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SCIENTIFIC OPINION

Pest categorisation of *Crisicoccus seruratus*

EFSA Panel on Plant Health (PLH) | Claude Bragard | Paula Baptista | Elisavet Chatzivassiliou | Francesco Di Serio | Paolo Gonthier | Josep Anton Jaques Miret | Annemarie Fejer Justesen | Christer Sven Magnusson | Panagiotis Milonas | Juan A. Navas-Cortes | Stephen Parnell | Roel Potting | Philippe Lucien Reignault | Emilio Stefani | Hans-Hermann Thulke | Wopke Van der Werf | Antonio Vicent Civera | Jonathan Yuen | Lucia Zappalà | Jean-Claude Grégoire | Chris Malumphy | Spyridon Antonatos | Virag Kertesz | Dimitrios Papachristos | Oresteia Sfyra | Alan MacLeod

Correspondence: plants@efsa.europa.eu

Abstract

Following the commodity risk assessments of *Acer palmatum* plants grafted on *A. davidii* from China, in which *Crisicoccus matsumotoi* (Hemiptera: Pseudococcidae) was identified as a pest of possible concern, the European Commission requested the EFSA Panel on Plant Health to conduct a pest categorisation of *C. matsumotoi* for the territory of the European Union. Recent taxonomic revision of the genus *Crisisoccus* concluded that *C. matsumotoi* is a synonym of *C. seruratus*; therefore, the categorisation will use the current valid name *C. seruratus*. It is an insect pest native to Japan, feeding on species in 13 plant families. There are reports of its presence also in China and the Republic of Korea, but there is great uncertainty about the identity of the species for these records. Therefore, there is uncertainty about the species referred to as *C. matsumotoi* in the commodity risk assessments of *A. palmatum*. *C. seruratus* is a multivoltine species. It has three generations per year and overwinters as a nymph. The most important crops that may be affected by *C. seruratus* are figs (*Ficus carica*), grapes (*Vitis* spp.), nashi pears (*Pyrus pyrifolia* var. *culta*), persimmons (*Diospyros kaki*) and walnuts (*Juglans regia*). Plants for planting and fruits provide potential pathways for entry into the EU. Host availability and climate suitability suggest that the central, northern and some areas of southern EU countries would be suitable for the establishment of *C. seruratus*. The introduction of this mealybug would likely have an economic impact in the EU through yield reduction and fruit downgrading because of honeydew deposition and the consequent growth of sooty moulds. This insect is not listed in Annex II of Commission Implementing Regulation (EU) 2019/2072. Phytosanitary measures are available to reduce the likelihood of entry and spread of this species into the EU. *C. seruratus* satisfies the criteria that are within the remit of EFSA to assess for it to be regarded as a potential Union quarantine pest.

KEYWORDS

Hemiptera, mealybug, pest risk, plant health, plant pest, Pseudococcidae, 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

C. seruratus is one of a number of pests relevant to Annex 1C of 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

This pest categorisation was initiated following the commodity risk assessments of *Acer palmatum* plants grafted on *Acer davidii* from China (EFSA PLH Panel, 2022), in which *Crisicoccus matsumotoi* was identified as a relevant non-regulated EU pest of possible concern, which could potentially enter the EU on *Acer* plants. However, the commodity risk assessment recognised that there was uncertainty on its occurrence in China. The current valid name of *C. matsumotoi* is *C. seruratus*, on which this pest categorisation was performed. However, there is uncertainty about the species referred to as *C. matsumotoi* in the commodity risk assessment of *A. palmatum*, due to misidentifications in the literature, see Section 3.1.1 (identity) for details.

2 | DATA AND METHODOLOGIES

2.1 | Data

2.1.1 | Literature search

A literature search on *C. seruratus* and *C. matsumotoi* 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.

2.1.2 | Database search

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 *C. matsumotoi* and *C. seruratus* 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 *C. seruratus* following guiding principles and steps presented in the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel et al., 2018), the EFSA 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) is 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. While 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 pest is established and Crisicoccus seruratus (Kanda 1933) is the accepted name.

The mealybug *Crisicoccus seruratus* (Kanda 1933) is an insect within the order Hemiptera, suborder Sternorrhyncha, family Pseudococcidae. *C. seruratus* was first described as *Pseudococcus seruratus* by Kanda in 1933 from roots of *Obelicea serurata* in Yokohama (Japan). It was also described by Shiraiwa in 1935 as *P. matsumotoi* from pear, walnut, fig and maple in Japan. Moreover, Shinji in 1936 described the same species as *P. astericola* from *Aster indicus* in Morioka and Iwate-ken in Japan (García Morales et al., 2016). *P. astericola* was synonymised with *P. seruratus* by Kanda (1941). Paik (1978) transferred *P. seruratus* and *P. matsumotoi* to the genus *Crisicoccus* (García Morales et al., 2016). Until recently the species *C. matsumatoi* and *C. seruratus* were considered as different. However, Tanaka and Kamitani (2022) recently revised the genus *Crisicoccus* and found that *C. matsumatoi* was a synonym of *C. seruratus*. Moreover, specimens from Japan previously reported by Ezzat and McConnell (1956) and Williams (2004) as *C. matsumotoi* were found to differ from the description of *C. seruratus* and were described as a distinct new species, *C. ezzati* Tanaka and Kamitani (Tanaka & Kamitani, 2022). According to Tanaka and Kamitani (2022), in the Republic of Korea, Paik (1978) and Kwon et al. (2003) regarded *C. seruratus* and *C. matsumotoi* as distinct species; however, the species they recognised as *C. matsumotoi* in the Republic of Korea was a misidentification of *Spilococcus pacificus* (Borchsenius 1949).

The common name is Matsumoto mealybug, in Japanese Matsumoto-kona-kaigaramushi.

Currently *C. seruratus* is designated by EPPO as *C. matsumotoi* with the EPPO code CRIZMA (EPPO, 2019; Griessinger & Roy, 2015).

3.1.2 | Biology of the pest

C. seruratus is multivoltine and in Japan has three generations per year (Nakagaki, 1964). It is an oviparous or ovoviviparous species and reproduces sexually (Shiraiwa, 1935). The females emit a sex pheromone to attract the males for mating (Tabata et al., 2012). Female mealybugs have three nymphal instars, while males have five. The male feeds from the host during first, second and third nymphal instars, while during the prepupa and pupa stages do not feed and are sessile (Australian Department of Agriculture, 2014; EFSA PLH Panel, 2022). The egg stage lasts from 8 to 11 days and the nymphal stages last from 34 to 38 days. The adult females live 12–15 days (Nakagaki, 1964). Male adults are winged, short lived and do not feed (Australian Department of Agriculture, 2014). The overwintering stage is the second- or third-instar nymph in the roots, as well as under rough bark (Nakagaki, 1964).

The eggs are laid in ovisacs (Nakagaki, 1964). The first-instar nymph is the crawler. Once the crawler emerges from the ovisac, it is very active and searches for an appropriate feeding site (Ben – Dov & Hodgson, 1997). *C. seruratus* feeds on leaves and fruits (Australian Department of Agriculture, 2014). After harvest in autumn, second- and third-instar nymphs migrate from leaves to roots to overwinter and they feed there. However, some individuals remain feeding in the roots throughout the year (Nakagaki, 1964). The nymph inserts its stylets into the plant tissue and commences feeding from the phloem. Subsequent instars may wander and select different feeding sites. In females, the body of the second instar increases in size and the third instar is very similar to the adult. In males, the second-instar nymphs are gregarious, and they secrete a cover which encloses all subsequent instars (Ben – Dov & Hodgson, 1997). Adults of the overwintering generation emerge in May. Emerged females lay their eggs from late May to early June and the first generation occurs from June to mid-July while the second generation occurs from August to September. The adults of the second generation lay eggs in late September that overwinter as nymphs (Nakagaki, 1964).

3.1.3 | Host range/species affected

C. seruratus is reported to feed on 19 plant species belonging to 13 families. The full list of host plant species is presented in Appendix A. There are important crops in the EU that are hosts such as figs (*Ficus carica*), grapes (*Vitis* spp.), nashi pears (*Pyrus pyrifolia* var. *culta*), persimmons (*Diospyros kaki*) and walnuts (*Juglans regia*) (García Morales et al., 2016; Tanaka & Kamitani, 2022).

3.1.4 | Intraspecific diversity

No intraspecific diversity is reported for this species.

3.1.5 | Detection and identification of the pest

Are detection and identification methods available for the pest?

Yes, there are methods available for detection and morphological identification of C. seruratus.

Detection

Careful visual examination of plants, including roots, is an effective way for the detection of *C. seruratus*. However, nymphs and adult females are very small and often difficult to detect by visual inspection when there is low infestation level as they tend to hide in crevices and in protected spaces on host plants (Australian Department of Agriculture, 2014).

Identification

The identification of *C. seruratus* requires microscopic examination of slide-mounted adult females and verification of the presence of key morphological characteristics. A detailed morphological description and illustration of adult female can be found in Tanaka and Kamitani (2022).

Molecular diagnostic protocols for species identification have also been suggested by Park, Leem, et al. (2010), Park, Suh, et al. (2010); Park et al. (2011), Tabata et al. (2016) and Wang et al. (2016). GenBank contains 78 gene nucleotide sequences for *C. matsumotoi* and three gene nucleotide sequences for *C. seruratus* (NCBI, 2024). However, there is an uncertainty about the validity of the sequences which refer to *C. matsumotoi* because according to Tanaka and Kamitani (2022) previously specimens identified as *C. matsumotoi* may be a misidentification of the newly described species *Crisicoccus ezzati* or *Spilococcus pacificus* (Borchsenius). Moreover, according to Park, Leem, et al. (2010) and Park et al. (2011), the sequence analyses of *C. matsumotoi* revealed that the specimens of the species showed substantial genetic difference, possibly reflecting cryptic species overlooked by taxonomic classification. However, there is an uncertainty about the validity of the identification of some specimens by Park, Leem, et al. (2010) as *C. matsumotoi* (= *C. seruratus*).

Taking into account that the validity of some sequences is questionable, the only identification method that can be considered as valid is morphological.

Symptoms

C. seruratus may feed on leaves, fruits and occasionally on roots. According to the Australian Department of Agriculture (2014) and Mani and Shivaraju (2016), the main symptoms of infestation are:

- Production of honeydew on the leaves and fruit on which sooty moulds grow
- Detracted plant appearance by contaminating grape bunches with egg sacs, nymphs and adults

- Reduced plant photosynthesis
- Reduced marketability of fruits
- Weakens and stunts of plants
- Leaf distortion
- Premature leaf drop
- Fruit distortion and drop
- Dieback
- Death of highly infested plants

Note that the above symptoms are common to many other plant-sap feeding insects and should not be considered as species-specific.

Description

Mature adult females have an ovoid body, 3–4 mm long and 1.7 mm wide, dark purple, wingless and covered with a white cottony secretion that is moisture repellent and protects them against desiccation. Projections of the wax secretion from body margin not so developed and limited to a few segments of posterior part of body. Males are winged but weak flyers and short-lived (Tanaka & Kamitani, 2022).

3.2 | Pest distribution

3.2.1 | Pest distribution outside the EU

The distribution of *C. seruratus* is restricted to Japan (Tanaka & Kamitani, 2022; Figure 1). There are also reports of it in the Republic of Korea, but they are considered uncertain. The presence of the species in the Republic of Korea is reported in the National Species list of Korea (National Institute of Biological Resources, 2019). According to Tanaka and Kamitani (2022), in the Republic of Korea, Paik (1978) and Kwon et al. (2003) regarded *C. seruratus* and *C. matsumotoi* as distinct species; however, the species they recognised as *C. matsumotoi* in the Republic of Korea was a misidentification of *Spilococcus pacificus* (Borchsenius 1949). In other previous reports from the Republic of Korea (Park et al., 2011; Park, Leem, et al., 2010; Park, Suh, et al., 2010), the identification of the specimens was based on the description of Kwon et al. (2003), and according to recent taxonomic revision of the genus *Crisisoccus* by Tanaka and Kamitani (2022), the species may have been misidentified. The insect has also been reported in India and the Philippines by Williams (2004), but it is likely a misidentification of the insects which actually belong to the newly described species *Crisicoccus ezzati* (Tanaka & Kamitani, 2022). Moreover, *C. seruratus* under its synonym, *C. matsumotoi*, was also reported from China (Wang et al., 2016), but the morphological identification was based on Williams (2004) and most likely is a misidentification of another species (Tanaka, personal communication, 2024). Therefore, its presence in China is uncertain. The list of countries where the presence of *C. seruratus* is confirmed is shown in Appendix B, with details in specific subnational units.

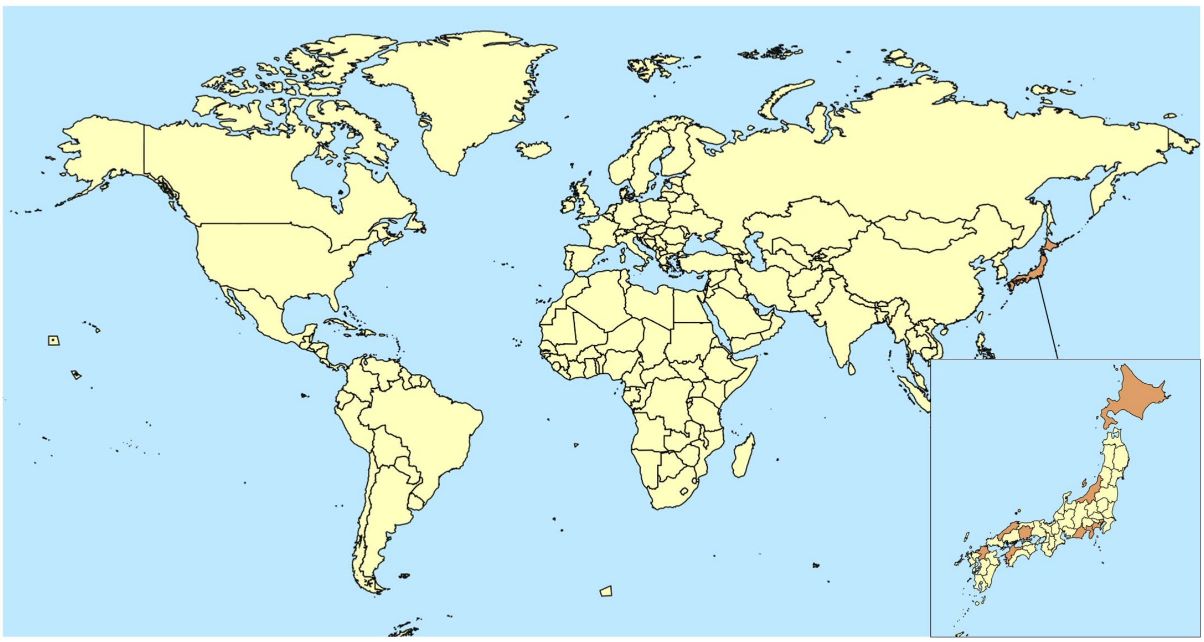

FIGURE 1 Global distribution of *Crisicoccus seruratus* (Source: literature; for details, see Appendix B).

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.

No, *C. seruratus* is not known to be present in the EU territory.

3.3 | Regulatory status

3.3.1 | Commission implementing Regulation 2019/2072

C. seruratus is not listed in Annex II of Commission Implementing Regulation (EU) 2019/2072, an implementing act of Regulation (EU) 2016/2031, or amendments to high-risk plants Regulation (EU) 2018/2019 or in any emergency plant health legislation.

3.3.2 | Hosts or species affected that are prohibited from entering the union from third countries

TABLE 2 List of plants, plant products and other objects that are *Crisicoccus seruratus* 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 *Chaenomeles* Ldl., […] *Pyrus* 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, Türkiye, Ukraine and the United Kingdom
9	Plants for planting of […] and *Pyrus* 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, Türkiye, Ukraine, the United Kingdom 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
12	Plants for planting of *Photinia* Ldl., other than dormant plants free from leaves, flowers and fruits	ex 0602 10 90 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	China, Democratic People's Republic of Korea, Japan, Republic of Korea and United States

Plants for planting of *Acer* L., *Diospyros* L., *Ficus carica* L. and *Juglans* L. which are hosts of *C. seruratus* (Appendix A) are considered high-risk plants for the EU and their import is prohibited pending risk assessment (EU 2018/2019).

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 could enter the EU territory. Possible pathways of entry are plants for planting and fruits.

Comment on plants for planting as a pathway.

Plants for planting are one of the main pathways for *C. seruratus* to enter the EU although some of the host plants from some third countries are prohibited (Table 2).

Potential pathways for *C. seruratus* to enter the EU territory are presented in Table 3.

TABLE 3 Potential pathways for *Crisicoccus seruratus* into the EU.

Pathways	Life stage	Relevant mitigations [e.g. prohibitions (Annex VI), special requirements (Annex VII) or phytosanitary certificates (Annex XI) within implementing Regulation 2019/2072]
Plants for planting	Eggs, nymphs and adults	Plants for planting that are hosts of *C. seruratus* and are prohibited from being imported from third countries (Regulation 2019/2072, Annex VI) are listed in Table 2. A phytosanitary certificate is required for plants for planting from third countries to be imported into the EU (Regulation 2019/2072, Annex XI, Part A). Some hosts are considered high-risk plants (EU 2018/2019) for the EU and their import is prohibited subject to risk assessment.
Fruits	Eggs, nymphs, and adults	A phytosanitary certificate is required for fruits from third countries to be imported into the EU (2019/2072, Annex XI, Part A).

C. seruratus has many plant species as hosts (Appendix A). Although there are some prohibitions in imports of some host plants for planting from third countries (Regulation 2019/2072, Annex VI), there are many other hosts that can be imported to the EU with a phytosanitary certificate, for example artificially dwarfed (bonsai) plants of *Zelkova serrata*.

Fruits of some host plants of *C. seruratus* (grapes, pears and persimmons) are imported into the EU from areas where the pest occurs. A phytosanitary certificate for fruits that are imported into the EU is required (Regulation 2019/2072, Annex XI, Part A). However, the fruits may carry insects, and this may be a pathway for the entry of the insect. Detailed data of the annual imports of host plant commodities into the EU from countries where the pest occurs are provided in Appendix C.

Notifications of interceptions of harmful organisms began to be compiled in Europhyt in May 1994 and in TRACES in May 2020. As at 15 December 2023, there were no records of interception of *C. seruratus* or *C. matsumotoi* in the Europhyt and TRACES databases (EUROPHYT, online).

Interceptions of *C. matsumotoi* were reported in the USA on *Codiaeum* sp. from the Philippines, on *Chaenomeles, Codiaeum, Firmiana* and *Pyrus* from Japan and the Philippines and on *Pyrus* from the Republic of Korea (Australian Department of Agriculture and Water Resources, 2019). However, there is uncertainty if these interceptions were indeed for *C. matsumotoi* (= *C. seruratus*) or a misidentification (Tanaka & Kamitani, 2022).

3.4.2 | Establishment

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

Yes, in the central, northern and some areas of southern EU countries the climate is suitable and there are many available hosts that can 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*

C. seruratus is a polyphagous pest feeding on a relatively wide range of crop plants. The main hosts of the pest cultivated in the EU between 2018 and 2022 are shown in Table 4. The main cultivated host plants of the pest which are economically important in the EU are pears, grapes, figs and walnuts.

TABLE 4 Crop area of *Crisicoccus seruratus* hosts in the EU in 1000 ha (Eurostat accessed on 14/12/2023).

Crop	2018	2019	2020	2021	2022
Grapes	3135.50	3155.20	3146.24	3120.22	3109.62
Pears	113.54	110.66	108.29	106.96	103.07
Walnuts	80.60	87.62	99.21	97.00	102.05
Figs	24.99	25.59	27.63	25.79	26.29

3.4.2.2 | *Climatic conditions affecting establishment*

C. seruratus occurs in humid continental and temperate areas. Figure 2 shows the world distribution of selected Köppen–Geiger climate types (Kottek et al., 2006) that occur in the EU, and which occur in countries where *C. seruratus* has been reported (Cfa, Cfb, Dfb and Dfc). Based on current distribution, establishment is most likely to occur in cool areas of EU. Northern, central and some parts of southern EU countries provide suitable climatic conditions for the establishment of *C. seruratus*.

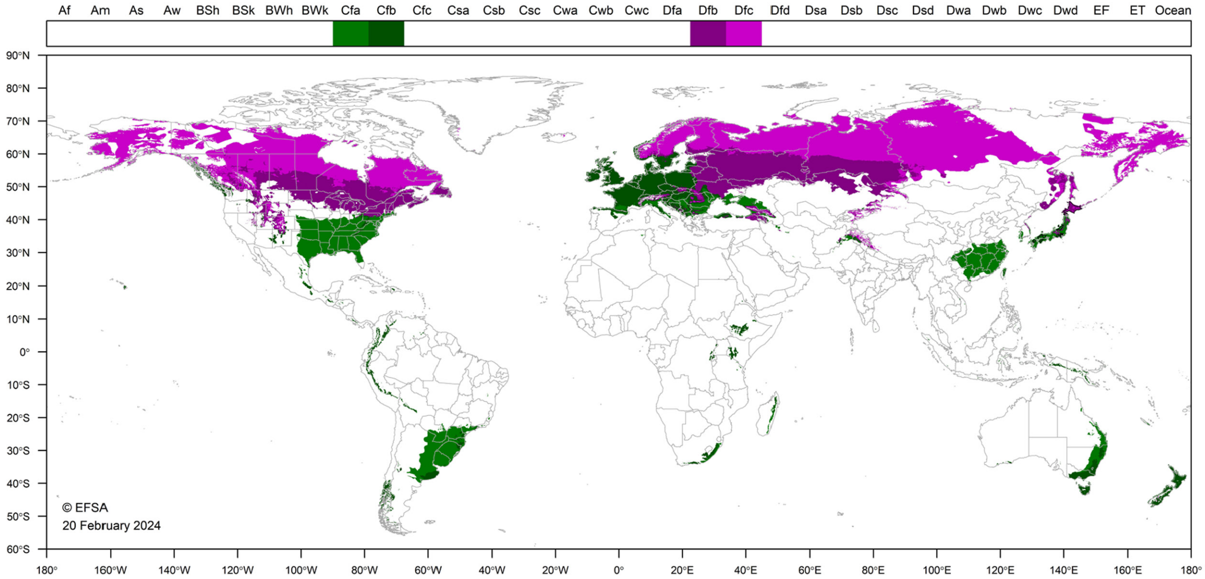

FIGURE 2 World distribution of Köppen–Geiger climate types that occur in the EU and which occur in countries where *Crisicoccus seruratus* has been reported.

3.4.3 | Spread

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

C. seruratus would spread mainly by the crawlers, either naturally or by air currents. Trade of infested plants for planting and fruits would enable long distance spread.

Comment on plants for planting as a mechanism of spread.

The trade of infested plants for planting and fruits are the main pathways of *C. seruratus* spread within the EU territory.

The pest is able to spread over short distances naturally mainly by the crawlers which are more active although nymphs and adults are also able to crawl. The crawlers can also spread by air currents and animals. For long-distance spread, the trade of infested plants for planting and fruits is the main pathway.

3.5 | Impacts

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

Yes, *if C. seruratus is established in the EU, it would most probably have an economic impact on its host species.*

There are many hosts of *C. seruratus* that are cultivated plants with economic importance in the EU, including figs (*Ficus carica*), grapes (*Vitis* spp.), pears (*Pyrus* spp.), persimmons (*Diospyros kaki*) and walnuts (*Juglans regia*). *C. seruratus* is considered an important pest in Japan mainly damaging figs, grapes, persimmons and walnuts (Australian Department of Agriculture, 2014; Nakagaki, 1964). *Pseudococcus comstocki* (Kuwana) and *C. seruratus* were reported as the principal mealybug species injurious to pears in Chiba prefecture of Japan (Nakagaki, 1964). The damage caused by mealybugs is due to their direct feeding from plant phloem which stresses the host plant and reduces yield. The production of honeydew and the growth of sooty moulds reduce the marketability and the commercial value of fruits (Australian Department of Agriculture, 2014).

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, plants of the genera *Pyrus*, *Vitis* and *Photinia* are prohibited as plants for planting from third countries (Section 3.3.2) while other species and fruits require a phytosanitary certificate to import into the EU territory (Section 3.4.1). Moreover, according to the Commission Implementing Regulation (EU) 2018/2019 (for high-risk plants), the import of plants for planting of *Acer* spp., *Juglans* spp. and *Ficus carica is* prohibited. There are also additional measures (Section 3.6.1) to mitigate the likelihood of *C. seruratus* entry, 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 et al., 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	As a pest with low mobility, a risk reduction option could be to source plants from a pest free area, or place of production or production site.	Entry/Spread
Growing plants in isolation	Plants could be grown in insect proof places such as glass or plastic greenhouses or in places with complete physical isolation. That measure could mitigate the likelihood of entry and spread of *C. seruratus*.	Entry/Spread
Roguing and pruning	Mealybugs are usually found feeding in colonies in protected areas such as between two touching fruits, in the crown of a plant, in branch crotches, on stems near soil, between the stem and touching leaves (University of California, 2016) or in the roots (Nakagaki, 1964). Roguing (removal of infested plants) and pruning (removal of infested plant parts only without affecting the viability of the plant) can reduce the population density of the pest.	Entry/Spread/Impact

TABLE 5 (Continued)

Control measure/Risk reduction option (Blue underline = Zenodo doc, Blue = WIP)	RRO summary	Risk element targeted (entry/establishment/spread/impact)
Chemical treatments on crops including reproductive material	Used to mitigate likelihood of infestation of pests susceptible to chemical treatments. Spray of insecticides can kill all stages of mealybugs although they are protected by wax and difficult to reach. Acetamiprid, Abamectin and Cypermethrin have some effect on the mealybugs (EFSA PLH Panel et al., 2022). According to Seo et al. (2016), there are 14 registered insecticides in the Republic of Korea that can be used to control *C. seruratus* in the field.	Entry/Establishment/Spread/Impact
Chemical treatments on consignments or during processing	The chemical compounds that may be applied to plants or to plant products after harvest, during process or packaging operations and storage could mitigate the likelihood of infestation of pests susceptible to chemical treatment.	Entry/Spread
Physical treatments on consignments or during processing	Brushing, washing and other mechanical cleaning methods can be used to reduce the likelihood of the presence of the pest in consignments to be exported to be planted.	Entry/Spread
Heat and cold treatments	Controlled temperature treatments aimed to kill or inactivate pests without causing any unacceptable prejudice to the treated material itself.	Entry/Spread
Controlled atmosphere	Treatment of plants by storage in a modified atmosphere (including modified humidity, O_2, CO_2, temperature, pressure) could mitigate the likelihood of entry and spread of the pest. Controlled atmosphere storage can be used in commodities such as fresh and dried fruits, cut flowers and vegetables.	Entry/Spread (via commodity)

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 et al., 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	ISPM 5 (FAO, 2023) defines inspection 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. The effectiveness of sampling and subsequent inspection to detect pests may be enhanced by including trapping and luring techniques. Any shipments of fresh plant material from an infested country to another that is not infested should be inspected thoroughly to detect *C. seruratus*.	Entry/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/spread
Sampling	According to ISPM 31 (FAO, 2008), 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/spread
Phytosanitary certificate and plant passport	According to ISPM 5 (FAO, 2023), a phytosanitary certificate and a plant passport are official paper documents or their official electronic equivalents, consistent with the model certificates of the IPPC, attesting that a consignment meets phytosanitary import requirements: a. export certificate (import) b. plant passport (EU internal trade)	Entry/spread

(Continues)

TABLE 6 (Continued)

Supporting measure (Blue underline = Zenodo doc, Blue = WIP)	Summary	Risk element targeted (entry/establishment/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
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
Surveillance	Surveillance to guarantee that plants and produce originate from a Pest Free Area could be an option.	Spread

3.6.1.3 | *Biological or technical factors limiting the effectiveness of measures*

- *C. seruratus* has many host plants, making the inspections of all consignments containing hosts from countries where the pest occurs difficult.
- *C. seruratus* nymphs and adult females are very small and difficult to detect by visual inspection when there is a low infestation level. Moreover, they tend to hide in crevices, in protected spaces and on roots of host plants (Australian Department of Agriculture, 2014).
- Some insecticide treatments may not be effective because of the waxy cover.

3.7 | Uncertainty

No key uncertainty has been identified.

4 | CONCLUSIONS

Crisicoccus seruratus satisfies all the criteria that are within the remit of EFSA to assess for it to be regarded as a potential Union quarantine pest. Table 7 provides a summary of the PLH Panel conclusions.

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 clearly defined and *Crisicoccus seruratus* (Kanda 1933) is now the accepted name.	None
Absence/presence of the pest in the EU (Section 3.2)	The pest is not known to be present in the EU territory.	None
Pest potential for entry, establishment and spread in the EU (Section 3.4)	*C. seruratus* is able to enter into, become established, and spread within the EU territory. The main pathways are plants for planting and fruits.	None
Potential for consequences in the EU (Section 3.5)	The pests' introduction could have an economic impact on several crops in EU such as pears, grapes, walnuts and figs.	None
Available measures (Section 3.6)	There are measures available to prevent the entry, establishment and spread of *C. seruratus* within the EU. These measures include the inspections and chemical treatments on consignments of fresh plant material from infested countries.	None
Conclusion (Section 4)	The criteria assessed by EFSA for consideration as a potential quarantine pest are met.	None
Aspects of assessment to focus on/scenarios to address in future if appropriate:	This categorisation focussed on *C. seruratus* whose occurrence in China on *Acer* is uncertain. The identity of the Pseudococcidae species on *Acer* in China needs taxonomic clarification.	

GLOSSARY

Containment (of a pest)	Application of phytosanitary measures in and around an infested area to prevent spread of a pest (FAO, 2023)
Control (of a pest)	Suppression, containment or eradication of a pest population (FAO, 2023)
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, 2023)
Eradication (of a pest)	Application of phytosanitary measures to eliminate a pest from an area (FAO, 2023)
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO, 2023)
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 & Newfield, 2023).
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, 2023)
Pathway	Any means that allows the entry or spread of a pest (FAO, 2023)
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, 2023)
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, 2023)
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, 2023)

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

CONFLICT OF INTEREST

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PANEL MEMBERS

Claude Bragard, Paula Baptista, Elisavet Chatzivassiliou, Francesco Di Serio, Paolo Gonthier, Josep Anton Jaques Miret, Annemarie Fejer Justesen, Alan MacLeod, Christer Sven Magnusson, Panagiotis Milonas, Juan A. Navas-Cortes, Stephen Parnell, Roel Potting, Philippe L. Reignault, Emilio Stefani, Hans-Hermann Thulke, Wopke Van der Werf, Antonio Vicent Civera, Jonathan Yuen and Lucia Zappalà.

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APPENDIX A

Crisicoccus seruratus host plants/species affected

Source: Shiraiwa (1935), García Morales et al. (2016), Tanaka and Kamitani (2022).

Host status	Host name	Plant family	Common name
Cultivated hosts	*Acer* spp.	Sapindaceae	Maple
	Acer palmatum	Sapindaceae	Japanese maple, palmate maple, smooth Japanese maple
	Buxus microphylla	Buxaceae	Japanese box, littleleaf box
	Buxus sinica	Buxaceae	Chinese box, small-leaved box
	Chaenomeles speciosa	Rosaceae	Flowering quince, Chinese quince, Japanese quince
	Diospyros kaki	Ebenaceae	Oriental persimmon, Chinese persimmon, Japanese persimmon, kaki persimmon
	Ficus spp.	Moraceae	Fig
	Ficus carica	Moraceae	Common fig
	Juglans mandshurica	Juglandaceae	Monkey nuts, tigernut
	Juglans regia	Juglandaceae	Common walnut, Persian walnut, English walnut
	Photinia glabra	Rosaceae	Japanese photinia
	Platanus orientalis	Platanaceae	Old World sycamore, Oriental plane
	Pyrus pyrifolia var. culta	Rosaceae	Asian pear, Persian pear, Japanese pear, Chinese pear, country pear, Korean pear, sand pear
	Vitis spp.	Vitaceae	Grape
	Wisteria floribunda	Fabaceae	Japanese wisteria
	Zelkova serrata	Ulmaceae	Japanese zelkova, Japanese elm, saw-leaf zelkova
Wild/weed hosts	*Celtis sinensis*	Cannabaceae	Japanese hackberry, Chinese hackberry
	Kalimeris indica	Asteraceae	Indian aster, Indian Kalimeris
	Mallotus japonicus	Euphorbiaceae	East Asian mallotus, Food wrapper plant

APPENDIX B

Distribution of *Crisicoccus seruratus*

Distribution records based on literature.

Region	Country	Sub-national (e.g. state)	Status	Reference
Asia	Japan	Hokkaido	Present, no details	Shiraiwa (1935)
		Niigata	Present, no details	Shiraiwa (1935)
		Tokyo	Present, no details	Shiraiwa (1935)
		Kanagawa	Present, no details	Shiraiwa (1935)
		Shizuoka	Present, no details	Shiraiwa (1935)
		Shimane	Present, no details	Shiraiwa (1935)
		Okayama	Present, no details	Shiraiwa (1935)
		Ehime	Present, no details	Shiraiwa (1935)
		Fukuoka	Present, no details	Shiraiwa (1935)

APPENDIX C

Import data

TABLE C.1 **Grapes fresh or dried (CN code: 0806)** imported in 100 kg into the EU from regions where *Crisicoccus seruratus* is known to occur (Source: Eurostat accessed on 1/12/2023).

COUNTRY	2018	2019	2020	2021	2022
Japan	1.52	1.19	21.09	34.49	4.99

TABLE C.2 **Fresh apples, pears and quinces (CN code: 0808)** imported in 100 kg into the EU from regions where *Crisicoccus seruratus* is known to occur (Source: Eurostat accessed on 1/12/2023).

COUNTRY	2018	2019	2020	2021	2022
Japan	1.40		19.25	10.64	20.01

TABLE C.3 **Fresh persimmons (CN code: 081070)** imported in 100 kg into the EU from regions where *Crisicoccus seruratus* is known to occur (Source: Eurostat accessed on 1/12/2023).

COUNTRY	2018	2019	2020	2021	2022
Japan	0.76	0.27	0.02	0.32	0.11

TABLE C.4 **Fresh or dried figures (CN code: 080420)** imported in 100 kg into the EU from regions where *Crisicoccus seruratus* is known to occur (Source: Eurostat accessed on 1/12/2023).

COUNTRY	2018	2019	2020	2021	2022
Japan					0.03