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Pest categorisation of *Maconellicoccus hirsutus*

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Abstract

The EFSA Panel on Plant Health performed a pest categorisation of *Maconellicoccus hirsutus* (Hemiptera: Pseudococcidae), the pink hibiscus mealybug, for the EU. *M. hirsutus* is native to Southern Asia and has established in many countries in tropical and subtropical regions throughout the world. Within the EU, the pest has been reported from Cyprus and Greece (Rhodes). *M. hirsutus* is not listed in Annex II of Commission Implementing Regulation (EU) 2019/2072. It is highly polyphagous, feeding on plants assigned to 229 genera in 78 plant families, and shows some preference for hosts in the families Malvaceae, Fabaceae and Moraceae. Economically important crops in the EU such as cotton (*Gossypium* spp.), citrus (*Citrus* spp.), ornamentals (*Hibiscus* spp.), grapes (*Vitis vinifera)*, soybean (*Glycinae max*), avocado (*Persea americana*) and mulberry trees (*Morus alba*) may be significantly affected by *M. hirsutus*. The lower and upper developmental temperature threshold of *M. hirsutus* on *Hibiscus rosa-sinensis* are 14.5 and 35.0°C, respectively, with optimal female development estimated to be at 29.0°C. There are about 10 generations a year in the subtropics but as many as 15 may occur under optimal conditions. Plants for planting, fruits, vegetables and cut flowers provide potential pathways for entry into the EU. Climatic conditions in EU member states around the Mediterranean Sea and host plant availability in those areas are conducive for establishment. The introduction of *M. hirsutus* is expected to have an economic impact in the EU through damage to various ornamental plants, as already observed in Cyprus and Greece, and reduction in yield and quality of many significant crops. Phytosanitary measures are available to reduce the likelihood of entry and further spread. Some uncertainties include the area of establishment, whether it could become a greenhouse pest, impact, and the influence of natural enemies. *M. hirsutus* meets the criteria that are within the remit of EFSA to assess for it to be regarded as a potential Union quarantine pest.

Keywords: pink hibiscus mealybug, Hemiptera, pest risk, plant health, plant pest, Pseudococcidae, quarantine

Requestor: European Commission

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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

Maconellicoccus hirsutus is one of a number of pests listed in Annex 1A to the Terms of Reference (ToR) (Section 1.1.2) 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 European Commission 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 assessment of *Ficus carica* plants from Israel performed by EFSA (EFSA PLH Panel, 2021), in which *M. hirsutus* was identified as a relevant non-regulated EU pest which could potentially enter the EU on *F. carica*.

2. Data and methodologies

2.1. Data

2.1.1. Information on pest status from NPPOs

In the context of the commodity risk assessment of *Ficus carica* plants from Israel (EFSA PLH Panel, 2021), EFSA consulted (in April-May 2020) the NPPOs where the pest is present, in order to have an updated information on the pest status. For the information on pest status in Cyprus and Greece, please see Section 3.2.2.

2.1.2. Literature search

A literature search on *M. hirsutus* 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 European and Mediterranean Plant Protection Organization (EPPO) Global Database (EPPO, online), the CABI databases and scientific literature databases as referred above in Section 2.1.2.

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 EU, 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.

2.2. Methodologies

The Panel performed the pest categorisation for *M. hirsutus,* following guiding principles and steps presented in the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel, 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 to this 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 defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column)

Criterion of pest categorisation	Criterion in Regulation (EU) 2016/2031 regarding Union quarantine pest (article 3)
Identity of the pest (Section 3.1)	Is the identity of the pest established, or has it been shown to produce consistent symptoms and to be transmissible?
Absence/presence of the pest in the EU territory (Section 3.2)	Is the pest present in the EU territory? If present, is the pest widely distributed within the EU? Describe the pest distribution briefly
Regulatory status (Section 3.3)	If the pest is present in the EU but not widely distributed in the risk assessment area, it should be under official control or expected to be under official control in the near future
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
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 the entry into the EU such that the likelihood of introduction becomes mitigated?
Conclusion of pest categorisation (Section 4)	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential quarantine pest were met and (2) if not, which one(s) were not met

3. Pest categorisation

3.1. Identity and biology of the pest

3.1.1. Identity and taxonomy

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

Yes, the identity of the pest is established and *Maconellicoccus hirsutus* (Green) is the accepted name.

The pink hibiscus mealybug, also known as the hibiscus mealybug, *Maconellicoccus hirsutus* (Green, 1908) is an insect within the order Hemiptera, family Pseudococcidae. This species was initially described by Green in 1908 as *Phenacoccus hirsutus* from specimens collected on an undetermined shrub attended by ants in India (García Morales et al., 2016). Indeed, this species is likely to be native to southern Asia (Williams, 2004). Former scientific names include *Maconellicoccus pasaniae*, *Maconellicoccus perforatus*, *Paracoccus pasaniae*, *Phenacoccus glomeratus*, *Phenacoccus hirsutus*, *Phenacoccus quaternus*, *Pseudococcus hibisci* and *Spilococcus perforatus* (CABI, 2021). The genus *Maconellicoccus* includes eight described species (Williams, 1996; CABI, 2021). Detailed morphological descriptions, illustrations and keys to the eight species of the genus *Maconellicoccus* can be found in

Williams (1996), Meyerdirk et al. (2001) and EPPO (2006). The EPPO code (Griessinger & Roy, 2015; EPPO, 2019) for this species is PHENHI (EPPO, 2021).

3.1.2. Biology of the pest

Adult females of *M. hirsutus* in Jordan appear in early February and show their highest abundance in mid-July (Al-Fwaeer et al., 2014). *M. hirsutus* reproduces parthenogenetically or sexually (Williams, 1996). Reproduction is mostly parthenogenetic in Egypt and the State of Bihar, India (Hall, 1921; Singh and Ghosh, 1970), while it is sexual in the Indian state of West Bengal (Ghose, 1971) and probably in the Caribbean (Williams, 1996). According to Bartlett (1978) and Mani (1989), an adult female lays 150–600 eggs over a period of about 1 week on the host plants. The eggs are laid in an ovisac, consisting of a mass of sticky wax filaments. Oviposition occurs mainly in the outer parts of the host, such as the growing points, buds and fruits, but in case of cold weather conditions the females search for shelter to oviposit (Meyerdirk et al., 2001). The lower and upper developmental temperature threshold of *M. hirsutus* on *Hibiscus rosa-sinensis* are 14.5 and 35.0°C, respectively. The optimal developmental temperature for females was estimated to be 29.0°C (Chong et al., 2008). In warm, but unspecified conditions, it takes 5 weeks for a generation to be completed (Bartlett, 1978). Chong et al. (2008) stated that the generation time is 41 days at 25°C and 82 days at 20°C. In countries with a cool winter the species overwinters as eggs (Bartlett, 1978) or other stages in protected parts of the host plant or as eggs in the soil (Pollard, 1995). There are about 10 generations a year in the subtropics (Meyerdirk et al., 2001). However, under optimum conditions, there may be as many as 15 generations per year (Pollard, 1995).

There are three immature instars in the female and four in the male (EPPO, 2005). First instar nymphs are known as crawlers and are mobile. The crawlers prefer the apical and tender regions of the host. However, large populations of nymphs may also settle on the older plant parts including stems, leaves, petioles, roots, tubers and pods (Ghose, 1972). After locating a suitable feeding site on a host plant, nymphs settle to feed and develop. Later instars turn grey–pink and start to secrete white wax that covers their bodies (Chong et al., 2015). In heavy infestations white masses of wax concealing the insect may occur in axils and on twigs and stems (EPPO, 2006) (Figure 1). Female adults live for 19–28 days (Chong et al., 2008; Sahito et al., 2012; Negrini et al., 2017). Males have one pair of wings, but they are weak flyers, only live a day or two, and are not commonly observed (Chong et al., 2015).

Key features of the biology of each life stage are summarised in Table 2.

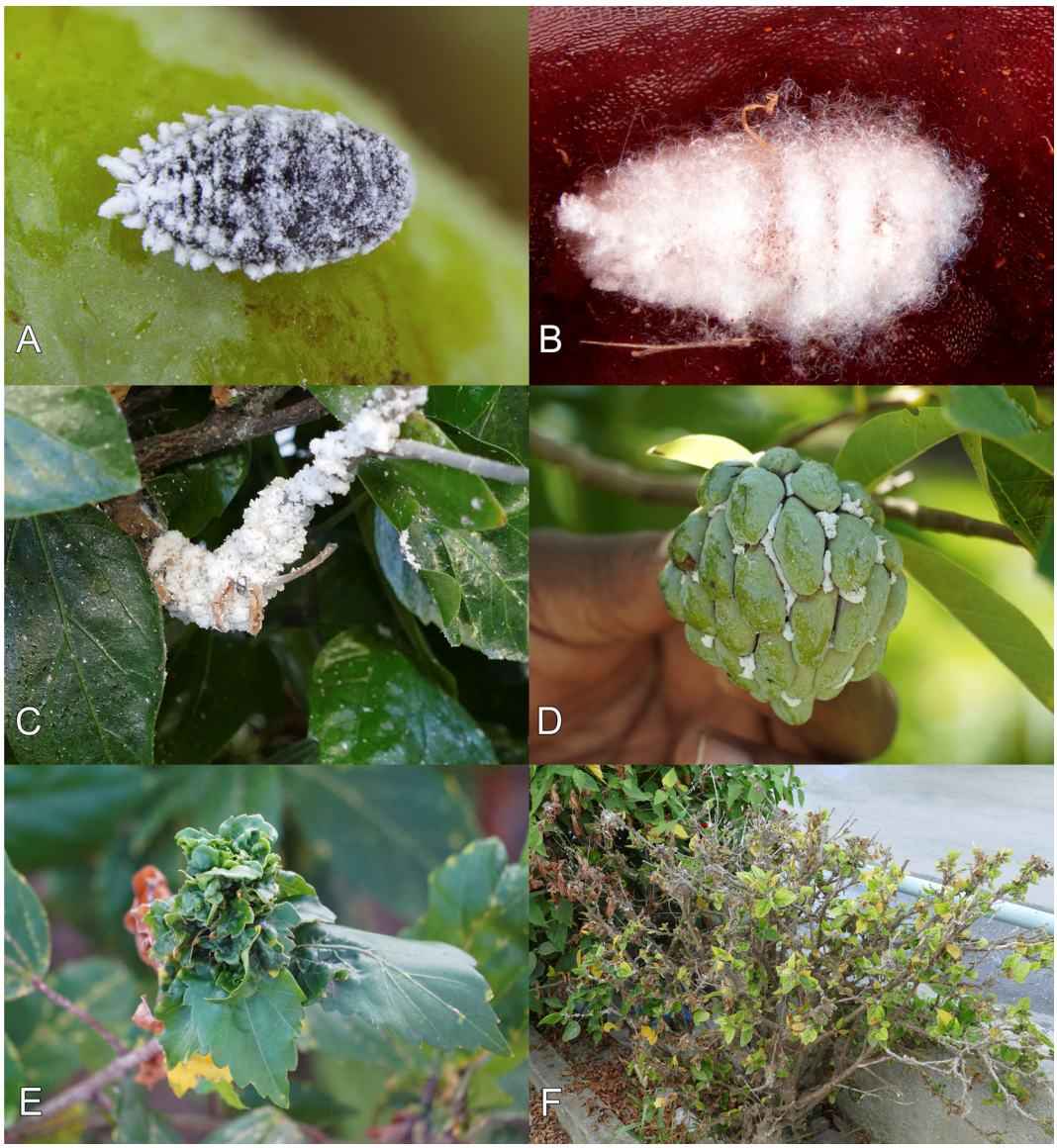

Figure 1: *Maconellicoccus hirsutus*: (A) adult female; (B) adult female covered in waxy filaments; (C) large infestation on hibiscus; (D) ovisacs in the crevices of *Annona* fruit; (E) distorted growth characteristic of plants infested by *M. hirsutus*; (F) hibiscus plant in Rhodes, severely damaged by *M. hirsutus* © Chris Malumphy

Table 2: Important features of the life history strategy of *Maconellicoccus hirsutus*

Life stage	Phenology and relation to host	Other relevant information
Egg	Adult female lays 150–600 eggs in a sticky waxy ovisac. Oviposition occurs mainly on the outer areas of the host, including the buds and fruit	The eggs hatch in 6–9 days at temperatures between 25 and 35°C but it requires 16 days at 20°C. The lower and upper threshold for the eggs and the optimal developmental temperature were estimated at 14.5, 39.8 and 33.4°C, respectively (Chong et al., 2008)
First instar nymph	First instar nymphs are known as crawlers. They prefer the apical and tender parts of the host. However, large populations of nymphs may also settle on the older plant parts	The crawlers disperse by walking to other parts of the host plant. They may also be transported by water, wind or animals

Life stage	Phenology and relation to host	Other relevant information
	including stems, leaves, petioles, roots, tubers, and pods. After locating a suitable host plant, nymphs settle on the host to feed and develop	
Later instar nymphs	Later instars start to secrete white wax that covers their bodies. There are three immature instars in the female and four in the male	White masses of wax concealing the insect may occur in axils and on twigs and stems. The nymphal development is affected by both temperature and host plant. At 25°C, the female nymphs need 23 and 26.6 days on *H. rosa-sinensis* and *Morus alba*, respectively, to complete their development (Chong et al., 2008; Sahito et al., 2012). On *H. rosa-sinensis* and at 27°C nymphal development was reported to last either 17.5 or 20.6 days (Chong et al., 2008; Negrini et al., 2017). Whereas at 30 and 20°C the female nymphal stages last 26.6 and 50.1 days, respectively. The lower and upper threshold and the optimal developmental temperature for female nymphs were estimated at 15.1, 35.0 and 28.8°C, respectively (Chong et al., 2008)
Adult	Males have one pair of wings, but they are weak flyers. Female adults live for 19–28 days (Chong et al., 2008; Sahito et al., 2012; Negrini et al., 2017) while males only 1 or 2 days and are not commonly observed (Chong et al., 2015)	*M. hirsutus* reproduces parthenogenetically or sexually. The lower and upper developmental temperature threshold on *H. rosa-sinensis* were 14.5 and 35°C, respectively. The optimal developmental temperature for females was estimated to be 29°C

3.1.3. Host range/species affected

There is a long list of host plants of *M. hirsutus* worldwide. The host range of *M. hirsutus* is broad with more than 229 plant genera from 78 plant families (García Morales et al., 2016). Appendix A provides the full list of plant species reported to be *M. hirsutus* hosts. Economically important crops in the EU such as cotton (*Gossypium* spp.), citrus (*Citrus* spp.), ornamentals (*Hibiscus* spp.), grapes (*Vitis vinifera)*, soybean (*Glycinae max*), avocado (*Persea americana*) and mulberry trees (*Morus alba*) may be significantly affected by *M. hirsutus*. *M. hirsutus* has also been recorded on several rosaceous crops that are important in the EU, including apple (*Malus domestica*), apricot (*Prunus armeniaca*), peach (*Prunus persica*), pear (*Pyrus communis*) and plum (*Prunus domestica*), but there appears to be no economic impact recorded on these hosts.

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 and molecular identification of *M. hirsutus*.

Detection

Careful visual examination of plants is an effective way for the detection of the insect. The white waxy covering of mealybug instars and white waxy filaments in the egg mass allow detection (Meyerdirk et al., 2001). The mealybugs themselves are in general visible, although they are hidden in the swollen growth. Male adults can also be caught using sticky cards baited with a sex pheromone

which contains esters of lavandulyl and maconellyl and allow detection in areas of low density of the pest (Francis et al., 2007).

Symptoms

The main symptoms of *M. hirsutus* infestation are (Dufour and Léon, 1997; Sagarra and Peterkin, 1999; Kairo et al., 2000; Alleyne, 2004; Chong et al., 2015):

- large quantities of honeydew
- black sooty mould
- leaf curling
- shoot and leave malformation
- fruit malformation
- bunchy top appearance
- premature senescence of flowers and foliage
- heavy infestation may cause a complete defoliation of the plant, leading to their death

Identification

The identification of *M. hirsutus* requires microscopic examination of slide-mounted adult females and verification of the presence of key morphological characteristics as given in Meyerdirk et al. (2001) and Williams (1996). Moreover, a key is available (EPPO, 2006) to distinguish *M. hirsutus* from other species of the genus. Molecular techniques for species identification have also been developed (Malausa et al., 2011; Abd-Rabou et al., 2012).

Description (detailed morphological descriptions are available from Meyerdirk et al. (2001) and EPPO (2006))

The main morphological characteristics of *M. hirsutus* are:

- The eggs are 0.3 mm long and initially orange, turning pink before hatching (Chong et al., 2015).
- Crawlers 0.37 mm long (Aristizábal et al., 2012), pink and oval with antennae; they lack the waxy body coating (CABI, 2021).
- Second instars average length 0.70 mm, third instars 1.1 mm and male fourth instar 1.1 mm (Aristizábal et al., 2012). Immature females and newly matured females have greyish-pink bodies dusted with mealy white wax (CABI, 2021).
- Mature adult females are wingless, elongate oval, slightly flattened in profile, 2.5–4 mm long, and their ovisacs cover most of the body. Body is greyish pink or occasionally purple, and covered with a thin white cotton like wax forming a protective ovisac for her eggs. The entire colony tends to become covered by white, waxy ovisac material (EPPO, 2005, 2006; Chong et al., 2015).
- On microscopic examination of slide-mounted females, the combination of nine-segmented antennae, anal lobe bars, numerous large dorsal oral rim ducts on all parts of the body, and long, flagellate dorsal setae make the species fairly easy to recognize in parts of the world where other *Maconellicoccus* species do not occur. Males have one pair of very simple wings, long antennae, white wax filaments projecting posteriorly and lack mouthparts CABI (2021).

3.2. Pest distribution

3.2.1. Pest distribution outside the EU

M. hirsutus has established in many tropical and subtropical regions throughout the world in the past 100 years (Culik et al., 2013). It has a wide distribution which includes many countries in Africa, South Asia, Australia, Central America, South America, Caribbean and the southern part of North America (EPPO, 2021) (Figure 2). For a detailed list of countries where *M. hirsutus* is present, see Appendix B.

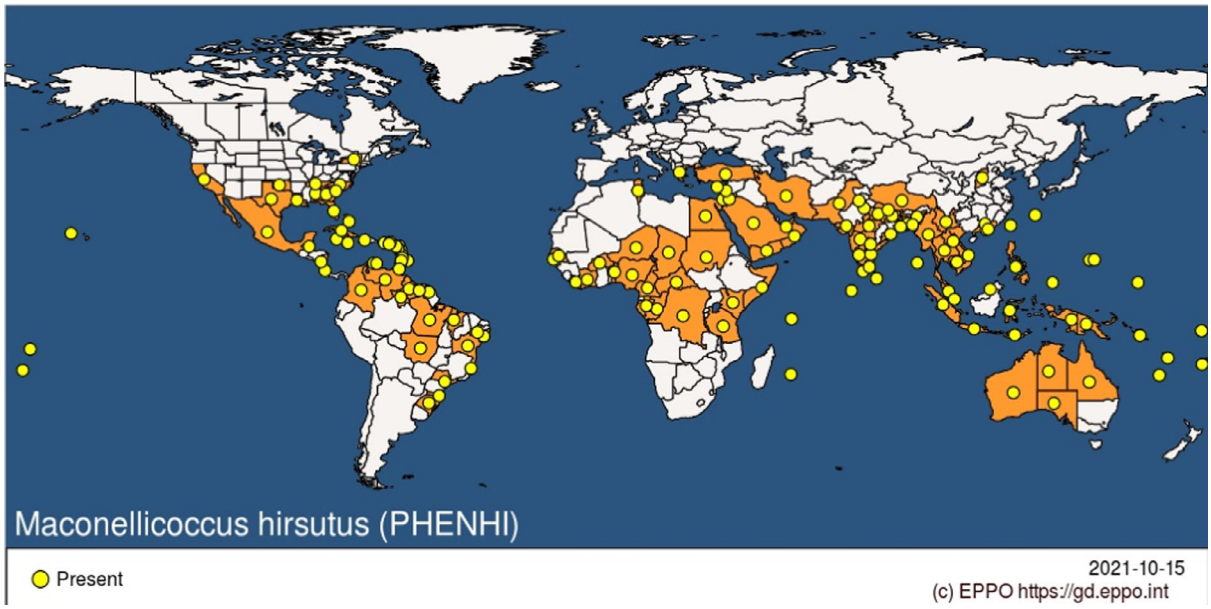

Figure 2: Global distribution of *Maconellicoccus hirsutus* (Source: EPPO Global Database accessed on 15/10/2021)

3.2.2. Pest distribution in the EU

Is the pest present in the EU territory? If present, is the pest widely distributed within the EU?
M. hirsutus has a restricted distribution in the EU. It is present in Greece and Cyprus.

The pest is widespread only in the island of Rhodes in southern eastern part of Greece. The pest is present, widespread and under official control in Cyprus (EPPO GD, online).

According to Miller et al. (2014), between 1995 and 2012 the species had been intercepted in USA ports in commodities originating from France and Italy. However, there are no records of the species from France and Italy. This has probably resulted from produce being imported to Europe from areas where the mealybug occurs and re-exported to the USA.

3.3. Regulatory status

3.3.1. Commission Implementing Regulation 2019/2072

M. hirsutus is not listed in Annex II of Commission 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 *M. hirsutus* hosts in the Union from certain third countries is prohibited (Table 3).

Table 3: List of plants, plant products and other objects that are *Maconellicoccus hirsutus* 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., *Crateagus* L., *Cydonia* Mill., *Malus* Mill., *Prunus* L., *Pyrus* 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 *Cydonia* Mill., *Malus* Mill., *Prunus* L. and *Pyrus* L. and their hybrids, and *Fragaria* L., 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
11.	Plants of *Citrus* L., *Fortunella* Swingle, *Poncirus* Raf., and their hybrids, other than fruits and seed	ex 0602 10 90 ex 0602 20 20 0602 20 30 ex 0602 20 80 ex 0602 90 45 ex 0602 90 46 ex 0602 90 47 ex 0602 90 50 ex 0602 90 70 ex 0602 90 91 ex 0602 90 99 ex 0604 20 90 ex 1404 90 00	
18.	Plants for planting of Solanaceae other than seeds and the plants covered by entries 15, 16 or 17	ex 0602 90 30 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, Azerbaijan, Belarus, Bosnia and Herzegovina, Canary Islands, Egypt, Faeroe Islands, Georgia, Iceland, Israel, Jordan, Lebanon, Libya, Liechtenstein, Moldova, Monaco, Montenegro, Morocco, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (Severo-Zapadny federalny okrug), Southern Federal

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**
			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 and Ukraine
20.	Growing medium as such, other than soil, consisting in whole or in part of solid organic substances, other than that composed entirely of peat or fibre of *Cocos nucifera* L., previously not used for growing of plants or for any agricultural purposes	ex 2530 10 00 ex 2530 90 00 ex 2703 00 00 ex 3101 00 00 ex 3824 99 93	Third countries other than Switzerland

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.

Comment on plants for planting as a pathway.

Yes. The pest has already entered the EU territory. The main pathways are plants for planting, fruits, vegetables and cut flowers.

Plants for planting, fruits, vegetables and cut flowers are the main pathways for entry of *M. hirsutus* (EPPO, 2005; Culik et al., 2013). It can also be associated with soil, which could however be considered as a closed pathway (Table 4).

Table 4: Potential pathways for *Maconellicoccus hirsutus* into the EU 27

Pathways description (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 2019/2072]**
Plants for planting	Eggs, nymphs and adults	Plants for planting that are hosts of *M. hirsutus*, and are prohibited to import from third countries (Regulation 2019/2072, Annex VI), are listed in Table 3. The growing medium attached to or associated with plants, intended to sustain the vitality of the plants, are regulated in Regulation 2019/2072, Annex VII. Plants for planting from third countries require a phytosanitary certificate (Regulation 2019/2072, Annex XI, Part A)
Fruits, vegetables and cut flowers	Eggs, nymphs and adults	Fruits, vegetables and cut flowers from third countries require a phytosanitary certificate to import into the EU (2019/2072, Annex XI, Part A). However, no requirements are specified for *M. hirsutus*. According to Regulation 2019/2072, Annex XI, Part C there is a list of plants which a phytosanitary certificate is not required for their introduction into the Union territory.

Pathways description (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 2019/2072]
		M. hirsutus infests fruits that are included in that list (*Ananas comosus* and *Musa* spp.)
Soil	Eggs	Import of soil from third countries is prohibited (Regulation 2019/2072, Annex VI)

The import of some host plants of *M. hirsutus* for planting from third countries is not allowed (Regulation 2019/2072, Annex VI), while there are many other hosts that can be imported to the EU with a phytosanitary certificate.

Vegetables, cut flowers and most fruits that are imported into the EU must have a phytosanitary certificate. However, pineapple (*Ananas comosus*) and banana (*Musa* spp.), which are hosts for *M. hirsutus*, are exempt by Regulation 2019/2072, Annex XI, Part C.

EU legislation (2019/2072) prohibits the import of soil from third countries so that pathway can be considered as closed.

Annual imports of *M. hirsutus* hosts from countries where the pest is known to occur 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 16/9/2021 (search date) there were two records of interceptions of *M. hirsutus* in the Europhyt and TRACES databases:

- in 2008 on *Colocasia* sp. plants for planting imported from India
- in 2018 on *Annona squamosa* fruits imported from Brazil

In the UK, a former member of the EU, there were more than 240 interceptions of *M. hirsutus* between 1994 and 2021, mostly on *Annona squamosa* fruits from India. *M. hirsutus* was also found on *Annona* fruits from Egypt, Indonesia, Kenya, Pakistan, Saint Lucia and Vietnam, and a range of fresh fruits and vegetables imported from Asia, Africa, and the Caribbean (Fera unpublished records). No action was taken against these findings.

3.4.2. Establishment

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

Yes, in the EU countries of southern Europe the climate is suitable and there are many available hosts that can support establishment. Given that *M. hirsutus* occurs in Greece and has a wide distribution in Cyprus, it must have been able to transfer following entry.

3.4.2.1. EU distribution of main host plants

M. hirsutus is a polyphagous pest. The main hosts of the pest cultivated in the EU 27 between 2016 and 2020 are shown in Table 5. Among others, citrus, cotton, soybeans, grapes, pome fruits and stone fruits are highly economically important crops in the EU.

Table 5: Crop area of *Maconellicoccus hirsutus* hosts in EU 27 in 1,000 ha (Eurostat accessed on 21/09/2021)

Crop	2016	2017	2018	2019	2020
Citrus	519.01	502.84	508.99	512.53	487.08
Cotton	301.34	326.12	345.64	361.78	349.94
Soybeans	831.18	962.39	955.40	907.91	939.86
Grapes	3,136.04	3,133.21	3,135.02	3,158,32	3,160.27
Cucumbers	32.33	31.81	32.65	33.69	33.15
Bananas	20.30	18.91	17.94	18.19	19.61
Pome fruits	No data	627.98	629.42	610.11	589.85

Crop	2016	2017	2018	2019	2020
Stone fruits	No data	625.46	621.32	612.33	No data
Avocados	12.24	12.72	13.22	15.52	17.27

3.4.2.2. Climatic conditions affecting establishment

M. hirsutus occurs mainly in tropical and subtropical regions in Asia, Africa, Australia, and America. Moreover, it has also been recorded in Greece, Cyprus and Turkey, countries with a Mediterranean climate. According to the global Köppen-Geiger climate zones (Kottek et al., 2006), *M. hirsutus* is present in countries with climate zones Aw (Equatorial savannah with dry winter), Am (Equatorial monsoon), Af (Equatorial rainforest, fully humid), BWh (Desert climate, hot desert), Bsh (Steppe climate, hot steppe) and Csa (warm temperate climate with dry hot summer). The lower and upper developmental temperature threshold of *M. hirsutus* on *H. rosa-sinensis* is 14.5 and 35°C, respectively (Chong et al., 2008), temperatures that are relatively high. Figure 3 shows the World distribution of Köppen–Geiger climate types that occur in the EU and which occur in countries where *M. hirsutus* has been reported. Southern EU countries provide suitable climatic conditions that would support the establishment of *M. hirsutus*. There is uncertainty as to whether *M. hirsutus* could establish in the EU countries of central Europe. It is unlikely that the insect could establish in the northern EU, and if it did, the populations are likely to be small and have no impact. Countries and areas of the EU most suitable include Cyprus, Greece, Malta, Portugal, Spain, coastal areas of southern France, including Corsica, as well as southern Italy, including Sardinia and Sicily. There is a possibility that *M. hirsutus* could occur in glasshouses and on indoor plantings in cooler areas.

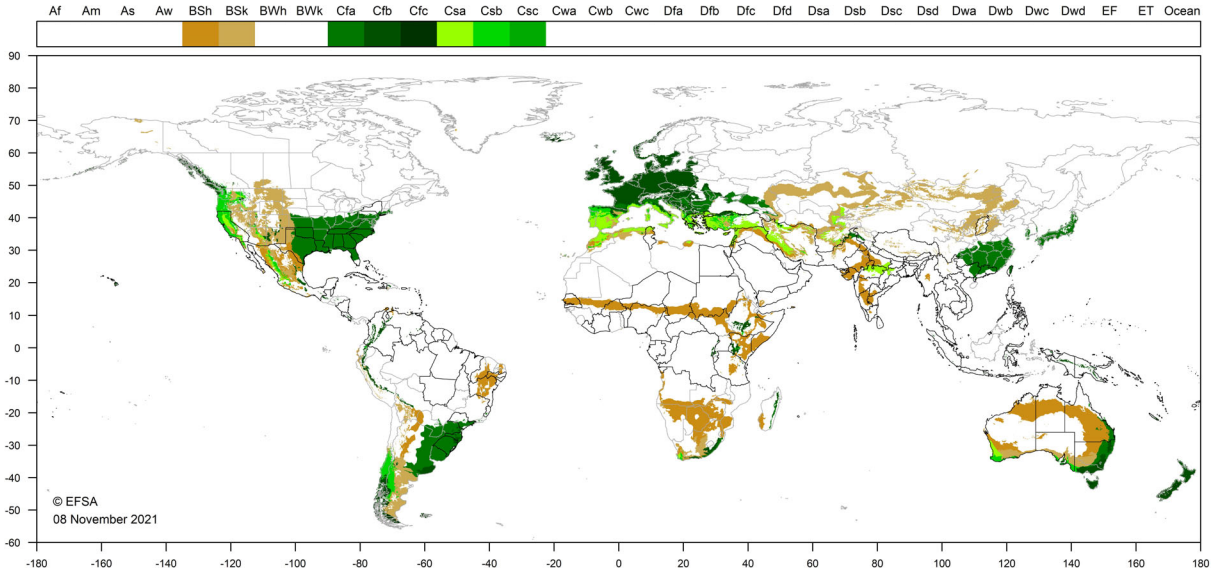

Figure 3: World distribution of Köppen–Geiger climate types that occur in the EU and which occur in areas where *Maconellicoccus hirsutus* has been reported

3.4.3. Spread

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

First instar nymphs are spread by crawling, wind, rainfall and on humans and animals. Overwintering eggs may be moved in soil. All stages may be moved over long distances in trade.

Comment on plants for planting as a mechanism of spread.

Plants for planting are one of the main pathways of spread of the pest over long distances.

First instar nymphs are active and spread by crawling, wind and rainfall. The sticky egg masses and mobile crawlers may also be carried to new areas on humans and other animals (Sagarra and Peterkin, 1999; EPPO, 2005; Culik et al., 2013). Moreover, overwintering eggs can be found in soil (Pollard, 1995) and spread through the soil attached to plants for planting and machinery.

The introduction of this pest to new territories over long distance is possible through the movement of infested plants for planting (e.g. fruit tree and ornamental nursery seedlings), and trade of infested fruit, vegetables, cut flowers or other plant products (Meyerdirk et al., 2001; CABI, 2021).

Plants for planting, fruits, vegetables and cut flowers are the main pathways of spread of the pest over long distances.

3.5. Impacts

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

Yes, if *M. hirsutus* established more widely in the EU, it would most probably have an economic impact on the host species of the pest.

The pest may seriously affect the commercial value of various ornamental plants and potentially have a high economic impact on crop production in the EU. *M. hirsutus* egests large quantities of honeydew, and as a result black sooty mould develops on the plants, which reduces the aesthetic value, normal growth and reproduction (Kairo et al., 2000; Chong et al., 2015). *M. hirsutus* also injects toxic saliva into the plant during feeding, which results in leaf curling, fruit malformation, bunchy top appearance (Figure 1E) and premature senescence of flowers and foliage (Dufour and Léon, 1997; Chong et al., 2015). Heavy infestations may cause a complete defoliation of the plant, leading to its death (Figure 1F) (Dufour and Léon, 1997; Sagarra and Peterkin, 1999). These impacts have been documented in city parks and gardens in Cyprus (Ülgentürk et al., 2015) and Greece (Milonas and Partsinevelos, 2017).

The potential annual economic impact of *M. hirsutus* to avocado (*Persea americana*), citrus (*Citrus* spp.), cotton (*Gossypium hirsutum*), peanut (*Arachis hypogaea*), soybean (*Glycine max*), nursery and vegetable crops was estimated at US$163 million in Florida or US$1.6 billion for the entire United States (Ranjan, 2006). In Egypt, *M. hirsutus* was reported to cause damage to *Albizia lebbek*, mulberry, *Hibiscus* spp., and cotton. In Africa, it was considered as a possible pest of cocoa. In India, Bangladesh and Pakistan it is a pest of cotton, mulberry and several fibre crop species. In India, it has also been considered to be a severe pest of grapes (Muralidharan and Badaya, 2000; Culik et al., 2013). When *M. hirsutus* was introduced in the Caribbean islands it became a very serious problem. Grenada reported economic losses of $3.5 to $10 million for the season 1996–1997 and Trinidad and Tobago estimated potential losses exceeding $125 million/year, if infestations continued to escalate (Meyerdirk et al., 2001). However, in many countries *M. hirsutus* is restricted to *Hibiscus* species and is not a serious pest, possibly because natural enemies effectively reduce its populations (Meyerdirk et al., 2001).

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 *M. hirsutus,* they mitigate the likelihood of its entry into and spread within the EU (see also Section 3.6.1).

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 6.

Table 6: 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)	RRO summary	Risk element targeted (entry/establishment/spread/impact)
Growing plants in isolation	Description of possible exclusion conditions that could be implemented to isolate the crop from pests and if applicable relevant vectors. E.g. a dedicated structure such as glass or plastic greenhouses. Used to mitigate likelihood of infestation by specified pest in vicinity of growing site. Plants could be grown in glass or plastic structures	Entry (reduce contamination/ infestation)/spread
Chemical treatments on crops including reproductive material	Used to mitigate likelihood of infestation of pests susceptible to chemical treatments. Pesticide application for the control of *M. hirsutus* has been considered to be impractical (Culik et al., 2013). Some neonicotinoid and pyrethroid insecticides (e.g. imidacloprid, thiamethoxam, bifenthrin) as well as their mixture have provided encouraging results regarding the control of the pest (Castle and Prabhaker, 2011; Fatima et al., 2016). However, the use of some neonicotinoids for outdoor use in EU has been banned. Moreover, the natural wax coating covering the various stages of the insect protects it from pesticides (Meyerdirk et al., 2001)	Entry/establishment/ impact
Chemical treatments on consignments or during processing	Use of chemical compounds that may be applied to plants or to plant products after harvest, during process or packaging operations and storage. The treatments addressed in this information sheet are: a) fumigation; b) spraying/dipping pesticides; c) surface disinfectants; d) process additives; e) protective compounds Used to mitigate likelihood of infestation of pests susceptible to chemical treatments. Eggs, nymphs and adults of *M. hirsutus* were susceptible to methyl bromide fumigations. A dose of 48 mg/litre methyl bromide at 21–26°C produced 100% mortality of all life stages (Zettler et al., 2002)	Entry/spread
Physical treatments on consignments or during processing	This information sheet deals with the following categories of physical treatments: irradiation/ionisation; mechanical cleaning (brushing, washing); sorting and grading, and; removal of plant parts (e.g. debarking wood). This information sheet does not address: heat and cold treatment (information sheet 1.14); roguing and pruning (information sheet 1.12). Used to mitigate likelihood of infestation of pests susceptible to physical treatments Washing, brushing and other mechanical cleaning methods can be used to reduce the prevalence of the pest in the consignments to be exported or to be planted	Entry/spread
Cleaning and disinfection of facilities, tools and machinery	The physical and chemical cleaning and disinfection of facilities, tools, machinery, transport means, facilities and other accessories (e.g. boxes, pots, pallets, palox, supports, hand tools). The measures addressed in this information sheet are: washing, sweeping and fumigation.	Entry/spread

Control measure/risk reduction option (Blue underline = Zenodo doc)	RRO summary	Risk element targeted (entry/ establishment/ spread/impact)
	Used to mitigate likelihood of entry or spread of soil borne pests	
Limits on soil	Used to mitigate likelihood of entry or spread of *M. hirsutus* eggs in soil	Entry/spread
Soil treatment	The control of soil organisms by chemical and physical methods listed below: a) Fumigation; b) Heating; c) Solarisation; d) Flooding; e) Soil suppression; f) Augmentative Biological control; g) Biofumigation Used to mitigate likelihood of presence of eggs in the soil	Entry/establishment/ impact
Heat and cold treatments	Controlled temperature treatments aimed to kill or inactivate pests without causing any unacceptable prejudice to the treated material itself. The measures addressed in this information sheet are: autoclaving; steam; hot water; hot air; cold treatment Used to mitigate likelihood of infestation of pests susceptible to physical treatments. Hot water immersion treatment of fruits has been reported as an effective measure for disinfestation of fresh fruits. Effective temperature time combinations for control of *M. hirsutus* on fruits were 55 min at 47°C, 23 min at 48°C and 13 min at 49°C (Hara and Jacobsen, 2005)	Entry/spread
Controlled atmosphere	Treatment of plants by storage in a modified atmosphere (including modified humidity, O_2, CO_2, temperature, pressure). Used to mitigate likelihood of infestation of pests susceptible to modified atmosphere (usually applied during transport) hence to mitigate entry. Controlled atmosphere storage can be used in commodities such as fresh and dried fruits, flowers and vegetables	Entry/spread (via commodity)
Post-entry quarantine and other restrictions of movement in the importing country	This information sheet covers post-entry quarantine (PEQ) of relevant commodities; temporal, spatial and end-use restrictions in the importing country for import of relevant commodities; Prohibition of import of relevant commodities into the domestic country. 'Relevant commodities' are plants, plant parts and other materials that may carry pests, either as infection, infestation, or contamination. Plants in PEQ are held in conditions that prevent the escape of pests; they can be carefully inspected and tested to verify they are of sufficient plant health status to be released, or may be treated, re-exported or destroyed. Tests on plants are likely to include laboratory diagnostic assays and bioassays on indicator hosts to check whether the plant material is infected with particular pathogens	Establishment/spread

3.6.1.2. Additional supporting measures

Potential additional supporting measures are listed in Table 7.

Table 7: 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	RRO 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. Used to mitigate likelihood of infestation by specified pest at origin. Any shipments of fresh plant material from an infested country to another that is not infested should be examined thoroughly to detect *M. hirsutus* (CABI, 2021)	Establishment/spread
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) Used to attest which of the above requirements have been applied	Entry/spread

3.6.1.3. Biological or technical factors limiting the effectiveness of measures

- *M. hirsutus* hide in cracks and crevices on the plant bark and in the calyx of *fruit*s, making its detection, especially in early infestations and low population, difficult.
- The high number of host plants and the wide distribution of *M. hirsutus* makes the inspections of all consignments imported from countries where the pest occurs difficult.
- The natural wax coating covering the various stages of *M. hirsutus* protects it from treatments with contact insecticides.

3.7. Uncertainty

- Uncertainty exists regarding the suitability of the climate of EU countries in central Europe for the establishment of *M. hirsutus*. However, its establishment in the southern EU countries is very likely since it has already been detected in Cyprus and Greece (Rhodes).
- In many countries where climate is suitable, *M. hirsutus* is not a serious pest, largely due to natural enemies (Kairo et al., 2000), thus there is uncertainty on the magnitude of impact. For example, it is not known if, and how quickly, natural enemies such as the parasitoid *Anagyrus kamali, will follow the spread of M. hirsutus in the EU*.
- The presence of *M. hirsutus* in France and Italy, implied by some interceptions in the USA, is uncertain (Miller et al., 2014). It is likely that the interceptions recorded in the US are on produce imported into the EU from other countries and reexported (see Section 3.2.2).

4. Conclusions

The criteria assessed by EFSA for consideration of *M. hirsutus* as a potential EU quarantine pest are met (Table 8).

Table 8: 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 (3.1)	The identity of the pest is established. Taxonomic keys based on morphology of female adults exist	None
Absence/presence of the pest in the EU (3.2)	The pest has a restricted distribution in the EU territory (Rhodes Island in Greece and Cyprus)	None
Regulatory status (3.3)	*Maconellicoccus hirsutus* is not regulated as a quarantine pest in the EU; the Cypriot NPPO is taking official action	None
Pest potential for entry, establishment and spread in the EU (3.4)	*Maconellicoccus hirsutus* is able to enter into, become established, and spread within the EU territory. The main pathways are: – plants for planting (regulated, some prohibited, some permitted) – fruits, vegetables and cut flowers (regulated, except bananas and pineapple)	None
Potential for consequences in the EU (3.5)	The pests' introduction could reduce the aesthetic value of various ornamental plants and the production of many crops	In many countries *M. hirsutus* is not a serious pest, possibly due to the climate being less favourable, and natural enemies reducing its population levels
Available measures (3.6)	There are measures available to prevent the entry, establishment and spread of *M. hirsutus* within the EU. Risk reduction options include the inspections and physical treatments on consignments of fresh plant material from infested countries and the production of plants for import into the EU in pest free areas (this could be difficult due to wide distribution of the pest)	Eradication and containment actions taken in the Caribbean (for example, restricting the movement of host plant material) were unsuccessful. There is uncertainty regarding how effective risk reduction measures would be in the EU
Conclusion (4)	The criteria assessed by EFSA for consideration as a potential quarantine pest are met	
Aspects of assessment to focus on/scenarios to address in future if appropriate	Establishment, impact, and natural enemies	

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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.
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 – *Maconellicoccus hirsutus* host plants/species affected

Source: EPPO Global Database (EPPO, online), García Morales et al. (2016) and other references.

Host status	Host name	Plant family	Common name	Reference
Cultivated hosts	*Abutilon indicum*	Malvaceae	Country mallow	CABI (2021)
	Acalypha hispida	Euphorbiaceae	Copperleaf	CABI (2021)
	Aegle marmelos	Rutaceae	Indian bael	Chong et al. (2015)
	Aglaonema	Araceae	Aglaonema	Chong et al. (2015)
	Albizia niopoides	Fabaceae	Guanacaste, monkey's earring	García Morales et al. (2016)
	Albizia saman	Fabaceae	Crow bean tree, monkey pod	García Morales et al. (2016)
	Allamanda	Apocynaceae		CABI (2021)
	Allamanda cathartica	Apocynaceae	Yellow allamanda	CABI (2021)
	Alocasia cucullata	Araceae	Chinese taro	Chong et al. (2015)
	Alpinia	Zingiberaceae	Alpina (ginger and galangal)	Chong et al. (2015)
	Alpinia purpurata	Zingiberaceae	Red ginger	CABI (2021)
	Althaea	Malvaceae	Marshmallow	Chong et al. (2015)
	Amaranthus	Amatanthaceae	Amaranth	Chong et al. (2015)
	Abelmoschus esculentus	Malvaceae	Gumbo, lady's fingers, okra	EPPO GD (2021)
	Abelmoschus manihot	Malvaceae	Sunset musk mallow, sunset hibiscus, hibiscus manihot	García Morales et al. (2016)
	Ananas comosus	Bromeliaceae	Pineapple	EPPO GD (2021)
	Annona	Annonaceae		CABI (2021)
	Annona cherimola	Annonaceae	Cherimoya, custard apple, graveola	EPPO GD (2021)
	Annona muricata	Annonaceae	Prickly custard apple	EPPO GD (2021)
	Annona reticulata	Annonaceae	Bullock's heart	CABI (2021)
	Annona squamosa	Annonaceae	Cachiman, Cuban sugar apple, sugar apple, sweetsop	EPPO GD (2021)
	Anthurium andraeanum	Araceae	Flamingo flower, flamingo lily, oilcloth flower, tail flower	EPPO GD (2021)
	Arachis hypogaea	Fabaceae	Groundnut, monkeynut, peanut	EPPO GD (2021)
	Aralia	Araliaceae		CABI (2021)
	Artocarpus	Moraceae	Breadfruit trees	CABI (2021)
	Artocarpus altilis	Moraceae	Breadfruit	CABI (2021)
	Asparagus	Asparagaceae		CABI (2021)
	Asparagus densiflorus	Liliaceae	Sprenger's asparagus fern	Chong et al. (2015)
	Asparagus officinalis	Asparagaceae	Asparagus, garden asparagus, wild asparagus	EPPO GD (2021)
	Asparagus setaceus	Liliaceae	Asparagus fern	CABI (2021)
	Averrhoa carambola	Oxalidaceae	Caramba, carambola, Chinese gooseberry, country gooseberry, star fruit	EPPO GD (2021)
	Azadirachta indica	Meliaceae	Neem tree	CABI (2021)
	Basella alba	Basellaceae	Malabar spinach	García Morales et al. (2016)
	Bauhinia	Fabaceae	Camel's foot	CABI (2021)
	Bauhinia variegata	Fabaceae	Mountain ebony	CABI (2021)
	Begonia	Begoniaceae	Begonia	Chong et al. (2015)
	Beta	Chenopodiaceae		CABI (2021)

Host status	Host name	Plant family	Common name	Reference
	Beta vulgaris	Amaranthaceae	Beet	EPPO GD (2021)
	Bignonia	Bignoniaceae		CABI (2021)
	Boehmeria	Urticaceae		CABI (2021)
	Boehmeria nivea	Urticaceae	China grass, false nettle, ramie	EPPO GD (2021)
	Bougainvillea	Nyctaginaceae		CABI (2021)
	Bougainvillea	Nyctaginaceae	Bougainvillea	Chong et al. (2015)
	Bougainvillea spectabilis	Nyctaginaceae	Great bougainvillea	Chong et al. (2015)
	Brassica oleracea	Brassicaceae	Cabbage, cauliflower	CABI (2021)
	Caesalpinia coriaria	Fabaceae	Divi-divi	Chong et al. (2015)
	Caesalpinia pulcherrima	Fabaceae	Pride-of-Barbados	Chong et al. (2015)
	Cajanus cajan	Fabaceae	Bengal pea, cajan pea, Congo pea, dal, pigeon pea, red gram	EPPO GD (2021)
	Calliandra	Fabaceae	stick pea	Chong et al. (2015)
	Callistemon	Myrtaceae	Bottlebrush	Chong et al. (2015)
	Calostemma	Amatanthaceae	Wilcannia lily	Chong et al. (2015)
	Camaesyce (Euphorbia) hypericifolia	Euphorbiaceae	Graceful sandmat	Chong et al. (2015)
	Campsis (Tecoma) grandiflora	Bignoniaceae	Chinese trumpet vine	Chong et al. (2015)
	Cananga odorata	Annonaceae	Ilang-ilang (kenanga)	Chong et al. (2015)
	Capsicum	Solanaceae		García Morales et al. (2016)
	Capsicum annuum	Solanaceae	Bell pepper, chilli, paprika, red pepper, sweet pepper	EPPO GD (2021)
	Capsicum frutescens	Solanaceae	Bird chilli, bird pepper, cayenne pepper, chilli pepper, hot pepper	EPPO GD (2021)
	Carica papaya	Caricaceae	Papaw, papaya, pawpaw, tree melon	EPPO GD (2021)
	Carissa macrocarpa	Apocynaceae	Amatungulu (num-num)	Chong et al. (2015)
	Cassia	Fabaceae	Cassia	Chong et al. (2015)
	Cassia javanica	Fabaceae	APPLE BLOSSOM (JAVA CASSIA)	Chong et al. (2015)
	Casuarina	Casuarinaceae	BEEFWOOD	CABI (2021)
	Catharanthus roseus	Apocynaceae	Madagascar periwinkle	Chong et al. (2015)
	Ceiba pentandra	Bombacaceae	Kapok	CABI (2021)
	Celosia argentea	Amatanthaceae	Cock's comb	Chong et al. (2015)
	Centipede tongavine	Araceae		Chong et al. (2015)
	Ceratonia	Fabaceae		CABI (2021)
	Ceratonia siliqua	Fabaceae	Carob, carob tree, locust bean, locust tree, St John's bread	EPPO GD (2021)
	Cestrum nocturnum	Solanaceae	Night jessamine	Chong et al. (2015)
	Chrysanthemum	Asteraceae	Daisy	CABI (2021)
	Chrysanthemum coronarium	Asteraceae	Garland chrysanthemum	CABI (2021)
	Chrysothemis pulchella	Gesneriaceae	Squarestem	Chong et al. (2015)

Host status	Host name	Plant family	Common name	Reference
	Cissus verticillata	Vitaceae	Possum grape vine	García Morales et al. (2016)
	Citrus	Rutaceae		EPPO GD (2021)
	Citrus aurantiifolia	Rutaceae	Lime	CABI (2021)
	Citrus aurantium	Rutaceae	Bigarade, bitter orange, seville orange, sour orange	EPPO GD (2021)
	Citrus maxima	Rutaceae	Pummelo	CABI (2021)
	Citrus medica	Rutaceae	Citron	Chong et al. (2015)
	Citrus nobilis	Rutaceae	Tangor	Chong et al. (2015)
	Citrus paradisi	Rutaceae	Grapefruit, pomelo	EPPO GD (2021)
	Citrus reticulata	Rutaceae	Clementine, mandarin, tangerine	EPPO GD (2021)
	Citrus sinensis	Rutaceae	sweet orange	EPPO GD (2021)
	Clerodendrum aculeatum	Verbenaceae	Haggarbush	Chong et al. (2015)
	Clerodendrum infortunatum	Lamiaceae		CABI (2021)
	Codiaeum	Euphorbiaceae	Codiaeum	Chong et al. (2015)
	Codiaeum variegatum	Euphorbiaceae	Garden croton	CABI (2021)
	Coffea	Rubiaceae	Coffee	CABI (2021)
	Coffea arabica	Rubiaceae	Arabian coffee	EPPO GD (2021)
	Coffea canephora	Rubiaceae	Congo coffee, robusta coffee	EPPO GD (2021)
	Colubrina arborescens	Rhamnaceae	Greenheart	Chong et al. (2015)
	Cordyline terminalis	Liliaceae	Ti plant, palm lily	Chong et al. (2015)
	Couroupita guianensis	Lecythidaceae	Cannonball tree	Chong et al. (2015)
	Crataegus	Rosaceae	Hawthorn	Chong et al. (2015)
	Crescentia cujete	Bignoniaceae	Calabash tree	Chong et al. (2015)
	Crotalaria	Fabaceae		CABI (2021)
	Croton	Euphorbiaceae	Croton	Chong et al. (2015)
	Cucumis sativus	Cucurbitaceae	Cucumber, gherkin	EPPO GD (2021)
	Cucurbita	Cucurbitaceae	Pumpkin	CABI (2021)
	Cucurbita maxima	Cucurbitaceae	Giant pumpkin, marrow	EPPO GD (2021)
	Cucurbita moschata	Cucurbitaceae	Pumpkin	CABI (2021)
	Cucurbita pepo	Cucurbitaceae	Edible gourd, garden marrow, pumpkin, summer squash	EPPO GD (2021)
	Cydonia oblonga	Rosaceae	Quince	CABI (2021)
	Dahlia	Asteraceae		CABI (2021)
	Delonix regia	Fabaceae	Flamboyant	CABI (2021)
	Dendrobium	Orchidaceae	Dendrobium orchid	Chong et al. (2015)
	Dieffenbachia	Araceae	Dieffenbachia	Chong et al. (2015)
	Dimocarpus longan	Sapindaceae	Longan	Chong et al. (2015)
	Diospyros kaki	Ebenaceae	Chinese date plum, Chinese persimmon, Japanese persimmon, kaki, persimmon	EPPO GD (2021)
	Dodonaea viscosa	Sapindaceae	Switch sorrel	CABI (2021)
	Dovyalis (Aberia)	Flacourtiaceae	Ceylon goose berry	Chong et al. (2015)
	Dracaena	Liliaceae	Dracaena (dragon tree)	Chong et al. (2015)
	Duranta	Verbenaceae		CABI (2021)

Host status	Host name	Plant family	Common name	Reference
	Duranta erecta	Verbenaceae	Golden dewdrops	Chong et al. (2015)
	Elaeagnus	Elaeagnaceae	Elaeagnus (oleaster)	Chong et al. (2015)
	Epipremnum pinnatum	Araceae	Centipede tonga vine	Chong et al. (2015)
	Eranthemum pulchellum	Acanthaeceae	Blue-sage	Chong et al. (2015)
	Eriobotrya japonica	Rosaceae	Loquat	Chong et al. (2015)
	Eryngium foetidum	Apiaceae	Culantro, shadow beni, Mexican coriander	García Morales et al. (2016)
	Erythrina	Fabaceae		CABI (2021)
	Erythrina corallodendron	Fabaceae	Coral erythrina	Chong et al. (2015)
	Erythrina crista-galli	Fabaceae	Cry baby tree	Chong et al. (2015)
	Erythrina spp.	Fabaceae		CABI (2021)
	Erythrina subumbrans	Fabaceae	December tree	CABI (2021)
	Erythrina variegata	Fabaceae	Flame tree, Indian coral tree, mountain ebony, tiger's claw	EPPO GD (2021)
	Euphorbia	Euphorbiaceae	Spurge	Chong et al. (2015)
	Euphorbia pulcherrima	Euphorbiaceae	Christmas flower, Christmas star, common poinsettia, lobster plant, Mexican flame-leaf, painted leaf, poinsettia	EPPO GD (2021)
	Ficus	Moraceae		CABI (2021)
	Ficus benghalensis	Moraceae	Banyan	CABI (2021)
	Ficus benjamina	Moraceae	Benjamin's fig, Java fig, small-leaved rubber plant, tropical laurel, weeping fig, Benjamin tree	EPPO GD (2021)
	Ficus carica	Moraceae	Common fig, edible fig	EPPO GD (2021)
	Ficus elastica	Moraceae	Rubber plant	CABI (2021)
	Ficus laurifolia	Moraceae		CABI (2021)
	Ficus obtusifolia	Moraceae		CABI (2021)
	Ficus pertusa	Moraceae		CABI (2021)
	Ficus platyphylla	Moraceae		CABI (2021)
	Ficus pumila	Moraceae	Creeping fig	CABI (2021)
	Ficus racemosa	Moraceae	Cluster tree	CABI (2021)
	Ficus religiosa	Moraceae	Sacred fig tree	CABI (2021)
	Ficus semicordata	Moraceae		CABI (2021)
	Flacourtis indica	Flacourtiaceae	Governor's plum	Chong et al. (2015)
	Gerbera	Asteraceae	Gerbera	Chong et al. (2015)
	Glebionis coronaria	Asteraceae	Garland chrysanthemum, chrysanthemum greens, edible chrysanthemum	García Morales et al. (2016)
	Gliricidia sepium	Fabaceae	Gliricidia	CABI (2021)
	Glycine max	Fabaceae	Soybean	EPPO GD (2021)
	Glycosmis pentaphylla	Rutaceae	Orange berry, gin berry	García Morales et al. (2016)
	Cocos nucifera	Arecaceae	Common coconut palm	EPPO GD (2021)
	Colocasia	Araceae		CABI (2021)
	Colocasia esculenta	Araceae	Chinese potato, cocoyam, dasheen, eddoe, Egyptian colocasia, elephant's-ear, kalo, taro, wild taro, yam	EPPO GD (2021)

Host status	Host name	Plant family	Common name	Reference
	Gossypium	Malvaceae	Cotton	CABI (2021)
	Gossypium arboreum	Malvaceae	Cotton, tree	CABI (2021)
	Gossypium herbaceum	Malvaceae	Short staple cotton	CABI (2021)
	Gossypium hirsutum	Malvaceae	American upland cotton, upland cotton	EPPO GD (2021)
	Grevillea	Proteaceae		CABI (2021)
	Grevillea robusta	Proteaceae	Silk oak	Chong et al. (2015)
	Hamelia	Rubiaceae	Hamelia (firebush)	Chong et al. (2015)
	Helianthus annuus	Asteraceae	Common sunflower, sunflower	EPPO GD (2021)
	Hevea	Euphorbiaceae		García Morales et al. (2016)
	Hevea brasiliensis	Euphorbiaceae	Brazilian rubber tree, para rubber, para rubber tree	EPPO GD (2021)
	Hibiscus boryanus	Malvaceae		García Morales et al. (2016)
	Hibiscus	Malvaceae	Rose mallows	CABI (2021)
	Hibiscus acetosella	Malvaceae	African rosemallow	Chong et al. (2015)
	Hibiscus cannabinus	Malvaceae	Bombay hemp, Deccan hemp, kenaf	EPPO GD (2021)
	Hibiscus elatus	Malvaceae	Blue mahoe	CABI (2021)
	Hibiscus manihot	Malvaceae	Bele	CABI (2021)
	Hibiscus mutabilis	Malvaceae	Cotton rose	CABI (2021)
	Hibiscus rosa-sinensis	Malvaceae	China rose, Chinese hibiscus, Chinese rose, Hawaiian hibiscus, rose mallow, rose of China, shoe-black plant, shoe-flower	EPPO GD (2021)
	Hibiscus sabdariffa	Malvaceae	Jamaica sorrel, red sorrel, roselle, tropical cranberry	EPPO GD (2021)
	Hibiscus schizopetalus	Malvaceae	Fringed hibiscus	CABI (2021)
	Hibiscus surattensis	Malvaceae		CABI (2021)
	Hibiscus syriacus	Malvaceae	Shrubby althaea	CABI (2021)
	Hibiscus tiliaceus	Malvaceae	Coast hibiscus, hau tree, linden hibiscus, mahoe, mahoe tree, wild cotton tree	EPPO GD (2021)
	Holmskioldia sanguinea	Verbenaceae	Chinese hatplant	Chong et al. (2015)
	Jacaranda	Bignoniaceae		CABI (2021)
	Jacaranda mimusifolia	Bignoniaceae	Black poui	Chong et al. (2015)
	Jasminum	Oleaceae	Jasmine	CABI (2021)
	Jasminum sambac	Oleaceae	Arabian jasmine	CABI (2021)
	Kalanchoe	Crassulaceae	Widow's-thrill	Chong et al. (2015)
	Kigelia	Bignoniaceae	Sausage tree	Chong et al. (2015)
	Lactuca sativa	Asteraceae	Garden lettuce, lettuce	EPPO GD (2021)
	Lagerstroemia speciosa	Lythraceae	Pride of India	Chong et al. (2015)
	Lantana	Verbenaceae	Lantana	Chong et al. (2015)
	Lantana camara	Verbenaceae	Lantana	CABI (2021)

Host status	Host name	Plant family	Common name	Reference
	Leonotis	Lamiaceae	Lion's ear	Chong et al. (2015)
	Manihot esculenta	Euphorbiaceae	Cassava, manioc, tapioca	EPPO GD (2021)
	Mangifera	Anacardiaceae		CABI (2021)
	Mangifera indica	Anacardiaceae	Mango	EPPO GD (2021)
	Manilkara zapota	Sapotaceae	Bully tree, chapoti, chicle, chiku, marmalade plum, noseberry, sapodilla, sapodilla plum, sapota	EPPO GD (2021)
	Malpighia glabra	Malpighiaceae	Barbados cherry	EPPO GD (2021)
	Malus domestica	Rosaceae	Apple	EPPO GD (2021)
	Malus sylvestris	Rosaceae	Crab apple, wild apple, wild crab	EPPO GD (2021)
	Malvaviscus arboreus	Malvaceae	Wax mallow	CABI (2021)
	Medicago sativa	Fabaceae	Lucerne	CABI (2021)
	Melia azedarach	Meliaceae	Chinaberry tree	Chong et al. (2015)
	Melicocca bijugatus	Sapindaceae	Spanish lime	Chong et al. (2015)
	Mimosa	Fabaceae	Sensitive plants	CABI (2021)
	Mimosa caesalpiniifolia	Fabaceae		EPPO GD (2021)
	Mimosa diplotricha	Fabaceae	Creeping-sensitive plant	CABI (2021)
	Mimosa hostilis	Fabaceae		EPPO GD (2021)
	Mimosa pigra	Fabaceae	Giant sensitive plant	CABI (2021)
	Mimosa pudica	Fabaceae	Sensitive plant	CABI (2021)
	Morus	Moraceae	Mulberry tree	CABI (2021)
	Morus alba	Moraceae	Silkworm mulberry, white mulberry	EPPO GD (2021)
	Morus nigra L.	Moraceae	Black mulberry	Chong et al. (2015)
	Murraya exotica	Rutaceae	Chinese box, orange jessamine	Chong et al. (2015)
	Murraya koenigii	Rutaceae	Curry leaf, karapincha	EPPO GD (2021)
	Murraya paniculata	Rutaceae	Orange jasmine, orange jessamine, china box, mock orange	García Morales et al. (2016)
	Musa	Musaceae	Banana	CABI (2021)
	Musa paradisiaca	Musaceae	Plantain	CABI (2021)
	Mussaenda	Rubiaceae		CABI (2021)
	Myrtus communis	Myrtaceae	Myrtle	CABI (2021)
	Nephrolepis biserrata	Dryopteridaceae	Giant swordfern	Chong et al. (2015)
	Nephrolepis exaltata	Dryopteridaceae	Boston swordfern	Chong et al. (2015)
	Nerium oleander	Apocynaceae	Common oleander, oleander, rose bay	EPPO GD (2021)
	Pachystachys lutea	Acanthaeceae	Pachystachys, lollipop-plant	Chong et al. (2015)
	Passiflora	Passifloraceae	Passionflower	CABI (2021)
	Passiflora caerulea	Passifloraceae	Bluecrown passionflower	Chong et al. (2015)
	Passiflora edulis	Passifloraceae	Passionfruit	CABI (2021)
	Passiflora quadrangularis	Passifloraceae	Giant granadilla	Chong et al. (2015)
	Pavonia	Malvaceae	Swampmallow	Chong et al. (2015)
	Peperomia pellucid	Piperaceae	Man-to-Man	Chong et al. (2015)
	Pereskia bleo	Cactaceae	Rose cactus	Chong et al. (2015)
	Persea americana	Lauraceae	Alligator pear, avocado, avocado pear, holly ghost pear	EPPO GD (2021)

Host status	Host name	Plant family	Common name	Reference
	Petrea volubilis	Verbenaceae	Queen's-wreath	Chong et al. (2015)
	Phaseolus vulgaris	Fabaceae	Bush bean, climbing French bean, climbing kidney bean, field bean, flageolet bean, French bean, garden bean, green bean, haricot bean, kidney bean, pop bean, snap bean, string bean	EPPO GD (2021)
	Philodendron	Araceae	Philodendron	Chong et al. (2015)
	Phoenix dactylifera	Arecaceae	Common date palm, date palm	EPPO GD (2021)
	Phoenix sylvestris	Arecaceae	East Indian wine palm, silver date palm, wild date palm	EPPO GD (2021)
	Phyllanthus acidus	Euphorbiaceae	Tahitian gooseberry tree	Chong et al. (2015)
	Phyllanthus elsiae	Euphorbiaceae		CABI (2021)
	Phyllanthus niruri	Euphorbiaceae	Seed-under-the-leaf	CABI (2021)
	Plumbago auriculata	Plumbaginaceae	Cape leadwort	Chong et al. (2015)
	Portulaca grandiflora	Portulacaceae	Rose moss	CABI (2021)
	Portulaca oleracea	Portulacaceae	Common purslane, duckweed, little hogweed, pursley	García Morales et al. (2016)
	Portulaca pilosa	Portulacaceae	Kiss-me-quick, rimson-flowered purslane, hairy pigweed, pink purslane, shaggy portulaca	García Morales et al. (2016)
	Prunus armeniaca	Rosaceae	Apricot	EPPO GD (2021)
	Prunus domestica	Rosaceae	European plum, garden plum, plum	EPPO GD (2021)
	Prunus persica	Rosaceae	Peach	EPPO GD (2021)
	Prunus salicina	Rosaceae	Japanese plum	CABI (2021)
	Psidium	Myrtaceae	Guava	CABI (2021)
	Psidium guajava	Myrtaceae	Common guava, guava, yellow guava	EPPO GD (2021)
	Punica granatum	Lythraceae	Pomegranate	EPPO GD (2021)
	Pyrus communis	Rosaceae	Common pear, pear	EPPO GD (2021)
	Quercus	Fagaceae	Oak	Chong et al. (2015)
	Rhododendron	Ericaceae	Azalea	CABI (2021)
	Ricinus communis	Euphorbiaceae	Castor-oil plant, castor bean	EPPO GD (2021)
	Rivina humilis	Phytolacaceae	Rougeplant	Chong et al. (2015)
	Robinia pseudoacacia	Fabaceae	Black locust	CABI (2021)
	Rosa	Rosaceae	Rose	Chong et al. (2015)
	Russelia equisetiformis	Scrophulariaceae	Fountainbush	Chong et al. (2015)
	Saccharum officinarum	Poaceae	Sugarcane	CABI (2021)
	Salix	Salicaceae	Willows	CABI (2021)
	Schefflera	Araliaceae	Schefflera	Chong et al. (2015)
	Senna	Fabaceae	Senna	Chong et al. (2015)
	Senna siamea	Fabaceae	Yellow cassia	CABI (2021)
	Solanum aethiopicum	Solanaceae	African scarlet eggplant	CABI (2021)
	Solanum bicolor	Solanaceae		Chong et al. (2015)
	Solanum lycopersicum	Solanaceae	Tomato	EPPO GD (2021)

Host status	Host name	Plant family	Common name	Reference
	Solanum melongena	Solanaceae	Aubergine, eggplant	EPPO GD (2021)
	Spondias dulcis	Anacardiaceae	Otaheite apple	CABI (2021)
	Spondias purpurea	Anacardiaceae	Red mombin, purple mombin	CABI (2021)
	Stachytarpheta jamaicensis	Verbenaceae	Light-blue snakeweed	Chong et al. (2015)
	Syngonium podophyllum	Araceae	American evergreen	Chong et al. (2015)
	Syzygium cumini	Myrtaceae	Black plum	CABI (2021)
	Syzygium malaccense	Myrtaceae	Malaysian apple	Chong et al. (2015)
	Tabebuia	Bignoniaceae	Trumpet-tree	Chong et al. (2015)
	Tabebuia heterophylla	Bignoniaceae	Pink trumpet tree	CABI (2021)
	Tamarindus indica	Fabaceae	Tamarind	Chong et al. (2015)
	Tamarix	Tamaricaceae	Tamarisk	CABI (2021)
	Tecoma capensis	Bignoniaceae	Cape honeysuckle	Chong et al. (2015)
	Tecoma stans	Bignoniaceae	Yellow trumpetbush	Chong et al. (2015)
	Terminalia catappa	Combretaceae	Singapore almond	CABI (2021)
	Theobroma bicolor	Malvaceae	Bacao, Nicaraguan cocoa	EPPO GD (2021)
	Theobroma cacao	Malvaceae	Cacao, cocoa, common cacao, common cocoa	EPPO GD (2021)
	Theobroma grandiflorum	Malvaceae	Cupuassu	EPPO GD (2021)
	Thunbergia erecta	Acanthaeceae	Bush clockvine	Chong et al. (2015)
	Vinca minor	Apocynaceae	Common periwinkle, vinca	Chong et al. (2015)
	Vitis	Vitaceae	Rape	CABI (2021)
	Vitis vinifera	Vitaceae	Common grapevine, grapevine, European grape	EPPO GD (2021)
	Zea mays	Poaceae	Maize	CABI (2021)
	Ziziphus	Rhamnaceae		CABI (2021)
	Ziziphus	Rhamnaceae	Jujube	Chong et al. (2015)
	Ziziphus jujuba	Rhamnaceae	Common jujube	CABI (2021)
	Ziziphus mauritiana	Rhamnaceae	Indian jujube	EPPO GD (2021)
	Ziziphus mucronata	Rhamnaceae		CABI (2021)
	Ziziphus spina-christi	Rhamnaceae	Christ's thorn jujube	CABI (2021)
Wild weed hosts	*Abutilon fruticosum*	Malvaceae	Texas Indian mallow, pelotazo, sweet Indian mallow	García Morales et al. (2016)
	Acacia	Fabaceae	Wattles	CABI (2021)
	Acacia acatlensis	Fabaceae		CABI (2021)
	Acacia cochliacantha	Fabaceae		CABI (2021)
	Acacia farnesiana	Fabaceae	Huisache	CABI (2021)
	Acacia hindsii	Fabaceae		CABI (2021)
	Acacia nilotica	Fabaceae	Gum arabic tree	CABI (2021)
	Acalypha	Euphorbiaceae	Copperleaf	CABI (2021)
	Acalypha indica	Euphorbiaceae	Indian acalypha, Indian mercury, Indian copperleaf, Indian nettle, Three-seeded mercury	García Morales et al. (2016)
	Acalypha wilkesiana	Euphorbiaceae	Copperleaf and Jacob's coat	García Morales et al. (2016)
	Acanthus ilicifolius	Acanthaceae	Copperleaf	CABI (2021)
	Acharia	Limacodidae		CABI (2021)

Host status	Host name	Plant family	Common name	Reference
	Achyranthes aspera	Amaranthaceae	Devil's horsewhip	CABI (2021)
	Acokanthera	Apocynaceae		García Morales et al. (2016)
	Aegiphila martinicensis	Lamiaceae		CABI (2021)
	Albizia	Fabaceae		CABI (2021)
	Albizia lebbeck	Fabaceae	Indian siris	CABI (2021)
	Angelica	Apiaceae		CABI (2021)
	Anthurium	Araceae		CABI (2021)
	Bauhinia forficata	Fabaceae	Brazilian orchid tree	García Morales et al. (2016)
	Bauhinia racemosa	Fabaceae		García Morales et al. (2016)
	Bauhinia vahlii	Fabaceae		García Morales et al. (2016)
	Biancaea decapetala	Fabaceae	Shoofly, Mauritius, Mysore thorn	García Morales et al. (2016)
	Bidens pilosa	Asteraceae	Beggar tick, bur marigold, butterfly needles	García Morales et al. (2016)
	Blighia sapida	Sapindaceae	Akee	Chong et al. (2015)
	Byttneria aculeata	Malvaceae		CABI (2021)
	Calathea warszewiczii	Marantaceae		García Morales et al. (2016)
	Calophyllum	Calophyllaceae		García Morales et al. (2016)
	Carissa bispinosa	Apocynaceae		García Morales et al. (2016)
	Cassia glauca	Fabaceae		García Morales et al. (2016)
	Cassia renigera	Fabaceae		García Morales et al. (2016)
	Cedrela odorata	Meliaceae	Spanish cedar	CABI (2021)
	Centrolobium paraense	Fabaceae		EPPO GD (2021)
	Chenopodium album	Amaranthaceae	Goosefoot, green pigweed, lamb's quarters, wild spinach, fat-hen, white goosefoot, pigweed	EPPO GD (2021)
	Clitoria ternatea	Fabaceae	Butterfly-pea	CABI (2021)
	Coccoloba uvifera	Polygonaceae	Jamaica kino, platter leaf, sea grape, common sea grape	EPPO GD (2021)
	Combretum	Combretaceae		García Morales et al. (2016)
	Corchorus	Tiliaceae	Jutes	CABI (2021)
	Corchorus capsularis	Tiliaceae	White jute	CABI (2021)
	Corchorus olitorius	Tiliaceae	Jute	CABI (2021)
	Cordia curassavica	Boraginaceae	Black sage or wild sage	García Morales et al. (2016)
	Cordia dichotoma	Boraginaceae	Indian cherry	CABI (2021)
	Cordyline fruticosa	Asparagaceae	Bongbush, cabbage palm, kiwi, palm lily, ti-palm	García Morales et al. (2016)

Host status	Host name	Plant family	Common name	Reference
	Cosmos	Asteraceae		EPPO GD (2021)
	Crotalaria micans	Fabaceae		CABI (2021)
	Croton flavens	Euphorbiaceae		García Morales et al. (2016)
	Cyperus	Cyperaceae		García Morales et al. (2016)
	Dalbergia	Fabaceae	Rosewoods	CABI (2021)
	Datura	Solanaceae	Jimsonweed (angel trumpet)	Chong et al. (2015)
	Daucus carota	Apiaceae	Queen Anne's lace	Chong et al. (2015)
	Desmanthus virgatus	Fabaceae	False tamarind	CABI (2021)
	Dioscorea	Dioscoreaceae		García Morales et al. (2016)
	Emilia	Asteraceae		García Morales et al. (2016)
	Enterolobium	Fabaceae		CABI (2021)
	Enterolobium cyclocarpum	Fabaceae	Ear pod tree	CABI (2021)
	Epipremnum aureum	Araceae	Golden pothos, Ceylon creeper, Hunter's robe, ivy arum	García Morales et al. (2016)
	Erythrina resinifera	Fabaceae		García Morales et al. (2016)
	Erythrina speciosa	Fabaceae		García Morales et al. (2016)
	Erythrina vespertilio	Fabaceae		García Morales et al. (2016)
	Eugenia uniflora	Myrtaceae	Surinam cherry	CABI (2021)
	Euphorbia atoto			CABI (2021)
	Euphorbia hypericifolia	Euphorbiaceae	Graceful spurge, golden spurge, and chickenweed	García Morales et al. (2016)
	Ficus amplissima	Moraceae	Indian Bat tree, Indian Bat fig, Pimpri	García Morales et al. (2016)
	Ficus lacor	Moraceae		García Morales et al. (2016)
	Flacourtia indica	Flacourtiaceae	Governor's plum	García Morales et al. (2016)
	Gliricidia	Fabaceae		CABI (2021)
	Gliricidia maculata	Fabaceae		CABI (2021)
	Grevillea robusta	Proteaceae	Australian silky oak, silk oak, silk-bark oak, silky oak	EPPO GD (2021)
	Grewia	Tiliaceae		CABI (2021)
	Guazuma ulmifolia	Sterculiaceae	Bastard cedar	CABI (2021)
	Gymnanthemum urticifolium	Asteraceae		García Morales et al. (2016)
	Haldina cordifolia	Rubiaceae	Heart-leaf adina	García Morales et al. (2016)
	Heliconia	Heliconiaceae		EPPO GD (2021)
	Hoya carnosa	Asclepiadaceae	Wax plant	CABI (2021)
	Inga	Fabaceae		García Morales et al. (2016)
	Inga edulis	Fabaceae	Food inga, icecream bean, St John's bread	EPPO GD (2021)

Host status	Host name	Plant family	Common name	Reference
	Inga ingoides	Fabaceae		CABI (2021)
	Inga vera	Fabaceae		CABI (2021)
	Ipomoea	Convolvulaceae	Morning glory	CABI (2021)
	Ipomoea batatas	Convolvulaceae	Sweet potato	EPPO GD (2021)
	Ixora	Rubiaceae		EPPO GD (2021)
	Ixora chinensis	Rubiaceae	Flame of the woods, jungle flame, jungle geranium	EPPO GD (2021)
	Jatropha curcas	Euphorbiaceae	Barbados nut, purging nut, physic nut	EPPO GD (2021)
	Laportea aestuans	Urticaceae	West Indian woodnettle	García Morales et al. (2016)
	Lawsonia	Lythraceae		García Morales et al. (2016)
	Lawsonia inermis	Lythraceae	Egyptian privet	CABI (2021)
	Leonotis nepetifolia	Lamiaceae	Christmas candlestick	García Morales et al. (2016)
	Leucaena	Fabaceae		CABI (2021)
	Leucaena leucocephala	Fabaceae	Leucaena	CABI (2021)
	Lithocarpus	Fagaceae	Stone oak	Chong et al. (2015)
	Macaranga	Euphorbiaceae		CABI (2021)
	Malachra alceifolia	Malvaceae		CABI (2021)
	Malpighia	Malpighiaceae		CABI (2021)
	Malpighia emarginata	Malpighiaceae		CABI (2021)
	Malvaviscus conzattii	Malvaceae		CABI (2021)
	Miconia cornifolia	Melastomataceae		García Morales et al. (2016)
	Mikania cordata	Asteraceae		García Morales et al. (2016)
	Mimosa tenuiflora	Fabaceae		García Morales et al. (2016)
	Momordica charantia	Cucurbitaceae	Bitter gourd	CABI (2021)
	Montanoa grandiflora	Asteraceae		CABI (2021)
	Mussaenda erythrophylla	Rubiaceae	Ashanti blood, red flag bush, red flag mussaenda	EPPO GD (2021)
	Nephelium lappaceum	Sapindaceae	Rambutan	EPPO GD (2021)
	Nerium indicum	Apocynaceae		García Morales et al. (2016)
	Opuntia	Cactaceae		EPPO GD (2021)
	Paritium	Malvaceae		García Morales et al. (2016)
	Parkinsonia aculeata	Fabaceae	Mexican palo-verde	CABI (2021)
	Parthenium hysterophorus	Asteraceae	Parthenium weed	CABI (2021)
	Persea	Lauraceae		CABI (2021)
	Petiveria alliacea	Phytolaccaceae		García Morales et al. (2016)
	Phyllanthus amarus	Euphorbiaceae	Gale of the wind, carry me seed, seed on the leaf	García Morales et al. (2016)
	Phyllanthus urinaria	Euphorbiaceae	Leafflower	García Morales et al. (2016)

Host status	Host name	Plant family	Common name	Reference
	Piper tuberculatum	Piperaceae		García Morales et al. (2016)
	Pithecellobium	Fabaceae		CABI (2021)
	Pithecellobium caribaeum	Fabaceae		García Morales et al. (2016)
	Plerandra elegantissima	Araliaceae	False aralia	
	Prosopis	Fabaceae		CABI (2021)
	Prosopis cineraria	Fabaceae	Screw-bean	CABI (2021)
	Prosopis laevigata	Fabaceae		CABI (2021)
	Quisqualis	Combretaceae		CABI (2021)
	Rosa obtusifolia	Rosaceae		García Morales et al. (2016)
	Samanea saman	Fabaceae	Rain tree	CABI (2021)
	Schefflera actinophylla	Araliaceae	Octopus tree, Queensland umbrella tree, star leaf, umbrella tree	EPPO GD (2021)
	Schefflera pueckleri	Araliaceae	Mallet flower	García Morales et al. (2016)
	Schinus molle	Anacardiaceae	False pepper tree	García Morales et al. (2016)
	Schinus terebinthifolia	Anacardiaceae	Brazilian pepper tree	García Morales et al. (2016)
	Scoparia dulcis	Plantaginaceae	Licorice weed, goat weed, scoparia-weed, sweet-broom	García Morales et al. (2016)
	Senna italica	Fabaceae	Senegal senna	García Morales et al. (2016)
	Senna obtusifolia	Fabaceae	Sicklepod	García Morales et al. (2016)
	Senna polyphylla	Fabaceae		García Morales et al. (2016)
	Senna sulfurea	Fabaceae		García Morales et al. (2016)
	Senna surattensis	Fabaceae	Golden senna, foetid cassia, glaucous cassia, glossy shower	García Morales et al. (2016)
	Sesbania sesban	Fabaceae	Sesban, common sesban, Egyptian pea, Egyptian rattle pod	García Morales et al. (2016)
	Sida acuta	Malvaceae	Sida	CABI (2021)
	Solandra	Solanaceae		CABI (2021)
	Solanum americanum	Solanaceae	Eastern black nightshade, glossy nightshade, West Indian nightshade, American black nightshade	EPPO GD (2021)
	Solanum donianum	Solanaceae		García Morales et al. (2016)
	Solanum umbellatum	Solanaceae		CABI (2021)
	Spondias	Anacardiaceae	Purple mombin	CABI (2021)
	Spondias mombin	Anacardiaceae	Golden apple, hog-plum tree, yellow mombin	EPPO GD (2021)
	Spondias tuberosa	Anacardiaceae	Imbu	EPPO GD (2021)
	Synedrella nodiflora	Asteraceae	Synedrella	García Morales et al. (2016)

Host status	Host name	Plant family	Common name	Reference
	Syzygium aqueum	Myrtaceae	Water apple	García Morales et al. (2016)
	Syzygium aromaticum	Myrtaceae	Clove	CABI (2021)
	Tabernaemontana divaricata	Apocynaceae		García Morales et al. (2016)
	Talinum paniculatum	Talinaceae	Fame flower, Jewels-of-Opar, pink baby-breath	EPPO GD (2021)
	Taliparitі elatum	Malvaceae	Blue mahoe	García Morales et al. (2016)
	Tamarindus	Fabaceae		CABI (2021)
	Tectona grandis	Lamiaceae	Common teak	EPPO GD (2021)
	Templetonia	Fabaceae		García Morales et al. (2016)
	Tephrosia	Fabaceae	Hoary-pea	CABI (2021)
	Teramnus labialis	Fabaceae	Blue wiss	CABI (2021)
	Terminalia	Combretaceae		García Morales et al. (2016)
	Terminalia mantaly	Combretaceae		CABI (2021)
	Terminalia neotaliala	Combretaceae	Madagascar almond tree	García Morales et al. (2016)
	Tetracera	Dilleniaceae		CABI (2021)
	Theobroma speciosum	Malvaceae		EPPO GD (2021)
	Thespesia	Malvaceae		CABI (2021)
	Thespesia lampas	Malvaceae		CABI (2021)
	Thespesia populnea	Malvaceae	Portia tree	CABI (2021)
	Tithonia diversifolia	Asteraceae	Mexican sunflower	CABI (2021)
	Tradescantia	Commelinaceae		García Morales et al. (2016)
	Trema micrantha	Cannabaceae	Jamaican nettle tree, capulin	García Morales et al. (2016)
	Vachellia nilotica	Fabaceae	Gum arabic tree, babul, thorn mimosa, Egyptian acacia, thorny acacia	García Morales et al. (2016)
	Verbesina fastigiata	Asteraceae		CABI (2021)
	Viburnum odoratissimum	Caprifoliaceae	Sweet viburnum	García Morales et al. (2016)
	Vigna mungo	Fabaceae	Black gram	García Morales et al. (2016)
	Vigna unguiculata	Fabaceae	Cowpea	García Morales et al. (2016)
	Volkameria aculeata	Lamiaceae		García Morales et al. (2016)
	Xanthosoma	Araceae	Cocoyam	CABI (2021)
	Zinnia	Asteraceae		CABI (2021)

Appendix B – Distribution of *Maconellicoccus hirsutus*

Distribution records based on EPPO Global Database (EPPO, online) and García Morales et al. (2016).

Region	Country	Sub-national (e.g. State)	Status	Reference
North America	Mexico		Present, restricted distribution	EPPO GD (2021)
	USA		Present, restricted distribution	EPPO GD (2021)
	USA	Alabama	Present, no details	EPPO GD (2021)
	USA	California	Present, restricted distribution	EPPO GD (2021)
	USA	Florida	Present, few occurrences	EPPO GD (2021)
	USA	Georgia	Present, few occurrences	EPPO GD (2021)
	USA	Louisiana	Present, no details	EPPO GD (2021)
	USA	New York	Present, no details	EPPO GD (2021)
	USA	North Carolina	Present, no details	EPPO GD (2021)
	USA	Oklahoma	Present, no details	EPPO GD (2021)
	USA	South Carolina	Present, no details	EPPO GD (2021)
	USA	Tennessee	Present, no details	EPPO GD (2021)
	USA	Texas	Present, no details	García Morales et al. (2016)
Central America	Belize		Present, no details	EPPO GD (2021)
	Costa Rica		Present, restricted distribution	EPPO GD (2021)
	Guatemala		Absent, unreliable record	EPPO GD (2021)
	Nicaragua		Present, restricted distribution	EPPO GD (2021)
Caribbean	Anguilla		Absent, unreliable record	EPPO GD (2021)
	Antigua and Barbuda		Present, no details	EPPO GD (2021)
	Aruba		Present, no details	EPPO GD (2021)
	Bahamas		Present, no details	EPPO GD (2021)
	Barbados		Present, no details	EPPO GD (2021)
	Cayman Islands		Present, no details	EPPO GD (2021)
	Cuba		Present, no details	García Morales et al. (2016)
	Dominica		Present, no details	EPPO GD (2021)
	Dominican Republic		Absent, unreliable record	EPPO GD (2021)
	Grenada		Present, restricted distribution	EPPO GD (2021)
	Guadeloupe		Present, no details	EPPO GD (2021)
	Haiti		Present, widespread	EPPO GD (2021)
	Jamaica		Present, few occurrences	EPPO GD (2021)
	Martinique		Present, no details	EPPO GD (2021)
	Montserrat		Present, no details	EPPO GD (2021)
	Netherlands Antilles		Present, no details	EPPO GD (2021)
	Puerto Rico		Present, no details	EPPO GD (2021)
	Saint Lucia		Present, no details	EPPO GD (2021)
	St Kitts-Nevis		Present, no details	EPPO GD (2021)
	St Vincent and the Grenadines		Present, no details	EPPO GD (2021)
	Saint Barthelemy		Present, no details	García Morales et al. (2016)
	Saint Martin		Present, no details	García Morales et al. (2016)

Region	Country	Sub-national (e.g. State)	Status	Reference
	Trinidad and Tobago		Present, no details	EPPO GD (2021)
	Virgin Islands (British)		Present, no details	EPPO GD (2021)
	Virgin Islands (US)		Present, no details	EPPO GD (2021)
South America	Brazil		Present, restricted distribution	EPPO GD (2021)
	Brazil	Alagoas	Present, no details	EPPO GD (2021)
	Brazil	Bahia	Present, restricted distribution	EPPO GD (2021)
	Brazil	Espirito Santo	Present, restricted distribution	EPPO GD (2021)
	Brazil	Maranhao	Present, no details	EPPO GD (2021)
	Brazil	Mato Grosso	Present, no details	EPPO GD (2021)
	Brazil	Para	Present, no details	EPPO GD (2021)
	Brazil	Pernambuco	Present, no details	EPPO GD (2021)
	Brazil	Rio Grande do Sul	Present, no details	EPPO GD (2021)
	Brazil	Roraima	Present, restricted distribution	EPPO GD (2021)
	Brazil	Santa Catarina	Present, no details	EPPO GD (2021)
	Brazil	Sao Paulo	Present, no details	EPPO GD (2021)
	Colombia		Present, restricted distribution	EPPO GD (2021)
	French Guiana		Present, no details	EPPO GD (2021)
	Guyana		Present, widespread	EPPO GD (2021)
	Suriname		Present, restricted distribution	EPPO GD (2021)
	Venezuela		Present, no details	EPPO GD (2021)
EU (27)	Cyprus		Present, widespread	EPPO GD (2021)
	Greece		Present, restricted distribution	EPPO GD (2021)
Africa	Algeria		Absent, invalid record	EPPO GD (2021)
	Benin		Present, no details	EPPO GD (2021)
	Burkina Faso		Present, no details	EPPO GD (2021)
	Cameroon		Present, no details	EPPO GD (2021)
	Central African Republic		Present, no details	EPPO GD (2021)
	Chad		Present, no details	EPPO GD (2021)
	Congo		Present, no details	EPPO GD (2021)
	Congo, Democratic republic of the		Present, no details	EPPO GD (2021)
	Cote d'Ivoire		Present, no details	EPPO GD (2021)
	Egypt		Present, no details	EPPO GD (2021)
	Gabon		Present, no details	EPPO GD (2021)
	Gambia		Present, no details	EPPO GD (2021)
	Kenya		Present, no details	EPPO GD (2021)
	Liberia		Present, no details	EPPO GD (2021)
	Niger		Present, no details	EPPO GD (2021)
	Nigeria		Present, no details	EPPO GD (2021)
	Reunion		Present, no details	EPPO GD (2021)
	Senegal		Present, no details	EPPO GD (2021)
	Seychelles		Present, no details	EPPO GD (2021)
	Socotra Island		Present, no details	García Morales et al. (2016)
	Somalia		Present, no details	EPPO GD (2021)
	Sudan		Present, no details	EPPO GD (2021)

Region	Country	Sub-national (e.g. State)	Status	Reference
	Tanzania		Present, no details	EPPO GD (2021)
	Tunisia		Present, restricted distribution	EPPO GD (2021)
	Zambia		Absent, invalid record	EPPO GD (2021)
	Zaire		Present, no details	García Morales et al. (2016)
	Zanzibar		Present, no details	García Morales et al. (2016)
Asia	Bali		Present, no details	García Morales et al. (2016)
	Bangladesh		Present, no details	EPPO GD (2021)
	Brunei Darussalam		Present, no details	EPPO GD (2021)
	Cambodia		Present, no details	EPPO GD (2021)
	China		Present, restricted distribution	EPPO GD (2021)
	China	Aomen (Macau)	Present, no details	EPPO GD (2021)
	China	Guangdong	Present, no details	EPPO GD (2021)
	China	Guangxi	Present, no details	García Morales et al. (2016)
	China	Shanxi	Present, no details	EPPO GD (2021)
	China	Xianggang (Hong Kong)	Present, no details	EPPO GD (2021)
	China	Xizhang	Present, no details	EPPO GD (2021)
	China	Yunnan	Present, no details	EPPO GD (2021)
	China	Hong Kong	Present, no details	García Morales et al. (2016)
	India		Present, widespread	EPPO GD (2021)
	India	Andaman and Nicobar Islands	Present, no details	EPPO GD (2021)
	India	Andhra Pradesh	Present, no details	EPPO GD (2021)
	India	Assam	Present, no details	EPPO GD (2021)
	India	Bihar	Present, no details	EPPO GD (2021)
	India	Delhi	Present, no details	EPPO GD (2021)
	India	Gujarat	Present, no details	EPPO GD (2021)
	India	Karnataka	Present, no details	EPPO GD (2021)
	India	Kerala	Present, no details	EPPO GD (2021)
	India	Madhya Pradesh	Present, no details	EPPO GD (2021)
	India	Maharashtra	Present, no details	EPPO GD (2021)
	India	Odisha	Present, no details	EPPO GD (2021)
	India	Punjab	Present, no details	EPPO GD (2021)
	India	Tamil Nadu	Present, no details	EPPO GD (2021)
	India	Telangana	Present, no details	EPPO GD (2021)
	India	Tripura	Present, no details	EPPO GD (2021)
	India	Uttar Pradesh	Present, no details	EPPO GD (2021)
	India	West Bengal	Present, no details	EPPO GD (2021)
	Indonesia		Present, widespread	EPPO GD (2021)
	Indonesia	Flores	Present, no details	García Morales et al. (2016)
	Indonesia	Irian Jaya	Present, no details	EPPO GD (2021)
	Indonesia	Java	Present, no details	EPPO GD (2021)
	Indonesia	Lombok	Present, no details	García Morales et al. (2016)

Region	Country	Sub-national (e.g. State)	Status	Reference
	Indonesia	Nusa Tenggara	Present, no details	EPPO GD (2021)
	Indonesia	Sulawesi	Present, no details	EPPO GD (2021)
	Indonesia	Sumatra	Present, no details	EPPO GD (2021)
	Iran		Present, no details	EPPO GD (2021)
	Israel		Present, few occurrences	EPPO GD (2021)
	Japan		Present, restricted distribution	EPPO GD (2021)
	Japan	Ryukyu Archipelago	Present, no details	EPPO GD (2021)
	Jordan		Present, no details	EPPO GD (2021)
	Laos		Present, no details	EPPO GD (2021)
	Lebanon		Present, no details	EPPO GD (2021)
	Malaya		Present, no details	García Morales et al. (2016)
	Malaysia		Present, no details	EPPO GD (2021)
	Malaysia	West	Present, no details	EPPO GD (2021)
	Maldives		Present, no details	EPPO GD (2021)
	Myanmar		Present, no details	EPPO GD (2021)
	Nepal		Present, no details	EPPO GD (2021)
	Oman		Present, no details	EPPO GD (2021)
	Pakistan		Present, no details	EPPO GD (2021)
	Philippines		Present, no details	EPPO GD (2021)
	Saudi Arabia		Present, no details	EPPO GD (2021)
	Singapore		Present, no details	EPPO GD (2021)
	Sri Lanka		Present, no details	EPPO GD (2021)
	Taiwan		Present, no details	EPPO GD (2021)
	Thailand		Present, no details	EPPO GD (2021)
	Turkey		Present, no details	EPPO GD (2021)
	United Arab Emirates		Present, no details	EPPO GD (2021)
	Vietnam		Present, no details	EPPO GD (2021)
	Yemen		Present, no details	EPPO GD (2021)
Oceania	Australia		Present, no details	EPPO GD (2021)
	Australia	Northern Territory	Present, no details	EPPO GD (2021)
	Australia	Queensland	Present, no details	EPPO GD (2021)
	Australia	South Australia	Present, no details	EPPO GD (2021)
	Australia	Western Australia	Present, no details	EPPO GD (2021)
	Fiji		Present, no details	EPPO GD (2021)
	Guam		Present, no details	EPPO GD (2021)
	Micronesia		Present, restricted distribution	EPPO GD (2021)
	New Caledonia		Present, no details	EPPO GD (2021)
	Northern Mariana Islands		Present, no details	EPPO GD (2021)
	Palau		Present, no details	EPPO GD (2021)
	Papua New Guinea		Present, no details	EPPO GD (2021)
	Samoa		Present, no details	EPPO GD (2021)
	Solomon Islands		Present, no details	EPPO GD (2021)
	Tonga		Present, no details	EPPO GD (2021)
	Tuvalu		Present, no details	EPPO GD (2021)
	USA	Hawaii	Present, no details	EPPO GD (2021)
	Vanuatu		Present, no details	EPPO GD (2021)

Appendix C – Import data

Table C.1: **Fresh or dried citrus (CN code: 0805)** imported in 100 kg into the EU (27) from regions where *Maconellicoccus hirsutus* is known to occur (Source: Eurostat accessed on 22/9/2021)

COUNTRY	2016	2017	2018	2019	2020
Australia	3,279.84	1,284.38	644.97	10,645.40	2,733.47
Bangladesh	227.61	229.58	159.67	322.42	1,183.66
Brazil	864,863.09	903,432.95	900,907.24	822,134.46	902,354.68
Burkina Faso	78.14	148.57	103.95	38.95	53.52
Cameroon	10.48	0.20			
China	827,840.57	1,084,857.27	1,024,163.15	1,108,595.22	1,098,691.70
Colombia	44,825.37	79,400.99	123,887.46	136,914.85	172,413.40
Costa Rica	4,700.31	921.32	704.93	231.20	461.60
Cuba	7,165.74	3,863.97	4,438.14	3,422.11	556.03
Dominica	865.67	193.34	57.65	76.50	78.69
Egypt	1,931,586.64	2,246,998.88	2,643,272.02	2,206,932.71	2,850,742.72
Guyana					24.00
Haiti	207.41	176.53	72.10	31.00	248.29
Hong Kong		0.00		2.27	1.00
India	246.80	1.00	449.63	88.51	254.95
Indonesia	566.73	555.70	779.35	836.73	864.54
Iran	1,533.22	1,218.52	1,208.01	2,174.22	1,882.74
Jamaica	3,633.97	3,325.11	675.68	2,409.55	1,646.87
Israel	799,118.49	969,403.62	824,601.66	812,738.57	878,713.15
Jordan	1.17	0.00	3.79	1.40	11.80
Japan	352.58	417.44	270.73	319.24	162.50
Kenya			8.80		34.56
Laos	51.94	2.10			20.23
Lebanon	503.21	1,504.91	7.46	7.28	3.19
Malaysia	4.18	39.02	83.45	7.71	
Mexico	570,402.80	553,818.66	589,021.12	443,743.54	349,628.56
Nepal		1,170.00			
Nigeria			0.03	0.10	200.00
Pakistan			2.45	0.59	
Philippines			0.20	7.71	0.10
Somalia	490.30	193.21	367.52	514.30	342.10
Sudan			2.10		20.58
Taiwan	157.49				0.01
Tanzania	179.90	190.01	144.12	35.95	75.50
Thailand	426.42	1,283.13	659.74	624.93	194.87
Tunisia	175,010.90	172,515.76	125,258.30	133,950.15	75,620.02
Turkey	2,569,671.58	2,026,980.05	3,149,386.85	2,102,077.48	2,573,806.18
United States	301,229.06	231,210.47	185,706.99	177,755.45	148,845.72
Venezuela	744.08	2,216.36	681.07		
Viet Nam	28,649.46	46,738.17	70,934.07	73,964.35	63,730.13

Table C.2: **Cotton linters (CN code: 140420)** imported in 100 kg into the EU (27) from regions where *Maconellicoccus hirsutus* is known to occur (Source: Eurostat accessed on 22/9/2021)

COUNTRY	2016	2017	2018	2019	2020
Benin	400.00	294.95	608.38	132.94	87.99
Brazil	13,493.54	57,840.63	68,605.72	50,783.56	57,176.03
China	1,530.80	10.00	44.83	102.75	188.29
Egypt		1.47			
India	1,136.10	589.38	487.65	735.71	2,148.17
Indonesia			27.55		5.38
Iran					3.93
Turkey	40,881.83	115,022.78	88,098.66	82,852.55	81,157.09
United States	56,181.45	32,472.85	16,629.25	7,933.06	19,150.08
Viet Nam			0.21	0.34	

Table C.3: **Fresh or dried bananas (CN code: 0803)** imported in 100 kg into the EU (27) from regions where *Maconellicoccus hirsutus* is known to occur (Source: Eurostat accessed on 22/9/2021)

COUNTRY	2016	2017	2018	2019	2020
Bangladesh	174.66	79.85	72.75	38.05	35.64
Brazil	149,108.03	26,855.08	59,677.31	104,909.74	98,434.39
Cameroon	2,521,882.41	2,341,539.74	1,791,447.01	1,520,648.04	1,579,456.86
China	252.64	188.73	390.56	545.74	854.93
Colombia	10,120,590.13	11,594,479.46	11,282,545.88	11,524,355.75	12,193,049.39
Costa Rica	9,662,138.79	9,663,219.69	10,125,330.57	9,405,488.40	10,342,372.80
Cuba					1.28
Egypt	42.98	0.18	146.87		
India	515.19	445.99	571.13	607.74	1,418.91
Indonesia		0.01	37.27	14.72	64.17
Iran			0.09	2.86	12.33
Israel	2.10				0.75
Kenya	1.90	0.72	6.15	11.23	14.95
Malaysia			8.02		
Mexico	516,367.97	558,896.47	348,905.62	239,173.11	141,492.42
Nigeria	0.72	2.04	2.50	0.84	6.35
Pakistan			2.60	49.70	
Philippines	2,480.90	11,415.47	1,674.92	2,160.35	1,240.80
Saudi Arabia			5.00		
Singapore		0.06	0.12		
Taiwan	0.15				
Tanzania	28.02	11.93	33.68	34.24	34.74
Thailand	550.44	674.34	603.32	526.15	334.58
Turkey	202.06		210.60	0.14	
United States	7.00	6.37	1.54	6.32	10.37
Viet Nam	276.26	178.84	190.96	210.11	142.71
Zambia		0.72			

Table C.4: **Fresh grapes (CN code: 080610)** imported in 100 kg into the EU (27) from regions where *Maconellicoccus hirsutus* is known to occur (Source: Eurostat accessed on 22/9/2021)

COUNTRY	2016	2017	2018	2019	2020
Australia	2.95	0.50			
Bangladesh	1.05		0.50		
Brazil	194,152.79	249,279.81	271,987.56	196,465.22	228,095.15
China	0.00	6.00	0.03		
Colombia		0.00	381.30	669.12	186.96
Egypt	330,565.57	404,801.23	429,994.87	442,798.85	462,890.07
India	640,933.67	827,467.67	722,802.04	950,910.96	733,881.71
Iran			2,158.50	366.00	399.80
Israel	13,169.16	7,165.09	6,397.33	318.24	1,080.90
Japan	4.84	1.19	1.17	1.15	20.67
Kenya			186.96		
Mexico		358.96		186.71	184.62
Thailand	0.37	0.14	0.16		0.87
Tunisia	657.82		239.62	40.60	192.00
Turkey	298,205.16	375,776.41	227,616.42	272,447.02	287,021.27
United States	1,714.93	8,868.74	4,413.37	1,866.20	1,072.48
Zambia		0.28	0.03		

Table C.5: **Fresh or dried avocados (CN code: 080440)** imported in 100 kg into the EU (27) from regions where *Maconellicoccus hirsutus* is known to occur (Source: Eurostat accessed on 22/9/2021)

COUNTRY	2016	2017	2018	2019	2020
Brazil	44,357.36	71,040.50	68,697.61	78,673.73	48,183.82
Cameroon	133.50	173.54	221.30	259.38	205.93
China	193.97	35.28		1.23	0.04
Colombia	152,115.55	210,139.60	251,050.33	387,367.23	663,149.95
Costa Rica		21.56	9.98	428.45	686.40
Cuba	109.09	73.94	41.53	131.08	34.33
Egypt	211.20	5.35	4.58	79.92	363.95
India	0.04	2.06	0.52	0.06	
Israel	301,123.91	424,267.97	370,378.23	437,318.01	345,663.97
Kenya	228,426.16	243,947.31	404,593.87	346,231.90	435,309.11
Malaysia	0.03		47.04		
Mexico	503,687.52	445,611.06	463,741.28	767,878.48	716,205.77
Nigeria	1.06	3.15	3.18	0.51	
Tanzania	26,823.05	25,773.58	55,517.16	60,480.96	50,769.74
Thailand	3.68	9.76	9.66	9.06	3.39
Turkey	213.41	477.05	1,530.93	2,172.09	1,864.65
United States	8,819.53	1.19	2,546.86	0.02	4.66
Viet Nam	1.00			0.05	
Zambia			53.68		

Table C.6: **Fresh tamarinds, cashew apples, lychees, jackfruit, sapodillo plums, passion fruit, carambola and pitahaya (CN code: 08109020)** imported in 100 kg into the EU (27) from regions where *Maconellicoccus hirsutus* is known to occur (Source: Eurostat accessed on 22/9/2021)

COUNTRY	2016	2017	2018	2019	2020
Australia					12.50
Bangladesh	140.15	222.55	291.61	206.12	382.00
Brazil	49.36	147.37	368.88	966.63	1,220.26
Cameroon	41.84	100.53	38.52	92.00	46.11
China	314.75	287.38	1,112.11	1,014.77	823.41
Colombia	69,743.63	72,656.37	83,639.84	89,847.31	90,741.20
Costa Rica	9.11	3.52	0.13	18.62	
Egypt		13.79			39.05
Hong Kong		9.66			
India	324.19	621.75	1,095.12	1,168.69	754.33
Indonesia	103.20	333.37	297.72	246.67	463.60
Iran	6.25		1.75	0.50	3.88
Israel	2,943.37	2,919.30	1,061.09	1,125.92	594.86
Kenya	714.44	221.45	603.11	481.00	697.14
Malaysia	15,348.23	14,205.33	13,879.92	14,235.96	7,849.69
Mexico	543.90	212.78	1,295.08	669.87	2,331.91
Nigeria		0.00		1.91	3.09
Pakistan	2.22	3.34	8.17		
Philippines	9.78	14.26		0.88	
Singapore	9.00		8.48		
Taiwan	11.92		10.59	25.97	8.97
Tanzania	0.35		1.27	8.77	4.52
Thailand	9,774.93	10,279.68	12,461.38	14,900.21	10,138.74
Turkey			8.61	18.92	23.40
United States	3.97	3.00	0.07		0.02
Viet Nam	33,078.82	38,428.61	44,070.83	52,846.33	45,652.75
Zambia		631.60	4,568.50	3,526.04	3,087.70

Table C.7: **Fresh or dried pineapples (CN code: 08043000)** imported in 100 kg into the EU (27) from regions where *Maconellicoccus hirsutus* is known to occur (Source: Eurostat accessed on 19/11/2021)

COUNTRY	2016	2017	2018	2019	2020
Algeria		0.00		0.01	
Aruba		0.00			
Australia		0.00		0.00	0.01
Bahamas		0.00			
Belize		0.00			
Benin	29,484.88	9,456.56	8,065.08	7,481.67	12,849.58
Brazil	1,522.02	1,272.34	484.83	639.05	280.66
Burkina Faso			145.92	19.68	3.57
Cameroon	38,878.76	39,301.85	30,633.74	23,825.83	13,811.36
China	69.90	25.05	9.91	62.65	42.74
Colombia	64,893.82	123,462.45	91,067.04	53,663.49	42,136.78
Congo		0.00		2.87	3.40
Congo, Democratic Republic of	0.78	2.56	0.85		0.07

COUNTRY	2016	2017	2018	2019	2020
Costa Rica	6,095,312.66	6,832,249.09	7,693,551.48	7,543,050.71	6,650,975.31
Côte d'Ivoire (Ivory Coast)	202,205.93	255,038.72	220,581.56	244,175.93	203,552.53
Cuba	10,645.21	4,382.57	3,838.50	1,998.42	976.85
Dominican Republic	29,667.00	15,582.31	19,723.37	20,566.35	20,525.91
Egypt		201.60			28.16
Fiji		0.00			
Gabon		0.00			
Grenada		0.00			
Guatemala		229.74	40.08	64.03	282.50
Guinea	17.35	98.34	83.45	72.90	19.95
Guyana		0.00			22.00
India	186.71	17.99	75.85	11.52	1.00
Indonesia	0.24	543.77	0.09		2.50
Iran, Islamic Republic of		0.00		0.01	0.00
Israel		2.81	0.20	0.01	
Jamaica		0.00			
Japan	0.02	0.00			
Jordan		0.00		36.00	
Kenya		761.13	745.19	2,147.97	23,799.06
Lao People's Democratic Republic (Laos)		0.00			
Lebanon	0.16	0.00		5.05	
Libya		0.00			
Malaysia	13.60	5.00		2.40	
Maldives		0.00			
Mexico	1,268.22	2,957.94	773.74	142.42	174.97
Nicaragua		0.00			
Nigeria	0.54	0.95	0.13	0.24	0.01
Oman		0.00			
Pakistan		0.00			
Palau		0.00			
Philippines	93.71	114.23	183.83	86.03	566.04
Saudi Arabia		0.00		0.45	0.17
Singapore	0.20	0.00		0.29	
Sri Lanka	1,774.66	5,755.44	4,125.57	2,675.19	2,636.02
Suriname		0.00			
Taiwan		0.00		0.07	0.05
Thailand	10,183.30	11,093.21	9,505.48	8,056.49	8,828.72
Trinidad and Tobago		0.00			
Tunisia	0.05	0.00		0.01	0.03
Turkey		0.00		25.20	0.04
United Arab Emirates		0.00			0.02
United States	69.72	56.66	22.03	28.28	57.29
Venezuela, Bolivarian Republic of	0.15	0.00	0.19	0.04	
Viet Nam	91.31	65.87	9.88	20.20	2.18
Virgin Islands, British		0.00			
Virgin Islands, United States		0.00			
Zambia		0.00			