mem. ser. B 74: 1-20.

ONNIS A., 1969 - *Althenia filiformis* Petit in Sicilia. Giorn. Bot. Ital. 103: 623.

ONNIS A., 1974 - *Althenia filiformis* Petit: contributo alla conoscenza della ecologia della Germinazione. Giornale botanico italiano 108(3-4): 105-111.

ORELLANA J.V. & DE MERA A.G., 2003 - The vegetation in the Villuercas region (Extremadura, Spain) and in Serra de San Mamede (Alto Alenteio, Portugal). The effect of different land use on the vegetation pattern. Phytocoenologia 33(4): 727-748.

PARDUCCI L., SZMIDT A. E., RIBEIRO M.M. & DROUZAS A., 2001 - Taxonomic position and origin of the endemic Sicilian fir *Abies nebrodensis* (Lojac.) Mattei based on Allozyme analysis. Forest Genetics 8(2): 119-127.

PASSALACQUA N.G., BERNARDO L. & SPAMPINATO G., 2007 - Aggiornamento alla lista dei syntaxa segnalati per la Regione Calabria (2000-2004). Fitosociologia 44(1): 65-79.

PASSARGE H., 1978 - Übersicht über mitteleuropäische Gefässpflanzengesellschaften. Feddes Repert. 89: 133-195.

PASTA S., 2004 - La conservazione delle emergenze botaniche nell'area costiera siciliana: il caso della R.N.O. Isole dello Stagnone di Marsala (Trapani, Sicilia Occidentale). Naturalista sicil., S. IV, XXVIII (1): 243-263.

PASTA S., BAMBINA A., COLONNA L., ROMANO S., GIANCONTIERI G., MESSANA G., LA MANTIA T., OTTONELLO D. & SCUDERI L., 2008 - Il sito di "Castello della Pietra" e "Riserva Zangara" (Castelvetrano, Sicilia sud-occidentale). Indagine multidisciplinare e proposte di tutela. Naturalista sicil., S. IV, 22 (1-2): 3-60.

PASTA S., GARFÌ G., CARIMI F. MARCENÒ CO., 2017 - Human disturbance, habitat degradation and niche shift: the case of the endemic *Calendula maritima* Guss. (W Sicily, Italy). Rendiconti Lincei 28 (2): 415–424.

PASTA S. & LA MANTIA T., 2001 – Note sul paesaggio vegetale delle isole minori circum sicialiane. I. Consorzi forestali e preforestali dell'isola di Lampedusa ed effetto degi impianti artificiali sulla vegetazoine naturale. Nat. Sic. s.4, 25(suppl.): 71-89.

PAVONE P., SPAMPINATO G., TOMASELLI V., MINISSALE P., COSTA R., SCIANDRELLO S. & RONSISVALLE F., 2007 - Cartografia degli habitat della Direttiva CEE 92/43 nei biotopi della Provincia di Siracusa (Sicilia orientale). Fitosociologia 44 (2) suppl.1: 183-193.

PEDLEY H. M., HOUSE M.R. & WAUGH B., 1978 - The geology of the Pelagian block: the Maltese Islands. In Nairn A.E.M., Kanes W.H.& Stehli F.G. (eds.), The ocean basins and margins. 4B, the Western Mediterranean. Plenum Press, New York: 417-433.

PEDROTTI F., 1970 - Un relitto di bosco planiziale a *Quercus robur* e *Fraxinus angustifolia* lungo il fiume Sinello in Abruzzo. Publ. Ist. Bot. Camerino.

PEDROTTI F., 2013 - Plant and Vegetation Mapping. Geobotany Studies, Springer, 294 pp.

PEDROTTI F., 2015 - La Fitosociologia in Italia. In: Cristea V., Gafta D. & Pedrotti F., Fitosociologia, Temi Editrice, Trento, 408 pp.

PEDROTTI F. & GAFTA D. 1992 - Tipificazione di tre nuove associazioni forestali riparali nell'Italia meridionale. Doc. Phytosoc. 14: 557-560.

PEDROTTI F. & GAFTA D. 1996 - Ecologia delle foreste ripariali e paludose dell'Italia.L'Uomo e l'Ambiente 23: 1-165.

PEDROTTI F., SANESI G., BALLELLI S., CORTINI PEDROTTI C. & ORSOMANDO E., 1979 - Il Piano di Rascino (Rieti): note fitogeografiche. Biogeography 6: 81-92.

PEINADO LORCA M., BARTOLOMÈ ESTEBAN C., MARTINEZ PARRAS J. M. & ANDRADE OLLALA A., 1988 - Notas sobre vegetazion nitrofila, III: Contribucion al estudio de la classe Bidentetea tripartitae en Espańa. Acta Bot. Barc., 37: 307-316.

PERDIGÓ I ARISÓ M. T. & PAPIÓ I PERDIGÓ C., 1985 - Littoral vegetation in the Torredembarra area (south of Catalonia). Collect. Bot. 16(1): 215-226.

PÉRES, J.M., 1984 - La régression des herbiers à Posidonia oceanica In: C.F. Boudouresque, A. Meinesz, E. Fresi and V. Gravez (eds.), Int. Workshop Posidonia oceanica Beds, GIS Posidonie publ., 1: 445-454.

PEREZ CARRO F.J., DIAZ T.E., FERN_ANDEZ ARECES M.P. & SALVO E., 1989 - Contribucion al estudio de las comunidades rupıcolas de la *Cheilanthetalia marantho-maderensis* y *Androsacetalia vandellii* en la Penınsula Iberica. Acta Bot. Malac.14: 171–191.

PÉREZ-LATORRE A. V., CABALLERO G., CASIMIRO-SORIGUER SOLANAS F., GAVIRA O., CABEZUDO B., 2008 - Vegetación del sector malacitano-axarquiense (Comarca de la Axarquía. Montes de Málaga y Corredor de Colmenar), Málaga (España). Acta Botanica Malacitana 33. 215- 270.

PÉREZ PRIETO D. & FONT X., 2005 - Revisión sintaxonómica a nivel de subalianza del orden *Helianthemetalia guttati* en la Península Ibérica e Islas Baleares. Acta Botanica Malacitana 30: 139-156.

PÉREZ RAYA & LÓPEZ NIETO J. M., 1991 - Vegetaciòn de acuàtica y helofitica de la depresiòn de Padul (Granada). Acta Botanica Malacitana 16(2): 373-389.

PERGETN-MARTINI, C., 1994 - Impact d'un rejet d'eaux usées urbaines sur l'herbier à Posidonia oceanica, avant et après la mise en service d'une station d'épuration. Ph.D. thesis, Univ. Corse, Fr.

PESARESI S., BIONDI E., VAGGE I., GALDENZI D. & CASAVECCHIA S., 2017 - The *Pinus halepensis* Mill. forests in the central-eastern European Mediterranean basin. Plant Biosystems 151(3): 512-529.

PETRONICI C. & AVERNA V., 1959 - I microelementi nei terreni della zona agrumicola di Bagheria (Palermo). Tecnica Agricola, 4-5(9): 428-439.

PETRONICI C., MAZZOLA P. & RAIMONDO F. M., 1978 - Nota introduttiva allo studio degli ambienti idromorfi delle Madonie. Naturalista Sicil. s.4, 2 (1-2): 11-24

PHILIPPI G., 1956 - Einige Moosgesellschaften des Siidschwarz waldes und der angrenzenden Rheinebene. Beitr. nat. Forsch. Siidwestdeutschl., 15: 91-124.

PHILIPPI G., 1973 - Zur Kenntnis einiger Röhrichtgesellschaften des Oberrheingebietes. Beitr. Naturk. Forsch. Südwestdeutschl. 32: 53–95

PIETSCH W., 1973 - Beitrag zur Gliederung der europäischen Zwergbinsengesellschaften (Isoëto-Nanojuncetea Br.-Bl. et Tx. 1943). Vegetatio 28: 401–438.

PIGNATTI S., 1951 - La vegetazione delle spiagge della costa settentrionale siciliana. Nuov. Giorn. Bot. Ital. n.s. 58: 581-582.

PIGNATTI S., 1952° - Note fitosociologiche su alcune associazioni del litorale tunisino. Boll. Soc. Ven. Stor. Nat. Mus. Civ. Stor. Nat,, 6: 77-94.

PIGNATTI S., 1952b - Introduzione allo studio fitosociologico della pianura veneta orientale con particolare riguardo alla vegetazione litoranea. Archivio Botanico 28: 265-329.

PIGNATTI S., 1952c - Un escursione fitosiociologica sul litorale di Beyrout (Libano). Nuovo Giorn. Bot. Ital. n.s. 59: 75-87.

PIGNATTI S., 1953 - Introduzione allo studio fitosociologico della pianura veneta orientale con particolare riguardo alla vegetazione litoranea. Archivio Botanico 29: 1–25, 65–98, 129– 174.

PIGNATTI S., 1959 - Ricerche sull'ecologia e sul popolamento delle dune del litorale di Venezia. Boll. Muss. Civ. Storia Nat. Venezia 12: 61-142.

PIGNATTI S., 1978 - Evolutionary trends in Mediterranean flora and vegetation. Vegetatio 37: 175-185.

PIGNATTI S., 1979 - Geobotanica. In: (Cappelletti C. ed.) "Botanica". UTET, Torino, 801-997.

PIGNATTI S., 1982 - Flora d'Italia, 1-3 vol. Edagricole, Bologna.

PIGNATTI S., 2017-2019 - Flora d'Italia, 1-4 vol. Edagricole-New Business Media, Milano.

PIGNATTI-WIKUS E., PIGNATTI S., NIMIS P.L. & AVANZINI A., 1980 - La vegetazione ad arbusti spinosi emisferici: Contributo alla interpretazione delle fasce di vegetazione delle alte montagne dell'Italia mediterranea. Quad. C.N.R. AQ/1/79, Roma.

PINTO GOMES C., CANO-ORTIZ A., QUINTO-CANAS R., VILA-VIÇOSA C. & MARTÍNEZ LOMBARDO M.C., 2012 - Analysis of the *Cytisetea scopario-striati* scrubs in the south-west-centre of the Iberian Peninsula. Acta botanica Gallica 159(2):251–266.

PIIRAINEN M., LIEBISCH O. & KADEREIT G. 2017 - Phylogeny, biogeography, systematics and taxonomy of Salicornioideae (Amaranthaceae/Chenopodiaceae). A Cosmopolitan, highly specialized hygrohalophyte lineage dating back to the Oligocene. Taxon 66(1): 109–132.

PIROLA A., 1959 - Aspetti della vegetazione delle dune del litorale catanese. Sicilia orientale. Boll. Ist. Bot. Univ. Catania. s.2, 3: 35-64.

PIROLA A., 1961 - L'associazione a *Scabiosa cretica* Taormina (Sicilia orientale). Ist. Bot. Reale Univ.Reale Lab. Crittog. Pavia Atti ser. 5, 19:140-152.

PIROLA A. & ROSSETTI A., 1974 - *Polygono-Xanthietum italici* ass. nova, vegetazione di greto del corso medio del Reno (Bologna). Not. Fitosoc. 8:15-27.

PIRONE G., 1995 - La vegetazione alofila della costa abruzzese (Adriatico centrale). Fitosociologia 30:233-256.

PIRONE G., CIASCHETTI G. & FRATTAROLI A. R., 2009 - The vegetation of the river bed and the first alluvial terraces of the River Trigno (Abruzzo-Molise). Fitosociologia vol. 46 (2): 49-66

PIRONE G., CIASCHETTI G., FRATTAROLI A. R. & CORBETTA F., 2003 - La vegetazione della Riserva Naturale Regionale "Lago di Serranella" (Abruzzo - Italia). Fitosociologia 40(2): 55-71.

POIRON L. & BARBERO M., 1965 - Groupements a *Isoetes velata* A. Braun (Isoetes variabilis Le Grand). Bull. Soc Bot. Fr. 112: 436-442.

POITTIER-ALAPETITE G., 1954 - L'ile de Zembra. Mém. Soc. Sc. Nat. Tun. 2: 35-44.

POLDINI L., VIDALI M., BIONDI E. & BLASI C., 2002 - La classe *Rhamno-Prunetea* in Italia. Fitosociologia 39 (1) - Suppl. 2: 145-162.

POLI MARCHESE E., 1965 - La vegetazione altomontana dell'Etna. Flora et Veg. Italica. Mem. 5: 1-253.

POLI MARCHESE E. & CARFÌ M.G., 1996 - La vegetazione della riserva naturale "Macchia-Foresta del fiume Irminio" Sicilia sud-orientale. Documents phytosociologiques n.s. 26: 335-363.

POLI MARCHESE E., MAUGERI G., RONSISVALLE G. A., 1981 - Note illustrative della Carta della vegetazione dell'Etna. C.N.R. AQ/1/131: 1-29.

POLTE T., 2001- *Juncetea maritimi*. In: BERG C., DENGLER J. & ABDANK A. (eds.) Die Pflanzengesellschaften Mecklenburg-Vorpommerns und ihre Gef€ahrdung. Tabellenband, pp. 84–89. Weissdorn, Jena, DE

POLTE T., 2004 - Klasse: Juncetea maritimi Tx. & Oberd. 1958 – Salzwiesen und Brackwasserr€ohrichte. In: Berg, C., Dengler, J., Abdank, A. & Isermann, M. (eds.) Die Pflanzengesellschaften Mecklenburg-Vorpommerns und ihre Gef€ahrdung. Textband, pp. 225–245. Weissdorn, Jena, DE.

PONS A., 1984 - Les changements de la végétation de la région Méditerranéenne durant le Pliocène et le Quaternaire en relation avec l'histoire du climat et de l'action de l'homme. Webbia 38: 427-439.

PONS A. & SUC J.P., 1980 - Les témoignages de structures de végétation Méditerranéennes dans le passéantérieur à l'action de l'homme. Fondation Louis Emberger. La mise en place, l'évolution et la caractérisation de la flora et de la vegétation circum-meditàrranéennes. Montpellier 9-10 April Naturalis Monspeliensa.

PONZO A., 1900 - La flora trapanese. Palermo, Tipografia Puccio, 140 pp.

POST G.E. & DINSMORE G.E., 1932 - Flora of Syria, Palestine and Sinai. American Press, Beirut, 919 pp.

POTT R., 1995 - Die Pflanzengesellschaften Deutschlands. Verlag Eugen Ulmer, Stuttgart, 622 pp.

POTT R., 2011 - Phytosociology: A modern geobotanical method. Plant Biosystems 145 supL. 1: 9-18.

POTTIER-ALAPETITE G., 1954 - L'ile de Zembra. Mem. Soc. SC. Nat. Tun. 2:35-44.

PRIVITERA M., 1990 - La classe *Platyhypnidio-Fontinaletea antypireticae* Philippi 1956 in Sicilia. Boll. Acc. Gioenia Sci. Nat., Catania 23: 337-354.

PRIVITERA M. & L0 GIUDICE R., 1981 - Vegetazione muscinale della faggeta del bosco di Malabotta (Peloritani). Cryptogamie, Bryol. Lichénol., 2 (2): 181-200.

PRIVITERA M. & LO GIUDICE R., 1986 - Sulla briovegetazione dei tufi calcarei dell'Ennese (Sicilia). Cryptogamie Briol. Lichénol. 7(2): 129-139.

PRIVITERA M. & PUGLISI M., 1994 - *Octodiceras fontanum* (Musei): a new record from Sicily. Flora Medit. 4: 171-174.

PRIVITERA M. & PUGLISI M., 1995 - Osservazioni fitosociologiche sulla briovegetazione igro-idrofila dell'Aspromonte (Calabria). Inform. Bot. Ital. 27(1): 144-152.

PRIVITERA M. & PUGLISI M., 1996 - La vegetazione briofitica dell'Etna (Sicilia, Italia). Braun Blanquetia 19, 59 pp.

PRIVITERA M. & PUGLISI M., 1997 - *Riella notarisii* (Mont.) Mont. (Hepaticae, Riellaceae), rediscovered in Italy. Fl. Medit. 7: 149-152.

PRIVITERA M., PUGLISI M., 2004 - La vegetazione briofitica della Sicilia. Braun-Blanquetia 34: 129-141.

PUGLISI M., 1991 - Considerazioni fitogeografiche e sistematiche su *Homalia lusitanica* Schimp. in Sicilia. Giorn. Bot. Ital. 125(3): 377.

PUGLISI M., 1994 - *Homalio lusitanicae-Adiantetum*, nuova associazione della classe *Adiantetea* Br. Bl 1947. Boll. Accad. Gioenia Sci. Nat. 27: 93-98..

PUGLISI M., 1997 - Bryophyte vegetation on the archaeological sites of Syracuse (SE Sicily). Arch. Geobot. 3 (2): 201-211.

PUGLISI M. & PRIVITERA M., 2012 - A Synopsis of the Italian Bryophyte vegetation. Cryptogamie, Bryologie 33(4), 357-382.

PUNTILLO D. & PUNTILLO M., 2014 - On the presence of Riella notarisii (Riellaceae) in the peninsular Italy. Fl. Medit. 24: 93-97.

QUÉZEL P., BARBERO M., BENABID A., LOISEL R. & RIVAS-MARTÍNEZ S.,1988- Contribution à l'étude des groupements préforestiers et des matorrals rifains. Ecol. Medit. 14(1-2): 77-122.

RAIMONDO F.M. 1979 - *Rhamnus lojaconoi*, nuova specie endemica della Sicilia. Giornale Botanico Italiano 113(5–6): 369–377.

RAIMONDO F.M., 1980° - Carta della vegetazione di Piano della Battaglia e del territorio circostante (Madonie, Sicilia). Quaderni C.N.R. AQ/1/336: 1-43.

RAIMONDO F.M., 1984 - La vegetazione rupestre delle Serre di Quacella (Madonie, Sicilia). Atti Soc. Tosc. Sci. Nat. Pisa Mem., s.B, 90: 31-41.

RAIMONDO F.M., 1996 - *Potamogeton gramineus* and *P. angustifolius*, new to the Sicilian flora. Flora Mediterranea 6: 81-84.

RAIMONDO F.M., 2015 - Analisi fitosociologica della vegetazione ripicola nel tratto montano del Fiume Flascio (Parco dei Nebrodi, Sicilia). Paper presented at Congresso Ancona 24-26 September 2015, Ancona, Riassunti: 38.

RAIMONDO F.M., & BAZAN G. 2008 - Una nuova associazione a palma nana della Sicilia sud-occidentale. Atti 44° Congresso Società Italiana di Scienze della Vegetazione. Ravenna 27-29 Febbraio: 66.

RAIMONDO F. M, BAZAN G., GIANGUZZI L, ILARDI V., SCHICCHI R. & SURANO N., 2000 – Carta del paesaggio e della biodiversità vegetale della provincia di Palermo. Quaderni di Botanica Ambientale e Applicata 9(1998): 3-160.

RAIMONDO F. M., BAZAN G. & TROIA A., 2011 - Taxa a rischio nella flora vascolare della Sicilia. Biogeographia 30: 229-239.

RAIMONDO F.M., & DIA M. G., 1980 - Aspetti dell'*Adiantion* Br.-Bl. 1931 (*Adiantetea* Br.-Bl. 1947) in Sicilia. Giorn. Bot. Ital. 114: 136-137.

RAIMONDO F.M., DIA M.G. & ROSSITTO M., 1981 - L'*Eucladio-Adiantetum* Br.-Bl. 1931 in Sicilia. Atti Acc. Sci. Lett. Arti Palermo 40: 1-12.

RAIMONDO F. M., DOMINA G. & SPADARO V., 2010 - Checklist of the vascular flora of Sicily. Quaderni Botanica Ambientale e Applicata 21: 189-252.

RAIMONDO F.M., & ILARDI V. 2009 - Indagini fitosociologiche sulla vegetazione a *Bupleurum fruticosum* (Umbelliferae) del versante tirrenico della Sicilia orientale. Il Naturalista Siciliano, 33(3-4), 361-372.

RAIMONDO F.M., GIANGUZZI L., VENTURELLA G. & LO VALVO M., 1990 - Indagine preliminare sul patrimonio biologico e ambientale delle coste siciliane. Quaderni di Botanica Ambientale e Applicata, 1: 131-182.

RAIMONDO F.M., MARINO P., SCHICCHI R., 2010 - Osservazioni fitosociologiche su aspetti di vegetazione a *Prunus mahaleb* subsp. *cupaniana* (Rosaceae) dei Monti Madonie (Sicilia). Quaderni di Botanica Ambientale e Applicata, 21: 275-281.

RAIMONDO F.M., MARINO P., SCHICCHI R., 2011 - Hydrophytic vegetation aspects in the Nebrodi Mountains (Sicily). Fitosociologia 48 (2): 123-128.

RAIMONDO F. M., MARINO P. & SCHICCHI R., 2011 - Hydrophytic vegetation aspects in the Nebrodi Mountains (Sicily). Fitosociologia 48(2): 123-128.

RAIMONDO F.M., SCHICCHI R., BAZAN G., 2009 - Studio fitosociologico dei cerreti con agrifoglio della Sicilia. Naturalista siciliano, 33(3-4), 373-388.

RAIMONDO F.M., SCHICCHI R. & SURANO N., 2004 -Carta del paesaggio e della biodiversità vegetale del parco delle Madonie. Naturalista Sicil., Ser. IV, XXVII (1).71-137.

RAIMONDO F.M., SCIALABBA A. & DIA M.G., 1980 - Note briogeografiche. III. Distribuzione in Italia di *Aulaconmnium palustre* (Hedw.) Schwaegr. ed ecologia della specie nelle stazioni siciliane (Bryales, Aulacomniaceae). Nat. Sic. S. IV, 4(3-4): 79-99.

RAIMONDO F.M., VENTURELLA G. & GIANGUZZI L., 1990 - Lineamenti floristici e vegetazionali del bacino del fiume Oreto (Palermo) con annessa carta del paesaggio vegetale (1:50.000) – Quad. Bot. Amb. Appl. 1: 77-91.

RAMÍREZ E., RUFO L., SÁNCHEZ-MATA D. & DE LA FUENTE V., 2019 - *Arthrocaulon meridionalis* (Chenopodiaceae), a new species of Mediterranean flora. Medit. Bot. 40(1): 33-41.

RANĐELOVIĆ V. & BLAŽENČIĆ J., 1996 - Hidrofilna flora i vegetacija Vlasinskog jezera. In: BLAŽENČIĆ J. (ed.), Vlašinsko jezero – hidrobiologiška studija, Biologiški fakultet Univerziteta u Beogradu, Beograd, pp. 207–230.

RAŢIU O., GERGELY I., BOŞCAIU N., CODOREANU V., BECHET M., SILAGHI G., RAŢIU F., RURCU L., LÖRINCZI F., PÉTERFI L. C., MICLE F., PLEŞA C. & NICOLAU M.,1966 - Flora şi vegetaţia rezervaţiei naturale "Defileul Cruşului Repede". Contribuţii Botanice 1: 7-271.

RAUS T., 1979 - Die Vegetation Ostthessaliens (Griechenland) II. *Quercetea ilicis* and *Cisto-Micromerietea*. Bot. Jahrb. 101: 17-82.

RENNWALD E. (ed.), 2000 - Verzeichnis und Rote Liste der Pflanzengesellschaften Deutschlands mit Synonymen und Formationseinteilung. Schriftenreihe Vegetationsk. 35: 91–112.

RIBERA G., COLOREU M., RODRIGUEZ PRIETO C. & BALLESTEROS E., 1997 - Phytobenthic assemblages of Addaia Bay (Menorca, Western Mediterranean): composition and distribution. Botanica Marina 40: 523-532.

RIBEIRO S., GONÇALVES P. & ESPÍRITO-SANTO M.D., 2012 - Land-use influence on Mediterranean perennial swards of *Poa bulbosa*: a case study in the International Tagus Region. Lazaroa 33: 51-64

RIIS T. & SAND-JENSEN K., 2001 - Historical changes in species composition and richness accompanying perturbation and eutrophication of Danish lowland streams over 100 years. Freshwater Biology 46:269–280.

RIOUX J.A., ROUX J. & PIGNATTI S., 1955 - Les associations littorales des Albères (étude critique). Vie et Milieu 6(1): 1-37.

RIVAS-GODAY S., 1956 - Comportamiento fitosociologico del *Eryngium corniculatum* Lam. Y de otras especies de *Phragmitetea* e *Isoeto-Nanojuncetea*. Anal. Inst. Bot. Cavanilles 14: 1-528.

RIVAS-GODAY S., 1957 - Nuevos órdenes y alianzas de *Helianthemetea annua* Br.-Bl. Anal. Inst. Bot. A. J. Cavanilles de Madrid 16: 539–651.

RIVAS GODAY S., 1964 - Vegetación y flòrula de la cuenca extrermena del Guadiana. Publ. Excma. Diputación Badajoz, Madrid, 777 pp.

RIVAS GODAY S., 1970 - Revisión de las comunidades hispanas de la clase Isoëto-Nanojuncetea Br.-Bl. et Tx. 1943. Anales Inst. Bot. Cavanilles 27: 225–276.

RIVAS-GODAY S., BORJA J., MONASTERIO A., GALIANO E.F. & RIVAS-MARTINEZ S., 1956 – Aportaciones a la fitosociologia hispanica (Nota I). Anales Inst. Bot. Cavanilles 13: 335-422.

RIVAS-GODAY S. & RIVAS-MARTINEZ S., 1959 - Acerca de la "Ammophiletea" del Este y Sur de España. Anal. Jard. Bot. Madrid 16: 549-564.

RIVAS-GODAY S. & RIVAS-MARTINEZ S., 1963 - Estudio y classification de los pastizales espanoles. Pub. Ministerio de Agricultura Madrid 277, 269 pp.

RIVAS-MARTINEZ S., 1960 - Roca, clima y comunidades rupicolas. Sinopsis de las alliancias hispanas de *Asplenietea rupestris*. Anales Real Acad. Farm. 26(2): 153-168.

RIVAS MARTINEZ S., 1965 - Esquema de la vegetaciòn potencial y su correspondencia con los suelos de la Espaňa peninsular. Anal Inst. Bot. Cavanilles: 341-405.

RIVAS MARTINEZ S., 1966 - Situación ecológica y fitosociológica del *Lythrurn flexuosum*. Lag. Bol. Real Soc. Hist. Nat., 64: 363-368.

RIVAS MARTINEZ S., 1969 – Vegetatio Hispaniae. Notula I. Publ. Inst. Biol. Aplicada 46: 5-34.

RIVAS MARTINEZ S., 1972 - Vegetatio Hispaniae. Notula III. Bol. R. Soc. Esp. Ist. Nat. (Biol.) 70: 153-162.

RIVAS MARTINEZ S., 1974 - Vegetatio Hispaniae. Notula IV. Anal. Ist. Bot. A. J. Cavanilles 31: 199-207.

RIVAS-MARTINEZ S. 1975 - La vegetación de la clase *Quercetea ilicis* en España y Portugal. Anal. Inst. Bot. Cavanilles 31(2): 205-259.

RIVAS MARTINEZ S., 1975b - Sobre la nueva clase *Polygono-Poetea annuae*. Phytocoenologia 2 (1-2): 123-140.

RIVAS MARTINEZ S., 1975c - Mapa de vegetacion de la provincia de Avila. Anal. Inst. Bot. Cavanilles 32 (2): 1493-1556.

RIVAS MARTINEZ S., 1976 - Sinfitosociologia, una nueva metodologia para elestudio del paisaje vegetal. Anales Inst. Bot. Cavallines, 33: 179-188.

RIVAS MARTINEZ S., 1978a - La vegetacion del *Hordeion leporini* en Espana. Doc. Phytosoc., n.s., 2: 377-392.

RIVAS MARTINEZ S., 1978b - Sur la syntaxonomie des pelouses therophytiques de l'Europe occidentale. Coll. Phytosoc. 6: 55-71.

RIVAS MARTINEZ S., 1978c - Vegetatio hispaniae. Notula V. Anales Inst. Bot. Cavallines 34(2): 553-570.

RIVAS MARTINEZ S., 1979 - Brezales y jarales de Europa occidental (Revisión Fitosociológica de las clases *Calluno-Ulicetea* y *Cisto-Lavanduletea*). Lazaroa 1: 5-128.

RIVAS MARTINEZ S., 1983 - Pisos bioclimáticos de España. Lazaroa 5: 33-43.

RIVAS MARTINEZ S., 1984 - Vegetatio Hispaniae. Notula VI. Stud. Bot. 3: 7-16.

RIVAS MARTINEZ S., 1985 - Biogeografia y vegetaciòn. Real Acad. Ciencias Exactas, Fisicas y Naturales, Madrid, 103 pp.

RIVAS MARTINEZ S., 1990 - Sintaxonomia de la clase *Thero-Salicornietea* en Europa occidental. Ecol. Medit. 16: 359-364.

RIVAS MARTINEZ S., 2003 - *Parietarietea* Rivas-Martínez ex Rivas Goday 1964 es un nombre válido. Fitosociologia 40(1): 33-34.

RIVAS MARTINEZ S., 2005 - Notions of dynamic-catenal phytosociology as a basis of landscape science. Plant Biosystems 139(2): 135-144.

RIVAS MARTINEZ S., ASENSI A., COSTA M., FERNÁNDEZ-GONZÁLEZ F., LLORENS L., MASALLES R., MOLERO MESA J., PENAS A. & PEREZ DE PAZ P.L., 1994 - El proyecto de cartografia e inventariacion de los tipos de habitats de la Directiva 92/43/CEE en España. Coll. Phytosoc. 22: 611- 661.

RIVAS-MARTÍNEZ S., ASENSI A., DÍAZ-GARRETAS B., MOLERO J., VALLE F., CANO E., COSTA M. & DÍAZ T.E., 2011 - Mapa de series, geoseries y geopermaseries de vegetación de España (Memoria del mapa de vegatación potencial de España). Parte II. Itinera Geobotanica 18(1-2): 1-424.

RIVAS MARTINEZ S., BĀSCONES J.C.., DIÁZ GONZÁLEZ T.E., FERNÁNDEZ-GONZÁLEZ F., LOIDI J., 1991 - Vegetacìon del Pireneo occidental y Navarra 5: 5-546.

RIVAS-MARTÍNEZ, S., BIONDI E., COSTA M. & MOSSA L., 2003 - Datos sobra la vegetacion de la clase *Quercetea ilicis* en Cerdeña. Fitosociologia 40(1): 35-38.

RIVAS-MARTÍNEZ S. & COSTA M., 1976 - Datos sobre la vegetación halófila de la Mancha (España). Coll. Phytosoc. 4:81-97.

RIVAS MARTINEZ S., COSTA M., CASTROVIEJO S. & VALDES E., 1980 - Vegetacion de Doñana (Huelva, España). Lazaroa 2: 5-189.

RIVAS MARTINEZ S., COSTA M. & LOIDI J., 1992 - La vegetación de las islas de Ibiza y Formentera (Islas Baleares, España). Itinera Geobotánica 6: 99-236.

RIVAS-MARTÍNEZ S., DÍAZ T.E., FERNÁNDEZ-GONZÁLEZ F., IZCO J., LOIDI J., LOUSÃ M. & PENAS A., 2002 - Vascular plant communities of Spain and Portugal. Addenda to the Syntaxonomical checklist of 2001. Itinera Geobotanica 15(1-2): 5-922.

RIVAS-MARTÍNEZ S., FERNÁNDEZ GONZÁLEZ F. & LOIDI J., 1999 - Checklist of plant communities of Iberian Peninsula, Balearic and Canary Islands to suballiance level. Itin. Geobot. 13:353–451.

RIVAS MARTINEZ S., FERNÁNDEZ-GONZÁLEZ F., LOIDI J., LOUSA M. & PENAS A., 2001 - Syntaxonomical checklist of vascular plant communities of Spain and Portugal to association level. Itinera Geobot. 14: 5-341.

RIVAS-MARTÍNEZ S., LOUSÃ M. , DÍAZ T.E., FERNÁNDEZ GONZÁLEZ F. & COSTA M., 1990 - La vegetación del sur de Portugal (Sado, Alentejo y Algarve). Itinera Geobot., 3: 5-126.

RIVAS-MARTINEZ S., WILDPRET M.W., DEL ARCO O.M., PEREZ DE PAZ RODRIGUEZ P. L., GARCIA GALLO A., ACEBES J.R., DIAZ T.E. & FERNANDEZ GONZALES F., 1993 - Las

comunidades vegetales de la Isla de Tenerife (Islas Canarias). Itinera Geobot. 7: 169-374.

RIVAS-MARTÍNEZ, S. & coauthores, 2011 - Mapa de series, geoseries y geopermaseries de vegetación de España (Memoria del mapa de vegetación potencial de España).

RODWELL J. S. (ed.), 1992 - British plant communities. Vol. 3. Grasslands and montane communities. Cambridge University Press, Cambridge.

RODWELL J. S. (ed.), 1995 - British plant communities. Vol. 4. Aquatic communities, swamps and tall-herb fens. Cambridge University Press, Cambridge.

RODWELL J. S. (ed.), 2000 - British plant communities. Vol. 5. Maritime communities and vegetation of open habitats. Cambridge University Press, Cambridge.

ROMANO S., OTTONELLO D. & MARCENÒ C., 1994 - Contributo alla floristica siciliana: nuovi rinvenimenti ed ulteriori dati distributive di alcune entità indigene ed esotiche. Nat. Sic. Ser. 4, 18: 3-14.

ROMANO S., 2004- Nuovi reperti per la flora esotica della Sicilia. Quad. Bot. Amb. Appl. 15: 149-152.

ROMERO BUJÁN M. I. & VÁZQUEZ J. A., 1996. Datos sobre una comunidad de *Potametea* Tüxen & Preising 1942, deI NO ibérico: *Potametum perfoliato-crispi* BeIIot 1951. Lazaroa 16: 185-189.

RONSISVALLE G.A., 1971- Lembi di vegetazione naturale nei dintorni di Gela (Sicilia meridionale). Boll. Acc. Gioenia Sc. Nat. Catania, 11: 119-125.

RONSISVALLE G.A., 1972- Conservazione del paesaggio nelle spiagge della Sicilia meridionale. Giorn. Bot. Ital. 106: 298.

RONSISVALLE G.A., 1973 - Flora e vegetazione dell'Isola di Ustica. Lav. Soc. Ital. Biogeogr. n.s., 3: 1-63.

RONSISVALLE G.A. & SIGNORELLO P. 1977 - Interesse naturalistico e fitosociologico della faggeta del Bosco di Malabotta (Montalbano Elicona – Monti Peloritani). Bollettino Accademia Gioenia di Scienze Naturali 13(1-2): 62-71.

ROYER J. M., 1991 - Synthèse eurosibérienne, phytosociologique et phytogéographique de la classe des *Festuco-Brometea* [Eurosiberian, Phytosociological and Phytogeographic Synthesis of the Class *Festuco-Brometea*]. Dissertationes Botanicae 178: 1–296.

RUCI B., HODA P., VANGJELI J., DRAGOTI N., XHULAJ M., BUZO K., MERSINLLARI M., 2001 - Biodiversity of the Albanian national parks and its problems. In : RICCIARDI L., MYRTA A., DE CASTRO F. (eds.). Italo-Albanian cooperation for the enhancement of plant biodiversity. Options Méditerranéennes: Série A. Séminaires Méditerranéens 47: 27-41.

RUFO L., DE LA FUENTE V. & SÁNCHEZ-MATA D. 2016 - *Sarcocornia* plant communities of the Iberian Peninsula and Balearic Islands. Phytocoenologia 46(4): 383–396. doi: 10.1127/phyto/2016/0113.

SADORI L. & NARCISI B., 2001 - The Postglacial record of environmental history from Lago di Pergusa, Sicily. The Holocene 11(6): 655-671.

SAENZ, C. & RIVAS MARTINEZ S., 1979 - Revision del genero *Cheilanthes* (Sinopteridaceae) en Espaňa. Lagascalia 8(2): 214-215.

SANCHEZ P. M. & GIL J.A., 1982 - Vegetacion criptogamica de las tobas de la provincia de Granada (Espana). Collect. Bot. 13(1): 231-245.

SANDA V., POPESCU A. & ARCUŞ M., 1999 - Revizia critică a comunităţilor de plante din România. Tilia Press International, Constanţa, 141 pp.

SAND-JENSEN K., RIIS T., VESTERGAARD O. & LARSEN S., 2000 - Macrophyte decline in Danish lakes and streams over the past 100 years. Journal of Ecology 88: 1030–1040.

SANTAGATI M. & ASERO V., 2018 - Storia geologica di Sicilia. Alma Editore, Catania, 96 pp.

SANTAMARIA L., 1995 - The ecology of Ruppia drepanensis Tineo in a Mediterranean brackish marsh (Donana National Park, SW Spain): a basis for the management of semiarid floodplain wetlands. A.A. Balkema/Rotterdam/Brookfield, 240 pp.

SARIKA M., 2012 - Flora and vegetation of some coastal ecosystems of Sterea Ellas and eastern continental Greece. Lazaroa 33: 65-99.

SBURLINO G., BRACCO F., BUFFA G., GHIRELLI L., 1996 - Rapporti dinamici e spaziali nella vegetazione legata alle torbiere basse neutro-alcaline delle risorgive della Pianura Padana orientale (Italia settentrionale). Coll. Phytosoc., XXIV: 285-294.

SBURLINO G., SCOPPOLA A. & MARCHIORI S., 1985 - Contributo alla conoscenza degli ambienti umidi della pianura padana orientale: la classe *Lemnetea minoris* R.Tx. 1955 em. Schw. &R. Tx. 1981. Not. Fitosoc. 21: 61-70.

SBURLINO G., TOMASELLA M., ORIOLO G. & POLDINI L., 2004 - La vegetazione acquatica e palustre dell'Italia nord-orientale. 1- La classe *Lemnetea* R.Tx. ex O.Bolòs & Masclans 1955. Fitosociologia 41(1): 27-42.

SBURLINO G., TOMASELLA M., ORIOLO G., POLDINI L. & BRACCO F., 2008 - La vegetazione acquatica e palustre dell'Italia nord-orientale 2 - La classe Potametea Klika in Klika et V. Novák 1941. Fitosociologia 45 (2): 3-40.

SCAMONI, A. & PASSARGE, H. 1959 - Gedanken zu einer natürli-cheren Ordnung der Waldgesellschaften. Archiv für Forst-wesen 8: 386–426.

SCHELLART W. P., 2010 - Evolution of Subduction Zone Curvature and its Dependence on the Trench Velocity and the Slab to Upper Mantle Viscosity Ratio. Journal of Geophysical Researches 115(B11): 1-18.

SCHRATT L., 1993- *Lemnetea*. In Grabherr G. & Mucina L. (Eds.). Die Pflanzengesellschaften Österreichs 2, Natürliche waldfreie Vegetation, G. Fischer, Jena, pp: : 31-44.

SCHRATT L., 1993 - *Potametea*. In Grabherr G. & Mucina L. (Eds.). Die Pflanzengesellschaften Österreichs 2, Natürliche waldfreie Vegetation: 31-44. G. Fischer, Jena.

SCHUBERT R., HERDAM H., WEINITSCHKE H. & FRANK J., 2001 - Prodromus der Pflanzengesellschaften Sachsen-Anhalts. Mitt. Florist. Kart. Sachsen-Anhalt, Sonderheft 2 (2001): 1–688.

SCHULZ A. W., 1938 - Ein Beitrag zur Geschichte der oberhessischen Salzflora. Ber. Oberhess. Ges. Natur. - u. Heilk. Giessen 18: 212-221.

SCHWABE-BRAUN A. & TÜXEN R., 1981 - Zur Synsystematik der Klasse *Lemnetea minoris* in Europa. In Dierschke H. (Ed.). Ber. Int. Symp. Int. Verein. Veg.. Syntaxonomie: 181-205.

SCHWICKERATH M., 1944 - Das Hohe Venn und seine Randgebiete. Pflanzensoziologie 6: 1-278.

SCIANDRELLO S., 2004 - La vegetazione dei pantani salmastri costieri della Sicilia. Tesi di dottorato. Dipartimento di Botanica, Università di Catania.

SCIANDRELLO S., 2007 - La vegetazione alofila di Piana del Signore (Gela - Sicilia meridionale): proposte di conservazione e gestione del biotopo. Infor. Bot. Ital., 39 (1): 129-141.

SCIANDRELLO S., 2009 - La vegetazione igrofila dei bacini artificiali della Provincia di Caltanissetta (Sicilia centro-meridionale). Informatore Botanico Italiano 41(1): 53–62.

SCIANDRELLO S., D'AGOSTINO S. & MINISSALE P., 2013 - Vegetation analysis of the Taormina Region in Sicily: a plant landscape characterized by geomorphology variability and both ancient and recent anthropogenic influences. Lazaroa 34: 151-190.

SCIANDRELLO S., GUGLIELMO A. & SPAMPINATO G., 2014 - Spatial patterns and floristic composition of plant communities in coastal salt marshes of southeastern Sicily (Italy). Acta botanica Gallica: bulletin de la Société botanique de France 161(2): 99–109 .

SCIANDRELLO S., MINISSALE P. & STURIALE G., 2017 - Plant communities supported by the geological setting: the case history of the Isole dei Ciclopi (east Sicily). Lazaroa 38(1): 27-51.

SCIANDRELLO S., SILLETTI G. & TOMASELLI V. 2015 - First record of *Scorzoneroides muelleri* (Asteraceae) in Apulia:Phytosociological analysis and conservation status in Italy.Biologia 70: 565-573.

SCIANDRELLO S. & TOMASELLI V., 2014 - Coastal salt-marshes plant communities of the Salicornietea fruticosae class in Apulia (Italy). Biologia 69(1): 53—69.

SCIANDRELLO S., TOMASELLI V. & MINISSALE P., 2015 - The role of natural vegetation in the analysis of the spatio-temporal changes of coastal dune system: a case study in Sicily. Journal of Coastal Conservation 19 (2): 199–212.

SCOPPOLA A., 1982 - Considérations nouvelles sur les Végétations des Lemnetea minoris (R.Tx. 1955) Em. A. Schwabe et R.Tx. 1981 et contribution à l'etude de cette classe en Italie centrale. Doc. Phytosoc., n.s., 6: 1-130.

SCUDERI L., 2007 - Flora e Vegetazione della provincia di Trapani. Tesi di Dottorato in Scienze Ambientali I-Fitogeografia dei territori Mediterranei, XIX Ciclo, Università degli Studi di Catania.

SCUDERI, G., ILARDI, V., & RAIMONDO, F.M., 1994 - La sughera nella vegetazione arborea del Trapanese. Quaderni di Botanica Ambientale Applicata, 3: 223–233.

SEABLOOM E.W. & WIEDEMANN A.M., 1994 - Distribution and effects of *Ammophila breviligulata* Fern. (American beachgrass) on the foredunes of the Washington coast. Journal of Coastal Research 10: 178–188.

SEGAL S., 1969 - Ecological notes on wall vegetation. Junk the Hague, 325 pp.

SELISKAR A., 1983 - Prispevec k poznavanju vegetagije razredov Lemnetea in Potamogetonetea v sloveniji. Biloski vestnik 31 (1): 25-34.

SFRISO A., 2011 - Chlorophyta multicellulari e fanerogame acquatiche. Ambiente di transizione italiani e litorali adiacenti. Arpa Emilia-Romagna, Bologna, 318 pp.

SGHAIER Y.R., ZAKHAMA-SRAIEB R. & CHARFI F., 2014 - Effects of the invasive seagrass *Halophila stipulacea* on the native seagrass *Cymodocea nodosa*. 5° Mediterranean Symposium on Marine Vegetation (Portorož, Slovenia, 27-28 october 2014).

ŠILC U., 2006 - Slovenian Phytosociology in a Database: state of the art, basic statistics and perspectives. Hladnikia 19: 27-34.

SILLETTI G.N., 2012 - *Halopeplis amplexicaulis* nei pressi di Taranto (Puglia). Informatore Botanico Italiano 44: 75-79.

SILVA V., PINTO-CRUZ C. & ESPIRITO-SANTO M.D., 2009 - Temporary ponds and hygrophilous grasslands plant communities in the Monfurado Site of Community Importance. Lazaroa 30: 81-88

SIRACUSA G., 1996 - La vegetazione dell'Etna. Tesi di Dottorato, Catania, 223 pp.

SIRACUSA G., 1998 - *Phleo ambigui-Secalietum stricti*, nuova associazione dei *Cerastio-Carlinetea nebrodensis* della Sicilia. Boll. Acc. Gioenia , 30 (353): 321-325.

SISSINGH, G., 1974 - Comparaison du Roso-Ephedretum de Bretagne avec des unités de végétation analogues (Contribution à la systématique des associations de dunes grises atlantiques et méditerranéennes). Doc. Phytosoc. 7-8 : 95-106.

ŠKVORC1 Z., JASPRICA N., ALEGRO A., KOVAČIĆ S., FRANJIĆ J., KRSTONOŠIĆ D., VRANEŠA A., ČARNI A., 2017 - Vegetation of Croatia: Phytosociological classification of the high-rank syntaxa. Acta Bot. Croat. 76(2): 200-224.

SNOGERUP S., 1971 - Evolutionary and plant geographical aspects of chasmophytic plant communities. In: Davis, P . H . (ed.). Plant life of South-West Asia. Edinburgh, 157-170.

SRAMKÓ G., MOLNÁR V.A., TÓTH J.P., LACZKÓ L., KALINKA A., HORVÁTH O., SKUZA L., LUKÁCS B.A. & POPIELA A., 2016 - Molecular phylogenetics, seed morphometrics, chromosome number evolution and systematics of European *Elatine* L. (Elatinaceae) species. PeerJ 4, e2800. http://dx.doi.org/10.7717/peerj.2800.

SOÓ R., 1968 - A magyar flòra ès vegetàcio Rendszertani-növényföldrajzi. Kézikönyve. III Budapest.

SORTINO M., 1967 - Flora e vegetazione terrestre e marina del litorale di Palma di Montechiaro (AG). Lavori dell'Istit. Bot. e del Giard. Col. di Palermo XXIII: 3-100.

SORTINO M. & DI MARTINO A., 1974 - La flora del litorale di Licata (AG). Lav. Ist. Bot. Giardino Colon. Palermo 25: 59-70.

SORTINO M. & GIACCONE G., 1968 - Flora e vegetazione della fascia costiera del golfo di Castellammare (TP). Lavori dell'Istit. Bot. e del Giard. Col. di Palermo 24: 1-49.

SORTINO M., MARCENO' C., MAGGIO F. & GIANGUZZA A., 1974 - Tipologia e distribuzione della vegetazione riparia e lotica di due corsi d'acqua del versante nord del fiume Platani. Bollettino di Studi ed Informazioni del Giardino Coloniale di Palermo XXVI: 90-102.

SORTINO M., RAIMONDO F. M., MARCENÒ C., DIA G. & GENCHI C., 1977 - Phytoecologie de certains milieux humides des Monts Madonie (Sicilie, Centre-Septentrionelle). Rev. Biol. Ecol. Méd. 4: 19-34.

SPAMPINATO G., CAMERIERE P., CARIDI D. & CRISAFULLI A., 2008 - Carta della biodiversità vegetale del Parco Nazionale dell'Aspromonte (Italia meridionale). Quad. Bot. Amb. Appl. 19: 3-36.

SUC J.P., 1984 - Origin and evolution of the Mediterranean vegetation and climate in Europe. Nature 307: 429-432.

SUC J. P., POPESCU S.-M., FAUQUETTE S., BESSEDIK M., JIMÉNEZ-MORENO G. et al., 2018 - Reconstruction of Mediterranean flora, vegetation and climate for the last 23 millionyears based on an extensive pollen dataset. Ecologia mediterranea, Faculté des sciences et techniquesde St Jérôme, Institut méditerranéen d'écologie et de paléoécologie 44 (2): 53-85.

SUEHS C.M., AFFRE L. & MÉDAIL F., 2004 - Invasion dynamics of two alien *Carpobrotus* (Aizoaceae) taxa on a Mediterranean island: I. Genetic diversity and introgression. Heredity 92: 31–40.

ŠUMBEROVÁ K., 2011 - Vegetation of free floating aquatic plants (*Lemnetea*), pp: 43-99. In: Vegetation of the Czech Republic 3. Aquatic and Wetland Vegetation, Chytrý (eds), Academia Praha, 828 pp.

SUNDING, P., 1972 - The vegetation of Gran Canaria. Vid.-Akad. Skr. I. Mat.-Nat. Kl., n.s., 29, 186 pp.

SZALMA E. & BODROGKÖZY G., 1985 - Phyocenology of Wolffietum arrhizae Miyaw. et J. Tx 60. Element content of its species components as well as sediment- and water samples. Tiscia (Szeged), vol. XX: 45-53.

TAKAMURA N., KADONO Y., FUKUSHIMA M., NAKAGAWA M. & BAIK-H. O. K., 2003 - Effects of aquatic macrophytes on water quality and phytoplankton communities in shallow lakes. Ecol. Res. 18: 381–395.

TAKÁCS A., MOLNÁR V.A., HORVÁTH O., SRAMKÓ G. POPIELA A., MESTERHÁZY A., LOVAS-KISS A., GREEN A.J., LÖKI V., NAGY T. & LUKÁCS B.A., 2017 - The rare aquatic

angiosperm *Elatine gussonei* (Elatinaceae) is more widely distributed than previously thought. Aquatic Botany 141: 47-50.

TARAN G. S. & TJURIN V. N., 2006 - Očerk rastitel'nosti pojmy Obi i goroda Surguta. Biol. Resursy Prirodopol'zovanie 9: 3–55.

TÄUBER T., 2000 - Zwergbinsen-Gesellschaften (Isoëto-Nanojuncetea) in Niedersachsen. Verbreitung, Gliederung, Dynamik, Keimungsbedingungen der Arten und Schutzkonzepte. Cuvillier Verlag, Göttingen.

THOMPSON J.D., 2005 - Plant Evolution in the Mediterranean. OUP Oxford, 304 pp.

TOMASELLI M., BOLPAGNI R., GUALMINI M, PETRAGLIA A. & LONGHI D., 2006 - Studio fitosociologico, cartografia della vegetazione ed analisi dello stato trofico delle acque delle "Paludi del Busatello" (Italia settentrionale). Boll. Mus. Civico Storia Nat. Verona 30: 3–37.

TOMASELLI M., SPITALE D. & PETRAGLIA A., 2011 - Phytosociological and ecological study of springs in Trentino (south-eastern Alps, Italy). In: M. Cantonati, R. Gerecke, I. Jüttner and E.J. Cox (Guest Editors). Springs: neglected key habitats for biodiversity conservation. J. Limnol., 70(Suppl. 1): 23-53.

TOMASELLI V., 1999 **-** Studio fitosociologico del territorio di Militello in Val di Catania (Sicilia orientale). Doc. Phytosoc. 19: 467-493.

TOMASELLI V., 2004 - Contributo alla conoscenza della vegetazione ripale della Sicilia sud-orientale. Arch. Geobot 7(2): 11-24.

TOMASELLI V., DI PIETRO R. & SCIANDRELLO S., 2011 - Plant communities structure and composition in three coastal wetlands in southern Apulia (Italy). Biologia 66/6: 1027-1043.

TOMASELLI V. & PERRINO E.V. & CIMMARUSTI G., 2008 - Paludi Sfinale e Gusmay, due aree umide di rilevante interesse naturalistico nel Parco Nazionale del Gargano. Informatore Botanico Italiano, 40(2): 183-192

TOMASELLI V. & SCIANDRELLO S., 2017 - Contribution to the knowledge of the coastal vegetation of the SIC IT9110005 "Zone Umide della Capitanata" (Apulia, Italy). Plant Biosystems 151(4): 673-694.

TOMASELLI V., SCIANDRELLO S., DIBITONTO P., WAGENSOMMER R.P., URBANO M., CALABRESE I.T., GARZIANO G., CIMMARUSTI G. & DI PIETRO R., 2010a - Analisi del paesaggio vegetale ed agricolo della Riserva Naturale Statale di "Torre Guaceto" (Brindisi - Puglia). Cartografia della vegetazione, degli habitat e dell'uso del suolo. Quad. Bot. Amb. Appl., 21: 33-49.

TOMASELLI V., URBANO M., SCIANDRELLO S., WAGENSOMMER R., COSTANZO E., ALBANO A., MEDAGLI P., MELE C. & DI PIETRO R., 2010b - Cartografia tematica ed analisi del paesaggio vegetale ed agricolo del Parco Naturale Regionale "Saline di Punta della Contessa" (Brindisi - Puglia). Quad. Bot. Amb. Appl., 21: 53-76.

TOWSEND C.C., 1962 - A note on *Scirpus subulatus* Vahl. Kew Bull. 15(3): 415-417.

TRAINA N., MARCENÒ C.. 2001 - Condizioni attuali del popolamento floristico del fiume Oreto (Sicilia Nord-Occidentale). Naturalista Sicil., 4, 25 (1-2): 227-254.

TROIA A., 2011 - Strategia di gestione delle popolazioni di Calendula maritima Guss. (Asteraceae). Naturalista Sicil., S. 4, 35(1): 51-63.

TROIA A., ADRAGNA F., F, CAMPISI P., DIA M. G., ILARDI V., LA MANTIA T., LA ROSA A., LO VALVO M., MUSCARELLA C., PASTA S., PIERI V., SCUDERI L., SPARACIO I., STOCH F. & MARRONE F., 2016 - I pantani di Anguillara (Calatafimi Segesta, Trapani): dati preliminari sulla biodiversità a supporto della tutela del biotopo. Naturalista Siciliano S. IV, XL(2): 171-200.

TROIA A. & GREUTER W., 2015 - Isoëtaceae (vers. 1.0). In: Peruzzi L., Cecchi L., Cristofolini G., Domina G., Greuter,W., Nardi E., Raimondo F.M., Selvi F. & Troia A. (Eds.) Flora critica d'italia. Firenze: Fondazione per la Flora Italiana. Available from: http://www.oraditalia.it (accessed 14 February 2018)

TROIA A. & LANSDOWN R., 2016 - The First Confirmed Population of the Globally Endangered *Pilularia minuta* (Marsileaceae) in Sicily. Webbia 71 (2): 283–286.

TROIA A. & RAIMONDO F.M., 2009 - Isoëtes todaroana (Isoëtaceae, Lycopodiophyta), a New Species from Sicily (Italy). American Fern Journal 99(4):238-243.

TURRISI R.E., 2005 - Inquadramento fitosociologico dei popolamenti ad *Ipomoea imperati* (Convolvulaceae) della Sicilia. Quad. Bot. Ambientale Appl. 16: 87-92.

TURRISI R.E., GALLETTI I. & ILARDI V., 2001 - Contributo alla conoscenza della vegetazione di Cava Randello. Quad. Bot. Ambientale Appl., 12: 117-130.

TÜXEN R., 1950 - Grundiss einer Systematik der nitrophilen unkraut-gesellschaften in der Eurosibirischen Region Europas. Mitt. Flor.-soz. Arbeitsg., n f. 2: 94-175.

TÜXEN R., 1955 - Das System der nordwestdeutschen Pflanzengesellschaften. Mitt. Flor. soz. Arb.-Gem., n. f. 5: 155-176.

TÜXEN R., 1974 - Die Pflanzengesellschaften Nordwestdeutschlands. Lehre, J. Cramer, Vaduz, 207 pp.

TÜXEN R., 1975 - Sobre las comunidades del orden *Euphorbietalia peplis* (*Cakiletea maritimae*). Anales Inst. Bot. Cavanilles 32(2): 453-464.

TÜXEN R., 1978 - Grundlagen der synsozyiologie. Assotiationskomplexe (Sig- meten). Ed. Cramer J, Vaduz.

TÜXEN R., 1979a - Sigmeten und geosigmeten, ihre Ordnung und ihre Bedeutung für Wissenschaft, Naturschutz und Planung. Biogeographica, L'Aia, Junk, 16: 79-92

TÜXEN R., 1979b - Die Pflanzengesellschaften Nordwestdeutschands. Lieferung 2. Ed. 2. J. Cramer, Vaduz.

TÜXEN R. & OBERDORFER E., 1958 - Die Pflanzenwelt Spaniens II Teil. Eurosibirische Phanerogamen-Gesellschaften Spanien. Veroff. Geobot. Inst. Riibel Zurich, 32, Bern.

TÜXEN R. & WESTHOFF V., 1963 - *Saginetea maritimae*, eine Gesellschaftsgruppe im wechselhalinen Grenzbereich dereuropäischen Meeresküsten. Mitt. Florist.-soz. Arbeitsg.,N.F. Heft 10:116-129.

UBALDI D. 1995 - Tipificazione dei syntaxa forestali appenninici e siciliani. Ann. Bot.(Roma) St. Terr. 51 (Suppl. 10):113-127

UBALDI D., 2011 - Le vegetazioni erbacee e gli arbusteti italiani. Aracne editrice, Roma, 336 pp.

UBALDI D., ZANOTTI A.L., PUPPI G., SPERANZA M. & CORBETTA F. 1990 - Sintassonomia dei boschi caducifogli mesofili dell'Italia peninsulare. Notiziario Fitosociologico 23: 31-62.

VALACHOVIC M., OTAHELOVA H. & HRIVNAK R., 2002 - Diversity of reeds and tall-sedge wetlands in Carpathian-Pannonian region and application of vegetation units for nature conservation. Atti del Congresso Sociale Vegetazione acquatica e palustre: sintassonomia, sinecologia, sincorologia: 38.

VALSECCHI F., 1980 - Le pianta endemiche della Sardegna. Boll. Soc. Sard. Sci. Nat. 19: 323-342.

VAN CAMPO M.M., 1984 - Relations entre la végétation de l'Europe et les températures de surface océaniques après le dernier maximum glaciaire. Pollen et Spores 26: 497-518.

VANDEN BERGHEN C., 1979 - Quelques groupements végétaux nitrophile reconnus a Djerba (Tunisie méridionale). Doc. Phytosoc., n.s., 4: 923-928.

VAN DER BEN D., 1971 - Les epiphytes des feuilles de Posidonia oceanica Delile sur le còtes francaises de la Mèditerranèe. Institut Royal des Sciences Naturelles de Belgique, Rue Vautier, 31 pp.

VARSHNEY C.K., RZÓSKA J., 1973 - Aquatic Weeds in South East Asia. Dr. W. Junk V.B. Publishers, 407 pp.

VENANZONI R. & GIGANTE D., 2000 - Contributo alla conoscenza della vegetazione degli ambienti umidi dell'Umbria (Italia). Fitosociologia 37 (2): 13-63.

VENEZIANO V., 2011 - Studio ecologico-vegetazionale e cambiamenti ambientali del bacino del fiume Morello (Sicilia centrale) con restituzione cartografica dei tipi vegetazionali. Tesi di Dottorato di ricerca in Biologia ed Ecologia Vegetale in ambiente mediterraneo XXIV ciclo, Università degli studi di Catania.

VENTURELLA G., 2004 - Climatic and pedological features of Sicily. Bocconea, 17: 47-53.

VENTURELLA G., OTTONELLO D. & RAIMONDO F.M., 1986 - La vegetazione ad Aster sorrentini (Tod.) Lojac. nelle argille del Miocene superiore in Sicilia. Not. Fitosoc. 21: 1-22.

VERHOEVEN J. T. A., 1980 - The ecology of Ruppia-dominated communities in western Europe. I. Distribution of Ruppia representatives in relation to their autecology. Aquatic Botany 6: 197-267.

VILLARI R., 1988 - Segnalazioni Floristiche Italiane: 565. Halophila stipulacea (Forssk.) Aschers. Inform. Bot. Ital., 20: 672.

VLIEGER, J. 1937 - Aperçu sur les unités phytosociologiques supérieures des Pays-Bas. Nederlandsch Kruidkundig Archief 47: 335–353.

WATT S. C. L., GARCÍA-BERTHOU E. & VILAR L., 2007 - The influence of water level and salinity on plantassemblages of a seasonally flooded Mediterranean wetland. Pl. Ecol. 189: 71–85.

WATTEZ, J.R., 1975 - Étude phytosociologique des peuplements d'Apium nodiflorum (L.) Lag. et de Nasturtium officinale R.B. dans le Nord de la France. Doc. Phytosoc, 9-14: 279-290.

WEBER H.E., MORAVEC J. & THEURILLAT J.-P., 2000 - International code of phytosociological nomenclature. 3rd edition. J. Veg. Sci. 11: 739-768.

WESTHOFF V., 1987 - Salt marsh communities of three West Frisian Islands, with some notes on their long-term succession during half a century. In: Huiskes, A.H.L., Blom, C.W.P.M. & Rozema, J. (eds.) Vegetation between land and sea, pp. 16-41. Junk, Dordrecht.

WESTHOFF V. & DEN HELD A.J., 1969 - Plantengemeenschappen in Nederland. Zutphen, 324 pp.

WESTHOFF V., LEEUWEN van C. G. & ADRIANI M. J., 1962 - Enkele aspecten van vegetatie enbodem der duinenvanGoeree, in het bijzonder de contactgordels tussen zoet enzout milieu. Jaarb. Wet. Gen. Goeree: 47-92.

WIEGLEB G., 1991 - Die Lebens- und Wuchsformen der makrophytischen Wasserpflanzen und deren Beziehungen zur Ökologie, Verbreitung und Vergesellschaftung der Arten. Tuexenia 11: 135-147.

WILLNER W. 2015 - *Carpino-Fagetea* (*Querco-Fagetea* p.p.). In: Willner W., Theurillat J.-P., Pallas J. & Mucina L. (eds), On the nomenclature of some high-rank syntaxa of European forest vegetation. Phytocoenologia 45 (1–2): 175–181

WILLNER W., GRABHERR G., PALLAS J. & WEBER H.E., 2011 - Report of the Committee for Nomina Conservanda, Ambigua, Inversa and Mutata: 1. Phytocoenologia 41 (1): 59-70.

WILLNER, W., SOLOMESHCH, A., CARNI, A., BERGMEIER, E., ERMAKOV, N. & MUCINA, L. 2016 - Description and validation of some European forest syntaxa – a supplement to the EuroVegChecklist. Hacquetia 15/1: 15–25.

WILLNER, W., THEURILLAT, J.-P., PALLAS, J. & MUCINA, L. 2015 - On the nomenclature of some high-rank syntaxa of European forest vegetation. Phytocoenologia 45: 175–181.

WILMANNS O, 1998 - Okologische Pflanzensoziologie. Eine Einführung in die Vegetation Mitteleuropas, 6th edn, Quelle & Meyer, Wiesbaden.

WYNNE, M.J., 2017 - A checklist of benthic marine algae of the tropical and subtropical western Atlantic: fourth revision. Nova Hedwigia Beihefte 145: 1-202.

ZAHRAN M. A. & WILLIS A.J., 1992 - The vegetation of Egypt. Springer Science+Business media, 423 pp.

ZAMPINO S. DURO A., PICCIONE V., SCALIA C., 1997 - Fitoclima della Sicilia. Termoudogrammi secondo Walter & Lieth in Guerrini A. ed. “Atti (2). 5°Workshop Prog. Strat. C.N.R. “Clima, Ambiente e Territorio nel Mezzogiorno”. Amalfi 2: 7-54.

ZECHMEISTER H. & MUCINA L., 1994 - Vegetation of European springs: High-rank syntaxa of the *Montio-Cardaminetea*. J. Veg. Sci. 5: 385-402.

ZIMMITTI A, MANGIAFICO R. & PITRUZZELLO P., 2015 - Requalification of coastal plant landscape of South-Eastern Sicily, Italy: the case of Marina di Priolo. Biodiv. J. 6 (1): 165–170.

ZIMMITTI A., RONSISVALLE F. B. F. & RONSISVALLE G. A., 2007 - Aree d'interesse naturalistico per la rete ecologica dei M.ti Iblei (Sicilia sud-orientale): il territorio dei Monti Climiti (Siracusa). Quad. Bot. Amb. Appl., 18: 319-342.

ZOHARY M., 1950 - The vegetal plant communities of Palestine. Vegetatio 2: 387-411.