

ADOPTED: 28 March 2019

doi: 10.2903/j.efsa.2019.5672

Pest categorisation of non-EU Margarodidae

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Abstract

The Panel on Plant Health performed a pest categorisation of species in the family Margarodidae (Hemiptera: Coccoomorpha; Coccoidea). Of 107 species of Margarodidae, 97 are not known to occur in the EU. Margarodids are cosmopolitan soil-dwelling species. The nymphs suck on the roots of host plants, while the adults have no mouthparts and do not feed. Some species are serious destructive pests of grape vines, sugar cane, oil palms, cotton or turf grass. The import of soil or rooted plants for planting with soil are potential pathways for entry. Measures are available to inhibit entry. Non-European species in the genus *Margarodes* are regulated on *Vitis* plants for planting by Council Directive 2000/29/EC (Annex IIAI). Non-EU Margarodidae species were categorised into three groups. The first group includes 11 species reported as pests of crop plants that satisfy all of the criteria that are within the remit of EFSA to assess, to be regarded as Union quarantine pests. The second group includes 10 species that are not reported to cause economic damage to plants although they do feed on plants that are grown in the EU; these species do not satisfy all the criteria to be regarded as Union quarantine pests. Uncertainty exists whether species in this group could cause damage if they were introduced into the EU. The third group includes 76 species that appear restricted to climate and soil types that do not occur in the EU, feed on hosts that have limited significance in the EU, or are little studied due to their lack of impact. There is no evidence that these species satisfy the criteria to be regarded as Union quarantine pests in the EU. For completeness, the 10 species of Margarodidae that are known to occur in the EU are named in the opinion.

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Keywords: ground pearls, pest risk, plant health, soil pest, quarantine

Requestor: European Commission

Question number: EFSA-Q-2018-00791

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Suggested citation: EFSA PLH Panel (EFSA Panel on Plant Health), Bragard C, Dehnen-Schmutz K, Di Serio F, Gonthier P, Jacques M-A, Jaques Miret JA, Justesen AF, Magnusson CS, Milonas P, Navas-Cortes JA, Parnell S, Potting R, Reignault PL, Thulke H-H, Van der Werf W, Vicent Civera A, Yuen J, Zappalà L, Malumphy C, Czwienczek E and MacLeod A, 2019. Pest categorisation of non-EU Margarodidae. *EFSA Journal* 2019;17(4):5672, 42 pp. <https://doi.org/10.2903/j.efsa.2019.5672>

ISSN: 1831-4732

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1. Introduction

1.1. Background and Terms of Reference as provided by the requestor

1.1.1. Background

Council Directive 2000/29/EC¹ on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community establishes the present European Union plant health regime. The Directive lays down the phytosanitary provisions and the control checks to be carried out at the place of origin on plants and plant products destined for the Union or to be moved within the Union. In the Directive's 2000/29/EC annexes, the list of harmful organisms (pests) whose introduction into or spread within the Union is prohibited, is detailed together with specific requirements for import or internal movement.

Following the evaluation of the plant health regime, the new basic plant health law, Regulation (EU) 2016/2031² on protective measures against pests of plants, was adopted on 26 October 2016 and will apply from 14 December 2019 onwards, repealing Directive 2000/29/EC. In line with the principles of the above mentioned legislation and the follow-up work of the secondary legislation for the listing of EU regulated pests, EFSA is requested to provide pest categorisations of the harmful organisms included in the annexes of Directive 2000/29/EC, in the cases where recent pest risk assessment/ pest categorisation is not available.

1.1.2. Terms of Reference

EFSA is requested, pursuant to Article 22(5.b) and Article 29(1) of Regulation (EC) No 178/2002³, to provide scientific opinion in the field of plant health.

EFSA is requested to prepare and deliver a pest categorisation (step 1 analysis) for each of the regulated pests included in the appendices of the annex to this mandate. The methodology and template of pest categorisation have already been developed in past mandates for the organisms listed in Annex II Part A Section II of Directive 2000/29/EC. The same methodology and outcome is expected for this work as well.

The list of the harmful organisms included in the annex to this mandate comprises 133 harmful organisms or groups. A pest categorisation is expected for these 133 pests or groups and the delivery of the work would be stepwise at regular intervals through the year as detailed below. First priority covers the harmful organisms included in Appendix 1, comprising pests from Annex II Part A Section I and Annex II Part B of Directive 2000/29/EC. The delivery of all pest categorisations for the pests included in Appendix 1 is June 2018. The second priority is the pests included in Appendix 2, comprising the group of *Cicadellidae* (non-EU) known to be vector of Pierce's disease (caused by *Xylella fastidiosa*), the group of *Tephritidae* (non-EU), the group of potato viruses and virus-like organisms, the group of viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L. and the group of *Margarodes* (non-EU species). The delivery of all pest categorisations for the pests included in Appendix 2 is end 2019. The pests included in Appendix 3 cover pests of Annex I part A section I and all pests categorisations should be delivered by end 2020.

For the above mentioned groups, each covering a large number of pests, the pest categorisation will be performed for the group and not the individual harmful organisms listed under "such as" notation in the Annexes of the Directive 2000/29/EC. The criteria to be taken particularly under consideration for these cases, is the analysis of host pest combination, investigation of pathways, the damages occurring and the relevant impact.

Finally, as indicated in the text above, all references to 'non-European' should be avoided and replaced by 'non-EU' and refer to all territories with exception of the Union territories as defined in Article 1 point 3 of Regulation (EU) 2016/2031.

¹ Council Directive 2000/29/EC of 8 May 2000 on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community. OJ L 169/1, 10.7.2000, p. 1–112.

² Regulation (EU) 2016/2031 of the European Parliament of the Council of 26 October 2016 on protective measures against pests of plants. OJ L 317, 23.11.2016, p. 4–104.

³ Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. OJ L 31/1, 1.2.2002, p. 1–24.

1.1.2.1. Terms of Reference: Appendix 1

List of harmful organisms for which pest categorisation is requested. The list below follows the annexes of Directive 2000/29/EC.

Annex IIAI

(a) Insects, mites and nematodes, at all stages of their development

<i>Aleurocantus</i> spp.	<i>Numonia pyrivorella</i> (Matsumura)
<i>Anthonomus bisignifer</i> (Schenkling)	<i>Oligonychus perditus</i> Pritchard and Baker
<i>Anthonomus signatus</i> (Say)	<i>Pissodes</i> spp. (non-EU)
<i>Aschistonyx eppoi</i> Inouye	<i>Scirtothrips aurantii</i> Faure
<i>Carposina niponensis</i> Walsingham	<i>Scirtothrips citri</i> (Moultex)
<i>Enarmonia packardi</i> (Zeller)	<i>Scolytidae</i> spp. (non-EU)
<i>Enarmonia prunivora</i> Walsh	<i>Scrobipalopsis solanivora</i> Povolny
<i>Grapholita inopinata</i> Heinrich	<i>Tachypterellus quadrigibbus</i> Say
<i>Hishomonus phycitis</i>	<i>Toxoptera citricida</i> Kirk.
<i>Leucaspis japonica</i> Ckll.	<i>Unaspis citri</i> Comstock
<i>Listronotus bonariensis</i> (Kuschel)	

(b) Bacteria

Citrus variegated chlorosis	<i>Xanthomonas campestris</i> pv. <i>oryzae</i> (Ishiyama) Dye and
<i>Erwinia stewartii</i> (Smith) Dye	pv. <i>oryzicola</i> (Fang, et al.) Dye

(c) Fungi

<i>Alternaria alternata</i> (Fr.) Keissler (non-EU pathogenic isolates)	<i>Elsinoe</i> spp. Bitanc. and Jenk. Mendes
<i>Anisogramma anomala</i> (Peck) E. Müller	<i>Fusarium oxysporum</i> f. sp. <i>albedinis</i> (Kilian and Maire) Gordon
<i>Apiosporina morbosa</i> (Schwein.) v. Arx	<i>Guignardia piricola</i> (Nosa) Yamamoto
<i>Ceratocystis virescens</i> (Davidson) Moreau	<i>Puccinia pittieriana</i> Hennings
<i>Cercoseptoria pini-densiflorae</i> (Hori and Nambu) Deighton	<i>Stegophora ulmea</i> (Schweinitz: Fries) Sydow & Sydow
<i>Cercospora angolensis</i> Carv. and Mendes	<i>Venturia nashicola</i> Tanaka and Yamamoto

(d) Virus and virus-like organisms

Beet curly top virus (non-EU isolates)	Little cherry pathogen (non- EU isolates)
Black raspberry latent virus	Naturally spreading psorosis
Blight and blight-like	Palm lethal yellowing mycoplasma
Cadang-Cadang viroid	Satsuma dwarf virus
Citrus tristeza virus (non-EU isolates)	Tatter leaf virus
Leprosis	Witches' broom (MLO)

Annex IIB

(a) Insect mites and nematodes, at all stages of their development

<i>Anthonomus grandis</i> (Boh.)	<i>Ips cembrae</i> Heer
<i>Cephalcia lariciphila</i> (Klug)	<i>Ips duplicatus</i> Sahlberg
<i>Dendroctonus micans</i> Kugelán	<i>Ips sexdentatus</i> Börner
<i>Gilpinia hercyniae</i> (Hartig)	<i>Ips typographus</i> Heer
<i>Gonipterus scutellatus</i> Gyll.	<i>Sternochetus mangiferae</i> Fabricius
<i>Ips amitinus</i> Eichhof	

(b) Bacteria

<i>Curtobacterium flaccumfaciens</i> pv. <i>flaccumfaciens</i> (Hedges) Collins and Jones

(c) Fungi

Glomerella gossypii Edgerton
Gremmeniella abietina (Lag.) Morelet

Hypoxyton mammatum (Wahl.) J. Miller

1.1.2.2. Terms of Reference: Appendix 2

List of harmful organisms for which pest categorisation is requested per group. The list below follows the categorisation included in the annexes of Directive 2000/29/EC.

Annex IAI**(a) Insects, mites and nematodes, at all stages of their development**

Group of Cicadellidae (non-EU) known to be vector of Pierce's disease (caused by *Xylella fastidiosa*), such as:

- | | |
|---|---|
| 1) <i>Carneiocephala fulgida</i> Nottingham | 3) <i>Graphocephala atropunctata</i> (Signoret) |
| 2) <i>Draeculacephala minerva</i> Ball | |

Group of Tephritidae (non-EU) such as:

- | | |
|--|---|
| 1) <i>Anastrepha fraterculus</i> (Wiedemann) | 12) <i>Pardalaspis cyanescens</i> Bezzi |
| 2) <i>Anastrepha ludens</i> (Loew) | 13) <i>Pardalaspis quinaria</i> Bezzi |
| 3) <i>Anastrepha obliqua</i> Macquart | 14) <i>Pterandrus rosa</i> (Karsch) |
| 4) <i>Anastrepha suspensa</i> (Loew) | 15) <i>Rhacochlaena japonica</i> Ito |
| 5) <i>Dacus ciliatus</i> Loew | 16) <i>Rhagoletis completa</i> Cresson |
| 6) <i>Dacus curcurbitae</i> Coquillet | 17) <i>Rhagoletis fausta</i> (Osten-Sacken) |
| 7) <i>Dacus dorsalis</i> Hendel | 18) <i>Rhagoletis indifferens</i> Curran |
| 8) <i>Dacus tryoni</i> (Froggatt) | 19) <i>Rhagoletis mendax</i> Curran |
| 9) <i>Dacus tsuneonis</i> Miyake | 20) <i>Rhagoletis pomonella</i> Walsh |
| 10) <i>Dacus zonatus</i> Saund. | 21) <i>Rhagoletis suavis</i> (Loew) |
| 11) <i>Epochra canadensis</i> (Loew) | |

(c) Viruses and virus-like organisms

Group of potato viruses and virus-like organisms such as:

- | | |
|----------------------------------|--|
| 1) Andean potato latent virus | 4) Potato black ringspot virus |
| 2) Andean potato mottle virus | 5) Potato virus T |
| 3) Arracacha virus B, oca strain | 6) non-EU isolates of potato viruses A, M, S, V, X and Y (including Yo, Yn and Yc) and Potato leafroll virus |

Group of viruses and virus-like organisms of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L., such as:

- | | |
|--------------------------------------|--|
| 1) Blueberry leaf mottle virus | 8) Peach yellows mycoplasma |
| 2) Cherry rasp leaf virus (American) | 9) Plum line pattern virus (American) |
| 3) Peach mosaic virus (American) | 10) Raspberry leaf curl virus (American) |
| 4) Peach phony rickettsia | 11) Strawberry witches' broom mycoplasma |
| 5) Peach rosette mosaic virus | 12) Non-EU viruses and virus-like organisms of <i>Cydonia</i> Mill., <i>Fragaria</i> L., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L., <i>Ribes</i> L., <i>Rubus</i> L. and <i>Vitis</i> L. |
| 6) Peach rosette mycoplasma | |
| 7) Peach X-disease mycoplasma | |

Annex IIAI**(a) Insects, mites and nematodes, at all stages of their development**

Group of *Margarodes* (non-EU species) such as:

- | | |
|--|--|
| 1) <i>Margarodes vitis</i> (Phillipi) | 3) <i>Margarodes prieskaensis</i> Jakubski |
| 2) <i>Margarodes vredendalensis</i> de Klerk | |

1.1.2.3. Terms of Reference: Appendix 3

List of harmful organisms for which pest categorisation is requested. The list below follows the annexes of Directive 2000/29/EC.

Annex IAI

(a) Insects, mites and nematodes, at all stages of their development

<i>Acleris</i> spp. (non-EU)	<i>Longidorus diadecturus</i> Eveleigh and Allen
<i>Amauromyza maculosa</i> (Malloch)	<i>Monochamus</i> spp. (non-EU)
<i>Anomala orientalis</i> Waterhouse	<i>Myndus crudus</i> Van Duzee
<i>Arrhenodes minutus</i> Drury	<i>Nacobbus aberrans</i> (Thorne) Thorne and Allen
<i>Choristoneura</i> spp. (non-EU)	<i>Naupactus leucoloma</i> Boheman
<i>Conotrachelus nenuphar</i> (Herbst)	<i>Premnotrypes</i> spp. (non-EU)
<i>Dendrolimus sibiricus</i> Tschetverikov	<i>Pseudopityophthorus minutissimus</i> (Zimmermann)
<i>Diabrotica barberi</i> Smith and Lawrence	<i>Pseudopityophthorus pruinosus</i> (Eichhoff)
<i>Diabrotica undecimpunctata howardi</i> Barber	<i>Scaphoideus luteolus</i> (Van Duzee)
<i>Diabrotica undecimpunctata undecimpunctata</i> Mannerheim	<i>Spodoptera eridania</i> (Cramer)
<i>Diabrotica virgifera zea</i> Krysan & Smith	<i>Spodoptera frugiperda</i> (Smith)
<i>Diaphorina citri</i> Kuway	<i>Spodoptera litura</i> (Fabricus)
<i>Heliothis zea</i> (Boddie)	<i>Thrips palmi</i> Karny
<i>Hirschmanniella</i> spp., other than <i>Hirschmanniella</i> <i>gracilis</i> (de Man) Luc and Goodey	<i>Xiphinema americanum</i> Cobb <i>sensu lato</i> (non-EU populations)
<i>Liriomyza sativae</i> Blanchard	<i>Xiphinema californicum</i> Lamberti and Bleve-Zacheo

(b) Fungi

<i>Ceratocystis fagacearum</i> (Bretz) Hunt	<i>Mycosphaerella larici-leptolepis</i> Ito et al.
<i>Chrysomyxa arctostaphyli</i> Dietel	<i>Mycosphaerella populorum</i> G. E. Thompson
<i>Cronartium</i> spp. (non-EU)	<i>Phoma andina</i> Turkensteen
<i>Endocronartium</i> spp. (non-EU)	<i>Phyllosticta solitaria</i> Ell. and Ev.
<i>Guignardia laricina</i> (Saw.) Yamamoto and Ito	<i>Septoria lycopersici</i> Speg. var. <i>malagutii</i> Ciccarone and Boerema
<i>Gymnosporangium</i> spp. (non-EU)	<i>Thecaphora solani</i> Barrus
<i>Inonotus weirii</i> (Murril) Kotlaba and Pouzar	<i>Trechispora brinkmannii</i> (Bresad.) Rogers
<i>Melampsora farlowii</i> (Arthur) Davis	

(c) Viruses and virus-like organisms

Tobacco ringspot virus	Pepper mild tigré virus
Tomato ringspot virus	Squash leaf curl virus
Bean golden mosaic virus	Euphorbia mosaic virus
Cowpea mild mottle virus	Florida tomato virus
Lettuce infectious yellows virus	

(d) Parasitic plants

Arceuthobium spp. (non-EU)

Annex IAI

(a) Insects, mites and nematodes, at all stages of their development

<i>Meloidogyne fallax</i> Karssen	<i>Rhizoecus hibisci</i> Kawai and Takagi
<i>Popillia japonica</i> Newman	

(b) Bacteria

<i>Clavibacter michiganensis</i> (Smith) Davis et al. ssp. <i>sepedonicus</i> (Spieckermann and Kotthoff) Davis et al.	<i>Ralstonia solanacearum</i> (Smith) Yabuuchi et al.
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(c) Fungi*Melampsora medusae* Thümen*Synchytrium endobioticum* (Schilbersky) Percival**Annex I B****(a) Insects, mites and nematodes, at all stages of their development***Leptinotarsa decemlineata* Say*Liriomyza bryoniae* (Kaltenbach)**(b) Viruses and virus-like organisms**

Beet necrotic yellow vein virus

1.2. Interpretation of the Terms of Reference

Margarodes (non-EU species) are one of a number of pest groups listed in the Appendices to the Terms of Reference (ToR) to be subject to pest categorisation to determine whether they fulfil the criteria of quarantine pests or those of regulated non-quarantine pests for the area of the EU excluding Ceuta, Melilla and the outermost regions of Member States (MS) referred to in Article 355(1) of the Treaty on the Functioning of the European Union (TFEU), other than Madeira and the Azores.

Three species of non-EU *Margarodes* are given as examples in the EU plant health legislation, 2000/29 EC: *Margarodes vitis* (Phillipi), *Margarodes vredendalensis* de Klerk and *Margarodes prieskaensis* Jakubski. However, restricting the species to be considered in this opinion to the genus *Margarodes* is no longer appropriate due to taxonomic changes that have reassigned some *Margarodes* pest species to other genera. There are also some Margarodidae that are important economic pest species described in related genera. Therefore, all non-EU species in the higher taxonomic category of the family Margarodidae will be considered.

2. Data and methodologies**2.1. Data****2.1.1. Literature search**

A literature search on non-European species in the family Margarodidae was conducted at the beginning of the categorisation in the ISI Web of Science bibliographic database. Relevant papers were reviewed, and further references and information were obtained from experts, as well as from citations within the references and grey literature.

2.1.2. Database search

Pest information on host(s) and distribution, was retrieved from the European and Mediterranean Plan Protection Organization (EPPO) Global Database (EPPO, 2019), ScaleNet (García Morales et al., 2019) and relevant publications.

Data about the import of commodity types that could potentially provide a pathway for the pest to enter the EU and about the area of hosts grown in the EU were obtained from EUROSTAT (Statistical Office of the European Communities).

The Europhyt database was consulted for pest-specific notifications on interceptions and outbreaks. Europhyt is a web-based network hosted by the Directorate General for Health and Food Safety (DG SANTÉ) of the European Commission, and is a subproject of PHYSAN (Phyto-Sanitary Controls) specifically concerned with plant health information. The Europhyt database manages notifications of interceptions of plants or plant products that do not comply with EU legislation, as well as notifications of plant pests detected in the territory of the MS and the phytosanitary measures taken to eradicate or avoid their spread.

2.2. Methodologies

The Panel performed the pest categorisation for non-EU Margarodidae following guiding principles and steps presented in the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018) and in the International Standard for Phytosanitary Measures No 11 (FAO, 2013) and No 21 (FAO, 2004).

This work was initiated following an evaluation of the EU plant health regime. Therefore, to facilitate the decision-making process, in the conclusions of the pest categorisation, the Panel addresses explicitly each criterion for a Union quarantine pest and for a Union regulated non-quarantine pest in accordance with Regulation (EU) 2016/2031 on protective measures against pests of plants, and includes additional information required in accordance with the specific terms of reference received by the European Commission. In addition, for each conclusion, the Panel provides a short description of its associated uncertainty.

Table 1 presents the Regulation (EU) 2016/2031 pest categorisation criteria on which the Panel bases its conclusions. All relevant criteria have to be met for the pest to potentially qualify either as a quarantine pest or as a regulated non-quarantine pest. If one of the criteria is not met, the pest will not qualify. A pest that does not qualify as a quarantine pest may still qualify as a regulated non-quarantine pest that needs to be addressed in the opinion. For the pests regulated in the protected zones only, the scope of the categorisation is the territory of the protected zone; thus, the criteria refer to the protected zone instead of the EU territory.

It should be noted that the Panel's conclusions are formulated respecting its remit and particularly with regard to the principle of separation between risk assessment and risk management (EFSA founding regulation (EU) No 178/2002); therefore, instead of determining whether the pest is likely to have an unacceptable impact, the Panel will present a summary of the observed pest impacts. Economic impacts are expressed in terms of yield and quality losses and not in monetary terms, whereas addressing social impacts is outside the remit of the Panel.

Table 1: Pest categorisation criteria under evaluation, as defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column)

Criterion of pest categorisation	Criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Criterion in Regulation (EU) 2016/2031 regarding protected zone quarantine pest (articles 32–35)	Criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest
Identity of the pest (Section 3.1)	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?
Absence/ presence of the pest in the EU territory (Section 3.2)	Is the pest present in the EU territory? If present, is the pest widely distributed within the EU? Describe the pest distribution briefly!	Is the pest present in the EU territory? If not, it cannot be a protected zone quarantine organism.	Is the pest present in the EU territory? If not, it cannot be a regulated non-quarantine pest. (A regulated non-quarantine pest must be present in the risk assessment area).
Regulatory status (Section 3.3)	If the pest is present in the EU but not widely distributed in the risk assessment area, it should be under official control or expected to be under official control in the near future.	The protected zone system aligns with the pest free area system under the International Plant Protection Convention (IPPC). The pest satisfies the IPPC definition of a quarantine pest that is not present in the risk assessment area (i.e. protected zone).	Is the pest regulated as a quarantine pest? If currently regulated as a quarantine pest, are there grounds to consider its status could be revoked?
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	Is the pest able to enter into, become established in, and spread within, the EU territory? If yes, briefly list the pathways!	Is the pest able to enter into, become established in, and spread within, the protected zone areas? Is entry by natural spread from EU areas where the pest is present possible?	Is spread mainly via specific plants for planting, rather than via natural spread or via movement of plant products or other objects? Clearly state if plants for planting is the main pathway!

Criterion of pest categorisation	Criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Criterion in Regulation (EU) 2016/2031 regarding protected zone quarantine pest (articles 32–35)	Criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest
Potential for consequences in the EU territory (Section 3.5)	Would the pests' introduction have an economic or environmental impact on the EU territory?	Would the pests' introduction have an economic or environmental impact on the protected zone areas?	Does the presence of the pest on plants for planting have an economic impact, as regards the intended use of those plants for planting?
Available measures (Section 3.6)	Are there measures available to prevent the entry into, establishment within or spread of the pest within the EU such that the risk becomes mitigated?	Are there measures available to prevent the entry into, establishment within or spread of the pest within the protected zone areas such that the risk becomes mitigated? Is it possible to eradicate the pest in a restricted area within 24 months (or a period longer than 24 months where the biology of the organism so justifies) after the presence of the pest was confirmed in the protected zone?	Are there measures available to prevent pest presence on plants for planting such that the risk becomes mitigated?
Conclusion of pest categorisation (Section 4)	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential quarantine pest were met and (2) if not, which one(s) were not met	A statement as to whether (1) all criteria assessed by EFSA above for consideration as potential protected zone quarantine pest were met, and (2) if not, which one(s) were not met	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential regulated non-quarantine pest were met, and (2) if not, which one(s) were not met

The Panel will not indicate in its conclusions of the pest categorisation whether to continue the risk assessment process, but following the agreed two-step approach, will continue only if requested by the risk managers. However, during the categorisation process, experts may identify key elements and knowledge gaps that could contribute significant uncertainty to a future assessment of risk. It would be useful to identify and highlight such gaps so that potential future requests can specifically target the major elements of uncertainty, perhaps suggesting specific scenarios to examine.

3. Pest categorisation

3.1. Identity and biology of the pest

3.1.1. Identity and taxonomy

Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?

Yes. The identity of the family Margarodidae is well established as are all the species within it.

There is some disagreement regarding the higher classification of the scale insects (superfamily Coccoidea). For example, some researchers assign the scale insects to the superfamily Coccoidea in the order Hemiptera, suborder Sternorrhyncha, infraorder Coccoomorpha (Williams and Hodgson, 2014) while others assign the group to the order Homoptera, suborder Coccinea (Gavrilov-Zimin and Danzig, 2015).

The classification used here follows Williams and Hodgson (2014). The family Margarodidae is assigned to the superfamily Coccoidea in the infraorder Coccoomorpha in the order Hemiptera. The members of the Margarodidae are commonly known as ground pearls or margarodids. The name ground pearl refers to the second-instar nymph which forms a protective cyst (the 'pearl'). The

concept of the Margarodidae *sensu stricto* used here follows Koteja (1974). The family forms a monophyletic group with a worldwide distribution (Foldi, 2005).

Despite the disagreement between taxonomists regarding their higher classification, the identities of all Margarodidae are well established and keys are available to identify them. Some examples of keys and diagnostic protocols to species are provided in Appendix A.

3.1.2. Biology of the pest

General overview: The biology of the Margarodidae has been reviewed by Foldi (2005). They are subterranean plant sucking parasites. Some are serious destructive pests of grape vines, sugar cane, oil palm, cotton or turf grass around the world. Nymphs attach themselves to, and feed on, the roots of a wide variety of plants. Both female and male development is characterised by an apodous, feeding second-instar nymph, called a cyst. The cyst is spherical and often colourful, shiny, metallic or pearl-like, from which the common name 'ground pearls' is derived. Other unique features are the strongly developed fossorial prothoracic legs for digging, construction of a protective test from their own liquid excreta in which the cyst is enclosed and modification of their life cycle to survive in adverse environmental conditions such as drought.

Species of ground pearls reproduce either bisexually or parthenogenetically. Females undergo three, four or five developmental stages, and males have five. Adults lack mouthparts and do not feed. Adult males, if present, are winged and die after mating. During the cyst stage, one, two or three moults may occur. Most species have a single generation each year, although development in *M. vitis* requires 3 years including three instars of cysts. They may survive several years in the cyst stage (up to 17 years according to Ferris (1919)).

The biology of some of the most economically important species has been studied in detail. Here we summarise the biology of five of the most well-known.

- ***Dimargarodes meridionalis***

Dimargarodes meridionalis are found in the soil up to 25 cm below the surface (Dale, 2017). Clusters of pinkish-white eggs, covered in a white waxy sac, are deposited in the soil from March to June. The first-stage nymphs (called crawlers) emerge from eggs approximately 9–15 days later, attach to the roots of turf grass, and enclose themselves in a hard, yellow-brown, spherical shell or cyst, which is the basis of the name 'pearl'. These cysts range in size from about 0.5 to 1.5 mm. Ground pearls overwinter in the cyst stage and females reach maturity in late spring. Females can reproduce without mating and adult males are rarely observed. One generation may last from 1 to 2 years, or possibly longer depending on environmental conditions. There are no known natural enemies of ground pearls *D. meridionalis*.

- ***Margarodes capensis***

Various aspects of the biology of *M. capensis*, a grapevine infesting species, were studied under field conditions in South Africa. Cysts occurred throughout the year and although adult females can emerge without the cysts reaching their maximum size, the whole population of cysts does not develop into adult females annually. Adult females occurred from December to May with a peak from end February to middle March (i.e. southern hemisphere summer). First instar nymphs were present from late February to late May. During the observation period of 1 year, no males were found. Cysts were found in the soil to a depth of 120 cm, the highest number occurring at a depth of 46–60 cm. The highest number of adult females occurred at a depth of 16–75 cm, and first instar nymphs were found from a depth of 16 to 120 cm in the soil (de Klerk, 1982).

- ***Margarodes prieskaensis***

The biology and behaviour of *M. prieskaensis* in South Africa has been described in detail by du Toit (1975). Eggs are laid in the spring in the soil close to grapevine roots at a depth of about 50 cm. Newly hatched nymphs attach themselves to the roots by their mouthparts and become sessile. The second nymphal stage has two phases: a feeding and growing phase followed by a non-feeding phase. Once feeding is complete, the nymphs are capable of secreting a protective waxy covering to form pearl-like cysts enabling them to resist unfavourable conditions. The cysts can remain inactive and viable in the soil for a very long period (several years). It is not known precisely what triggers, or can prevent, cyst formation (or what is their maximum longevity). Sexually mature females and male prepupae emerge from the cysts. The females make their way upwards through the soil in mid-July

just after the lowest subterranean winter temperatures (6–7°C) have been reached. Males undergo complete metamorphosis, pupating just below the soil surface in early May when temperatures are about 16°C. Mating is usually complete by early September and females then burrow into the soil. The peak period of oviposition is from the end of October to the beginning of November.

- ***Margarodes vitis***

Margarodes vitis lives on the roots of grape vines usually at a depth of 20–60 cm, but may occur at depths of up to 120 cm. Adult females lay eggs into an ovisac during the summer. The number of eggs laid varies widely (150–900), depending on the size of the adult female. The second and third-instars are capable of producing cysts which can survive for many years. Adult females occur spring and early summer (Gonzalez et al., 1960). According to Foldi and Soria (1989), *M. vitis* is parthenogenetic. However, Jakubski (1965) gives a description for adult males which are apparently very rare, and live for up to 14 days, appearing above ground for a brief period. Mating occurs between late spring and early summer (mid-November and the end of December). The life cycle from egg to adult takes 3 years (Foldi and Soria, 1989).

- ***Margarodes vredendalensis***

The biology of *M. vredendalensis* has been described in detail by de Klerk (1980). This species is parthenogenetic living in zones of greatest root abundance of its host *Vitis vinifera*, usually at a depth of 46–60 cm. It can occur at depths of up to 120 cm. Under laboratory conditions, adult females emerged during mid and late summer (January and February), but only 10–16% of the cysts developed into females annually. Although cysts were detached from the host plant (*Vitis vinifera*), females emerged during four successive years from the same population. The average adult female lifespan was 40 days with an oviposition period of 18 days resulting in 507 eggs per female. The vertical distribution of cysts was directly related to the vertical distribution of roots and has significant negative correlation with soil moisture and percentage of clay in the soil.

3.1.3. Intraspecific diversity

No significant intraspecific diversity has been reported.

3.1.4. Detection and identification of the pest

Are detection and identification methods available for the pest?

Yes

Detection

Margarodidae are subterranean and can be difficult to detect. The first indication of an infestation is usually a patchy, gradual decline in host vigour (symptoms similar to those caused by other below ground plant-parasitic organisms for example nematodes,). Examination of the roots may reveal the presence of the margarodids. They live usually at depths of 20–60 cm, but can occur at depths of up to 120 cm. The cysts of nymphs are the most likely life stage to be detected. Cysts are found throughout the year, while adult females occur only for a month each year.

The EPPO diagnostic standard for Margarodidae provides information on the detection of Margarodidae associated with grapevines although the protocol may also be applicable to other host plants (OEPP/EPPO, 2007). Grapevines infested with root-feeding margarodids exhibit a gradual decline in vigour, shoots become thinner and shorter, and leaves smaller (Annecke and Moran, 1982). One or more of the branches of the vine may die, followed in severe infestations by the eventual death of the whole plant. The duration of this process varies greatly. Infestations of vineyards are usually patchy. The patches increase in size, presumably because of the gradual subterranean movement of the larvae and adult females. This epidemiology resembles the decline caused by grapevine phylloxera (*Viteus vitifoliae* (Fitch)) in *Vitis vinifera* but, in the case of margarodids, no root galls are formed, with the one exception of *Eurhizococcus colombianus* which may induce deep pit-like galls on the roots (Kondo and Gómez, 2008).

Identification

Morphological identification is the recommended method; there is very limited molecular data available to inform identification to species.

The taxonomy of scale insects is based almost entirely on the adult female morphology and a good slide preparation of a teneral female is required for identification to species level. A high-power binocular microscope is required. For keys to Coccoidea families, see Gill (1993) and Kosztarab (1996). For a key of Margarodidae genera, see Morrison (1928), Jakubski (1965), Gill (1993) and Foldi (2005) for an updated version; for *Margarodes* genus on *Vitis*, see the EPPO diagnostic standard for the identification of *M. prieskaensis*, *M. vitis* and *M. vredendalensis* (OEPP/EPPO, 2007). Appendix A provides examples of diagnostic keys to identify margarodid species of most plant health concern to the EU.

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

Appendix B shows the world distribution of each of the 107 species of Margarodidae. Table 2 indicates the distribution of 11 species reported to cause economic damage to relevant plants outside the EU, and which therefore may potentially be of most plant health concern to the EU (see Section 4 Conclusion) Information on the distribution of these species is from the EPPO Global Database (2019), García Morales et al. (2019) and references therein (Camerino, 2005).

Five of the species are only known to occur in South Africa, three in South America, one in North America, one in North America and Australia and one in Central Asia and the Middle East.

Table 2: Geographic distribution of eleven non-EU species of Margarodidae potentially of most plant health concern to the EU

Species	Distribution	Reference
<i>Dimargarodes meridionalis</i> (= <i>Margarodes meridionalis</i> in EPPO 2019 Global database)	USA (south-west; Arizona and California: and south east; Florida and Georgia)	Morrison (1927); Kerr (1957); Jakubski (1965); Gill (1993)
<i>Eumargarodes laingi</i>	Australia and USA (southern States)	Allsopp et al. (2000)
<i>Eurhizococcus brasiliensis</i>	Brazil (south; Parana, Rio Grande do Sul, Santa Catarina and Sao Paulo: north-east; Pernambuco)	Jakubski (1965); Foldi (1987, 1989); Foldi and Soria (1989); Efrom et al. (2012)
<i>Eurhizococcus colombianus</i>	Colombia	Jakubski (1965); Kondo and Gómez (2008); Kondo (2001)
<i>Margarodes capensis</i>	South Africa	Giard (1897); Brain (1915); Jakubski (1965)
<i>Margarodes greeni</i>	South Africa	Brain (1915)
<i>Margarodes prieskaensis</i>	South Africa	Jakubski (1965)
<i>Porphyrophora tritici</i>	Armenia, Iran, Syria and Turkey	Sarkisov et al. (1990); Vahedi (2001); Kaydan et al. (2007)
<i>Margarodes trimeni</i>	South Africa	Brain (1915)
<i>Margarodes vitis</i>	Widespread in South America, e.g. Argentina (Buenos Aires, Corrientes, Entre Rios, La Rioja, Mendoza, Misiones, Rio Negro and San Juan), Brazil (Rio Grande do Sul and Santa Catarina), Chile (Santiago), Paraguay, Uruguay and Venezuela	Reed (1895); Giard (1897); Jakubski (1965); González (1989); CABI (2000)
<i>Margarodes vredendalensis</i>	South Africa	de Klerk (1983)

The distribution of species listed in Table 2 is shown in Figure 1.

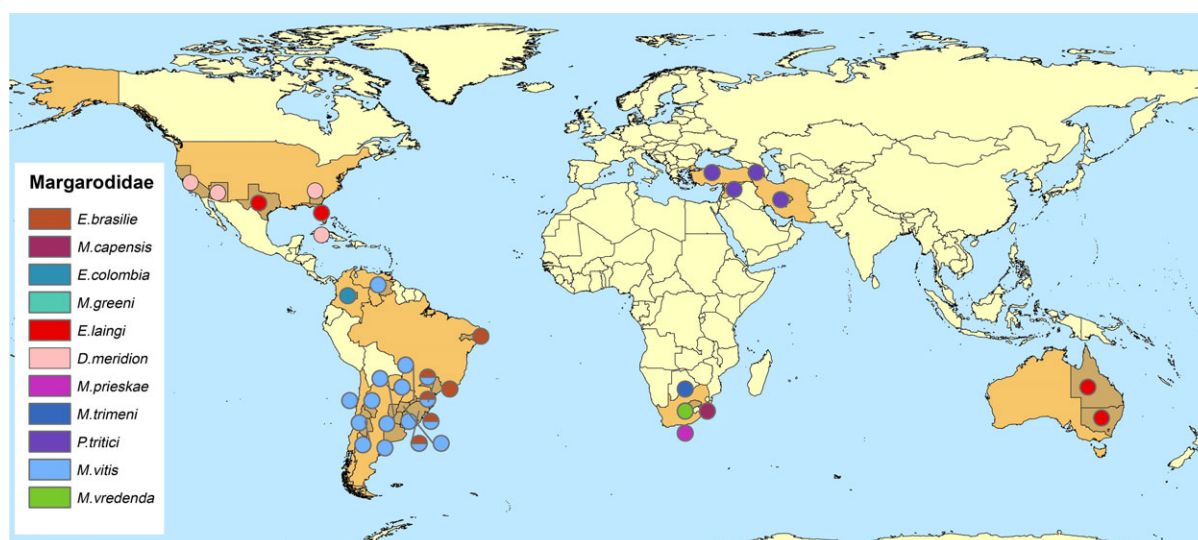


Figure 1: Global distribution map for species of Margarodidae of most potential plant health concern to the EU

Table 3 indicates the distribution of 10 non-EU Margarodidae that may potentially be of lesser plant health concern to the EU as they are not known to be harmful organisms but have hosts that are crops in the EU (see Appendix D). Information on the distribution of these species is from the EPPO (2019) Global Database and García Morales et al. (2019) and references therein.

Table 3: Global distribution of ten non-EU species of Margarodidae of lesser potential plant health concern to the EU

Name	Distribution	References
<i>Margarodes floridanus</i>	USA (Florida)	García Morales et al. (2019)
<i>Margarodes formicarum</i>	Antigua and Barbuda; Bahamas; Barbados; Chile; Montserrat; Puerto Rico and Vieques Island; Saint Kitts and Nevis Islands; US Virgin Islands	García Morales et al. (2019)
<i>Margarodes gimenezi</i>	Paraguay	García Morales et al. (2019)
<i>Margarodes salisburyensis</i>	Zimbabwe	Coates Palgrave (1974); Foldi (2005)
<i>Neomargarodes cucurbitae</i>	China (Shanxi)	García Morales et al. (2019)
<i>Porphyrophora jashenkoi</i>	Iran	García Morales et al. (2019)
<i>Porphyrophora medicaginis</i>	Iran, Kazakhstan	García Morales et al. (2019)
<i>Porphyrophora minuta</i>	Turkey, Ukraine	García Morales et al. (2019)
<i>Porphyrophora parieli</i>	Morocco	García Morales et al. (2019)
<i>Porphyrophora ussuriensis</i>	China, Mongolia, Russia	García Morales et al. (2019)

3.2.2. Pest distribution in the EU

Of 107 species in the family Margarodidae, 97 are not known to occur in the EU (Appendix B). For completeness, the 10 species that are known to be present in the EU are also listed in Appendix C. *Porphyrophora tritici* in Turkey is the non-EU species closest to the EU (García Morales et al., 2019).

Is the pest present in the EU territory? If present, is the pest widely distributed within the EU?

No. No non-EU Margarodidae are known to be present in the EU.

3.3. Regulatory status

3.3.1. Council Directive 2000/29/EC

Margarodes spp. is listed in Council Directive 2000/29/EC. Details are presented in Tables 4 and 5.

Table 4: *Margarodes* spp. in Council Directive 2000/29/EC

Annex II Part A	Harmful organisms whose introduction into, and spread within, all member states shall be banned if they are present on certain plants or plant products	
Section 1	Harmful organisms not known to occur in the community and relevant for the entire community	
(a)	Insects, mites and nematodes, at all stages of their development	
	Species	Subject of contamination
19	<i>Margarodes</i> , non-European species, such as: (a) <i>Margarodes vitis</i> (Phillipi) (b) <i>Margarodes vredendalensis</i> de Klerk (c) <i>Margarodes prieskaensis</i> Jakubski	Plants of <i>Vitis</i> L., other than fruit and seeds

3.3.2. Legislation addressing the hosts of non-EU *Margarodes*

Table 5: Regulated hosts and commodities that could provide potential pathways for non-EU *Margarodes* spp. (Margarodidae); taken from Annexes III, and V of Council Directive 2000/29/EC

Annex II Part A	Plants, plant products and other objects the introduction of which shall be prohibited in all member states	
	Description	Country of origin
15	Plants of <i>Vitis</i> L., other than fruits	Third countries other than Switzerland
19	Plants of the family <i>Graminaceae</i> , other than plants of ornamental perennial grasses of the subfamilies <i>Bambusoideae</i> and <i>Panicoideae</i> and of the genera <i>Buchloe</i> , <i>Bouteloua</i> Lag., <i>Calamagrostis</i> , <i>Cortaderia</i> Stapf., <i>Glyceria</i> R. Br., <i>Hakonechloa</i> Mak. ex Honda, <i>Hystrix</i> , <i>Molinia</i> , <i>Phalaris</i> L., <i>Shibataea</i> , <i>Spartina</i> Schreb., <i>Stipa</i> L. and <i>Uniola</i> L., intended for planting, other than seeds	Third countries, other than European and Mediterranean countries
Annex V	Plants, plant products and other objects which must be subject to a plant health inspection [...] in the country of origin or the consignor country, if originating outside the Community) before being permitted to enter the Community	
Part A	Plants, plant products and other objects originating in the Community	
Section II	Plants, plant products and other objects produced by producers whose production and sale is authorised to persons professionally engaged in plant production, other than those plants, plant products and other objects which are prepared and ready for sale to the final consumer, and for which it is ensured by the responsible official bodies of the Member States, that the production thereof is clearly separate from that of other products	
1.4	Plants of [...] <i>Vitis</i> L., other than fruits and seeds.	

3.4. Entry, establishment and spread in the EU

3.4.1. Host range

The main source of data is García Morales et al. (2019) and references cited therein.

The host range of most margarodids are poorly known as they are subterranean (hypogean) throughout most of their lifecycle, and consequently, they have been inadequately recorded and studied. For example, the host plants are completely unknown for 23 species (21% of the Margarodidae) and are poorly known for many others (see Appendix B). The most important host-

plant family for the Margarodidae is the Poaceae (hosts for 49 margarodid species, 46% of total), but in many cases, the specific grass host has not been determined. Several margarodid species (e.g. *M. capensis*, *M. greeni*, *M. prieskaensis* and *M. vredendalensis*) have only been found feeding on crops that are non-native to the range of the margarodid; their native hosts are unknown.

Eleven non-EU species of Margarodidae of most potential plant health concern are all monophagous or oligophagous with the exception of the two *Eurhizococcus* species which are polyphagous (Table 6).

Table 6: Hosts for non-EU Margarodidae of most potential plant health concern to the EU

Margarodid species	Hosts
<i>Dimargarodes meridionalis</i>	Poaceae: <i>Cynodon dactylon</i> (Bermuda grass) and various unspecified grasses. Vitaceae: <i>Vitis vinifera</i> (common grape vine)
<i>Eumargarodes laingi</i>	Poaceae: <i>Buchloe dactyloides</i> (buffalo grass), <i>C. dactylon</i> , <i>Eremochloa ophiuroides</i> , <i>Saccharum officinarum</i> , <i>Stenotaphrum secundatum</i> , <i>Zoysia</i> and unspecified grasses, including turf grasses
<i>Eurhizococcus brasiliensis</i>	Asteraceae: many hosts Rosaceae: many hosts 23 other plant families
<i>Eurhizococcus colombianus</i>	Apiaceae: <i>Arracacia xanthorrhiza</i> Lauraceae: <i>Persea americana</i> Rosaceae: <i>Rubus</i> Vitaceae: <i>Vitis labrusca</i>
<i>Margarodes capensis</i>	Vitaceae: <i>V. vinifera</i>
<i>Margarodes greeni</i>	Vitaceae: <i>V. vinifera</i>
<i>Margarodes prieskaensis</i>	Vitaceae: <i>V. vinifera</i>
<i>Margarodes trimeni</i>	Poaceae: unspecified grass Vitaceae: <i>V. vinifera</i>
<i>Margarodes vitis</i>	Cactaceae: <i>Opuntia</i> (prickly pear). Rhamnaceae: <i>Colletia spinosissima</i> Vitaceae: <i>V. vinifera</i>
<i>Margarodes vredendalensis</i>	Vitaceae: <i>V. vinifera</i>
<i>Porphyrophora tritici</i>	Poaceae: <i>Hordeum vulgare</i> (barley), <i>Triticum aestivum</i> (common wheat), <i>Triticum durum</i> (durum wheat)

Ten non-EU species of Margarodidae known to feed on host species of commercial importance in the EU, but which have not been recorded as pest species in their current area of distribution, are listed in Table 7.

Table 7: Non-EU Margarodidae not known to be harmful but with hosts that include species grown in the EU

Margarodid species	Hosts of economic importance in EU
<i>Margarodes floridanus</i> (Jakubski)	<i>Citrus sinensis</i> (sweet orange)
<i>Margarodes formicarum</i> Guilding	<i>Citrus</i>
<i>Margarodes gimenezi</i> (Podtiaguin)	<i>Citrus x aurantium</i> (Seville orange)
<i>Margarodes salisburyensis</i> (Hall)	<i>Zea mays</i> (maize)
<i>Neomargarodes cucurbitae</i> Tang and Hao	<i>Cucurbita</i>
<i>Porphyrophora jashenkoi</i> Vahedi	<i>Triticum aestivum</i> (common wheat)
<i>Porphyrophora medicaginis</i> Jashenko	<i>Medicago sativa</i> (alfalfa)
<i>Porphyrophora minuta</i> Borchsenius	<i>Medicago sativa</i> (alfalfa)
<i>Porphyrophora parieli</i> (Vayssière)	<i>Hordeum vulgare</i> (barley)
<i>Porphyrophora ussuriensis</i> Borchsenius	<i>Fragaria</i> (strawberry)

3.4.2. Entry

Is the pest able to enter into the EU territory?

Yes, although there have been no interception records and the probability appears to be low.

No interceptions of Margarodidae are reported in the Europhyt database (1995–February 2019) which records notifications of non-compliance.

Pathways:

- soil
- plants of *Vitis* (other than fruit and seed)
- rooted plants for planting (with soil).

The first pathway (soil) is regulated and closed due to existing legislation prohibiting the import of soil from outside the EU.

The second pathway (plants of *Vitis*, other than fruit and seed) is regulated and closed as such plants of *Vitis* are prohibited from outside the EU, other than Switzerland (see Section 3.3.2).

The third pathway is not entirely closed. Almost half of all margarodids feed on the roots of grasses (Poaceae = Graminaceae) and the import of many grasses (other than as seed) is prohibited from third countries, other than European and Mediterranean countries (Section 3.3.2, Table 5). While grass with roots from Mediterranean countries such as Morocco (where *Porphyrophora parieli* occurs) and Turkey (where *P. tritici* occurs) could be shipped into the EU, there is considerable doubt as to whether such trade occurs in reality. Nevertheless, margarodids on rooted host plants for planting from other plant families have the potential for entering the EU. In particular, *E. brasiliensis* is broadly polyphagous (see Appendix B) and there is a possibility of introduction with the import of ornamental plants from Brazil.

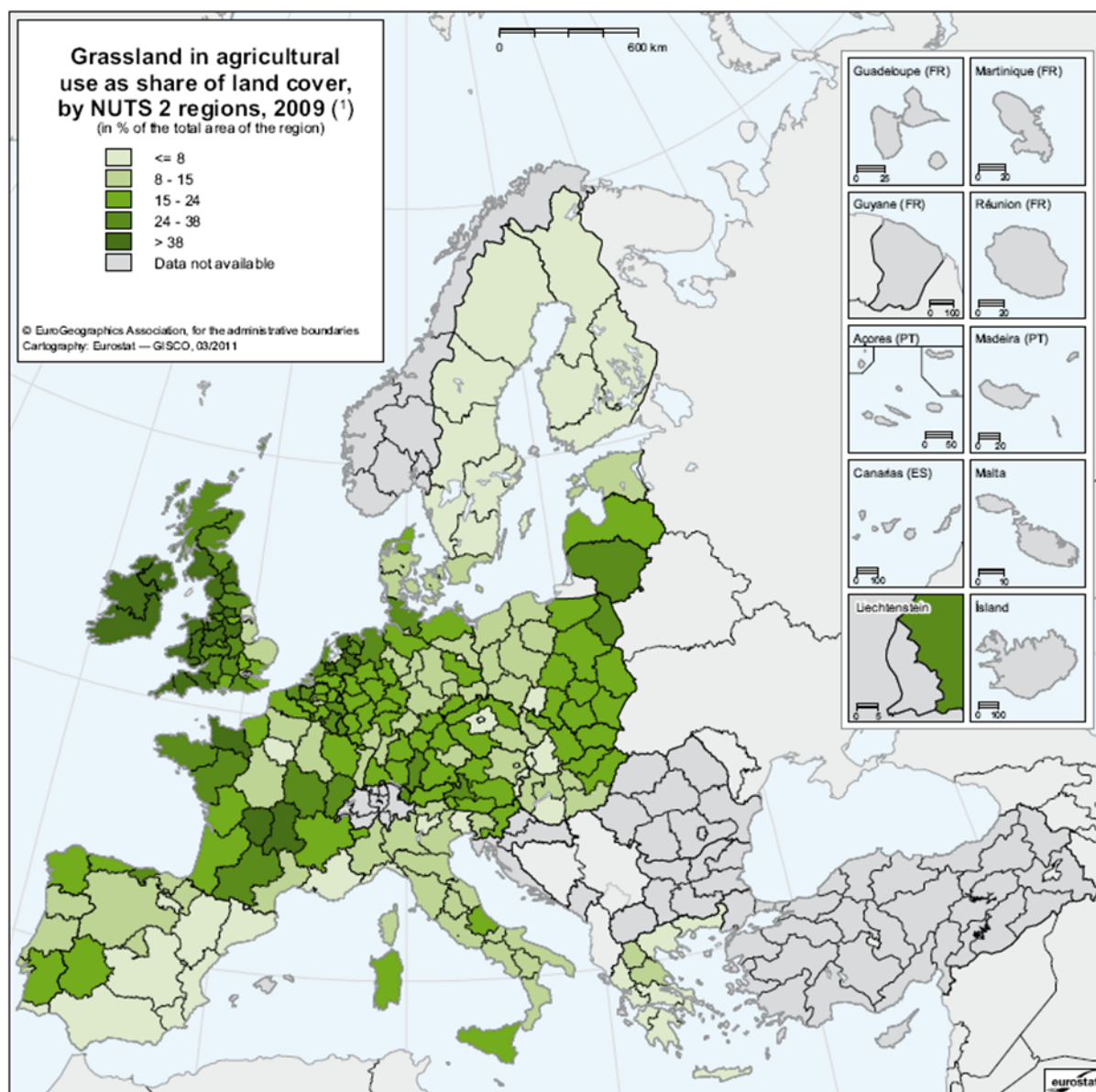
3.4.3. Establishment

Is the pest able to become established in the EU territory?

Yes, biotic and abiotic conditions are conducive for the establishment of these pests in parts of the EU.

3.4.3.1. EU distribution of main host plants

Poaceae in the form of pasture grasses and cereals are widely grown across the entire EU (Figure 2 and Appendix E) while *Vitis* is primarily restricted to more southern EU (de Rougemont, 1989).



(*) Bulgaria, Cyprus, Malta and Romania were not included in the LUCAS 2009 survey.

Figure 2: Grassland in agricultural use as share of land over by NUTS 2 regions (2009) Source: Eurostat http://ec.europa.eu/eurostat/statistics-explained/images/f/f6/Grassland_in_agricultural_use_as_share_of_land_cover%2C_by_NUTS_2_regions%2C_2009.PNG

Table 8: Harvested area of *Vitis* sp. in different Member States 2013–2017 (1000 ha). Source: EUROSTAT (accessed on 21.2.2019)

GEO/TIME	2013	2014	2015	2016	2017
European Union – 28 countries	:	:	3,167.97	3,141.92	3,143.14
Spain	946.97	947.28	941.06	935.11	937.76
France	760.55	757.34	752.33	751.69	750.46
Italy	702.11	682.18	678.98	673.76	675.26
Portugal	179.50	178.99	178.97	179.05	178.84
Romania	176.88	174.63	176.12	174.17	175.32
Germany	:	:	:	:	:
Greece	110.98	110.90	108.53	98.09	101.75
Hungary	69.32	70.72	72.20	72.20	68.12

GEO/TIME	2013	2014	2015	2016	2017
Austria	44.00	44.79	43.78	46.49	48.05
Bulgaria	50.20	31.89	38.71	36.55	34.11
Croatia	26.10	25.75	25.59	23.40	21.90
Slovenia	16.10	16.02	15.71	15.84	15.86
Czech Republic	15.65	15.78	15.81	15.80	15.81
Slovakia	11.96	8.76	8.80	8.71	8.47
Cyprus	5.92	6.16	6.60	6.07	5.93
United Kingdom	1.40	2.00	1.80	1.79	1.99
Luxembourg	1.24	1.25	1.25	1.26	1.26
Poland	0.70	0.70	0.60	0.62	0.67
Malta	:	:	0.68	0.68	0.68
Belgium	0.00	0.00	0.18	0.24	0.25
Netherlands	0.00	0.00	0.15	0.14	0.16
Sweden	0.03	0.05	0.05	0.05	0.04

': no data available.

Appendix F provides area for *Vitis* sp. by use.

3.4.3.2. Climatic conditions affecting establishment

The distribution and abundance of an organism that cannot control or regulate its body temperature is largely determined by host distribution and climate. The Köppen–Geiger climate classification system (Kottek et al., 2006) can inform judgements of establishment during pest categorisation and abbreviated systems of simplified pest risk assessment. Regarding the 11 species of Margarodidae that are known as pests of crops which are grown in the EU, *D. meridionalis*, *E. brasiliensis* and *M. vitis* occur in countries with a range of climate types including climate type Cfa (temperate, humid subtropical) which also occurs in the EU. *E. laingi*, *E. colombianus*, *M. capensis*, *M. greeni*, *M. prieskaensis*, *M. trimeni* and *M. vredendalensis* occur in countries with a range of climate types, including Cfb (temperate oceanic). *P. tritici* occurs in countries with number of zones such as Csa (temperate, dry hot summer) (MacLeod and Korycinska, 2019). After this piece of text: Margarodidae that are known as pests of crops which are grown in the EU, *D. meridionalis*, *E. brasiliensis* and *M. vitis* occur in countries with a range of climate types including climate type Cfa (temperate, humid subtropical) which also occurs in the EU. *E. laingi*, *E. colombianus*, *M. capensis*, *M. greeni*, *M. prieskaensis*, *M. trimeni* and *M. vredendalensis* occur in countries with a range of climate types, including Cfb (temperate oceanic). *P. tritici* occurs in countries with number of zones such as Csa (temperate, dry hot summer) (MacLeod and Korycinska 2019). These climate zones all occur in the EU where hosts are grown. We assume that climatic conditions in the EU will not limit the ability of such margarodids to establish.

As soil-dwelling pests, soil type could be very relevant with respect to establishment. The presence of *M. vredendalensis* has been found to be negatively related to soil moisture and the percentage of clay in the soil (de Klerk, 1980). We assume all species of Margarodidae also prefer free draining soils where hosts are grown. Good drainage is a prerequisite for cultivation of many crops, so this should not be a limiting factor for establishment in the EU. Given the variety of soil types across the EU and the wide availability of hosts, we assume non-EU Margarodidae would be able to establish in the EU (see also Appendix G).

3.4.4. Spread

Is the pest able to spread within the EU territory following establishment?

Yes. Margarodidae are free-living organisms so they will be able to spread following establishment. Movement with soil and host plants for planting would also spread margarodids within the EU.

RNQPs (Regulated Non-Quarantine Pest): Is spread mainly via specific plants for planting, rather than via natural spread or via movement of plant products or other objects?

Long-distance spread would primarily be via movement of plants for planting.

Margarodids are small soil-dwelling organisms that attach to the roots of hosts. Individuals dig through the soil to locate a feeding site. Some life stages are immobile so they do not spread far or fast. Hoffman and Smith (1991) calculated *Margarodes meridionalis* spreading at a maximum rate of 10–15 cm per year. Other species could be expected to disperse at the same rate.

Following establishment, spread via rooted plants for planting, including with turf grass, would provide the main and fastest means of spread.

3.5. Impacts

Would the pests' introduction have an economic or environmental impact on the EU territory?

Yes, should any of the 11 species of non-native margarodid listed in Appendix A enter and establish in the EU, economic impacts on relevant hosts such as grapevine, turf grasses and cereals would be expected.

RNQPs: Does the presence of the pest on plants for planting have an economic impact, as regards the intended use of those plants for planting?

Yes, the presence of the pest on plants for planting has a potential economic impact on its intended use.

All margarodids feed on plant roots and are subterranean throughout most of their lifecycle. Consequently, impacts are likely to be underrecorded due to difficulties in detection, identification and lack of information on the host plants (see Section 3.4.1 for further discussion). Symptoms of margarodid infestation are similar to those caused by other subterranean pests such as nematodes, and in the case of grapevines, grapevine phylloxera (*Viteus vitifoliae*). Symptoms include a patchy, gradual decline of host vigour, thinner and shorter shoots, and smaller leaves (Annecke and Moran, 1982). This may be followed by leaf loss, dieback and mortality.

Only host plants that are grown as crops in the EU are considered in this section. There appears to be very little published quantitative data on yield and quality loss.

The majority of the margarodids of concern to the EU are pests of grapevine (*Vitis vinifera*), including: *E. brasiliensis*, *E. colombianus* and *M. vitis* in South America (Olalquiaga Fauré and Contesse Pinto, 1959; Gonzalez et al., 1969; Gonzalez, 1983; Foldi, 2005; Botton et al., 2010), and *M. capensis*, *M. greeni*, *M. prieskaensis*, *M. trimeni* and *M. vredendalensis* in South Africa (du Toit, 1975; de Klerk, 1980; de Klerk, 1982; Foldi, 2005; de Klerk, 2017). In southern Brazil, in the state of Rio Grande do Sul, several hundred hectares of vineyards were infested by *E. brasiliensis*, resulting in vines dying in patches which gradually expanded until the whole vineyard declined in vitality and was finally destroyed (Foldi and Soria, 1989). Vines can be killed within 4 years resulting in great economic hardship as the growers have to abandon grape cultivation or move to new areas free of the pest (Botton et al., 2010). In South Africa, serious economic damage is inflicted on table, raisin and wine grapes and margarodes are present in almost all viticultural areas (de Klerk, 1982, 1985, 2017).

European grape vines are grafted onto rootstocks of North American *Vitis* species as they co-evolved with grapevine phylloxera (*Viteus vitifoliae*) and have natural resistance to the pest. Grapevine rootstocks in commercial use in South Africa are similar to those used in Europe and the potential impact of South African margarodids in European vineyards is therefore suspected to be similar. Grapevine rootstocks in South America may differ to those used in Europe and therefore there is a greater degree of uncertainty regarding the impact of the South American margarodids in European vineyards.

E. brasiliensis is also recorded as a pest of alfalfa or lucerne (*Medicago sativa*), blackberry (*Rubus* sp.), raspberry (*Rubus idaeus*) and blueberry (*Vaccinium* sp.) (Kalvelage, 1987; Efrom et al., 2012), and has been reared on the roots of potato (*Solanum tuberosum*) and winter squash (*Cucurbita maxima*) (Foldi, 2005). Infested blackberry, raspberry and blueberry plants in Brazil exhibited chlorotic leaves, gradual wasting, reduced fruit production, and mortality (Efrom et al., 2012). *E. colombianus* is also recorded feeding on avocado (*Persea americana*) and *Rubus* sp. (Kondo and Gómez, 2008).

D. meridionalis and *E. laingi* are serious pests of turf grass in the USA (Hoffman and Smith, 1991; Gill, 1993; Foldi, 2005). *P. tritici* is a pest of wheat (*Triticum aestivum*) and barley (*Hordeum vulgare*) in Turkey, Syria and Iran (Safar Alizadeh and Bahador, 1987; Vahedi, 2001; Foldi, 2005). In Iran, most of the infested wheat plants do not reach the fertilisation and ear formation stage and in those plants that do produce ears, there is a significant reduction in numbers of grains produced. For example, the average number of grains produced per healthy plant was 138.5, compared with 23.75 produced by infested plants. Therefore, *P. tritici* can cause a significant reduction in yield (83%) and is a major economic pest in some years (Safar Alizadeh and Bahador, 1987).

3.6. Availability and limits of mitigation measures

Are there measures available to prevent the entry into, establishment within or spread of the pest within the EU such that the risk becomes mitigated?

Yes, there are measures aimed to prevent the introduction of non-European *Margarodes* including: *Margarodes* spp. are listed in Council Directive 2000/29/EC; the import of soil from outside the EU is prohibited (see Section 3.3); plants of *Vitis*, other than fruit and seed, are prohibited from outside the EU, other than Switzerland; some plants of the family Poaceae (Graminaceae) intended for planting other than seeds, from third countries, other than European and Mediterranean countries are prohibited. Additional measures are also available (see below).

RNQPs: Are there measures available to prevent pest presence on plants for planting such that the risk becomes mitigated?

Yes. Growing nursery plants in isolation could mitigate the risk.

3.6.1. Identification of additional measures

Phytosanitary measures are currently applied to plants for planting of *Vitis* and some plants of Poaceae, specifically in relation to non-European *Margarodes* (see Section 3.3). The prohibition of soil from third countries not belonging to continental Europe (See Annex III, point 14) will significantly assist in reducing the risk of entry of non-European Margarodidae into the EU with host plants for planting not specifically listed in the plant health directive, 2000/29 EC. Some margarodid species are polyphagous, most notably *E. brasiliensis* and *E. colombianus*, therefore numerous other plants could represent potential pathways. Additional and supporting measures are shown in Sections 3.6.1.1 and 3.6.1.2.

3.6.1.1. Additional control measures

Potential additional control measures are listed in Table 9.

Table 9: Selected control measures (a full list is available in EFSA PLH Panel, 2018) for pest entry/establishment/spread/impact in relation to currently unregulated hosts and pathways. Control measures are measures that have a direct effect on pest abundance

Information sheet title (with hyperlink to information sheet if available)	Control measure summary	Risk component (entry/establishment/ spread/impact)
Growing plants in isolation	Margarodids are hypogeal and have a relatively slow natural dispersal potential. It may therefore be possible to grow plants in isolated pest free areas	Entry (limits infestation at source)
Cleaning and disinfection of facilities, tools and machinery	The physical and chemical cleaning and disinfection of facilities, tools, machinery, transport means, facilities and other accessories (e.g., boxes, pots, pallets, palox, supports, hand tools). The measures addressed in this information sheet are: washing, sweeping and fumigation Margarodids are easily spread within and between fields by soil cultivation implements and good hygiene measures are required, e.g., all soil should be washed from tractor tyres, machinery and implements when moving them between fields	Spread
Soil treatment	The control of soil organisms by chemical and physical methods listed below: a) fumigation; b) heating; c) solarisation; d) flooding; e) soil suppression; f) augmentative biological control; g) biofumigation	Entry (reduces population at source) Spread (causes mortality within established populations, reducing pressure to spread)

Information sheet title (with hyperlink to information sheet if available)	Control measure summary	Risk component (entry/establishment/spread/impact)
Roguing and pruning	Roguing is defined as the removal of infested plants and/or uninfested host plants in a delimited area, whereas pruning is defined as the removal of infested plant parts only, without affecting the viability of the plant	Entry (reduces population at source) Spread (causes mortality within established populations, reducing pressure to spread)
Crop rotation, associations and density, weed/volunteer control	Crop rotation, associations and density, weed/volunteer control are used to prevent problems related to pests and are usually applied in various combinations to make the habitat less favourable for pests The measures deal with (1) allocation of crops to field (over time and space) (multi-crop, diversity cropping) and (2) to control weeds and volunteers as hosts of pests/vectors Crop rotation using annual plants may help control the problem. Cysts, however, may remain inactive in the soil without feeding for several years. Newly emerging females may then re-infest the newly replanted crops. Crop rotation plants must therefore be alternated over a number of years	Entry (reduces population at source) Spread (causes mortality within established populations, reducing pressure to spread)
Post-entry quarantine and other restrictions of movement in the importing country	This information sheet covers post-entry quarantine of relevant commodities; temporal, spatial and end-use restrictions in the importing country for import of relevant commodities; Prohibition of import of relevant commodities into the domestic country Relevant commodities are plants, plant parts and other materials that may carry pests, either as infection, infestation, or contamination This measure is appropriate for pests infesting plants for planting that are difficult to detect. Given that margarodids are hypogeal, this measure could be considered	Spread (causes mortality within established populations, reducing pressure to spread)

3.6.1.2. Additional supporting measures

Potential additional supporting measures are listed in Table 10.

Table 10: Selected supporting measures (a full list is available in EFSA PLH Panel, 2018) in relation to currently unregulated hosts and pathways. Supporting measures are organisational measures or procedures supporting the choice of appropriate risk reduction options that do not directly affect pest abundance

Information sheet title (with hyperlink to information sheet if available)	Supporting measure summary	Risk component (entry/establishment/spread/impact)
Inspection and trapping	Inspection is defined as the official visual examination of plants, plant products or other regulated articles to determine if pests are present or to determine compliance with phytosanitary regulations (ISPM 5) The effectiveness of sampling and subsequent inspection to detect pests may be enhanced by including trapping and luring techniques Examination of the roots and taking soil samples to look for the presence of the margarodids is required. There are no effective trapping and luring techniques available	Entry

Information sheet title (with hyperlink to information sheet if available)	Supporting measure summary	Risk component (entry/ establishment/spread/ impact)
Laboratory testing	The taxonomy of scale insects is based almost entirely on the adult female morphology and a good slide preparation of a teneral female is required for identification to species level	Entry
Certified and approved premises	Mandatory/voluntary certification/approval of premises is a process including a set of procedures and of actions implemented by producers, conditioners and traders contributing to ensure the phytosanitary compliance of consignments. It can be a part of a larger system maintained by a National Plant Protection Organization in order to guarantee the fulfilment of plant health requirements of plants and plant products intended for trade. Key property of certified or approved premises is the traceability of activities and tasks (and their components) inherent the pursued phytosanitary objective. Traceability aims to provide access to all trustful pieces of information that may help to prove the compliance of consignments with phytosanitary requirements of importing countries	Entry
Delimitation of Buffer zones	ISPM 5 defines a buffer zone as 'an area surrounding or adjacent to an area officially delimited for phytosanitary purposes in order to minimize the probability of spread of the target pest into or out of the delimited area, and subject to phytosanitary or other control measures, if appropriate' (ISPM 5). The objectives for delimiting a buffer zone can be to prevent spread from the outbreak area and to maintain a pest free production place, site or area	Entry and Spread
Sampling	According to ISPM 31, it is usually not feasible to inspect entire consignments, so phytosanitary inspection is performed mainly on samples obtained from a consignment. It is noted that the sampling concepts presented in this standard may also apply to other phytosanitary procedures, notably selection of units for testing For inspection, testing and/or surveillance purposes the sample may be taken according to a statistically based or a non-statistical sampling methodology Margarodids may be detected in soil samples taken for nematode testing	Entry
Phytosanitary certificate and plant passport	An official paper document or its official electronic equivalent, consistent with the model certificates of the IPPC, attesting that a consignment meets phytosanitary import requirements (ISPM 5) a) export certificate (import) b) plant passport (EU internal trade)	Entry
Surveillance	- ISPM 5 defines surveillance as an official process which collects and records data on pest occurrence or absence by survey, monitoring or other procedures.	Spread

3.6.1.3. Biological or technical factors limiting the effectiveness of measures to prevent the entry, establishment and spread of the pest

- Margarodids are not easily detectable because of their small size and hypogeal nature.
- Margarodids form a cyst that can survive environmentally unfavourable conditions for several years. For example, Ferris (1919) reported that an adult female of *M. vitis* survived 17 years of cyst dormancy.

- Margarodids can be moved with soil.
- Many species are parthenogenetic.
- Some species are polyphagous.
- The host range of most margarodid species is inadequately recorded.
- Host plants are widely available throughout the EU.
- Availability of effective active substances registered in the EU.

3.7. Uncertainty

Host plants (see Section 3.4.1)

Biology (some species are less well-studied than others)

Impact (for species that feed on crops which are also grown in the EU, but which are not regarded as pests in their current area of distribution, there is no guarantee that they would not become pests if they established in the EU).

The significance of the different grapevine rootstocks used in Europe and South America to the susceptibility of the vines.

4. Conclusions

Dimargarodes meridionalis, *Eumargarodes laingi*, *Eurhizococcus brasiliensis*, *Eurhizococcus colombianus*, *Margarodes capensis*, *M. greeni*, *M. prieskaensis*, *M. trimeni*, *M. vitis*, *M. vredendalensis* and *Porphyrophora tritici* meet the criteria assessed by EFSA for consideration as potential Union quarantine pests (they are absent from the EU, potential pathways exist, and their establishment would cause an economic impact). The criterion of the pests being present in the EU, which is a prerequisite for RNQP and PZ QP status, is not met. Table 11 provides the summary of the conclusions for each part of the pest categorisation for these pests.

Table 11: The Panel's conclusions on the pest categorisation criteria defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column) for species of non-EU Margarodidae **reported to cause economic damage to relevant plants outside the EU** (*Dimargarodes meridionalis*, *Eumargarodes laingi*, *Eurhizococcus brasiliensis*, *Eurhizococcus colombianus*, *Margarodes capensis*, *M. greeni*, *M. prieskaensis*, *M. trimeni*, *M. vitis*, *M. vredendalensis* and *Porphyrophora tritici*)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pests (Section 3.1)	The identity of each of the 11 species (<i>Dimargarodes meridionalis</i> , <i>Eumargarodes laingi</i> , <i>Eurhizococcus brasiliensis</i> , <i>Eurhizococcus colombianus</i> , <i>Margarodes capensis</i> , <i>M. greeni</i> , <i>M. prieskaensis</i> , <i>M. trimeni</i> , <i>M. vitis</i> , <i>M. vredendalensis</i> and <i>Porphyrophora tritici</i>) is well established	The identity of each of the 11 species (<i>Dimargarodes meridionalis</i> , <i>Eumargarodes laingi</i> , <i>Eurhizococcus brasiliensis</i> , <i>Eurhizococcus colombianus</i> , <i>Margarodes capensis</i> , <i>M. greeni</i> , <i>M. prieskaensis</i> , <i>M. trimeni</i> , <i>M. vitis</i> , <i>M. vredendalensis</i> and <i>Porphyrophora tritici</i>) is well established	None
Absence/ presence of the pest in the EU territory (Section 3.2)	None of the 11 species are known to occur in the EU	None of the 11 species are known to occur in the EU and so fail this criterion	None
Regulatory status (Section 3.3)	Currently, non-European species of the genus <i>Margarodes</i> are regulated in Annex II/AI of 2000/29 EC	Currently, non-European species of the genus <i>Margarodes</i> are regulated in Annex II/AI of 2000/29 EC there are no grounds to consider this status could be revoked	None

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	Import of soil and rooted host plants for planting provide potential pathways for entry into the EU. Suitable hosts, climate and soil types occur in the EU to enable establishment	Movement of soil and rooted host plants for planting provide potential pathways for spread within the EU. Plants for planting would provide the main means of spread within the EU	None
Potential for consequences in the EU territory (Section 3.5)	Should any of the 11 species of non-native margarodid listed above enter and establish in the EU, economic impacts on relevant hosts such as grapevine would be expected		None
Available measures (Section 3.6)	Prohibition of soil		
Conclusion on pest categorisation (Section 4)	The 11 species are known to cause economic damage to hosts of importance in the EU and entry and establishment is, in principle, possible although phytosanitary control limits the likelihood of entry. The criteria to categorise these 11 species as quarantine pests are therefore satisfied	The 11 species are not known to occur in the EU and so they do not satisfy all of the criteria for them to be categorised as regulated non-quarantine pests for the EU	None
Aspects of assessment to focus on/ scenarios to address in future if appropriate	None		

Margarodes floridanus, *M. formicarum*, *M. gimenezi*, *M. salisburyensis*, *Neomargarodes cucurbitae*, *P. jashenkoi*, *P. medicaginis*, *P. minuta*, *P. parieli* and *P. ussuriensis* do not meet all criteria assessed by EFSA consideration as potential Union quarantine pests, because they are not known to cause damage to the relevant plants. The criterion of the pests being present in the EU, which is a prerequisite for RNQP and PZ QP status, is not met. Table 12 provides the summary of the conclusions for each part of the pest categorisation for these pests.

Table 12: The Panel's conclusions on the pest categorisation criteria defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column) for species of non-EU Margarodidae **not known to cause economic damage to relevant plants** (*Margarodes floridanus*, *M. formicarum*, *M. gimenezi*, *M. salisburyensis*, *Neomargarodes cucurbitae*, *P. jashenkoi*, *P. medicaginis*, *P. minuta*, *P. parieli* and *P. ussuriensis*)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Identity of the pests (Section 3.1)	The identity of each of the 10 species (<i>Margarodes floridanus</i> , <i>M. formicarum</i> , <i>M. gimenezi</i> , <i>M. salisburyensis</i> , <i>Neomargarodes cucurbitae</i> , <i>P. jashenkoi</i> , <i>P. medicaginis</i> , <i>P. minuta</i> , <i>P. parieli</i> and <i>P. ussuriensis</i>) is well established	The identity of each of the 10 species is well established	None

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union regulated non-quarantine pest	Key uncertainties
Absence/ presence of the pest in the EU territory (Section 3.2)	None of the 10 species are known to occur in the EU	None of the 10 species are known to occur in the EU and so fail this criterion	None
Regulatory status (Section 3.3)	Currently, non-European species of the genus <i>Margarodes</i> are regulated in Annex II/AI of 2000/29 EC	Currently, non-European species of the genus <i>Margarodes</i> are regulated in Annex II/AI of 2000/29 EC there are no grounds to consider this status could be revoked	None
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	Import of soil and rooted host plants for planting provide potential pathways for entry into the EU. Suitable hosts, climate and soil types occur in the EU to enable establishment	Movement of soil and rooted host plants for planting provide potential pathways for spread within the EU. Plants for planting would provide the main means of spread within the EU	None
Potential for consequences in the EU territory (Section 3.5)	There is no evidence that these species have any harmful impacts on their hosts so this criterion is not satisfied	There is no evidence that these species have any harmful impacts on their hosts so this criterion is not satisfied	None
Available measures (Section 3.6)	Prohibition of soil		
Conclusion on pest categorisation (Section 4)	Entry and establishment of these 10 species in the EU is, in principle, possible although phytosanitary control limits the likelihood of entry. Nevertheless, they are not known to cause economic damage to hosts of importance in the EU and so not all of the criteria to categorise these 10 species as quarantine pests have been satisfied	The 10 species are not known to occur in the EU, nor are they known to cause any impacts, hence they do not satisfy all of the criteria for them to be categorised as regulated non-quarantine pests for the EU	None
Aspects of assessment to focus on/ scenarios to address in future if appropriate	Likelihood of any impact in the EU		

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Glossary

Containment (of a pest)	Application of phytosanitary measures in and around an infested area to prevent spread of a pest (FAO, 1995, 2017)
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO, 1995, 2017)

Entry (of a pest)	Movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled (FAO, 2017)
Eradication (of a pest)	Application of phytosanitary measures to eliminate a pest from an area (FAO, 2017)
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO, 2017)
Impact (of a pest)	The impact of the pest on the crop output and quality and on the environment in the occupied spatial units
Introduction (of a pest)	The entry of a pest resulting in its establishment (FAO, 2017)
Measures	Control (of a pest) is defined in ISPM 5 (FAO 2017) as "Suppression, containment or eradication of a pest population" (FAO, 1995). Control measures are measures that have a direct effect on pest abundance. Supporting measures are organisational measures or procedures supporting the choice of appropriate Risk Reduction Options that do not directly affect pest abundance.
Pathway	Any means that allows the entry or spread of a pest (FAO, 2017)
Phytosanitary measures	Any legislation, regulation or official procedure having the purpose to prevent the introduction or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests (FAO, 2017)
Protected zones (PZ)	A Protected zone is an area recognised at EU level to be free from a harmful organism, which is established in one or more other parts of the Union.
Quarantine pest	A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled (FAO, 2017)
Regulated non-quarantine pest	A non-quarantine pest whose presence in plants for planting affects the intended use of those plants with an economically unacceptable impact and which is therefore regulated within the territory of the importing contracting party (FAO, 2017)
Risk reduction option (RRO)	A measure acting on pest introduction and/or pest spread and/or the magnitude of the biological impact of the pest should the pest be present. A RRO may become a phytosanitary measure, action or procedure according to the decision of the risk manager
Spread (of a pest)	Expansion of the geographical distribution of a pest within an area (FAO, 2017)

Abbreviations

DG SANTÉ	Directorate General for Health and Food Safety
EPPO	European and Mediterranean Plant Protection Organization
EUROSTAT	Statistical Office of the European Communities
FAO	Food and Agriculture Organization
IPPC	International Plant Protection Convention
ISPM	International Standards for Phytosanitary Measures
MS	Member State
PHYSAN	Phyto-Sanitary Controls
PLH	EFSA Panel on Plant Health
PZ	Protected Zone
RNQP	Regulated Non-Quarantine Pest
TFEU	Treaty on the Functioning of the European Union
ToR	Terms of Reference

Appendix A – Identity and taxonomy of 11 species of non-EU Margarodidae satisfying criteria to be regarded as EU quarantine pests

Name	Synonyms	Common name and notes on identification	Impact reports on potential EU hosts
<i>Dimargarodes meridionalis</i> (Morrison, 1927)	<i>Margarodes meridionalis</i> Morrison, 1927; <i>Coccionella meridionalis</i> (Morrison)	Commonly known as the centipede grass ground pearl (Gill, 1993) Can be identified using the diagnostic keys to <i>Margarodes</i> by Morrison (1928) and McDaniel (1965, 1966, to <i>Margarodes</i> present in North America)	Poaceae: various unspecified grasses. Vitaceae: <i>Vitis vinifera</i> . In USA, serious pest of lawns, golf courses and grass farms
<i>Eumargarodes laingi</i> Jakubski 1950	<i>Eumargarodes laingi</i> Jakubski 1950; <i>Margarodes dactyloides</i> McDaniel 1966	Commonly known as the pink ground pearl. Can be identified using the key by Morrison (1928) and McDaniel (1966)	Poaceae: Various grasses. In USA pest of turfgrasses
<i>Eurhizococcus brasiliensis</i> (Wille, 1922)	<i>Margarodes brasiliensis</i> Wille 1922; <i>Margarodes brasiliensis</i> (Wille), <i>Eurhizococcus brasiliensis</i> (Wille); <i>Margarodes soria</i> Foldi 1987	Can be identified using the keys by Campos da Silva and Carvalho (2012, to the subfamily Termitococcinae) and (Kondo and Gómez, 2008, separates the two-species assigned to the genus <i>Eurhizococcus</i>)	Major pest of vineyards in Brazil (Botton et al., 2010); pest of blackberry, blueberry, vineyards (Kalvelage, 1987; Efrom et al., 2012); reared on potato and winter squash by Foldi (2005)
<i>Eurhizococcus colombianus</i> Jakubski 1965	<i>Eurhizococcus brasiliensis</i> (Wille, 1922) (misidentification, for details see Jakubski, 1965); <i>Eurhizococcus silvestri</i> Jakubski (<i>nomen nudum</i> , see Jakubski, 1965)	Can be identified using the keys by Campos da Silva and Carvalho (2012, to the Termitococcinae) and Kondo and Gómez (2008, separates the two-species assigned to the genus <i>Eurhizococcus</i>)	Pest of grapevines (Botton et al., 2010), also feeds on <i>Rubus</i> (Kondo and Gómez, 2008)
<i>Margarodes capensis</i> Giard 1897	<i>Margarodes (Sphaeraspis) capensis</i> Giard 1897; <i>Coccionella capensis</i> (Giard)	Can be identified by using the diagnostic keys to <i>Margarodes</i> by Morrison (1928). de Klerk (1982) provide a detailed description and illustration of this species	Pest of grapevine (de Klerk, 1982; Foldi, 2005)
<i>Margarodes greeni</i> Brain 1915	<i>Coccionella greeni</i> (Brain); <i>Promargarodes greeni</i> (Brain)	de Klerk (1982) and Jakubski (1965) provide descriptions and illustrations of <i>M. greeni</i>	Pest of grapevine (Foldi, 2005)
<i>Margarodes prieskaensis</i> (Jakubski 1965)	<i>Sphaeraspis prieskaensis</i> Jakubski 1965	de Klerk (1982) provide a description and illustration of <i>M. prieskaensis</i> and there is an excellent EPPO diagnostic standard for the identification of <i>M. prieskaensis</i> , <i>M. vitis</i> and <i>M. vredendalensis</i> (OEPP/EPPO, 2007)	Pest of grapevine (du Toit, 1975; Foldi, 2005)
<i>Margarodes trimeni</i> Giard 1897	<i>Coccionella trimeni</i> (Giard)	Can be identified using the diagnostic key to the <i>Margarodes</i> by Morrison (1928). de Klerk (1982) provide a description and illustration of this species	

Name	Synonyms	Common name and notes on identification	Impact reports on potential EU hosts
<i>Margarodes vitis</i> (Philippi 1884)	<i>Heterodera vitis</i> Philippi 1884; <i>Margarodes vitium</i> Giard 1894; <i>Margarodes trilobitum</i> Reed, 1895; <i>Margarodes</i> (<i>Sphaeraspis</i>) <i>vitium</i> (Philippi); <i>Margarodes vitium</i> (Philippi); <i>Margarodes vitium orientalis</i> Silvestri 1939; <i>Sphaeraspis vitis</i> (Philippi); <i>Margarodes orientalis</i> (Philippi)	Commonly known as the 'grape ground pearl' (Foldi, 2005) and 'margarodes del la vid' in Spanish (González, 1989). Can be identified using the diagnostic key to the <i>Margarodes</i> by Morrison (1928) and there is an EPPO diagnostic standard for the identification of <i>M. prieskaensis</i> , <i>M. vitis</i> and <i>M. vredendalensis</i> (OEPP/EPPO, 2007)	Pest of grapevine (Olalquiaga Fauré and Contesse Pinto, 1959; Gonzalez et al., 1969; Gonzalez, 1983; Foldi, 2005)
<i>Margarodes vredendalensis</i> de Klerk 1983	<i>Margarodes vredendalensis</i> de Klerk 1980 (<i>nomen nudum</i>)	Can be identified using the EPPO diagnostic standard for <i>M. prieskaensis</i> , <i>M. vitis</i> and <i>M. vredendalensis</i> (OEPP/EPPO, 2007)	Pest of grapevine (de Klerk, 1980 – identity uncertain – see 1982; Foldi, 2005)
<i>Porphyrophora tritici</i> (Bodenheimer 1941)	<i>Margarodes tritici</i> Bodenheimer 1941; <i>Acystomargarodes tritici</i> (Bodenheimer); <i>Coccionella tritici</i> (Bodenheimer)	Commonly known in German as kleinasiatische and Weizenwurzelschildlaus. Vahedi and Hodgson (2007) provide a diagnostic key to the <i>Porphyrophora</i> species present in Europe, the Middle East and North Africa, including <i>P. tritici</i>	Pest of wheat and barley (Safar Alizadeh and Bahador, 1987; Vahedi, 2001; Foldi, 2005)

Appendix B – Margarodidae of the World

(Sources: EPPO Global database online, accessed on 10 December 2018; García Morales et al. (2019), accessed on 10 December 2018, and references cited therein). Includes species in Appendix A.

Margarodid species	Host plants	Hosts of economic importance in the EU	Geographical distribution
<i>Dimargarodes mediterraneus</i> (Silvestri)	Poaceae: <i>Cynodon dactylon</i> . Xanthorrhoeaceae: <i>Asphodelus macrocarpus</i> .		France, Greece, Italy, Spain, Ukraine
<i>Dimargarodes meridionalis</i> (Morrison)	Poaceae: <i>Cynodon dactylon</i> and various unspecified grasses. Vitaceae: <i>Vitis vinifera</i>	<i>Vitis vinifera</i>	USA (southern states)
<i>Dimargarodes tanganyicus</i> Jakubski	Unknown		Tanzania
<i>Eumargarodes laingi</i> Jakubski	Poaceae: <i>Buchloe dactyloides</i> , <i>Cynodon dactylon</i> , <i>Eremochloa ophiuroides</i> , <i>Saccharum officinarum</i> , <i>Stenotaphrum secundatum</i> , <i>Zoysia</i> and unspecified grasses		Australia, USA (southern states)
<i>Eurhizococcus brasiliensis</i> (Wille)	Amaryllidaceae: <i>Amaryllis</i> . Apiaceae: <i>Apium graveolens</i> ; <i>Daucus carota</i> ; <i>Petroselinum crispum</i> ; <i>Pimpinella anisum</i> . Asteraceae: <i>Amphiachyris</i> ; <i>Baccharis genistelloides</i> ; <i>Chaptalia nutans</i> ; <i>Cichorium endivia</i> ; <i>Cichorium intybus</i> ; <i>Dahlia</i> ; <i>Lactuca sativa</i> ; <i>Matricaria</i> ; <i>Solidago chilensis</i> . Brassicaceae: <i>Brassica napus</i> ; <i>Brassica nigra</i> ; <i>Brassica rapa</i> ; <i>Raphanus sativus</i> . Convolvulaceae: <i>Ipomoea batatas</i> . Cucurbitaceae: <i>Cucurbita maxima</i> , <i>Lagenaria siceraria</i> ; <i>Sechium edule</i> . Ericaceae: <i>Vaccinium</i> . Euphorbiaceae: <i>Croton antisiphiliticus</i> ; <i>Manihot esculenta</i> ; <i>Manihot palmata</i> . Fabaceae: <i>Arachis hypogaea</i> ; <i>Medicago sativa</i> . Juglandaceae: <i>Juglans regia</i> . Lamiaceae: <i>Ocimum basilicum</i> ; <i>Salvia officinalis</i> ; <i>Salvia splendens</i> . Lythraceae: <i>Punica granatum</i> . Malvaceae: <i>Abelmoschus esculentus</i> . Myrtaceae: <i>Acca sellowiana</i> . Onagraceae: <i>Fuchsia</i> . Oxalidaceae: <i>Oxalis articulata</i> ; <i>Oxalis conorrhiza</i> . Phytolaccaceae: <i>Phytolacca americana</i> . Polygonaceae: <i>Rumex</i> . Rosaceae: <i>Cydonia oblonga</i> ; <i>Malus prunifolia</i> ; <i>Prunus domestica</i> ; <i>Prunus persica</i> ; <i>Pyrus communis</i> ; <i>Rubus</i> ; <i>Rubus idaeus</i> . Rubiaceae: <i>Gardenia</i> . Salicaceae: <i>Salix babylonica</i> ; <i>Salix humboldtiana</i> . Talinaceae: <i>Talinum paniculatum</i> . Vitaceae: <i>Vitis vinifera</i>	<i>Apium graveolens</i> , <i>Daucus carota</i> , <i>Petroselinum crispum</i> , <i>Cichorium endivia</i> , <i>Lactuca sativa</i> , <i>Brassica napus</i> , <i>Brassica rapa</i> , <i>Ipomoea batatas</i> , <i>Vaccinium</i> , <i>Medicago sativa</i> , <i>Juglans regia</i> , <i>Ocimum basilicum</i> , <i>Salvia officinalis</i> , <i>Punica granatum</i> , <i>Abelmoschus esculentus</i> , <i>Cydonia oblonga</i> , <i>Malus prunifolia</i> , <i>Prunus domestica</i> , <i>Prunus persica</i> , <i>Pyrus communis</i> , <i>Rubus idaeus</i> , <i>Vitis vinifera</i>	Brazil (south)
<i>Eurhizococcus brevicornis</i> (Silvestri)	Unknown		Paraguay

Margarodid species	Host plants	Hosts of economic importance in the EU	Geographical distribution
<i>Eurhizococcus colombianus</i> Jakubski	Apiaceae: <i>Arracacia xanthorrhiza</i> . Lauraceae: <i>Persea americana</i> . Rosaceae: <i>Rubus</i> . Umbelliferae: <i>Arracacia xanthorrhiza</i> . Vitaceae: <i>Vitis labrusca</i>	<i>Persea americana</i> ; <i>Rubus</i> ; <i>Vitis labrusca</i>	Colombia
<i>Heteromargarodes americanus</i> Jakubski	Unknown		USA
<i>Heteromargarodes chukar</i> La Rivers	Poaceae: <i>Broma tectorum</i>		USA, Mexico
<i>Heteromargarodes hiemalis</i> (Cockerell)	Amaranthaceae: <i>Atriplex canescens</i> . Fabaceae: <i>Prosopis glandulosa</i>		USA
<i>Margarodes aurelianus</i> (Hall)	Poaceae: <i>Cynodon dactylon</i>		Sudan
<i>Margarodes australis</i> (Jakubski)	Poaceae: <i>Saccharum officinarum</i>		Australia, Papua New Guinea
<i>Margarodes basrahensis</i> Jakubski	Unknown		Iraq
<i>Margarodes cadeti</i> Foldi	Poaceae: <i>Saccharum officinarum</i>		Burkina Faso
<i>Margarodes capensis</i> (Giard)	Vitaceae: <i>Vitis vinifera</i>	<i>Vitis vinifera</i>	South Africa
<i>Margarodes carvalhoi</i> Costa Lima	Poaceae: <i>Saccharum officinarum</i>		Brazil
<i>Margarodes congolensis</i> Jakubski	Unknown		Congo
<i>Margarodes floridanus</i> Jakubski	Rutaceae: <i>Citrus sinensis</i>	<i>Citrus sinensis</i>	USA (Florida)
<i>Margarodes formicarum</i> Guilding	Euphorbiaceae: <i>Acalypha</i> . Poaceae: <i>Saccharum</i> . Rutaceae: <i>Citrus aurantium</i>	<i>Citrus</i>	Antigua and Barbuda; Bahamas; Barbados; Chile; Montserrat; Puerto Rico and Vieques Island; Saint Kitts and Nevis Islands; US Virgin Islands
<i>Margarodes gallicus</i> (Signoret)	Polygonaceae: <i>Polygonum aviculare</i>		France
<i>Margarodes gimenezi</i> (Podtiaguin)	Rutaceae: <i>Citrus aurantium</i>	<i>Citrus aurantium</i>	Paraguay
<i>Margarodes greeni</i> Brain	Vitaceae: <i>Vitis vinifera</i>	<i>Vitis vinifera</i>	South Africa
<i>Margarodes morrisoni</i> McDaniel	Poaceae: <i>Stenotaphrum secundatum</i>		USA
<i>Margarodes newsteadi</i> (Brain)	Poaceae: unspecified grass		South Africa
<i>Margarodes papillosus</i> (Green)	Poaceae: <i>Cynodon dactylon</i>		India
<i>Margarodes paulistus</i> (Silvestri)	Poaceae: unspecified grass		Brazil
<i>Margarodes peringueyi</i> (Brain)	Poaceae: unspecified grass		South Africa
<i>Margarodes perrisii</i> (Signoret)	Unknown		France

Margarodid species	Host plants	Hosts of economic importance in the EU	Geographical distribution
<i>Margarodes prieskaensis</i> Jakubski	Vitaceae: <i>Vitis vinifera</i>	<i>Vitis vinifera</i>	South Africa
<i>Margarodes rileyi</i> (Giard)	Unknown		Bahamas, Jamaica and USA (Florida)
<i>Margarodes ruber</i> (Brain)	Poaceae: unspecified grass		South Africa
<i>Margarodes salisburyensis</i> (Hall)	Poaceae: <i>Pennisetum clandestinum</i> ; <i>Saccharum officinarum</i> ; <i>Zea mays</i>	<i>Zea mays</i>	Zimbabwe
<i>Margarodes similis</i> Morrison	Burseraceae: <i>Bursera graveolens</i> , <i>Bursera</i> . Celastraceae: <i>Maytenus</i> , <i>Tricerna octogonu</i> ; Goodeniaceae: <i>Scaevola</i>		Ecuador (Galapagos Islands)
<i>Margarodes sinensis</i> (Silvestri)	Poaceae: unspecified grass		China
<i>Margarodes trimeni</i> Giard	Poaceae: unspecified grass; Vitaceae: <i>Vitis vinifera</i>	<i>Vitis vinifera</i>	South Africa
<i>Margarodes upingtonensis</i> de Klerk	Poaceae: <i>Cynodon dactylon</i>		South Africa
<i>Margarodes vitis</i> (Philippi)	Cactaceae: <i>Opuntia</i> . Rhamnaceae: <i>Colletia spinosissima</i> ; Vitaceae: <i>Vitis vinifera</i>	<i>Vitis vinifera</i>	Argentina; Brazil; Chile; Paraguay, Uruguay; Venezuela
<i>Margarodes vredendalensis</i> de Klerk	Vitaceae: <i>Vitis vinifera</i>	<i>Vitis vinifera</i>	South Africa
<i>Margarodes williamsi</i> (Jakubski)	Unknown		Ghana
<i>Margarodesia desmieri</i> Foldi	Arecaceae: <i>Elaeis guineensis</i> (African oil palm)		Cote d'Ivoire
<i>Neomargarodes aethiopicus</i> Silvestri	Unknown		Eritrea
<i>Neomargarodes aristidae</i> Borchsenius	Poaceae: <i>Aristida</i> , <i>Stipagrostis pennata</i> , <i>Stipagrostis pungens</i>		Algeria, Kazakhstan, Libya, Turkmenistan, Uzbekistan
<i>Neomargarodes chondrillae</i> Archangelskaya	Asteraceae: <i>Chondrilla</i> . Malvaceae: <i>Gossypium hirsutum</i>		China, Kazakhstan
<i>Neomargarodes cucurbitae</i> Tang and Hao	Cucurbitaceae: <i>Cucurbita</i>	<i>Cucurbita</i>	China (Shanxi)
<i>Neomargarodes erythrocephalus</i> Green	Unknown		Algeria, Sudan, Western Sahara, Yemen
<i>Neomargarodes europaeus</i> Goidanich	Poaceae: <i>Cynodon dactylon</i>		France, Italy (Sicily)
<i>Neomargarodes festucae</i> Archangelskaya	Poaceae: <i>Cleistogenes serotina</i> , <i>Dactylis</i> , <i>Festuca ovina</i> , <i>Festuca rupicola</i> , <i>Festuca vaginata</i> , <i>Koeleria macrantha</i> , <i>Koeleria vallesiana</i> , <i>Stipa capillata</i>		Czech Republic, France, Georgia, Hungary, Italy, Poland, Turkey, Ukraine
<i>Neomargarodes hyparrheniae</i> Hall	Poaceae: <i>Hyparrhenia filipendula</i>		Zimbabwe

Margarodid species	Host plants	Hosts of economic importance in the EU	Geographical distribution
<i>Neomargarodes niger</i> (Green)	Fabaceae: <i>Alhagi maurorum</i> , <i>Arachi hypogaea</i> . Poaceae: <i>Cynodon dactylon</i>		China, India, Pakistan
<i>Neomargarodes pilosus</i> (Jakubski)	Unknown		South Africa
<i>Neomargarodes polygonis</i> Jashenko	Unknown		Kazakhstan
<i>Neomargarodes ramosus</i> Jashenko	Poaceae: <i>Agropyron cristatum</i> , <i>Agropyron fragile</i> , <i>Leymus angustus</i> , <i>Leymus racemosus</i> , <i>Stipa kirghisorum</i> , <i>Stipa lessingiana</i> , <i>Stipa sareptana</i>		Kazakhstan
<i>Neomargarodes rutae</i> Borchsenius	Rutaceae: <i>Haplophyllum pedicellatum</i> , <i>Ruta</i>		Uzbekistan
<i>Neomargarodes setosus</i> Borchsenius	Poaceae: <i>Cleistogenes serotina</i> , <i>Festuca ovina</i> , <i>Festuca rupicola</i> , <i>Festuca</i> , <i>Stipa bromoides</i> , <i>Stipa kirghisorum</i> , <i>Stipa</i>		Georgia
<i>Neomargarodes trabuti</i> Marchal	Plumbaginaceae: <i>Limoniastrum guyonianum</i>		Algeria, Tunisia
<i>Neomargarodes triodonotus</i> Jashenko	Poaceae: unspecified grass		Kazakhstan
<i>Porphyrophora akirtobiensis</i> Jashenko	Poaceae: <i>Festuca</i>		Kazakhstan
<i>Porphyrophora altaiensis</i> Jashenko	Unknown		Kazakhstan
<i>Porphyrophora arnebiae</i> (Archangelskaya)	Asteraceae: <i>Artemisia cinn</i> . Boraginaceae: <i>Arnebia guttata</i> , <i>Lappula</i>		Kazakhstan, Uzbekistan
<i>Porphyrophora bolivari</i> (Balachowsky)	Caryophyllaceae: <i>Arenaria tetraquetra</i>		Spain
<i>Porphyrophora buxtoni</i> (Newstead)	Unknown		Algeria
<i>Porphyrophora chelodonta</i> Vahedi	Unknown		Iran
<i>Porphyrophora crithmi</i> (Goux)	Apiaceae: <i>Crithmum maritimum</i>		France
<i>Porphyrophora cynodontis</i> (Archangelskaya)	Poaceae: <i>Aeluropus littoralis</i> , <i>Cynodon dactylon</i> , <i>Phragmites</i>		Iran, Uzbekistan
<i>Porphyrophora elinae</i> Jashenko	Unknown		Kazakhstan
<i>Porphyrophora embiensis</i> Jashenko	Poaceae: <i>Agropyron acutiforme</i>		Kazakhstan
<i>Porphyrophora epigaea</i> Danzig	Euphorbiaceae. Fabaceae: <i>Astragalus</i> . Poaceae: <i>Poa bulbosa</i>		Uzbekistan
<i>Porphyrophora eremospartonae</i> Jashenko	Fabaceae: <i>Eremosparton aphyllum</i>		Kazakhstan
<i>Porphyrophora erythraea</i> Silvestri	Unknown		Eritrea

Margarodid species	Host plants	Hosts of economic importance in the EU	Geographical distribution
<i>Porphyrophora gigantea</i> Jashenko	Poaceae: <i>Leymus racemosus</i>		Kazakhstan
<i>Porphyrophora hamelii</i> (Brandt in Brandt and Ratzeburg)	Poaceae: <i>Aeluropus lagopoides</i> , <i>Aeluropus littoralis</i> , <i>Cynodon</i> , <i>Phragmites australis</i> , <i>Poa</i>		Armenia, Iran, Turkey
<i>Porphyrophora hirsutissima</i> (Hall)	Poaceae: <i>Chloris gayana</i> , <i>Imperata cylindrica</i>		Egypt
<i>Porphyrophora iliensis</i> Matesova and Jashenko	Amaranthaceae: <i>Camphorosma monspeliaca</i>		Kazakhstan
<i>Porphyrophora indica</i> Green	Unknown		Nepal
<i>Porphyrophora italica</i> Goidanich	Poaceae: <i>Avena sativa</i> , <i>Catapodium</i>	<i>Avena sativa</i>	Italy
<i>Porphyrophora ivorontzovi</i> Jashenko	Caryophyllaceae: <i>Gypsophilla trichotoma</i>		Kazakhstan
<i>Porphyrophora jaapi</i> Jakubski	Fabaceae: <i>Lotus cytisoides</i>		Croatia
<i>Porphyrophora jakubskii</i> Vahedi	Unknown		Armenia
<i>Porphyrophora jashenkoi</i> Vahedi	Poaceae: <i>Triticum aestivum</i>	<i>Triticum aestivum</i>	Iran
<i>Porphyrophora kazakhstanica</i> Matesova and Jashenko	Unknown		Kazakhstan
<i>Porphyrophora ketmeniensis</i> Jashenko	Unknown		Kazakhstan
<i>Porphyrophora kiritshenkoi</i> Jakubski	Fabaceae: <i>Securigera varia</i>		Ukraine
<i>Porphyrophora lappulae</i> Jashenko	Boraginaceae: <i>Lappula microcarpa</i>		Kazakhstan
<i>Porphyrophora libica</i> Silvestri	Fabaceae		Libya
<i>Porphyrophora madraguensis</i> (Goux)	Poaceae: <i>Festuca ovina</i>		France
<i>Porphyrophora matesovae</i> Jashenko	Poaceae: <i>Psathyrostachys fragilis</i>		Kazakhstan
<i>Porphyrophora medicaginis</i> Jashenko	Fabaceae: <i>Medicago</i> , <i>Medicago falcata</i> , <i>Medicago sativa</i> . Poaceae: <i>Cynodon</i> , <i>Phragmites</i>	<i>Medicago sativa</i>	Iran, Kazakhstan
<i>Porphyrophora minuta</i> Borchsenius	Brassicaceae: <i>Diplotaxis tenuifolia</i> , <i>Lepidium draba</i> . Fabaceae: <i>Medicago sativa</i>	<i>Medicago sativa</i>	Turkey, Ukraine
<i>Porphyrophora mongolica</i> Jashenko	Poaceae: <i>Achnatherum</i>		Mongolia
<i>Porphyrophora monticola</i> Borchsenius	Fabaceae: <i>Dorycnium graecum</i> , <i>Dorycnium pentaphyllum</i> , <i>Securigera varia</i>		Armenia, Georgia
<i>Porphyrophora nuda</i> (Archangelskaya)	Poaceae: <i>Cynodon dactylon</i> , <i>Festuca</i> , <i>Festuca rupicola</i> , <i>Hordeum</i> , <i>Hordeum murinum</i> , <i>Lolium</i> , <i>Poa bulbosa</i>		Azerbaijan, Kazakhstan, Uzbekistan

Margarodid species	Host plants	Hosts of economic importance in the EU	Geographical distribution
<i>Porphyrophora odorata</i> (Archangelskaya)	Caryophyllaceae: <i>Acanthophyllum spinosum</i> , <i>Dianthus crinitus</i> , <i>Silene</i> . Fabaceae: <i>Medicago</i> Plumbaginaceae: <i>Acantholimon</i>		Tajikistan, Uzbekistan
<i>Porphyrophora parieli</i> (Vayssière)	Poaceae: <i>Hordeum vulgare</i>	<i>Hordeum vulgare</i>	Morocco
<i>Porphyrophora polonica</i> (Linnaeus)	Asteraceae: <i>Pilosella officinarum</i> . Boraginaceae: <i>Alkanna</i> Caryophyllaceae: <i>Cerastium</i> ; <i>Dianthus</i> ; <i>Gypsophila fastigiata</i> ; <i>Herniaria</i> ; <i>Scleranthus</i> ; <i>Scleranthus perennis</i> ; <i>Spergularia</i> . Fabaceae: <i>Caragana</i> ; <i>Caragana korshinskii</i> ; <i>Lens culinaris</i> ; <i>Medicago</i> . Orobanchaceae: <i>Melampyrum</i> . Poaceae: <i>Agropyron</i> ; <i>Festuca</i> ; <i>Koeleria micrathera</i> . Rosaceae: <i>Dasiphora subcaulis</i> ; <i>Fragaria</i> ; <i>Potentilla</i> ; <i>Potentilla inclinata</i> ; <i>Potentilla recta</i> ; <i>Sibbaldianthe bifurca</i>		China, Czech Republic, France, Germany, Hungary, Kazakhstan, Lithuania, Netherlands, Poland, Slovakia, Sweden, Switzerland, Turkey
<i>Porphyrophora rhodesiensis</i> Hall	Poaceae: <i>Hyparrhenia filipendula</i>		Zimbabwe
<i>Porphyrophora salsa</i> Jashenko	Poaceae: <i>Psathyrostachys juncea</i>		Kazakhstan
<i>Porphyrophora sophorae</i> (Archangelskaya)	Fabaceae: <i>Glycyrrhiza glabra</i> , <i>Glycyrrhiza uralensis</i> , <i>Hedysarum scoparium</i> , <i>Sophora alopecuroides</i> , <i>Sophora flavescens</i>		China, Kazakhstan, Uzbekistan
<i>Porphyrophora tritici</i> (Bodenheimer)	Poaceae: <i>Hordeum vulgare</i> ; <i>Triticum aestivum</i> ; <i>Triticum durum</i>	<i>Hordeum vulgare</i> ; <i>Triticum aestivum</i> ; <i>Triticum durum</i>	Armenia, Iran, Syria, Turkey
<i>Porphyrophora turaigiriensis</i> Jashenko	Poaceae: <i>Festuca rupicola</i>		Kazakhstan
<i>Porphyrophora turkmenica</i> Jashenko	Euphorbiaceae: <i>Euphorbia</i>		Turkmenistan
<i>Porphyrophora ussuriensis</i> Borchsenius	Poaceae: <i>Cleistogenes</i> . Rosaceae: <i>Fragaria</i> , <i>Potentilla</i>	<i>Fragaria</i>	China, Mongolia, Russia
<i>Porphyrophora victoriae</i> Jashenko	Brassicaceae: <i>Lepidium draba</i> . Caryophyllaceae: <i>Acanthophyllum pungens</i>		Iran, Kazakhstan
<i>Porphyrophora villosa</i> Danzig	Asteraceae: <i>Artemisia</i> . Fabaceae		Russia
<i>Porphyrophora violaceae</i> Matesova and Jashenko	Boraginaceae: <i>Lappula semiglabra</i>		Kazakhstan
<i>Porphyrophora yemenica</i> Yang	Unknown		Yemen
<i>Termitococcus aster</i> Silvestri	Unknown		Paraguay
<i>Termitococcus carratoi</i> Silvestri	Poaceae: unspecified grass		Brazil

Appendix C – Margarodidae present in the EU

Source: García Morales et al. (2019)

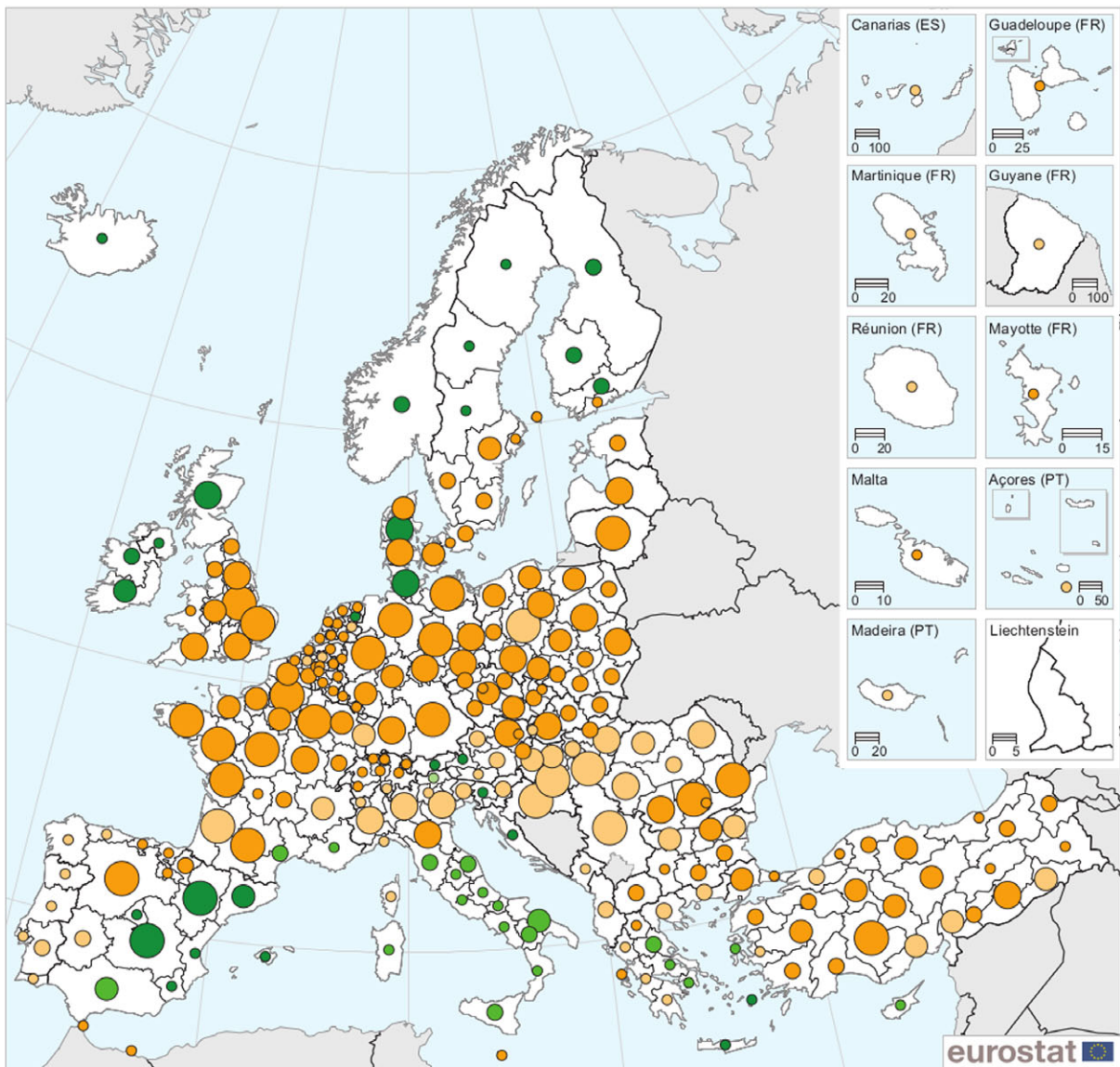
Margarodid species	Distribution in the EU
<i>Dimargarodes mediterraneus</i> (Silvestri)	France, Greece, Italy and Spain
<i>Margarodes gallicus</i> (Signoret)	France
<i>Margarodes perrisii</i> (Signoret)	France
<i>Neomargarodes festucae</i> Archangelskaya	Czech Republic, France, Hungary, Italy and Poland
<i>Porphyrophora bolivari</i> (Balachowsky)	Spain
<i>Porphyrophora crithmi</i> (Goux)	France
<i>Porphyrophora italica</i> Goidanich	Italy
<i>Porphyrophora jaapi</i> Jakubski	Croatia
<i>Porphyrophora madraguensis</i> (Goux)	France
<i>Porphyrophora polonica</i> (L.)	Czech Republic, France, Germany, Hungary, Lithuania, Netherlands, Poland, Slovakia and Sweden

Appendix D – Identity and economically important hosts growing in the EU of 10 species of non-EU Margarodidae failing to satisfy all criteria to be regarded as EU quarantine pests

Name	Hosts
<i>Margarodes floridanus</i> (Jakubski)	<i>Citrus sinensis</i> (sweet orange)
<i>Margarodes formicarum</i> Guilding	<i>Citrus</i>
<i>Margarodes gimenezi</i> (Podtiaguin)	<i>Citrus x aurantium</i> (Seville orange)
<i>Margarodes salisburyensis</i> (Hall)	<i>Zea mays</i> (maize)
<i>Neomargarodes cucurbitae</i> Tang and Hao	<i>Cucurbita</i>
<i>Porphyrophora jashenkoi</i> Vahedi	<i>Triticum aestivum</i> (common wheat)
<i>Porphyrophora medicaginis</i> Jashenko	<i>Medicago sativa</i> (alfalfa)
<i>Porphyrophora minuta</i> Borchsenius	<i>Medicago sativa</i> (alfalfa)
<i>Porphyrophora parieli</i> (Vayssière)	<i>Hordeum vulgare</i> (barley)
<i>Porphyrophora ussuriensis</i> Borchsenius	<i>Fragaria</i> (strawberry)

Appendix E – Harvested production of most common cereals

Harvested production of cereals (including seed) and most commonly grown cereals, by NUTS 2 regions, 2016
(million tonnes)



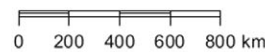
Most commonly grown cereal

- Common wheat and spelt
- Grain maize and corn-cob mix
- Barley
- Durum wheat
- Rye and winter cereal mixtures (maslin)

EU-28 = 301.7
Harvested production of cereals (including seed)

- < 0.5
- 0.5 - < 1.5
- 1.5 - < 2.5
- 2.5 - < 3.5
- ≥ 3.5

Administrative boundaries: © EuroGeographics © UN-FAO © Turkstat
Cartography: Eurostat — GISCO, 06/2018



Note: the map shows the harvested production of cereals (including seed) as proportional circles for each region, while the colour of each circle denotes the most commonly grown cereal in that region. Germany and the United Kingdom: NUTS level 1. Norway, Albania and Serbia: national data. Toscana (IT1) and the United Kingdom: 2015. Montenegro: provisional.

Source: Eurostat (online data code: agr_r_acs)

Appendix F – Harvested area of *Vitis* sp. in EU (28) by use, 2013–2018 (ha).

Source: EUROSTAT (accessed on 21.2.2019)

Year/ Use Eurostat code	Grapes W1000	Grapes for wines W1100	Grapes for table use W1200	Grapes for raisins W1200
2013	:	3,062.75	98.67	:
2014	:	3,024.07	95.80	:
2015	3,167.97	3,019.20	93.71	:
2016	3,141.92	2,990.71	95.03	25.44
2017	3,143.14	:	:	:
2018	:	:	:	:

': no data available.

Appendix G – Soil comparison (FAO classification)

The maps below show that soil types in regions where non-EU Margarodidae occur are also found across the EU.

