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Pest categorisation of *Oligonychus perseae*

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Abstract

The EFSA Panel on Plant Health performed a pest categorisation of *Oligonychus perseae* (Acari: Prostigmata: Tetranychidae), the persea mite, for the EU. *O. perseae* is a tropical species that originated in Mesoamerica and has now spread and established in California, Florida, Hawaii, Morocco, southern Europe and Israel. Within the EU, it is established in Italy, Portugal and Spain. *O. perseae* is not listed in Commission Implementing Regulation (EU) 2019/2072. It is polyphagous, feeding on plants in 20 genera in 17 families. It is most frequently reported on avocado (*Persea americana*), where it is considered a key pest. No evidence was found indicating damage to other crops. *O. perseae* live on leaves and do not attack the fruit. Populations usually grow exponentially at the beginning of summer and decline at the end of this season. High population densities can cause severe defoliation, resulting in downgrading of fruit through sunburn. However, this type of damage is common only if trees additionally suffer from water stress. The lack of additional avocado pests in the EU, which facilitates the production of organic avocados, is jeopardised by the occurrence of this mite, as it may require pesticide applications. This is why *O. perseae* is considered an important pest of avocados in Spain, where more than 80% of EU avocado production occurs. Natural dispersal is restricted to neighbouring trees. However, human-assisted movement can result in long-distance spread. Plants for planting provide potential pathways for further entry and spread, including *O. perseae*-free EU MS where avocados are grown (i.e. Cyprus, France, Greece). Climatic conditions and availability of host plants in southern EU countries are conducive for establishment. Phytosanitary measures are available to reduce the likelihood of further entry and spread. *O. perseae* satisfies with no key uncertainties the criteria that are within the remit of EFSA to assess for it to be regarded as a potential Union quarantine pest.

Keywords: Avocado, invasive species, persea mite, pest risk, plant health, plant pest, quarantine

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1. Introduction

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

1.1.1. Background

The new Plant Health Regulation (EU) 2016/2031, on the protective measures against pests of plants, is applying from 14 December 2019. Conditions are laid down in this legislation in order for pests to qualify for listing as Union quarantine pests, protected zone quarantine pests or Union regulated non-quarantine pests. The lists of the EU regulated pests together with the associated import or internal movement requirements of commodities are included in Commission Implementing Regulation (EU) 2019/2072. Additionally, as stipulated in the Commission Implementing Regulation 2018/2019, certain commodities are provisionally prohibited to enter in the EU (high risk plants, HRP). EFSA is performing the risk assessment of the dossiers submitted by exporting to the EU countries of the HRP commodities, as stipulated in Commission Implementing Regulation 2018/2018. Furthermore, EFSA has evaluated a number of requests from exporting to the EU countries for derogations from specific EU import requirements.

In line with the principles of the new plant health law, the European Commission with the Member States are discussing monthly the reports of the interceptions and the outbreaks of pests notified by the Member States. Notifications of an imminent danger from pests that may fulfil the conditions for inclusion in the list of the Union quarantine pest are included. Furthermore, EFSA has been performing horizon scanning of media and literature.

As a follow-up of the above-mentioned activities (reporting of interceptions and outbreaks, HRP, derogation requests and horizon scanning), a number of pests of concern have been identified. EFSA is requested to provide scientific opinions for these pests, in view of their potential inclusion by the risk manager in the lists of Commission Implementing Regulation (EU) 2019/2072 and the inclusion of specific import requirements for relevant host commodities, when deemed necessary by the risk manager.

1.1.2. Terms of Reference

EFSA is requested, pursuant to Article 29(1) of Regulation (EC) No 178/2002, to provide scientific opinions in the field of plant health.

EFSA is requested to deliver 53 pest categorisations for the pests listed in Annex 1A, 1B, 1D and 1E (for more details see mandate M-2021-00027 on the Open.EFSA portal). Additionally, EFSA is requested to perform pest categorisations for the pests so far not regulated in the EU, identified as pests potentially associated with a commodity in the commodity risk assessments of the HRP dossiers (Annex 1C; for more details see mandate M-2021-00027 on the Open.EFSA portal). Such pest categorisations are needed in the case where there are not available risk assessments for the EU.

When the pests of Annex 1A are qualifying as potential Union quarantine pests, EFSA should proceed to phase 2 risk assessment. The opinions should address entry pathways, spread, establishment, impact and include a risk reduction options analysis.

Additionally, EFSA is requested to develop further the quantitative methodology currently followed for risk assessment, in order to have the possibility to deliver an express risk assessment methodology. Such methodological development should take into account the EFSA Plant Health Panel Guidance on quantitative pest risk assessment and the experience obtained during its implementation for the Union candidate priority pests and for the likelihood of pest freedom at entry for the commodity risk assessment of High Risk Plants.

1.2. Interpretation of the Terms of Reference

O. perseae is one of a number of pests relevant to Annex 1C to the Terms of Reference (ToR) to be subject to pest categorisation to determine whether it fulfils the criteria of a potential Union quarantine pest for the area of the EU excluding Ceuta, Melilla and the outermost regions of Member States referred to in Article 355(1) of the Treaty on the Functioning of the European Union (TFEU), other than Madeira and the Azores, and so inform EU decision-making as to its appropriateness for potential inclusion in the lists of pests of Commission Implementing Regulation (EU) 2019/2072. If a pest fulfils the criteria to be potentially listed as a Union quarantine pest, risk reduction options will be identified.

1.3. Additional information

O. perseae had been included in the EPPO alert list in 2003 but was deleted in 2008. This pest categorisation was initiated following the commodity risk assessment of avocado (*Persea americana* Mill.) scions and grafted plants from Israel performed by EFSA (EFSA PLH Panel, 2021), in which *O. perseae* was identified as a relevant non-regulated EU pest[1] which could potentially enter the EU on *P. americana*.

2. Data and methodologies

2.1. Data

2.1.1. Information on pest status from NPPOs

In the context of the current mandate, EFSA is preparing pest categorisations for new/emerging pests that are not yet regulated in the EU. When official pest status is not available in the European and Mediterranean Plant Protection Organization (EPPO) Global Database (EPPO, online), EFSA consults the NPPOs of the relevant MSs. To obtain information on the official pest status for *O. perseae*, EFSA has consulted the NPPOs of Italy, Portugal and Spain. The results of this consultation are presented in Section 3.2.2.

2.1.2. Literature search

A literature search on *O. perseae* was conducted at the beginning of the categorisation in the ISI Web of Science bibliographic database, using the scientific name of the pest as search term. Papers relevant for the pest categorisation were reviewed, and further references and information were obtained from experts, as well as from citations within the references and grey literature.

2.1.3. Database search

Pest information, on host(s) and distribution, was retrieved from the EPPO Global Database, the CABI databases and scientific literature databases as referred above in Section 2.1.1.

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 and TRACES databases were consulted for pest-specific notifications on interceptions and outbreaks. Europhyt is a web-based network run by the Directorate General for Health and Food Safety (DG SANTÉ) of the European Commission as a subproject of PHYSAN (Phyto-Sanitary Controls) specifically concerned with plant health information. TRACES is the European Commission's multilingual online platform for sanitary and phytosanitary certification required for the importation of animals, animal products, food and feed of non-animal origin and plants into the European Union, and the intra-EU trade and EU exports of animals and certain animal products. Up until May 2020, the Europhyt database managed 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 Member States and the phytosanitary measures taken to eradicate or avoid their spread. The recording of interceptions switched from Europhyt to TRACES in May 2020.

GenBank was searched to determine whether it contained any nucleotide sequences for *O. perseae* which could be used as reference material for molecular diagnosis. GenBank® (www.ncbi.nlm.nih.gov/genbank/) is a comprehensive publicly available database that as of August 2019 (release version 227) contained over 6.25 trillion base pairs from over 1.6 billion nucleotide sequences for 450,000 formally described species (Sayers et al., 2020).

2.2. Methodologies

The Panel performed the pest categorisation for *O. perseae*, following guiding principles and steps presented in the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018), the EFSA

[1] The criteria for relevance of non-regulated pests in the EU are based on evidence that: (i) the pest is present in the third country under scrutiny; (ii) the pest is absent or has a limited distribution in the EU (i.e. present in three or less EU countries); (iii) the plant species is a host of the pest; (iv) one or more life stages of the pest can be associated with the specified commodity; (v) the pest may have an impact in the EU (EFSA PLH Panel, 2019).

guidance on the use of the weight of evidence approach in scientific assessments (EFSA Scientific Committee, 2017) and the International Standards for Phytosanitary Measures No. 11 (FAO, 2013).

The criteria to be considered when categorising a pest as a potential Union quarantine pest (QP) are given in Regulation (EU) 2016/2031 Article 3 and Annex I, Section 1 of the Regulation. Table 1 presents the Regulation (EU) 2016/2031 pest categorisation criteria on which the Panel bases its conclusions. In judging whether a criterion is met the Panel uses its best professional judgement (EFSA Scientific Committee, 2017) by integrating a range of evidence from a variety of sources (as presented above in Section 2.1) to reach an informed conclusion as to whether or not a criterion is satisfied.

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, deemed to be a risk management decision, the Panel will present a summary of the observed impacts in the areas where the pest occurs, and make a judgement about potential likely impacts in the EU. Whilst the Panel may quote impacts reported from areas where the pest occurs in monetary terms, the Panel will seek to express potential EU impacts in terms of yield and quality losses and not in monetary terms, in agreement with the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018). Article 3 (d) of Regulation (EU) 2016/2031 refers to unacceptable social impact as a criterion for quarantine pest status. Assessing social impact is outside the remit of the Panel.

Table 1: Pest categorisation criteria under evaluation, as derived from 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 (article 3)
Identity of the pest (Section 3.1)	Is the identity of the pest clearly defined, 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 in a limited part of the EU or is it scarce, irregular, isolated or present infrequently? If so, the pest is considered to be not widely distributed.
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 for entry and spread.
Potential for consequences in the EU territory (Section 3.5)	Would the pests' introduction have an economic or environmental impact on the EU territory?
Available measures (Section 3.6)	Are there measures available to prevent pest entry, establishment, spread or impacts?
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.

3. Pest categorisation

3.1. Identity and biology of the pest

3.1.1. Identity and taxonomy

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

Yes, the identity of the persea mite is well established. Its scientific name is *Olygonychus perseae*.

Oligonychus perseae Tuttle, Baker & Abbatiello, 1976, is a phytophagous mite (Acari: Prostigmata: Tetranychidae). The species was first described from specimens found on Mexican avocado plant material intercepted in Texas in 1975 (Tuttle et al., 1976). Junior synonyms include *Oligonychus* (*Homonychus*) *perseae* Tuttle, Baker and Abbatiello, 1976. The taxonomy of the genus *Oligonychus* was fully revised in 2021 (Mushtaq et al., 2021).

The EPPO code[2] (Griessinger and Roy, 2015; EPPO, 2019) for this species is OLIGPA (EPPO, online).

3.1.2. Biology of the pest

According to the commodity risk assessment of *Persea americana* scions and grafted plants from Israel performed by EFSA (EFSA PLH Panel, 2021), along with other sources cited below, all life stages of *O. perseae* can be found in nests (Figure 1). These are on the underside of avocado leaves, mostly along the veins, where feeding, mating, reproduction and development occur. Individuals leave the nest to strengthen their walls, to build new nests and to defecate. Therefore, there is a constant movement of mites in and out of the nests. The sex ratio is generally female biased (1:2). *O. perseae* has five developmental stages: egg, larva, protonymph, deutonymph and adult. At 15°C, a female can initiate up to six nests and up to 12 nests at 20°C. Likewise, the number of eggs per nest may increase up to 15 at 20°C and then decrease. As a poikilothermic species, the duration of the life cycle also depends on temperature and ranges from 34.9 days (at 15°C) to 9.8 days (at 30°C) (Aponte and McMurtry, 1997). Populations tend to exponentially grow at the beginning of summer followed by a rapid decline at the end of summer (Hoddle, 1999, 2000; Kerguelen and Hoddle, 1999; Montserrat et al., 2013). Female longevity and fecundity are significantly influenced by the intrinsic quality of the leaves, considering that the chemical composition of sap and leaves of avocados varies both with season and cultivar (Kerguelen and Hoddle, 2000; Zappala et al., 2015). When reaching high-population densities, *O. perseae* may disperse using silk threads that favour their passive dispersal with the wind (Hoddle, 2003) (see Section 3.4.3).

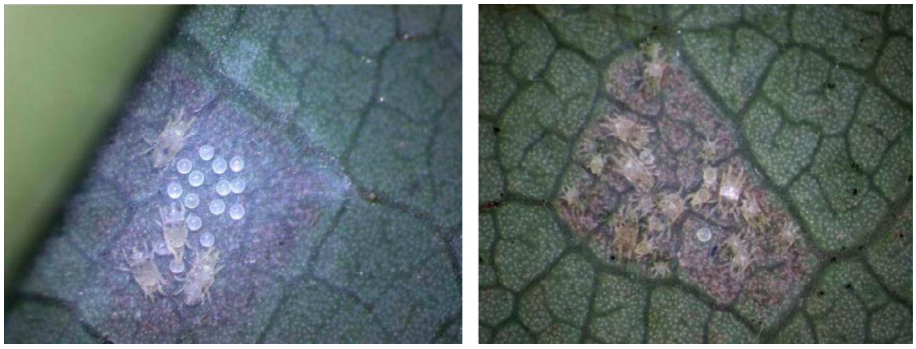

Figure 1: *Oligonychus perseae* nests on the underside of avocado leaves. Left: new nest containing eggs and adults. Right: old nest containing all life stages and showing the necrotic leaf tissue underneath. The body width and length of females (the larger specimens in the photo) are 0.17 × 0.32 mm. Source: Hernández Suárez et al. (2010)

3.1.3. Host range/Species affected

O. perseae is a pest of avocado (*Persea americana*), which is considered its main host. However, it is a polyphagous spider mite, which can feed on around 20 different hosts in 17 botanical families (Appendix A). In addition to avocado, *O. perseae* can feed on the leaves of other fruit species like carob (*Ceratonia siliqua)*, persimmon (*Diospyros* spp.), *Prunus* and *Vitis*, on ornamentals like *Acacia*, *Bambusa*, *Rosa* and *Salix,* as well as on weeds (EPPO, online; EPPO mini datasheet; Torres et al., 2018). However, no evidence was found indicating damage to crops other than avocado (Hernández-Suárez et al., 2010).

3.1.4. Intraspecific diversity

Molecular studies carried out by Lara et al. (2017) on populations of *O. perseae* from different origins (native and exotic populations from Mexico, and California, Israel, and Spain, respectively), uncovered significant and concordant genetic divergence in both mitochondrial (COI) and ribosomal DNA markers (ITS2) and a section of the 28S gene region, pointing to the potential occurrence of

[2] An EPPO code, formerly known as a Bayer code, is a unique identifier linked to the name of a plant or plant pest important in agriculture and plant protection. Codes are based on genus and species names. However, if a scientific name is changed, the EPPO code remains the same. This provides a harmonised system to facilitate the management of plant and pest names in computerised databases, as well as data exchange between IT systems (Griessinger & Roy, 2015; EPPO, 2019).

three cryptic species within *O. perseae*. However, biological (e.g. interpopulation mating studies) and ecological data (e.g. niche overlapping and feeding damage) to support this speciation are currently lacking.

3.1.5. Detection and identification of the pest

Are detection and identification methods available for the pest?

Yes, detection and identification methods are available for *O. perseae*.

Detection

Visual examination of plants is an effective way for the detection of *O. perseae*. Nests on the underside of leaves, which harbour all life stages, eventually result in chlorotic spots on the foliage (Figure 2), which are easily detectable.

Identification

The identification of *O. perseae* requires microscopic examination of slide-mounted adult males and verification of the presence of key morphological characteristics as given by Mushtaq et al. (2021).

Molecular techniques for species identification have been developed (Lara et al., 2017). GenBank contains nucleotide sequences for *O. perseae*.

Symptoms

According to EPPO (online), feeding damage produces characteristic circular necrotic spots (of about 1–5 mm^2) on leaves (Figure 2). High populations (> 500 mites per leaf) can cause partial or total tree defoliation, and as a consequence increase the risk of sunburn to young fruit (Figure 3) and exposed tree trunks. Premature fruit drop may occur.

Source: Hernández Suárez et al. (2010).

Figure 2: Typical leaf damage caused by *O. perseae*

Figure 3: Sunburnt avocado fruit subsequent to severe defoliation caused by *O. perseae*

Description

According to Zappalà et al. (2015), *O. perseae* adult females (0.17 mm wide × 0.32 mm long) have an oval-shaped body that is slightly flattened and elongated (Figure 1). Females and immatures are yellowish or greenish with two or more dark food spots on the hysterosoma. Males are pear-shaped, slightly flattened and yellowish with or without small dark spots; they are smaller than reproductive females. Eggs are spherical and yellowish (Torres et al., 2018).

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

The persea mite originated in Mesoamerica and has now spread and established in California, Florida and Hawaii, North Africa, southern Europe and Israel (Figure 4).

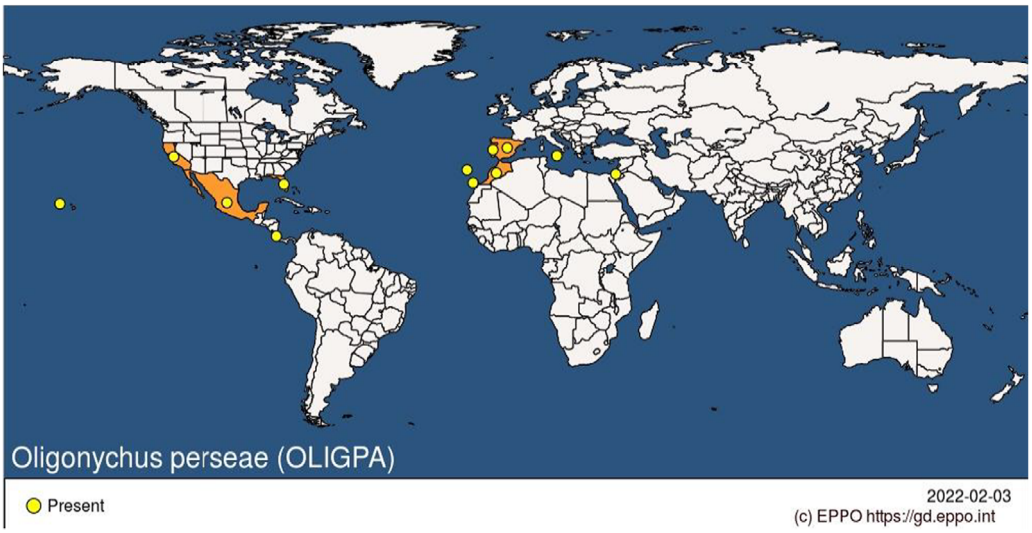

Figure 4: Global distribution of *Oligonychus perseae* (Source: EPPO Global Database accessed on February 3, 2022)

3.2.2. Pest distribution in the EU

Is the pest present in the EU territory? If present, is the pest in a limited part of the EU or is it scarce, irregular, isolated or present infrequently? If so, the pest is considered to be not widely distributed.

Yes, *O. perseae* is present in three EU MS. It is known to occur in Italy, Portugal and Spain, where this pest has a restricted distribution.

Presence in:

- Italy: First found in August 2014 in Sicily (Zappalà et al., 2015). Status evaluated by EPPO: present, restricted distribution (EPPO, online). The NPPO of Italy stated that there are no reports declared by farmers of damage by *O. perseae*, and no specific measures are taken. The NPPO is not aware of further reports other than the one in Sicily in 2014.
- Portugal: First detected in 2005 in the island of Madeira (2005). In 2006, it was found in Algarve (southern Portugal) and in 2020 in Estremadura (Óbidos, Centro Region) (EPPO, online). Status evaluated by EPPO: present, restricted distribution (EPPO, online).
- Spain: First found in 2004 in the province of Málaga (Andalusia; southern Spain). In 2010, it was reported as present in all avocado-growing regions of Spain, including the Canary Islands, where it was detected for the first time in 2006 (EPPO, online; MAPA, 2021). Status evaluated by EPPO: present, restricted distribution (EPPO, online). The NPPO of Spain regard *O. persea* as being present in Galicia, Valencian Community, Andalusia and the Canary Islands (which are outside the risk assessment area (see Section 1.2)).

Note that when a pest is found in parts of its potential distribution and there are areas free from the pest that could suffer losses were the pest to spread or be introduced to such areas, the pest can be considered as not widely distributed (FAO, 2021 (ISPM No. 5, Supplement 1)). Hence, because *O. perseae* is not known to occur in France, Greece and Cyprus where there is some avocado production and impacts would be likely were *O. perseae* to be introduced there, *O. perseae* can be regarded as being not widely distributed in the EU.

3.3. Regulatory status

3.3.1. Commission Implementing Regulation 2019/2072

O. perseae is not listed in Annex II of Commission Implementing Regulation (EU) 2019/2072, an implementing act of Regulation (EU) 2016/2031, or in Commission Implementing Regulation (EU) 2021/2285 amending Implementing Regulation (EU) 2019/2072.

3.3.2. Hosts or species affected that are prohibited from entering the Union from third countries

According to the Commission Implementing Regulation (EU) 2019/2072, Annex VI, introduction of several *O. perseae* hosts into the EU from certain third countries is prohibited (Table 2).

Table 2: List of plants, plant products and other objects that are *Oligonychus perseae* hosts whose introduction into the Union from certain third countries is prohibited (Source: Commission Implementing Regulation (EU) 2019/2072, Annex VI)

List of plants, plant products and other objects whose introduction into the Union from certain third countries is prohibited			
	Description	**CN Code**	**Third country, group of third countries or specific area of third country**
8.	Plants for planting of [...] *Prunus* L., [. . .] and *Rosa* L., other than dormant plants free from leaves, flowers and fruits	ex 0602 10 90 ex 0602 20 20 ex 0602 20 80 ex 0602 40 00 ex 0602 90 41 ex 0602 90 45 ex 0602 90 46 ex 0602 90 47 ex 0602 90 48 ex 0602 90 50 ex 0602 90 70 ex 0602 90 91 ex 0602 90 99	Third countries other than: Albania, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canary Islands, Faeroe Islands, Georgia, Iceland, Liechtenstein, Moldova, Monaco, Montenegro, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (Severo-Zapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo-Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug)), San Marino, Serbia, Switzerland, Turkey and Ukraine
9.	Plants for planting of [. . .] *Prunus* L. [. . .] and their hybrids [...] other than seeds	ex 0602 10 90 ex 0602 20 20 ex 0602 90 30 ex 0602 90 41 ex 0602 90 45 ex 0602 90 46 ex 0602 90 48 ex 0602 90 50 ex 0602 90 70 ex 0602 90 91 ex 0602 90 99	Third countries, other than: Albania, Algeria, Andorra, Armenia, Australia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canada, Canary Islands, Egypt, Faeroe Islands, Georgia, Iceland, Israel, Jordan, Lebanon, Libya, Liechtenstein, Moldova, Monaco, Montenegro, Morocco, New Zealand, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (Severo-Zapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo-Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug)), San Marino, Serbia, Switzerland, Syria, Tunisia, Turkey, Ukraine, and United States other than Hawaii
10.	Plants of *Vitis* L., other than fruits	0602 10 10 0602 20 10 ex 0604 20 90 ex 1404 90 00	Third countries other than Switzerland

High-risk plant regulation 2018–2019 includes temporary prohibition of *Acacia*, *Diospyros*, *Juglans*, *Persea*, *Prunus* and *Salix,* which are hosts of *O. perseae*, pending risk assessment.

3.4. Entry, establishment and spread in the EU

3.4.1. Entry

Is the pest able to enter into the EU territory? If yes, identify and list the pathways

Yes, the pest has already entered the EU territory. It could further enter the EU territory with plants for planting (mainly avocados).

Comment on plants for planting as a pathway

O. perseae could further enter the EU territory with plants for planting (mainly avocados) although some of the host plants from some third countries are prohibited (Table 3).

Plants for planting are the main potential pathways for entry of *O. perseae* (Table 3).

Table 3: Potential pathways for *Oligonychus perseae* into the EU 27

Pathways (e.g. host/intended use/source)	Life stage	Relevant mitigations [e.g. prohibitions (Annex VI), special requirements (Annex VII) or phytosanitary certificates (Annex XI) within Implementing Regulation indicates 2019/2072]
Plants for planting	All stages	Annex VI prohibits the import of plants for planting of (…) *Prunus* and *Rosa* other than dormant plants free from leaves, flowers and fruits (8.), those of (…) *Prunus* L. […] and their hybrids [...] other than seeds (9.), as well as those of *Vitis* other than fruits (10), from most countries where *O. perseae* is present. However, imports of plants for planting of *Prunus* and their hybrids from the USA are permitted. Moreover, not all *O. perseae* host plants are included in annex VI (e.g. avocado, persimmon, carob) There is a temporary prohibition for high-risk plants (Regulation 2018/2019) some of which are *O. perseae* hosts (*Acacia* Mill., *Diospyros* L., *Juglans* L., *Persea* Mill., *Prunus* L. and *Salix* L.).

According to EPPO (online), *O. perseae* mostly moves over long distances on infested avocado and other host plants for planting. The risk associated with movements of fruits appears very low as this species does not feed on them and avocados are harvested and traded without leaves.

The import of some host plants for planting of *O. perseae* from most third countries where it occurs is not allowed (Implementing Regulation 2019/2072, Annex VI: *Prunus* L., *Rosa L*. and *Vitis* L.). The main exception is *Prunus* plants for planting from the USA. However, *Prunus* is prohibited according to the high-risk plants regulation (Regulation 2018/2019), which also includes some additional *O. perseae* hosts (*Acacia* Mill., *Diospyros* L., *Juglans* L., *Persea* Mill. and *Salix* L). All the other known host plants for planting can be imported to the EU with a phytosanitary certificate (Implementing Regulation 2019/2072, Annex XI, Part A). The requirement of *O. perseae* for fresh foliage to survive means that the risk of *O. perseae* introduction associated with the movement of fruit is minimal (Lara et al., 2017; EPPO, 2008).

Notifications of interceptions of harmful organisms began to be compiled in Europhyt in May 1994 and in TRACES in May 2020. As of 8 February 2022, there were no records of interception of *O. perseae* in the Europhyt and TRACES databases. However, this species was originally described from specimens detected on avocado plant material by quarantine inspectors in Texas (see Section 3.1.1). Because the main entry pathway for this mite is plants for planting, there are no uncertainties over the pests' ability to transfer to a suitable host following arrival into the EU.

3.4.2. Establishment

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

Yes, *O. perseae* has already established in the EU. It occurs in almost all avocado-growing areas of Portugal and Spain, as well as in Sicily. In the EU countries of southern Europe, the climate is suitable and there are available hosts that support establishment.

Climatic mapping is the principal method for identifying areas that could provide suitable conditions for the establishment of a pest taking key abiotic factors into account (Baker, 2002). Availability of hosts is considered in Section 3.4.2.1. Climatic factors are considered in Section 3.4.2.2.

3.4.2.1. EU distribution of main host plants

Although *O. perseae* is a polyphagous species (see Section 3.1.3), it is considered a pest of avocados only (EPPO, online; see Section 3.1.3). When *O. perseae* was first observed in California in the early 1990s, individual mites from heavily infested avocado trees were seen drifting onto leaves of adjacent stone fruit trees (*Prunus* spp.). However, they did not feed on them (UC IPM, 2016). Similar observations on other hosts have been made in the Canary Islands (Torres et al., 2018).

From the almost 20,000 ha of avocados cultivated in EU 27 in 2020 (Table 4), more than half correspond to Spain (14,000 ha with considerable growth), of which around 12,000 in mainland Spain (mostly in the coastal districts of the provinces of Málaga and Granada in Andalusia) and 1,700 ha in the Canary Islands (Bienvenido et al., 2021; MAPA, 2021). The area allocated to avocado production in different EU MS is rapidly increasing. Although not captured yet by Eurostat (Table 4), Italy and Spain are the only European countries with significant commercial production of avocados (Migliore et al., 2017). Italian production areas are mostly located in Sicily, those in Portugal in Algarve and those in Greece in Crete.

Table 4: Harvested area of avocados in EU 27, 2016–2020 (thousand ha, Code: F2300) (Eurostat accessed on 10 March 2022)

MS/Year	2016	2017	2018	2019	2020
EU 27	12.24	12.72	13.22	17.50	19.60
Spain	11.44	11.81	12.16	14.10	15.85
Portugal	0.00	0.00	0.00	1.98	2.31
Greece	0.48	0.60	0.72	1.08	1.10
France	0.23	0.23	0.24	0.24	0.24
Cyprus	0.09	0.08	0.10	0.10	0.10
Italy[1]	0.00	0.00	0.00	0.00	0.00

1: The situation of avocado production in Italy is not captured by Eurostat.

3.4.2.2. Climatic conditions affecting establishment

O. perseae is a thermophilic mite and is distributed mainly in areas with tropical and subtropical climates in the Americas, the Macaronesia, and the Mediterranean Basin. It has established in Italy (Sicily), Portugal (Madeira Islands and mainland) and Spain (Canary Islands and mainland). Figure 5 shows the World distribution of Köppen–Geiger climate types (Kottek et al., 2006) that occur in the EU and which occur in countries where *O. perseae* has been reported (BSh, BSk, Cfa, Csa, Csb and Csc). Southern EU MS provide suitable climatic conditions for the establishment of *O. perseae*. Indeed, it is already established in some of those areas where avocados are grown. It is unlikely that the mite could establish in the central and northern EU MS and if it did, the populations are likely to be small and have no impact. There is a possibility that *O. perseae* could occur in greenhouses and on indoor plantings in cooler areas.

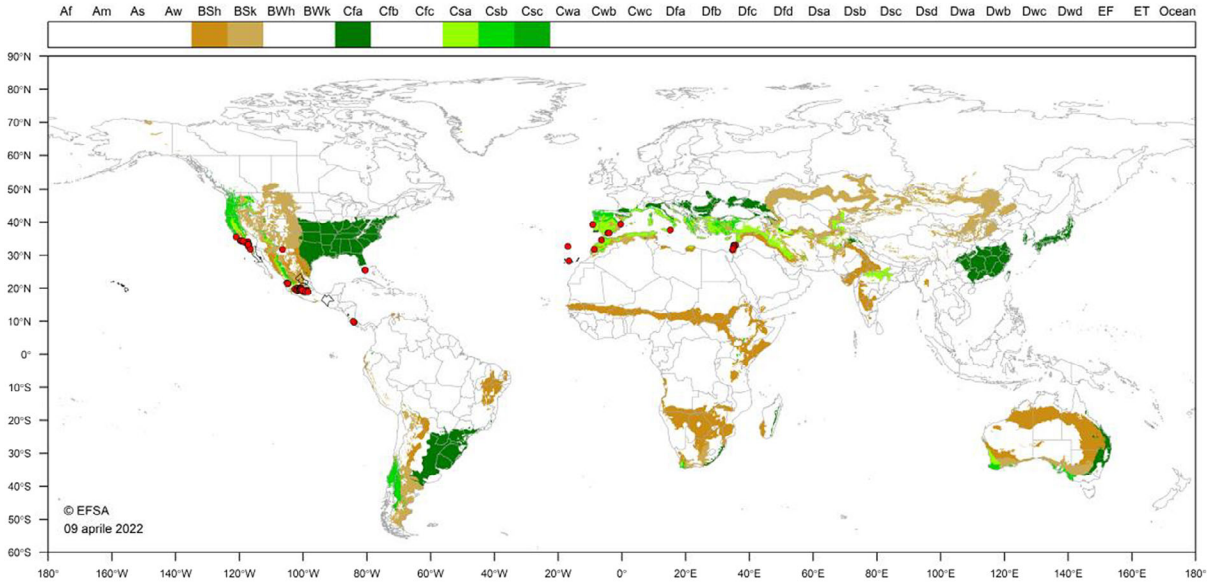

Figure 5: World distribution of Köppen–Geiger climate types that occur in the EU and which occur in sites where *Oligonychus perseae* has been reported (red dots)

3.4.3. Spread

Describe how the pest would be able to spread within the EU territory following establishment?

As mites can't actively fly, natural spread will occur locally and relatively slowly. All stages may be moved over long distances by the trade of infested plant materials (plants for planting).

Comment on plants for planting as a mechanism of spread

O. perseae could further spread within the EU territory with plants for planting (mainly avocados).

According to the EPPO (online), this mite can move over short distances. The major means of interplant dispersal of *O. perseae* is by spinning down from the foliage on a silk strand of webbing and wafting in the wind. The intra-plant dispersal of *O. perseae* also occurs by crawling to various portions of the plants, particularly to the new leaves. Over long distances, movements of infested avocado plants and other hosts can ensure dissemination. The risk associated with movements of fruits appears very low (EPPO, 2008). The mite can also be dispersed opportunistically, for instance on the equipment and clothing of farm workers (Aponte and McMurtry, 1997). Kennedy and Smitley (1985) found that spider mites can be spread both between and within orchards on farm machinery.

3.5. Impacts

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

Yes, the introduction of *O. perseae* into the EU has had an economic impact on avocado production. Further introductions and/or spread within the EU could increase this type of impact.

According to the Spanish Ministry of Agriculture, Fisheries and Food (MAPA, 2021) *O. perseae* is considered the only important pest of avocado in Spain. Although this mite does not attack the fruit, necrotic damage on leaves reduces their photosynthetic capacity. Severe attacks produce defoliation, which may result in fruit sunburn. Defoliation is especially relevant in the Canary Islands, where it is common when high population densities coincide with water stress. Cultivar Hass is more susceptible than Fuerte, Lamb Hass and Bacon (Junta de Andalucía, 2016; MAPA, 2021). In the Canary Islands, the presence of *O. perseae* in avocados triggered a change in the management of this crop, from organic to conventional. This change increased production costs and decreased the value of the produce, which in many cases could no longer be sold as organic (Torres et al., 2018). According to

the Spanish NPPO, *O. perseae* is controlled in Andalusia (southern Spain) with the application of sulfur and oils, as well as releases of phytoseiid predatory mites (see Section 2.1.1). *Neoseiulus californicus* McGregor, a commercially available specialist predator that forages inside the nests of *O. perseae,* and Euseius *stipulatus* Athias-Henriot and *E. scutalis* (Athias-Henriot), two generalist predators, coexist with *O. perseae* in avocados in Spain and are used as biological control agents of this mite, either by augmentative releases (*N. californicus*) or by conservation (Guzmán et al., 2016).

In California, *O. perseae* is considered a key pest of avocados (UC IPM, 2016). Partial or severe defoliation can be caused by high mite densities, especially on the cultivars Hass and Gwen that are the most susceptible ones (Kerguelen and Hoddle, 2000). Significant impact on leaf damage and on average yield (20% decreases in yield at the infestation rate of 250 mites/leaf) was recorded in Israel (Maoz et al., 2011). Control measures in Israel and USA include removal of weeds and of fallen leaves, use of predators (i.e. *N. californicus, Galendromus annectens* De Leon*, G. helveolus* (Chant)) and applications of acaricides.

3.6. Available measures and their limitations

Are there measures available to prevent pest entry, establishment, spread or impacts such that the risk becomes mitigated?

Yes, although the existing phytosanitary measures identified in Section 3.3.2 do not specifically target *O. perseae*, they mitigate the likelihood of its entry into, establishment and spread within the EU.

3.6.1. Identification of potential additional measures

Phytosanitary measures (prohibitions) are currently applied to some host plants for planting (see Section 3.3.2).

Additional potential risk reduction options and supporting measures are shown in Sections 3.6.1.1 and 3.6.1.2.

3.6.1.1. Additional potential risk reduction options

Potential additional control measures are listed in Table 5.

Table 5: 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

Control measure/Risk reduction option (Blue underline = Zenodo doc, Blue = WIP)	**RRO summary**	**Risk element targeted (entry/establishment/spread/impact)**
Require pest freedom	Source hosts from pest-free area	Entry/Spread
Use of resistant and tolerant plant species/varieties	Resistant plants are used to restrict the growth and development of a specified pest and/or the damage they cause when compared to susceptible plant varieties under similar environmental conditions and pest pressure. Cultivars Fuerte, Lamb Hass and Bacon are less susceptible to *O. persea* than cv. Hass (MAPA, 2021; Junta de Andalucía, 2016).	Impact
Biological control and behavioural manipulation	Augmentative and conservation biological control exploiting phytoseiid predatory mites have been used against *O. perseae* (Guzmán et al., 2016)	Spread/impact
Chemical treatments on crops including reproductive material	Miticides can be used to decrease the density of *O. perseae* as is the case in Spain	Spread, impact
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) should be used in nurseries.	Entry/Spread/Impact

3.6.1.2. Additional supporting measures

Potential additional supporting measures are listed in Table 6.

Table 6: 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

Supporting measure (Blue underline = Zenodo doc, Blue = WIP)	Summary	Risk element targeted (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.	Establishment/Spread
Laboratory testing	Examination, other than visual, to determine if pests are present using official diagnostic protocols. Diagnostic protocols describe the minimum requirements for reliable diagnosis of regulated pests.	Entry/Impact
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.	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/Spread/Impact
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 the NPPO 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/Spread/Impact
Certification of reproductive material (voluntary/official)	Plants come from within an approved propagation scheme and are certified pest free (level of infestation) following testing; Used to mitigate against pests that are included in a certification scheme	Entry/Spread/Impact
Surveillance	Surveillance to guarantee that plants and produce originate from a pest-free area could be an option.	Entry/establishment/ Spread

3.6.1.3. Biological or technical factors limiting the effectiveness of measures

- Due to its small size, *O. perseae* may not be easily detected in cases where low densities occur.
- *O. perseae* is polyphagous, making the inspections of all consignments containing hosts from countries where the pest occurs difficult.
- Limited number of available registered active substances for use in avocado against *O. perseae*.
- Although pesticide applications may be cost-effective, pesticide resistance has been detected among *O. perseae* populations sampled from California (Humeres and Morse, 2005).

3.7. Uncertainty

The main source of uncertainty regarding the establishment and impact potential of *O. perseae* within the EU consists of the magnitude of potential economic impact on hosts other than avocado, given that there are no records of *O. perseae* causing damage in any other crop apart from avocado. This uncertainty, though, does not affect the conclusions of this categorisation, as the impact on avocados is well documented within the EU.

4. Conclusions

O. perseae satisfies with no key uncertainties the criteria that are within the remit of EFSA to assess for it to be regarded as a potential Union quarantine pest (Table 7).

Table 7: 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)

Criterion of pest categorisation	Panel's conclusions against criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest	Key uncertainties
Identity of the pest (Section 3.1)	The identity of the pest is established. Taxonomic keys based on morphology of male adults exist.	None
Absence/presence of the pest in the EU (Section 3.2)	The pest has a restricted distribution in the EU territory: southern Italy (Sicily), Portugal and Spain	None
Pest potential for entry, establishment and spread in the EU (Section 3.4)	*O. perseae* is able to enter into, become established, and spread within the EU territory. The main pathway is plants for planting (regulated, some hosts from some third countries are prohibited)	None. This mite has already entered, established and spread within the EU.
Potential for consequences in the EU (Section 3.5)	*O. perseae* is a key pest of avocado in Spain. Management intervention may be required to reduce losses. Losses could also be expected in other avocado-producing areas of the EU, where this mite is not present, such as Cyprus, France and Greece.	None.
Available measures (Section 3.6)	There are measures available to prevent the re-entry, establishment and spread of *O. perseae* within the EU. Risk reduction options include the inspections and the production of plants for import into the EU in pest-free areas.	None.
Conclusion (Section 4)	*O. perseae* satisfies with no key uncertainties the criteria that are within the remit of EFSA to assess for it to be regarded as a potential Union quarantine pest.	None.
Aspects of assessment to focus on/scenarios to address in future if appropriate:		

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Abbreviations

EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization
IPPC	International Plant Protection Convention
ISPM	International Standards for Phytosanitary Measures
MS	Member State
PLH	EFSA Panel on Plant Health

PZ	Protected Zone
TFEU	Treaty on the Functioning of the European Union
ToR	Terms of Reference

Glossary

Containment (of a pest)	Application of phytosanitary measures in and around an infested area to prevent spread of a pest (FAO, 2018)
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO, 2018)
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, 2018)
Eradication (of a pest)	Application of phytosanitary measures to eliminate a pest from an area (FAO, 2018)
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO, 2018)
Greenhouse	A walk-in, static, closed place of crop production with a usually translucent outer shell, which allows controlled exchange of material and energy with the surroundings and prevents release of plant protection products (PPPs) into the environment.
Hitchhiker	An organism sheltering or transported accidentally via inanimate pathways including with machinery, shipping containers and vehicles; such organisms are also known as contaminating pests or stowaways (Toy and Newfield, 2010).
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, 2018)
Pathway	Any means that allows the entry or spread of a pest (FAO, 2018)
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, 2018)
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, 2018)
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, 2018)

Appendix A – *Oligonychus perseae* host plants/species affected

Host status	Host name	Plant family	Common name	Reference
Cultivated hosts	*Acacia*	Fabaceae		EPPO (online)
	Bambusa	Poaceae		EPPO (online)
	Bixa orellana	Bixaceae	Blood tree	EPPO (online)
	Capsicum sp.	Solanaceae		Torres et al. (2018)
	Ceratonia siliqua	Fabaceae	Carob tree	EPPO (online)
	Diospyros kaki	Ebenaceae	Chinese date plum	EPPO (online)
	Diospyros virginiana	Ebenaceae	American persimmon	EPPO (online)
	Juglans regia	Juglandaceae	Common walnut	EPPO (online)
	Passiflora edulis	Passifloraceae	Passionfruit	Torres et al. (2018)
	Persea americana	Lauraceae	Avocado	EPPO (online)
	Prunus	Rosaceae		EPPO (online)
	Prunus avium	Rosaceae	Cherry	EPPO (online)
	Prunus domestica	Rosaceae	European plum	EPPO (online)
	Prunus persica	Rosaceae	Peach	Torres et al. (2018)
	Rhus	Anacardiaceae		EPPO (online)
	Ricinus communis	Euphorbiaceae	Castor bean	Torres et al. (2018)
	Rosa	Rosaceae		EPPO (online)
	Salix	Salicaceae		EPPO (online)
	Vitis vinifera	Vitaceae	Common grapevine	EPPO (online)
Wild weed hosts	*Asclepias fascicularis*	Apocynaceae	Mexican whorled milkweed	EPPO (2008)
	Bidens pilosa	Asteraceae		EPPO (online)
	Chenopodium album	Amaranthaceae	Wild spinach	EPPO (2008)
	Oxalis corniculata	Oxalidaceae		Torres et al. (2018)
	Sonchus	Asteraceae		EPPO (2008)
	Sonchus oleraceus	Asteraceae	Common sowthistle	Torres et al. (2018)

Appendix B – Distribution of *Oligonychus perseae*

Distribution records based on EPPO Global Database (EPPO, online).

Region	Country	Subnational (e.g. State)	Status
North America	Mexico		Present, no details
	USA		Present, restricted distribution
		California	Present, no details
		Florida	Present, no details
		Hawaii	Present, no details
Central America	Costa Rica		Present, no details
EU (27)	Italy		Present, restricted distribution
		Sicilia	Present, restricted distribution
	Portugal		Present, restricted distribution
		Madeira	Present, no details
	Spain		Present, restricted distribution
		Islas Canarias	Present, no details
Africa	Morocco		Present, restricted distribution
Asia	Israel		Present, widespread