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Commodity risk assessment of *Persea americana* from Israel

EFSA Panel on Plant Health (PLH),
Claude Bragard, Katharina Dehnen-Schmutz, Francesco Di Serio, Paolo Gonthier, Marie-Agnès Jacques, Josep Anton Jaques Miret, Annemarie Fejer Justesen, Alan MacLeod, Christer Sven Magnusson, Panagiotis Milonas, Juan A Navas-Cortes, Stephen Parnell, Roel Potting, Philippe Lucien Reignault, Hans-Hermann Thulke, Wopke Van der Werf, Antonio Vicent Civera, Lucia Zappalà, Pedro Gómez, Andrea Lucchi, Gregor Urek, Sara Tramontini, Olaf Mosbach-Schulz, Eduardo de la Peña and Jonathan Yuen

Abstract

The EFSA Panel on Plant health was requested to prepare and deliver risk assessments for commodities listed in the relevant Implementing Acts as 'High risk plants, plant products and other objects' (Commission Implementing Regulation (EU) 2018/2019 establishing a provisional list of high risk plants, plant products or other objects, within the meaning of Article 42 of Regulation (EU) 2016/2031). This scientific opinion covers the plant health risks posed by the following commodities: (i) scions and (ii) grafted plants of *Persea americana* imported from Israel, taking into account the available scientific information, including the technical information provided by the Plant Protection and Inspection Services from Israel. The relevance of an EU quarantine pest for this opinion was based on evidence that: (i) the pest is present in Israel; (ii) *P. americana* is a host of the pest and (iii) the pest can be associated with the commodity. The relevance of any other pest, not regulated in the EU, was based on evidence that: (i) the pest is present in Israel; (ii) the pest is absent in the EU; (iii) *P. americana* is a host of the pest; (iv) the pest can be associated with the commodity and (v) the pest may have an impact and can pose a potential risk for the EU territory. Twenty-six pests (15 insects, one mite, 9 fungi and one viroid) that fulfilled all criteria were selected for further evaluation. For the 26 selected pests, the risk mitigation measures proposed in the technical dossier were evaluated. Limiting factors on the effectiveness of the measures were documented. For each of the 26 pests, an expert judgement is given on the likelihood of pest freedom taking into consideration the risk mitigation measures acting on the pest, including any uncertainties. The fungi *Lasiodiplodia pseudotheobromae* and *Neoscytalidium dimidiatum* were the pests most frequently expected on the imported commodities. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,573 and 10,000 bundles of scions per 10,000; and 9,747 and 10,000 grafted plants per 10,000 would be free of these two fungi.

Keywords: *Persea americana*, Avocado, plants for planting, Israel, European Union, commodity risk assessment, plant health, scions, rooted plants, grafted plants

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Correspondence: alpha@efsa.europa.eu

Panel members: Claude Bragard, Katharina Dehnen-Schmutz, Francesco Di Serio, Paolo Gonthier, Marie-Agnès Jacques, Josep Anton Jaques Miret, Annemarie Fejer Justesen, Alan MacLeod, Christer Sven Magnusson, Panagiotis Milonas, Juan A. Navas-Cortes, Stephen Parnell, Roel Potting, Philippe L Reignault, Hans-Hermann Thulke, Wopke Van der Werf, Antonio Vicent, Jonathan Yuen, Lucia Zappalàtting, Philippe L Reignault, Hans-Hermann Thulke, Wopke Van der Werf, Antonio Vicent, Jonathan Yuen and Lucia Zappalà.

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1. Introduction

1.1. Background and Terms of Reference as provided by European Commission

1.1.1. Background

The new Plant Health Regulation (EU) 2016/2031[1], on the protective measures against pests of plants, has been applied since December 2019. Provisions within the above Regulation are in place for the listing of 'high risk plants, plant products and other objects' (Article 42) on the basis of a preliminary assessment, and to be followed by a commodity risk assessment. A list of 'high risk plants, plant products and other objects' has been published (EU) 2018/2019[2]. Scientific opinions are therefore needed to support the European Commission and the Member States in the work connected to Article 42 of Regulation (EU) 2016/2031, as stipulated in the terms of reference.

1.1.2. Terms of reference

In view of the above and in accordance with Article 29 of Regulation (EC) No 178/2002[3], the Commission asks EFSA to provide scientific opinions in the field of plant health.

In particular, EFSA is expected to prepare and deliver risk assessments for commodities listed in the relevant Implementing Acts as 'High risk plants, plant products and other objects'. Article 42, paragraphs 4 and 5, establishes that a risk assessment is needed as a follow-up to evaluate whether the commodities will remain prohibited, removed from the list and additional measures will be applied or removed from the list without any additional measures. This task is expected to be on-going, with a regular flow of dossiers being sent by the applicant required for the risk assessment.

Therefore, to facilitate the correct handling of the dossiers and the acquisition of the required data for the commodity risk assessment, a format for the submission of the required data for each dossier is needed.

Furthermore, a standard methodology for the performance of 'commodity risk assessment' based on the work already done by Member States and other international organizations needs to be set.

In view of the above and in accordance with Article 29 of Regulation (EC) No 178/2002, the Commission asks EFSA to provide scientific opinion in the field of plant health for *Persea americana* from Israel taking into account the available scientific information, including the technical dossier provided by *Israel*.

1.2. Interpretation of the Terms of Reference

The EFSA Panel on Plant Health (hereafter referred to as 'the Panel') conducted a commodity risk assessment of *P. americana* Mill., from Israel (IL) following the Guidance on commodity risk assessment for the evaluation of high-risk plant dossiers (EFSA PLH Panel, 2019a).

The EU quarantine pests that are regulated as a group in the Commission Implementing Regulation (EU) 2019/2072 were considered and evaluated separately at species level. The references to 'non-European' refer to all territories with exception of the Union territories as defined in Article 1 point 3 of Regulation (EU) 2016/2031.

The criteria used in this opinion to determine if a Scolytidae spp. (non-European) is considered as potentially quarantine for the EU followed the proposal and criteria specified in EFSA, 2020, i.e. a non-EU Scolytinae is defined by its geographical distribution outside of the EU territory. As such, Scolytinae not reported from the EU and occurring only outside of the EU territory are considered as non-EU Scolytinae. Furthermore, Scolytinae occurring outside the EU and having only a limited

[1] Regulation (EU) 2016/2031 of the European Parliament of the Council of 26 October 2016 on protective measures against pests of plants, amending Regulations (EU) 228/2013, (EU) 652/2014 and (EU) 1143/2014 of the European Parliament and of the Council and repealing Council Directives 69/464/EEC, 74/647/EEC, 93/85/EEC, 98/57/EC, 2000/29/EC, 2006/91/EC and 2007/33/EC. OJ L 317, 23.11.2016, pp. 4–104.

[2] Commission Implementing Regulation (EU) 2018/2019 of 18 December 2018 establishing a provisional list of high risk plants, plant products or other objects, within the meaning of Article 42 of Regulation (EU) 2016/2031 and a list of plants for which phytosanitary certificates are not required for introduction into the Union, within the meaning of Article 73 of that Regulation C/2018/8877. OJ L 323, 19.12.2018, pp. 10–15.

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

presence in the EU (reported from up to three EU Member States (MSs), with restricted distribution) are also considered as non-EU.

Pests listed as 'Regulated Non-Quarantine Pest' (RNQP)' in Commission Implementing Regulation (EU) 2019/2072 were not considered for further evaluation, in line with a letter from European Commission from 24 October 2019, Ref. Ares (2019)6579768 - 24/10/2019, on Clarification on EFSA mandate on high risk plants.

In its evaluation, the Panel:

- Checked whether the provided information in the technical dossier (hereafter referred to as 'the Dossier') provided by Israel (IL) was sufficient to conduct a commodity risk assessment. When necessary, additional information was requested to the Israel Authority (Plant Protection and Inspection Services – PPIS).
- Selected the relevant union EU-regulated quarantine pests and protected zone quarantine pests (as specified in Commission Implementing Regulation (EU) 2019/2072[4], hereafter referred to as 'EU quarantine pests') and other relevant pests present in Israel and associated with the commodity.
- For those Union quarantine pests for which specific measures are in place for the import of the commodity from the specific country in Commission Implementing Regulation (EU) 2019/2072, the assessment was restricted to whether or not the applicant country applies those measures. The effectiveness of those measures was not assessed.
- For those Union quarantine pests for which no specific measures are in place for the import of the commodity from the specific applicant country and other relevant pests present in applicant country and associated with the commodity, the effectiveness of the measures described by the applicant in the dossier was assessed.

Risk management decisions are not within EFSA's remit. Therefore, the Panel provided a rating for the likelihood of pest freedom for each relevant pest given the risk mitigation measures proposed by the PPIS of Israel.

2. Data and methodologies

2.1. Data provided by the PPIS of Israel

The Panel considered all the data and information (hereafter called 'the Dossier') provided by the PPIS of Israel on 16 October 2019, including the additional information provided by the PPIS of Israel on 17 March 2020 and 5 July 2020. The Dossier is managed by EFSA.

The structure and overview of the Dossier is shown in Table 1. The number of the relevant section will be indicated in the opinion when referring to a specific part of the Dossier.

Table 1: Structure and overview of the Dossier and additional material submitted by the PPIS of Israel

Dossier section	Overview of contents	Filename
1.	Technical dossier on *Persea americana* (complete document)	Avocado information for EFSA 23.docx
2.	COMMODITY DATA	Avocado information for EFSA 23.docx
2.1.	Taxonomic information	Avocado information for EFSA 23.docx
2.2.	Plants for planting specification (ISPM 36 – FAO, 2012)	Avocado information for EFSA 23.docx
2.3.	Production period	Avocado information for EFSA 23.docx
2.4.	Phytosanitary status and management	Avocado information for EFSA 23.docx
2.5.	Intended use	Avocado information for EFSA 23.docx
2.6.	Production area	Avocado information for EFSA 23.docx
2.7.	Separation of production areas	Avocado information for EFSA 23.docx

[4] Commission Implementing Regulation (EU) 2019/2072 of 28 November 2019 establishing uniform conditions for the implementation of Regulation (EU) 2016/2031 of the European Parliament and the Council, as regards protective measures against pests of plants, and repealing Commission Regulation (EC) No 690/2008 and amending Commission Implementing Regulation (EU) 2018/2019, OJ L 319, 10.12.2019, p. 1–279.

Dossier section	Overview of contents	Filename
2.8.	Climatic classification	Avocado information for EFSA 23.docx
2.9.	Pictures and description	Avocado information for EFSA 23.docx
3.	PESTS LIST	Avocado information for EFSA 23.docx
3.1.	List of all the pests potentially associated with the commodity plant species or genus in the exporting country	Pest list for Avocado_and presence in Israel 4.docx
3.2.	List of EU regulated pests (Table D.1)	D1 Avocado 21.docx
3.3.	List of non-regulated pests (Table D.2)	D2 Avocado 40.docx
3.4.	Summary table of relevant pests associated with the commodity (Table D.3)	D3 Avocado 5.docx
	Data for each pest of Table D.3	Ambrosia datasheet 1.docx *Aonidiella orientalis* datasheet.docx *Bemisia tabaci* datasheet 1.docx *Eutetranychus orientalis* datasheet 1.docx Fig Borer datasheet 2.docx *Fusarium pallidoroseum* datasheet 2.docx *Helicoverpa armigera* datasheet 1.docx *Icerya aegyptiaca* datasheet 3.docx *Maladera insanabilis* datasheet 2.docx *Milviscutulus mangiferae* datasheet 1.docx *Parabemisia myricae* datasheet 1.docx *Retithrips syriacus* datasheet 2.docx *Scirtothrips dorsalis* datasheet 1.docx *Spodoptera littoralis* datasheet 1.docx
3.4.1.	Scientific name	
3.4.2.	Taxonomic classification	
3.4.3.	Geographical distribution	
3.4.4.	Prevalence of the pest during the season	
3.4.5.	Biology of the pest	
3.4.6.	Main hosts	
3.4.7.	Arthropods and nematodes description	
3.4.8.	Pathogens description	
3.4.9.	Other living organisms description	
3.4.10.	Impact of the pest	
3.4.11.	Information from other pest risk assessment(s)	
4.	DATA ON PHYTOSANITARY MITIGATION MEASURES	Avocado information for EFSA 23.docx
4.1.	Description of phytosanitary mitigation measures	Avocado information for EFSA 23.docx
4.2.	Description of phytosanitary regulations	Avocado information for EFSA 23.docx
4.3.	Description of surveillance and monitoring	Avocado information for EFSA 23.docx
4.4.	Trade volumes and frequencies	Avocado information for EFSA 23.docx
4.5.	Description of post-harvest procedures	Avocado information for EFSA 23.docx
5.	Appendix E tables	Avocado information for EFSA 23.docx
5.1.	Table E.1 – Details of pesticide treatment	Avocado information for EFSA 23.docx
5.2.	Table E.2 – Details of other treatments/measures	Avocado information for EFSA 23.docx
5.3	Table E.4 – Assessment of the overall efficacy of phytosanitary mitigation measures	Avocado information for EFSA 23.docx
6.	Response after the request for clarification on the characteristics of the plant material for export by the PPIS of Israel	Additional Information on *Persea americana* (EFSA-Q-2019-00654 and 0007-ISRAEL).msg
7.	Response after the request of additional information regarding the request to provide a scientific opinion on the risk assessment for the EU territory of Persea americana submitted by the Plant Protection and Inspection Services (PPIS), Israel	2020.7.5 - Answers to EFSA questions Avocado May 2020.pdf

The data and supporting information provided by the PPIS of Israel formed the basis of the commodity risk assessment. Additionally, the PPIS of Israel used several databases and references to compile the dossier and provide the requested information (Tables 2 and 3).

Table 2: Scientific literature mainly used by the Israelian Authority when preparing the Dossier

References
Abd-Rabou S and Evans GA, 2018. The Mango Shield Scale, *Milviscutulus mangiferae* (Green) (Hemiptera: Coccidae) – A New Invasive Soft Scale in Egypt. Acta Phytopathologica et Entomologica Hungarica, 53, 91–96.
Amin PW, Reddy DVR and Ghanekar AM, 1981. Transmission of tomato spotted wilt virus, the causal agent of bud necrosis of peanut, by *Scirtothrips dorsalis* and *Frankliniella schultzei*. Plant Disease, 65, 663–665.
Anderson H and MacLeod A, 2008. CSL Pest Risk Analysis for *Milviscutulus mangiferae*. Available online: https://secure.fera.defra.gov.uk/phiw/riskRegister/downloadExternalPra.cfm?id=3886
Australian Government Department of Agriculture and Water Resources, 2017. Final group pest risk analysis for thrips and orthotospoviruses on fresh fruit, vegetable, cut-flower and foliage imports. CC BY 3.0.
Baker R, Caffier D, Choiseul JW, de Clerc P and Dormannsne-Simon E, 2008. Pest risk assessment made by France on Citrus chlorotic dwarf virus considered by France as harmful in the French overseas departments of French Guiana, Guadeloupe, Martinique and Réunion - Scientific Opinion of the Panel on Plant Health. [Contract] European Commission, 17 pp.
Belisario A, Luongo L, Vitale S and Santori A, 2010. First Report of *Fusarium semitectum* as the Agent of Twig Cankers on Persian (English) Walnut in Italy. APS Publications, 94, 791.
Blumberg D and Wysoki M, 2012. Japanese bayberry whitefly *Parabemisia myricae* Kuwana (Hemiptera: Aleyrodidae). Alon Hanotea, 66, 38–40.
CABI and EPPO for the EU under Contract 90/399003. Data Sheets on Quarantine Pests: *Bemisia tabaci.*
Campbell LR, Robb KL and Ullman DE, 2005. The complete tospovirus resource guide (http://www.oznet.ksu.edu/tospovirus/tospo_list.htm), Kansas State University.
EFSA PLH Panel (EFSA Panel on Plant Health), 2013. Scientific Opinion on the risk to plant health posed by *Eutetranychus orientalis* Klein in the EU territory, with the identification and evaluation of risk reduction options. EFSA Journal 2013;11(7):3317, 81 pp. https://doi.org/10.2903/j.efsa.2013.3317
EFSA PLH Panel (EFSA Panel on Plant Health), 2013. Scientific Opinion on the risks to plant health posed by *Bemisia tabaci* species complex and viruses it transmits for the EU territory. EFSA Journal 2013;11(4):3162, 302 pp. https://doi.org/10.2903/j.efsa.2013.3162. Available online: www.efsa.europa.eu/efsajournal
European Commission report of an audit performed in Israel in March 2018, on the Export Controls of plants. Report number 2018-6493. Available online: http://ec.europa.eu/food/audits-analysis/audit_reports/details.cfm?rep_id=4008
Freeman S, Sharon M, Maymon M, Mendel Z, Protasov A, Aoki T, Eskalen A and O'Donnell K, 2013. *Neocosmospora euwallaceae*sp. nov.- a symbiotic fungus of *Euwallacea* sp., an invasive ambrosia beetle in Israel and California. Mycologia, 105, 1595–1606.
der Gaag and der Straten, 2017. Assessment of the potential impact of American *Spodoptera* species for the European Union. Netherlands Food and Consumer Product Safety Authority Utrecht, the Netherlands.
Gerson U and Zor Y, 1973. The armoured scale insects (Homoptera: Diaspididae) of avocado trees in Israel. Journal of natural History, 7, 513–533.
Gupta RK, 2017. Foodborne infectious diseases. In: Food Safety in the 21st Century, Public Health Perspective, pp. 13–28. Academic Press.
ISPM standards (adopted). Available online: https://www.ippc.int/en/core-activities/standards-setting/ispms
Kumar V, Seal DR and Kakkar G, 2017. *Scirtothrips dorsalis* Hood. Entomology and Nematology Department, University of Florida. Available online: http://entnemdept.ufl.edu/creatures/orn/thrips/chilli_thrips.htm
Mannion MC, Derksen A, Seal D, Osborne L and Martin C, 2014. Population Dynamics of *Scirtothrips dorsalis* (Thysanoptera: Thripidae) and Other Thrips Species on Two Ornamental Host Plant Species in Southern Florida. Environmental Entomology, 43. 10.1603/EN13263
Mendel Z, Protasov A, Wysoki M, Elyihu M, Maoz Y, Sharon M, Zveibil A, Noy M, Ben Yehuda S and Freeman S, 2012. A major treat on the Avocado industry in Israel, an ambrosia beetle that vectors a fusarial pathogen. Alon Hanotea', 66, 30–35 (in Hebrew).
Mendel Z, 2014. Study on the Avocado shot-hole borer, *Euwallacea* aff. *fornicata* and its symbiotic fungus as a basis for development of environmentally friendly management (in Hebrew).
Mendel Z, 2017. Study on the avocado ambrosia problem with emphasis on the development of environmentally friendly management tools (in Hebrew).
Mendel Z, Protasov A, Maoz Y, Maymon M, Miller G, Elazar M and Freeman S, 2017. The role of *Euwallacea* nr. *fornicatus* (Coleoptera: Scolytinae) in the wilt syndrome of avocado trees in Israel. Phytoparasitica, https://doi.org/10.1007/s12600-017-0598-6

References
Procedure for checking and approval of shipments for export of propagation material. Available online: https://www.moag.gov.il/Procedures/Documents/ishur_mishkochim_ribui.pdf (In Hebrew, no English version) Procedure for issuance and application of phytosanitary certificates for plants and plant products. Available online: https://www.moag.gov.il/Procedures/Documents/hanpaka_teudot_briut_zmachim.pdf (In Hebrew, no English version).
Rao RDVJP, Reddy AS, Reddy SV, Thirumala-Devi K, Rao SC, Kumar VM, Subramaniam K, Reddy TY, Nigram SN and Reddy DVR, 2003. The host range of Tobacco streak virus in India and transmission by thrips. Annals of Applied Biology, 142, 365–368.
Regulation concerning the production of *Persea americana* in Israel: Seed Regulations (Cultivation and marketing of plants) – 1964. Section E – Cultivation and marketing of avocado plants. Available online: https://www.nevo.co.il/law_html/Law01/137_006.htm#med5 (In Hebrew, no English version).
Potting R, Jan van der Gaag D and Wessels-Berk B, 2008. Short PRA BATOCERA RUFOMACULATA, Mango Tree Stem Borer, Version 1.0. Netherlands Plant Protection Service. Available online: file:///C:/Users/danai/Downloads/Risicobeoordeling+Pest+Risk+Analysis+-+Batocera+Rufomaculata.pdf
Rotem Y, Plati Y, and Ben Yefet Y, 1998. Plant Diseases in Israel. Volcani Center Beit Dagan Israel. 523 pp.
Seal DR, Klassen W and Kumar V, 2009, in review. Biological parameters of chilli thrips, *Scirtothrips dorsalis* Hood, on selected hosts. Environmental Entomology.
Shimon B, 2018. Pests, Diseases and Weeds and their Management in Deciduous Fruit Tree Orchards. Extension services in Ministry of Agriculture, Israel.
Swirski E, Wysoki M and Izhar Y, 2002. Subtropical Fruits Pests in Israel. Volcani Center, Beit Dagan Israel, 285 pp.
The Food and Environment Research Agency, UK. Rapid Pest Risk Analysis (PRA) for Polyphagous Shot Hole Borer (*Euwallacea* sp.) and Husarium Dieback (*Neocomospora euwallaceae*). Available online: https://secure.fera.defra.gov.uk/phiw/riskRegister/downloadExternalPra.cfm?id=4055
The Law of Supervision of Plant and Plant Product Export, 1954. Available online: https://fs.knesset.gov.il//2/law/2_lsr_208430.PDF (In Hebrew, no English version).
The Israeli Plant and Plant Products Exportation Supervision Regulations, 1979. Available online: https://www.moag.gov.il/ppis/Laws/Regulation/Pages/1979-%20pikuah%20al%20yatzu.aspx (In Hebrew, no English version).

Table 3: Database sources used by the Israelian Authority when preparing the Dossier

Acronym/short title	Database name and service provider	URL of database	Justification for choosing database
CABI	Name: CABI Crop Protection Compendium Provider: CAB International	https://www.cabi.org/cpc/	A database that draws together scientific information on all aspects of crop protection, including extensive global coverage of pests, diseases, weeds and their natural enemies, the crops that are their hosts and the countries in which they occur.
EPPO	Name: EPPO Global Database Provider: European and Mediterranean Plant Protection Organization	https://gd.eppo.int/	This database provides all pest-specific information that has been produced or collected by EPPO.
Fauna Europaea	Name: Fauna Europaea Provider: Museum für Naturkunde in Berlin	https://fauna-eu.org/	A database which lists main zoological taxonomic index in Europe.
PPME	Name: Plant Pests of the Middle East Provider: The Robert H Smith Faculty of Agriculture, Food and Environment, The Hebrew University of Jerusalem	http://www.agri.huji.ac.il/mepests/	This database provides considerable information of the different pest species, their biology, host range and how to control them.

Acronym/short title	Database name and service provider	URL of database	Justification for choosing database
Scalenet	Name: Scalenet Provider: García Morales M, Denno BD, Miller DR, Miller GL, Ben-Dov Y, Hardy NB	http://scalenet.info/associates/	This database provides information on scale insects, their taxonomic diversity, nomenclatural history, biogeography, ecological associations and economic importance.
Plantwise Knowledge Bank	CABI	https://www.cabi.org/publishing-products/plantwise-knowledge-bank/	An open access gateway to actionable plant health information and services – from diagnostic and management advice to pest location maps and news.
Agricultural Pest Management Guidelines	Name UC-IPM, Pest Management Guidelines Provider: University of California	https://www2.ipm.ucanr.edu/agriculture/	Information sheets for different crops and pests.
Lepiforum	Provider: The Lepiforum Society (Germany)	http://www.lepiforum.de/lepiwiki.pl	Internet forum with information on species occurrence and biology for Lepidoptera.

2.2. Literature searches performed by EFSA

Literature searches were undertaken by EFSA to complete a list of pests potentially associated with *P. americana* in Israel. Two searches were combined: (i) a general search to identify pests of *P. americana* in different databases and (ii) a tailored search to identify whether these pests are present or not in Israel and the EU. The searches were run between 11 November 2019 and 25 November 2019. No language, date or document type restrictions were applied in the search strategy.

Additional information used by PPIS and details on literature searches along with full list of references can be found in the Dossier i.e. Sections 2 and 3.

The Panel used the databases indicated in Table 4 to compile the list of pests associated with *P. americana*. As for Web of Science, the literature search was performed using a specific, ad hoc established search string (see Appendix B). The string was run in 'All Databases' with no range limits for time or language filters. This is further explained in Section 2.3.2.

Table 4: Databases used by the Panel for the compilation of the pest list associated with *P. americana*

Database	Platform/link
Aphids on World Plants	http://www.aphidsonworldsplants.info/C_HOSTS_AAIntro.htm
CABI Crop Protection Compendium	https://www.cabi.org/cpc/
Catalog of the Cecidomyiidae (Diptera) of the world	https://bit.ly/33GNuvM
Catalog of the Eriophoidea (Acarina: Prostigmata) of the world	https://bit.ly/3btGQMh
Database of Insects and their Food Plants	http://www.brc.ac.uk/dbif/hosts.aspx
Database of Plant Pests in Israel	https://www.moag.gov.il/en/Pages/SearchNegaim.aspx
Database of the World's Lepidopteran Hostplants	https://www.nhm.ac.uk/our-science/data/hostplants/search/index.dsml
EPPO Global Database	https://gd.eppo.int/
EUROPHYT	https://webgate.ec.europa.eu/europhyt/
Nemaplex	http://nemaplex.ucdavis.edu/Nemabase2010/PlantNematodeHostStatusDDQuery.aspx
Plant Viruses Online	http://bio-mirror.im.ac.cn/mirrors/pvo/vide/famindex.htm
Scalenet	http://scalenet.info/associates/
Spider Mites Web	https://www1.montpellier.inra.fr/CBGP/spmweb/advanced.php

Database	Platform/link
USDA ARS Fungi Database	https://nt.ars-grin.gov/fungaldatabases/fungushost/fungushost.cfm
Web of Science: All Databases (Web of Science Core Collection, CABI: CAB Abstracts, BIOSIS Citation Index, Chinese Science Citation Database, Current Contents Connect, Data Citation Index FSTA, KCI-Korean Journal Database, Russian Science Citation Index, MEDLINE SciELO Citation Index, Zoological Record)	Web of Science https://www.webofknowledge.com
World Agroforestry	http://apps.worldagroforestry.org/treedb2/speciesprofile.php?Spid=1274
Xu & Zhao 2019: Longidoridae and Trichodoridae (Nematoda: Dorylaimida and Triplonchida)	https://bit.ly/2UhDRAB

2.3. Methodology

When developing the opinion, the Panel followed the EFSA Guidance on commodity risk assessment for the evaluation of high-risk plant dossiers (EFSA PLH Panel, 2019a).

In the first step, pests potentially associated with the commodity in the country of origin (EU-quarantine pests and other pests) that may require risk mitigation measures are identified. The EU non-quarantine pests not known to occur in the EU were selected based on evidence of their potential impact in the EU. After the first step, all the relevant pests that may need risk mitigation measures were identified.

In the second step, the proposed risk mitigation measures for each relevant pest were evaluated in terms of efficacy or compliance with EU requirements as explained in Section 1.2.

A conclusion on the likelihood of the commodity being free from each of the relevant pest was determined and uncertainties identified using expert judgements. Pest freedom was assessed by estimating the number of infested/infected consignments (i.e. bundles of scions or grafted plants) out of 10,000.

2.3.1. Commodity data

Based on the information provided by the PPIS of Israel, the characteristics of the commodity were summarised.

2.3.2. Identification of pests potentially associated with the commodity

A pest list was compiled to evaluate the pest risk associated with the importation of *P. americana* from Israel. The pest list is a compilation of all identified plant pests associated with *P. americana* based on information provided in the Dossier Sections 1, 2 and 3 and on searches performed by the Panel.

The search strategy and search syntax were adapted to each of the databases used (Table 3) according to the options and functionalities of the different databases and using several search terms as provide in the CABI keyword thesaurus. The scientific name of the host plant (i.e. *P. americana*) was used when searching in the EPPO Global database and CABI Crop Protection Compendium. The same strategy was applied to the other databases excluding EUROPHYT and Web of Science.

EUROHYT was investigated by searching for the interceptions associated with *P. americana* commodities imported from Israel and from other countries different from Israel from 1995 to 2019. For the pests selected for further evaluation, a search in the EUROPHYT was performed for the interceptions from the whole world on any other host species, from 1995 to present.

The search strategy used for the Web of Science Databases was designed combining common names for pests and diseases, terms describing symptoms of plant diseases and the scientific and common names of the commodity. All of the pests already retrieved using the other databases were removed from the search terms in order to be able to reduce the number of records to be screened.

The established search string is detailed in Appendix B and was run on 15 November 2019.

The titles and abstracts of the scientific papers retrieved were screened and the pests associated with *P. americana* were included in the pest list. The pest list was eventually further compiled with other relevant information (e.g. EPPO code per pest, taxonomic information, categorisation, distribution) useful for the selection of the pests relevant for the purposes of this opinion.

The compiled pest list (see Microsoft Excel® filename in Appendix D) includes all identified pests that use as host *P. americana.* According to the Interpretation of Terms of Reference, the EU quarantine pests that are regulated as a group in the Commission Implementing Regulation (EU) 2019/2072 were considered and evaluated separately at species level. The evaluation of the compiled pest list was done in two steps: first, the relevance of the EU-quarantine pests was evaluated (Section 4.1); second, the relevance of any other plant pest was evaluated (Section 4.2).

For those EU quarantine pests for which specific measures are in place for the import of the commodity from Israel in Commission Implementing Regulation (EU) 2019/2072, the assessment was restricted to whether or not Israel applies those measures. The effectiveness of those measures was not assessed.

Pests for which limited information was available on one or more criteria used to identify them as relevant for this opinion, e.g. on potential impact, are listed in Appendix C (List of pests that can potentially cause an effect not further assessed).

2.3.3. Listing and evaluation of risk mitigation measures

All currently used risk mitigation measures were listed and evaluated. When evaluating the likelihood of pest freedom at origin, the following types of potential infection sources for *P. americana* plants in export nurseries and relevant risk mitigation measures were considered (see also Figure 1):

- pest entry from surrounding areas,
- pest entry with new plants/seeds,
- pest spread within the nursery.

The risk mitigation measures adopted in the plant nurseries (as communicated by the PPIS of Israel) were evaluated with Expert Knowledge Elicitation (EKE) according to the Guidance on uncertainty analysis in scientific assessment (EFSA Scientific Committee, 2018).

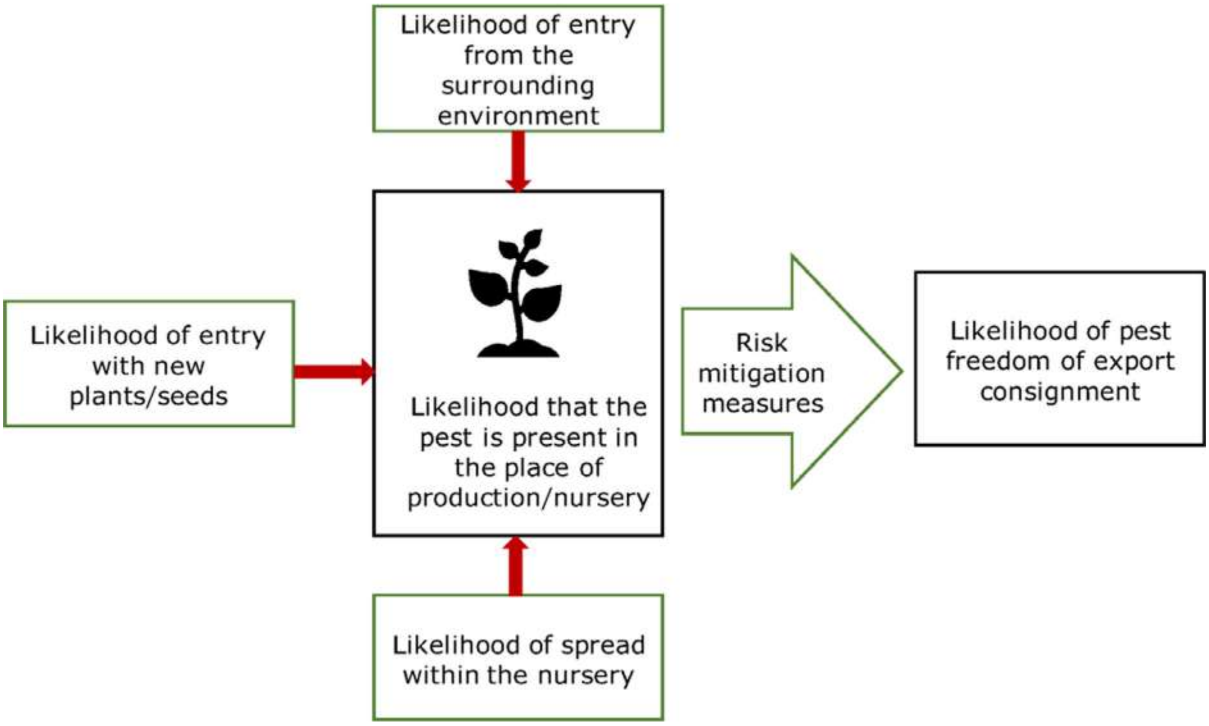


Figure 1: Conceptual framework to assess likelihood that plants are exported free from relevant pests. Source EFSA PLH Panel, 2019b

Information on the biology, estimates of likelihood of entry of the pest to the nursery and spread within the nursery and the effect of the measures on the specific pest were summarised in pest datasheets compiled for each pest selected for further evaluation (see Appendix A).

To estimate the pest freedom of the commodity, a semi-formal expert knowledge elicitation (EKE) was performed following EFSA guidance (Annex B.8 of EFSA Scientific Committee, 2018). The specific questions for the EKE were: 'Taking into account, the risk mitigation measures in place in the nurseries, and other relevant information, how many of 10,000 grafted plants or bundles of scions will be infested with the relevant pest when arriving in the EU?'. The EKE questions were common to all pests for which the pest freedom of the two different commodities was estimated. The submitted dossier by Israel included three different types of grafted plants (i.e. grafted plants in substrate in 750 cc. pots, 1 L bags and 6 L bags) and scions. Because it is not possible to know *a priori* the exact proportion of the different types of grafted plants in the consignments, the EKE specific question was answered by incorporating the variability into the high- and low-risk scenarios. Scions are according to the information provided in the dossier (Section 4) bundled and put inside bags, and therefore, the panel considers that a bagged bundle was the minimum unit to assess considering the potential infestation/infection by scions inside a bundle. Each bundle contains eight scions. The Panel considered the bundle as the elicitation unit since the scions are attached to each other and the spread of any pest/pathogen/disease can be considered unavoidable within the bundle.

The uncertainties associated with the EKE were taken into account and quantified in the probability distribution applying the semi-formal method described in Section 3.5.2 of the EFSA-PLH Guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018). Finally, the results were transformed in terms of the likelihood of pest freedom. The lower 5% percentile of the uncertainty distribution reflects the opinion that pest freedom is with 95% certainty above this limit.

3. Commodity data

3.1. Description of the commodity

The commodities to be imported are scions and grafted plants of *Persea americana* Miller (Lauraceae) also known as alligator pear, avocado, avocado pear, holly ghost pear.

The *P. americana* planting material considered to be imported in EU from Israel corresponds to:

1) Scions: harvested from approved mother plants (in PPIS-supervised orchards). These include mostly leaf buds but may include undeveloped leaves with no photosynthetic tissue.
2) Grafted plants in a 750 cc pot, 10 cm height, 0.6 cm diameter. These include mostly leaf buds but may include undeveloped leaves, up to 2.5 cm long, with no photosynthetic tissue. Stocks are cultivated from seed (from a PPIS-approved source) in a greenhouse, in 750 cc pots in a new substrate consisting of 45% coconut fibre, 45% peat and 10% polystyrene. After germination of the seed, the stock is grown up to 4–5 mm diameter when fungicide-treated scions (from a PPIS-approved source) are grafted onto the stock. The grafted plants are maintained in the same pots and substrate and in the same greenhouse until graft acceptance is validated by leaf bud eruption and consequently, marketing or transfer to a larger container for larger product types.
3) Grafted plants with leaves in a 1 L bag in substrate. This product type for export is cultured from a seed and a scion from PPIS-approved mother plants. The seed is planted in the aforementioned bag and a new substrate consisting of 30% coconut fibre substrate, 30% peat and 30% tuff until the germinating stock reaches 4–5 mm diameter, when scions are grafted onto the stocks. The grafted plants are maintained in the same bags and substrate and in the same greenhouse until grafting success is validated by leaf bud eruption, growth until they reach the desired dimensions for marketing, or transfer into larger container for a larger product type. The interval between grafting and potential export is 3–6 months, depending on the season.
4) Grafted plants with leaves in a 6 L bag in a new substrate consisting of 40% coconut fibre substrate, 40% peat and 20% tuff (20.) 0.8 m height, 0.8–1 cm diameter. This product type for export is cultured from a plant transferred from a 1 L bag, cultivated as described in the previous section, into the 6 L bag. The larger bag is then cultivated either in an open field or in a roofless net house. The interval between grafting and potential export is 6–9 months, depending on the season. (Dossier Section 2.2).

According to the information provided in the dossier, different scion varieties are meant to be exported i.e. 'Degania 117', 'Schiller', 'Ashdot 17', 'Fairchild', 'VC66', 'VC320', 'VC801'; for grafted plants, the following stock varieties were used: 'Hass', 'Ettinge'r', 'Reed', 'Gem', 'Pinkerton'.

According to ISPM 36 (FAO, 2012), the commodities included in the Dossier can be classified as 'plants for planting – unrooted cuttings and rooted plants in pots'.

Plants are delivered to avocado growers at export destinations (Dossier Section 3.9).

3.2. Description of the production areas

Current sites of avocado cultivation in Israel for export to the EU are placed in Bet Haemek in the Western Galillee, Almagor in the Galillee area, Bnei Zion and Kfar Vitkin in the Sharon area (Figure 2). Phytosanitary conditions are maintained for all plants according to the export required standards in the production greenhouses (Section 1). There are no hedges or shelter plants around the avocado cultivation nursery areas. The export nurseries are located in different places with a minimal distance of approximately 20 km between two of them (in Kfar Vitkin and Bnei Zion). All plants for export are grown in structures at densities of 8,000–12,000 plants/dunam (1 dunam = 0.1 hectare). Approximately 10–15% of the avocado plants, grown at the different sites are destined for export, but all plants including those destined for the local market are produced according to export standards (section 6 and 7 of dossier). In the same nurseries, other crops may be cultivated e.g. papaya, mango, blueberry and kiwi plants. Other fruit tree species are grown in separate areas to those of avocado for export, and are usually grown in tunnel greenhouses and nethouses, at a minimum distance of
20–100 m. The nursery areas are clean of weeds and are regularly treated against weeds (Reply Letter c, Q A1–A6).

Agricultural crops in a radius of 2 km from the avocado nurseries are avocado, banana, citrus and other field crops. The natural vegetation in a radius of 2 km from the avocado nursery includes diverse native plants as well as ornamentals. The minimal distance between the nurseries of avocado for export and the nearest natural areas is approximately 100–200 m (Dossier Section 6).

Within a radius of 2 km from the cultivation sites of avocado for export, species that are present out of the given list: *Acacia* spp. (in the wild), *Persea americana* (in agriculture and possibly in private yards), *Ricinus communis* (in the wild) (Section 6).

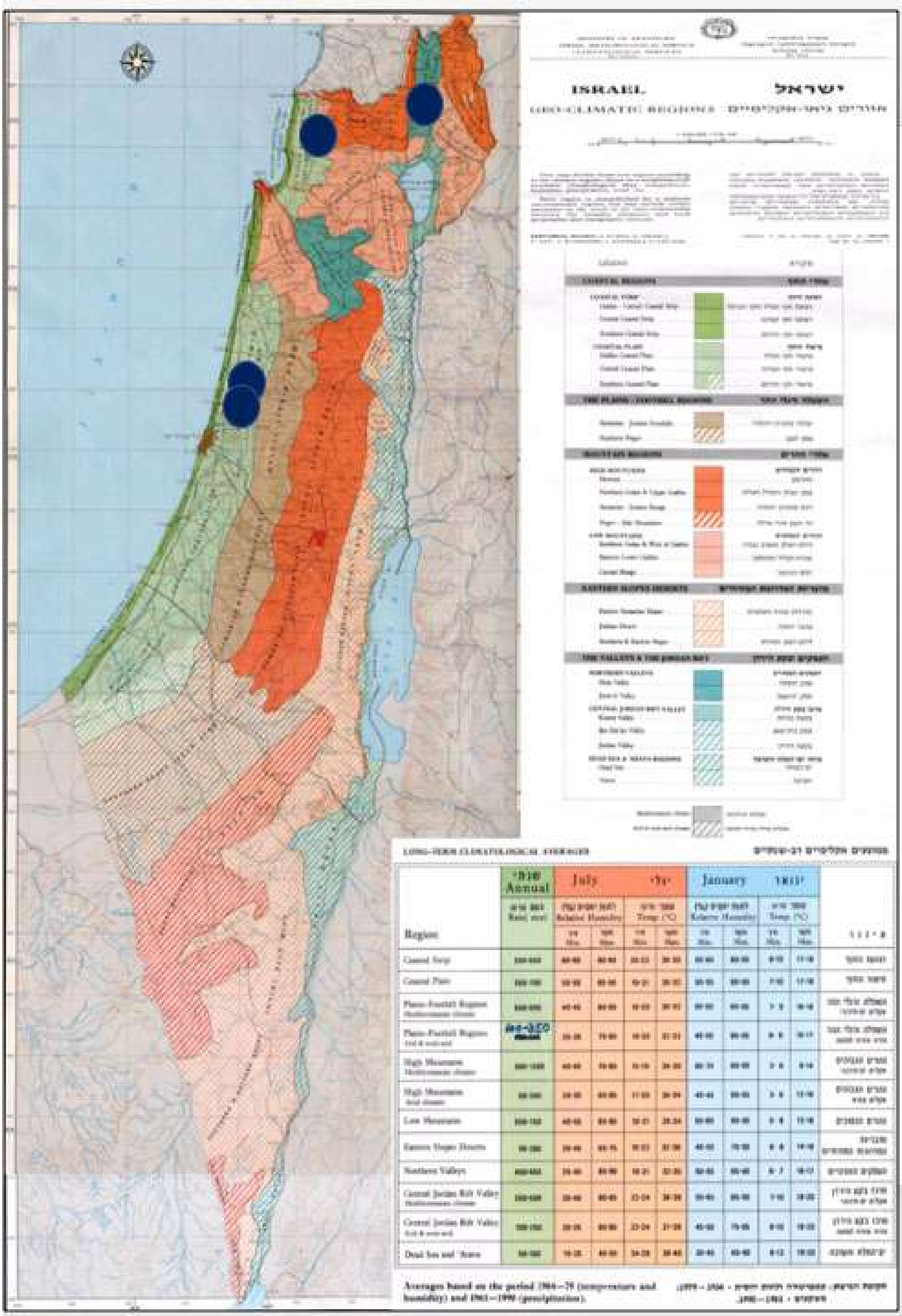


Figure 2: Map of the Israel that highlights the location of nurseries designated for the export (Dossier Section 3.10–3.11; Source: MAFWM)

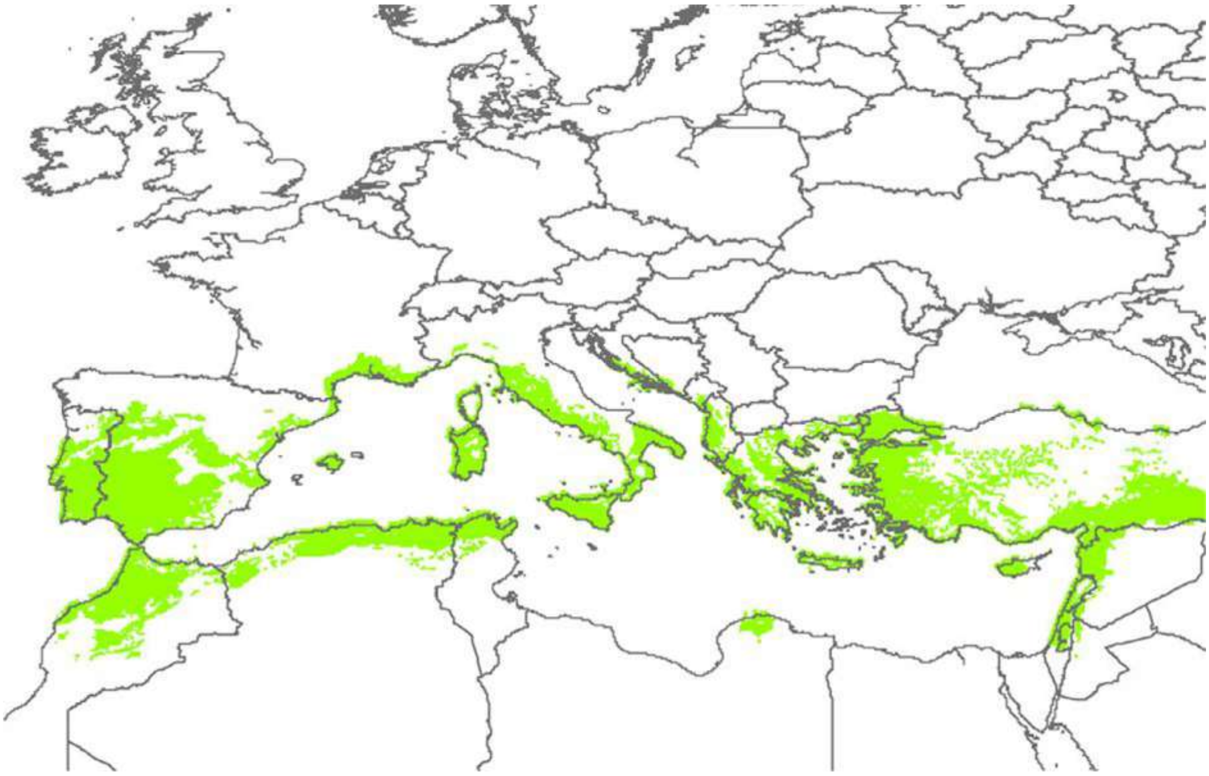


Figure 3: Distribution of Köppen–Geiger climate subgroup Csa (Mediterranean hot summer climates) areas in the Mediterranean basin (MacLeod and Korycinska, 2019)

Based on the global Köppen–Geiger climate zone classification (Kottek et al., 2006), the climate of the production areas of *P. americana* in Israel is classified as Csa: 'C' correspond with areas with an average temperature above 0°C, but below 18°C in their coolest months. 's' represents dry summers, i.e. a month with less than 30 mm of precipitation from April to September; 'a' represents an average temperature in the warmest month above 22°C.

3.3. Production and handling processes

3.3.1. Growing conditions

New substrate is used for the production, depending on the type of planting material (see Section 3.1), are coconut fibre, peat, polystyrene (synthetic media) or tuff (volcanic rock) (according to the ISPM 40, FAO 2017; see also Section 5.4 of this opinion regarding additional measures).

3.3.2. Source of planting material

The scions are harvested from approved mother plants (in PPIS-supervised orchards).

The stocks for grafted plants of 750cc pots, 1 L bags and 6 L bags are cultivated from seeds, originated from a PPIS-approved source and the scions are fungicide treated, originated from a PPIS-approved source which are grafted onto the stock.

3.3.3. Production cycle

As described in the dossier grafted plants are produced in different pot and bag sizes and following the following procedures:

- Grafted plants in 750 cc pots. Seeds undergo germination for rootstock. After germination of the seed, the stock is grown up to 4–5 mm diameter when sterilised scions (from a PPIS-approved source) are grafted onto the stock (1–2 months or more depending on weather) and then grafting takes place. Graft acceptance is validated within 1–2 months. The grafted plants are maintained in the same pots and substrate and in the same greenhouse until graft

acceptance is validated by checking leaf bud eruption. The interval between grafting and potential export is ca. 30 day.
- Grafted plants in 1 L bags: the production is similar to plants in 750 cc pots but are grown through the spring season and are considered ready either for planting, or for transfer into the 6 L bags, the transfer to new bags occurs in April to June. In this case, plants are brought to a height of 0.8 m which takes approximately three more months, until July–September. The interval between grafting and potential export is 3–6 months.
- Grafted plants in 6 L bags: these plants come from those grown in a 1 L bag and are cultivated as described in the previous section. The larger bag is then cultivated either in an open field or in a roofless net house until it reaches the desired size (0.8 m). The interval between grafting and potential export is 3–6 months.

Scions are harvested from approved mother plants (in PPIS-supervised orchards).

3.3.4. Pest monitoring during production

Problems with pests or diseases are very rare in the nursery for avocado plants in Israel as revealed by the regular monitoring of the production sites by the grower (i.e. at least twice a week). All plant material that arrives at the nursery is derived from orchards and growers approved by the PPIS. Seeds are certified by the PPIS.

Preventative phytosanitary measures that are applied regularly:

- Fruit for seeds that, after germination provide the stocks, are harvested from PPIS-approved mother plants only.
- Approval of plots for stocks and scions is done according to the PPIS internal guidelines for approval of plots for production of avocado stocks and scions (continuously updated, recent version 2019).
- Lab tests are performed for the 1 L and 6 litre bagged plants to detect *Phytophthora cinnamomi* and nematodes (Dossier, Section 3.8, but this was not mentioned for grafted plants grown in 750 cc pots).

In case of suspected viral symptoms, plants are discarded, and a sample is sent to a diagnostic laboratory. PPIS are informed of the finding including its location.

The roots are checked weekly in the framework of regular visual inspections and in the case of mealybugs in the root system, plants are treated with appropriate insecticides. In case that nematodes are found in roots of the grafted plants during the routine sampling, plants are destroyed (Reply c, Q C 26–29). For the detection of small pests, inspectors use magnifying glasses and portable binoculars (section 7 of dossier).

3.3.5. Post-harvest processes and export procedure

The harvested scions are treated with suitable fungicides and stored in chilled storage rooms at a temperature of 2°C and 70% humidity. Scions are packed after fungicides have evaporated in nylon bags and placed in cardboard boxes. Cuttings – bundles of nine cuttings are wrapped in Parafilm and approximately 70 bundles are placed in a polystyrene box (100 × 60 × 40 cm).

Based on the information provided in the dossier (see Section 1), plants are produced using a new substrate, but this is not changed prior to export. The use of new substrate appears to be consistent with Point 20 of Annex VI and point 1 of Annex VII of Commission Implementing Regulation (EU) 2019/2072. Prior to export, pot plants are placed in a controlled cultivation area to undergo pest and disease control, as well as weeding. The pot plants are treated against *Botryosphaeriaceae* with fungicide. Prior to export, plants are tested for the presence of *Phytophthora cinnamomi* and nematodes.

The plants are transferred from the storage rooms directly to a refrigerated container which keeps a temperature of 2–4°C. The container is loaded onto the ship and unloaded when arriving to the customers in the EU, so that the refrigerated conditions are maintained throughout the shipment process (Dossier, Section 5). Plants in 1 L bag/pot – 55 plants are placed in a 100 × 60 × 40 cm box, which weighs about 50–55 kg when full. Plants in 750 cc pots – packages contain 30 plants in smaller boxes. Materials coming from different nurseries are not mixed or combined Again, (section 7).

Plant material is examined for pests prior to shipment, according to the destination country requirements. Export plants are inspected by nursery staff as well as a PPIS inspectors.

4. Identification of pests potentially associated with the commodity

The search for potential pests associated with *P. americana* rendered 1,028 species (see Microsoft Excel® file in Appendix D).

4.1. Selection of relevant EU-quarantine pests associated with the commodity

The EU listing of union quarantine pests and protected zone quarantine pests (Commission Implementing Regulation (EU) 2019/2072) is based on assessments concluding that the pests can enter, establish, spread and have potential impact in the EU.

There were 37 EU-quarantine pests that are reported to use *P. americana* as a host plant, and their relevance was evaluated (Table 4) for being included in this opinion.

The relevance of an EU-quarantine pest for this opinion was based on evidence that:

a) the pest is present in Israel;
b) *P. americana* is host of the pest;
c) one or more life stages of the pest can be associated with the specified commodity.

Pests that fulfilled all three criteria were selected for further evaluation.

Of these 37 EU-quarantine pest species evaluated, 4 species are present in Israel and 3 species (*Euwallacea fornicatus, Scirtothrips dorsalis, Bemisia tabaci*) known to use *P. americana* as host and be associated with the commodity were selected for further evaluation. More information on these three species can be found in the pest datasheets (Appendix A).

Table 5: Overview of the evaluation of the 37 EU-quarantine pest species known to use *Persea americana* as a host plant for their relevance for this opinion

No	Pest name according to EU legislation[(a)]	EPPO code	Group	Pest present in Israel	*P. americana* confirmed as a host	Pest can be associated with the commodities	Pest relevant for the opinion
1	*Xylella fastidiosa*	XYLEFA	Bacteria	Yes	Yes (EPPO, Online)	Yes	No[(a),(c)]
2	*Phymatotrichopsis omnivora*	PHMPOM	Fungi	No	Not evaluated	Not evaluated	No
3	*Aleurocanthus woglumi*	ALECWO	Insects	No	Not evaluated	Not evaluated	No
4	*Anastrepha fraterculus*	ANSTFR	Insects	No	Not evaluated	Not evaluated	No
5	*Anastrepha ludens*	ANSTLU	Insects	No	Not evaluated	Not evaluated	No
6	*Anastrepha suspensa*	ANSTSU	Insects	No	Not evaluated	Not evaluated	No
7	*Araptus schwartzi* as Scolytidae spp. (non-European)		Insects	No	Not evaluated	Not evaluated	No
8	*Zeugodacus cucurbitae* (Synonym: *Bactrocera cucurbitae*)	DACUCU	Insects	No	Not evaluated	Not evaluated	No
9	*Bactrocera dorsalis*	DACUDO	Insects	No	Not evaluated	Not evaluated	No
10	*Bactrocera tryoni*	DACUTR	Insects	No	Not evaluated	Not evaluated	No
11	*Bemisia tabaci* (non-European populations)	BEMITA	Insects	Yes	*Yes (Dossier)*	Yes, only in the case of grafted plants	Yes
12	*Pterandrus rosa* (Synonym: *Ceratitis rosa*)	CERTRO	Insects	No	Not evaluated	Not evaluated	No
13	*Euwallacea fornicatus* as Scolytidae spp. (non-European)	XYLBFO	Insects	*Yes*	*Yes (CABI CPC, Online)*	Yes, only in the case of grafted plants	Yes
14	*Heliothis zea* (Synonym: *Helicoverpa zea*)	HELIZE	Insects	No	Not evaluated	Not evaluated	No
15	*Homalodisca vitripennis*	HOMLTR	Insects	No	Not evaluated	Not evaluated	No
16	*Pagiocerus fiorii* as Scolytidae spp. (non-European)	PAGIFI	Insects	No data	Yes (Costilla and Coronel, 1994)	No	No
17	*Rhynchophorus palmarum*	RHYCPA	Insects	No	Not evaluated	Not evaluated	No
18	*Scirtothrips dorsalis*	SCITDO	Insects	Yes	Yes (Dossier)	Yes, for both commodities (i.e. scions and grafted plants)	Yes
19	*Spodoptera eridania*	PRODER	Insects	No	Not evaluated	Not evaluated	No
20	*Thaumatotibia leucotreta*	ARGPLE	Insects	*Yes*	Yes (CABI CPC, Online)	No	No
21	*Thrips palmi*	THRIPL	Insects	No	Not evaluated	Not evaluated	No
22	*Unaspis citri*	UNASCI	Insects	No	Not evaluated	Not evaluated	No

No	Pest name according to EU legislation[(a)]	EPPO code	Group	Pest present in Israel	*P. americana* confirmed as a host	Pest can be associated with the commodities	Pest relevant for the opinion
23	*Xyleborus affinis*[(1)] as Scolytidae spp. (non-European)	XYLBAF	Insects	Yes	Yes	No	No
24	*Xyleborus ferrugineus* as Scolytidae spp. (non-European)	XYLBFE	Insects	No	Not evaluated	Not evaluated	No
25	*Xyleborus glabratus* as Scolytidae spp. (non-European)	XYLBGR	Insects	No	Not evaluated	Not evaluated	No
26	*Xyleborus immaturus* as Scolytidae spp. (non-European)	XYLBPE	Insects	No	Not evaluated	Not evaluated	No
27	*Xyleborus perforans*[(1)] as Scolytidae spp. (non-European)	XYLBPE	Insects	No	Not evaluated	Not evaluated	No
28	*Xyleborus neivai* as Scolytidae spp. (non-European)	XYLBNE	Insects	No	Not evaluated	Not evaluated	No
29	*Xyleborus volvulus* as Scolytidae spp. (non-European)	XYLBTO	Insects	No	Not evaluated	Not evaluated	No
30	*Xylosandrus morigerus* as Scolytidae spp. (non-European)	XYLSMO	Insects	No	Not evaluated	Not evaluated	No
31	*Xiphinema americanum sensu stricto*	XIPHAA	Nematodes	No	Not evaluated	Not evaluated	No
32	*Xiphinema bricolense*	XIPHBC	Nematodes	No	Not evaluated	Not evaluated	No
33	*Xiphinema californicum*	XIPHCA	Nematodes	No	Not evaluated	Not evaluated	No
34	*Xiphinema inaequale*	XIPHNA	Nematodes	No	Not evaluated	Not evaluated	No
35	*Xiphinema intermedium*	XIPHIM	Nematodes	No	Not evaluated	Not evaluated	No
36	*Xiphinema rivesi* (non-EU populations)	XIPHRI	Nematodes	Yes	Not evaluated	No	No
37	*Xiphinema tarjanense*	XIPHTA	Nematodes	No	Not evaluated	Not evaluated	No

(a): Commission Implementing Regulation (EU) 2019/2072.
(b): The question if the pest can be associated with the commodity is evaluated only if the questions on the presence in Israel and the association with *P. americana* were answered with 'yes'.
(c): Although both commodities, scions and grafted plants can act as a pathway for *Xylella fastidiosa,* the criterion was set to 'No' because *P. americana* plants for export are produced in officially approved pest-free areas (Confirmed by PPIS in Dossier Section 2.0 and the relevant valid document can be found at the official website of the European Union in the section 'Declarations from non-EU countries concerning the status of *X. fastidiosa*' using the following link https://ec.europa.eu/food/sites/food/files/plant/docs/ph_biosec_decl_xylella_isr_20190703.pdf).
(1): *Xyleborus perforans* and *Xyleborus affinis* are not reported in Israel according to EPPO global database or CABI; however, both species are reported for Israel in Alonso et al. 2017. Cooperative Catalogue of Palaearctic Coleoptera Curculionoidea, Monografías electrónicas de la Sociedad Entomológica Aragonesa., vol. 8, 729. According to the Israel NPPO after information request by EFSA, *Xyleborus perforans* is not present in Israel. The occurrence of *Xyleborus affinis* in Israel is sporadic and scarce, the pest is rarely found in oaks and carobs and has never been considered a pest in agriculture or natural areas in Israel.

4.2. Selection of other relevant pests (EU not regulated) associated with the commodity

The information provided by Israel, integrated with the search EFSA performed, was evaluated in order to assess whether there are other potentially relevant pests present in the country. For these potential pests that are not regulated in the EU, pest risk assessment information on the probability of introduction, establishment, spread and impact is usually lacking.

Therefore, these pests that are potentially associated with *P. americana* were also evaluated to determine their relevance for this opinion based on evidence that:

a) the pest is present in Israel;
b) the pest is absent or has a limited distribution in the EU (i.e. present in 3 or less EU countries);
c) *P. americana* is a host of the pest;
d) one or more life stages of the pest can be associated with the specified commodity;
e) the pest may have an impact in the EU.

Pests that fulfilled all five criteria were selected for further evaluation.

Based on the information collected, 1,028 potential pests known to be associated with *P. americana* were evaluated for their relevance to this opinion. Species were excluded from further evaluation when at least one of the conditions listed above (a–e) was not met. Details can be found in Appendix D (Microsoft Excel® file). Of the evaluated EU not regulated pests, 23 pests (Avocado sunblotch viroid, *Aonidiella orientalis, Aulacaspis tubercularis, Icerya aegyptiaca, Maconellicoccus hirsutus, Milviscutulus mangiferae, Nipaecoccus viridis, Paracoccus marginatus, Penthimiola bella, Pseudococcus cryptus, Oligonychus perseae, Pulvinaria psidii, Retithrips syriacus, Tetraleurodes perseae, Colletotrichum aenigma, Colletotrichum alienum, Colletotrichum fructicola, Colletotrichum perseae, Colletotrichum siamense, Colletotrichum theobromicola, Neocomospora euwallaceae, Lasiodiplodia pseudotheobromae and Neoscytalidium dimidiatum*) were selected for further evaluation because they met all of the selection criteria. More information on these 23 species can be found in the pest datasheets (Appendix A).

4.3. Overview of interceptions

Data on the interception of harmful organisms on plants of *P. americana* can provide information on some of the organisms that can be present on the exported plants despite the current measures taken. Based on the information available in the EUROPHYT/TRACES online databases, no interceptions of pests have been detected on plants of *P. americana* from Israel imported into the EU between 1995 and 2020 (accessed 26/10/2020).

4.4. List of potential pests not further assessed

From the list of pests not selected for further evaluation, the Panel highlighted five species (see Appendix C) for which the currently available evidence and some uncertainties provide no reason to select these species for further evaluation in this opinion. A specific justification of the inclusion in this list is provided for each species in Appendix C.

4.5. Summary of pests selected for further evaluation

There are 26 pests known to be present in Israel that have a potential association with *P. americana* destined for export (Table 6); Fifteen insects (*Aonidiella orientalis, Aulacaspis tubercularis, Bemisia tabaci* complex, *Euwallacea fornicatus, Icerya aegyptiaca, Maconellicoccus hirsutus, Milviscutulus mangiferae, Nipaecoccus viridis, Paracoccus marginatus, Penthimiola bella*, *Pseudococcus cryptus, Pulvinaria psidii, Retithrips syriacus, Scirtothrips dorsalis* and *Tetraleurodes perseae*), one mite (*Oligonychus perseae*); 9 fungi (*Colletotrichum aenigma, C. alienum, C. fructicola, C. perseae, C. siamense, C. theobromicola, Lasiodiplodia pseudotheobromae, Neocomospora euwallaceae, Neoscytalidium dimidiatum*); and one viroid (avocado sunblotch viroid).

Given that there were two types of commodities with different characteristics and hence with different likelihoods for hosting certain pests i.e. grafted plants and scions, some pests were not considered to be associated with one of the commodities. All of the 26 identified pest species were considered to be potentially associated with grafted plants. For three pests (*Bemisia tabaci* complex, *Tetraleurodes perseae* and *Penthimiola bella*), scions were not considered to be a pathway because the lack of leaves (or the presence of small leaflets with no photosynthetic activity).

The effectiveness of the risk mitigation measures applied to the commodities were evaluated for these selected pests. Moreover, for these pests, the likelihood of the pest freedom after the evaluation of the currently proposed risk mitigation measures relevant for the specific commodities of *P. americana* designated for export to the EU was estimated.

In some cases, given that some pests showed similar biology, behaviour, phylogenetic relatedness, harmfulness, regulatory status or uncertainties regarding the association with the specified commodities, the Panel decided to group those species for the elicitations.

This was the case for Botryosphaeriaceae fungi (*Lasiodiplodia pseudotheobromae, Neoscytalidium dimidiatum*) which have extremely similar life cycles. The *Colletotrichum* species causing anthracnose on *P. americana* (*C. aenigma, C. alienum, C. fructicola, C. siamense, C. theobromicola and C. perseae*) mentioned here were recently reported from a study in Israel (Sharma et al. 2017) and detailed information about the distribution of these species is scarce. They can only be distinguished from each other using molecular techniques.

For insects, mealybugs and soft scale insects were divided in two groups (i.e. group A and B). Group A includes five species i.e. *Nipaecoccus viridis, Paracoccus marginatus, Pseudococcus cryptus, Icerya aegyptiaca, Milviscutulus mangiferae*; group B includes *Maconelicoccus hirsutus* and *Pulvinaria psidii.* Both species of group B were considered apart from group A since they have the same regulatory status in Israel as quarantine pests and therefore commodities are more thoroughly inspected. Because of this, the two mealybug and scale insect groups (group A and B) were considered separately in the EKEs for both commodities (scions and grafted plants). Two other groups of species were also elicited together because of their similar, harmfulness, taxonomic status, when considering both commodities i.e. armoured scales (*Aonidiella orientalis, Aulacaspis tubercularis*) and thrips (*Scirtothrips dorsalis, Retithrips syriacus*).

Finally, the bark beetle–fungi complex (*Euwallaceae fornicatus* and *Neocomospora euwallaceae*) was considered together for both commodities because the beetle is associated with the fungus and is considered its vector.

Table 6: List of relevant pests selected for further evaluation

Number	Current scientific name	EPPO code	Name used in the EU legislation	Taxonomic information	Group	Regulatory status
1	*Avocado sunblotch viroid*	ASBVD0		Viroid	Viroid	Not regulated in the EU
2	*Aonidiella orientalis*	AONDOR		Hemiptera, Diaspididae	Insects	Not regulated in the EU
3	*Aulacaspis tubercularis*	AULSTU		Hemiptera, Diaspididae	Insects	Not regulated in the EU
4	*Bemisia tabaci*	BEMITA	*Bemisia tabaci* Genn. (non-European populations) known to be vector of viruses	Hemiptera Aleyrodidae	Insects	EU Quarantine Pest according to Commission Implementing Regulation (EU) 2019/2072
5	*Euwallacea fornicatus*	XYLBFO	Scolytidae spp. (non-European) [1SCOLF]	Coleoptera, Scolytidae	Insects	EU Quarantine Pest according to Commission Implementing Regulation (EU) 2019/2072
6	*Icerya aegyptiaca*	ICERAE		Hemiptera, Monophlebidae	Insects	Not regulated in the EU
7	*Maconellicoccus hirsutus*	PHENHI		Hemiptera. Pseudococcidae	Insects	Not regulated in the EU
8	*Milviscutulus mangiferae*	MILVMA		Hemiptera, Coccidae	Insects	Not regulated in the EU
9	*Nipaecoccus viridis*	NIPAVI		Hemiptera, Pseudococcidae	Insects	Not regulated in the EU
10	*Paracoccus marginatus*	PACOMA		Hemiptera, Pseudococcidae	Insects	Not regulated in the EU
11	*Penthimiola bella*	PETHBE		Hemiptera Cicadellidae	Insects	Not regulated in the EU
12	*Pseudococcus cryptus*	DYSMCR		Hemiptera, Pseudococcidae	Insects	Not regulated in the EU
13	*Pulvinaria psidii*	PULVPS		Hemiptera, Coccidae	Insects	Not regulated in the EU
14	*Retithrips syriacus*	RETTSY		Thysanoptera, Thripidae	Insects	Not regulated in the EU
15	*Scirtothrips dorsalis*	SCITDO	*Scirtothrips dorsalis* Hood [SCITDO]	Thysanoptera Thripidae	Insects	EU Quarantine Pest according to Commission Implementing Regulation (EU) 2019/2072
16	*Tetraleurodes perseae*	TETLPE		Hemiptera, Aleyrodidae	Insects	Not regulated in the EU
17	*Colletotrichum aenigma*	COLLAE		Phyllachorales, Glomerellaceae	Fungi	Not regulated in the EU
18	*Colletotrichum alienum*	COLLAI		Phyllachorales, Glomerellaceae	Fungi	Not regulated in the EU
19	*Colletotrichum fructicola*	COLLFC		Phyllachorales, Glomerellaceae	Fungi	Not regulated in the EU

Number	Current scientific name	EPPO code	Name used in the EU legislation	Taxonomic information	Group	Regulatory status
20	*Colletotrichum perseae*	COLLPV		Phyllachorales, Glomerellaceae	Fungi	Not regulated in the EU
21	*Colletotrichum siamense*	COLLSM		Phyllachorales, Glomerellaceae	Fungi	Not regulated in the EU
22	*Colletotrichum theobromicola*	COLLTH		Phyllachorales, Glomerellaceae	Fungi	Not regulated in the EU
23	*Neocosmospora euwallaceae,* (now known as *Neocosmospora euwallaceae*)	FUSAEW		Hypocreales, Nectriaceae	Fungi	Not regulated in the EU
24	*Lasiodiplodia pseudotheobromae*			Botryosphaeriaceae, Botryosphaeriales	Fungi	Not regulated in the EU
25	*Neoscytalidium dimidiatum*	HENLTO		Botryosphaeriales, Botryosphaeriaceae	Fungi	Not regulated in the EU
26	*Oligonychus perseae*	OLIGPA		Acari, Tetranychidae	Mites	Not regulated in the EU

5. Risk mitigation measures

The Panel assessed the possibility of each selected pest (Table 6) could be present in a *P. americana* nursery, and assessed the probability that pest freedom of a consignment is achieved by the proposed risk mitigation measures acting on the pest under evaluation.

The information used in the evaluation of the effectiveness of the risk mitigation measures is summarised in a pest datasheet (see Appendix A).

5.1. Possibility of pest presence in the export nurseries

The Panel evaluated the likelihood that each pest (Table 6) could be present in a *P. americana* nursery by evaluating the possibility that *P. americana* in the export nursery are infested either by:

- introduction of the pest from the environment surrounding the nursery;
- introduction of the pest with new plants/seeds;
- spread of the pest within the nursery.

5.2. Risk mitigation measures applied in Israel

With the information provided by the applicant (Dossier, Section 5), the Panel summarised the risk mitigation measures (see Table 7) that are currently applied in the production nurseries.

Table 7: Overview of the proposed risk mitigation measures for *Persea americana* plants designated for export to the EU from Israel

No.	Risk mitigation measure	Commodity (scions/ grafted plants)	Proposed measures in Israel
1	Registration of production sites	Both	Approval of plots for avocado stocks and scions is done according to internal PPIS internal guidelines.
2	Selection of seeds for stocks	Grafted plants	Fruits for seeds for the stock are harvested from PPIS approved mother plants only.
3	Disinfestation of seeds	Grafted plants	The seeds are treated after extraction from fruit, with suitable fungicides.
4	Disinfestation of scions	Both	Scions are treated prior to grafting, with suitable fungicides.
5	Surveillance and monitoring	Both	• All plants for planting exported from Israel originate from nurseries that are approved by PPIS and are under PPIS inspection. • In nurseries that export trees, PPIS inspection is carried out every 45 days. • Further to the PPIS inspection, the producers carry out regular comprehensive self-inspections, once a week. This inspection is performed by the nurseries agronomists and according to the PPIS inspector's instructions. The results are recorded in the nursery logbook and every adverse finding is reported immediately to the inspector. The logbook is regularly reviewed during the inspector visits to the site. • Whenever a harmful organism of interest is found at any production site, the grower is required to inform PPIS and to treat the site as appropriate. During consecutive inspections, if there is no further evidence to the presence of the pest, the PPIS considers the site of production to be free from this harmful organism. • Further diagnostic procedures may be performed according to requirements of the importing country and in the case of inspection findings that necessitate identification of a causative agent. • Root samples with attached soil are tested once during the active growth for nematodes, although no such problem has been reported in avocado in Israel.

No.	Risk mitigation measure	Commodity (scions/ grafted plants)	Proposed measures in Israel
			• Internal guidelines for detection of pathogens in avocado: Instructions for sampling of *Phytophthora cinnamomi* in avocado plants. • Instructions for detection of avocado sunblotch viroid in avocado plants. • All avocado plants for planting exported from Israel originate from nurseries that are approved by PPIS and are under PPIS inspection Instructions for sampling avocado for detection of Avocado Sunblotch Viroid (ASBV): One sample is taken per 10 dunam. During spring–summer, a sample is to be taken from 5 trees, 3 leaves each (15 total). During fall and winter, 1 sample is taken from 5 trees along with sampling of trichomes from the soil. In the case of symptoms in the orchard, the whole orchard should be sampled: each sample taken from 3 trees, 5 leaves each. During the cold season, roots should be sampled instead of leaves. • Detection of the viroid is done by RT-PCR and real-time RT-PCR. • Regular monitoring of the production sites by the grower – at least twice a week.
6	Growing conditions	Both	Plants are grown in bags that are raised off the ground.
7	Scions selection	Both	Scions are collected only from mother plants that are free from *Euwallacea fornicatus*.
8	Stem size	Both	Only plant material with a stem diameter $\leq$ 1 cm is used for export.
9	Fungicide treatments	Both	Regular treatment against Botryosphaeria: disinfestation of scions and preventative spraying with appropriate fungicide. Captan against general fungi, including *Fusarium* spp. (e.g. *Fusarium pallidoroseum and F. euwallaceae*): • On seeds and scions, prior to grafting (0.1%, spray). • After planting, in a preventative manner (0.15%, spray). • In mother plants of the grafted scions large enough in diameter to host *Euwallacea fornicatus,* periodically, in a preventative manner (0.1%, spray).
			Pyraclostrobin and Boscalid against general fungi: • On seeds and scions, plants during growth, prior to grafting and periodically, in a preventative manner (0.1%, spray. • On cuttings and pot plants, prior to export (0.1%, spray).
			Cyprodinil and Fludioxonil against general fungi and specifically against Botryosphaeriaceae: • Seeds and scions prior to grafting and plants during growth, periodically, in a preventive manner (0.1%, spray). • On cuttings and pot plants, prior to export (0.1%, spray). • Post-harvest on scions and plants during growth, before export and periodically in a preventive manner (0.1%, spray).
			Thiophanate-methyl against general fungi: • On plants during growth, periodically, in a preventative manner (70%, spray).
			Potassium phosphite, against: • *Phytophthora cinnamomi*: on grafted plants during growth, in a 6 L bag, in a preventative manner (0.5%, spray). • General fungi, including *Botryosphaeria spp.,* on plants during growth, periodically, in a preventative manner (0.5%, spray).

No.	Risk mitigation measure	Commodity (scions/ grafted plants)	Proposed measures in Israel
10	Insecticide/ Acaricide treatments	Both	Tau-fluvalinate against aphids, during plant growth, in a preventative manner (0.05%, spray).
			Imidacloprid against: • Aphids, during plant growth, in a preventative manner (0.2%, drenching). • Various sap sucking insects, after planting, in a preventative manner (1 cc/plant, drenching). • Bark insects, after planting, in a preventative manner (1 cc/plant, drenching).
			Mineral oil against spider mites, including: *Oligonychus perseae, Eutetranychus orientalis*, during growth, in a preventative manner (1–2%, spray).
			Summer oil against: • Spider mites, including: *Oligonychus perseae, Eutetranychus orientalis*, during growth, in a preventative manner (80%, spray). • *Aonidiella aurantii*, during growth, in a preventative manner (82%, spray).
			Spirotetramat against: • Aonidiella aurantii, during growth, in a preventative manner (100 g/L, spray). • Spider mites, including: *Oligonychus perseae, Eutetranychus orientalis,* during growth, in a preventative manner (0.08%, spray).
			Abamectin against spider mites, including: *Oligonychus perseae, Eutetranychus orientalis,* during growth, in a preventative manner (0.05%, spray).
			Spirodiclofen against spider mites, including: *Oligonychus perseae, Eutetranychus orientalis,* during growth, in a preventative manner (0.02%, spray).
			Spinosad against: • *Retithrips syriacus*, during growth, in a preventative manner (0.08%, spray). • *Chaetanaphothrips orchidii*, during growth, in a preventative manner (120 gr/L, spray).
			Bacillus thuringiensis against: • *Ascotis selenaria,* during growth, in a preventative manner, sprayed, maybe in combination with surfactant). • *Cryptoblabes gnidiella,* during growth, in a preventative manner (0.25%, sprayed, maybe in combination with surfactant). • *Helicoverpa armigera,* during growth, in a preventative manner aimed against *Ascotis selenaria,* (sprayed, maybe in combination with surfactant). • *Spodoptera littoralis,* during growth, in a preventative manner maybe in combination with surfactant.
			Spinetoram against *Chaetanaphothrips orchidii,* during growth, in a preventative manner (60 gr/L spray).
			Chlorpyrifos against: • *Chaetanaphothrips orchidii,* during growth, in a preventative manner (0.08%, spray, applied only on soil and trunk). • *Spodoptera littoralis,* during growth, in a preventative manner, aimed against ants (spray, applied only on soil and trunk).

No.	Risk mitigation measure	Commodity (scions/ grafted plants)	Proposed measures in Israel
			Acetamiprid against: • *Parabemisia myricae,* during growth, in a preventative manner (0.06%, spray). • *Aonidiella orientalis,* during growth, in a preventative manner (0.06%, spray). • *Milviscutulus mangiferae*, during growth, in a preventative manner (0.06%, spray). • *Aphids,* during growth, in a preventative manner (0.035/0.06%, spray, depending on the product). • *Bemisia tabaci,* during growth, in a preventative manner (0.035/0.06%, spray, depending on the product). • *Euwallacea fornicatus,* during growth, in a preventative manner (0.06%).
11	Natural enemies against insects/ mites	Both	• *Rodolia cardinalis,* against eggs and crawlers of *Icerya aegyptiaca*. • *Aphytis spp.* and *Chilocorus bipustulatus* against crawlers or other stages of *Aonidiella aurantii*. • A complex of natural enemies, including *Apanteles cerialis* and *Compsilura concinnata* against larvae of *Ascotis selenaria*.
12	Storage conditions	Both	The plants are transferred from the storage rooms directly to a refrigerated container which maintains 2–4°C. The container is loaded onto the ship and unloaded when with the customers in the EU, so that the refrigerated conditions are maintained throughout the shipment process.

5.3. Evaluation of the current measures for the selected relevant pests including uncertainties

For some pests which showed similar biology, behaviour, phylogenetic relatedness, harmfulness, regulatory status or uncertainties regarding the association with the specified commodities, the Panel decided to group those species for the elicitations, for details on the groupings made for elicitations, see Section 4.5.

For each evaluated pest or group, the relevant risk mitigation measures acting on the pest or group were identified. Any limiting factors on the effectiveness of the measures were documented.

Therefore, the Panel assumes that applications are effective in controlling the pest to an acceptable level. If there are serious uncertainties or evidence of pest presence despite application of the pesticide (e.g. reports of interception at import, limited control efficacy), this will be considered in the EKE on the effectiveness of the measures.

All the relevant information including the related uncertainties deriving from the limiting factors used in the evaluation are summarised in a pest datasheet provided in Appendix A. Based on this information, for each selected relevant pest, an expert judgement is given for the likelihood of pest freedom taking into consideration the risk mitigation measures and their combination acting on the pest.

An overview of the evaluation of each relevant pest is given in the sections below (Sections 5.3.1–5.3.12). The outcome of the EKE regarding pest freedom after the evaluation of the currently proposed risk mitigation measures is summarised in Section 5.3.13. The likelihood of pest freedom is given by the median with a 90% uncertainty interval.

5.3.1. Overview of the evaluation of avocado sunblotch viroid (ASBVd)

Rating of the likelihood of pest freedom- Grafted plants	Pest free with some exceptional cases (based on the median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free grafted plants	**9,912** out of 10,000 grafted plants	**9,939** out of 10,000 grafted plants	**9,961** out of 10,000 grafted plants	**9,979** out of 10,000 grafted plants	**9,995** out of 10,000 grafted plants
Proportion of infested grafted plants	**5** out of 10,000 grafted plants	**21** out of 10,000 grafted plants	**39** out of 10,000 grafted plants	**61** out of 10,000 grafted plants	**88** out of 10,000 grafted plants
Percentile of the distribution	5%	25%	Median	75%	95%
Rating of the likelihood of pest freedom of bundles of scions	Pest free with some exceptional cases (based on the median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free bundles of scions	**9,912** out of 10,000 bundles of scions	**9,939** out of 10,000 bundles of scions	**9,961** out of 10,000 bundles of scions	**9,979** out of 10,000 bundles of scions	**9,995** out of 10,000 bundles of scions
Proportion of infested bundles of scions	**5** out of 10,000 bundles of scions	**21** out of 10,000 bundles of scions	**39** out of 10,000 bundles of scions	**61** out of 10,000 bundles of scions	**88** out of 10,000 bundles of scions
Summary of the information used for the evaluation	The evaluation was done first for grafted plants and subsequently for scions, but results in distribution were the same**.** Both grafted plants and scions were considered to be at the same potential risk infection level, since both plant materials are coming from mother plants and similar chances of cross-contamination. **Possibility that the pest could become associated with the commodity** Avocado sunblotch viroid (ASBVd) is present with restricted distribution in Israel. The only natural host for ASBVd is *P. americana*. The possible pathways for spread of ASBVd are vegetative propagation material and trees, grafting practices, pruning and harvesting, with contaminated tools, in addition to the exporting of asymptomatic fruits and infected seeds. It is not directly vector transmitted but potential transmission by pollen has been experimentally reported via bee movement. Propagation material from symptomless carriers (with latent infections) can efficiently transmit ASBVd to seeds, in addition to plants by graft through infected roots, buds and scions. **Measures proposed against the pest and their efficacy** The relevant proposed measure is number 5: surveillance and monitoring (see more details in Table 6) surveillance and monitoring. **Interception records** There are no records of interceptions from Israel. **Shortcomings of the proposed measures/procedures** The certification used to ensure that plants are grown from seeds free of ASBVd is not described in details and it is unclear which cleaning procedure is implemented to prevent potential infections by grafting/cutting tools. Moreover, the detection of this viroid by RT-PCR is methodologically appropriate, but it is uncertain to what extent the survey inspections and monitoring procedure are able to ensure the absence of the ASBVd from asymptomatic carriers. The unnoticed presence of this viroid during the inspections, with further use of contaminated tools during grafting and pruning process may contribute to the infection spread of ASBVd.				

	Main uncertainties • Pollen transmission of ASBVd by bees has been reported in experimental conditions. Despite transmission rate to plants is very low, there might be a potential way to introduce inoculum from surrounding infected avocado crops. • Seeds are certified by the PPIS, but there is a lack of information related to this certification. It is therefore unclear to what extent the seeds that are used to germinate the stocks and scions are viroid-free. • It is uncertain to what extent the monitoring inspections (detection and sampling strategies) are effective to detect latent infections or symptomless carriers. • Latent infection is a major issue for this viroid, it is uncertain to what extent the sampling inspections (1 sample per 10 dunam) are feasible to detect asymptomatic plants. • It is unknown whether any preventive measures are carried out during both grafting and pruning processes to ensure the control of ASBVd within the nursery.

5.3.2. Overview of the evaluation of *Colletotrichum* spp. (*C. aenigma C. alienum, C. fructicola, C. siamense, C. theobromicola* and *C. perseae*)

Rating of the likelihood of pest freedom – Grafted plants	Very frequently pest free (based on the median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free grafted plants	**9,747** out of 10,000 grafted plants	**9,834** out of 10,000 grafted plants	**9,895** out of 10,000 grafted plants	**9,943** out of 10,000 grafted plants	**9,980** out of 10,000 grafted plants
Proportion of infested grafted plants	**20** out of 10,000 grafted plants	**57** out of 10,000 grafted plants	**105** out of 10,000 grafted plants	**166** out of 10,000 grafted plants	**253** out of 10,000 grafted plants
Rating of the likelihood of pest freedom – Bundles of scions	Very frequently pest free (based on the Median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free bundles of scions	**9,811** out of 10,000 bundles of scions	**9,852** out of 10,000 bundles of scions	**9,897** out of 10,000 bundles of scions	**9,942** out of 10,000 bundles of scions	**9,980** out of 10,000 bundles of scions
Proportion of infested bundles of scions	**20** out of 10,000 bundles of scions	**58** out of 10,000 bundles of scions	**103** out of 10,000 bundles of scions	**148** out of 10,000 bundles of scions	**189** out of 10,000 bundles of scions
Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity** These *Colletotrichum* spp. have been reported from avocado plants in Israel. Several host plants have been reported around the world. The main pathways of these *Colletotrichum* spp. are infected nursery stock, contaminated soil/substrate and fruits. These fungi can be dispersed through dead twigs, leaves and mummified fruits, with rain and humidity facilitating their multiplication and spore dispersal. The presence of host species in the environment of the nurseries with *P. americana* plants is an important factor for the possible migration of inoculum into the nursery. Planting of contaminated seeds or plants of other plant species in the nursery may also contribute to the spread of the disease. The use of scions with dormant infections for grafting may contribute to the spread within the nursery. Contamination of grafting tools with spores may also contribute to the spread of disease. If *Colletotrichum* spp. are present within the nursery, it can spread to other plants via conidia.				

	Measures proposed against the pest and their efficacy The relevant proposed measures are: selection of seeds for stocks, fungicides treatments on seeds and scions, disinfestation of seeds and scions official surveillance and monitoring and storage room conditions. **Interception records** There are no records of interceptions from Israel. **Shortcomings of the proposed measures/procedures** Due to the potential dormant phase of *Colletotrichum* spp., the visual inspection might be insufficient. The fungicide treatment may not be sufficient to remove quiescent infections. Some fungal pathogens can develop resistance to different fungicides, and the risk of fungicide resistance can vary according to the compounds. The effect of low temperatures on latent or endophytic presence is unclear. **Main uncertainties** Many *Colletotrichum* species can have extended hemibiotrophic or quiescent phases of their life cycles in asymptomatic plants. Latent infections might be present in the scions and in the exported plants if *Colletotrichum spp*. is undetectable in the mother plants due to an extended quiescent phase.

5.3.3. Overview of the evaluation of *Botryosphaeriaceae* (*Lasiodiplodia pseudotheobromae* and *Neoscytalidium dimidiatum*)

Rating of the likelihood of pest freedom – Grafted plants	Very frequently pest free (based on the median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free grafted plants	**9,747** out of 10,000 grafted plants	**9,834** out of 10,000 grafted plants	**9,895** out of 10,000 grafted plants	**9,943** out of 10,000 grafted plants	**9,980** out of 10,000 grafted plants
Proportion of infested grafted plants	**20** out of 10,000 grafted plants	**56** out of 10,000 grafted plants	**105** out of 10,000 grafted plants	**166** out of 10,000 grafted plants	**253** out of 10,000 grafted plants
Rating of the likelihood of pest freedom – Bundles of scions	Very frequently pest free (based on the Median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free bundles of scions	**9,573** out of 10,000 bundles of scions	**9,669** out of 10,000 bundles of scions	**9,781** out of 10,000 bundles of scions	**9,889** out of 10,000 bundles of scions	**9,974** out of 10,000 bundles of scions
Proportion of infested bundles of scions	**26** out of 10,000 bundles of scions	**111** out of 10,000 bundles of scions	**219** out of 10,000 bundles of scions	**331** out of 10,000 bundles of scions	**427** out of 10,000 bundles of scions
Summary of the information used for the evaluation	**Possibility that the pest could become associate with the commodity** Both species are present in Israel and have several host plants. The main pathways are spores that are released from infected plants and propagation plant material in the soil, through wounds caused by mechanical methods, latently infected grafting material and contaminated grafting tools. The spread of conidia is facilitated by wind, rain and insects. The presence of host species in the environment of the nurseries with *P. americana* plants is an important factor for the possible migration of inoculum into the nursery. If these *Botryosphaeriaceae* are present within the nursery, it can spread when scions from mother plants with endophytic or latent infections are used for grafting.				

	Measures proposed against the pest and their efficacy The relevant proposed measures are: (i) PPIS approved propagation material from only approved mother plants, (ii) fungicides application on seeds and scions, (iii) fungicide application during the cultivation period, (iv) official surveillance and monitoring, (v) scions are stored in chilled rooms. **Interception records** There are no records of interceptions from Israel. **Shortcomings of the proposed measures/procedures** Due to the potential dormant phase of these Botryosphaeriac*eae*, the visual inspection might be insufficient. The fungicide treatment may not be sufficient to remove quiescent infections. Some fungal pathogens can develop resistance to different fungicides, and the risk of fungicide resistance can vary according to the compounds. The effect of low temperatures on latent or endophytic presence is unclear. **Main uncertainties** • Latent infections or endophytic presence of *Botryosphaeriaceae* in the scions may be undetectable by the visual inspections. • The infection potential of endophytic presence is not known.

5.3.4. Overview of the evaluation of *Euwallacea fornicatus* and *Neocomospora euwallaceae* (Bark beetle–fungi complex)

Rating of the likelihood of pest freedom – Grafted plants	Pest free with some exceptional cases (based on the median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest free grafted plants	**9,953** out of 10,000 grafted plants	**9,966** out of 10,000 grafted plants	**9,979** out of 10,000 grafted plants	**9,990** out of 10,000 grafted plants	**9,999** out of 10,000 grafted plants
Proportion of infested grafted plants	**1** out of 10,000 grafted plants	**10** out of 10,000 grafted plants	**21** out of 10,000 grafted plants	**34** out of 10,000 grafted plants	**46** out of 10,000 grafted plants
Rating of the likelihood of pest freedom – Bundles of scions	Almost always pest free (based on the Median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free bundles of scions	**9,991** out of 10,000 bundles of scions	**9,994** out of 10,000 bundles of scions	**9,996** out of 10,000 bundles of scions	**9,998** out of 10,000 bundles of scions	**9,999** out of 10,000 bundles of scions
Proportion of infested bundles of scions	**1** out of 10,000 bundles of scions	**2** out of 10,000 bundles of scions	**4** out of 10,000 bundles of scions	**6** out of 10,000 bundles of scions	**9** out of 10,000 bundles of scions
Summary of the information used for the evaluation	**Possibility that the pest could become associate with the commodity** Both species are present in Israel, with *E. fornicatus* distributed in the Galillee area, along the coastal plain and in central Israel. A survey in Israel, revealed that 52 tree species from 26 botanical families have been affected by *E. fornicatus*, but only 12 species were suitable for beetle reproduction. The main pathways of entry are plants for planting and wood of reproductive host species. The presence of reproductive hosts in the environment of the nurseries with *P. americana* plants is an important factor for the possible migration of infected beetles into the nursery. The *F. euwallaceae* fungi can be introduced into the nursery only by the insect vector *E. fornicatus*. There are divergences in the literature about the flying capacity of *Euwallacea* spp. Both natural and human-assisted movement can spread the pest within the nursery.				

	Measures proposed against the pest and their efficacy The relevant proposed measures are: (i) plants are grown in bags that are raised off the ground (ii) scions are collected only from mother plants, free of *E. fornicatus* (iii) pesticide and fungicide treatments during the cultivation period applied in a preventative (iv) official surveillance and monitoring (v) plants with stem diameter $\leq$ 1 cm are used for export. **Interception records** There are no records of interceptions from Israel. **Shortcomings of proposed measures/procedures** This fungus is found inside the plants and is vectored by *E. fornicatus*. Thus, fungicide applications of some of these chemicals to the exterior of the plants are not expected to be particularly effective against the fungi inside the plant, nor to the fungi vectored by the insect. Documentation of the effect of Captan, applied to the exterior of the plant, in controlling the disease caused by *F. euwallaceae* seems to be lacking. Some fungal pathogens can develop resistance to different fungicides, and the risk of fungicide resistance can vary according to the compounds. **Main uncertainties** Due to the small size of adult females (1.83 $\pm$ 0.07 mm long and 0.80 $\pm$ 0.6 mm wide), the attack of thinner stems or branches cannot be completely dismissed. The EPPO Panel on Phytosanitary Measures agreed therefore that attacks to 'plants at early growth stages' cannot be completely excluded because of the high uncertainty (EPPO, 2017).

5.3.5. Overview of the evaluation of mealybugs and soft scales Group A (*Icerya aegyptiaca*–*Nipaecoccus viridis*–*Paracoccus marginatus*–*Pseudococcus cryptus*–*Milviscutulus mangiferae*)

Rating of the likelihood of pest freedom- Grafted plants	Pest free with some exceptional cases (based on the median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free grafted plants	**9,981** out of 10,000 grafted plants	**9,986** out of 10,000 grafted plants	**9992** out of 10,000 grafted plants	**9,996** out of 10,000 grafted plants	**9,999** out of 10,000 grafted plants
Proportion of infested grafted plants	**1** out of 10,000 grafted plants	**4** out of 10,000 grafted plants	**8** out of 10,000 grafted plants	**14** out of 10,000 grafted plants	**19** out of 10,000 grafted plants
Rating of the likelihood of pest freedom – Bundles of scions	Almost always pest free (based on the median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free bundles of scions	**9,991** out of 10,000 bundles of scions	**9,994** out of 10,000 bundles of scions	**9,996** out of 10,000 bundles of scions	**9,998** out of 10,000 bundles of scions	**9,999** out of 10,000 bundles of scions
Proportion of infested bundles of scions	**1** out of 10,000 bundles of scions	**2** out of 10,000 bundles of scions	**4** out of 10,000 bundles of scions	**6** out of 10,000 bundles of scions	**9** out of 10,000 bundles of scions
Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity** All pests are present in Israel, with *M. mangiferae* mainly present in and around mango cultivation areas and all pests are highly polyphagous. The main pathways are plants for planting, plant materials and human movement. These pests could be present on *P. americana* mother plants or other host plants (e.g. mango) occurring in the surrounding environment and can infest the commodity mainly through human assisted spread.				

	Measures proposed against the pest and their efficacy The relevant proposed measures are: (i) storage conditions, temperature (ii) pesticide treatment, (iii) natural enemies, (iv) official surveillance and monitoring. **Interception records** There are no records of interceptions from Israel. **Shortcomings of proposed measures/procedures** The storage temperatures could only slow down the life cycle without killing the pests. The pesticides are applied only in case of infestation and could affect natural enemies. **Main uncertainties** • Not possible to exclude completely the possibility that juveniles or adults of these species can enter into the nursery by movement of mother plant material where juveniles and/or adults can be hidden in a protected site on the bark, roots, stems or leaves.

5.3.6. Overview of the evaluation of mealybugs and soft scales (Group B) with similar biology (*Maconelicoccus hirsutus* and *Pulvinaria psidii*)

Rating of the likelihood of pest freedom – Grafted plants	Pest free with some exceptional cases (based on the median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free grafted plants	**9,921** out of 10,000 grafted plants	**9,949** out of 10,000 grafted plants	**9,966** out of 10,000 grafted plants	**9,979** out of 10,000 grafted plants	**9,992** out of 10,000 grafted plants
Proportion of infested grafted plants	**8** out of 10,000 grafted plants	**21** out of 10,000 grafted plants	**34** out of 10,000 grafted plants	**51** out of 10,000 grafted plants	**79** out of 10,000 grafted plants
Rating of the likelihood of pest freedom - Bundles of scions	Pest free with some exceptional cases (based on the median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free bundles of scions	**9,963** out of 10,000 bundles of scions	**9,976** out of 10,000 bundles of scions	**9,984** out of 10,000 bundles of scions	**9,990** out of 10,000 bundles of scions	**9,997** out of 10,000 bundles of scions
Proportion of infested bundles of scions	**3** out of 10,000 bundles of scions	**10** out of 10,000 bundles of scions	**16** out of 10,000 bundles of scions	**24** out of 10,000 bundles of scions	**37** out of 10,000 bundles of scions
Summary of the information used for the evaluation	**Possibility that the pest could become associate with the commodity** Both pests are present in Israel and highly polyphagous. Main pathways are locally by wind and long distance by plants for planting/flowers/fruits. *M. hirsutus* in Israel is reported as a quarantine pest and the nurseries are at the minimum distance of 8 km and maximum 90 km. In Israel, P. psidii is reported to be present mainly in litchi and mango and on ornamental plants scattered throughout the country. Given the wide host range of this pest, it is possible that local populations of *P. psidii* are present in the neighbouring environment of the greenhouses with avocado plants destined for export. **Measures proposed against the pest and their efficacy** The relevant proposed measures are: (i) storage conditions, (ii) pesticide treatment, (iii) official surveillance and monitoring. **Interception records** There are no records of interceptions from Israel.				

	Shortcomings of proposed measures/procedures The storage temperatures could only slow down the life cycle without killing the pests. The pesticides are applied only in case of infestation. **Main uncertainties** • Not possible to exclude completely the possibility that juveniles or adults of these species can enter into the nursery by movement of mother plant material where juveniles and/or adults can be hidden in a protected site on the bark, roots, stems or leaves. • There is no surveillance information on the presence and population pressure of *P. psidii* in the neighbouring environment of the greenhouse. • There is no information on the presence of suitable host plants (e.g. mango orchards) and other sources of population of *P. psidii* in the area surrounding the greenhouse. • Although the risk of introduction of *M. hirsutus* from the surrounding environment seems limited by the distance from the places where the scales was reported, it is known that scale crawlers can be transported by wind at distances of several kilometres. • Not possible to totally exclude the movement of the pest within the nursery by human-assisted spread.

5.3.7. Overview of the evaluation of armoured scales (*Aonidiella orientalis* and *Aulacaspis tubercularis*)

Rating of the likelihood of pest freedom – Grafted plants	Extremely frequently pest free (based on the median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free grafted plants	**9,827** out of 10,000 grafted plants	**9,882** out of 10,000 grafted plants	**9,917** out of 10,000 grafted plants	**9,947** out of 10,000 grafted plants	**9,978** out of 10,000 grafted plants
Proportion of infested grafted plants	**22** out of 10,000 grafted plants	**53** out of 10,000 grafted plants	**83** out of 10,000 grafted plants	**118** out of 10,000 grafted plants	**173** out of 10,000 grafted plants
Rating of the likelihood of pest freedom – Bundles of scions	Pest free with some exceptional cases (based on the median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free bundles of scions	**9,916** out of 10,000 bundles of scions	**9,951** out of 10,000 bundles of scions	**9,975** out of 10,000 bundles of scions	**9,990** out of 10,000 bundles of scions	**9,997** out of 10,000 bundles of scions
Proportion of infested bundles of scions	**3** out of 10,000 bundles of scions	**10** out of 10,000 bundles of scions	**25** out of 10,000 bundles of scions	**49** out of 10,000 bundles of scions	**84** out of 10,000 bundles of scions
Summary of the information used for the evaluation	**Possibility that the pest could become associate with the commodity** Both pests are present in Israel and are highly polyphagous. Main pathways are planting material and less often fruits. Possibly present on *P. americana* mother plants or other host plants occurring in the surrounding environment and they can infest the commodity mainly by human-assisted spread. **Measures proposed against the pest and their efficacy** The relevant proposed measures are: (i) storage temperature, (ii) pesticide treatment, (iii) natural enemies, (iv) official surveillance and monitoring.				

	Interception records There are no records of interceptions from Israel. **Shortcomings of the proposed measures/procedures** The storage temperatures could only slow down the life cycle without killing the pests. The pesticides are applied only in case of infestation and they can affect natural enemies. **Main uncertainties** • Though orchards and grafted plants are supervised by PPIS, it cannot be excluded that these two highly polyphagous pests, possibly present on *P. americana* mother plants or other host plants occurring in the surrounding environment, can infest the commodity mainly for human-assisted spread. • Not possible to completely exclude that juveniles or adults of these species can enter into the nursery by movement of mother plant material where juveniles and/or adults can be hidden in a protected site on the bark, roots, stems or leaves. • It is not possible to totally exclude the movement of the pests within the nursery by human-assisted spread.

5.3.8. Overview of the evaluation of *Tetraleurodes perseae*

Rating of the likelihood of pest freedom – Grafted plants	Pest free with some exceptional cases (based on the median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free grafted plants	**9,921** out of 10,000 grafted plants	**9,949** out of 10,000 grafted plants	**9,966** out of 10,000 grafted plants	**9,979** out of 10,000 grafted plants	**9,992** out of 10,000 grafted plants
Proportion of infested grafted plants	**22** out of 10,000 grafted plants	**53** out of 10,000 grafted plants	**83** out of 10,000 grafted plants	**118** out of 10,000 grafted plants	**173** out of 10,000 grafted plants
Summary of the information used for the evaluation	**Possibility that the pest could become associate with the commodity** For *Tetraleurodes perseae* scions were not considered to be a pathway because of the lack of leaves (or the presence of small leaflets with no photosynthetic activity) needed for development. *T. persae* is present in Israel on avocado and other Lauraceae. Natural dispersal occurs by flying adults. Over long distances, *T. perseae* can spread through infested plants for planting, plant materials and human-assisted movement. This pest could infest the commodity mainly as grafted plants, because of the presence of leaves. **Measures proposed against the pest and their efficacy** The relevant proposed measures are: (i) storage temperature, (ii) pesticide treatment, (iii) official surveillance and monitoring. **Interception records** There are no records of interceptions from Israel. **Shortcomings of the proposed measures/procedures** The storage temperatures could only slow down the life cycle without killing the pest. The pesticides are applied only in case of infestation, which can be overlooked especially if limited, and they can affect natural enemies. **Main uncertainties** • Though orchards and grafted plants are supervised by PPIS, we cannot exclude that this pest, possibly present on *P. americana* mother plants or other Lauraceae host plants occurring in the surrounding environment, can infest the commodity mainly for human assisted movement as well as natural dispersal. • Not possible to completely exclude that juveniles or adults of these species can enter into the nursery by movement of mother plant material where juveniles and/or adults can be hidden in a protected site on stems or leaves. • It is not possible to totally exclude the movement of the pest within the nursery by natural dispersal and human-assisted spread.					

5.3.9. Overview of the evaluation of *Bemisia tabaci*

Rating of the likelihood of pest freedom – Grafted plants	Pest free with some exceptional cases (based on the Median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free grafted plants	**9,872** out of 10,000 grafted plants	**9,924** out of 10,000 grafted plants	**9,952** out of 10,000 grafted plants	**9,974** out of 10,000 grafted plants	**9,992** out of 10,000 grafted plants
Proportion of infested grafted plants	**8** out of 10,000 grafted plants	**26** out of 10,000 grafted plants	**48** out of 10,000 grafted plants	**76** out of 10,000 grafted plants	**128** out of 10,000 grafted plants
Summary of the information used for the evaluation	**Possibility that the pest could become associate with the commodity** For *Bemisia tabaci* complex scions were not considered to be a pathway because of the lack of leaves (or the presence of small leaflets with no photosynthetic activity) needed for development. *B. tabaci* is a polyphagous pest with a wide host range, including more than 1000 different plant species. Some species of Lauraceae and *P. americana* are considered as minor hosts. Natural dispersal occurs by flying adults. Over long distances, *B. tabaci* can spread through infested plants for planting, plant materials and human-assisted movement. This pest could infest the commodity mainly as grafted plants, because of the presence of leaves. **Measures proposed against the pest and their efficacy** The relevant proposed measures are: (i) storage temperature, (ii) pesticide treatment, (iii) official surveillance and monitoring. **Interception records** There are no records of interceptions from Israel on *P. americana*. **Shortcomings of the proposed measures/procedures** The storage temperatures could only slow down the life cycle without killing the pest. The pesticides are applied only in case of infestation, which can be overlooked especially if limited, and they can affect natural enemies. **Main uncertainties** • Though orchards and grafted plants are supervised by PPIS, we cannot exclude that this pest, possibly present on *P. americana* mother plants or other host plants occurring in the surrounding environment, can infest the commodity mainly for human-assisted movement as well as natural dispersal. • Not possible to completely exclude that juveniles or adults of these species can enter into the nursery by movement of mother plant material where juveniles and/or adults can be hidden in a protected site on stems or leaves. • It is not possible to totally exclude the movement of the pest within the nursery by natural dispersal and human-assisted spread.				

5.3.10. Overview of the evaluation of thrips *Scirtothrips dorsalis* and *Retithrips syriacus*

Rating of the likelihood of pest freedom – Grafted plants	Very frequently pest free (based on the median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free grafted plants	**9,761** out of 10,000 grafted plants	**9,810** out of 10,000 grafted plants	**9,870** out of 10,000 grafted plants	**9,930** out of 10,000 grafted plants	**9,979** out of 10,000 grafted plants

Proportion of infested grafted plants	**21** out of 10,000 grafted plants	**70** out of 10,000 grafted plants	**130** out of 10,000 grafted plants	**190** out of 10,000 grafted plants	**239** out of 10,000 grafted plants
Rating of the likelihood of pest freedom – Bundles of scions	Pest free with some exceptional cases (based on the median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest free – Bundles of scions	**9,916** out of 10,000 Bundles of scions	**9,951** out of 10,000 Bundles of scions	**9,975** out of 10,000 Bundles of scions	**9,990** out of 10,000 Bundles of scions	**9,997** out of 10,000 Bundles of scions
Proportion of infested – Bundles of scions	**3** out of 10,000 Bundles of scions	**10** out of 10,000 Bundles of scions	**25** out of 10,000 Bundles of scions	**50** out of 10,000 Bundles of scions	**84** out of 10,000 Bundles of scions
Summary of the information used for the evaluation	**Possibility that the pest could become associate with the commodity** Both species are polyphagous. *S. dorsalis* is polyphagous and has been collected from *P. americana* plants. According to the PPIS, it has been rarely seen in avocado in Israel (not known to cause damage in this crop, as well as in other commercial crops in Israel). It might be present externally on budwood as well as in pot plants. *R. syriacus* is a pest of avocado. **Measures proposed against the pest and their efficacy** The relevant proposed measures are: (i) storage temperature, (ii) pesticide treatment, (iii) official surveillance and monitoring. **Interception records** There are no records of interceptions from Israel. **Shortcomings of the proposed measures/procedures** The storage temperatures could only slow down the life cycle without killing the pests. The pesticides are applied only in case of infestation, which can be overlooked especially if limited, and they can affect natural enemies. **Main uncertainties** • Though orchards and grafted plants are supervised by PPIS, we cannot exclude that this pest, possibly present on *P. americana* mother plants or other host plants occurring in the surrounding environment, can infest the commodity mainly for human-assisted movement as well as natural dispersal. • Not possible to completely exclude that juveniles or adults of these species can enter into the nursery by movement of mother plant material where juveniles and/or adults can be hidden in a protected site on stems or leaves. • It is not possible to totally exclude the movement of the pests within the nursery by natural dispersal and human-assisted spread.					

5.3.11. Overview of the evaluation of *Penthimiola bella*

Rating of the likelihood of pest freedom – Grafted plants	Extremely frequently pest free (based on the median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free grafted plants	**9,859** out of 10,000 grafted plants	**9,891** out of 10,000 grafted plants	**9,927** out of 10,000 grafted plants	**9,962** out of 10,000 grafted plants	**9,990** out of 10,000 grafted plants
Proportion of infested grafted plants	**10** out of 10,000 grafted plants	**38** out of 10,000 grafted plants	**73** out of 10,000 grafted plants	**109** out of 10,000 grafted plants	**141** out of 10,000 grafted plants

Summary of the information used for the evaluation	**Possibility that the pest could become associate with the commodity** For *P. bella* scions were not considered to be a pathway because of the lack of leaves (or presence of small leaflets with no photosynthetic activity) needed for development. *Penthimiola bella* is present in Israel since the 70s. It is mainly reported associated to *Citrus*, but avocado is also an important host. Fruits are probably the main pathway of introduction. Nonetheless, the importation of plants for planting of suitable hosts from outside of the EU may be also a pathway for introduction. **Measures proposed against the pest and their efficacy** The relevant proposed measures are: (i) storage temperature, (ii) pesticide treatment, (iii) official surveillance and monitoring. **Interception records** There are no records of interceptions from Israel. **Shortcomings of the proposed measures/procedures** The storage temperatures could only slow down the life cycle without killing the pest. The pesticides are applied only in case of infestation, which can be overlooked especially if limited, and they can affect natural enemies. **Main uncertainties** • Though orchards and grafted plants are supervised by PPIS, it cannot be excluded that this pest, possibly present on *P. americana* mother plants or other host plants (*Citrus* spp.) occurring in the surrounding environment, can infest the commodity mainly for human-assisted movement as well as natural dispersal. • It is not possible to completely exclude that juveniles or adults of these species can enter into the nursery by movement of mother plant material where juveniles and/or adults can be hidden in a protected site on stems or leaves. • It is not possible to totally exclude the movement of the pest within the nursery by natural dispersal and human-assisted spread.

5.3.12. Overview of the evaluation of *Oligonychus perseae*

Rating of the likelihood of pest freedom – Grafted plants	Extremely frequently pest free (based on the median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free grafted plants	**9,827** out of 10,000 grafted plants	**9,882** out of 10,000 grafted plants	**9,917** out of 10,000 grafted plants	**9,947** out of 10,000 grafted plants	**9,978** out of 10,000 grafted plants
Proportion of infested grafted plants	**22** out of 10,000 grafted plants	**53** out of 10,000 grafted plants	**83** out of 10,000 grafted plants	**118** out of 10,000 grafted plants	**173** out of 10,000 grafted plants
Rating of the likelihood of pest freedom – Bundles of scions	Pest free with some exceptional cases (based on the median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free bundles of scions	**9,916** out of 10,000 bundles of scions	**9,951** out of 10,000 bundles of scions	**9,975** out of 10,000 bundles of scions	**9,990** out of 10,000 bundles of scions	**9,997** out of 10,000 bundles of scions
Proportion of infested bundles of scions	**3** out of 10,000 bundles of scions	**10** out of 10,000 bundles of scions	**25** out of 10,000 bundles of scions	**49** out of 10,000 bundles of scions	**84** out of 10,000 bundles of scions

Summary of the information used for the evaluation	**Possibility that the pest could become associate with the commodity** *P. americana* is reported as a major host plant for *O. perseae.* This mite can also feed on a wide range of fruit species (e.g. carob, persimmon, grape), ornamentals (e.g. *Acacia, Bambusa, Bixa orellana, Rhus, Rosa, Salix*) and weeds. The mites can move over short distances. Movements of infested avocado plants, and other hosts can ensure dissemination. The major means of long-distance inter-plant dispersal of *O. perseae* is by spinning down from the foliage on a silk strand of webbing and wafting through the air in the wind. The mite can also be dispersed on the equipment and clothing of farm workers. This pest could infest the commodity mainly as grafted plants, because of the presence of leaves. **Measures proposed against the pest and their efficacy** The relevant proposed measures are: (i) storage temperature, (ii) pesticide treatment, (iii) natural enemies, (iv) official surveillance and monitoring. **Interception records** There are no records of interceptions from Israel. **Shortcomings of the proposed measures/procedures** The storage temperatures could only slow down the life cycle without killing the pest. The pesticides are applied only in case of infestation, which can be overlooked especially if limited, and they can affect natural enemies. **Main uncertainties** • Though orchards and grafted plants are supervised by PPIS, we cannot exclude that this pest, possibly present on *P. americana* mother plants or other host plants occurring in the surrounding environment, can infest the commodity mainly for human-assisted movement as well as natural dispersal. • Not possible to completely exclude that juveniles or adults of these species can enter into the nursery by movement of mother plant material where juveniles and/or adults can be hidden in a protected site on stems or leaves. • It is not possible to totally exclude the movement of the pest within the nursery by natural dispersal and human-assisted spread.

5.3.13. Outcome of Expert Knowledge Elicitation

Table 8 and Figure 4 show the outcome of the EKE regarding pest freedom of grafted plants after the evaluation of the currently proposed risk mitigation measures for all the evaluated pests.

Table 9 and Figure 5 show the outcome of the EKE regarding pest freedom of bundles of scions after the evaluation of the currently proposed risk mitigation measures for all the evaluated pests.

Figure 6 provides an explanation of the descending distribution function describing the likelihood of pest freedom after the evaluation of the currently proposed risk mitigation measures for *P. americana* commodities designated for export to the EU for *Botryosphariaceae* (*L. pseudotheobromae, N. dimidiatum*).

Table 8: Assessment of the likelihood of pest freedom following evaluation of the proposed risk mitigation measures against avocado sunblotch viroid, Botryosphaeriaceae (*Lasiodiplodia pseudotheobromae*, *Neoscytalidium dimidiatum*), *Colletotrichum* spp. (*C. aenigma, C. alienum, C. fructicola, C. siamense, C. theobromicola and C. perseae*), bark beetle–fungi complex (*Euwallaceae fornicatus* and *Neocomospora euwallaceae*), mealybugs and soft scales group A (*Nipaeccoccus viridis*, *Paracoccus marginatus, Pseudococcus cryptus, Icerya aegyptiaca, Milviscutulus mangiferae*), mealybugs and soft scales group B (*Maconelicoccus hirsutus, Pulvinaria psidii*), armoured scales (*Aonidiella orientalis*, *Aulacaspis tubercularis*), thrips (*Scirtothrips dorsalis, Retithrips syriacus*), *Bemisia tabaci* complex, *Tetraleurodes perseae, Penthimiola bella, Oligonychus perseae* on grafted plants for export to the EU. The median value for the assessed level of pest freedom for each pest is indicated by 'M', the 5% percentile is indicated by L and the 95% percentile is indicated by U. The percentiles together span the 90% uncertainty range regarding pest freedom

PANEL A

Number	Group	Pest species	Sometimes pest free	More often than not pest free	Frequently pest free	Very frequently pest free	Extremely frequently pest free	Pest free with some exceptional cases	Pest free with few exceptional cases	Almost always pest free
1	Virus	Avocado sunblotch viroid					**L**	**M**	**U**	
2	Fungi	Botryosphaeriaceae: *Lasiodiplodia pseudotheobromae, Neoscytalidium dimidiatum*				**LM**		**U**		
3	Fungi	*Colletotrichum* spp.: *C. aenigma, C. alienum, C. fructicola, C. siamense, C. theobromicola* and *C. perseae*				**LM**		**U**		
4	Insect and fungus	Bark beetle–fungi complex: *Euwallaceae fornicatus* and *Neocomospora euwallaceae*						**LM**		**U**
5	Insects	Mealybugs and soft scales group A: *Nipaecoccus viridis, Paracoccus marginatus, Pseudococcus cryptus, Icerya aegyptiaca, Milviscutulus mangiferae*						**L**	**M**	**U**
6	Insects	Mealybugs and soft scales group B: *Maconelicoccus hirsutus*, *Pulvinaria psidii*					**L**	**M**	**U**	
7	Insects	Armoured scales: *Aonidiella orientalis, Aulacaspis tubercularis*				**L**	**M**	**U**		
8	Insects	*Tetraleurodes perseae*					**L**	**M**	**U**	

Number	Group	Pest species	Sometimes pest free	More often than not pest free	Frequently pest free	Very frequently pest free	Extremely frequently pest free	Pest free with some exceptional cases	Pest free with few exceptional cases	Almost always pest free
9	Insects	*Bemisia tabaci* complex				**L**		**M**	**U**	
10	Insects	Thrips: *Scirtothrips dorsalis, Retithrips syriacus*				**LM**		**U**		
11	Insects	*Penthimiola bella*				**L**	**M**		**U**	
12	Mites	*Oligonychus perseae*				**L**	**M**	**U**		

PANEL B

Pest freedom category		Pest-free plants out of 10,000	Legend of marked pest freedom categories	
	Sometimes pest free	< 5,000	**L**	Pest freedom category includes the elicited lower bound of the 90% uncertainty range
	More often than not pest free	5,000 – < 9,000		
	Frequently pest free	9,000 – < 9,500	**M**	Pest freedom category includes the elicited median
	Very frequently pest free	9,500 – < 9,900	**U**	Pest freedom category includes the elicited upper bound of the 90% uncertainty range
	Extremely frequently pest free	9,900 – < 9,950		
	Pest free with some exceptional cases	9,950 – < 9,990		
	Pest free with few exceptional cases	9,990 – < 9,995		
	Almost always pest free	9,995 – 10,000		

Table 9: Assessment of the likelihood of pest freedom following evaluation of the proposed risk mitigation measures against avocado sunblotch viroid, Botryosphaeriaceae (*Lasiodiplodia pseudotheobromae*, *Neoscytalidium dimidiatum*), *Colletotrichum* spp. (*C. aenigma, C. alienum, C. fructicola, C. siamense, C. theobromicola and C. perseae*), bark beetle–fungi complex (*Euwallaceae fornicatus* and *Neocomospora euwallaceae*), mealybugs and soft scales group A (*Nipaeccoccus viridis*, *Paracoccus marginatus, Pseudococcus cryptus, Icerya aegyptiaca, Milviscutulus mangiferae*), mealybugs and soft scales group B (*Maconelicoccus hirsutus, Pulvinaria psidii*), armoured scales (*Aonidiella orientalis*, *Aulacaspis tubercularis*), thrips (*Scirtothrips dorsalis, Retithrips syriacus*) and *Oligonychus perseae* on bundles of scions for export to the EU. The median value for the assessed level of pest freedom for each pest is indicated by 'M', the 5% percentile is indicated by L and the 95% percentile is indicated by U. The percentiles together span the 90% uncertainty range regarding pest freedom

Number	Group	Pest species	Sometimes pest free	More often than not pest free	Frequently pest free	Very frequently pest free	Extremely frequently pest free	Pest free with some exceptional cases	Pest free with few exceptional cases	Almost always pest free
1	Virus	Avocado sunblotch viroid					**L**	**M**	**U**	
2	Fungi	Botryosphaeriaceae: *Lasiodiplodia pseudotheobromae, Neoscytalidium dimidiatum*				**LM**		**U**		
3	Fungi	*Colletotrichum* spp.: *C. aenigma, C. alienum, C. fructicola, C. siamense, C. theobromicola and C. perseae*				**LM**		**U**		
4	Insect and fungus	Bark beetle–fungi complex: *Euwallaceae fornicatus* and *Neocomospora euwallaceae*							**L**	**MU**
5	Insects	Mealybugs and soft scales group A: *Nipaecoccus viridis, Paracoccus marginatus, Pseudococcus cryptus, Icerya aegyptiaca, Milviscutulus mangiferae*							**L**	**MU**
6	Insects	Mealybugs and soft scales group B: *Maconelicoccus hirsutus, Pulvinaria psidii*						**LM**		**U**
7	Insects	Armoured scales: *Aonidiella orientalis, Aulacaspis tubercularis*					**L**	**M**		**U**
8	Insects	Thrips: *Scirtothrips dorsalis, Retithrips syriacus*					**L**	**M**		**U**
9	Mites	*Oligonychus perseae*					**L**	**M**		**U**

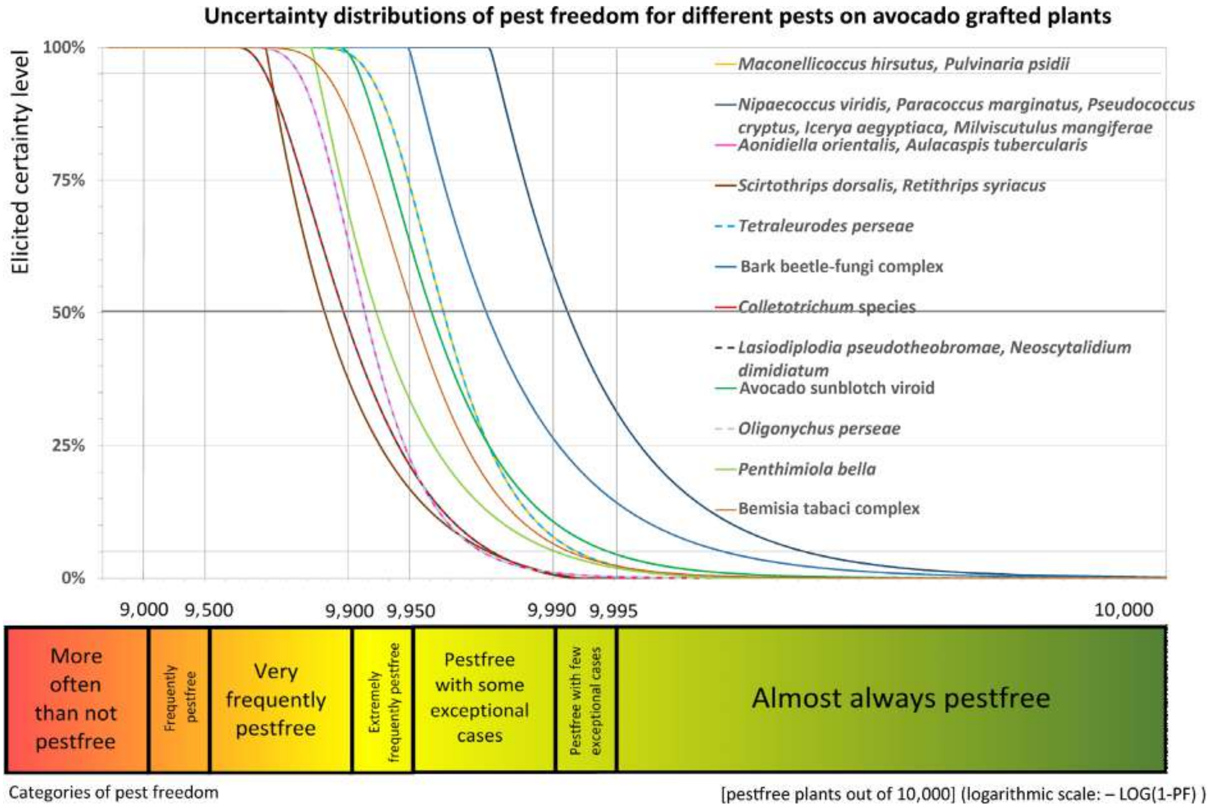


Figure 4: Elicited certainty (y-axis) of the number of pest-free avocado grafted plants (x-axis; log-scaled) out of 10,000 grafted plants designated for export to the EU introduced from Israel for all evaluated pests visualised as descending distribution function. Horizontal lines indicate the percentiles (starting from the bottom 5%, 25%, 50%, 75%, 95%)

The Panel is 95% sure that:

9,747 or more grafted plants per 10,000 will be free from Botryosphaeriaceae (*Lasiodiplodia pseudotheobromae, Neoscytalidium dimidiatum*)

9,747 or more grafted plants per 10,000 will be free from *Colletotrichum* spp. (*C. aenigma, C. alienum, C. fructicola, C. siamense, C. theobromicola and C. perseae*)

9,761 or more grafted plants per 10,000 will be free from thrips (*Retithrips syriacus*, *Scirtothrips dorsalis*)

9,827 or more grafted plants per 10,000 will be free from armoured scales (*Aonidiella orientalis, Aulacaspis tubercularis*)

9,827 or more grafted plants per 10,000 will be free from *Oligonychus perseae*

9,872 or more grafted plants per 10,000 will be free from *Bemisia tabaci*

9,912 or more grafted plants per 10,000 will be free from avocado sunblotch viroid

9,921 or more grafted plants per 10,000 will be free from mealybugs and soft scales group B (*Maconelicoccus hirsutus, Pulvinaria psidii*)

9,921 or more grafted plants per 10,000 will be free from *Tetraleurodes perseae*

9,927 or more grafted plants per 10,000 will be free from *Penthimiola bella*

9,953 or more grafted plants per 10,000 will be free from *Euwallaceae fornicatus* and *Neocomospora euwallaceae*

9,981 or more grafted plants per 10,000 will be free from mealybugs and soft scales group A (*Nipaecoccus viridis, Paracoccus marginatus, Pseudococcus cryptus, Icerya aegyptiaca, Milviscutulus mangiferae*)

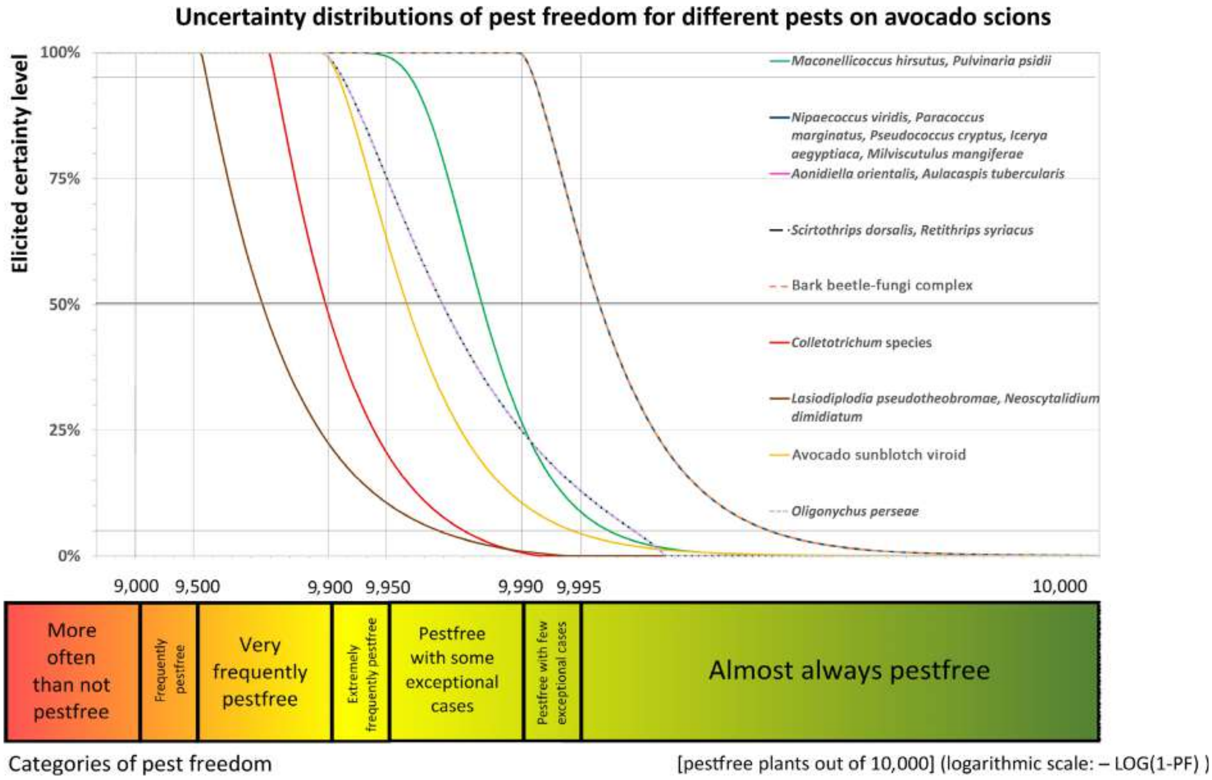


Figure 5: Elicited certainty (y-axis) of the number of pest-free P. americana bundles of scions (x-axis; log-scaled) out of 10,000 bundles of scions designated for export to the EU introduced from Israel for all evaluated pests visualised as descending distribution function. Horizontal lines indicate the percentiles (starting from the bottom 5%, 25%, 50%, 75%, 95%)

The Panel is 95% sure that:

9,573 or more bundles of scions per 10,000 will be free from Botryosphaeriaceae (*Lasiodiplodia pseudotheobromae, Neoscytalidium dimidiatum*)

9,811 or more bundles of scions per 10,000 will be free from *Colletotrichum* spp. (*C. aenigma, C. alienum, C. fructicola, C. siamense, C. theobromicola and C. perseae*)

9,912 or more bundles of scions per 10,000 will be free from avocado sunblotch viroid*,*

9,916 or more bundle of scions per 10,000 will be free from thrips (*Retithrips syriacus Scirtothrips dorsalis*)

9,916 or more bundles of scions per 10,000 will be free from armoured scales (*Aonidiella orientalis, Aulacaspis tubercularis*)

9,916 or more bundles of scions per 10,000 will be free from *Oligonychus perseae*

9,963 or more bundles of scions per 10,000 will be free from mealybugs and soft scales group B (*Maconelicoccus hirsutus, Pulvinaria psidii*)

9,991 or more bundles of scions per 10,000 will be free from *Euwallaceae fornicatus* and *Neocomospora euwallaceae*

9,991 or more bundles of scions per 10,000 will be free from mealybugs and soft scales group A (*Nipaecoccus viridis, Paracoccus marginatus, Pseudococcus cryptus, Icerya aegyptiaca, Milviscutulus mangiferae*)

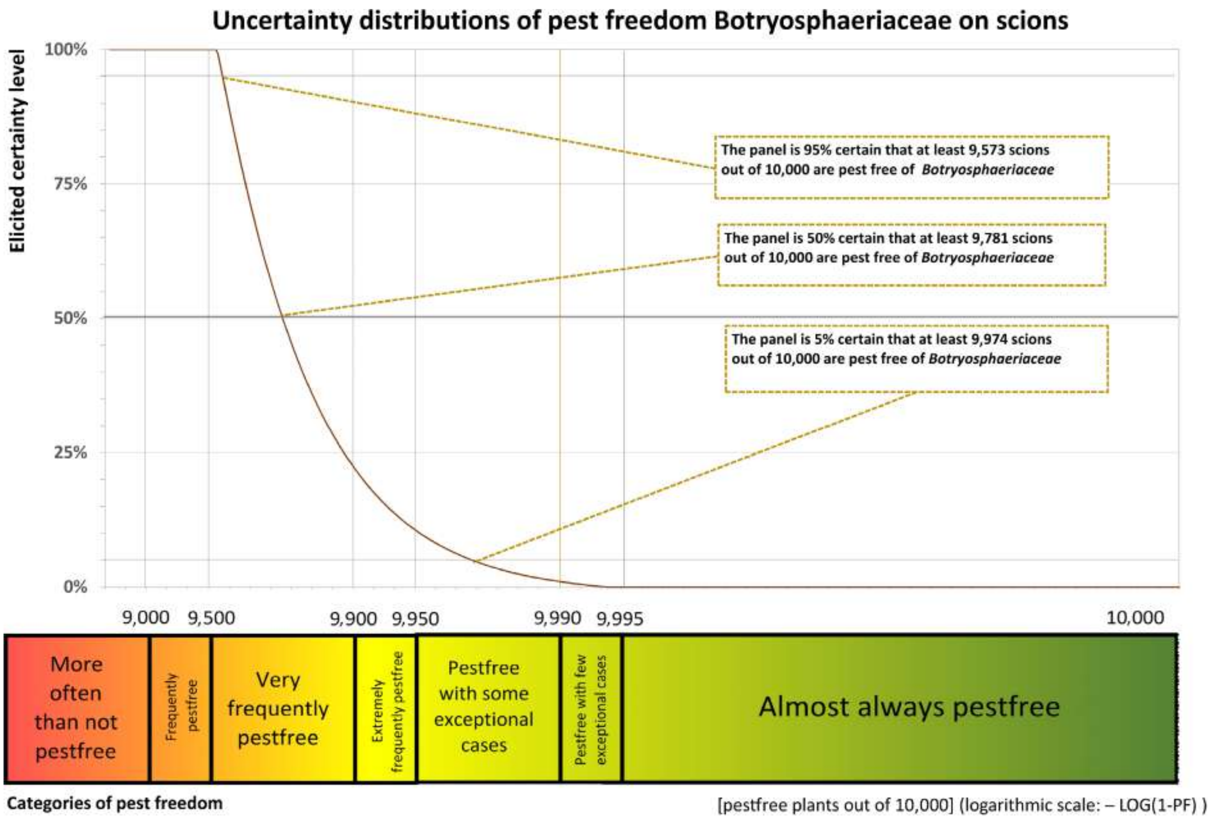


Figure 6: Explanation of the descending distribution function describing the likelihood of pest freedom after the evaluation of the currently proposed risk mitigation measures for bundles of scions designated for export to the EU based on the example of *Botryosphariaceae (L. pseudotheobromae, N. dimidiatum*)

5.4. Evaluation of the application of specific measures

Commission Implementing Regulation 2019/2072, Annex VII, Point 1 regarding growing medium attached to or associated with plants. Based on the information provided in the dossier, the use of new substrate consisting of a mixture of peat, fibre of *Cocos nucifera* and an inorganic filler (tuff or polystyrene) may fulfil the requirements specified in Annex VII, Item 1, (a) (ii). The requirements of (b) (i) are partially fulfilled in that the plants are physically isolated from the soil (see Table 7 for description of the implemented mitigation measures). The panel does not have sufficient information in the dossier or additional information to make any statement about hygiene measures and water quality for irrigation.

The Commission Implementing Regulation (EU) 2020/1201 specifies measures to prevent the introduction into and the spread within the Union of *Xylella fastidiosa* (Wells et al., 1987).

Specific measures regarding *X. fastidiosa* which are in place for the import of *P. americana* plants from Israel are specified in the Article 29 of the Commission Implementing Regulation (EU) 2020/1201. The Article 29 of the above Regulation allows introduction into the Union of host plants originating in a pest-free area of an infected country.

Based on the information provided in the dossier and in the reply by Israel to the clarification request sent by EFSA, the commodities under consideration (i.e. grafted plants and scions of P. americana) are declared to be produced in a pest-free area. This meets partly the requirements specified in point (a) and (b) of Commission Implementing Regulation (EU) 2020/1201. Details of the surveillance sampling scheme were not provided in the dossier. The national plant protection organisation of the Israel has communicated in writing to the Commission the name of that area. The relevant document can be found at the official website of the European Union in the section 'Declarations from non-EU countries concerning the status of *Xylella fastidiosa*' using the following link https://ec.europa.eu/food/sites/food/files/plant/docs/ph_biosec_decl_xylella_isr_20190703.pdf.

For other measures considered in point (a) and other points of the Implementing regulation, the Panel does not have sufficient information in the dossier or the additional information to make any statement. The panel is aware that the current implemented regulation was adopted after the initial dossier submission by Israel and the reply to the request for clarification by EFSA.

6. Conclusions

There are 26 pests potentially associated with *P. americana* in Israel and relevant for the EU i.e. *Aonidiella orientalis, Aulacaspis tubercularis,* avocado sunblotch viroid, *Bemisia tabaci* complex, *Colletotrichum aenigma, C alienum, C. fructicola, C. perseae, C. siamense, C. theobromicola, Euwallacea fornicatus, Neocomospora euwallaceae, Icerya aegyptiaca, Lasiodiplodia pseudotheobromae, Maconellicoccus hirsutus, Milviscutulus mangiferae, Neoscytalidium dimidiatum, Nipaecoccus viridis, Oligonychus perseae, Paracoccus marginatus, Penthimiola bella*, *Pseudococcus cryptus, Pulvinaria psidii, Retithrips syriacus, Scirtothrips dorsalis* and *Tetraleurodes perseae*.

For these pests, the likelihood of the pest freedom after the evaluation of the currently proposed risk mitigation measures relevant for the specific commodities (scions and grafted plants) of *P. americana* designated for export to the EU was estimated.

In some cases, given that some species showed similar biology or life-history traits and uncertainties regarding the use and association of the specified commodities, the Panel decided to group those species for the elicitations. This was the case for Botryosphaeriaceae fungi*, Colletotrichum* spp., bark beetle–fungi complex, the mealybugs and soft scales groups A and B, the armoured scales and the thrips. Moreover, given that there were two types of commodities with different characteristics and hence with different likelihoods for hosting certain pests i.e. grafted plants and scions, some pests were not considered to be associated with one of the commodities. For three pests (*Bemisia tabaci* complex, *Tetraleurodes perseae* and *Penthimiola bella*), scions were not considered to be a pathway because the lack of leaves (or the presence of small leaflets with no photosynthetic activity), and hence not considered in the elicitations for this commodity.

For avocado sunblotch viroid the likelihood of pest freedom for grafted plants following the evaluation of the proposed risk mitigation measures was estimated as 'pest free with some exceptional cases' with the 90% uncertainty range spanning from 'extremely frequently pest free' to 'pest free with few exceptional cases'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,912 and 10,000 grafted plants per 10,000 will be free of these pests. The likelihood of pest freedom for bundles of scions was as 'pest free with some exceptional cases' with the 90% uncertainty range spanning from 'extremely frequently pest free' to 'pest free with few exceptional cases'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,811 and 10,000 bundles of scions per 10,000 will be free of these pests.

For the Botryosphaeriaceae fungi *L. pseudotheobromae* and *N. dimidiatum,* the likelihood of pest freedom for grafted plants following the evaluation of the current risk mitigation measures was estimated as 'very frequently pest free' with the 90% uncertainty range reaching from 'very frequently pest free' to 'pest free with some exceptional cases'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,747 and 10,000 grafted plants per 10,000 will be free of these pests. The likelihood of pest freedom for grafted plants following the evaluation of the current risk mitigation measures was estimated as 'very frequently pest free' with the 90% uncertainty range reaching from 'very frequently pest free' to 'pest free with some exceptional cases'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,573 and 10,000 grafted plants per 10,000 will be free *L. pseudotheobromae* and *N. dimidiatum.*

For *Bemisia tabaci* complex, the likelihood of pest freedom for grafted plants following the evaluation of the proposed risk mitigation measures was estimated as 'very frequently pest free' with the 90% uncertainty range spanning from 'extremely pest free' to 'pest free with few exceptional cases'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,872 and 10,000 grafted plants per 10,000 will be free from *B. tabaci* complex.

For *Colletotrichum* spp. (*C. aenigma, C. alienum, C. fructicola, C. siamense, C. theobromicola and C. perseae*), the likelihood of pest freedom for grafted plants following the evaluation of the proposed risk mitigation measures was estimated as 'very frequently pest free' with the 90% uncertainty range spanning from 'very frequently pest free' to 'pest free with few exceptional cases'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,747 and 10,000 grafted plants per 10,000 will be free from *Colletotrichum* spp.. The likelihood of pest freedom for scions was estimated 'very frequently pest free' with the 90% uncertainty range spanning from 'very frequently pest free' to 'pest free with few exceptional cases'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,811 and 10,000 bundles of scions per 10,000 will be free from *Colletotrichum* spp.

For the bark beetle–fungi complex of *Euwallacea fornicatus* and *Neocomospora euwallaceae,* the likelihood of pest freedom for grafted plants following the evaluation of the current risk mitigation measures was estimated as 'pest free with some exceptional cases' with the 90% uncertainty range spanning from 'pest free with some exceptional case's to 'almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,953 and 10,000 grafted plants per 10,000 will be free of these pests. The likelihood of pest freedom for bundles of scions following the evaluation of the current risk mitigation measures was estimated as 'almost always pest free' with the 90% uncertainty range spanning from 'pest free with some exceptional cases' to 'almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,991 and 10,000 bundles of scions per 10,000 will be free of the bark beetle–fungi complex of *Euwallacea fornicatus* and *Neocomospora euwallaceae*.

For the mealybugs and soft scales group A i.e. *Icerya aegyptiaca, Nipaecoccus viridis, Paracoccus marginatus, Pseudococcus cryptus* and *Milviscutulus mangiferae,* the likelihood of pest freedom for grafted plants following the evaluation of the current risk mitigation measures was estimated as 'Pest free with few exceptional cases' with the 90% uncertainty range spanning from 'pest free with some exceptional cases' to 'almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,981 and 10,000 grafted plants per 10,000 will be free of these pests. The likelihood of pest freedom for bundles of scions following the evaluation of the current risk mitigation measures was estimated as 'pest free with few exceptional cases' with the 90% uncertainty range spanning from 'pest free with some exceptional cases' to 'almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,991 and 10,000 bundles of scions per 10,000 will be free of *Icerya aegyptiaca, Nipaecoccus viridis, Paracoccus marginatus, Pseudococcus cryptus* and *Milviscutulus mangiferae*.

For mealybugs and soft scales group B i.e. *Pulvinaria psidii* and *Maconellicoccus hirsutus,* the likelihood of pest freedom for grafted plants following the evaluation of the current risk mitigation measures was estimated as 'Pest free with some exceptional cases' with the 90% uncertainty range spanning from 'extremely frequently pest free' to 'pest free with few exceptional cases'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,981 and 10,000 grafted plants per 10,000 will be free of these pests. The likelihood of pest freedom for bundles of scions following the evaluation of the current risk mitigation measures was estimated as 'pest free with few exceptional cases' with the 90% uncertainty range spanning from 'pest free with some exceptional cases' to 'almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,981 and 10,000 bundles of scions per 10,000 will be free of *Pulvinaria psidii* and *Maconellicoccus hirsutus*.

For the armoured scales *Aonidiella orientalis* and *Aulacaspis tubercularis,* the likelihood of pest freedom for grafted plants following the evaluation of the current risk mitigation measures was estimated as 'extremely frequently pest free' with the 90% uncertainty range spanning from 'very frequently pest free' to 'pest free with some exceptional cases'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,827 and 10,000 grafted plants per 10,000 will be free of these pests. The likelihood of pest freedom for bundles of scions following the evaluation of the current risk mitigation measures was estimated as 'pest free with some exceptional cases' with the 90% uncertainty range spanning from 'extremely frequently pest free' to 'almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,916 and 10,000 grafted plants per 10,000 will be free of these pests.

For the thrips *Scirtothrips dorsalis* and *Retithrips syriacus* the likelihood of pest freedom for grafted plants following the evaluation of the current risk mitigation measures was estimated as 'very frequently pest free' with the 90% uncertainty range spanning from 'very frequently pest free' to 'pest free with some exceptional cases'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,761 and 10,000 grafted plants per 10,000 will be free of these pests. The likelihood of pest freedom for bundles of scions following the evaluation of the current risk mitigation measures was estimated as 'pest free with some exceptional cases' with the 90% uncertainty range spanning from 'extremely frequently pest free' to 'almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,916 and 10,000 grafted plants per 10,000 will be free of these pests.

For *Tetraleurodes perseae,* the likelihood of pest freedom for grafted plants following the evaluation of the current risk mitigation measures was estimated as 'pest free with some exceptional cases' with the 90% uncertainty range spanning from 'extremely frequently pest free' to 'pest free with few exceptional cases'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,921 and 10,000 grafted plants per 10,000 will be free of this pest.

For *Oligonychus perseae,* the likelihood of pest freedom for grafted plants following the evaluation of the current risk mitigation measures was estimated as 'extremely frequently pest free' with the 90% uncertainty range spanning from 'very frequently pest free' to 'almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,827 and 10,000 plants per 10,000 will be free of these pests. The likelihood of pest freedom for bundles of scions following the evaluation of the current risk mitigation measures was estimated as 'extremely frequently pest free' with the 90% uncertainty range spanning from 'very frequently pest free' to 'almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,916 and 10,000 plants per 10,000 will be free of these pests.

For *Penthimiola bella,* the likelihood of pest freedom for grafted plants following the evaluation of the current risk mitigation measures was estimated as 'extremely frequently pest free' with the 90% uncertainty range spanning from 'very frequently pest free' to 'pest free with few exceptional cases'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,827 and 10,000 plants per 10,000 will be free of these pests.

References

Alonso-Zarazaga MA, Barrios H, Borovec R, Bouchard P, Caldara R, Colonnelli E and Yunakov NN, 2017. Cooperative catalogue of palaearctic Coleoptera Curculionoidea. Monografías electrónicas SEA, 8.

Browne FG, 1961. The biology of Malayan Scolytidae and Platypodidae. The biology of Malayan Scolytidae and Platypodidae.

CABI (Centre for Agriculture and Bioscience International), online. CABI Crop Protection Compendium. Available online: https://www.cabi.org/cpc/

Costilla MA and Coronel NB, 1994. El taladrillo de la semilla del palto Pagiocerus fiorii Eggers, 1940 (Bostrichus frontalis Fabricius, 1801) (Coleoptera-Scolytidae). Rev. Ind. Agric. Tucumán, 71, 63–68.

Cox JM and Ben-Dov Y, 1986. Planococcine mealybugs of economic importance from the Mediterranean Basin and their distinction from a new African genus (Hemiptera: Pseudococcidae). Bulletin of Entomological Research, 76, 481–489.

EFSA PLH Panel (EFSA Panel on Plant Health), Jeger M, Bragard C, Caffier D, Candresse T, Chatzivassiliou E, Dehnen-Schmutz K and Gregoire J-C, 2018. Guidance on quantitative pest risk assessment. EFSA Journal 2018;16(8):5350, 86 pp. https://doi.org/10.2903/j.efsa.2018.5350

EFSA PLH Panel (EFSA Panel on Plant Health), 2019a. Guidance on commodity risk assessment for the evaluation of high risk plants dossiers. EFSA Journal 2019;17(4):5668, 20 pp. https://doi.org/10.2903/j.efsa.2019.5668

EFSA PLH Panel (EFSA Panel on Plant Health), 2019b. Commodity risk assessment of black pine (*Pinus thunbergii* Parl.) bonsai from Japan. EFSA Journal 2019;17(5):5667, 184 pp. https://doi.org/10.2903/j.efsa.2019.5668

EFSA PLH Panel (EFSA Panel on Plant Health), Bragard C, Dehnen-Schmutz K, Di Serio F, Gonthier P, Jacques MA and Milonas P, 2020. List of non-EU Scolytinae of coniferous hosts. EFSA Journal 2020;18(1):5933. https://doi.org/10.2903/j.efsa.2020.5933

EFSA Scientific Committee, 2018. Scientific Opinion on the principles and methods behind EFSA's Guidance on Uncertainty Analysis in Scientific Assessment. EFSA Journal 2018;16(1):5122, 235 pp. https://doi.org/10.2903/j.efsa.2018.5122 ISSN:1831-4732

EPPO (European and Mediterranean Plant Protection Organization), online. EPPO Global Database. Available online: https://www.eppo.int/ [Accessed: 26 November 2018].

EPPO (European and Mediterranean Plant Protection Organization), 2017. Report of a Pest Risk Analysis for Euwallacea fornicatus sensu lato and Fusarium euwallaceae.

EUROPHYT, online. European Union Notification System for Plant Health Interceptions - EUROPHYT. Available online: http://ec.europa.eu/food/plant/plant_health_biosecurity/europhyt/index_en.htm [Accessed: 14 January 2019].

FAO (Food and Agriculture Organization of the United Nations), 1995. ISPM (International standards for phytosanitary measures) No 4. Requirements for the establishment of pest free areas. Available online: https://www.ippc.int/en/publications/614/

FAO (Food and Agriculture Organization of the United Nations), 2012. ISPM (International standards for phytosanitary measures) No. 36. Integrated measures for plants for planting. FAO, Rome, 22 pp. Available online: https://www.ippc.int/en/publications/636/

FAO (Food and Agriculture Organization of the United Nations), 2017. ISPM (International standards for phytosanitary measures) No. 5. Glossary of phytosanitary terms. FAO, Rome. Available online: https://www.ippc.int/en/publications/622/

Kostovcik M, Bateman CC, Kolarik M, Stelinski LL, Jordal BH and Hulcr J, 2015. The ambrosia symbiosis is specific in some species and promiscuous in others: evidence from community pyrosequencing. The ISME Journal, 9, 126–138.

Kottek M, Grieser J, Beck C, Rudolf B and Rubel F, 2006. World map of Köppen- Geiger climate classification updated. Meteorologische Zeitschrift, 15, 259–263.
MacLeod A and Korycinska A, 2019. Detailing Köppen–Geiger climate zones at sub-national to continental scale: a resource for pest risk analysis. EPPO Bulletin, 49, 73–82.
Martínez AV, Moya KV and Herrera AG, 2011. Fluctuación Poblacional de los Trips (Insecta: Thysanoptera) Asociados al Cultivo de Aguacate (Persea americana Mill) en Santa Cruz de León Cortés, Costa Rica.
Sharma G, Maymon M and Freeman S, 2017. Epidemiology, pathology and identification of Colletotrichum including a novel species associated with avocado (Persea americana) anthracnose in Israel. Scientific Reports, 7, 15839. https://doi.org/10.1038/s41598-017-15946-w

Glossary

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

Abbreviations

APHIS	Animal and Plant Health Inspection Service
CABI	Centre for Agriculture and Bioscience International
CaCV	capsicum chlorosis virus
CLC	chilli leaf curl virus
EKE	Expert Knowledge Elicitation
EPPO	European and Mediterranean Plant Protection Organization

FAO	Food and Agriculture Organization
MSs	Member States
MYSV	melon yellow spot virus
PBNV	peanut necrosis virus
PCFV	peanut chlorotic fan virus
PLH	Plant Health
PPIS	Plant Protection and Inspection Services
PRA	Pest Risk Assessment
PSHB	Polyphagous Shot Hole Borer
PYSV	peanut yellow spot virus
RNQPs	Regulated Non-Quarantine Pests
TSV	tobacco streak virus
WsMoV	watermelon silver mottle virus

Appendix A – Datasheets of pests selected for further evaluation via Expert Knowledge Elicitation

A.1. Avocado sunblotch viroid (ASBVD0)

A.1.1. Organism information

<table>
<tr><td>Taxonomic information</td><td colspan="2">Current valid scientific name: Avocado sunblotch viroid
Synonyms: ASBVd, Avocado sunblotch avsunviroid, Avocado sunblotch viroid
Name used in the EU legislation:
Category: Viroids
Family: Avsunviroidae
Common name: sunblotch of avocado
Name used in the Dossier: Avocado sunblotch viroid</td></tr>
<tr><td>Group</td><td colspan="2">Virus and Viroids</td></tr>
<tr><td>EPPO code</td><td colspan="2">ASBVD0</td></tr>
<tr><td>Regulated status</td><td colspan="2">EU status: N/A
Non-EU: Morocco (Quarantine pest, 2018), Bahrain (A1 list, 2003), Jordan (A1 list, 2013), CAHFSA (A1 list, 1990) (EPPO, Online)</td></tr>
<tr><td>Pest status in Israel</td><td colspan="2">Present: Restricted distribution (EPPO, Online)
Present: No details (Dossier).</td></tr>
<tr><td>Pest status in the EU</td><td colspan="2">Present, no details (Spain) and few occurrences (Greece, Crete) (EPPO, Online)</td></tr>
<tr><td>Host status on Persea americana</td><td colspan="2">Persea americana is reported as the only natural host for ASBVd in the EPPO Global Database (EPPO, Online).</td></tr>
<tr><td>PRA information</td><td colspan="2">N/A</td></tr>
<tr><td colspan="3">Other relevant information for the assessment</td></tr>
<tr><td>Biology</td><td colspan="2">This viroid consists of a single-stranded circular RNA molecule of 247 nucleotides, replicating itself by using cell transcriptional machinery. It is dispersed by seeds and during grafting (Pérez et al., 2017).</td></tr>
<tr><td rowspan="3">Symptoms</td><td>Main type of symptoms</td><td>ASBVd causes irregular sunken areas of white, yellow or reddish colour on fruit, with sunken areas that can become necrotic.
It also induces discoloured streaks or stripes on the shoots and young branches.
Leaves show distorted/variegated areas.
Bark/branches with cracked appearance (also known as ‘alligator skin’).
Infected trees may render fruitless and remain stunted (although not common) (Saucedo Carabez et al., 2019).
Symptoms can vary depending on the cultivars, age of plants, environmental conditions, the variants of the viroid, concentration of the viroid in the tissue and type of predominant variant (ASBVd-B, ASBVd-V and ASBVd-Sc) (Pérez et al., 2017).
Symptom expression can be accelerated by incubating plants at high temperatures (30–32°C).</td></tr>
<tr><td>Presence of asymptomatic plants</td><td>Infected trees can be asymptomatic. In some cases, asymptomatic trees can develop symptoms under stress conditions (Saucedo Carabez et al., 2019). The yield of asymptomatic trees appears to be reduced by 15–30% (Geering, 2018).</td></tr>
<tr><td>Confusion with other pathogens/pests</td><td>N/A</td></tr>
<tr><td>Host plant range</td><td colspan="2">The natural host range of ASBVd is very narrow and restricted to avocado plants. Although it has also been experimentally transmitted to a few plant species of the family Lauraceae; i.e. Cinnamomum camphora, Cinnamomum zeylanicum, Persea schiedeana and Ocotea bullata (Saucedo Carabez et al., 2019).</td></tr>
</table>

Pathways	– Vegetative propagation material and trees (Pérez et al., 2017). – Artificial grafting and micrografting, and natural root grafting. – Pruning, harvesting and grafting contaminated tools. – Mechanically from leaves, petioles, stems and seeds of infected trees. – Exporting of asymptomatic fruits for consumption (Saucedo Carabez et al., 2019). – Pollen via bees (Desjardins et al., 1979).
Surveillance information	According to the information provided by the PPIS from Israel, it appears not to be restricted to a particular area but its occurrence is rare. Based on the Dossier, all plants for planting exported from Israel originate from nurseries are approved by PPIS and are under PPIS inspection • In nurseries that export trees, PPIS inspection is carried out every 45 days. • Further to the PPIS inspection, the producers carry out once a week regular comprehensive self-inspection. This inspection is performed by the nursery's agronomists and following PPIS inspector's instructions. The results are recorded in the nursery logbook and every adverse finding is reported immediately to the inspector. The logbook is regularly reviewed during the inspector visits to the site. • Whenever a harmful organism of interest is found at any production site, the grower is required to inform PPIS and to treat the site as appropriate. During consecutive inspections, if there is no further evidence to the presence of the pest, the PPIS considers the site of production to be free from this harmful organism. • Further diagnostic procedures may be performed according to requirements of the importing country and in the case of inspection findings that necessitate identification of a causative agent (Dossier, Section 5.3).

A.1.2. Possibility of pest presence in the nursery

A.1.2.1. Possibility of entry from the surrounding environment

The ASBVd occurrence in Israel is restricted. From the identification of ASBVd in Israel in 1964, its disease is under control by using certified disease-tested avocado mother trees (Spiegel et al., 1984), and the presence of ASBVd may be rare. Also, the natural host range of ASBVd is limited to avocado plants, with no other cultivated or wild plant species known as alternative hosts yet (Saucedo Carabez et al., 2019). Additionally, the dispersal range of ASBVd infection by natural processes is constrained, as no direct vector transmission is known. However, potential transmission of ASBVd by pollen has been reported with the use of bees, and although it was under experimental conditions (Desjardins et al., 1979), its potential transmission from close avocado field crops must be considered.

Uncertainties:

Pollen transmission of ASBVd has been reported by using bees in experimental conditions, and there might be a potential way to introduce inoculum from infected avocado crops.

Taking into consideration the above evidence and uncertainties, the Panel considers that the possibility of entry into the nursery infecting mother plants from surrounding avocado orchards is possible but highly unlikely.

A.1.2.2. Possibility of entry with new plants/seeds

Propagation material is coming from PPIS supervised and approved mother plants only. But, the occurrence of latent infections of ASBVd has been reported (Saucedo Carabez et al., 2019), and the presence asymptomatic trees (i.e. symptomless carriers) might contribute to unnoticed diseased material. The use of diseased propagative material (seeds and scions for grafting) may result in the spreading of this viroid (Desjardins et al., 1980). The avocado seeds from infected asymptomatic trees appear to be infected at very high frequency (80–100%), with the corresponding infected seedling plants showing no symptoms (Wallace and Drake, 1962).

Uncertainties:

- Seeds are certificated by the PPIS, but there is a lack of information related to this certification, which is required to provide in Section 3.3 of the Dossier. It is therefore unclear to what extent the seeds that are used to germinate the stocks and scions are viroid-free.

- It is uncertain to what extent the detection and sampling strategies are effective to detect latent infections or symptomless carriers.

Taking into consideration the above evidence and uncertainties, the Panel considers it may be possible that propagation material from symptomless carriers (with latent infections) can efficiently transmit ASBVd to seeds and to plants by graft through infected roots, buds and scions.

A.1.2.3. Possibility of spread within the nursery

Grafting practices could be the main pathway to spread this viroid within the nursery. This viroid can be isolated from leaves, petioles and stems of infected avocado trees (Marcos and Flores, 1990), and can also be efficiently transmitted mechanically from infected plants, and also from mother trees to progeny seed, as well as to plants through infected buds and scions by grafting (Wallace and Drake, 1962; Desjardins et al., 1980). A natural root graft transmission might be also expected among infected and healthy avocado trees (Semancik, 2003), but it seems to be very unlikely within a nursery. Despite there are three ASBVd variants (B, V and Sc) described, which have been characterised to vary in the nucleotide sequence and symptom expressions (Semancik and Szychowski 1994), when symptoms of ASBVd infection are expressed, it is easily recognisable by the sunken, and the longitudinal scars that appear on the fruit surface. However, as mentioned before, latent infections (symptomless carriers) may be present in the nursery and go unnoticed. Therefore, the use of asymptomatic plant material, as well as contaminated tools during grafting and pruning process may contribute to the infection spread, as ASBVd has also been reported to be transmitted by sap inoculation and razor slashing (Allen et al., 1981).

Uncertainties:

- Latent infection is a major issue for this viroid, and based on the information that we have from the Dossier (p. 14), it is uncertain to what extent the sampling inspections (1 sample per 10 dunam) are feasible to detect asymptomatic plants.
- It is unknown whether any preventive measures are carried out during both grafting and pruning processes to ensure the control of ASBVd within the nursery.

Taking into consideration the above evidence and uncertainties, the Panel considers that the spread of the pathogen within the nursery might be possible with the unnoticed symptom expressions.

A.1.3. Information from interceptions

Considering imports of *P. americana* plants from Israel to the EU, between 1995 and 2020, there are no records of interceptions of avocado sunblotch viroid (ASBVd) (EUROPHYT, online, [Accessed: 12/3/2020]).

A.1.4. Evaluation of the risk mitigation measures

All risk mitigation measures currently applied in Israel and an indication of their effectiveness on ASBVd is provided (Table 6). Evaluation and uncertainties of those that are applicable to this pest species are described below.

No.	Risk mitigation measures	Effect on pathogen	Evaluation and uncertainties for grafted plants	Evaluation and uncertainties for scions
5	Surveillance and monitoring • All plants for planting exported from Israel originate from nurseries that are approved by PPIS and are under PPIS inspection. • In nurseries that export trees, PPIS inspection is carried out every 45 days. • Further to the PPIS inspection, the producers carry out regular comprehensive self-inspections, once	Yes	1 – Surveillance and monitoring activities of the avocado plants are accordingly addressed by the PPIS. Uncertainties: All avocado cultivars have been reported to be susceptible to this disease, but symptom expressions may vary in infected trees, in addition to the presence of symptomless	Idem

No.	Risk mitigation measures	Effect on pathogen	Evaluation and uncertainties for grafted plants	Evaluation and uncertainties for scions
	a week. This inspection is performed by the nurseries agronomists and according to the PPIS inspector's instructions. The results are recorded in the nursery logbook and every adverse finding is reported immediately to the inspector. The logbook is regularly reviewed during the inspector visits to the site. • Whenever a harmful organism of interest is found at any production site, the grower is required to inform PPIS and to treat the site as appropriate. During consecutive inspections, if there is no further evidence to the presence of the pest, the PPIS considers the site of production to be free from this harmful organism. • Instructions for detection of avocado sunblotch viroid in avocado plants. • All avocado plants for planting exported from Israel originate from nurseries that are approved by PPIS and are under PPIS inspection Instructions for sampling avocado for detection of Avocado Sunblotch Viroid (ASBV): One sample is taken per 10 dunam. During spring–summer, a sample is to be taken from 5 trees, 3 leaves each (15 total). During fall and winter, 1 sample is taken from 5 trees along with sampling of trichomes from the soil. In the case of symptoms in the orchard, the whole orchard should be sampled: each sample taken from 3 trees, 5 leaves each. During the cold season, roots should be sampled instead of leaves. • Detection of the viroid is done by RT-PCR and real-time RT-PCR. 1) Regular monitoring of the production sites by the grower – at least twice a week.		carriers. Therefore, the unnoticed presence of this viroid during the inspections, with further use of contaminated tools during grafting and pruning process may contribute to the infection spread of ASBVd. 2 – All avocado plants for planting exported from Israel that are originated from nurseries are approved by PPIS and are under PPIS inspection. It would have been convenient to complete Section 3.3 of the Dossier, supporting specifically what type of certification is used to ensure that plants are grown from seeds free of ASBVd. <u>Uncertainties:</u> ASBVd can be transmitted by sap-contaminated cutting tools, and it is unclear the cleaning procedure that is implemented to prevent potential infections. 3 – The molecular detection of this viroid by RT-PCR is methodologically appropriated. <u>Uncertainties:</u> It is hard to think that sampling 5 trees out of 80,000–120,000 tress (0.04–0.06%) is above the threshold of detection. Additionally, it seems that all leaves from one survey are processed together, and this might even provide a dilution effect on the viroid load, reducing the chance to be detected. 4 – It is uncertain to what extent the survey inspections and monitoring procedure are able to ensure the absence of the ASBVd from asymptomatic carriers	

A.1.5. Overall likelihood of pest freedom

A.1.5.1. Reasoning for a scenario which would lead to a reasonably low number of infested consignments

- Inspections and surveillance are effective to detect the viroid.
- Symptoms are rapidly developed which helps its detection.

- Appropriate use of tools (cultivating/grafting) prevents the spread of the viroid.
- Mother plants are viroid-free.
- Pollinators in the orchard are not vectors of the viroid, so mother trees are not easily infected.
- Low prevalence in the avocado nurseries.
- Certification of PPIS ensures viroid-free planting material.

A.1.5.2. Reasoning for a scenario which would lead to a reasonably high number of infested consignments

- Inspection and surveillance fail to detect infections due to low number of sampling.
- Plants do not develop rapidly symptoms and many asymptomatic plants are present.
- Poor managing and pruning practices contribute to the spread of the disease.
- Latent infections in mother material that remain undetected result in rooted and scions that are carrying the pathogen.
- Pollinators contribute to the spread of the viroid among mother trees.
- High prevalence of viroid in avocado production areas.
- Certification of PPIS does not include viroid-free certification.

A.1.5.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infested consignments (Median)

The value of the median is based on:

- The viroid is restricted in Israel.
- The host range is limited.
- Low chance of mother plants being asymptomatic.

A.1.5.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

The main uncertainties are the effectivity of the sampling method and the ability of pollinators to spread the viroid.

A.1.5.5. Elicitation outcomes of the assessment of the pest freedom for avocado sunblotch viroid

The following tables show the elicited and fitted values for pest infestation/infection (Table A.1) and pest freedom (Table A.2).

Table A.1: Elicited and fitted values of the uncertainty distribution of pest infestation by avocado sunblotch viroid per 10,000 grafted plants/bundles of scions

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0.00					20.0		40.0		60.0					100
EKE	1.47	3.06	5.35	9.44	14.50	20.5	26.5	39.0	52.9	60.8	70.0	79.2	88.2	94.6	100

The EKE results are *BetaGeneral (1.2604, 2.0485, 0, 110)* fitted with @Risk version 7.6.

Based on the numbers of estimated infested plants, the pest freedom was calculated (i.e. = 10,000 – the number of infested grafted plants/bundles of scions per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.2.

Table A.2: The uncertainty distribution of plants free of avocado sunblotch viroid per 10,000 grafted plants/bundles of scions calculated by Table A.1

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,900					9,940		9,960		9,980					10,000
EKE results	9,900	9,905	9,912	9,921	9,930	9,939	9,947	9,961	9,973	9,979	9,985	9,990.6	9,994.7	9,996.9	9,998.5

The EKE results are the fitted values.

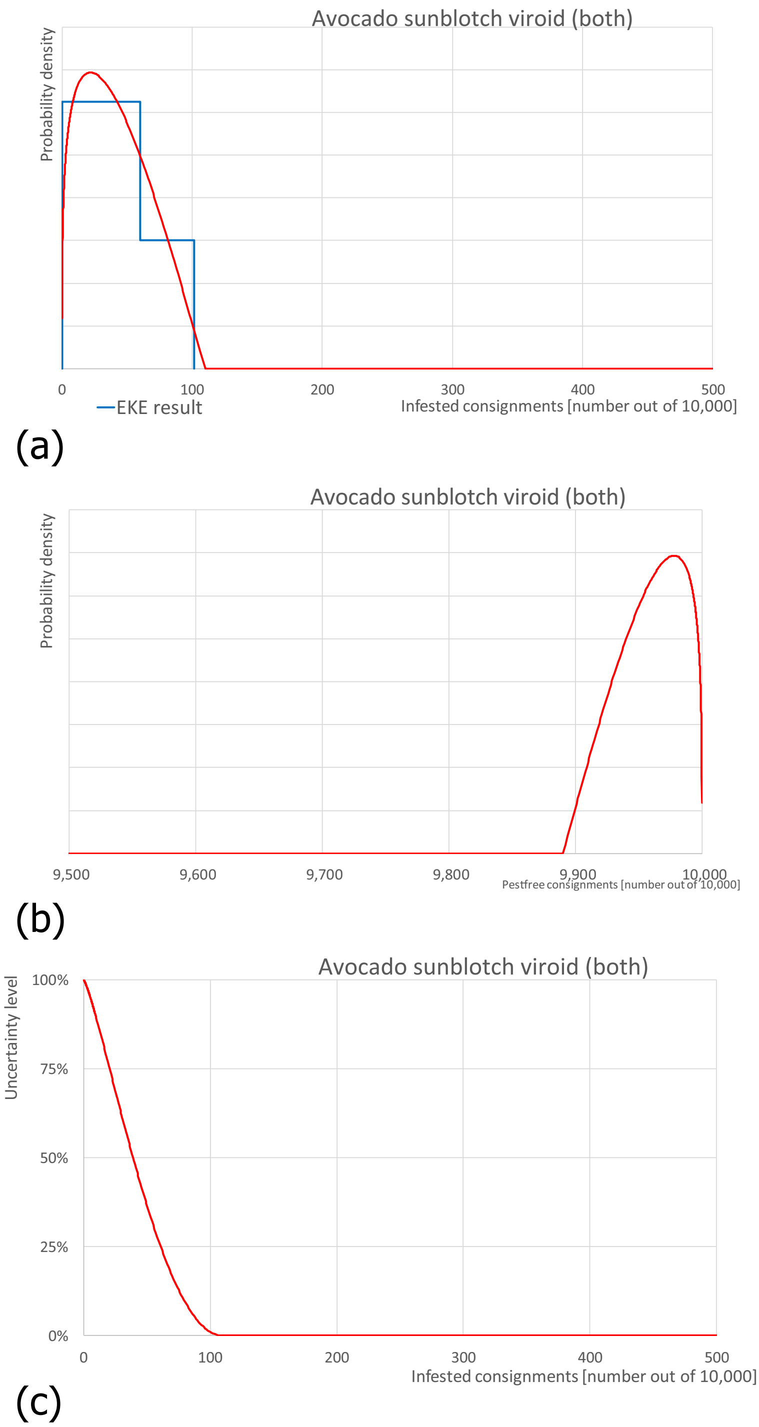


Figure A.1: (a) Elicited uncertainty of pest infestation per 10,000 grafted plants/bundles of scions for avocado sunblotch viroid (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free grafted plants/bundles of scions per 10,000 (i.e. =1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 grafted plants/bundles of scions

A.1.6. Reference list

Allen RN and Dale JL, 1981. Application of rapid biochemical methods for detecting avocado sunblotch disease. Annals of Applied Biology, 98, 451.

Desjardins PR, Saski PJ and Drake RJ, 1987. Chemical inactivation of avocado sunblotch viroid on pruning and propagation tools. California Avocado Society Yearbook, 71, 259–262.

Desjardins PR, Drake RJ and Swiecki SA, 1980. Infectivity studies of avocado sunblotch disease causal agent, possibly a viroid rather than a virus. Plant Disease, 64, 313–315.

Desjardins P, Drake R, Atkins E and Bergh B, 1979. Pollen transmission of avocado sunblotch virus experimentally demonstrated. California Agriculture, 33, 14.

EPPO (European and Mediterranean Plant Protection Organization), online. EPPO Global Database, Avocado sunblotch viroid datasheet, Available online: https://gd.eppo.int/taxon/ASBVD0 [Accessed: 20 April 2020]

Geering AD, 2018. A review of the status of Avocado sunblotch viroid in Australia. Australasian Plant Pathology, 47, 555–559.

Marcos J and Flores R, 1990. Subcellular localization of Avocado sunblotch viroid in avocado leaves. Plant Sciences, 67, 237–244. https://doi.org/10.1016/0168-9452(90)90248-M

Pérez MRV, Ortiz DT, Almaraz RDLT, Martinez JOL and Ángel DN, 2017. Avocado sunblotch viroid: Pest risk and potential impact in México. Crop Protection, 99, 118–127.

Saucedo Carabez JR, Téliz Ortiz D, Vallejo Pérez MR and Beltrán Peña H, 2019. The Avocado Sunblotch Viroid: An Invisible Foe of Avocado. Viruses, 11, 491.

Semancik JS, 2003. Avocado viroids: Avocado Sunblotch viroid. In: Hadidi A, Flores R, Randles JW and Semancik JS (eds.). The Viroids. CSIRO Publishing: Melbourne, Australia, pp. 171–177.

Semancik JS and SzychowskiJA, 1994. Avocado sunblotch disease a persistent viroid infection in which variants are associated with di_erential symptoms. Journal of Genetics Virology, 75, 1543–1549.

Spiegel S, Alper M and Allen RN, 1984. Evaluation of biochemical methods for the diagnosis of the avocado sunblotch viroid in Israel. Phytoparasitica, 12, 37–43.

Wallace JM and Drake RJ, 1962. The high rate of seed transmission of avocado sun-blotch virus from symptomless trees and the origin of such trees. Phytopathology, 52, 237–241.

A.2. *Colletotrichum* spp. (anthracnose pathogens): *C. aenigma, C. alienum, C. fructicola, C. siamense, C. theobromicola* and *C. perseae*

A.2.1. Organism information

Taxonomic information	**1. *Colletotrichum aenigma*** Current valid scientific name: *Colletotrichum aenigma* B.S. Weir & P.R. Johnst. 2012 Synonyms: *Colletotrichum populi* C.M. Tian & Z. Li 2012 (USDA Fungal Database) Name used in the EU legislation: N/A Name used in the Dossier: N/A EPPO Code: COLLAE **2. *Colletotrichum alienum*** Current valid scientific name: *Colletotrichum alienum* B. Weir & P.R. Johnst. 2012 Synonyms: N/A Name used in the EU legislation: N/A Name used in the Dossier: N/A EPPO Code: COLLAI **3. *Colletotrichum fructicola*** Current valid name: *Colletotrichum fructicola* Prihast., L. Cai & K.D. Hyde. 2009 Synonyms: *Colletotrichum ignotum* E.I. Rojas, S. A. Rehner & Samuels, 2010; *Glomerella cingulata* var. *minor* Wollenw., 1949 (USDA Fungal Database) Name used in the EU legislation: N/A Name used in the Dossier: N/A EPPO Code: COLLFC **4. *Colletotrichum siamense*** Current valid scientific name: *Colletotrichum siamense* Prihastuti, L. Cai & K.D. Hyde 2009 Synonyms: *Colletotrichum communis* G. Sharma, A.K. Pinnaka & B.D. Shenoy 2014, *Colletotrichum dianesei* N.B. Lima, M.P.S. Câmara & S.J. Michereff 2013, *Colletotrichum endomangiferae* W.A.S. Vieira, M.P.S. Camara & S.J. Michereff 2014, *Colletotrichum*

	hymenocallidis Y.L. Yang, Zuo Y. Liu, K.D. Hyde & L. Cai 2009, *Colletotrichum jasmini-sambac*Wikee, K.D. Hyde, L. Cai & McKenzie 2011, *Colletotrichum melanocaulon* V. Doyle, P.V. Oudem & S.A. Rehner 2013 (USDA Fungal Database) Name used in the EU legislation: N/A Name used in the Dossier: N/A EPPO Code: N/A **5. *Colletotrichum theobromicola*** Current valid scientific name: *Colletotrichum theobromicola* Delacr. 1905 Synonyms: *Colletotrichum theobromicolum* Delacr. 1905, *Colletotrichum fragariae* A.N. Brooks 1931, *Colletotrichum gloeosporioides* f. stylosanthis Munaut 2002 (USDA Fungal Database) Name used in the EU legislation: N/A Name used in the Dossier: N/A EPPO Code: COLLTH **6. *Colletotrichum perseae*** Current valid scientific name: *Colletotrichum perseae* G. Sharma & S. Freeman (Index Fungorum) Synonyms: N/A Name used in the EU legislation: N/A Name used in the Dossier: N/A EPPO Code: N/A These have previously been classified as Colletotrichum gloeosporoides.	
Group	Fungi	
Regulated status	**EU status:** N/A **Non-EU:** N/A	
Pest status in Israel	*C. aenigma, C. alienum, C. fructicola, C. siamense, C. theobromicola and C. perseae* have been reported from avocado in Israel (Sharma et al., 2017).	
Pest status in the EU	*C. aenigma* has been reported in Italy from: *Pyrus communis, Citrus sinensis* and *Olea europaea* (Schena et al., 2014). *C. alienum* has been reported from *Protea cynaroides* and *Leucadendron* sp., cv. 'High Gold' in Portugal (Liu et al., 2013). *C. fructicola* has been reported in Italy from *P. americana* (Guarnaccia et al., 2016). *C. siamense, C. theobromicola, C. perseae* are not present in the EU (CABI CPC, USDA Fungal Database).	
Host status on *Persea americana*	*C. aenigma, C. alienum, C. fructicola, C. siamense, C. theobromicola* and *C. persea* have been isolated from *P. americana* in Israel and they are identified as avocado anthracnose pathogens (Sharma et al., 2017).	
PRA information	Pest Risk Assessment on *Colletotrichum spp*. has been conducted by the Australian Government (Department of Agriculture, Water and the Environment) in strawberries imported from Japan. According to this PRA, *Colletotrichum spp*. are dispersed through asexual conidiospores which are produced on diseased plant tissue and dead leaves, but they can also produce ascospores through sexual production. Conidia and ascospores can be dispersed through rain drops, wind-blown rain, wind or insects. Infected nursery stock, contaminated soil and fruits are the main pathways. Moreover, *Colletotrichum spp*. can be distributed through asymptomatic hosts (mainly fruits) and can survive in the soil for a long period (80 days during summer, 120 days during winter). *C. aenigma* mycelium can grow between 10°C and 36°C with an optimum of 28°C. *Colletotrichum spp.* development, sporulation and spread are favoured by warm, wet weather with an optimum temperature of 27°C. They can remain dormant in fruits and leaves, without causing any symptoms (quiescent period) (De Silva et al., 2017).	
Other relevant information for the assessment		
Symptoms	**Main type of symptoms**	Anthracnose symptoms can develop on flowers, stems, fruits, leaves and twigs. Leaves • Spots (from yellowish to brown discolorations) • Necrosis across or between leaf veins and at leaf tips

		• Drop of leaves prematurely • Dead or unhealthy Shoots • Brown or purplish lesions • Dieback Flowers • Turn dark and die Fruits • Before harvest: Black lesions around lenticels (less than 5 mm) on the peel of young fruits which may result in reduced fruit quality and fruit drop (Marais, 2004) • Stem end rot • After harvest: Larger, blacker and increasingly sunken lesions • Pink spores on the surface • Drop of fruits prematurely, reduced fruit quality and shelf life (CABI, UC IPM, Marais, 2004)
	Presence of asymptomatic plants	Quiescent infections can occur in fruits and leaves. The fungus infects young fruits but enters a dormant phase until fruit maturity (Marais, 2004).
	Confusion with other pathogens/pests	*Dothiorella aromatica* (Sacc) Petr & Syd. (Marais, 2004).
Host plant range	*Colletotrichum aenigma* has been previously reported from *Pyrus communis, Citrus sinensis* (Italy) and *Pyrus pyrifolia* (Japan) strawberry, citrus, chili, avocado, dragon fruit, Asian pear, tara vine (China), grapevine, tea, olives and apple (Fu et al., 2019; Han et al., 2016; Schena et al. 2014; Schena et al., 2017; Velho et al., 2019; Wang et al., 2016; Weir et al., 2012; Yan et al., 2015); *C. alienum* from *Malus domestica* (New Zealand) (Sharma et al., 2017); *C. fructicola* from *Malus domestica* (Brazil, USA), *Fragaria sp*. (Canada, USA), *Limonium sp.* (Israel), *Pyrus pyrifolia* (Japan), *Dioscorea alata* (Nigeria), *Theobroma cacao* (Panama), *Coffea arabica* (Thailand), *Mangifera indica, Capsicum sp.* (India); *Persea americana* (Italy) (Guarnaccia et al., 2016; Jayawardena et al., 2016; Munir et al., 2016; Prihastuti et al. 2009; Sharma et al., 2014; Weir et al., 2012); *C. gloeosporioides* from *Citrus sp.* (Italy, New Zealand, USA), *Mangifera indica* (South Africa, India), *Carya illinoinensis* (Australia), *Ficus sp.* (New Zealand), *Vitis vinifera, Pueraria lobata* (USA) (Sharma et al., 2017); *C. siamense* from *Hymenocallis americana* (China), *Jasminum sambac* (Vietnam), *Carica papaya* (South Africa), *Dioscorea rotundata* (Nigeria), *Malus domestica*, *Vitis vinifera*, *Fragaria sp*. (USA), *Capsicum sp*., *Mangifera indica* (India, Thailand) (De Silva et al., 2019; Sharma et al., 2017; Weir et al., 2012; Wikee et al., 2011) and; *C. theobromicola* from *Acca sellowiana* (New Zealand), *Theobroma cacao* (Panama), *Olea europaea, Coffea arabica*, *Stylosanthes sp*. (Australia), *Annona diversifolia* (Mexico), *Mangifera indica* (Colombia, India), *Limonium sp*., *Cyclamen persicum* (Israel), *Fragaria sp*., and *Quercus sp.* (USA) (Pardo-De la Hoz et al., 2016; Rojas et al., 2010; Sharna et al., 2017; Weir et al., 2012).	
Pathways	• Infected nursery stock, contaminated soil/substrate and fruits are the main pathways (PRA by the Australian Government). • The pathogen can be dispersed through spores on dead twigs, leaves and mummified fruit (Marais, 2004). • Rain and humidity facilitate the spore production and dispersal (Marais, 2004). • According to Sharma et al. *(2017), Colletotrichum* isolates can be found on fruits, fresh and dry leaves and twigs of avocado. • The pathogen can over-winter mainly on fresh/dry leaves and on fresh twigs.	
Surveillance information	According to the information provided by the PPIS by Israel (Section 5.3, Dossier): • All plants for planting exported from Israel originate from nurseries that are approved by PPIS and are under PPIS inspection.	

	• In nurseries that export trees, PPIS inspection is carried out every 45 days. • Further to the PPIS inspection, the producers carry out regular comprehensive self-inspections, once a week. This inspection is performed by the nurseries agronomists and according to the PPIS inspector's instructions. The results are recorded in the nursery logbook and every adverse finding is reported immediately to the inspector. The logbook is regularly reviewed during the inspector visits to the site. • Whenever a harmful organism of interest is found at any production site, the grower is required to inform PPIS and to treat the site as appropriate. During consecutive inspections, if there is no further evidence to the presence of the pest, the PPIS considers the site of production to be free from this harmful organism. • Further diagnostic procedures may be performed according to requirements of the importing country and in the case of inspection findings that necessitate identification of a causative agent. • Root samples with attached soil are tested once during the active growth for nematodes, although no such problem has been reported in avocado in Israel.

A.2.2. Possibility of pest presence in the nursery

A.2.2.1. Possibility of entry from the surrounding environment

In addition to *P. americana*, *Colletotrichum* spp. have a wide host range. Both *C. siamense* and *C. theobromicola*, e.g. can infect a large number of plants, including fruits, vegetables and ornamentals (Weir, 2012; Meng et al., 2019). The major source of inoculum is from infected plant material, which can be leaves, twigs and fruit of the affected plant species. While splash dispersal from rain or irrigation water is required to dislodge the conidia from the acervuli of the fungus, subsequent drying of the water droplets can lead to air-borne inoculum, which can be further dispersed via wind. Therefore, the presence of host species in the environment of the nurseries with *P. americana* plants is an important factor for the possible migration of inoculum into the nursery.

<u>Uncertainties:</u>

In the dossier, there is no information concerning the types of plants that surround the nursery, and if any of them can be hosts of the relevant *Colletotrichum* species. In the answers provided by Israel to the questions raised by the working group (section 6 and 7 of the dossier), it is stated that in a radius of 2 km of the avocado nurseries, avocado, banana, citrus and field crops are grown. The natural vegetation includes diverse native plants as well as ornamental trees and bushes. A few hundreds of various urban trees are also present within a radius of 2 km from the avocado nursery. The minimal distance of the avocado nurseries of avocado for export and the nearest natural areas is approximately 100–200 m.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for the pest/pathogen to enter the nursery from the surrounding area. The pest/pathogens can be present in the surrounding areas and the transferring rate could be enhanced by suitable environmental conditions, including plant debris and irrigation practices.

A.2.2.2. Possibility of entry with new plants/seeds

The source of the planting material to produce *P. americana* scions for export is from approved mother plants in a PPIS-supervised nursery.

Rootstocks are plants of *P. americana* grown from seed from a PPIS-approved source; therefore, entry via this pathway is highly unlikely.

The plants are grown in a substrate consisting of coconut fibre, peat, tuff and polystyrene; therefore, entry with soil is unlikely.

<u>Uncertainties:</u>

Many *Colletotrichum* species can have extended hemibiotrophic or quiescent phases of their life cycles in asymptomatic plants (De Silva et al., 2017). Latent infections might be present in the scions if Colletotrichum sp. is undetectable in the mother plants due to an extended quiescent phase.

Taking the above evidence and uncertainties into consideration, the Panel considers it is possible but not very likely that the pathogen could enter the nursery with new plants/seeds (via scions with latent infections).

A.2.2.3. Possibility of spread within the nursery

If *Colletotrichum* spp. are present within the nursery, it can spread to other plants via conidia. Conidia are disseminated from infected plants by rain splash or wind onto healthy leaves, young fruits or blossoms (De Silva et al., 2017). The fungi continue to produce conidia throughout the season resulting in a polycyclic disease cycle and further spread of the disease within the nursery. The fungi overwinter in plant tissue or on plant debris in the soil. If the sexual stage of the *Colletotrichum* spp. occurs, perithecia are formed, which can act as overwintering structures and source of inoculum. Planting of contaminated seeds or plants of other plant species in the nursery may also contribute to the spread of the disease. The use of scions with dormant infections for grafting may contribute to the spread within the nursery. Contamination of grafting tools with spores may also contribute to the spread of disease.

Many *Colletotrichum* species can have extended hemibiotrophic or quiescent phases of their life cycles in asymptomatic plants, which can be overlooked by visual inspections and lead to an unintentional spread of the disease. (De Silva et al., 2017).

Uncertainties:

There is uncertainty of the length of a possible dormant phase of the *Colletotrichum* species and whether this will lead to undetected presence of *Colletotrichum* species in the exported plants and scions despite the regular inspections.

The *Colletotrichum* species have a wide host range. In the dossier, there is no information on whether other host plant species are present within the nursery from which the *Colletotrichum* spp. could potentially spread to the *P. americana* plants. However, in the answers provided by Israel to the questions raised by the working group (section 6 and 7 of the dossier), it is stated that papaya, mango, blueberry and kiwi are grown within the nurseries. Other fruit tree species grow in separate areas to those of the avocado for export, and are grown in tunnel greenhouses and nethouses and distances between them and the avocado cultivation areas are between 20 and 100s of metres.

Taking the above evidence and uncertainties into consideration, the Panel considers it is highly likely that the pathogen could spread within the nursery.

A.2.3. Information from interceptions

Considering imports of *P. americana* plants from Israel to the EU, between 1995 and 2020, there are no records of interceptions of Colletotrichum spp. (EUROPHYT, online, Accessed: 9/3/2020).

A.2.4. Evaluation of the risk mitigation options

No.	Risk mitigation measure	Effect on pest or pathogen	Evaluation and uncertainties on scions	Evaluation and uncertainties on grafted plants
1	Registration of production sites	Yes	No uncertainties	No uncertainties
2	Selection of seeds for stocks	Yes	NA	Uncertainties: Due to the potential dormant phase of *Colletotrichum* spp., the visual inspection might be insufficient.
3	Disinfestation of seeds	Yes	NA	No uncertainties
4	Disinfestation of scions	Yes	Fungicide treatment may not be sufficient to remove quiescent infections.	Idem
5	Surveillance and monitoring	Yes	Due to the potential dormant phase of	Idem

No.	Risk mitigation measure	Effect on pest or pathogen	Evaluation and uncertainties on scions	Evaluation and uncertainties on grafted plants
			Colletotrichum spp., the visual inspection might be insufficient.	
6	Growing conditions	Yes	No uncertainties	No uncertainties
7	Scions selection	Yes	Uncertainties: Due to the potential dormant phase of *Colletotrichum* spp., the visual inspection might be insufficient.	Idem
9	Fungicide treatments Fungicide application: • Captan • General fungi, including Fusarium sp. (e.g. Fusarium pallidoroseum) • Pyraclostrobin and Boscalid • Cyprodinil and Fludioxonil • Thiophanate-methyl • Potassium phosphite	Yes	Some fungal pathogens can develop resistance to different fungicides, and the risk of fungicide resistance can vary according to the compounds (FRAC, 2020): Captan low risk of developing resistance; Pyraclostrobin is high risk; Boscalid is medium to high risk; Cyprodinil is medium risk; Fludioxinil low to medium risk; Thiophanate-methyl is high risk; Potassium phosphite has poorly documented effect on this group of pathogens, and is generally effective only to oomycetes. Contact fungicides may have difficulties in controlling latent infections.	Idem
12	Storage rooms condition The harvested scions are treated with suitable fungicides and stored in chilled storage rooms at a temperature of 2°C and 70% humidity	Yes	Uncertainty: The effect on latent or endophytic presence is unclear.	Idem

A.2.5. Overall likelihood of pest freedom for grafted plants and scions

A.2.5.1. Reasoning for a scenario which would lead to a reasonably low number of infested consignments

Under this scenario, it is expected that there are no host plants present in the surroundings, there are no wild host plants or alternative hosts other than *P. americana* plants in the nursery/production areas, the use of dripping irrigation prevents and reduces the potential spread of fungal spores, there is a proper and effective application of fungicides to control fungal diseases; visual inspections of mother plants, seeds and scions are effective in detecting and discarding infected materials and latent infections are rare (with cuttings and grafted plants showing symptoms of infection if present).

A.2.5.2. Reasoning for a scenario which would lead to a reasonably high number of infested consignments

Under this scenario, there abundant host plants for *Colletotrichum* species in the surroundings including wild hosts for *Colletotrichum* in the natural vegetation; moreover, there are different host plants for *Colletotrichum* species in the nursery/production area; the use of overhead irrigation within and outside nurseries favours the spread of the fungal spores; the application of fungicides is not appropriate and timely used to control fungal diseases; visual inspections of mother plants, seeds and scions are not effective in detecting and discarding material and latent infections occur because either cuttings are taken when the pathogens are in dormant phase or infected plants do not show any symptom.

A.2.5.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infested consignments (Median)

Regarding the uncertainties on the pest pressure outside the nursery and the likelihood of introduction into the nursery by natural factors and human activity, the information on infections of these species on avocado plants, the absence of reported problems within the nursery and at EU borders, the Panel assumes a scenario in which infestations if occur would be below the estimated median value.

A.2.5.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

The main uncertainty is the presence of latent infections.

A.2.5.5. Elicitation outcomes of the assessment of the pest freedom for *Colletotrichum* species

The following tables show the elicited and fitted values for pest infestation/infection (Tables A.3 and A.5) and pest freedom (Tables A.4 and A.6).

Table A.3: Elicited and fitted values of the uncertainty distribution of pest infestation by *Colletotrichum species* per 10,000 grafted plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	10.0					60.0		100		170					300
EKE	11.0	14.6	19.8	29.5	41.8	56.8	72.1	105	143	166	194	223	253	276	298

The EKE results are *BetaGeneral (1.2112, 2.598, 7.9, 350)* fitted with @Risk version 7.6.

Based on the numbers of estimated infested grafted plants, the pest freedom was calculated (i.e. = 10,000 – the number of infested grafted plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.2.

Table A.4: The uncertainty distribution of plants free of *Colletotrichum species* per 10,000 grafted plants calculated by Table A.3

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,700					9,830		9,900		9,940					9,990
EKE results	9,702	9,724	9,747	9,777	9,806	9,834	9,857	9,895	9,928	9,943	9,958	9,970	9,980	9,985	9,989

The EKE results are the fitted values.

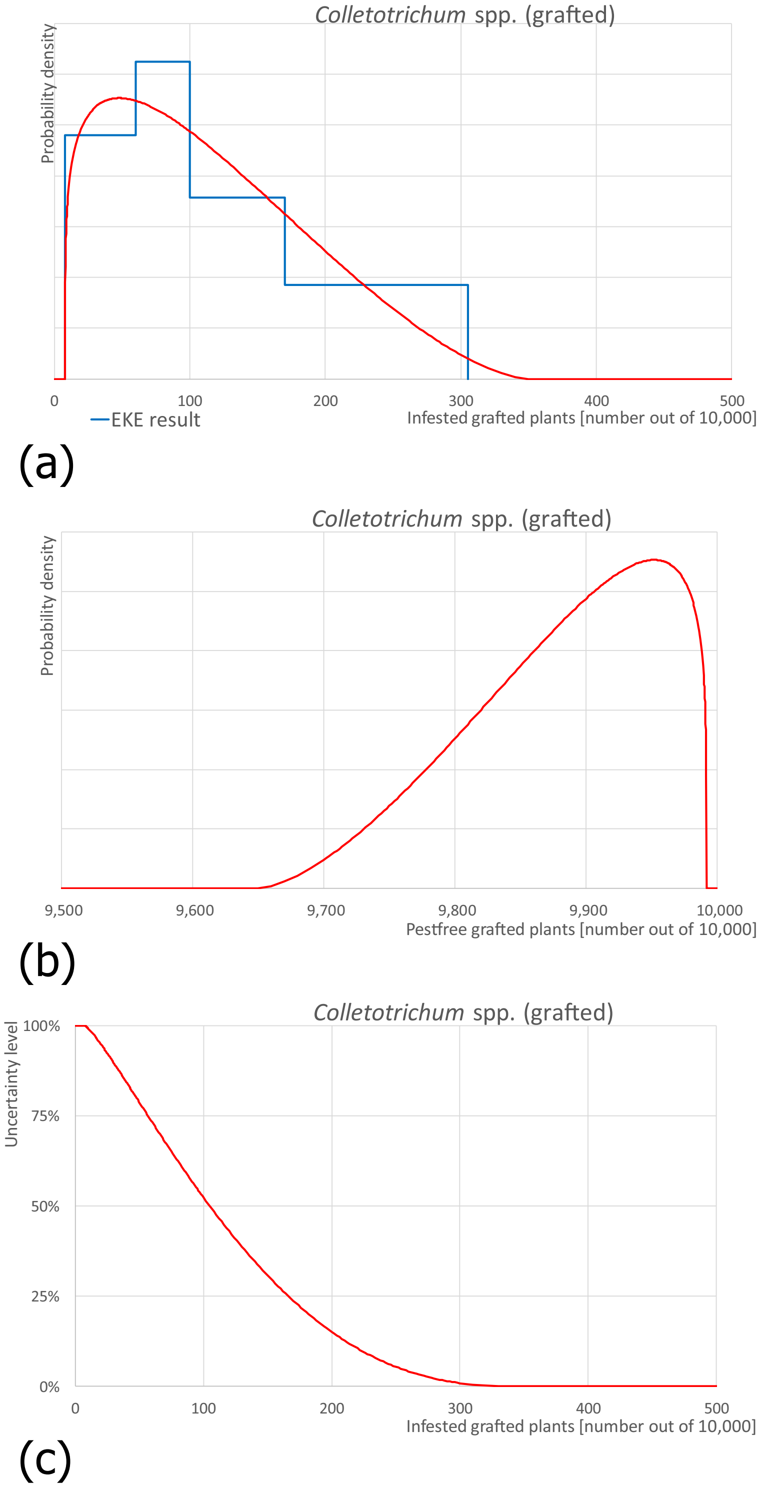


Figure A.2: (a) Elicited uncertainty of pest infestation per 10,000 grafted plants for *Colletotrichum* spp. (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free grafted plants per 10,000 (i.e. =1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 grafted plants

Table A.5: Elicited and fitted values of the uncertainty distribution of pest infestation by *Colletotrichum* species per 10,000 bundles of scions

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	10.0					60.0		100		150					200
EKE	10.7	14.2	19.7	29.8	42.6	57.9	73.0	103	133	148	164	178	189	195	199

The EKE results are *BetaGeneral (1.1238, 1.1617, 7.9, 202.1)* fitted with @Risk version 7.6.

Based on the numbers of estimated infested bundles of scions, the pest freedom was calculated (i.e. = 10,000 – the number of infested bundles of scions per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.6.

Table A.6: The uncertainty distribution of plants free of *Colletotrichum* species per 10,000 bundles of scions calculated by Table A.5

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,800					9,850		9,900		9,940					9,990
EKE results	9,801	9,805	9,811	9,822	9,836	9,852	9,867	9,897	9,927	9,942	9,957	9,970	9,980	9,986	9,989

The EKE results are the fitted values.

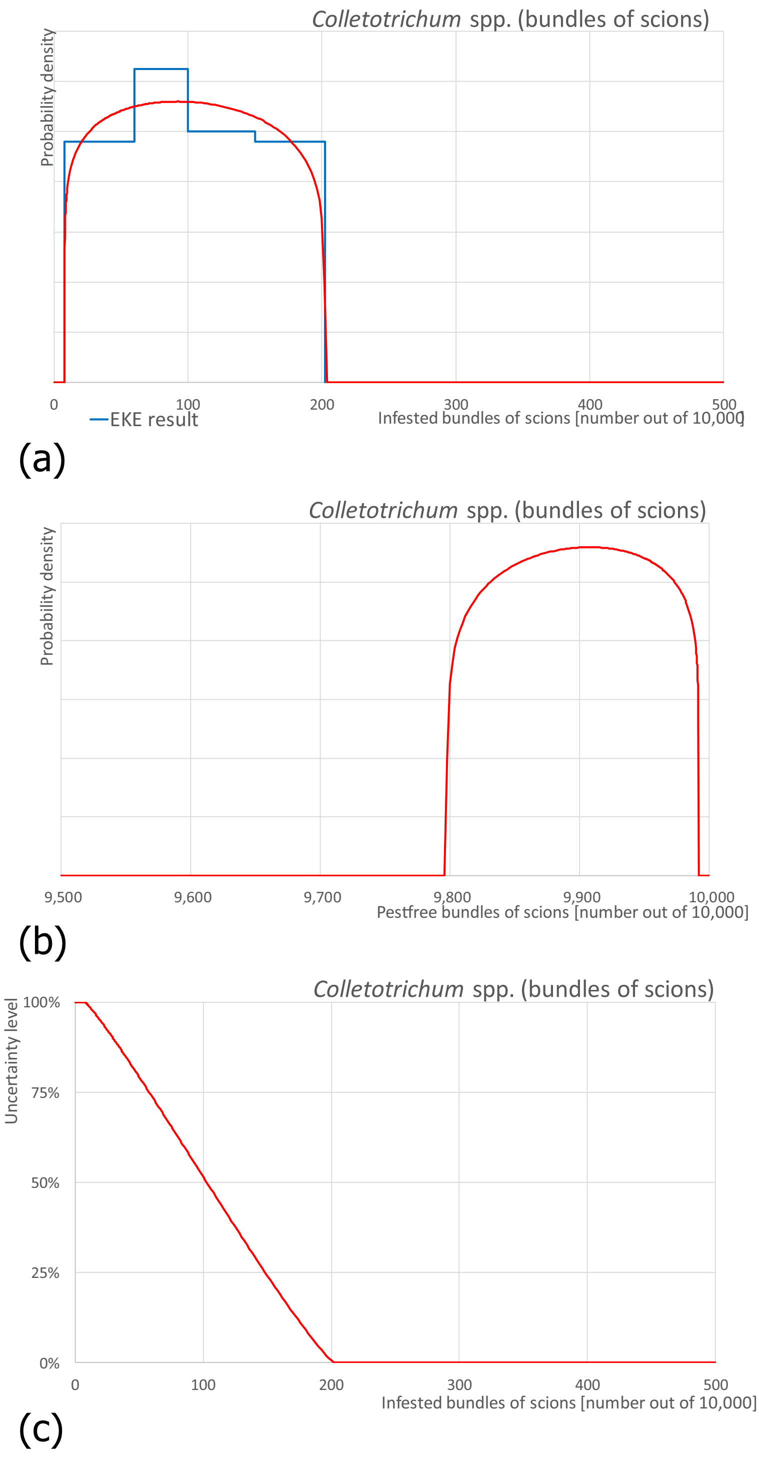


Figure A.3: (a) Elicited uncertainty of pest infestation per 10,000 bundles of scions for *Colletotrichum* spp. (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free bundles of scions per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 bundles of scions

A.2.6. Reference list

Australian Government, Department of Agriculture, Water and the Environment, Pest Risk Assessment, 2020. Final report for the review of biosecurity import requirements for fresh strawberry fruit from Japan.

CABI (Centre for Agriculture and Bioscience International), online. C. siamense, C. fructicola, Anthracnose on Avocado. Available online: https://www.cabi.org/cpc/datasheet/120362, https://www.cabi.org/cpc/datasheet/120333, https://www.cabi.org/ISC/FullTextPDF/2015/20157800755.pdf [Accessed: 16 April 2020].

Crous PW, Denman S, Taylor JE, Swart L, Bezuidenhout CM, Hoffman L, Palm ME and Groenewald JZ, 2013. Cultivation and disease of Proteaceae: Leucadendron, Leucospermum, and Protea: Second edition. CBS Biodivers. Ser. N/A: 360. (48167).

De Silva DD, Crous PW, Ades PK, Hyde KD and Taylor PW, 2017. Life styles of *Colletotrichum* species and implications for plant biosecurity. Fungal Biology Reviews, 31, 155–168.

De Silva DD, Groenewald JZ, Crous PW, Ades PK, Nasruddin A, Mongkolporn O and Taylor PWJ, 2019. Identification, prevalence and pathogenicity of Colletotrichum species causing anthracnose of Capsicum annuum in Asia. IMA Fungus, 10, 8 (54081).

Fu M, Crous PW, Bai Q, Zhang PF, Xiang J, Guo YS, Zhao FF, Yang MM, Hong N, Xu WX and Wang GP, 2019. Colletotrichum species associated with anthracnose of Pyrus spp. in China. Persoonia, 42, 1–35. (53645)

Guarnaccia V, Groenewald JZ, Polizzi G and Crous PW, 2017. High species diversity in *Colletotrichum* associated with citrus diseases in Europe. Persoonia: Molecular Phylogeny and Evolution of Fungi, 39, 32.

Guarnaccia V, Vitale A, Cirvilleri G, Aiello D, Susca A, Epifani F, Perrone G and Polizzi G, 2016. Characterisation and pathogenicity of fungal species associated with branch cankers and stem-end rot of avocado in Italy. European Journal of Plant Pathology, 146, 963–976. (50274)

Han YC, Zeng XG, Xiang FY, Ren L, Chen FY and Gu YC, 2016. Distribution and characteristics of Colletotrichum spp. associated with anthracnose of strawberry in Hubei, China. Plant Diseases, 100, 996–1006. (49469)

Jayawardena RS, Hyde KD, Damm U, Cai L, Liu M, Li XH, Zhang W, Zhao WS and Yan JY, 2016. Notes on currently accepted species of Colletotrichum. Mycosphere, 7, 1192–1260. (52308)

Liu F, Damm U, Cai L and Crous PW, 2013. Species of the Colletotrichum gloeosporioides complex associated with anthracnose diseases of Proteaceae. Fungal Diversity, 61, 89–105.

Marais LJ, 2004. Avocado diseases of major importance worldwide and their management. In Diseases of Fruits and Vegetables: Volume II (pp. 1–36). Springer, Dordrecht.

Meng Y, Gleason ML, Zhang R and Sun G, 2019. Genome sequence resource of the wide-host-range anthracnose pathogen *Colletotrichum siamense*. Molecular Plant-Microbe Interactions, 32, 931–934.

Munir M, Amsden B, Dixon E, Vaillancourt L and Ward Gauthier NA, 2016. Characterization of Colletotrichum species causing bitter rot of apple in Kentucky orchards. Plant Diseases, 100, 2194–2203. (50291)

Pardo-De la Hoz CJ, Calderon C, Rincon AM, Cardenas M, Danies G, Lopez-Kleine L, Restrepo S and Jimenez P, 2016. Species from the Colletotrichum acutatum, Colletotrichum boninense and Colletotrichum gloeosporioides species complexes associated with tree tomato and mango crops in Colombia. Plant Pathology, 65, 227–237. (48600)

Prihastuti H, Cai L, Chen H, McKenzie EHC and Hyde KD, 2009. Characterization of Colletotrichum speices associated with coffee berries in northern Thailand. Fung. Diversity, 39, 89–109. (44084)

Rojas EI, Rehner SA, Samuels GJ, Van Bael SA, Herre EA, Cannon P, Chen R, Pang J, Wang R, Zhang Y, Peng Y-Q and Sha T, 2010. Colletotrichum gloeosporioides s.l. associated with Theobroma cacao and other plants in Panama: multilocus phylogenies distinguish host-associated pathogens from asymptomatic endophytes. Mycologia, 102, 1318–1338. (44577)

Schena L, Mosca S, Cacciola SO, Faedda R, Sanzani SM, Agosteo GE, Sergeeva V and Magnano di San Lio G, 2014. Species of the *Colletotrichum gloeosporioides* and *C. boninense* complexes associated with olive anthracnose. Plant Pathology, 63, 437–446.

Sharma G, Maymon M and Freeman S, 2017. Epidemiology, pathology and identification of *Colletotrichum* including a novel species associated with avocado (*Persea americana*) anthracnose in Israel. Scientific Reports, 7, 1–16.

Sharma G and Shenoy BD, 2014. Colletotrichum fructicola and C. siamense are involved in chili anthracnose in India. Arch. Phytopathol. Pflanzenschutz, 47, 1179–1194. (50471)

UC IPM (University of California Agriculture and Natural Resources, Statewide Integrated Pest Management Program), Publication 3436, Online. Agriculture: Avocado Pest Management Guidelines. Available online: https://www2.ipm.ucanr.edu/agriculture/avocado/Anthracnose/ [Accessed: 20 April 2020].

USDA ARS Fungal Database, online. C. perseae. Available Online: https://nt.ars-grin.gov/fungaldatabases/ [Accessed:19 April 2020]

Velho AC, Stadnik MJ and Wallhead M, 2019. Unraveling Colletotrichum species associated with Glomerella leaf spot of apple. Trop. Plant Pathology, 44, 197–204. (55089)

Wang Y-C, Hao X-Y, Wang L, Xiao B, Wang X-C and Yang Y-J, 2016. Diverse Colletotrichum species cause anthracnose of tea plants (Camellia sinensis (L.) O. Kuntze) in China. Scientific Reports, 6, 35287. (52768)

Weir BS, Johnston PR and Damm U, 2012. The *Colletotrichum gloeosporioides* species complex. Studies in mycology, 73, 115–180.

Wikee S, Cai L, Pairin N, McKenzie EHC, Su Y-Y, Chukeatirote E, Thi HN, Bahkali AH, Moslem MA, Abdelsalam K and Hyde KD, 2011. Colletotrichum species from jasmine (Jasminum sambac). Fung. Diversity, 46, 171–182. (44735)

Yan J-Y, Jayawardena MMRS, Goonasekara ID, Wang Y, Zhang W, Liu M, Huang J-B, Wang Z-Y, Shang J-J, Peng Y-L, Bahkali A, Hyde KD and Li X.-H. 2015. Diverse species of Colletotrichum associated with grapevine anthracnose in China. Fung. Diversity, 71, 233–246. (47772)

A.3. Botryosphaeriaceae species: *Lasiodiplodia pseudotheobromae, Neoscytalidium dimidiatum*

A.3.1. *Lasiodiplodia pseudotheobromae*

A.3.1.1. Organism information

<table>
<tr><td>Taxonomic information</td><td colspan="2">Current valid scientific name: Lasiodiplodia pseudotheobromae A.J.L. Phillips, A. Alves & Crous 2008
Synonyms: N/A
Name used in the EU legislation: N/A
Category: Fungi
Family: Botryosphaeriaceae
Common name: post harvest fruit rot disease
Name used in the Dossier: Lasiodiplodia pseudotheobromae</td></tr>
<tr><td>Group</td><td colspan="2">Fungi</td></tr>
<tr><td>EPPO code</td><td colspan="2">N/A</td></tr>
<tr><td>Regulated status</td><td colspan="2">N/A</td></tr>
<tr><td>Pest status in Israel</td><td colspan="2">Present (Ministry of Agriculture and Rural Development, Database of the pests and disease, Available online, Mendel et al., 2017).</td></tr>
<tr><td>Pest status in the EU</td><td colspan="2">Present in the Netherlands (Phillips et al., 2013).</td></tr>
<tr><td>Host status on Persea americana</td><td colspan="2">P. americana is reported as a host of L. pseudotheobromae (Dissanayake et al., 2016).</td></tr>
<tr><td>PRA information</td><td colspan="2">No Pest Risk Analysis were available</td></tr>
<tr><td colspan="3">Other relevant information for the assessment</td></tr>
<tr><td>Biology</td><td colspan="2">Species of Botryosphaeriaceae cause cankers and fruit rots and they survive as saprophyte, parasites and even as endoparasites in symptomless tissues (McDonald et al., 2011).
L. pseudotheobromae overwinters in the soil or in twigs. The pycnidia or fruiting bodies of the fungus are produced near the canker. In the summer, conidia and conidiomata are spread by wind, rain or insects. Conidia exist all year round but, the disease spreads more rapidly during summer when the temperature is around or even higher than 30°C. The pathogen enters the plant through wounds (usually by pruning) which is the main reason of spreading (Liang et al., 2019).</td></tr>
<tr><td>Symptoms</td><td>Main type of symptoms</td><td>According to the PPIS of Israel, damage has been reported in avocado in Israel by L. pseudotheobromae. It might damage stems and it causes stem-end rot in avocado (Dossier, Table D.2)
Fruits:
• Buff to brown
• Leathery area encircling the stem end of the fruit
Leaves
• Brown necrotic lesions and leaves blight
• Yellow leaves</td></tr>
</table>

		Stems • Water soaked large patches on the basal portions of the stem near the ground level, Trees • Dried and cracked bark, • Canker on twigs, branches or trunks, • Stunting, • Wood discoloration, • Dieback, • Decline, • Gummosis (Munirah et al., 2017, Sultana et al. 2018, Trakunyingcharoen et al. 2015, USDA ARS Fungi Database, Online).
	Presence of asymptomatic plants	According to de Silva et al. (2019), one endophytic and 2 saprobic isolates of *L. pseudotheobromae* were identified on asymptomatic leaves of *Magnolia candolii.*
	Confusion with other pathogens/pests	*L. pseudotheobromae* has similar colony features as *L. theobromae* but they differ in the size, shape of their conidia and paraphyses. It is close to *L. crassispora* but the two species differ in that the pseudoparaphyses of *L. crassispora* are mostly septate, while in *L. pseudotheobromae* they are mostly aseptate Fusicoccum/Neofusicoccum rots can cause similar symptoms (Munirah et al., 2017).
Host plant range	*L. pseudotheobromae* has been isolated from several host plants: *Gmelina arborea*, *Osmanthus fragrans, Hevea brasiliensis, Psidium sp., Coffea arabica, Dimocarpus longan, Mangifera indica, Ficus racemose, Bouea burmanica, Syzygium samarangense, Phyllanthus acidus, Cananga odorata, Dimocarpus longan, Juniperus chinensis (*Trakunyingcharoen et al. 2015), *Citrus latifolia (tahiti lime), Diospyros kaki (persimmon), Macadamia, Macadamia integrifolia (macadamia nut)* (CABI CPC, Online), *Acacia mangium, Citrus aurantium, Coffea sp., Rosa sp.* (Phillips et al., 2013), *Bougainvillea spectabilis, Carica papaya, Cocos nucifera, Eucalyptus grandis, Jatropha curcas, Juglans regia* (*China,*) *Manihot esculenta* (*Brazil,*) *Hevea brasiliensis, Schizolobium parahyba, Tectona grandis, Vitis vinifera* (Dissanayake et al., 2016).	
Pathways	By contaminated tools used for grafting or/and pruning. Through wounds caused by pruning, other mechanical methods or frosting (McDonald et al., 2011). Through propagation material: scions, seedlings and young plantations (Shtienberg et al., 2015). The spread of conidia and conidiamata is facilitated by wind, rain and insects (Liang et al., 2019). Overwintering takes place in soil and twigs (Liang et al., 2019).	
Surveillance information	All plants for planting exported from Israel originate from nurseries that are approved by PPIS and are under PPIS inspection. • In nurseries that export trees, PPIS inspection is carried out every 45 days. • Further to the PPIS inspection, the producers carry out regular comprehensive self-inspections, once a week. This inspection is performed by the nurseries agronomists and according to the PPIS inspector's instructions. The results are recorded in the nursery logbook and every adverse finding is reported immediately to the inspector. The logbook is regularly reviewed during the inspector visits to the site. • Whenever a harmful organism of interest is found at any production site, the grower is required to inform PPIS and to treat the site as appropriate. During consecutive inspections, if there is no further evidence to the presence of the pest, the PPIS considers the site of production to be free from this harmful organism. • Further diagnostic procedures may be performed according to requirements of the importing country and in the case of inspection findings that necessitate identification of a causative agent.	

A.3.2. *Neoscytalidium dimidiatum*

A.3.2.1. Organism information

Taxonomic information	Current valid scientific name: *Neoscytalidium dimidiatum* (Penz.) Crous & Slippers, In Crous, Slippers, Wingfield, Rheeder, Marasas, Phillips, Alves, Burgess, Barber & Groenewald 2006 Synonyms: *Fusicoccum dimidiatum* (Penz.) D.F. Farr, Mycologia 97(3): 740 (2005) *Hendersonula toruloidea* Nattrass, Trans. Br. mycol. Soc. 18(3): 197 (1933) *Neoscytalidium dimidiatum* var. hyalinum (C.K. Campb. & J.L. Mulder) Madrid, Ruíz-Cendoya, Cano, Stchigel, Orofino & Guarro, Int. J. Antimicrob. Agents 34(4): 351–354 (2009) *Neoscytalidium hyalinum* (C.K. Campb. & J.L. Mulder) A.J.L. Phillips, M. Groenew. & Crous, in Phillips, Alves, Abdollahzadeh, Slippers, Wingfield, Groenewald & Crous, Stud. Mycol. 76: 148 (2013) *Scytalidium dimidiatum* (Penz.) B. Sutton & Dyko, Mycol. Res. 93(4): 484 (1989) *Scytalidium hyalinum* C.K. Campb. & J.L. Mulder, Sabouraudia 15(2): 163 (1977) Torula dimidiata Penz., in Saccardo, Michelia 2(no. 8): 466 (1887) Name used in the EU legislation: N/A Order: *Botryosphaeriales* Family: *Botryosphaeriaceae* Common name: sooty canker and branch wilt Name used in the Dossier: No	
Group	Fungi	
EPPO code	HENLTO	
Regulated status	Not regulated in the EU Egypt: A2 list (EPPO) Mexico: Quarantine Pest (EPPO)	
Pest status in Israel	Present (Ezra et al., 2015; Ezra, 2013)	
Pest status in the EU	Limited distribution (Polizzi et al., 2009)	
Host status on *Persea americana*	According to answers provided by Israel to the questions raised by the working group, the pathogen is occasionally appearing in avocado orchards in Israel (https://phytopathology.org.il/wp-content/uploads/2019/12/Avocado-1-2020-Elad.pdf).	
PRA information	No Pest Risk Analysis were available	
Other relevant information for the assessment		
Biology	Species belonging to *Botryosphaeriaceae* generally infects through wounds or natural openings (Slippers and Wingfield, 2007). For *N. dimidiatum,* it has also been reported that it infects juvenile dragon fruit cladodes via appressorium formation and direct penetration (Fullerton et al. Dragon Fruit Network accessed Aug 2020, https://dfnet.fftc.org.tw/Page/ArticleDetail.aspx?ArticleID=9LeTiREiqsA%3D&PI=ZeDMUJUrfPk%3D&Co=ztBzV%2F10sco%3D&Ca=ztBzV%2F10sco%3D&Ws=ztBzV%2F10sco%3D&Keyword=ztBzV%2F10sco%3D Neoscytalidium spp. can grow between 15 and 40°C. Optimum temperature for mycelial growth is 30–35 °C (Mayorquin et al., 2016). Pycniospores are the most important means of dispersal and infection. They are released from pycnidia during wet weather and spread by rain splash and wind (Fullerton et al. Dragon Fruit Nework, accessed Aug. 2020; Adesemoye et al. 2014).	
Symptoms	**Main type of symptoms**	*Neoscytalidium* spp. are reported to cause branch wilt, dieback, canker, leaf blight, gummosis, tree death, fruit rot and canker. In *P. americana*, Israel reports it to occasionally cause sooty canker and branch wilt (https://phytopathology.org.il/wp-content/uploads/2019/12/Avocado-1-2020-Elad.pdf; Ezra et al., 2015). Cankers are observed near pruning wounds or other wounds (Hajlaoui

		et al. 2018). In *Prunus* spp. symptoms of *N. dimidiatum* on young plants were seen as secretion of gummosis at the grafting area (Ezra et al., 2015). Symptoms are detectable, but may be difficult to detect in young plants as latent infections causing symptoms later in the growing cycle may occur (Ezra et al., 2015).
	Presence of asymptomatic plants	*Botryosphaeriaceae* species are known to be able to exist in the host as endophytes (Slippers and Wingfield, 2007). Disease expression is almost exclusively associated with some form of stress or non-optimal growth conditions of trees (Slippers and Wingfield, 2007). For *Prunus* spp., it has in some cases been seen that development of the disease caused by *N. dimidiatum* is delayed and expressed later e.g. when plants are transferred from nurseries to orchards (Ezra et al., 2015).
	Confusion with other pests	Several other fungi belonging to Botryosphaeriaceae may cause the same symptoms.
Host plant range	Primarily reported from woody plants such as *Prunus* spp. (California, Hajlaoui et al., 2018; Turkey, Oksal et al., 2020; Israel, Ezra et al., 2015), *Citrus* spp. (Italy, Polizzi 2009, California, Adesemoye et al., 2014), *Ficus spp. (Egypt, Al-Bedak et al., 2018)*, walnut (*Juglans regia*) (Turkey, Dervis et al., 2019), mango (*Mangifera indica*) (Austaliar, Ray et al., 2010), grapevine *Vitis vinifera (Turkey, Oksal et al., 2019), Pinus spp. (Turkey,* Türkölmez et al., 2019a), but also from tomato (*Solanum lycopersicum*) (Turkey, Türkölmez et al., 2019) and potato (*Solanum tuberosum*) (Turkey, Dervis et al., 2020).	
Pathways	Via spores released from infected plants and plant material in the soil. Through wounds caused by pruning and grafting. Via latently infected grafting material e.g. scions. Contaminated grafting tools.	
Surveillance information	All plants for planting exported from Israel originate from nurseries that are approved by PPIS and are under PPIS inspection. • In nurseries that export trees, PPIS inspection is carried out every 45 days. • Further to the PPIS inspection, the producers carry out regular comprehensive self-inspections, once a week. This inspection is performed by the nurseries agronomists and according to the PPIS inspector's instructions. The results are recorded in the nursery logbook and every adverse finding is reported immediately to the inspector. The logbook is regularly reviewed during the inspector visits to the site. • Whenever a harmful organism of interest is found at any production site, the grower is required to inform PPIS and to treat the site as appropriate. During consecutive inspections, if there is no further evidence to the presence of the pest, the PPIS considers the site of production to be free from this harmful organism. • Further diagnostic procedures may be performed according to requirements of the importing country and in the case of inspection findings that necessitate identification of a causative agent.	

A.3.3. Possibility of pest presence in the nursery

A.3.3.1. Possibility of entry from the surrounding environment

In addition to *P. americana*, these two species have a wide host range.

The major source of inoculum is from infected plant material, which can be leaves, twigs, fruit and cankers on larger branches of the affected plant species. Dispersal of conidia can take place by rain, wind or insects. Therefore, the presence of host species in the environment of the nurseries with *P. americana* plants is an important factor for the possible migration of inoculum into the nursery.

Uncertainties:

In the answers provided by Israel to the questions raised by the working group (section 6 and 7 of the dossier), it is stated that in a radius of 2 km of the avocado nurseries, avocado, banana, citrus and field crops are grown. The natural vegetation includes diverse native plants as well as ornamental trees and bushes. A few hundreds of various urban trees are also present within a radius of 2 km from the avocado nursery. The minimal distance of the avocado nurseries of avocado for export and the nearest natural areas is approximately 100–200 m.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for the pest/pathogen to enter the nursery from the surrounding area. The pest/pathogens can be present in the surrounding areas and the transferring rate could be enhanced by suitable environmental conditions, including plant debris and irrigation practices.

A.3.3.2. Possibility of entry with new plants/seeds

The source of the planting material to produce *P. americana* scions for export is from approved mother plants in a PPIS-supervised nursery.

Rootstocks are plants of *P. americana* grown from seed from a PPIS-approved source; therefore, entry via this pathway is highly unlikely.

The plants are grown in a substrate consisting of coconut fibre, peat, tuff and polystyrene therefore entry with soil is not likely.

Uncertainties:

Latent infections might be present in the scions.

Taking the above evidence and uncertainties into consideration, the Panel considers it is possible that the pathogen could enter the nursery with new plants/seeds (via scions with latent infections or growing media.

A.3.3.3. Possibility of spread within the nursery

If these two fungi are present within the nursery, it can spread when scions with endophytic or latent infections are used for grafting. Contamination of grafting tools with spores or mycelium may also contribute to the spread of the disease. Conidia can spread by wind, rain or insects. The fungi overwinter in the twigs or on plant debris in the soil. If other potential host plants are present within the nursery, these two species may spread to *P. americana* from these. Use of contaminated seeds (of other plant species) may also contribute to the spread of the disease.

Endophytic or latent infections (de Silva et al., 2019) can be overlooked by visual inspections and lead to an unintentional spread of the disease.

Uncertainties:

Both fungi have a wide host range. In the dossier, there is no information on whether other host plant species are present within the nursery from which *they* could potentially spread to the *P. americana* plants. In an answer provided by Israel to questions raised by the working group is has been stated that within the nursery papaya, mango, blueberry and kiwi is grown. Other fruit tree species grow in separate areas to those of the avocado for export. They are grown in tunnel greenhouses and nethouses and the distance between them and the avocado cultivation areas is between 20 and 100s of metres.

The infection potential of endophytic presence is not known.

Taking into consideration the above evidence and uncertainties, the Panel considers that the transfer of the pathogens within the nursery is possible.

A.3.3.4. Information from interceptions

Considering imports of *P. americana* plants from Israel to the EU, between 1995 and 2020, there are no records of interceptions of *L. pseudotheobromae or N. dimidiatum* (EUROPHYT, online, [Accessed: 12/03/20]).

A.3.3.5. Evaluation of the risk mitigation measures

All risk mitigation measures currently proposed in Israel are summarised and an indication of their effectiveness on *L. pseudotheobromae and N. dimidiatum* is provided.

No.	Risk mitigation measure	Effect on pest or pathogen	Evaluation and uncertainties on scions	Evaluation and uncertainties on grafted plants
1	Registration of production sites	Yes	No uncertainties	No uncertainties
2	Selection of seeds for stocks	Yes	NA	Uncertainties: Due to the potential dormant phase of these fungi the visual inspection might be insufficient.
3	Disinfestation of seeds	Yes	NA	No uncertainties
4	Disinfestation of scions	Yes	Fungicide treatment may not be sufficient to remove latent infections.	Idem
5	Surveillance and monitoring	Yes	Due to the potential dormant phase of *L. pseudotheobromae and N. dimidiatum*, the visual inspection might be insufficient.	Idem
6	Growing conditions	Yes	No uncertainties	No uncertainties
7	Scions selection	Yes	Uncertainties: Due to the potential dormant phase of *L. pseudotheobromae and N. dimidiatum*, the visual inspection might be insufficient.	Idem
9	Fungicide treatments Fungicide application: • Captan • General fungi, including Fusarium sp. (e.g. Fusarium pallidoroseum) • Pyraclostrobin and Boscalid • Cyprodinil and Fludioxonil • Thiophanate-methyl • Potassium phosphite		Some fungal pathogens can develop resistance to different fungicides, and the risk of fungicide resistance can vary according to the compounds (FRAC, 2020): Captan low risk; Pyraclostrobin is high risk; Boscalid is medium to high risk; Cyprodinil is medium risk; Fludioxinil low to medium risk; Thiophanate-methyl is high risk. Potassium phosphite has poorly documented effect on this group of pathogens, and is generally effective only to oomycetes. Contact fungicides may have difficulties in controlling latent infections.	Idem
12	Storage rooms condition The harvested scions are treated with suitable fungicides and stored in chilled storage rooms at a temperature of 2°C and 70% humidity.	Yes	Uncertainty: The effect on latent or endophytic presence is unclear.	Idem

A.3.3.6. Reasoning for a scenario which would lead to a reasonably low number of infested consignments

Under this scenario, it expected that there are no host plants present in the surroundings, there are no wild host plants or alternative hosts other than *P. americana* plants in the nursery/production areas, the use of dripping irrigation prevents and reduces the potential spread of fungal spores, there is a proper and effective application of fungicides to control fungal diseases; visual inspections of mother plants, seeds and scions are effective in detecting and discarding infected materials and latent infections are rare (with cuttings and grafted plants showing symptoms of infection if present).

A.3.3.7. Reasoning for a scenario which would lead to a reasonably high number of infested consignments

Under this scenario, there are abundant host plants for *L. pseudotheobromae* and *N. dimidiatum* in the surroundings including wild hosts in the natural vegetation; moreover, there are different host plants for *L. pseudotheobromae and N. dimidiatum* in the nursery/production area; the use of overhead irrigation within and outside nurseries favours the spread of the fungal spores; the application of fungicides is not appropriate and timely used to control fungal diseases; visual inspections of mother plants, seeds and scions are not effective in detecting and discarding material and latent infections occur because either cuttings are taken when the fungi are in dormant phase or infected plants do not show any symptom.

A.3.3.8. Reasoning for a central scenario equally likely to over- or underestimate the number of infested consignments (Median)

Regarding the uncertainties on the pest pressure outside and in the nursery and the likelihood of introduction into the nursery by natural factors and human activity, the information on infections of these species on avocado plants, the absence of reported problems within the nursery and at EU borders, the Panel assumes a lower scenario, in which infestations in the consignments if occurring will be below the estimated median.

A.3.3.9. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

As in the case of Colletotrichum latent infections are also an issue for *L. pseudotheobromae* and *N. dimidiatum* as there are asymptomatic plants, uncertainty on whether there is sensu stricto an asymptomatic phase, but certainly there are plants with the pathogen that are asymptomatic. It is also unclear how long does it take to develop detectable signs of infection. This is probably why the problems during grafting appeared in the past, probably because signs of infection were not apparent and therefore probably overlooked.

A.3.3.10. Elicitation outcomes of the assessment of the pest freedom for Botryosphaeriaceae (*L. pseudotheobromae* and *N. dimidiatum*)

The following tables show the elicited and fitted values for pest infestation/infection (Tables A.7 and A.9) and pest freedom (Tables A.8 and A.10).

Table A.7: Elicited and fitted values of the uncertainty distribution of pest infestation by *Botryosphaeriaceae* per 10,000 grafted plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	10.0					60.0		100		170					300
EKE	11.0	14.6	19.8	29.5	41.8	56.8	72.1	105	143	166	194	223	253	276	298

The EKE results are *BetaGeneral (1.2112, 2.598, 7.9, 350)* fitted with @Risk version 7.6.

Based on the numbers of estimated infested grafted plants, the pest freedom was calculated (i.e. = 10,000 – the number of infested grafted plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.8.

Table A.8: The uncertainty distribution of plants free of *Botryosphaeriaceae* per 10,000 grafted plants calculated by Table A.7

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,700					9,830		9,900		9,940					9,990
EKE results	9,702	9,724	9,747	9,777	9,806	9,834	9,857	9,895	9,928	9,943	9,958	9,970	9,980	9,985	9,989

The EKE results are the fitted values.

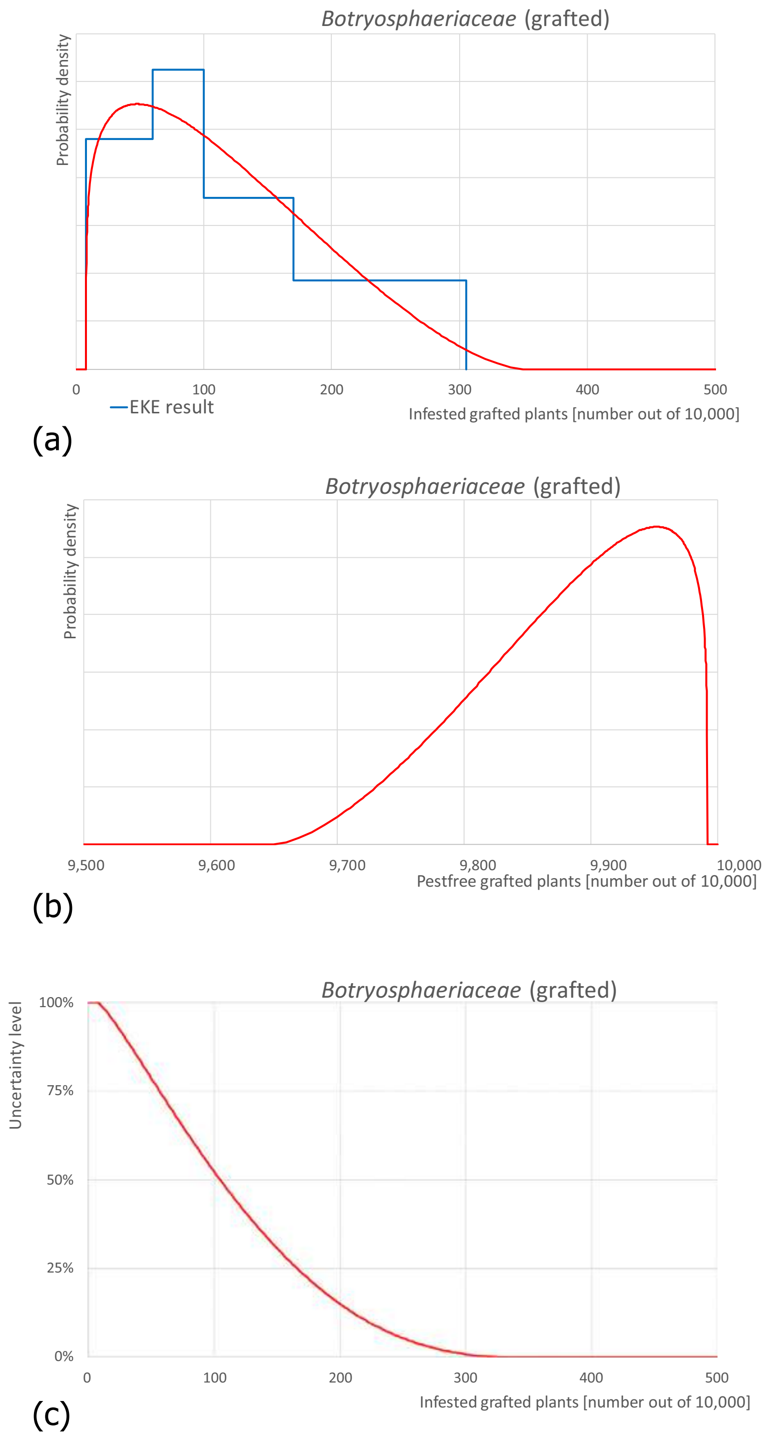


Figure A.4: (a) Elicited uncertainty of pest infestation per 10,000 grafted plants for Botryosphaeriaceae (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free grafted plants per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 grafted plants

Table A.9: Elicited and fitted values of the uncertainty distribution of pest infestation by *Botryosphaeriaceae* per 10,000 bundles of scions

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	10.0					110		220		330					450
EKE	9.90	16.1	26.5	47.4	75.5	111	146	219	293	331	370	402	427	440	449

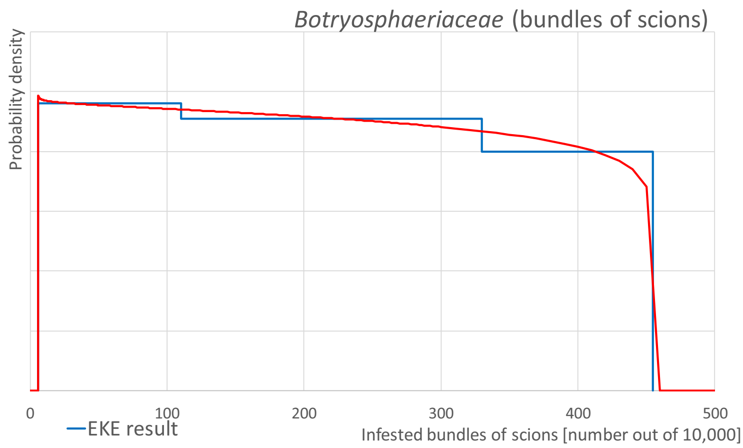
The EKE results are *BetaGeneral (0.99578, 1.0742, 5.8, 455* fitted with @Risk version 7.6.

Based on the numbers of estimated infested grafted plants the pest freedom was calculated (i.e. = 10,000 – the number of infested scions per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.10.

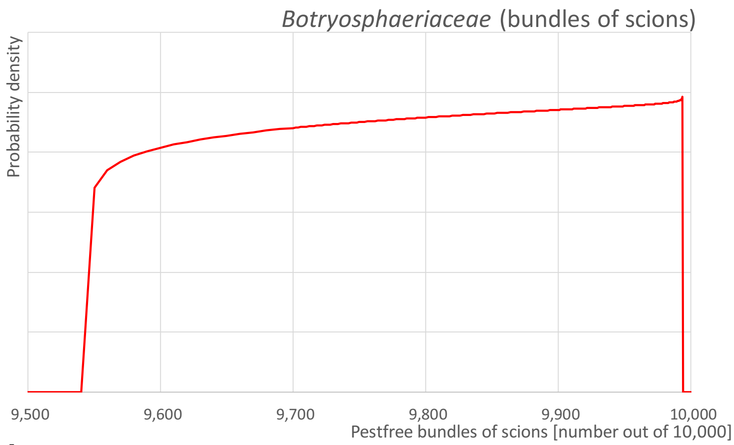
Table A.10: The uncertainty distribution of plants free of *Botryosphaeriaceae* per 10,000 bundles of scions calculated by Table A.9

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,550					9,670		9,780		9,890					9,990
EKE results	9,551	9,560	9,573	9,598	9,630	9,669	9,707	9,781	9,854	9,889	9,924	9,953	9,974	9,984	9,990.1

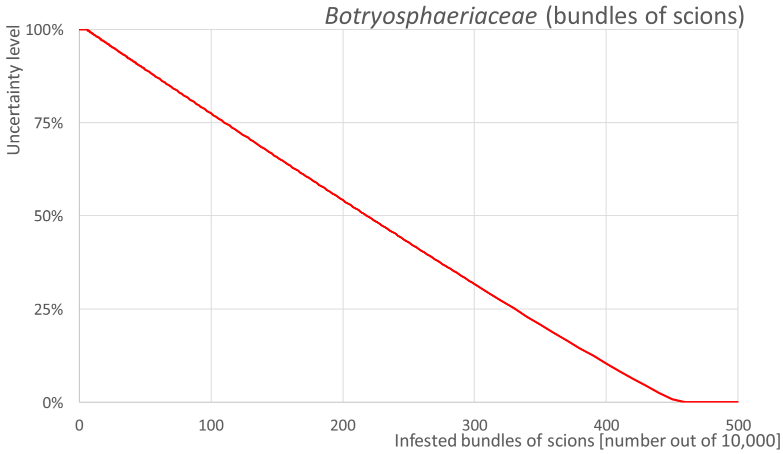
The EKE results are the fitted values.



(a)



(b)



(c)

Figure A.5: (a) Elicited uncertainty of pest infestation per 10,000 bundles of scions for Botryosphaeriaceae (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free bundles of scions per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 bundles of scions

A.3.3.11. Reference list

Adesemoye AO, Mayorquin JS, Wang DH, Twizeyimana M, Lynch SC and Eskalen A, 2014. Identification of species of Botryosphaeriaceae causing bot gummosis in citrus in California. Plant Disease, 98, 55–61.

Al-Bedak OA, Mohamed RA and Seddek NH, 2018. First detection of Neoscytalidium dimidiatum associated with canker disease in Egyptian Ficus trees. Forest Pathology, 48, e12411.

Derviş S, Özer G and Türkölmez Ş, 2020. First report of Neoscytalidium dimidiatum causing tuber rot of potato in Turkey.

Derviş S, Türkölmez Ş, Çiftçi O, Ulubaş Serçe Ç and Dikilitas M, 2019. First report of Neoscytalidium dimidiatum causing black canker and root rot of walnut in Turkey. Plant Disease, 103, 2129.

Dissanayake AJ, Phillips AJL, Li XH and Hyde KD, 2016. Botryosphaeriaceae: Current status of genera and species. Mycosphere, 7, 1001–1073.

Elad Y, 2020. Available online: https://phytopathology.org.il/wp-content/uploads/2019/12/Avocado-1-2020-Elad.pdf

Ezra D, Simanski E, Antman S, Shulhani R, Borenstein M, Golani M, Hershcovich M, Liarzi O and Shtienberg D, 2015. Botryosphaeria in deciduous trees: determination of the causal agent and disease development in young trees. Abstracts of presentations at the 36th Congress of the Israeli Phytopathological Society. Phytoparasitica, 43, 369–381.

Ezra D, Liarzi O, Gat T, Hershcovich M and Dudai M, 2013. First report of internal black rot caused by Neoscytalidium dimidiatum on Hylocereus undatus (Pitahaya) fruit in Israel. Plant Disease, 97, 1513.

Fullerton RA, Sutherland PA, Rebstock RS, Hieu NT, Thu NNA, Linh DT, Thanh NTK and Van Hoa N, 2018. The life cycle of dragon fruit canker caused by Neoscytalidium dimidiatum and implications for control. Management, 258.

Hajlaoui MR, Nouri MT, Hamrouni N, Trouillas FP, Yahmed NB, Eddouzi J and Mnari-Hattab M, 2018. First record of dieback and decline of plum caused by Neoscytalidium dimidiatum in Tunisia. New Disease Reports, 38, 20.

Liang L, Li H, Zhou L and Chen F, 2019. Lasiodiplodia pseudotheobromae causes stem canker of Chinese hackberry in China. Journal of Forestry Research, 1–10.

Mayorquin SJ, Wang DH, Twizeyimana M and Eskalen A, 2016. Idenfication, distribution and pahtogenicity of Diatrypaceae and Botrysphaeriaceae associated with Citrus Branch Canker in the Southern California Desert. Plant Disease, 100, 2402–2413.

McDonald V and Eskalen A, 2011. Botryosphaeriaceae species associated with avocado branch cankers in California. Plant Disease, 95, 1465–1473.

Mendel Z, Protasov A, Maoz Y, Maymon M, Miller G, Elazar M and Freeman S, 2017. The role of Euwallacea nr. fornicatus (Coleoptera: Scolytinae) in the wilt syndrome of avocado trees in Israel. Phytoparasitica, 45, 341–359.

Munirah MS, Azmi AR, Yong SYC and Nur Ain Izzati MZ, 2017. Characterization of Lasiodiplodia theobromae and L. pseudotheobromae causing fruit rot on pre-harvest mango in Malaysia. Plant Pathol Quar, 7, 202–213.

Oksal E, Çelik Y and Özer G, 2019. Neoscytalidium dimidiatum causes canker and dieback on grapevine in Turkey. Australasian Plant Disease Notes, 14, 33.

Phillips AJL, Alves A, Abdollahzadeh J, Slippers B, Wingfield MJ, Groenewald JZ and Crous PW, 2013. The Botryosphaeriaceae: genera and species known from culture. Studies in mycology, 76, 51–167.

Polizzi G, Aiello D, Vitale A, Giuffrida F, Groenewald JZ and Crous PW, 2009. First Report of Shoot Blight, Canker, and Gummosis Caused by Neoscytalidium. dimidiatum on Citrus in Italy. Plant Disease, 93, 1215.

Ray JD, Burgess T and Lanoiselet VM, 2010. First record of Neoscytalidium dimidiatum and N. novaehollandiae on Mangifera indica and N. dimidiatum on Ficus carica in Australia. Australasian Plant Disease Notes, 5, 48–50.

de Silva NI, Phillips AJ, Liu JK, Lumyong S and Hyde KD, 2019. Phylogeny and morphology of Lasiodiplodia species associated with Magnolia forest plants. Scientific reports, 9, 1–11.

Shtienberg D, Simanski E, Shulhani R, Borenstein M, Golani M, Okon-Levy N, Sharon M and Freeman S, 2015. Mortality of young avocado plants: identification of the causal agent and development of means for managementSlippers B and Wingfield MJ, 2007. Botryosphaeriaceae as endophytes and latent pathogens of woody plants: diversity, ecology and impact. Fungal Biology Reviews, 21, 90–106.

Sultana Rzia I, Rahman HA, Islam MD and Biswanath S, 2018. Characterization of Lasiodiplodia pseudotheobromae associated with citrus stem-end rot disease in Bangladesh. International Journal of Biosciences (IJB), 13, 252–262. https://doi.org/10.12692/ijb/13.5.252-262

Trakunyingcharoen T, Lombard L, Groenewald JZ, Cheewangkoon R, To-Anun C and Crous PW, 2015. Caulicolous Botryosphaeriales from Thailand. Persoonia: Molecular Phylogeny and Evolution of Fungi, 34, 87.

Trakunyingcharoen T, Cheewangkoon R and To-Anun C, 2015. Phylogenetic study of the Botryosphaeriaceae species associated with avocado and para rubber in Thailand. Chiang Mai University Journal of Natural Sciences, 42, 104–111.

Turkolmez S, Dervis S, Ciftci O and Dikilitas M, 2019. First report of *Neoscytalidium dimidiatum* causing shoot and needle blight of pines (Pinus spp.) in Turkey. Plant Diseases, 103, 2960–2961.

A.4. *Euwallacea fornicatus* and *Neocosmospora euwallaceae*

A.4.1. Organism information

Taxonomic information	**Insect** *Euwallacea fornicatus* (Eichhoff, 1868) In the EPPO Global Database *Euwallacea fornicatus* (polyphagus shot hole borer – PSHB) is considered as a species complex which includes: *E. fornicatus* sensu stricto, *E. fornicatior*, *E. whitforiodendrus* and *E. Kuroshio*. However, a recent taxonomic review of the species complex by Smith et al. (2019) proposed the following classification: *Euwallacea fornicatus* (= *E. tapatapaoensis* (Schedl, 1951); = *E. whitfordiodendrus* (Schedl, 1942)) syn. res.); *E. fornicatior* (Eggers, 1923) (= *E. schultzei* (Schedl, 1951) syn. nov.); *E. kuroshio* (Gomez and Hulcr, 2018) and *E. perbrevis* (Schedl, 1951) stat. res. Name used in the EU legislation: Scolytidae spp. (non-European) [1SCOLF] EPPO code: XYLBFO Order: Coleoptera Family: Curculionidae Common name: Polyphagous Shot Hole Borer (PSHB) Name used in the Dossier: *Euwallacea fornicatus* **Fungus** Current valid name: *Neocosmospora euwallaceae (S. Freeman, Z. Mendel, T. Aoki & O'Donnell) Sand.-Den., L. Lombard & Crous* *Synonyms: Fusarium euwallaceae* S. Freeman, Z. Mendel, T. Aoki & O'Donnell Name used in this Opinion: *Neocomospora euwallaceae* Name used in the Dossier: *Fusarium euwallaceae* EPPO code: FUSAEW Order: Hypocreales Family: Nectriaceae
Regulated status	The insect E*. fornicatus* is listed in Annex II/A of Regulation (EU) 2019/2072 as Scolytidae spp. (non-European) [1SCOLF]. The fungus *N. euwallaceae* is currently not regulated in the EU. Both, *E. fornicatus* and *N. euwallaceae* are listed as A2 quarantine pests by EPPO (i.e. recommended for regulation).
Pest status in Israel	*E. fornicatus and N. euwallaceae* (Gomez et al., 2018, EPPO online), are present in Israel. First record of *E. fornicatus* was in 2009 (EPPO online). *N. euwallaceae* was first described as new species in 2013 (Freeman et al., 2013). The beetle is distributed in Israel in the Galillee area, along the coastal plain and in central Israel (Mendel et al., 2012, Mendel, 2017). *N. euwallaceae has* recently been identified in association with *Euwallacea* sp. adults and larvae. *N. euwallaceae* is considered as the main pathogen associated with the emerging disease that is currently observed in Southern California and Israel (datasheet, EPPO, 2016).
Pest status in the EU	*E. fornicatus* is reported as 'Absent, pest eradicated' in Poland. *N. euwallaceae* is not present in the EU (EPPO, online).
Host status of *Persea americana*	*Persea americana* has been reported as a host of *E. fornicatus, N. euwallaceae* (EPPO, Online). Reproductive hosts of *E. fornicatus* are plant species that are capable of supporting beetle reproduction and growth of the fungus *N. euwallacea* that cause Fusarium dieback (Eskalen et al., 2013).
Pest Risk Analysis information	• Rapid Pest Risk Analysis (PRA) for polyphagous shot hole borer (*Euwallacea* sp.) and Fusarium dieback (*N. euwallaceae*) (FERA, 2015). • Express PRA for the Ambrosia beetle *Euwallacea* sp. including all the species within the genus *Euwallacea* that are morphologically similar to E*. fornicatus* (Ministerio de Agricultura, Alimentacion y Medio Ambiente, 2015, Spain). • Report of a Pest Risk Analysis for *Euwallacea fornicatus sensu lato* and *Fusarium euwallaceae* (EPPO, 2017).

Other relevant information for the assessment		
Biology		The polyphagous shot hole borer (PSHB) has a complex association with symbiotic fungi, particularly with *N. euwallaceae*. As reviewed by Paap et al. (2018) adult female beetles create galleries in the trees where they introduce the symbiotic fungus (being transported through the mandibular mycangia), which colonises gallery walls, becoming a food source for developing larvae and adult beetles. Successful reproduction occurs mainly in thin branches which usually desiccate after about two beetle generations. If larger branches are colonised, the beetle could survive for longer periods, and may produce more generations before moving to a new breeding site (branch, tree or plantation) (Ministerio de Agricultura, Alimentacion y Medio Ambiente, 2015).
Symptoms	**Main type of symptoms**	The symptoms caused by the beetle on a tree depend on the response to the fungus infection and vary among host species. The beetles infest stems and branches of various diameters (from 2 to > 30 cm, corresponding to 1- to 30-year-old growth) (Mendel et al., 2012) and commonly attack the main stem and larger branches of trees and shrubs (EPPO, 2017; CABI, online). However, due to the small size of adult females (1.83 ± 0.07 mm. long and 0.80 ± 0.6 mm wide), it cannot be completely dismissed an attack in thinner stems or branches (EPPO, 2017). After the attack of the beetle, the fungus invades the vascular tissue of the tree. It may interfere with water and mineral transport, cause brownish staining of the xylem, cambial necrosis, branch dieback and in the worst-case scenario, the death of the tree (Ministerio de Agricultura, Alimentacion y Medio Ambiente, 2015). In general, there is a correlation between severity of the beetle attack (which therefore increases severity of infection by fungi) and the observed dieback (Eskalen et al., 2013). *N. euwallacea* infections can be associated with an abundant production of blue to brownish macroconidia (Freeman et al., 2013). The symptoms include also leaf yellowing and wilting of the branches, which, when there is heavy yield, break down at the section where the beetle galleries are located. Those symptoms, together with the ones caused by the fungus associated to the beetle, could lead to the death of young and mature trees (Ministerio de Agricultura, Alimentacion y Medio Ambiente, 2015; EPPO, 2016; EPPO, 2017). A good description of symptoms on several host plant species is given by the California Department of Fish and Wildlife (online).
	Presence of asymptomatic plants	Newly infested trees exhibit few external symptoms. While there is no visible injury to the cortex at an early stage of colonisation, examination of the wood under the infested spot bored by the beetle has revealed the brownish staining of the xylem and necrosis caused by the *N. euwallacea* (Mendel et al., 2012).
	Confusion with other pathogens/pests	In the EPPO Global Database *Euwallacea fornicatus* is considered as a complex species which includes: *E. fornicatus sensu stricto*, *E. fornicatior*, *E. whitforiodendrus* and *E. kuroshio*. However, a recent taxonomic review of the species complex by Smith et al. (2019) proposed the following classification: *Euwallacea fornicatus* (= *E. tapatapaoensis* (Schedl, 1951); = *E. whitfordiodendrus* (Schedl, 1942) syn. res.); *E. fornicatior* (Eggers, 1923) (= *E. schultzei* (Schedl, 1951) syn. nov.); *E. kuroshio* (Gomez and Hulcr, 2018) and *E. perbrevis* (Schedl, 1951) stat. res.

Host plant range	*E. fornicatus* is one of the few ambrosia beetles that can infest healthy plants (EPPO, 2017). In the USA, Eskalen et al. (2013) reported that more than 200 tree species were used as a host plant by *E. fornicatus* and of these 200 species, 113 tree species were reported as a host for the fungus *N. euwallaceae* and classified as reproductive hosts. Fungal infection is most likely due to susceptibility of the tree to the fungus if the beetle is able to penetrate into or through this critical layer of tissue (Eskalen et al., 2013). According to EPPO a non-complete list of host plants include: *Acer buergerianum, Acer macrophyllum, Acer negundo, Acer palmatum, Acer paxii, Albizia julibrissin, Alectryon excelsus, Ailanthus altissima, Alnus rhombifolia, Castanospermum australe, Cercidium floridum, Erythrina corallodendrum, Eucalyptus ficifolia, Ilex cornuta, Liquidambar styraciflua, Parkinsonia aculeata, Persea americana, Platanus racemosa, Platanus x acerifolia, Populus fremontii, Populus trichocarpa, Prosopis articulata, Quercus suber, Quercus agrifolia, Quercus engelmannii, Quercus lobata, Quercus robur, Ricinus communis, Robinia pseudoacacia, Salix babylonica, Salix gooddingii, Salix laevigata, Wisteria floribund*a (EPPO, 2016; EPPO, 2017). In Israel, avocado (*P. americana)* is the host reporting the most significant economic damage, but several ornamental species are also affected, such *as Ricinus communis, Acer negundo, Quercus pedunculiflora, Quercus robur, Platanus occidentalis, Platanus orientalis* and *Acer buergerianum* (Mendel et al., 2017). A survey in Israel (Mendel et al., 2017), revealed that 52 tree species from 26 botanical families have been affected by the beetle, but only 12 species were suitable for beetle reproduction. The fungi were isolated from some of the species where the beetle did not reproduce.
Pathways	According to the PRA of EPPO (2017) the main pathways of entry are: plants for planting (except seeds) and wood of reproductive host species. *N. euwallaceae* causes serious damage to more than 20 tree species, and, according to Eskalen et al. (2013) it was isolated from 113 different plant species. An attempted beetle attack may serve as an infection site for the fungi in both reproductive and non-reproductive hosts of PSHB, however, in some cases the fungus was not able to infect the tissue (Eskalen et al., 2013).
Surveillance information	According to the information provided by the PPIS by Israel (Section 5.3, Dossier): All plants for planting exported from Israel originate from nurseries that are approved by PPIS and are under PPIS inspection. In nurseries that export trees, PPIS inspection is carried out every 45 days. Further to the PPIS inspection, the producers carry out regular comprehensive self-inspections, once a week. This inspection is performed by the nursery agronomists and according to the PPIS inspector's instructions. The results are recorded in the nursery logbook and every adverse finding is reported immediately to the inspector. The logbook is regularly reviewed during the inspector visits to the site. Whenever a harmful organism of interest is found at any production site, the grower is required to inform PPIS and to treat the site as appropriate. During consecutive inspections, if there is no further evidence to the presence of the pest, the PPIS considers the site of production to be free from this harmful organism. Further diagnostic procedures may be performed according to requirements of the importing country and in the case of inspection findings that necessitate identification of a causative agent. Additionally, the PPIS mentions that although it is a major pest in avocado orchards in Israel, concerning nursery plants in Israel, it has not been reported as a pest and there is no evidence of damage (Table D.2, Dossier).

A.4.2. Possibility of pest presence in the nurseries

A.4.2.1. Possibility of entry from the surrounding environment

In Israel, castor bean (*Ricinus communis*), box elder (*Acer negundo*), *Quercus pedunculiflora*, *Quercus robur*, *Persea americana*, *Platanus occidentalis*, *Platanus orientalis*, and *Acer buergerianum* are reported as reproductive hosts for PSHB and hosts of its associated fungus (*N. euwallaceae)* (Mendel et al., 2017). These reproductive hosts are significant drivers for the population dynamics of the beetle and the resulting disease. Therefore, the presence of such species in the environment of the nurseries with *P. americana* plants is an important factor for the possible migration of infected beetles into the nursery.

The fungus can be introduced into the nursery only by the insect vector *E. fornicatus*. There are divergences in the literature about the flying capacity of *Euwallacea sp*. It is considered that the beetle (only females can fly) is able to fly up to about 457 m (EPPO, 2017). Calnaido (1965) reported an estimated flight distance of 864 m without external help (e.g. wind) while Owens et al. (2019) found a maximum dispersal distance of 400 m. In any case, only a few insects fly this distance. Wind speed and direction can have a great effect on the number of beetles that disperse as well as on the distance they can cover within a single flight (Owens et al., 2019). Magnitude of natural spread is considered moderate with moderate uncertainty. Human-assisted spread is assessed to be high with low uncertainty (EPPO, 2017).

EPPO (2017) define as a risk area where there are many agricultural, forests and urban species that could be attacked: e.g. *Acacia* spp*., Acer negundo, Citrus* spp*., Ficus carica, Persea americana, Platanus, Populus, Quercus* and *Salix*.

There is no evidence that the nurseries are located in a pest-free area for *N. euwallaceae* so the Panel assumes that the fungus and *E. fornicatus* can be present in the production areas of *P. americana* destined for export to the EU.

In the answers given by the applicant country it is reported that within a radius of 2 km from the cultivation sites of avocado for export, the following species are present: *Acacia* spp. (in the wild), *Persea americana* (in agriculture and possibly in private yards), *Ricinus communis* (in the wild). These species are known as host plants of *E. fornicatus*.

Uncertainties:

Taking into consideration the above evidence and uncertainties, the Panel considers that the entry of the pest from the surrounding environment is likely.

A.4.2.2. Possibility of entry with new plants/seeds

Fruit for seeds that germinate the stocks are harvested from PPIS-approved mother plants only. Approval of plots for stocks and scions is done according to the PPIS internal guidelines for approval of plots for production of avocado stocks and scions (continuously updated, recent version 2019).

The seeds are treated after extraction from fruit, with fungicides. Scions are collected only from mother plants that are free from *Euwallacea fornicatus*. Scions are treated prior to grafting, with fungicides. The stocks and the grafted plants are regularly monitored by the grower for pests and disease symptoms (Dossier, Section 3.8).

Uncertainties:

Taking into consideration the above evidence and uncertainties, the Panel considers it is unlikely that the insect and the pathogen enter the nursery with new plants/seeds, but cannot be excluded.

A.4.2.3. Possibility of spread within the nursery

Introduction by the use of infected soil or water is not relevant for this risk assessment. It is also highly unlikely that the pathogen and its vector are transported by means of growing practices. Both natural and human-assisted movement can spread the pest within the nursery.

Uncertainties:

Taking into consideration the above evidence and uncertainties, the Panel considers that the spread of the pest within the nurseries is possible.

A.4.3. Information from interceptions

Considering imports of *P. americana* plants from Israel to the EU, between 1995 and 2020, there are no records of interceptions of *Euwallacea fornicatus* and/or *Neocosmospora euwallaceae* (EUROPHYT, online, Accessed: 9/3/2020).

A.4.4. Evaluation of the risk mitigation measures

In the table below, all risk mitigation measures currently proposed in Israel are summarized and an indication of their effectiveness on *Euwallacea fornicatus* and *Neocosmospora euwallaceae* is provided.

No.	Risk mitigation measure	Effect on pest	Evaluation and uncertainties for scions	Evaluation and uncertainties for grafted plants
7	Scions selection Scions are collected only from mother plants that are free from *Euwallacea fornicatus*	Yes	Uncertain whether visual inspection will detect newly infected plants	Idem
9	Fungicide **Captan**: i) Against general fungi, including Fusarium sp. (e.g. *Fusarium pallidoroseum*): a) On seeds and scions (prior to grafting, 0.1%) b) After planting (in a preventative manner, 0.15%) ii) Against *Neocomospora euwallaceae, in mother plants of the grafted scions large enough in diameter to host Euwallacea fornicatus (Periodically, in a preventative manner, 0.1%)* **Pyraclostrobin and Boscalid** (against general fungi) a) seeds and scions, plants during growth, prior to grafting and periodically, in a preventative manner, 0.1% b) Cuttings and pot plants, prior to export, 0.1% **Cyprodinil and Fludioxonil** (against general fungi) a) seeds and scions prior to grafting, 0.1% b) plants during growth, periodically, in a preventative manner, 0.1% c) Cuttings and pot plants, prior to export, 0.1% **Thiophanate-methyl** (against general fungi) Plants during growth, periodically, in a preventative manner, 70% **Potassium phosphite** (against general fungi, including Botryosphaeria spp.) – Plants during growth, periodically, in a preventative manner, 0.5%	Yes	Fungi are found inside the plants and are vectored by *Euwallacea fornicatus*. Thus, fungicide applications of these chemicals to the exterior of the plants is not expected to be particularly effective against the fungi inside the plant, nor to the fungi inside the insect vector. Documentation of the effect of Captan, applied to the exterior of the plant, in controlling the disease caused by Neocosmospora euwallaceae seems to be lacking. Some fungal pathogens can develop resistance to different fungicides, and the risk of fungicide resistance can vary according to the compounds (FRAC, 2020): Captan low risk of developing resistance; Pyraclostrobin is high risk; Boscalid is medium to high risk; Cyprodinil is medium risk; Fludioxinil low to medium risk; Thiophanate-methyl is high risk Potassium phosphite has a poorly documented effect on this group of pathogens, and is generally effective only to oomycetes. Systemic fungicides may be more effective against *N. euwallaceae* than contact fungicides.	Idem

10	**Insecticide and acaricide treatments** **Acetamiprid** (against *Euwallacea fornicatus)* – During growth, In a preventative manner, 0.06% *E. fornicatus* is not reported in avocado nurseries in Israel. Used preventatively, relevant against this pest in mother plants of the grafted scions that are large enough in diameter to host *Euwallacea fornicatus* (Table E.1, Dossier)	Yes	Systemic insecticide and therefore potentially effective against the beetle.	Idem
1	**Registration of production sites**	Yes	Given the regular inspections, it is likely that symptoms caused by the beetle or the fungi will be detected. It is uncertain whether newly infested/infected plants will be detected.	Idem
4	**Stock selection** • Fruit for seeds that germinate the stocks are harvested from PPIS-approved mother plants only. Approval of plots for stocks and scions is done according to the PPIS internal guidelines for approval of plots for production of avocado stocks and scions (continuously updated, recent version 2019). • The seeds are treated after extraction from fruit, with suitable fungicides. • Scions are harvested from PPIS-approved mother plants only. • Scions are treated prior to grafting, with suitable fungicides. • The stocks and the grafted plants are regularly monitored by the grower for pests and disease symptoms.	Yes	Given the regular inspections, it is likely that symptoms caused by the beetle or the fungi will be detected. It is uncertain whether newly infested/infected plants will be detected.	Idem
5	**Surveillance and monitoring** All plants for planting exported from Israel originate from nurseries that are approved by PPIS and are under PPIS inspection. • In nurseries that export trees, PPIS inspection is carried out every 45 days. • Further to the PPIS inspection, the producers carry out regular comprehensive self-inspections, once a week. This inspection is performed by the nurseries agronomists and	Yes	Given the regular inspections, it is likely that symptoms caused by the beetle or the fungus will be detected. It is uncertain whether newly infested/infected plants will be detected.	Idem

	according to the PPIS inspector's instructions. The results are recorded in the nursery logbook and every adverse finding is reported immediately to the inspector. The logbook is regularly reviewed during the inspector visits to the site. • Whenever a harmful organism of interest is found at any production site, the grower is required to inform PPIS and to treat the site as appropriate. During consecutive inspections, if there is no further evidence to the presence of the pest, the PPIS considers the site of production to be free from this harmful organism. • Further diagnostic procedures may be performed according to requirements of the importing country and in the case of inspection findings that necessitate identification of a causative agent.			
8	Stem size	Yes	According to the literature *Euwallacea* sp. usually attacks trunks and thick branches. Nevertheless, in some hosts (i.e. avocado) this beetle colonizes branches of 2–2.5 cm. The exported commodities present a diameter of ≤ 1cm, however due to the small size of adult females (1.83 ± 0.07 mm. long and 0.80 ± 0.6 mm wide), an attack in thinner stems or branches cannot be completely dismissed. The EPPO Panel on Phytosanitary Measures agreed that this option was not suitable as well as 'plants at early growth stages' because of the high uncertainty (EPPO, 2017).	Idem
12	Storage rooms condition The harvested scions are treated with suitable fungicides and stored in chilled storage rooms at a temperature of 2°C and 70% humidity.	Yes	Uncertainty: The effect on latent or endophytic presence is unclear.	Idem

A.4.5. Overall likelihood of pest freedom

A.4.5.1. Reasoning for a scenario which would lead to a reasonably low number of infested consignments

Production areas are isolated from the area where the beetle and the fungus are present. Plants in the surrounding environment are not hosts of the beetle and the fungus. The inspection regime would be effective (detection of the beetle). Scions are collected only from mother plants that are free from *E. fornicatus*. The beetle and the fungus are not reported in the exporting nurseries in Israel. The age and size of the exported plants is unsuitable for colonisation.

A.4.5.2. Reasoning for a scenario which would lead to a reasonably high number of infested consignments

Production areas are in places where *E. fornicatus* and *N. euwallaceae* are present. Host plants of the beetle and the fungus are abundant in the surrounding environment (e.g. *P. americana*, *R. pseudoacacia*). High population pressure of the beetle (e.g. abandoned infested fields of highly preferable hosts). Asymptomatic plants remain undetected. Presence of the beetle in the environment is not detected. Risk mitigation measures in place are not fully effective, insecticide and fungicide treatments cannot prevent colonisation of mother plants.

A.4.5.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infested consignments (Median)

Young and healthy plants with very small stem and branch diameter do not favour the attack of the beetle. Inspections before consignment are able to detect bark beetle infestations. If infestations occur would take values near or below the estimated median value.

A.4.5.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

The diameter of branches potentially attacked and infested by the beetle is uncertain. Although literature indicates that usually occurs in branches with a diameter of more than 2 cm. Incidental reports and experimental evidence suggest that attacks to small diameter branches and stems cannot be excluded.

A.4.5.5. Elicitation outcomes of the assessment of the pest freedom for Bark beetle-fungus complex (*Euwallacea fornicatus* and *Neocosmospora euwallaceae*

The following tables show the elicited and fitted values for pest infestation/infection (Tables A.11 and A.13) and pest freedom (Tables A.2 and A.14).

Table A.11: Elicited and fitted values of the uncertainty distribution of pest infestation by bark *beetle-fungus complex* per 10,000 grafted plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0.00					10.0		20.0		35.0					50.0
EKE	0.23	0.66	1.46	3.25	5.86	9.35	13.1	21.1	29.8	34.4	39.2	43.4	46.7	48.5	49.7

The EKE results are *BetaGeneral (0.87227, 1.1119, 0, 50.6)* fitted with @Risk version 7.6.

Based on the numbers of estimated infested grafted plants the pest freedom was calculated (i.e. = 10,000 – the number of infested grafted plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.12.

Table A.12: The uncertainty distribution of plants free of bark *beetle-fungus complex* per 10,000 grafted plants calculated by Table A.11

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,950					9,965		9,980		9,990					10,000
EKE results	9,950	9,951	9,953	9,957	9,961	9,966	9,970	9,979	9,987	9,990.6	9,994.1	9,996.8	9,998.5	9,999.3	9,999.8

The EKE results are the fitted values.

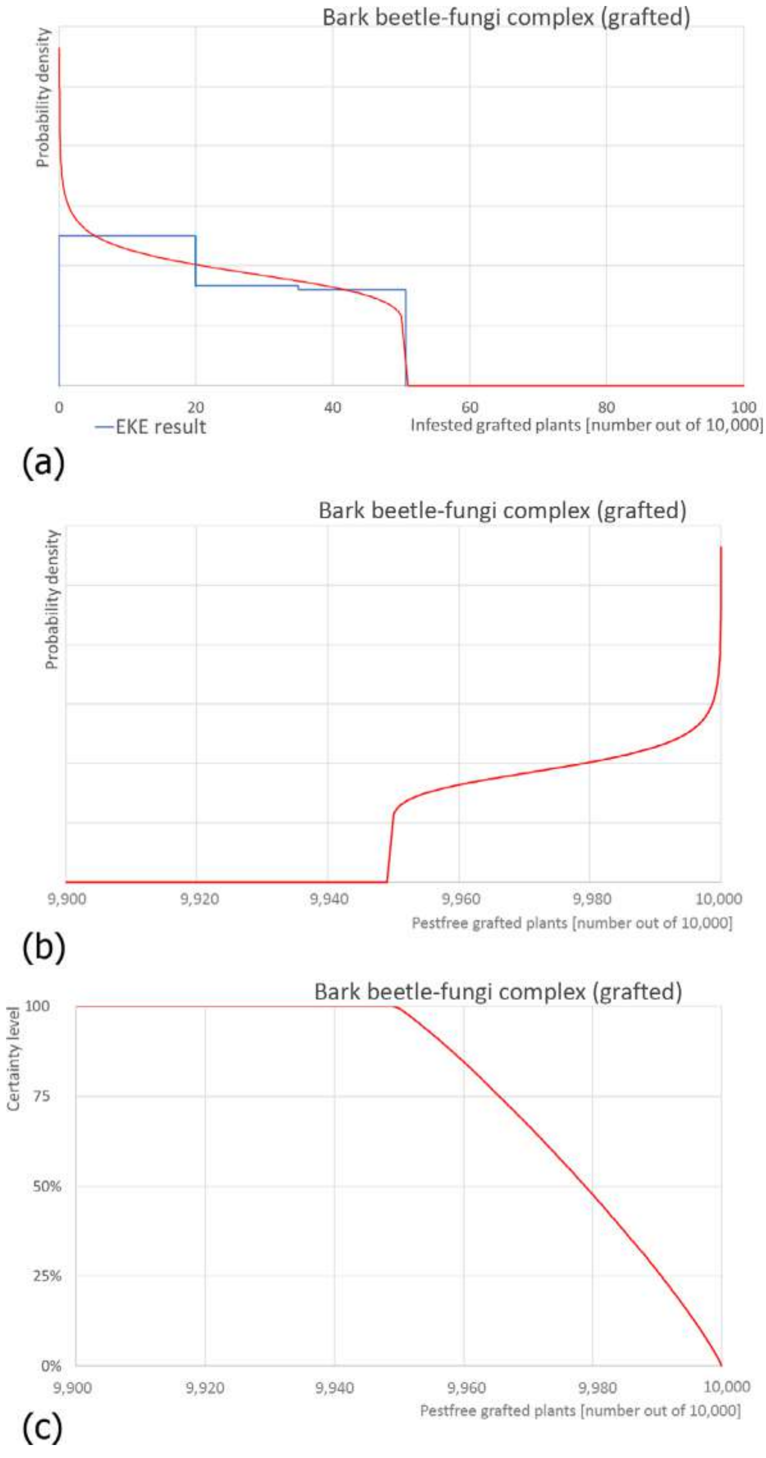


Figure A.6: (a) Elicited uncertainty of pest infestation per 10,000 grafted plants for bark beetle-fungus complex (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free grafted plants per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 grafted plants

Table A.13: Elicited and fitted values of the uncertainty distribution of pest infestation by bark *beetle-fungus complex* per 10,000 bundles of scions

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0.00					2.00		4.00		6.00					10.0
EKE	0.13	0.29	0.51	0.92	1.43	2.04	2.65	3.92	5.30	6.07	6.95	7.79	8.58	9.12	9.56

The EKE results are *BetaGeneral (1.2081, 1.7592, 0, 10.2)* fitted with @Risk version 7.6.

Based on the numbers of estimated infested bundles of scions the pest freedom was calculated (i.e. = 10,000 – the number of infested bundles of scions per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.14.

Table A.14: The uncertainty distribution of plants free of bark *beetle-fungus complex* per 10,000 bundles of scions calculated by Table A.13

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,990					9,994		9,996		9,998					10,000
EKE results	9,990.4	9,990.9	9,991.4	9,992.2	9,993.1	9,993.9	9,994.7	9,996.1	9,997.3	9,998.0	9,998.6	9,999.1	9,999.5	9,999.7	9,999.9

The EKE results are the fitted values.

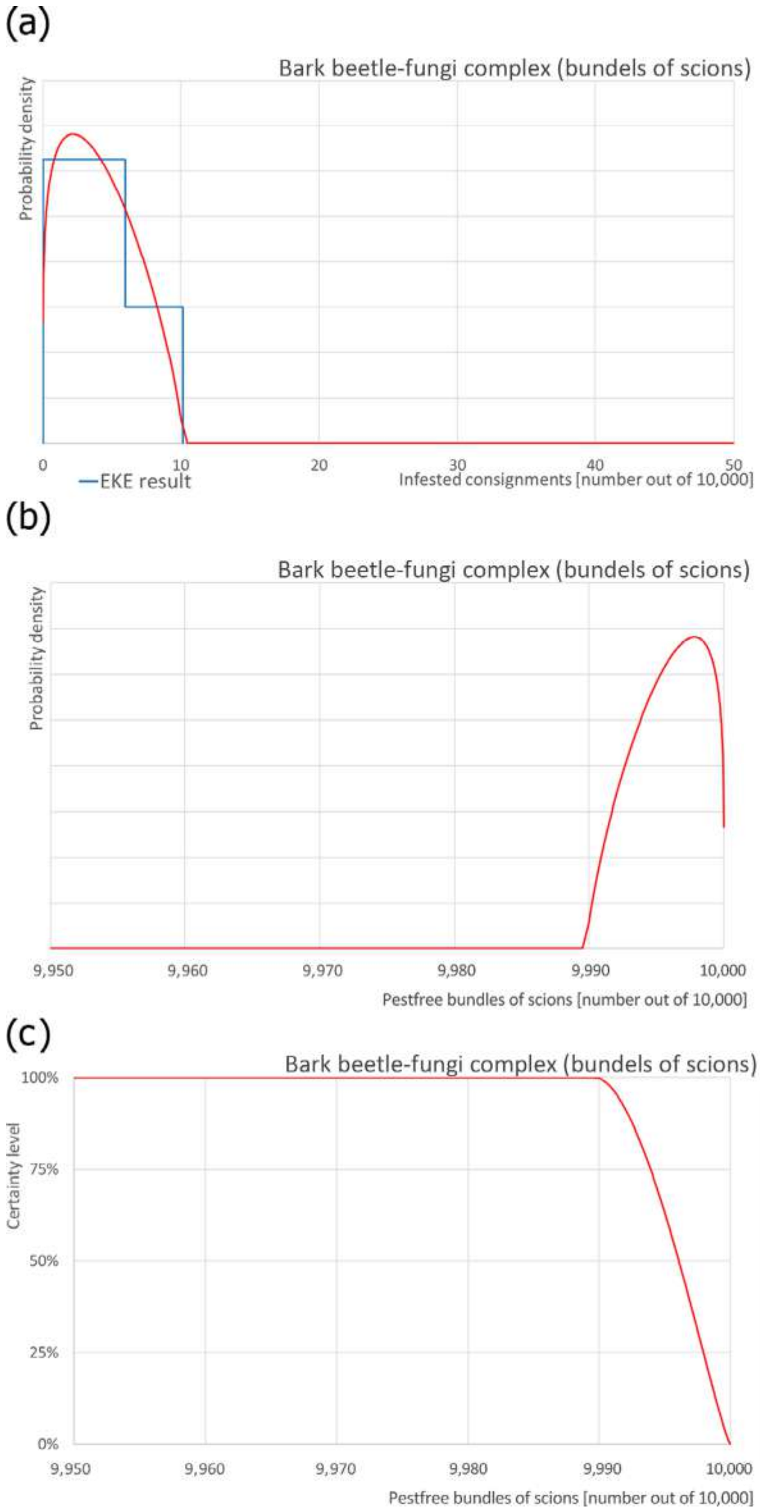


Figure A.7: (a) Elicited uncertainty of pest infestation per 10,000 bundles of scions for bark beetle-fungus complex (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free bundles of scions per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 bundles of scions

A.4.6. Reference list

CABI (Centre for Agriculture and Bioscience International), online. Fusarium euwallaceae. Available online: https://www.cabi.org/isc/datasheet/30860103 [Accessed: 16 July 2019].

CABI (Centre for Agriculture and Bioscience International), online. Euwallacea fornicatus (tea shot-hole borer). Available online: https://www.cabi.org/isc/datasheet/57163 [Accessed: 11 July 2019].

Calnaido D, 1965. The flight and dispersal of shot-hole borer of tea (Xyleborus fornicatus Eichh., Coleoptera: Scolytidae). EntomologiaExperimentalis et Applicata, 8, 249–262. https://doi.org/10.1111/j.1570-7458.1965.tb00859.x

EPPO (European and Mediterranean Plant Protection Organization), 2016. Mini data sheet on Euwallacea sp. And its symbiotic fungus Fusarium euwallaceae. Available online: https://gd.eppo.int/taxon/FUSAEW/documents

EPPO (European and Mediterranean Plant Protection Organization), 2017. Report of a Pest Risk Analysis for Euwallacea fornicatus sensu lato and Fusarium euwallaceae. Available online: https://gd.eppo.int/taxon/FUSAEW/documents

EPPO (European and Mediterranean Plant Protection Organization), online. EPPO Global Database: Euwallacea fornicatus. Available online: https://gd.eppo.int/taxon/XYLBFO [Accessed: 11 July 2019].

EPPO (European and Mediterranean Plant Protection Organization), online. EPPO Global Database: Fusarium euwallaceae. Available online: https://gd.eppo.int/taxon/FUSAEW [Accessed: 16 July 2019].

Eskalen A, Stouthamer R, Lynch SC, Twizeyimana M, Gonzalez A and Thibault T, 2013. Host range of Fusarium dieback and its ambrosia beetle (Coleoptera: Scolytinae) vector in southern California. Plant Disease, 97, 938–951. https://doi.org/10.1094/PDIS-11-12-1026-RE

FERA (Food and Environment Research Agency), 2015. Rapid Pest Risk Analysis (PRA) for Polyphagous Shot Hole Borer (Euwallacea sp.) and Fusarium Dieback (Fusarium euwallaceae) V2.09.06.2015.

Freeman S, Sharon M, Maymon M, Mendel Z, Protasov A, Aoki T, Eskalen A and O'Donnell K, 2013. Fusarium euwallaceae sp. nov.—a symbiotic fungus of Euwallacea sp., an invasive ambrosia beetle in Israel and California. Mycologia, 105, 1595–1606. https://doi.org/10.3852/13-066

Gomez DF, Skelton J, Steininger MS, Stouthamer R, Rugman-Jones P, Sittichaya W, Rabaglia RJ and Hulcr J, 2018. Species delineation within the Euwallacea fornicatus (Coleoptera: Curculionidae) complex revealed by morphometric and phylogenetic analyses. Insect Systematics and Diversity, 2, 1–11. https://doi.org/10.1093/isd/ixy018

Mendel Z, Protasov A, Sharon M, Zveibil A, Ben Yehuda S, O'Donnell K, Rabaglia R, Wysoki M and Freeman S, 2012. An Asian ambrosia beetle Euwallacea fornicatus and its novel symbiotic fungus Fusarium sp. pose a serious threat to the Israeli avocado industry. Phytoparasitica, 40, 235–238. https://doi.org/10.1007/s12600-012-0223-7

Mendel Z, Protasov A, Maoz Y, Maymon M, Miller G, Elazar M, Freeman S, 2017 The role of Euwallacea nr. fornicatus (Coleoptera: Scolytinae) in the wilt syndrome of avocado trees in Israel. Phytoparasitica, 45, 341–359. https://doi.org/10.1007/s12600-017-0598-6

Ministerio De Agricultura, Alimentacion Y Medio Ambiente, 2015. Express Pest Risk Analysis For The Ambrosia* BEETLE Euwallacea sp. including all the species within the genus Euwallacea that are morphologically similar to E. fornicatus. Reino De España, Dirección General de Sanidad de la Producción Agraria Subdirección General de Sanidad e Higiene Vegetal y Forestal. Available online: https://gd.eppo.int/download/doc/1267_pra_exp_XYLBFO.pdf

Owens D, Seo M, Montgomery WS, Rivera MJ, Stelinski LL and Kendra PE, 2019. Dispersal behaviour of Euwallacea nr. fornicatus (Coleoptera:Curculionidae: Scolytinae) in avocado groves and estimation of lure sampling range. Agricultural and Forest Entomology, 21, 199–208. https://doi.org/10.1111/afe.12321

Paap T, de Beer ZW, Migliorini D, Nel WJ and Wingfield MJ, 2018. The polyphagous shot hole borer (PSHB) and its fungal symbiont Fusarium euwallaceae: a new invasion in South Africa. Australasian Plant Pathology, 47, 233–237. https://doi.org/10.1007/s13313-018-0545-0

Smith SM, Gomez DF, Beaver RA, Hulcr J and Cognato AI, 2019. Reassessment of the species in the Euwallacea fornicatus (Coleoptera: Curculionidae: Scolytinae) complex after the rediscovery of the "lost" type specimen. Insects, 10, 261.

U.S. Department of Agriculture, Agricultural Research Service, U.S. National Fungus Collections Fungal Database. Available online: https://nt.ars-grin.gov/fungaldatabases/ [Accessed: 9 March 2020].

A.5. Mealybugs and soft scales Group A (*Nipaecoccus viridis, Paracoccus marginatus, Pseudococcus cryptus, Icerya aegyptiaca, Milviscutulus mangiferae*)

A.5.1. Organism information

A.5.1.1. *Nipaecoccus viridis*

Taxonomic information	Current valid scientific name: *Nipaecoccus viridis* (Newstead) Synonyms: *Dactylopius perniciosus*, *Dactylopius vastator, Dactylopius viridis*, *Nipaecoccus vastator, Pseudococcus albizziae*, *Pseudococcus filamentosus* var. *corymbatus*, *Pseudococcus perniciosus*, *Pseudococcus solitarius*, *Pseudococcus vastator, Pseudococcus viridis*, *Trionymus sericeus* Name used in the EU legislation: – Order: Hemiptera Family: Pseudococcidae Common name: spherical mealybug, coffee mealybug, cotton mealybug, globular mealybug Name used in the Dossier: *Nipaecoccus viridis*
Group	Insects
EPPO code	NIPAVI
Regulated status	*Nipaecoccus viridis* is a quarantine pest for Korea (PRF, 2004), New Zealand (PRF, 2004), and Syria (EPPO, 2001) (Thomas and Leppla 2008 - Proc. Fla. State Hort. Soc. 121:152–154). Categorization (EPPO GD): A1 list in Brazil and Turkey; A2 list in East Africa, Southern Africa, Bahrain.
Pest status in Israel	Present (CABI, online; EPPO, online_b).
Pest status in the EU	Absent (CABI, online; EPPO, online_b).
Host status on *Persea americana*	*Persea americana* is reported as a main host of *Nipaecoccus viridis.* CABI CPC: https://www.cabi.org/cpc/datasheet/36335 (11 October 2017); EPPO GD: https://gd.eppo.int/taxon/NIPAVI (11 July 2019); Kaspi et al. (2017).
PRA information	No PRA available
Other relevant information for the assessment	
Biology	This mealybug is small, cryptic, often polyphagous, and it is a notorious invader (Sharaf and Meyerdirk, 1987), feeding and ovipositing on leaves, stems, and fruit of citrus (Browning et al., 2007). Reproduction of *N. viridis* mainly occurs sexually and the eggs are laid in an ovisac, although females may also reproduce parthenogenetically (Sharaf and Meyerdirk, 1987). Females of this species are flightless (CABI CPC). The crawler (first-instar nymph) is the only life stage that can move readily and, due to the small size of crawlers, they usually settle on the same host (Sharaf and Meyerdirk, 1987). Crawlers and all other life stages of *N. viridis* can be transported over long distances on infested plant material, especially plants for propagation (Anderson, 1924). The fecundity of a single large female can exceed 1100 eggs; this pest can develop quickly large populations due to multiple, overlapping generations (Bartlett, 1978). Although there have been no specific studies on dispersal, *N. viridis* crawlers can be carried passively by the wind for a few meters to several kilometres (Gullan and Kosztarab, 1997). Transport by wind-blown infested leaves can occur in all stages of mealybug development (Williams, 2004). Also, the sticky, stringy ovisac can adhere to the feet of birds, leading to rapid and widespread dispersal (Bartlett, 1978). Overwintering took place as eggs, nymphs and adults (Thomas and Leppla, 2008). In citrus orchards at Rustenburg, South Africa, there are three generations of *N. viridis* per year (Cilliers and Bedford, 1978).

	Individuals often settle in cryptic places on plant material, such as under sepals of citrus fruits, and can easily be distributed on exported plants or plant products (CABI CPC). According to the USDA, Animal and Plant Health Inspection Service (APHIS), the likelihood of accidentally introducing *N. viridis* depends on several factors including the quantity of plants imported annually, the insect survival following postharvest treatment and shipment, its detection at the port of entry, and its ability to locate a suitable habitat and establish on a host plant (USDA–APHIS, 2000). The country of origin and commodity are also critical factors. The mealybug is an external feeder so there would be a high probability of detection relative to an internal pest. However, mealybugs are difficult to detect when concealed beneath the calyx or in packing material.	
Symptoms	**Main type of symptoms**	This mealybug feeds on branches, twigs, shoots, leaves, flower buds, and fruit of the host (Sharaf and Meyerdirk, 1987). It injects toxic saliva into host tissues and sucks the plant phloem content, resulting in curling of terminal growth and bulbous outgrowths on young twigs. Severe infestations may cause chlorosis, wilting and dieback of affected parts (Sharaf and Meyerdirk, 1987). Infested citrus fruit often become yellow and then partly black around the stem, eventually dropping off the tree. In addition, a fruit can develop lumpy outgrowths or raised shoulders near the stem end (Hattingh et al., 1998). A copious amount of honeydew (a sugary substance excreted by the scale) is produced by the spherical mealybug that can contaminate fruit and other plant parts, promoting the growth of sooty mold (Gross et al., 2000). Mani and Thontadarya (1987) reported that *N. viridis* caused up to 5% damage in two vineyards in Bangalore, India. In Hawaii, *N. viridis* was long considered the most destructive mealybug species (Bartlett, 1978). Cilliers and Bedford (1978) and Hattingh et al. (1998) described and illustrated the effect of this mealybug on citrus in South Africa. Feeding on young twigs causes bulbous outgrowths, and heavy infestations may severely stunt the growth of young trees. Occasionally, this mealybug becomes so abundant on citrus that the branches and leaves become covered with white cottony threads (Annecke and Moran, 1982). Also, the leaves and other parts of the tree become shining wet with honeydew. Frequently, fruits turn yellow and then partly black around the stem end, finally dropping off the tree. Late infestations on large green fruits result in congregations of young mealybugs in clumps over the face of the fruit. Each colony produces a raised spot which turns yellow. When maturing fruit is infested, such feeding areas become excessively yellow. Ghosh and Ghosh (1985) reported that the artificial infestation of cotton, citrus, jute, jack fruit (*Artocarpus heterophyllus*) and bhant (*Clerodendrum infortunatum*) with *N. viridis* resulted, in general, in arrestment of linear growth of the stems and petioles and great reduction and crumpling of the leaves.
	Presence of asymptomatic plants	N/A
	Confusion with other pests	Many mealybugs are very similar to each other in overall appearance, and are thus difficult to identify. a) This mealybug can be distinguished from other mealybugs on citrus by means of the key provided by Hattingh et al. (1998). Diagnostic features are the purple body contents of all stages and the eggs as well as the globular, finely woven, smooth-surfaced ovisac, the threads of which can be drawn out extensively. The gross appearance of this species can give an initial impression of a margarodid (e.g. *Icerya* sp.) rather than a mealybug.

Host plant range	Citrus, cotton, and grapes are some of its economically important host crops (CABI, 2006). Ben-Dov (1994) listed all recorded host plants of *N. viridis*. It is a rather polyphagous species, feeding on plants in 18 families, many of which are trees, and including crops such as citrus and coffee. Apparently, bhant (*Clerodendrum infortunatum*) is the original wild food-plant of the pest in West Bengal, India (Ghosh and Ghosh, 1985). Hosts include also *Citrus (incl. aurantium, reticulata), Vitis, Mangifera indica, Asparagus, Chrysanthemum, Carica papaya, Cucumis, Pyrus communis, Rosa, Solanum, Persea americana, Gossypium, Coffea* (Garcia Morales et al., 2016) (EPPO GD).
Pathways (EPPO GD)	Not mobile and often hidden, e.g. under sepals of citrus fruits, can easily be transported on exported plant commodities (CABI CPC). External feeder on table grapes (APHIS 2013) Other pathways, plants for planting, on which it can be present on all plant parts, except roots (CABI CPC).
Surveillance information	No surveillance information for these pests is currently available from PPIS. There is no information on whether these pests have ever been found in the nurseries or their surrounding environment.

A.5.1.2. *Paracoccus marginatus*

Taxonomic information	Current valid scientific name: *Paracoccus marginatus* Williams & Granara de Willink Synonyms: Name used in the EU legislation: Order: Hemiptera Family: Pseudococcidae Common name: marginal mealybug, papaya mealybug, cochenille du papayer. Name used in the Dossier: *Paracoccus marginatus*	
Group	Insects	
EPPO code	PACOMA	
Regulated status	*Paracoccus marginatus* is not regulated in the EU neither listed by EPPO. The pest is quarantine in Morocco (EPPO, online).	
Pest status in Israel	Present (CABI, online; EPPO, online_b).	
Pest status in the EU	Absent (CABI, online; EPPO, online_b).	
Host status on *Persea americana*	*Persea americana* is reported as a main host of *Paracoccus marginatus.* (CABI CPC; DROPSA, October 2016).	
PRA information	No PRA is available	
Other relevant information for the assessment		
Biology	This mealybug reproduces sexually. There are three nymphal instars and no pupal stage in the wingless female, and eggs are laid in a small, white ovisac of woolly wax. The winged male has two nymphal stages, a pre-pupa and a pupal stage. There are several generations per year (Muniappan, et al., 2009). The females lays 247–332 (291 $\pm$ 33.31) eggs within 4–9 (6.2 $\pm$ 0.82) days. Based on the studies of papaya mealybug on three different host plants, it can be inferred that papaya plant is the preferred host than brinjal and *Parthenium hysterophorus* (Seni & Sahoo, 2015). Parthenium weed is a serious invasive plant in Israel (Yaacoby, 2013), is a highly suitable host for papaya mealybug (Amarasekare et al., 2008) and may facilitate the spread of the mealybug.	
Symptoms	**Main type of symptoms**	This species causes deformation of new growth, leaf yellowing, leaf curl, early fruit drop, wax secretions (CABI CPC), chlorosis, plant stunting, leaf deformation, early leaf drop, honeydew, and plant death (Walker et al., 2006). Its importance recently increased; it causes damage especially on cassava, papaya, hibiscus, annona (CABI CPC), also avocado, citrus, cotton, tomato, eggplant, peppers, beans and peas, sweet potato, mango, cherry, and pomegranate (Walker et al., 2006). On papaya, heavy infestations rendered fruits inedible, and high infestation levels were observed in Rajasthan, India, in many gardens (> 80% damage, mat of mealybug on leaves, all leaves damaged, new

		shoots fully covered with mealybugs, fruit fall and blackening of fruits with full mealybug cover on fruits) (Mani et al., 2012). No specific data were found for Citrus.
	Presence of asymptomatic plants	No data available
	Confusion with other pests	No data available
Host plant range	b) Highly polyphagous, with more than 55 host plants in over 25 genera, including *Citrus, Carica papaya, Hibiscus, Persea americana, Gossypium, Solanum lycopersicon, Solanum melongena, Capsicum, Phaseolus, Pisum, Mangifera indica, Prunus (as cherry), Punica granatum (Walker* et al*., 2006), Annona squamosa, Coffea, Gardenia, Jatropha curcas, Manihot esculenta, Plumeria, Citrus sinensis, Dahlia pinnata, Rosa* (CABI CPC).	
Pathways (EPPO GD)	b) Fruit, plants for planting, cut flowers.	
Surveillance information	b) No surveillance information for these pests is currently available from PPIS. There is no information on whether these pests have ever been found in the nurseries or their surrounding environment.	

A.5.1.3. *Pseudococcus cryptus*

Taxonomic information	Current valid scientific name: *Pseudococcus cryptus* Hempel Synonyms: *Planococcus cryptus, Dysmicoccus cryptus, Pseudococcus citriculus* Name used in the EU legislation: Order: Hemiptera Family: Pseudococcidae Common name: citriculus mealybug, cochenille blanche, cochinilla harinosa de los cítricos. Name used in the Dossier: *Planococcus cryptus*	
Group	Insects	
EPPO code	DYSMCR	
Regulated status	*Pseudococcus cryptus* is not regulated in the EU neither listed by EPPO. The pest is quarantine in Morocco and Belarus, in A1 list in Argentina, Kazakhstan, Uzbekistan and Azerbaijan (EPPO GD).	
Pest status in Israel	Present (CABI, online; EPPO, online_b).	
Pest status in the EU	Absent (CABI, online; EPPO, online_b).	
Host status on *Persea americana*	*Persea americana* is a host of *Pseudococcus cryptus* (Ben-Dov, 1994).	
PRA information	No PRA is available	
Other relevant information for the assessment		
Biology	In the Coastal Plain of Israel, this mealybug is ovoviviparous (Kim et al. 2008) and is able to produce 6 generations annually (Gruenberg, 1956), which allows rapid population build up. This species infests the roots of coffee (Podtiaguin, 1944), citrus (Costa Lima, 1930; Bodenheimer, 1951a) and avocado and the aerial parts of the host plants. Regardless of the importance and invasiveness of *P. cryptus*, there have been few studies regarding the effect of temperature and host plant species on its development and fecundity (Arai 1996, Kim et al. 2008). The developmental threshold temperature has been determined as about 10°C (Arai 1996). Kim et al. (2008) reported that the total development time decreased with increasing temperature and ranged from 54.9 days at 16°C, 17.4 d at 28°C and 19.3 d at 32°C. P.	
Symptoms	**Main type of symptoms**	The cryptic mealybug feeds on the leaves, fruits and branches and produces honeydew on which sooty mold develops. Avidov and Harpaz (1969) mentioned that heavy infestations caused leaf and fruit drop and that the entire tree could become covered with sooty mold. In Israeli citrus groves, *P. cryptus* usually occurs together with the citrus mealybug, *Planococcus citri* (Risso). However, *P. citri* occurs and develops on the fruits whereas

		P. cryptus can infest all parts of the tree, being found mainly on leaves and twigs. Damage to citrus has been associated with fruit and flower drop, wilting and general debilitation of the plant and also, importantly, with the unsightly appearance of the fruit due to the large quantities of honeydew on which sooty mould develops. When the infestation levels of *P. cryptus* are high, it tends to aggregate in dense colonies covering the leaves, twigs and trunk.
	Presence of asymptomatic plants	No data available
	Confusion with other pests	Morphologically similar to *Pseudococcus aurantiacus* Williams, *Pseudococcus comstoki* Klein & Perzelan and *Pseudococcus viburni* (Signoret).
Host plant range	Fairly polyphagous species (Blumberg et al. (1999). About 90 host plant species recorded, it is a particular pest of citrus in Israel (Ben-Dov, 1988).	
Pathways (EPPO GD)	Often hidden, e.g. under sepals of citrus fruits, can easily be transported on exported plant commodities (CABI CPC). Other pathways: plants for planting.	
Surveillance information	No surveillance information for these pests is currently available from PPIS. There is no information on whether these pests have ever been found in the nurseries or their surrounding environment.	

A.5.1.4. *Icerya aegyptiaca*

Taxonomic information	Current valid scientific name: *Icerya aegyptiaca* (Douglas) Synonyms: *Crossotosoma aegyptiacum*, *Icerya aegyptiacum*, *Icerya tangalla* Name used in the EU legislation: – Order: Hemiptera Family: Margarodidae Common name: breadfruit mealybug, Egypt Icerya, Egyptian cushion scale, Egyptian fluted scale, Egyptian mealybug, Egyptian cottony cushion scale Name used in the Dossier: – *Icerya aegyptiaca* Family: Coccidae Common name: green shield scale; guava mealy scale; guava pulvinaria; mango scale. Name used in the Dossier: N/A
Group	Insects
EPPO code	ICERAE
Regulated status	*Icerya aegyptiaca* is not regulated in the EU neither listed by EPPO. The pest is quarantine in Mexico and United States of America (EPPO, online_a).
Pest status in Israel	Present (CABI, online; EPPO, online_b).
Pest status in the EU	Absent (CABI, online; EPPO, online_b).
Host status on *Persea americana*	*Persea americana* is a host of *Icerya aegyptiaca* (García Morales et al., online).
PRA information	No PRA is available
Other relevant information for the assessment	
Biology	This margarodid is either Australasian or Indo-Malayan species (Unruh and Gullan, 2008). It is parthenogenic going through 5 life stages: an egg, three nymphal instars and an adult. So far males have never been found. In Egypt there can be two or partially three generations per year. Depending on temperature, the duration of the life cycle ranges from 87.2 (28.7°C) to 105.4 days (26.4°C). The peak of adults can be observed in summer (Waterhouse, 1993). Female can lay from 70 to up 200 eggs, which have yellow orange colour. They are laid into a waxy egg sac, attached to the abdomen. Crawlers (first instar nymphs) are initially bright orange, then becoming covered by wax within a day. The second and third instar nymphs are yellow orange covered with white mealy secretion. Adults are deep orange with blackish legs and antennae. They are covered with white mealy

	secretion, mingled with granular wax. Through this waxy covering, the body appears salmon pink (Waterhouse, 1993). The main economic impact is reported on breadfruit trees (*Artocarpus altilis*), but also on avocado, banana, citrus, taro (*Colocasia esculenta*) and young coconut palms (Waterhouse, 1993). In Egypt, *I. aegyptiaca* was reported as a serious pest of citrus, figs and shade trees (Waterhouse, 1993).	
Symptoms	**Main type of symptoms**	Main symptoms are white wax on leaves, leaf drop and dieback of branches (Uesata et al., 2011). Heavy infestations of mealybugs reduce yield and may cause death of plants (Waterhouse, 1993). On breadfruit trees, *I. aegyptiaca* can be usually found along the midribs and larger veins on the undersides of the leaves, and on fruits (Waterhouse, 1993). *I. aegyptiaca* produce honeydew, which is colonized by sooty mould that covers leaves and interferes with photosynthesis. The honeydew may be gathered by ants that hamper pest control by its natural enemies (Plant Pests of the Middle East, online). According to Uesata et al. (2011) in Japan, *I. aegyptiaca* produces little or no honeydew and it is rarely associated with sooty mould.
	Presence of asymptomatic plants	No data available
	Confusion with other pests	*Icerya aegyptiaca* is very similar to *Icerya imperatae.* They can be distinguished from each other by specific morphological features (Miller et al., online).
Host plant range	*Icerya aegyptiaca* is a highly polyphagous pest of 113 hosts at genus level (García Morales et al., online). The hosts of *I. aegyptiaca* are apple (*Malus domestica*), avocado (*Persea americana*), banana (*Musa* sp.), black pepper (*Piper nigrum*), breadfruit tree (*Artocarpus altilis*), citrus (*Citrus* sp.), coconut (*Coccos nucifera*), coffee (*Coffea* ap.), European pear (*Pyrus communis*), fig (*Ficus* sp.), maize (*Zea mays*), mora (*Morus alba*), roses (*Rosa* ap.), shoeblackplant (*Hibiscus rosa-sinensis*), thuja (*Thuja* sp.), tomato (*Solanum lycopersicum*), vine (*Vitis vinifera*) and many more (CABI, online; García Morales et al., online).	
Pathways (EPPO GD)	Possible pathways of entry for mealybugs are plant materials of any kind (hiding in a protected site – on the bark, roots, stems, leaves), human transportation, irrigation water, wind, animals and ants (Mani and Shivaraju, 2016).	
Surveillance information	No surveillance information for these pests is currently available from PPIS. There is no information on whether these pests have ever been found in the nurseries or their surrounding environment.	

A.5.1.5. *Milviscutulus mangiferae*

Taxonomic information	Current valid scientific name: *Milviscutulus mangiferae* (Green, 1889) Synonyms: *Lecanium mangiferae, Coccus mangiferae, Lecanium psidii, Saissetia psidii, Coccus wardi, Lecanium wardi, Lecanium desolatum, Lecanium ixorae, Protopulvinaria mangiferae, Coccus ixorae, Coccus kuraruensis, Eucalymnatus tessellates, Protopulvinaria ixorae, Coccus desolatum, Kilifia mangiferae, Ptoropulvinaria mangiferae* (misspelling of genus name), *Udinia psidii* Name used in the EU legislation: N/A Order: Hemiptera Family: Coccidae Common name: mango shield scale or mango soft scale Name used in the Dossier: *Milviscutulus mangiferae*
Group	Insects
EPPO code	MILVMA
Regulated status	*Milviscutulus mangifera* is not regulated in the EU, neither is listed by EPPO.

Pest status in Israel	*Milviscutulus mangifera* was first reported in Israel in 1948 and has since become established in most mango-growing areas of the country, excluding the hot Arava Valley. (García Morales et al., 2016; Wysoki et al., 1993; Wysoki, 1997; Kfir and Rosen, 1980). It has been reported as a polyphagous pest; among its main hosts there are some important crops such as mango, avocado, persimmon, guajava, citrus, litchi, coconut and many ornamentals (CABI, Wysoki et al., 1993; García Morales et al., 2016). According to the pest-sheet provided by the P2\PIS, the pest is present in the various mango cultivation areas in Israel and in the vicinity of these areas.	
Pest status in the EU	Only one record in Italy (Botanical garden Padova) (Pellizzari & Porcelli, 2014). It has been intercepted in the Netherlands (Jansen, 1995) and in the UK on numerous occasions on imported cut flowers, ornamentals and aquatic plants (Anderson & MacLeod, 2008). No interceptions were ever recorded from Israel.	
Host status on *Persea americana*	*P. americana* is reported as a major host of *M. mangiferae* (García Morales et al., 2016; Abd-Rabdou & Evans, 2018). Avocados may be severely attacked by *M. mangiferae*, but populations do not reach the levels seen on mangoes (Avidov & Zaitzov, 1960).	
PRA information	Available Pest Risk Assessments: – CSL Pest Risk Analysis for *Milviscutulus mangiferae* (Anderson & MacLeod, 2008).	
Other relevant information for the assessment		
Biology	*Milviscutulus mangiferae* is a soft scale, described by Green (1889) from specimens collected on mango in Sri Lanka, and occurs throughout tropical and subtropical zones of the world (Abd-Rabou & Evans, 2018). This pest develops two annual generations or three in warmer regions, such as the Coastal Plain in Israel; nymphs of the first generation appear in March-May, of second generation in early June, and those of third generation in September (Avidov & Zaitzov, 1960). Reproduction is parthenogenetic, however Otanes (1936) and Avidov & Zaitzov (1960) reported on the occurrence of males at a very low rate. Blumberg & Swirski (1984) studied the encapsulation response to parasitoids. Reported as a mango pest in Israel (Avidov & Harpaz, 1969), Florida (Merrill, 1953), the Philippines (Otanes, 1936), South Africa (Kamburov, 1987), Vietnam (Danzig and Konstantinova, 1990) and Egypt (Abd-Rabou & Evans, 2018). Wysoki et al. (1993) reviewed the biology, economic importance, natural enemies and control in Israel. *M. mangiferae* crawlers settle on the lower sides of leaves. Damage is due to direct feeding on the plant juices and to secreting large amounts of honeydew which is colonised by sooty mold fungi, covering the fruit (reducing their commercial value) and leaves by a thick black mass. Photosynthesis is reduced, leaves may drop and branches dry up. Very heavy infestations (more than 500 scales/leaf) can cause much yield loss, tree decline and even death (Wysoki et al., 1993; Abd-Rabou & Evans, 2018; http://www.agri.huji.ac.il/mepests/pest/Milviscutulus_mangiferae/). Based on current knowledge of the biology and preferred environment of *M. mangiferae* it is considered very unlikely that this would survive outdoors in northern EU. In southern EU the likelihood of establishment outside is greater, and, although major commodity crops (such as *Citrus*) are unlikely to suffer from attacks, known hosts such as mangoes and avocados are grown commercially in the Mediterranean area. At present the area of the EU most at risk is the ornamental horticulture industry as the pest is highly polyphagous, likely to find many hosts in a confined area and may be unwittingly spread widely around a glasshouse or polytunnel by nursery staff. In southern EU there may be problems outdoors with amenity plants becoming affected (Anderson & Mac Leod, 2008).	
Symptoms	**Main type of symptoms**	The crawlers settle on the lower sides of leaves. Damage is due to secreting large amounts of honeydew which is colonised by sooty mold fungi, covering the fruit and leaves by a thick black mass. Photosynthesis is reduced, leaves may drop and branches dry up. The sooty mold covers the fruit, reducing their commercial value. Very heavy infestations (more than 500 scales/leaf) can cause much yield loss, tree decline and even death (Plant Pests of the Middle East). Direct feeding on the leaves can lead to yellowing and, with large populations, premature leaf drop, failure of buds to open, reduced crop yields the following season and in extreme

		cases the death of branches and whole trees (Avidov & Zaitzov, 1960; Wysoki et al., 1993).
	Presence of asymptomatic plants	Plant damage might not be obvious in early infestation, but the presence of scales on the plants could be observed. During the crawler stage, infestation is difficult to be noted.
	Confusion with other pests	*Milviscutulus mangiferae* is similar to *M. ciliatus* Williams and Watson by having similarly shaped and positioned anal plates and a triangular body shape. *M. mangiferae* differs by having the apices of the marginal setae strongly frayed (slightly frayed in *M. ciliatus*) and straight (curved in *M. ciliatus*). *Milviscutulus mangiferae* is also similar to *Protopulvinaria longivalvata* in body shape and the position of the anal plates on the dorsum but differs by lacking distorted coxae (present in *P. longivalvata*), and shorter anal plates (long in *P. longivalvata*).
Host plant range	*Milviscutulus mangiferae* is a highly polyphagous pest. It is known to feed on 42 different families and 82 different genera of plants (Abd-Rabou & Evans, 2018). Known hosts include economically important crops, such as mangoes (*Mangifera indica*), nutmeg (*Myristica fragrans*), breadfruit (*Artocarpus altilis*) (all of which are noted as a major hosts (CABI CPC, 2008)), avocados (*Persea americana*), cloves (*Syzygium aromaticum*), oranges (*Citrus sinensis*) and lemons (*Citrus limon*), as well as ornamentals such as Cordyline, *Jasminium* and *Hibiscus* spp. (Anderson & MacLeod, 2008).	
Pathways (EPPO GD)	Plants for planting, fruits. *M. mangiferae* has been intercepted once on mango fruit (from Brazil), but the scale does not actually attack the fruit itself and all other interceptions with plant material recorded since 1996 have been made on leaves or whole plants (Anderson & MacLeod, 2008). This suggests that the most likely entry route of *M. mangiferae* into the EU is on imported plants.	
Surveillance information	Various natural enemies control the populations of this pest in Israel In mango, where this pest is more common, the control plan includes the use of summer oil, and broad-range chemical insecticides in the case of severe outbreak. A treatment scheme in avocado has not been required as it is very rare in avocado and its damage is negligible.	

A.5.2. Possibility of pest presence in the nursery

A.5.2.1. Possibility of entry from the surrounding environment

As from the Dossier (Section 3.2), scions used in all product types (grafted plants grown in 750 cc pots, in 1 L and 6 L bags) are harvested from approved mother plants in PPIS-supervised orchards. Scions are then treated prior to grafting with suitable fungicides (Dossier, Section 3.8).

The plants in the 1 L bags are grown through the spring season in the greenhouse from April to June.

The plants in the 6 L bags are cultivated from the 1 L bag plants that are transferred to the larger bags during April to June. Growing the plants to a height of 0.8 m takes approximately three months, until July to September. These plants are cultivated either in an open field or in a roofless net house.

In the replies to EFSA questions the applicant country indicated that (i) papaya, mango, blueberry and kiwi are grown in the same nurseries where avocado is produced; (ii) nursery areas are clean of weeds and regularly treated against weeds; (iii) there are no hedges or shelter plants around avocado cultivation nursery areas. Besides, agricultural crops in a radius of 2 km from the avocado nurseries are avocado, banana, citrus and field crops. The natural vegetation in a radius of 2 km from the avocado nursery includes diverse native plants as well as ornamentals. There are a few hundreds of various urban ornamental trees and bushes in a radius of 2 km from the avocado nursery. The minimal distance between the nurseries of avocado for export and the nearest natural areas is approximately 100–200 m.

Maconellicoccus hirsutus in Israel is reported as a quarantine pest and the nurseries are at the minimum distance of 8 km and maximum 90 km.

Though orchards and grafted plants are supervised by PPIS, we cannot exclude that these highly polyphagous pests, possibly present on Avocado mother plants or other host plants (e.g. mango) occurring in the surrounding environment, can infest the commodity mainly for human assisted spread.

Uncertainties:

- Although the risk of introduction of *M. hirsutus* from the surrounding environment seems limited by the distance from the places where the scales was reported, it is known that scale crawlers can be transported by wind at distances of several kilometres.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible all the listed soft scales and mealybugs can enter a greenhouse from the surrounding area.

A.5.2.2. Possibility of entry with new plants/seeds

Stocks used for grafted plants in 750 cc pot or 1 L bag are cultivated from seed in a greenhouse (from a PPIS-approved source) and grown in a sterilised substrate made by coconut fibre, peat and polystyrene) whereas scions are harvested from approved mother plants in PPIS-supervised orchards (dossier, Section 3.2).

Uncertainties:

Not possible to completely exclude that juveniles or adults of these species can enter into the nursery by movement of mother plant material where juveniles and/or adults can be hidden in a protected site on the bark, roots, stems or leaves.

Taking into consideration the above evidence and uncertainties, the Panel considers it possible that the pest could enter the nursery with new plants.

A.5.2.3. Possibility of spread within the nursery

Grafted plants contained in 750 cc pots or in 1 L bag are grown continuously in greenhouse.

Uncertainties:

However, although very unlikely, it is not possible to totally exclude the movement of the pest within the nursery by human assisted spread.

Taking into consideration the above evidence and uncertainties, the Panel considers that the transfer of the pest within the nursery is possible

Introduction by the use of infected soil or water is not relevant for this risk assessment.

The insect within the greenhouse can spread by hitchhike on clothing of nursery staff. Local populations may first establish on mother plants and subsequently spread to new *P. americana* plants.

Taking into consideration the above evidence and uncertainties, the Panel considers that the transfer of the pest within the greenhouse is possible.

A.5.3. Information from interceptions

Considering imports of *P. americana* plants from Israel to the EU, between 1995 and 2020, there are no records of interceptions of A.5.1.1–A.5.1.5 (EUROPHYT, online, Accessed: 31 March 2020).

A.5.4. Evaluation of the risk mitigation measures

In the dossier and in the replies by the applicant country, it is reported that insecticide treatments (Tau-fluvalinate, Imidacloprid, Mineral oil, Spirotetramat, Spirodiclofen, Chlorpyrifos, Acetamiprid) are carried out after planting or during growth only when the pest is present and damage is recorded.

No specific chemical treatments are carried out against these species because no economic damage by these pests has been reported in avocado nurseries in Israel.

For *I. aegyptiaca* it is mentioned in the Dossier (Table E.1) that natural enemies (mostly natural/naturalised populations of the ladybird Rodolia cardinalis), can feed on eggs and crawlers.

However, in the replies to EFSA question n. 20, the applicant country states that 'Normally, natural enemies are not present in the greenhouses of avocado for export, due to the periodic spraying with insecticides'.

Uncertainties:

Being the insecticide treatments dependent on the presence and on the harmfulness of the pests, it is not possible to evaluate the efficacy of the mitigation measures carried out in the nurseries.

All risk mitigation measures currently applied in Israel (Table 7) and an indication of their effectiveness on soft scales and mealybugs is provided below.

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties for scions	Evaluation and uncertainties for grafted plants
12	Storage conditions The plants are transferred from the storage rooms directly to a reefer container which maintains 2–4°C.	No	These temperatures could only slow down the life cycle without killing the pests.	Idem
10	Pesticide treatments/Insecticide applications	Yes	The active ingredients (Tau-fluvalinate, Imidacloprid, Mineral oil, Spirotetramat, Spirodiclofen, Chlorpyrifos, Acetamiprid) could be effective in controlling scale insects. Uncertainties: These pesticides are applied only in case of infestation so treatments may not be applied timely if infestation is not detected.	Idem
11	Natural enemies Natural/naturalised populations of *Rodolia cardinalis* are used to control *Icerya aegyptiaca* *Aphytis* spp.. *Chilocorus bipustulatus* Cited in the dossier for the control of *Aonidiella aurantii*	Yes	*Rodolia cardinalis* adults and larvae are effective predators of *Icerya aegyptiaca*. Uncertainties: pesticides applied on the plants in the nursery have a detrimental effect on natural enemies (see reply n. 20). *Aphytis* spp. and *Chilocorus bipustulatus* are effective natural enemies of several insect scales. Uncertainties: pesticides applied on the plants in the nursery have a detrimental effect on natural enemies (see reply n. 20).	Idem
5	**Surveillance & Monitoring** In nurseries that export trees, PPIS inspection is carried out every 45 days. • Further to the PPIS inspection, the producers carry out regular comprehensive self-inspections, once a week. This inspection is performed by the nurseries agronomists and according to the PPIS inspector's instructions. The results are recorded in the nursery logbook and every adverse finding is reported immediately to the inspector. The logbook is regularly		Surveillance and monitoring of pest presence allow timely insecticide applications which could be effective against pests.	Idem

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties for scions	Evaluation and uncertainties for grafted plants
	reviewed during the inspector visits to the site. • Whenever a harmful organism of interest is found at any production site, the grower is required to inform PPIS and to treat the site as appropriate. During consecutive inspections, if there is no further evidence to the presence of the pest, the PPIS considers the site of production to be free from this harmful organism. • Further diagnostic procedures may be performed according to requirements of the importing country and in the case of inspection findings that necessitate identification of a causative agent. • Regular monitoring of the production sites by the grower – at least twice a week.			

A.5.5. Reasoning for a scenario which would lead to a reasonably low number of infested consignments

Surveillance takes place in the surroundings of cultivation areas. Visual inspections are effective to detect the pests. There are only a few alternative hosts in the surrounding. There are clear symptoms in the plant and also the potential association with ants will facilitate detection. Cultivation density is not dense and hampers the spread of the pest. Continuous and synchronic generations throughout the cultivation period that can be detected. Mother plants are sufficiently and efficiently screened and render pest-free material. Management practices prevent the introduction and spread of the pest. Insecticides applied during production are effective against these pests. Natural biological control agents keep pests at bay. Only young plants are used so they are cultivated in protected areas which are difficult to detect Young plants are protected and less exposed to natural dispersal by wind. Other. Mineral oils come in contact with the pests and are somewhat effective against scale insects. Young plants with limited canopy where pesticides are more effective after application. Temperature slows the cycle of the pest; affect its vitality and prevents movement during shipping. Pest does not survive on the scions after defoliation. Fungicide and pre-shipping treatments on the scions may have some detrimental effects on the pest Screening of rooted plants before shipping is effective in detecting pests.

A.5.6. Reasoning for a scenario which would lead to a reasonably high number of infested consignments

Surveillance does not take place or is not effective in the surroundings of cultivation areas. Visual inspections fail to detect the pest. Polyphagous species, so there are many potential hosts in the surroundings. Only juveniles are present which are difficult to spot during visual inspections. Cultivation density is very dense so facilitates the spread of the pest. Life-cycle of the pest falls in periods that prevents the species from being detected during inspections. Infestations are possible due to infested mother material that is poorly screened during inspections prior to grafting. Management practices do not prevent the introduction and spread of the pest. Insecticides are not effective or not applied properly for the management of the pests. Biological control agents because insecticide application or not appropriate management are not effective or are not present. Older plants are mainly used so are cultivated in open areas that are more easily infested. Plants are not protected and therefore exposed to the natural dispersal of the pest from the surrounding. Mineral oil treatments are not effective against these insects. Adult plants with more developed canopy and leaves are more difficult to be treated with contact pesticides and where abiotic factors limiting population growth have a reduced effect (temperature, humidity, radiation). Temperature does not stop the cycle of the pest, nor affect vitality or movement. Pest survive on the scions even if defoliated. Fungicide and pre shipping-treatments on scions before shipping have no effect on the pest. Screening of rooted plants before shipping is not effective in detection pests.

A.5.7. Reasoning for a central scenario equally likely to over- or underestimate the number of infested consignments (Median)

Non protected cultivation is a potential practice that allows the infestation by this type of pests. Early stages of development are difficult to detect. Some species may occur in roots of plants and therefore are difficult to detect even after inspection. A precautionary approach is taken and if infestation occurs for these pest species, infestations would take values near or over the estimated median value.

A.5.8. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

Distribution and pest pressure of some of the pests is not well known. The density of cultivation is not clear and this affects the spread of the pest.

A.5.9. Elicitation outcomes of the assessment of the pest freedom for mealybugs and soft scales group A (*Nipaecoccus viridis, Paracoccus marginatus, Pseudococcus cryptus, Icerya aegyptiaca, Milviscutulus mangiferae*)

The following tables show the elicited and fitted values for pest infestation/infection (Tables A.15 and A.17) and pest freedom (Tables A.16 and A.18).

Table A.15: Elicited and fitted values of the uncertainty distribution of pest infestation by mealybugs and soft scales group A per 10,000 grafted plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0.00					4.00		8.00		14.0					20.0
EKE	0.09	0.27	0.59	1.30	2.35	3.74	5.22	8.42	11.9	13.7	15.7	17.4	18.7	19.4	19.9

The EKE results are *BetaGeneral (0.87523, 1.1208, 0, 20.3) fitted* with @Risk version 7.6.

Based on the numbers of estimated infested plants the pest freedom was calculated (i.e. = 10,000 – the number of infested grafted plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.16.

Table A.16: The uncertainty distribution of plants free of mealybugs and soft scales group A per 10,000 grafted plants calculated by Table A.15

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,980					9,986		9,992		9,996					10,000
EKE results	9,980	9,981	9,981	9,983	9,984	9,986	9,988	9,991.6	9,994.8	9,996.3	9,997.7	9,998.7	9,999.4	9,999.7	9,999.9

The EKE results are the fitted values.

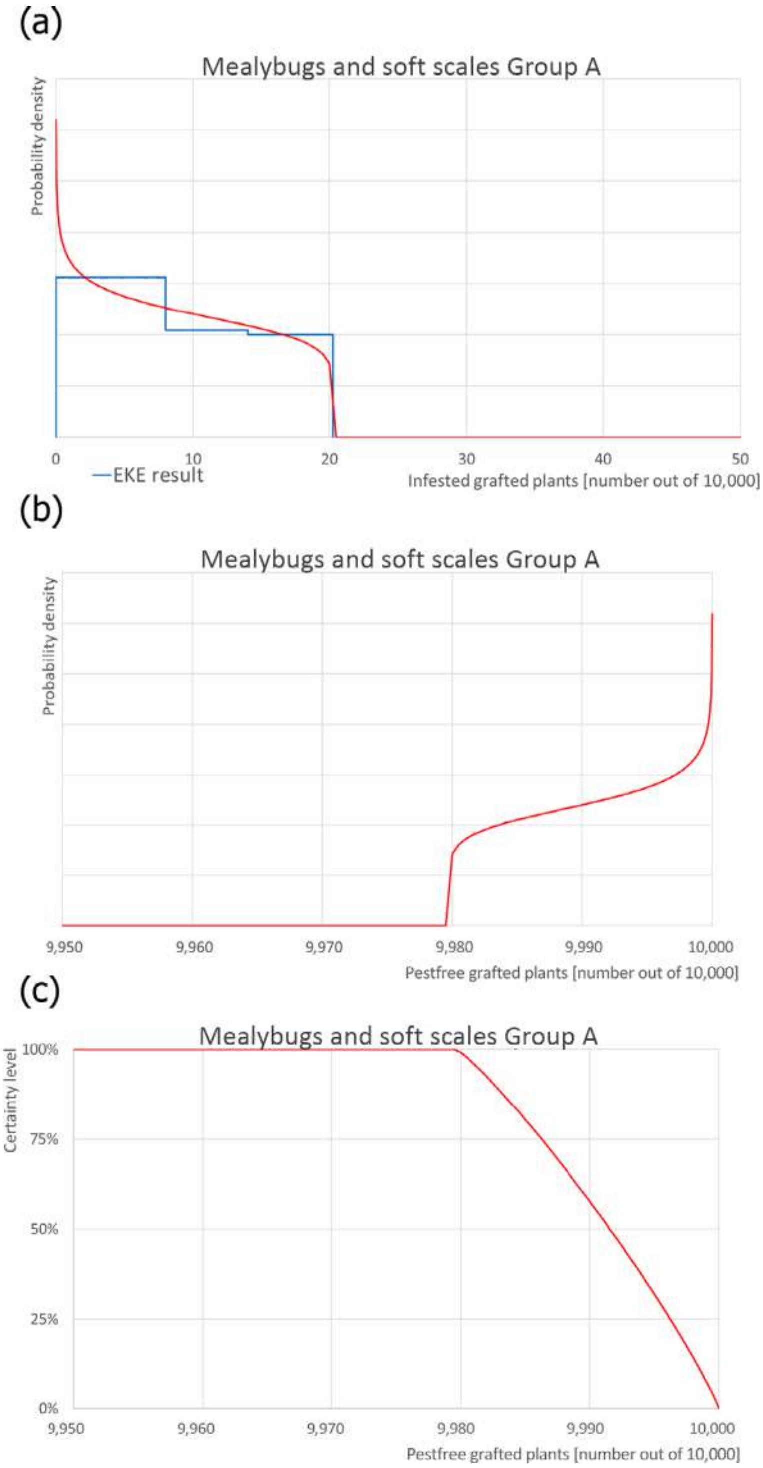


Figure A.8: (a) Elicited uncertainty of pest infestation per 10,000 grafted plants for mealybugs and soft scales group A (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free grafted plants per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 grafted plants

Table A.17: Elicited and fitted values of the uncertainty distribution of pest infestation by mealybugs and soft scales group A per 10,000 bundles of scions

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0.00					2.00		4.00		6.00					10.0
EKE	0.13	0.29	0.51	0.92	1.43	2.04	2.65	3.92	5.30	6.07	6.95	7.79	8.58	9.12	9.56

The EKE results are *BetaGeneral (1.2081, 1.7592, 0, 10.2)* fitted with @Risk version 7.6.

Based on the numbers of estimated infested plants the pest freedom was calculated (i.e. = 10,000 – the number of infested bundles of scions per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.18.

Table A.18: The uncertainty distribution of plants free of mealybugs and soft scales group A per 10,000 bundles of scions calculated by Table A.17

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,990					9,994		9,996		9,998					10,000
EKE results	9,990.4	9,990.9	9,991.4	9,992.2	9,993.1	9,993.9	9,994.7	9,996.1	9,997.3	9,998.0	9,998.6	9,999.1	9,999.5	9,999.7	9,999.9

The EKE results are the fitted values.

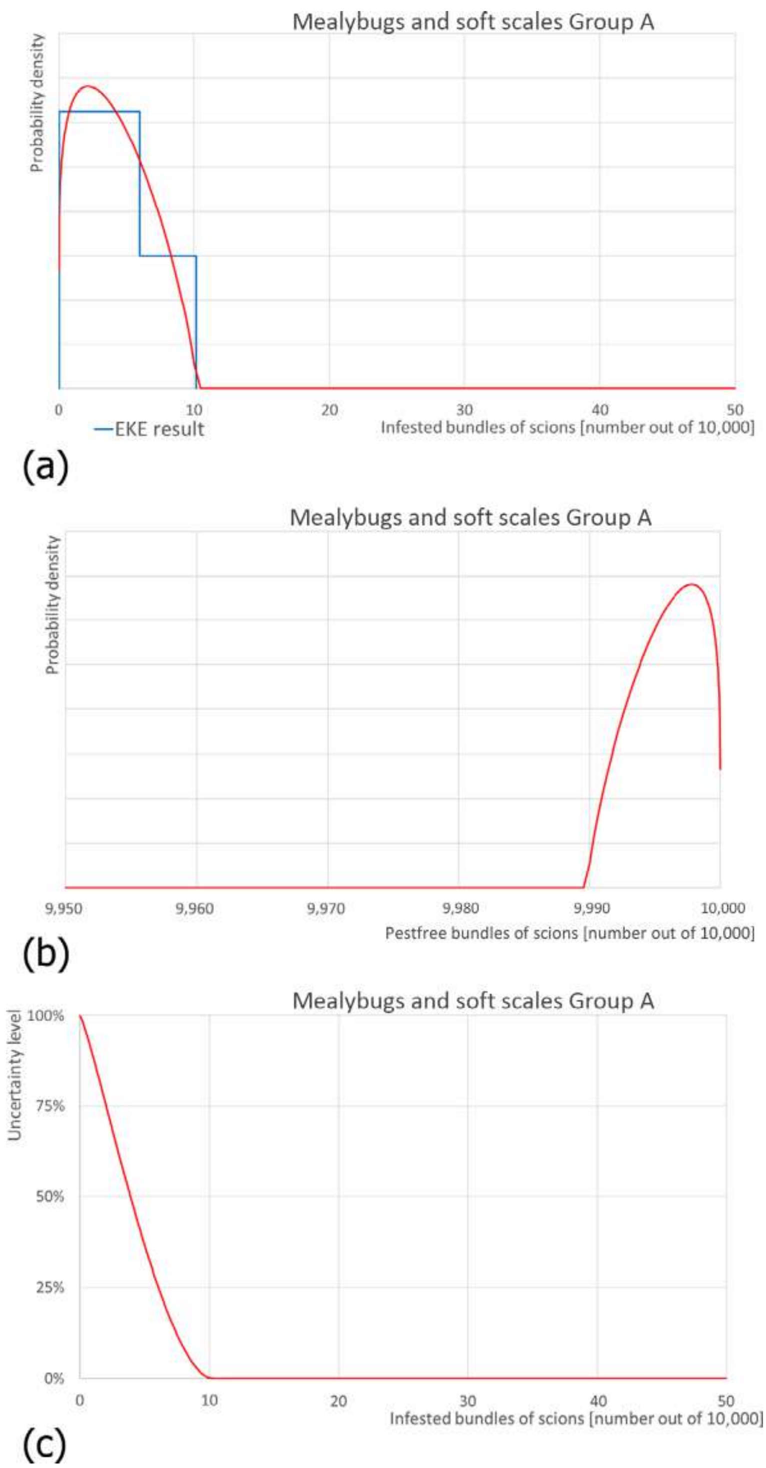


Figure A.9: (a) Elicited uncertainty of pest infestation per 10,000 bundles of scions for mealybugs and soft scales group A (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free bundles of scions per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 bundles of scions

A.5.10. Reference list

Abd-Rabou S and Evans GA, 2018. The mango shield scale, *Milviscutulus mangiferae* (Green) (Hemiptera: Coccidae)–A new invasive soft scale in Egypt. Acta Phytopathologica et Entomologica Hungarica, 53, 91–96.

Amarasekare KG, Chong JH, Epsky ND and Mannion CM, 2008. Effect of temperature on the life history of the mealybug *Paracoccus marginatus* (Hemiptera: Pseudococcidae). Journal of Economic Entomology, 101, 1798–1804.

Anderson H and MacLeod A, 2008. CSL Pest Risk Analysis for *Milviscutulus mangiferae*. Available online: https://secure.fera.defra.gov.uk/phiw/riskRegister/downloadExternalPra.cfm?id=3886 [Accessed on: 4 April 2020].

Anderson TJ, 1924. The coffee mealybug. Farmers J. 6(16):21. (Abstr.)

Annecke DP and Moran VC, 1982. Insects and mites of cultivated plants in South Africa. Butterworth.

Arai T, 1996. Temperature-dependent development rate of three mealybug species, *Pseudococcus citriculus* Green, *Planococcus citri* (Risso), and *Planococcus kraunhiae* (Kuwana) (Homoptera: Pseudococcidae) on *Citrus*. Japanese Journal of Applied Entomology and Zoology, 40, 25–34.

Avidov Z and Zaitzov A, 1960. On the biology of the Mango Shield Scale *Coccus mangiferae* (Green) in Israel. Ktavim, 10, 125–137.

Bartlett BR, 1978. Pseudococcidae, pp. 137–170. In: Clausen CP (ed.). Introduced parasites and predators of arthropod pests and weeds: A world review. Agr. Hdbk. 480. USDA, Washington, DC.

Ben-Dov Y, 1994. A systematic catalogue of the mealybugs of the world (Insecta: Homoptera: Coccoidea: Pseudococcidae and Putoidae) with data on geographical distribution, host plants, biology and economic importance. Intercept Limited.

Bodenheimer FS, 1951. Citrus entomology in the Middle East. Citrus Entomology in the Middle East.

Browning HW, Childers CC, Stansly PA, Pena J and Rogers ME, 2008. Florida citrus pest management guide: Soft-bodied insects attacking foliage and fruit. UF/IFAS EDIS ENY-604. 28 May 2008.

CABI (Centre for Agriculture and Bioscience International), online. *Paracoccus marginatus*. Available online: https://www.cabi.org/cpc/datasheet/39201 [Accessed: 7 April 2020].

Cilliers CJ and Bedford ECG, 1978. Citrus mealybugs. Citrus Pests in the Republic of South Africa. Bulletin, 391, 89–97.

Danzig EM and Konstantinova GM, 1990. On coccid (Homoptera: Coccinea) fauna of Vietnam. Trudy Zoologicheskogo Instituta Akademiya Nauk SSSR. Leningrad 209, 38–52 (In Russian).

Dufour-Dror JM, Fragman-Sapir O, Avishai M, Valczak M, Yaacoby T, Kagan S, Vered-Leshner H, Galon I, Heller A and Gotlieb A, 2013. Israel's least wanted alien ornamental plant species. The Ministry of Environmental Protection, Israel Nature & Parks Authority and the Ministry of Agriculture.

EPPO (European and Mediterranean Plant Protection Organization), online. EPPO Global Database. *Nipaecoccus viridis*, *Paracoccus marginatus*, *Icerya aegyptiaca*. Available online: https://gd.eppo.int/taxon/NIPAVI, https://gd.eppo.int/taxon/PACOMA, https://gd.eppo.int/taxon/ICERAE. [Accessed: 4 April 2020].

Garcia Morales M, Denno BD, Miller DR, Miller GL, Ben-Dov Y and Hardy NB, 2016: ScaleNet: A literature-based model of scale insect biology and systematics. Database. https://doi.org/10.1093/database/bav118. Available online: http://scalenet.info [Accessed: 2 April 2020].

Ghosh AB and Ghosh SK, 1985. Effect of infestation of *Nipaecoccus vastator* (Maskell) on host plants. Indian Agriculturist, 29, 141–147.

Gross S, Gefen D, Rotman N, Tadmor U, Zemer B, Gotlib A and Gefen Y, 2000. Chemical control of the spherical mealybug (*Nipaecoccus viridis*) (Newstead) in citrus. (in Hebrew; Summary in English). Alon Hanotea, 54, 234–240.

Gruenberg A, 1956. Citrus Pests and Their Control. Chachik Publishers, Tel-Aviv. 169 pp. (In Hebrew).

Gullan PJ and Kosztarab M, 1997. Adaptations in scale insects. Annual Review of Entomology, 42, 23-50.

Hattingh V, Cilliers CJ and Bedford ECG, 1998. Citrus mealybugs, p. 112–120. In: Bedford ECG, van den Berg MA and de Villiers EA (eds.). Citrus pests in the Republic of South Africa (2nd edn.). Dynamic Ad, Nelspruit, Republic of South Africa.

Jansen MGM, 1995. Scale insects (Homoptera: Coccinea) from import interceptions and greenhouses in the Netherlands. Israel Journal of Entomology, 29, 131–146.

Kamburov S, 1987. The mango shield scale *Protopulvinaria mangiferae* (Green) (Homoptera: Coccidae), a new pest on mango (Mangifera indica). Citrus and Subtropical Fruit Journal, 635, 10–11.

Kfir R and Rosen D, 1980. Biological studies of *Microterys flavus* (Howard) (Hymenoptera: Encyrtidae), a primary parasite of soft scales. J. Entomol. Soc. of Southern Africa, 43, 223–237.

Kim SC, Song JH and Kim DS, 2008. Effect of temperature on the development and fecundity of the Cryptic Mealybug, *Pseudococcus cryptus*, in the laboratory. Journal of Asia-Pacific Entomology, 11, 149–153.

Mani M, Shylesha AN and Shivaraju C, 2012. First report of the invasive papaya mealybug, *Paracoccus marginatus* Williams & Granara de Willink (Homoptera: Pseudococcidae) in Rajasthan. Pest Management in Horticultural Ecosystems, 18, 234–234.

Merrill GB, 1953. A revision of the scale insects of Florida. Bulletin of the Florida State Plant Board, 1, 1–143.

Muniappan R, Shepard BM, Watson GW, Carner GR, Rauf A, Sartiami D, Hidayat P, Afun JVK, Goergen G and Ziaur Rahman AKM, 2009. New records of invasive insects (Hemiptera: Sternorrhyncha) in Southeast Asia and West Africa. Journal of Agricultural and Urban Entomology, 26, 167–174.
Otanes FQ, 1936. Some observations on two scale insects injurious to mango flowers and fruits. Philippine Journal of Agriculture, 7, 129–141.
Pellizzari G and Porcelli F, 2014. Alien scale insects (Hemiptera Coccoidea) in European and Mediterranean countries: the fate of new and old introductions. Phytoparasitica. https://doi.org/10.1007/s12600-014-0414-5
Sharaf NS and Meyerdirk DE, 1987. A review on the biology, ecology and control of *Nipaecoccus viridis* (Homoptera: Pseudococcidae). Miscellaneous Publications of the Entomological Society of America, 66.
Thomas DD and Leppla NC, 2008. The likelihood and consequences of introduction of the spherical mealybug, *Nipaecoccus viridis* (newstead), into Florida, and its potential effect on citrus production. In Proceedings of the Florida State Horticultural Society (Vol. 121, pp. 152–154).
Uesato T, Kondo T, Unruh C and Williams DJ, 2011. Establishment and host records of *Icerya aegyptiaca* (Douglas) (Hemiptera: Coccoidea: Monophlebidae) in the Sakishima Islands of the Ryukyu Archipelago, Japan, with notes on its worldwide distribution. Entomological Science, 14, 49–55.
Unruh CM and Gullan PJ, 2008. Molecular data reveal convergent reproductive strategies in iceryine scale insects (Hemiptera: Coccoidea: Monophlebidae), allowing the re-interpretation of morphology and a revised generic classification. Systematic Entomology, 33, 8–50.
Walker A, Hoy M and Meyerdirk D, 2006. Papaya mealybug (*Paracoccus marginatus* Williams and Granara de Willink (Insecta: Hemiptera: Pseudococcidae)). Featured Creatures. Entomology and Nematology Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences (IFAS), University of Florida, Gainesville, FL.
Waterhouse DF, 1993. Biological Control Pacific Prospects-Supplement 2 (No. 435-2016-33743).
Wysoki M, 1997. Present status of arthropod fauna in mango orchards in Israel. Acta Horticulturae 455, 805–811.
Wysoki M, Ben-Dov Y, Swirski E and Izhar Y, 1993. The arthropod pests of mango in Israel. Acta Horticulturae 341, 452–466.

A.6. Mealybugs and soft scales group B (*Maconellicoccus hirsutus* and *Pulvinaria psidii*)

A.6.1. Organism information

A.6.1.1. *Maconellicoccus hirsutus*

Taxonomic information	Current valid scientific name: *Maconellicoccus hirsutus* (Green, 1908) Synonyms: *Phenacoccus hirsutus*, *Lecanium mangiferae, Coccus mangiferae, Lecanium psidii, Saissetia psidii, Coccus wardi, Lecanium wardi, Lecanium desolatum, Lecanium ixorae, Protopulvinaria mangiferae, Coccus ixorae, Coccus kuraruensis, Eucalymnatus tessellates, Protopulvinaria ixorae, Coccus desolatum, Kilifia mangiferae, Ptoropulvinaria mangiferae* (misspelling of genus name), *Udinia psidii* Name used in the EU legislation: N/A Order: Hemiptera Family: Pseudococcidae Common name: pink hibiscus mealybug, pink mealybug, hibiscus mealybug, grape mealybug, hirsutus mealybug Name used in the Dossier: *Maconellicoccus hirsutus*
Group	Insects
EPPO code	PHENHI
Regulated status	*Maconellicoccus hirsutus* is not regulated in the EU; it is included in the A2 list by EPPO, in the quarantine list in Israel, Mexico and Morocco, in the A1 list in South Africa, Argentina, Chile, Russia, Turkey and Ukraine.
Pest status in Israel	*Maconellicoccus hirsutus* was first found in 2015 in 2 locations (Northern Israel) on various ornamentals (Spodek et al., 2016). This mealybug is present in Israel, though it is not considered an agricultural pest in the country. It has been reported in the past in three locations in the north of Israel: Timrat, Acre, Yagur. Nevertheless, the mealybug is a Quarantine Pest in Israel. It has not been detected in avocado in Israel.

Pest status in the EU	Reported in Cyprus (EPPO, Online) and in Rhodes (Milonas & Partsinevelos, 2017)B. Absent, intercepted only. According to Fauna Europea is present in the Netherlands, however after consulting the NPPO of the Netherlands the record was based on an interception. Reported in the Canary Islands (Jaques & Urbaneja, 2016).	
Host status on *Persea americana*	*P. americana* is listed as a minor host of *M. hirsutus* (EPPO online database).	
PRA information	No PRA/Pest categorisations are available	
Other relevant information for the assessment		
Biology	Adult mealybugs are small (about 3 mm long) and pink in body colour but covered with a waxy secretion. Each adult female lays 150–600 eggs over a period of about one week, and these hatch in 6–9 days (Bartlett, 1978; Mani, 1989). A generation is completed in about 5 weeks in warm conditions. In countries with a cool winter, the species survives cold conditions as eggs (Bartlett, 1978) or other stages, both on the host plant and in the soil (Pollard, 1995). There may be as many as 15 generations per year (Pollard, 1995). Small 'crawlers' (0.3 mm long) are readily transported by water, wind or animal agents. Crawlers settle in cracks and crevices, usually on new growth which becomes severely stunted and distorted, in which densely packed colonies develop. There are three immature instars in the female and four in the male. Reproduction is mostly parthenogenetic in Egypt (Hall, 1921) and Bihar (India) (Singh & Ghosh, 1970), but *M. hirsutus* is bi-parental in West Bengal (India) (Ghose, 1971b; 1972a) and probably in the Caribbean (Williams, 1996). Infestations of *M. hirsutus* are often associated with attendant ants (Ghose, 1970; Mani, 1989).	
Symptoms	**Main type of symptoms**	Infested growing points become stunted and swollen. This varies according to the susceptibility of each host species. In highly susceptible plants, even brief probing of unexpanded leaves causes severe crumpling of the leaves, and heavy infestation can cause defoliation and even death of the plant. As the plant dies back, the mealybugs migrate to healthy tissue, so the colonies migrate from shoot tips to twigs to branches and finally down the trunk. The mealybugs themselves are in general readily visible, though sometimes hidden in the swollen growth. In its native range, *M. hirsutus* has been recorded causing economic damage to many crops. In India, losses have been reported for: cotton (Dhawan et al., 1980; Muralidharan & Badaya, 2000); the fibre crops Hibiscus sabdariffa, Hibiscus cannabinus and Boehmeria nivea (Ghose, 1961; 1971a; Singh & Ghosh, 1970; Raju et al., 1988); grapevine (Manjunath, 1985); mulberry (Rao et al., 1993); pigeonpea (Patel et al., 1990); *Zizyphus mauritiana* (Balikai & Bagali, 2000). Presumably, many ornamental woody plants are also affected, but populations and damage may be limited by natural enemies. In the Caribbean, where *M. hirsutus* has recently become established and biological control is only beginning to be used, damage to crops and environment has been heavy. For example, annual losses in Grenada are estimated at 3.5 million USD before establishment of biological control (François, 1996). Similar losses have been estimated in various other Caribbean islands. Various ornamentals important to the tourist industry have been attacked, and also important forest trees such as *Hibiscus elatus* and *Tectona grandis* (Pollard, 1995; Peters & Watson, 1999; Kairo et al., 2000). Affected countries suffered serious loss of trade because other countries would not accept shipments of agricultural produce from them (Peters & Watson, 1999). If the mealybug were to spread across the southern USA, it is estimated that it could cause losses of 750 million USD per year (Moffit, 1999).
	Presence of asymptomatic plants	No data available
	Confusion with other pests	No data available

Host plant range	Highly polyphagous mealybug (ScaleNet, online). *Persea americana* is a minor host (EPPO, online). *M. hirsutus* is highly polyphagous and has been recorded feeding on hosts of 73 plant families and over 200 plant genera. Further information on the distribution, list of host plants and biology are available on the CABI Crop Protection Compendium and in OEPP/EPPO (2005a). In its native range, *M. hirsutus* has been recorded causing economic damage to many crops. In India, losses have been reported for: cotton (Dhawan et al., 1980; Muralidharan & Badaya, 2000); the fibre crops *Hibiscus sabdariffa*, *Hibiscus cannabinus* and *Boehmeria nivea* (Ghose, 1961; 1971a; Singh & Ghosh, 1970; Raju et al., 1988); grapevine (Manjunath, 1985); mulberry (Rao et al., 1993); pigeonpea (Patel et al., 1990); *Zizyphus mauritiana* (Balikai & Bagali, 2000). Presumably, many ornamental woody plants are also affected, but populations and damage may be limited by natural enemies.
Pathways (EPPO GD)	It can spread locally by wind dispersal of the crawler stage. However, long-distance movement is most probable on plants for planting of host species. Cut flowers and fruits could possibly also carry the pest, though with less chance of its moving to endangered hosts.
Surveillance information	No surveillance information for these pests is currently available from PPIS. There is no information on whether the pests have ever been found in the nurseries or their surrounding environment.

A.6.1.2. *Pulvinaria psidii*

Taxonomic information	Current valid scientific name: Pulvinaria psidii Maskell, 1893 Synonyms: Chloropulvinaria psidii; Borchsenius, 1957; Lecanium vacuolatum Green Dash, 1916; Pulvinaria cupaniae Cockerell, 1893; Pulvinaria cussoniae Hall, 1932; Pulvinaria darwiniensis Froggatt, 1915; Pulvinaria gymnosporiae Hall, 1932; Pulvinaria psidii philippina Cockerell, 1905 Name used in the EU legislation: N/A Order: Hemiptera Family: Coccidae Common name: green shield scale; guava mealy scale; guava pulvinaria; mango scale. Name used in the Dossier: N/A	
Group	Insects	
EPPO code	PULVPS	
Regulated status	*Pulvinaria psidii* is not regulated in EU. It's a Regulated non-quarantine pest (RNQP) for fruit trees in Israel (EPPO, online).	
Pest status in Israel	Present, at low prevalence (EPPO, online). *Pulvinaria psidii* was found for the first time in Israel in 1999 on litchi, mango and ornamental plants (EPPO, online).	
Pest status in the EU	Absent, intercepted only. According to Fauna Europea is present in the Netherlands, however after consulting the NPPO of the Netherlands the record was based on an interception. Reported in the Canary Islands (Jaques & Urbaneja, 2016).	
Host status on *Persea americana*	*P. americana* is reported as a host of *P. psidii* (CABI CPC, Online).	
PRA information	No PRA/Pest categorisations are available	
Other relevant information for the assessment		
Biology	Adult females are between 2.0 and 4.5 mm long and between 1.5 to 3.0 mm wide. Female are oval, smooth and moderately convex before egg deposition and deep green becoming gradually lighter in colour. After egg deposition, the female gradually shrivels and the surface forms into ridges and valley. The ovisac at first projects only to the posterior, but eventually more or less can surround the adult female on all sides causing the elevation of the abdomen. The full life cycle takes 2–3 months, but the formation of ovisac and egg deposition takes place in only 5 days (Hamon, 1984). The pest can spread only as a first instar nymph (crawler). The insect secrets honeydew that covers the upper surface of the leaves reducing the photosynthesis and the respiration. The result is a crop of poor quality and quantity.	
Symptoms	**Main type of symptoms**	*Pulvinaria psidii* feeds on the phloem of leaves and tender young stems of the host plant. Under severe infestation, feeding causes yellowing, defoliation, reduction in fruit set and loss in plant

		vigour. The pest excretes honeydew, which serves as a medium for sooty mold. Sooty mold blackens the leaf and decrease the photosynthesis (Abd-Rabou, 2011).
	Presence of asymptomatic plants	The damage due to the feeding of an individual scale is small (Abd-Rabou, 2011).
	Confusion with other pests	In the field, adult *P. psidii* can easily be confused with other *Pulvinaria* species, as *P. floccifera* and *P. urbicola*. For a corrected identification slide-mounted adult female must be examined under a compound light microscope and the use of taxonomic keys (CABI CPC, online).
Host plant range	*P. psidii* has a very wide range of distribution and host plants: it has been recorded from 52 different families of host plants (Bhuiya et al., 1998). In Egypt *P. psidii* is described as one of the most important pests of mango and guava (Bakr, 2012). It is also a serious pest of *Citrus* spp., *Ficus* spp., coffee plants and *Capsicum* spp. in tropical South Pacific region (Bhuiya, 1998).	
Pathways(EPPO GD)	*P. psidii* occurs on leaves and stems, especially on young ones and occasionally on fruits. It needs tropical or subtropical conditions to thrive (CABI, online).	
Surveillance information	No surveillance information for this pest is currently available from Israel. There is no information available to assess whether the pest has ever been found in the nurseries or surrounding environment of the nurseries. The pest has a RNQP status for fruit trees in Israel, so it is expected to be absent in fruit tree nurseries.	

A.6.2. Possibility of pest presence in the nursery

A.6.2.1. Possibility of entry from the surrounding environment

As from the Dossier (Section 3.2), scions used in all product types (grafted plants grown in 750 cc pots, in 1 L and 6 L bags) are harvested from approved mother plants in PPIS-supervised orchards. Scions are then treated prior to grafting with suitable fungicides (Dossier, Section 3.8).

The plants in the 1 L bags are grown through the spring season in the greenhouse from April to June.

The plants in the 6 L bags are cultivated from the 1 L bag plants that are transferred to the larger bags during April to June. Growing the plants to a height of 0.8 m takes approximately three months, until July to September. These plants are cultivated either in an open field or in a roofless net house.

In the replies to EFSA questions the applicant country indicated that (i) papaya, mango, blueberry and kiwi are grown in the same nurseries where avocado is produced; (ii) nursery areas are clean of weeds and regularly treated against weeds; (iii) there are no hedges or shelter plants around avocado cultivation nursery areas. Besides, agricultural crops in a radius of 2 km from the avocado nurseries are avocado, banana, citrus and field crops. The natural vegetation in a radius of 2 km from the avocado nursery includes diverse native plants as well as ornamentals. There are a few hundreds of various urban ornamental trees and bushes in a radius of 2 km from the avocado nursery. The minimal distance between the nurseries of avocado for export and the nearest natural areas is approximately 100–200 m.

Maconellicoccus hirsutus in Israel is reported as a quarantine pest and the nurseries are at the minimum distance of 8 km and maximum 90 km.

In Israel, *P. psidii* is reported to be present mainly in litchi and mango and on ornamental plants scattered throughout the country. Given the wide host range of this pest it is possible that local populations of *P. psidii* are present in the neighbouring environment of the greenhouses with avocado plants destined for export.

After hatching, crawlers may be carried to neighbouring plants by wind, or by hitchhiking on clothing, equipment, or animals. There is no evidence that the nurseries are located in a pest-free area for *P. psidii,* so the Panel considers that *P. psidii* can be present in the production areas of *P. americana* destined for export to the EU. There are several reports of natural enemies affecting population abundance of *P. psidii* in the field in Egypt (Abd-Rabou, 2011). *P. americana* plants destined for export to the EU are grown in a protected environment (i.e. greenhouse). Introduction of the scale insects into a greenhouse is possible through holes in the netting (50 Mesh) or roof of the greenhouse structure or as a hitchhiker on clothing of nursery staff. The success rate of one of these events is only likely to occur in case of a high (local) density of *P. psidii* in the neighbouring environment of the greenhouse.

Though orchards and grafted plants are supervised by PPIS, we cannot exclude that these highly polyphagous pests, possibly present on Avocado mother plants or other host plants (e.g. mango) occurring in the surrounding environment, can infest the commodity mainly for human assisted spread.

Uncertainties:

- There is no surveillance information on the presence and population pressure of both pests in the neighbouring environment of the greenhouse.
- There is no information on the presence of suitable host plants (e.g. mango orchards) and other sources of population of *P. psidii* in the area surrounding the greenhouse.
- Although the risk of introduction of *M. hirsutus* from the surrounding environment seems limited by the distance from the places where the scales was reported, it is known that scale crawlers can be transported by wind at distances of several kilometres.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible that *Maconellicoccus hirsutus* and *Pulvinaria psidii* can enter a greenhouse from the surrounding area.

A.6.2.2. Possibility of entry with new plants/seeds

Stocks used for grafted plants in 750 cc pot or 1 L bag are cultivated from seed in a greenhouse (from a PPIS-approved source) and grown in a sterilised substrate made by coconut fibre, peat and polystyrene) whereas scions are harvested from approved mother plants in PPIS-supervised orchards (dossier, Section 3.2).

Uncertainties:

Not possible to completely exclude that juveniles or adults of these species can enter into the nursery by movement of mother plant material where juveniles and/or adults can be hidden in a protected site on the bark, roots, stems or leaves.

Taking into consideration the above evidence and uncertainties, the Panel considers it possible that the pest could enter the nursery with new plants.

A.6.2.3. Possibility of spread within the nursery

Grafted plants contained in 750 cc pots or in 1 L bag are grown continuously in greenhouse.

Uncertainties:

However, although very unlikely, it is not possible to totally exclude the movement of the pest within the nursery by human assisted spread.

Taking into consideration the above evidence and uncertainties, the Panel considers that the transfer of these pests within the nursery is possible.

Introduction by the use of infected soil or water is not relevant for this risk assessment.

The insect within the greenhouse can spread by hitchhike on clothing of nursery staff. Local populations may first establish on mother plants and subsequently spread to new *P. americana* plants.

Taking into consideration the above evidence and uncertainties, the Panel considers that the transfer of the pests within the greenhouse is possible.

A.6.3. Information from interceptions

Considering imports of *P. americana* plants from Israel to the EU, between 1995 and 2020, there are no records of interceptions of *M. hirsutus* and/or *P. psidii* (EUROPHYT, online, Accessed: 31 March 2020).

A.6.4. Evaluation of the risk mitigation options

In the dossier and in the replies by the applicant country, it is reported that insecticide treatments (Tau-fluvalinate, Imidacloprid, Mineral oil, Spirotetramat, Spirodiclofen, Chlorpyrifos, Acetamiprid) are carried out after planting or during growth only when the pest is present and damage is recorded.

No specific chemical treatments are carried out against these species because no economic damage by these pests has been reported in avocado nurseries in Israel.

Uncertainties:

Being the insecticide treatments dependent on the presence and on the harmfulness of the pests, it is not possible to evaluate the efficacy of the mitigation measures carried out in the nurseries.

In the table below, all risk mitigation measures currently applied in Israel are listed and an indication of their effectiveness on soft scales and mealybugs is provided. The description of the risk mitigation measures currently applied in Israel is provided in the Table 8.

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties for scions	Evaluation and uncertainties for grafted plants
12	Storage conditions The plants are transferred from the storage rooms directly to a reefer container which maintains 2–4°C.	Yes	Uncertainties: These temperatures could only slow down the life cycle without killing the pests.	Idem
10	Pesticide treatment/Insecticide applications	Yes	The a.i. listed (Tau-fluvalinate, Imidacloprid, Mineral oil, Spirotetramat, Spirodiclofen, Chlorpyrifos, Acetamiprid) could be effective in controlling scale insects. Uncertainties: These pesticides are applied only in case of infestation.	Idem
5	**Surveillance & Monitoring** In nurseries that export trees, PPIS inspection is carried out every 45 days. • Further to the PPIS inspection, the producers carry out regular comprehensive self-inspections, once a week. This inspection is performed by the nurseries agronomists and according to the PPIS inspector's instructions. The results are recorded in the nursery logbook and every adverse finding is reported immediately to the inspector. The logbook is regularly reviewed during the inspector visits to the site. • Whenever a harmful organism of interest is found at any production site, the grower is required to inform PPIS and to treat the site as appropriate. During consecutive inspections, if there is no further evidence to the presence of the pest, the PPIS considers the site of production to be free from this harmful organism. • Further diagnostic procedures may be performed according to requirements of the importing	Yes	Surveillance and monitoring of pest presence allow timely insecticide applications which could be effective against pests.	Idem

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties for scions	Evaluation and uncertainties for grafted plants
	country and in the case of inspection findings that necessitate identification of a causative agent. • Regular monitoring of the production sites by the grower – at least twice a week.			

A.6.5. Overall likelihood of pest freedom

A.6.5.1. Reasoning for a scenario which would lead to a reasonably low number of infested consignments

Surveillance takes place in the surroundings of cultivation areas. Visual inspections are effective to detect the pest. There are only a few alternative hosts in the surroundings. There are clear symptoms of infestation in the plant and also the potential association with ants facilitates detection. Cultivation density is not dense and prevents the spread of the pest. Continuous and synchronic generations throughout the cultivation period help to detect the pests. Mother plants are sufficiently and efficiently screened and render pest-free material. Management practices prevent the introduction and spread of the pest. Insecticides applied during production are effective against these pests. Natural biological control agents keep pests at bay. Most of the plants are cultivated in protected areas and plants are not exposed to the pest. Young plants are protected and less exposed to the natural dispersal of the pests by wind or other means. Mineral oils come in contact with the pests and are effective against scale insects. Most of the cultivated sites produce young plants with limited canopy where pesticides are more effective after application and abiotic factors limiting population growth have a stronger effect. Temperature slows the cycle of the pest; affect its vitality and prevents movement during shipping. Pest does not survive on the scions after defoliation Fungicide and pre-shipping treatments on the scions may have some detrimental effects on the pest. Screening of rooted plants before shipping is effective for the detections of the pests.

A.6.5.2. Reasoning for a scenario which would lead to a reasonably high number of infested consignments

Surveillance does not occur or is not effective in the surroundings of cultivation areas. Visual inspections fail to detect the pest. Polyphagous species with many potential hosts in the surroundings. Only juveniles are present and are difficult to spot during visual inspections. Cultivation density is very dense so it facilitates the spread of the pest. Life-cycle of the pest falls in periods difficult that make difficult detection. Infestations are possible due to infested mother material that is poorly screened during inspections. Management practices do not prevent the introduction and spread of the pests. Insecticides are not effective or not applied properly for the management of the pests. Natural occurring biological control agents do not have any effect because insecticide applications or due to inappropriate management. Older plants are cultivated in open areas that are more easily infested. Plants are not protected and therefore exposed to the natural dispersal of the pest from the surrounding. Mineral oil treatments are not effective against these insects. Adult plants with more developed canopy and leaves are more difficult to be treated with contact pesticides and abiotic factors limiting population growth have a reduced effect (temperature, humidity, radiation). Storage temperature does not stop the cycle of the pest; nor affect vitality or movement. Pest survive on the scions even if defoliated. Fungicide and pre shipping-treatments on scions before shipping have no effect on the pest. Screening of rooted plants before shipping is not effective in detecting pests.

A.6.5.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infested consignments (Median)

Both species are comparable regarding life history traits and phytosanitary status and hence the description of the scenarios are applicable to both species. The fact that *P. psidii* is a quarantine pest also in Israel may reflect a different awareness in inspections and hence in the chances of detecting the pest. Plants outside in large-volume pots have a higher risk. Taking all scenarios in consideration, in case of infestation, consignments are likely to be near or below the estimated median value.

A.6.5.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

Prevalence and distribution of the pests in Israel are not known.

A.6.6. Elicitation outcomes of the assessment of the pest freedom for mealybugs and soft scales group B (*M. hirsutus* and *P. psidii*)

The following tables show the elicited and fitted values for pest infestation/infection (Tables A.19 and A.21) and pest freedom (Tables A.20 and A.22).

Table A.19: Elicited and fitted values of the uncertainty distribution of pest infestation by mealybugs and soft scales group B per 10,000 grafted plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	3.00					20.0		35.0		50.0					100
EKE	3.00	5.09	7.64	11.6	15.9	20.6	25.0	34.1	44.5	50.8	58.8	68.0	79.1	89.1	101

The EKE results are Weibull (1.7409, 42.095) fitted with @Risk version 7.6.

Based on the numbers of estimated infested plants the pest freedom was calculated (i.e. = 10,000 – the number of infested grafted plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.20.

Table A.20: The uncertainty distribution of plants free of mealybugs and soft scales group B per 10,000 grafted plants calculated by Table A.19

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,900					9,950		9,965		9,980					9,997
EKE results	9,899	9,911	9,921	9,932	9,941	9,949	9,956	9,966	9,975	9,979	9,984	9,988	9,992.4	9,994.9	9,997.0

The EKE results are the fitted values.

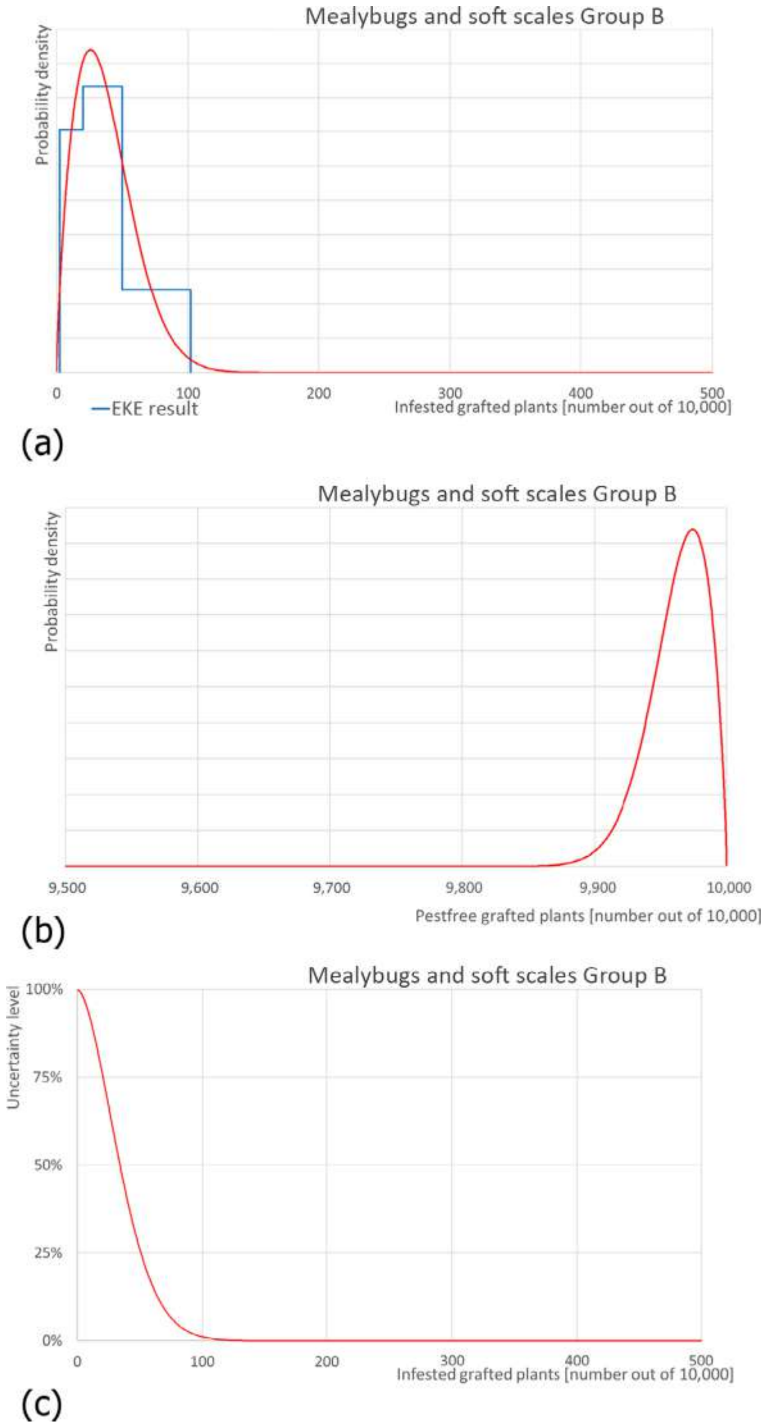


Figure A.10: (a) Elicited uncertainty of pest infestation per 10,000 grafted plants for mealybugs and soft scales group B (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free grafted plants per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 grafted plants

Table A.21: Elicited and fitted values of the uncertainty distribution of pest infestation by mealybugs and soft scales Group B per 10,000 bundles of scions

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	2.00					10.0		15.0		25.0					40.0
EKE	1.34	2.30	3.48	5.29	7.30	9.51	11.6	15.9	20.8	23.8	27.6	32.0	37.3	42.1	47.9

The EKE results are *Weibull (1.7144, 19.675)* fitted with @Risk version 7.6.

Based on the numbers of estimated infested plants the pest freedom was calculated (i.e. = 10,000 – the number of infested bundles of scions per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.22.

Table A.22: The uncertainty distribution of plants free of mealybugs and soft scales Group B per 10,000 bundles of scions calculated by Table A.23

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,960					9,975		9,985		9,990					9,998
EKE results	9,952	9,958	9,963	9,968	9,972	9,976	9,979	9,984	9,988	9,990.5	9,992.7	9,994.7	9,996.5	9,997.7	9,998.7

The EKE results are the fitted values.

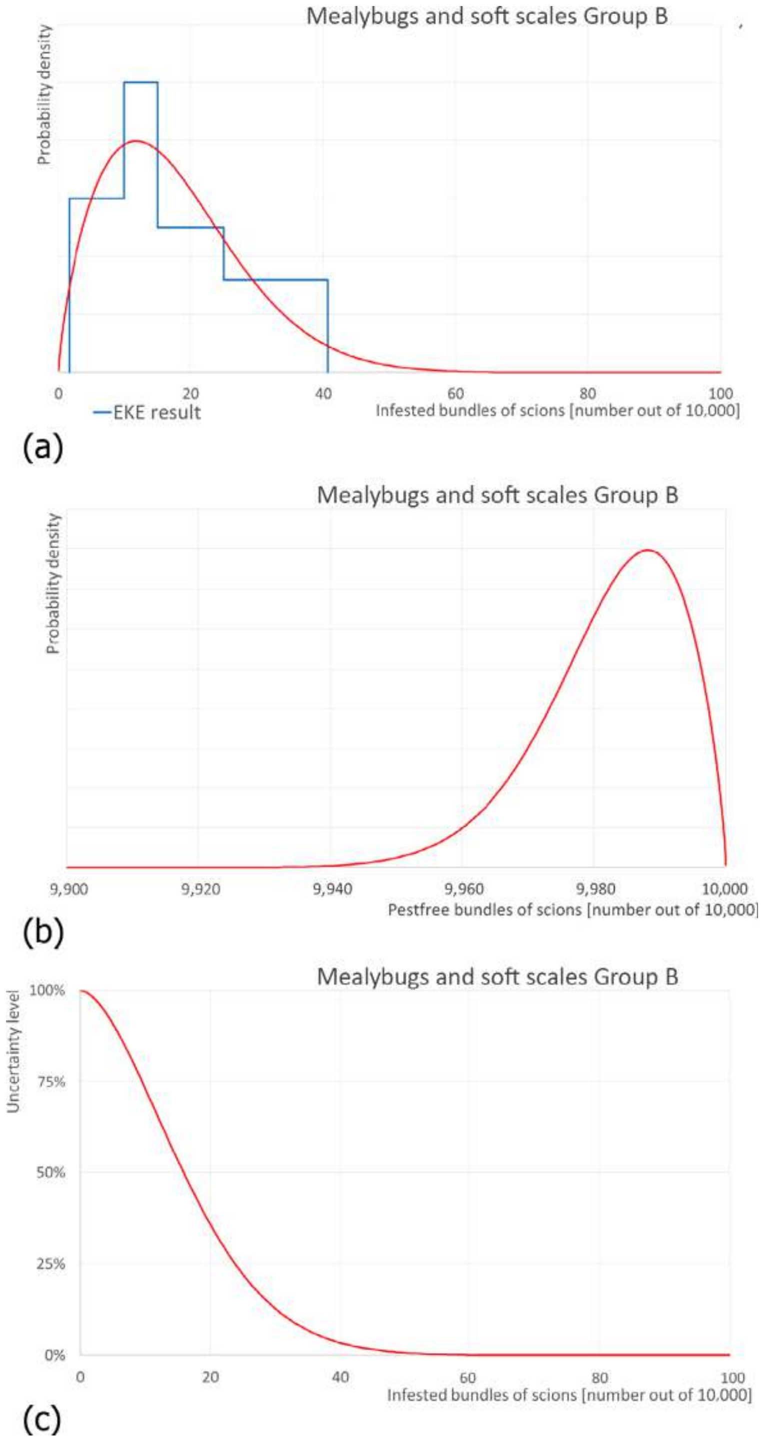


Figure A.11: (a) Elicited uncertainty of pest infestation per 10,000 bundles of scions for mealybugs and soft scales group B (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free bundles of scions per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 bundles of scions

A.6.7. Reference list

Abd-Rabou S and Moustafa M, 2011. The efficacy of some natural chemical formulations against the hibiscus mealybug, maconellicoccus hirsutus, green, and its natural enemies in the laboratory and field in Egypt. Egyptian Journal of Agricultural Research.

Bakr RF, Mousa SF, Hamouda LS, Badawy RM and Atteia SA, 2012. Scale insects infesting guava trees and control measure of *Pulvinaria psidii* (Hemiptera: Coccidae) by using the alternative insecticides. Egyptian Academic Journal of Biological Sciences. A, Entomology, 5, 89–106.

Balikai RA and Bagali AN, 2000. Population density of mealybug, *Maconellicoccus hirsutus* (green) on ber (Zizyphus mauritiana lamarck) and economic losses. Agricultural Science Digest, 20, 62–63.

Bartlett BR, 1978. Pseudococcidae. In Introduced Parasites and Predators of Arthropod Pests and Weeds – A World Review (Edited by Clausen, C.P.) U.S. Dept. Agric. Hand Book. No. 480, pp. 137–169.Google Scholar.

Bhuiya BA, 1998. Two new species of Encyrtidae (Hymenoptera: Chalcidoidea) from Bangladesh attacking *Pulvinaria psidii* Maskell (Homoptera: Coccidae) on guava. Oriental Insects, 32, 267–277.

CABI (Centre for Agriculture and Bioscience International), online. *Maconellicoccus hirsutus*, *Pulvinaria psidii*. Available online: https://www.cabi.org/cpc/datasheet/40171, https://www.cabi.org/cpc/datasheet/12953 [Accessed: 7 April 2020].

Dhawan AK, Joginder S and Sidhu AS, 1980. *Maconellicoccus* sp. attacking arboreum cotton in Punjab. Science and culture, 46.

EPPO (European and Mediterranean Plant Protection Organization), online. EPPO Global Database, *Pulvinaria psidii*, *Maconellicoccus hirsutus*. Available online: https://gd.eppo.int/taxon/PULVPS, https://gd.eppo.int/taxon/PHENHI [Accessed: 10 July 2020].

Fauna Europaea, online. *Pulvinaria psidii*, Available online: https://fauna-eu.org/cdm_dataportal/taxon/9dc7d6ca-c088-4209-a7dd-0fd413620145 [Accessed: 10 July 2020].

Francois B, 1996. Measuring the impact of mealybug infestation. In Proceedings of the First Symposium on the Hibiscus Mealybug in the Caribbean (pp. 24–27).

Ghose SK, 1972. Biology of the mealybug *Maconellicoccus hirsutus* (Green) (Pseudococcidae: Hemiptera). Indian Agriculture, 16, 232.

Ghose SK, 1971. Morphology of various instars of both sexes of the mealy-bug, *Maconellicoccus hirsutus* (Green) (Pseudococcidae: Hemiptera). Indian Journal of Agricultural Sciences, 41, 602–611.

Ghose SK, 1970. Predators, parasites and attending ants of the mealybug, *Maconellicoccus hirsutus* (Green) (Pseudococcidae, Hemiptera). Plant Protection Bulletin, India, 22, 22–30.

Ghose SK, 1961. Studies on some coccids (Coccoidea: Hemiptera) of economic importance of West Bengal, India. Indian Agriculturist, 5, 57–78.

Hall WJ, 1921. The hibiscus mealy bug (*Phenacoccus hirsutus*, Green). Bulletin Ministry of Agriculture Egypt Technical and Scientific Service Entomological Section, 17, 1–28.

Hamon AB and Williams ML, 1984. The soft scale insects of Florida:(Homoptera: Coccoidea: Coccidae) (No. QL434 H15).

Jaques J and Urbaneja A, 2006. *Pulvinaria psidii* Maskell (= *P. cupaniae* Cockerell, *P. cussoniae* may, *P. darwiniensis* Froggatt, *P. gymnosporiae* may, *P. psidii philippina* Cockerell, *Chloropulvinaria psidii* Borchsenius, *Lecanium vacuolatum* Dash) Homoptera: Coccidae. Levante Agrícola (379). http://redivia.gva.es/handle/20.500.11939/6413

Kairo MT, Pollard GV, Peterkin DD and Lopez VF, 2000. Biological control of the hibiscus mealybug, *Maconellicoccus hirsutus* Green (Hemiptera: Pseudococcidae) in the Caribbean. Integrated Pest Management Reviews, 5, 241–254.

Mani M, 1989. A review of the pink mealybug—*Maconellicoccus hirsutus* (Green). International Journal of Tropical Insect Science, 10, 157–167.

Manjunath TM, 1985. India-*Maconellicoccus hirsutus* on grapevine. FAO Plant Protection Bulletin, 33.

Milonas PG and Partsinevelos GK, 2017. The pink hibiscus mealybug *Maconellicoccus hirsutus* (green) (Hemiptera: Pseudococcidae) in Greece. Hellenic Plant Protection Journal, 10, 80–83.

Moffit LJ, 1999. Economic risk to united states agriculture of Pink hibiscus, European and Mediterranean Plant Protection Organization, 2005.

Muralidharan CM and Badaya SN, 2000. Mealy bug (*Maconellicoccus hirsutus*) (Pseudococcidae: Hemiptera) out break on herbaceum cotton (*Gossypium herbaceum*) in Wagad cotton belt of Kachchh. Indian Journal of Agricultural Sciences, 70, 705–706.

Patel IS, Dodia DA and Patel SN, 1990. First record of *Maconellicoccus hirsutus* (Homoptera: Pseudococcidae) as a pest of pigeonpea (*Cajanus cajan*). Indian Journal of Agricultural Sciences, 60.

Peters T and Watson GW, 1999. The biological control of Hibiscus mealybug in Grenada. Paths to Prosperity: Science and Technology in the Commonwealth 1999/2000, 130–132.

Pollard GV, 1995. Update of new pest introductions–Continuing spread of pink mealybug *Maconellicoccus hirsutus*. FAO Circular Letter, 4, 95.

Raju AK, Rao PRM, Apparao RV, Readdy AS and Rao KKP, 1988. Note on estimation of losses in yield of mesta due to mealy bug, *Maconellicoccus hirsutus* Green. Jute Development Journal, 8, 34–35.

Rao AA, Teotia RS, Chauhan SS, Chakraborty S and Rao GS, 1993. Studies on the seasonal incidence of the mealy bug (*Maconellicoccus hirsutus* Green) causing'tukra'on mulberry in West Bengal. Indian Journal of Sericulture, 32, 111–113.

ScaleNet, online. *Maconelicoccus hirsutus*. Available online: http://scalenet.info/catalogue/Maconellicoccus%20hirsutus/ [Accessed: 10 July 2020].

Singh MP and Ghosh SN, 1970. Studies on *Maconellicoccus* (*Phenacoccus*) *hirsutus* Gr. causing" bunchy top" in mesta. Indian Journal of Science and Industry, 4, 99–105.

Spodek M, Watson GW and Mendel Z, 2016. The pink hibiscus mealybug, *Maconellicoccus hirsutus* (Green) (Hemiptera: Coccomorpha: Pseudococcidae), a new threat to Israel's agriculture and horticulture. Bulletin OEPP/EPPO Bulletin, 46, 311–312.

A.7. Armoured scales (*Aonidiella orientalis* and *Aulacaspis tubercularis*)

A.7.1. Organism information

A.7.1.1. *Aonidiella orientalis*

Taxonomic information	Current valid scientific name: *Aonidiella orientalis* (Newstead, 1894) Synonyms: *Aonidiella cocotiphagus, Aonidiella taprobana, Aspidiotus cocotiphagus, Aspidiotus orientalis, Aspidiotus osbeckiae, Aspidiotus pedronis, Aspidiotus taprobanus, Chrysomphalus orientalis, Chrysomphalus pedroniformis, Chrysomphalus pedronis, Evaspidiotus orientalis, Furcaspis orientalis* Name used in the EU legislation: N/A Order: Hemiptera Family: Diaspididae Common name: Oriental scale Name used in the Dossier: *Aonidiella orientalis*
Group	Insects
EPPO code	AONDOR
Regulated status	*Aonidiella orientalis* is not regulated in the EU, neither is listed by EPPO. It is in the A1 list in Argentina and listed as quarantine pest in Morocco (EPPO, online).
Pest status in Israel	Present (CABI, online; Hamon and Edwards, 1994), widespread in North and Center of Israel (Dossier Section 6.0). It has been reported as a mango pest in Israel (Wysoki et al., 1993). According to the pest-sheet provided by the PPIS, the pest is present in various cultivation areas of Israel. The pest was first recorded at the Arava Valley (from the Gulf of Elat to the Dead sea), in the South of Israel (Ben-Dov, 1985). Over the years the pest spread to the North of the country where it was found around Lake Kinneret (Sea of Galilee) and, as reviewed by Wysoki et al. (1993) is now widely distributed in Israel.
Pest status in the EU	Absent (CABI, online; García Morales et al., online).
Host status on *Persea americana*	It is highly polyphagous. It can attack almost any host except conifers, according to Williams and Watson (1988). It can be an economic pest of crops from diverse families, including *Persea americana* (CABI, online).
PRA information	Generic PRA: Armoured scale insects (Hemiptera: Coccoidea: Diaspididae) on the fresh produce pathway, produced by the Ministry of Primary Industry of the New Zealand Government, in 2014 (Available Online: https://www.mpi.govt.nz/dmsdocument/5224/direct).

<table>
<tr><th colspan="3">Other relevant information for the assessment</th></tr>
<tr><td>Biology</td><td colspan="2">Aonidiella orientalis is an armoured scale, which originates from Oriental region and it is now widely distributed in tropical countries (Waterhouse and Sands, 2001).
A. orientalis reproduces sexually; adult females probably produce species-specific sex pheromone to attract adult males (Naturalis Biodiversity Center, online).
Parthenogenetic and viviparous forms of reproduction were also observed (Wagner et al., 2008). A. orientalis can have from three generations (in India) up to six generations (in Australia) each year (Naturalis Biodiversity Center, online; Waterhouse and Sands, 2001).
Females and males develop through four life stages: an egg, two larval instars and an adult. The larval instars of males are called pre-pupa and pupa. Adult males have wings and females are wingless (Waterhouse and Sands, 2001).
As reviewed by Elder et al. (1995), males need approximately 19.5 days to develop from the crawler stage to adult at 25°C, while females need on average 44 days from the crawler stage to production of the first crawler of the subsequent generation at the same temperature.
Females can lay about 200 eggs in a lifetime (Waterhouse and Sands, 2001). They are protected by waxy covering (Wagner et al., 2008). After hatching, the larvae (first instar crawlers) migrate to settle on the leaves, fruit and stems of the host plant where they remain until maturity. Crawlers may be carried to neighbouring plants by wind (Waterhouse and Sands, 2001) or by hitchhiking on clothing, equipment, or animals (Leathers, 2016).
According to Hennessey et al. (2013), the percentage of crawlers settling on a tree from an infested fruit is higher when the infested commodity (e.g. a fruit) is in contact with the tree than when it is placed 2 m away. Most of the stages of A. orientalis remain attached to a host during most of their lives. The only mobile stage is the first instar-nymph (i.e. crawler stage), but it is not considered to be a good coloniser of new environments because it is small, fragile, not able to fly and slow in movements (Hennessey et al., 2013). Additionally, crawlers tend to remain and feed on plants close to the one they hatched on.
The scale feeds externally on fruit, leaves and stems. Crawlers and female scales feed on dilute sap. Additional carbohydrate and nitrogen are converted into material to construct the scale cover, and not into honeydew as in other scale insect families (CABI CPC).</td></tr>
<tr><td rowspan="3">Symptoms</td><td>Main type of symptoms</td><td>Leaves are damaged due to the pest feeding exhibiting characteristic chlorotic streaks and plant vigour is reduced due to the removal of plant sap. Feeding often causes depressions, discoloration and distortion of leaves (CABI, online). The pest can cause yellowing or death of the leaves and consequent defoliation, dieback of twigs and fruit discoloration and early drop (Rajagopal and Krishnamoorthy, 1996; CABI, online).</td></tr>
<tr><td>Presence of asymptomatic plants</td><td>Plant damage might not be obvious in early infestation, but the presence of scales on the plants could be observed. During the crawler stage, infestation is difficult to be noted. As reviewed by Elder et al. (1995), males need approximately 19.5 days to develop from the crawler stage to adult at 25°C, while females need on average 44 days from the crawler stage to production of the first crawler of the subsequent generation at the same temperature.</td></tr>
<tr><td>Confusion with other pests</td><td>A. orientalis is one of a group of many similar species not easy to be distinguished. These includes A. aurantii Maskell, A. comperei McKenzie, A. eremocitri McKenzie, A. inornata McKenzie, A. citrina Coquillett and A. taxus Leonardi (EPPO, 2005). A microscope observation is needed for identification.</td></tr>
<tr><td>Host plant range</td><td colspan="2">A. orientalis is a polyphagous pest with a wide host range, including approximately 74 families and 163 genera (Garcıa Morales et al., 2016) except conifers. It has been described as an economically important pest due to damage on Citrus, Ficus, mango, papaya, bananas and palm trees. In Israel, it has been reported as a serious pest of mango (Wysoki et al., 1993).</td></tr>
</table>

Pathways (EPPO GD)	*Aonidiella orientalis*. Plants for planting, fruits. The pest is mainly found on leaves, but in heavy infestations also on branches, trunks, shoots and fruits of the host plants (CABI, online). The main dispersal stage is the first (crawling) instar, which can be dispersed naturally by wind or animals. After selecting a feeding site, the scale becomes sessile and no further dispersal occurs.
Surveillance information	All plants for planting exported from Israel originate from nurseries that are approved by PPIS and are under PPIS inspection. – In nurseries that export trees, PPIS inspection is carried out every 45 days. – Further to the PPIS inspection, the producers carry out regular comprehensive self-inspections, once a week. This inspection is performed by the nurseries agronomists and according to the PPIS inspector's instructions. The results are recorded in the nursery logbook and every adverse finding is reported immediately to the inspector. The logbook is regularly reviewed during the inspector visits to the site. – Whenever a harmful organism of interest is found at any production site, the grower is required to inform PPIS and to treat the site as appropriate. During consecutive inspections, if there is no further evidence to the presence of the pest, the PPIS considers the site of production to be free from this harmful organism. – Further diagnostic procedures may be performed according to requirements of the importing country and in the case of inspection findings that necessitate identification of a causative agent (Dossier, Section 5.3). 1. According to the PPIS of Israel, past outbreaks, due to biological imbalance, led to severe damages. They report that *A. orientalis* is usually naturally controlled in avocado by natural enemies and that no economic damage by this pest has been reported in avocado nurseries. It can be found mainly on mango and may be present externally on leaves, stem, fruits and pot plants (Dossier).

A.7.1.2. *Aulacaspis tubercularis*

Taxonomic information	Current valid scientific name: *Aulacaspis tubercularis* Synonyms: *Aulacaspis cinnamomi*, *Aulacaspis cinnamomi mangiferae*, *Aulacaspis tuberculatus* Name used in the EU legislation: – Order: Hemiptera Family: Diaspididae Common name: mango scale, white mango scale Name used in the Dossier: *Aulacaspis tubercularis*
Group	Insects
EPPO code	AULSTU
Regulated status	The pest is not regulated in the EU or anywhere else in the world. *Aulacaspis tubercularis* is not listed by EPPO.
Pest status in Israel	Present (Scalenet; CABI online)
Pest status in the EU	Present in Italy [first reported in Sicily on mango trees growing outdoors in a nursery in 1988 (Porcelli, 1990), then intercepted in 2013 on mango plants imported from Florida (USA) to the Botanical Garden in Padova (Italy) and recently found in two Sicilian mango orchards (Lo Verde et al., 2020)], Madeira (EPPO, online) and Spain (Canary Islands and mainland). *A. tubercularis* was first found in 2010 in the mango producing areas of Andalusia (del Pino et al. 2020; GBIF, online).
Host status on *Persea americana*	This scale infests several plants of commercial value, including avocado, coconut (*Cocos nucifera L.*), ginger (*Zingiber officinale Roscoe*), pumpkins (*Cucurbita* spp.) and mango (http://www.agri.huji.ac.il/mepests/pest/Aulacaspis_tubercularis/).
PRA information	Express PRA: Express PRA for *Aulacaspis tubercularis*, produced by Julius Kühn-Institut, Institute for National and International Plant Health in 2018 (Available Online: https://pra.eppo.int/pra/72e6e475-cdab-4295-8a67-36e92a87694f).

Other relevant information for the assessment		
Biology	*Aulacaspis tubercularis* is native to Asia and is mainly reported from tropical and subtropical countries (del Pino et al., 2020). A. tubercularis reproduces sexually. Adult females produce sex pheromones in order to attract males for mating. The life cycle begins when a mated female lays fertilised eggs underneath its cover. The total mean fecundity is between 50 and 260 eggs per female. Females develop through an egg, crawler, two nymphal instars and an adult. Males have two additional instars called prepupa and pupa. The crawlers can move several centimetres within 24 h until they find a suitable place to settle. Nymphs are fixed on the same place until they reach adulthood. Female nymphs are usually found on the upper side of the leaves, less often on the underside leaves and fruits. Males are settled around the female mother (del Pino et al., 2020). Female development from an egg to adulthood takes between 35 and 40 days. Male development is shorter, between 23 and 28 days. The sex ratio is in favour of males, 11:1. It can have between two and six generations annually (del Pino et al., 2020). Adult males can fly but cannot establish a colony. Only crawlers can move to further places by wind currents, birds and insects (Ali et al., 2015).	
Symptoms	**Main type of symptoms**	Main symptoms are chlorotic spots on leaves, leaf deformations, leaf drop, external lesions on ripe fruits, premature fruit drop, smaller size of fruits, deficient flowering, dryness and death of young branches and in extreme cases death of the tree (Abo-Shanab, 2012; de Pino et al., 2020).
	Presence of asymptomatic plants	The presence of the species is always associated with symptoms, although symptoms can be absent when the scale is present on the bark of plants without leaves.
	Confusion with other pests	The species can be confused with other diaspidid scales and morphological identification is required. See del Pino et al. (2020) for a thorough description.
Host plant range	According to del Pino et al. (2020), *A. tubercularis* is considered a highly polyphagous species that has been recorded on more than 50 plant species belonging to 30 genera and 18 botanical families worldwide, including many economically important fruit and ornamental species. It is considered one of the key pests of mango (*Mangifera indica*) worldwide. Other hosts are avocado (*Persea americana*), cinnamon (*Cinnamomum* sp.), citrus (*Citrus* sp.), coconut (*Cocos nucifera*), guava (*Psidium guajava*), laurel (*Laurus nobilis*), lychee (*Litchi chinensis*), pittospori (*Pittosporum glabratum*), *Prunus* sp. and squash (*Cucurbita pepo*).	
Pathways (EPPO GD)	Possible pathways of entry for *Aulacaspis tubercularis* are mainly plants for planting and rarely fruits.	
Surveillance information	No information on this scale is provided in the Dossier.	

A.7.2. Possibility of pest presence in the nursery

A.7.2.1. Possibility of entry from the surrounding environment

As from the Dossier (Section 3.2), scions used in all product types (grafted plants grown in 750 cc pots, in 1 L and 6 L bags) are harvested from approved mother plants in PPIS-supervised orchards. Scions are then treated prior to grafting with suitable fungicides (Dossier, Section 3.8).

The plants in the 1 L bags are grown through the spring season in the greenhouse from April to June.

The plants in the 6 L bags are cultivated from the 1 L bag plants that are transferred to the larger bags during April to June. Growing the plants to a height of 0.8 m takes approximately three months, until July to September. These plants are cultivated either in an open field or in a roofless net house.

In the replies to EFSA questions the applicant country indicated that (i) papaya, mango, blueberry and kiwi are grown in the same nurseries where avocado is produced; (ii) nursery areas are clean of weeds and regularly treated against weeds; (iii) there are no hedges or shelter plants around avocado cultivation nursery areas. Besides, agricultural crops in a radius of 2 km from the avocado nurseries are avocado, banana, citrus and field crops. The natural vegetation in a radius of 2 km from the avocado nursery includes diverse native plants as well as ornamentals. There are a few hundreds of various urban ornamental trees and bushes in a radius of 2 km from the avocado nursery. The minimal distance between the nurseries of avocado for export and the nearest natural areas is approximately 100–200 m.

Uncertainties:

Though orchards and grafted plants are supervised by PPIS, we cannot exclude that these highly polyphagous pests, possibly present on Avocado mother plants or other host plants occurring in the surrounding environment, can infest the commodity mainly for human assisted spread.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for the pest to enter the nursery.

A.7.2.2. Possibility of entry with new plants/seeds

Stocks used for grafted plants in 750 cc pot or 1 L bag are cultivated from seed in a greenhouse (from a PPIS-approved source) and grown in a sterilised substrate made by coconut fibre, peat and polystyrene) whereas scions are harvested from approved mother plants in PPIS-supervised orchards (dossier, Section 3.2).

Uncertainties:

Not possible to completely exclude that juveniles or adults of these species can enter into the nursery by movement of mother plant material where juveniles and/or adults can be hidden in a protected site on the bark, roots, stems or leaves.

Taking into consideration the above evidence and uncertainties, the Panel considers it possible that the pest could enter the nursery with new plants/seeds or soil growing media.

A.7.2.3. Possibility of spread within the nursery

Grafted plants contained in 750 cc pots or in 1 L bag are grown continuously in greenhouse.

Uncertainties:

However, although very unlikely, it is not possible to totally exclude the movement of the pests within the nursery by human assisted spread.

Taking into consideration the above evidence and uncertainties, the Panel considers that the transfer of the pests within the nursery is possible.

A.7.3. Information from interceptions

Considering imports of *P. americana* plants from Israel to the EU, between 1995 and 2020, there are no records of interceptions of *A. orientalis and A. tubercularis* (EUROPHYT, online, Accessed: 31 March 2020).

A.7.4. Evaluation of the risk mitigation options

In the dossier and in the replies by the applicant country, it is reported that insecticide treatments (Tau-fluvalinate, Imidacloprid, Mineral oil, Spirotetramat, Spirodiclofen, Chlorpyrifos, Acetamiprid) are carried out after planting or during growth only when the pest is present and damage is recorded. However, in the dossier it is also reported that no economic damage by these pests has been reported in avocado nurseries in Israel. No specific chemical treatments are carried out against these species because no economic damage by these pests has been reported in avocado nurseries in Israel.

Uncertainties:

Being the insecticide treatments dependent on the presence and on the harmfulness of the pests, it is not possible to evaluate the efficacy of the mitigation measures carried out in the nurseries.

In the table below, all risk mitigation measures currently applied in Israel (Table 7) are listed and an indication of their effectiveness on armoured scales is provided.

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties for scions	Evaluation and uncertainties for grafted plants
12	Storage conditions The plants are transferred from the storage rooms directly to a reefer container which maintains 2–4°C.	No	Uncertainties: These temperatures could only slow down the life cycle without killing the pests but uncertain to what extent.	Idem
10	Pesticide treatment Insecticide applications	Yes	The active ingredient listed (Tau-fluvalinate, Imidacloprid, Mineral oil, Spirotetramat, Spirodiclofen, Chlorpyrifos, Acetamiprid) could be effective in controlling armoured scales. Uncertainties: These pesticides are applied only in case of infestation.	Idem
11	Natural enemies *Aphytis* spp.. *Chilocorus bipustulatus* Cited in the dossier for the control of *Aonidiella aurantii*	Yes	*Aphytis* spp. and *Chilocorus bipustulatus* are effective natural enemies of several insect scales. Uncertainties: pesticides applied on the plants in the nursery have a detrimental effect on natural enemies (see reply n. 20).	Idem
5	Surveillance & Monitoring In nurseries that export trees, PPIS inspection is carried out every 45 days. • Further to the PPIS inspection, the producers carry out regular comprehensive self-inspections, once a week. This inspection is performed by the nurseries agronomists and according to the PPIS inspector's instructions. The results are recorded in the nursery logbook and every adverse finding is reported immediately to the inspector. The logbook is regularly reviewed during the inspector visits to the site. • Whenever a harmful organism of interest is found at any production site, the grower is required to inform PPIS and to treat the site as appropriate. During consecutive inspections, if there is no further evidence to the presence of the pest, the PPIS considers the site of		Surveillance and monitoring of pest presence allow timely insecticide applications which could be effective against pests.	Idem

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties for scions	Evaluation and uncertainties for grafted plants
	production to be free from this harmful organism. • Further diagnostic procedures may be performed according to requirements of the importing country and in the case of inspection findings that necessitate identification of a causative agent. • Regular monitoring of the production sites by the grower – at least twice a week.			

A.7.5. Overall likelihood of pest freedom

A.7.5.1. Reasoning for a scenario which would lead to a reasonably low number of infested consignments

Surveillance takes place in the surroundings of cultivation areas. Visual inspections are effective to detect the pest. There are only a few alternative hosts in the surrounding. There are clear symptoms in the plant that facilitate detection. Cultivation density is not dense and hampers the spread of the pest. Continuous and synchronic generations throughout the cultivation period facilitate the detection of the pests. Mother plants are sufficiently and efficiently screened and render pest-free material. Management practices prevent the introduction and spread of the pest. Natural biological control agents keep pests at bay. Only young plants are used so they are cultivated in protected areas which are difficult to detect. Young plants are protected and less exposed to the natural dispersal by wind or other factors. Mineral oils are somewhat effective against scale insects. Mainly young plants are cultivated and they present a small canopy where pesticides are more effective after application and abiotic factors limiting population growth have a stronger effect. Temperature during storage slows the cycle of the pest, affects its vitality and prevents movement during shipping. Pest does not survive on the scions after defoliation. Fungicide and pre-shipping treatments on the scions may have some detrimental effects on the pest. Screening of rooted plants before shipping is effective for the detection of the pests.

A.7.5.2. Reasoning for a scenario which would lead to a reasonably high number of infested consignments

Surveillance does not take place or is not effective in the surroundings of cultivation areas. Visual inspections fail to detect the pests. Species are polyphagous and therefore, there are many potential hosts in the surroundings. Only juveniles are present and these are difficult to be detected during visual inspections. Cultivation density is very dense so it facilitates the spread of the pest. Life-cycle of the pest falls in periods that make difficult detection during inspections. Infestations are possible due to infested mother material which is poorly screened. Management practices do not prevent the introduction and spread of the pests. Insecticides are not effective or not applied properly for the management of the pests. Natural occurring biological control agents do not have any effect because of insecticide applications or due to inappropriate management. Plants are cultivated in open areas more prone to be infested. Plants are not protected and therefore exposed to the natural dispersal of the pest from the surrounding. Mineral oil treatments are not effective against these insects. Adult plants with a developed canopy and leaves are difficult to be treated with contact pesticides. Abiotic factors limiting population growth have a reduced effect (temperature, humidity, radiation). Temperature during storage does not stop the cycle of the pest; nor affect vitality or movement. Pests survive on the scions even if defoliated. Fungicide and pre shipping-treatments on scions before shipping have no effect on the pest. Screening of rooted plants before shipping is not effective in detection pests.

A.7.5.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infested consignments (Median)

Pests are very inconspicuous and do not produce honeydew and/or wax, so they are more difficult to detect during inspections. Many fruit species hosting these pests may be grown inside and outside production sites. The pest species can also be present in leaves, stems. Adults are covered with a strong structure (scale). Traditionally very hard to control chemical treatments do not work well. Based on the described scenarios, the pests if present more likely to be in grafted plants than in scions. Accordingly, if infestation occurs in scions, expected values will be near or below the estimated median. In the case of grafted plants where the pest is probably more difficult to be detected and therefore, a contrary situation is expected. If infestations occur, consignment infestations will reach values near or above the estimated median for grafted plants.

A.7.5.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

Details on management practices (on staff) are not clear. Information on pest prevalence in the areas or production is not available.

A.7.6. Elicitation outcomes of the assessment of the pest freedom for armoured scales (*A. orientalis* and *A. tubercularis*)

The following tables show the elicited and fitted values for pest infestation/infection (Tables A.23 and A.25) and pest freedom (Tables A.24 and A.26).

Table A.23: Elicited and fitted values of the uncertainty distribution of pest infestation by armoured scales per 10,000 grafted plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	10.0					55.0		80.0		120					200
EKE	9.73	15.5	22.2	31.9	42.2	53.0	63.1	82.8	105	118	134	152	173	193	216

The EKE results are Weibull (1.9773, 99.612) fitted with @Risk version 7.6.

Based on the numbers of estimated infested plants the pest freedom was calculated (i.e. = 10,000 – the number of infested grafted plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.24.

Table A.24: The uncertainty distribution of plants free of armoured scales per 10,000 grafted plants calculated by Table A.23

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,800					9,880		9,920		9,945					9,990
EKE results	9,784	9,807	9,827	9,848	9,866	9,882	9,895	9,917	9,937	9,947	9,958	9,968	9,978	9,984	9,990.3

The EKE results are the fitted values.

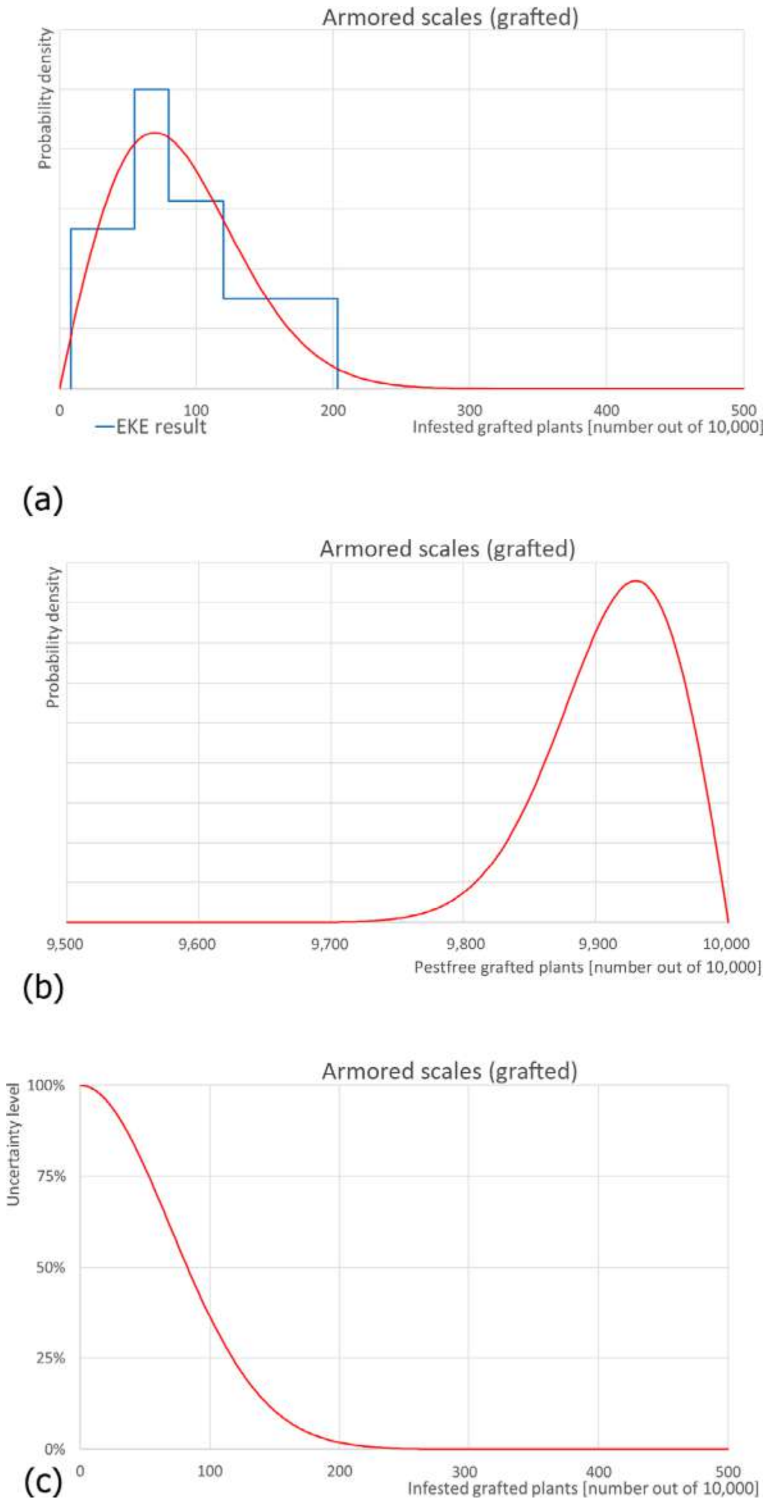


Figure A.12: (a) Elicited uncertainty of pest infestation per 10,000 grafted plants for armoured scales (*A. orientalis* and *A. tubercularis*) (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free grafted plants per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 grafted plants

Table A.25: Elicited and fitted values of the uncertainty distribution of pest infestation by armoured scales per 10,000 bundles of scions

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	2.00					10.0		25.0		50.0					100
EKE	1.88	2.09	2.59	3.93	6.30	9.95	14.3	25.4	40.2	49.5	60.8	72.5	84.2	92.4	99.4

The EKE results are *BetaGeneral (0.69739, 1.7797, 1.8, 110)* fitted with @Risk version 7.6.

Based on the numbers of estimated infested plants the pest freedom was calculated (i.e. = 10,000 – the number of infested bundles of scions per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.26.

Table A.26: The uncertainty distribution of plants free of armoured scales per 10,000 bundles of scions calculated by Table A.25

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,900					9,950		9,975		9,990					9,998
EKE results	9,901	9,908	9,916	9,928	9,939	99,51	9,960	9,975	9,986	9,990.1	9,993.7	9,996.1	9,997.4	9,997.9	9,998.1

The EKE results are the fitted values.

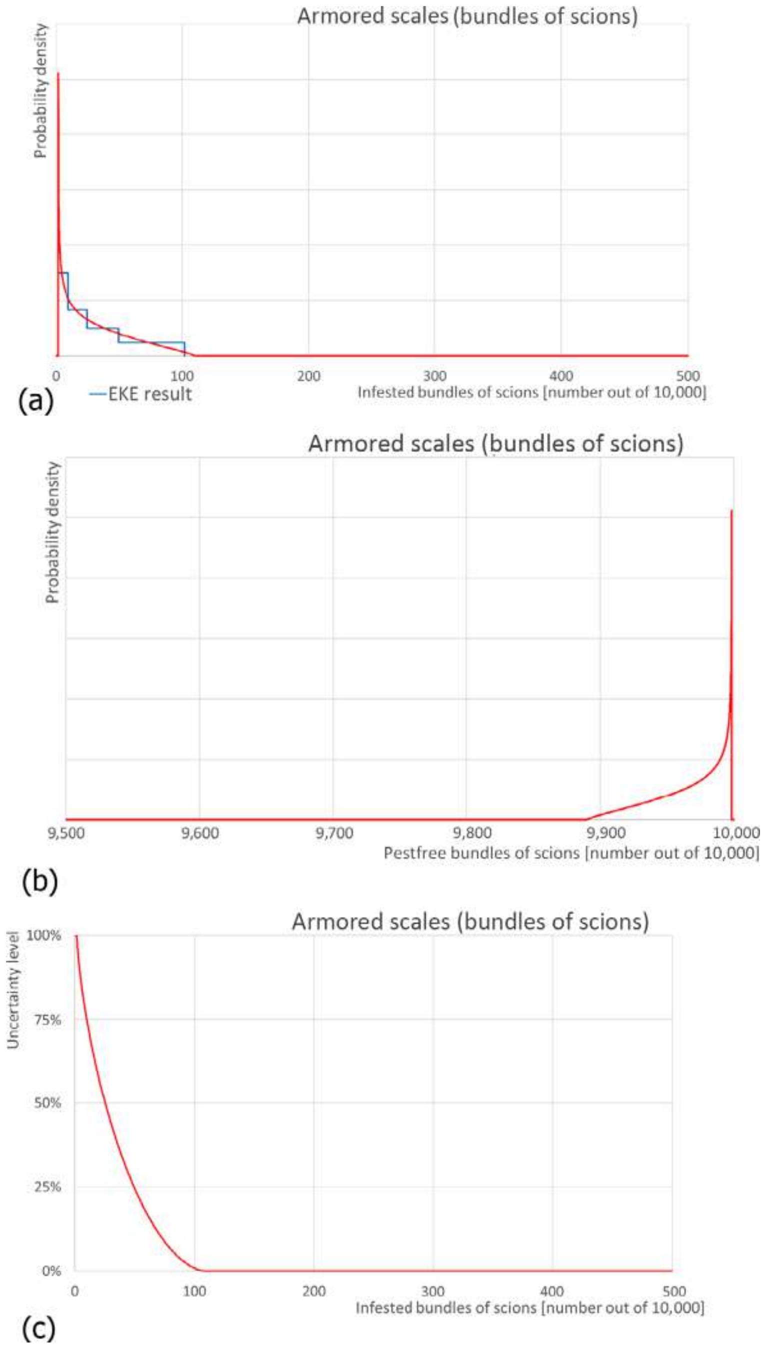


Figure A.13: (a) Elicited uncertainty of pest infestation per 10,000 bundles of scions for armoured scales (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free bundles of scions per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 bundles of scions

A.7.7. References

Abo-Shanab ASH, 2012. Suppression of white mango scale, *Aulacaspis tubercularis* (Hemiptera: Diaspididae) on mango trees in El-Beheira Governorate, Egypt. Egyptian Academic Journal of Biological Sciences: Entomology, 5, 43–50.

Ben-Dov Y, 1985. Further observations on scale insects (Homoptera: Coccoidea) of the Middle East. Phytoparasitica, 13, 185.

Berry AJ, 2014. New Zealand Government, Ministry for Primary Industries, Generic Pest Risk Assessment: Armoured scale insects (Hemiptera: Coccoidea: Diaspididae) on the fresh produce pathway, Available online: https://www.mpi.govt.nz/dmsdocument/5224/direct. [Accessed: 10 July 2020].

CABI (Centre for Agriculture and Bioscience International), online.. Available online: *Aonidiella orientalis*, *Aulacaspis tubercularis*. Available online: https://www.cabi.org/cpc/datasheet/5852, https://www.cabi.org/cpc/datasheet/7988 [Accessed: 16 July 2020].

EPPO (European and Mediterranean Plant Protection Organization), online. EPPO Global Database: *Aonidiella orientalis*, *Aulacaspis tubercularis* Available online: https://gd.eppo.int/taxon/AONDOR, https://gd.eppo.int/taxon/AULSTU. [Accessed: 11 July 2020].

EPPO (European and Mediterranean Plant Protection Organization), online. Express PRA for *Aulacaspis tubercularis*, Available online: https://pra.eppo.int/pra/72e6e475-cdab-4295-8a67-36e92a87694f. [Accessed: 11 July 2020].

Elder RJ and Smith D, 1995. Mass rearing of *Aonidiella oriental*is (Newstead)(Hemiptera: Diaspididae) on butternut gramma. Australian Journal of Entomology, 34, 253–254.

García Morales M, Denno BD, Miller DR, Miller GL, Ben-Dov Y and Hardy NB, 2016. ScaleNet: a literature-based model of scale insect biology and systematics. Database, 2016.

Germain JF, 2005. EPPO Standards. Diagnostic Protocols PM 7/51 *Aonidiella citrina*. Hennessey, M K; Peña, J E; Zlotina, M; Santos, K (2013) Likelihood of dispersal of the armoured scale, *Aonidiella orientalis* (Hemiptera: Diaspididae), to avocado trees from infested fruit discarded on the ground and observations on spread by handlers. pp. 401–411 In: Peña JE (ed.). Potential invasive pests of agricultural crops. CABI Invasive Species Series No. 3.

Leathers J, 2016. California pest rating proposals and final ratings of *Aonidiella orientalis* (Newstead): oriental scale. Available online: http://blogs.cdfa.ca.gov/Section3162/?tag=oriental-scale [Accessed: 10 July 2020].

Lo Verde G, Cerasa G, Altamore B and Farina V, 2020. First record of *Icerya seychellarum* and confirmed occurrence of *Aulacaspis tubercularis* (Hemiptera: Coccomorpha) in Italy. Phytoparasitica. https://doi.org/10.1007/s12600-020-00792-w

Naturalis Biodiversity Center, online. Diaspididae of the World 2.0, *Aonidiella orientalis*, Available online: https://diaspididae.linnaeus.naturalis.nl/linnaeus_ng/app/views/species/taxon.php?id=113045&epi=155 [Accessed: 10 July 2020].

del Pino M, Bienvenido C, Boyero JR and Vela JM, 2020. Biology, ecology and integrated pest management of the white mango scale, Aulacaspis tubercularis Newstead, a new pest in southern Spain-a review. Crop Protection, 105160.

Plant Pests of the Middle East, online. *Aulacaspis tubercularis*. Available online: http://www.agri.huji.ac.il/mepests/pest/Aulacaspis_tubercularis/ [Accessed: 10 July 2020].

Porcelli F, 1990. Cocciniglie nuove per l'Italia. Frustula Entomologica, 31–38.

Rajagopal D and Krishnamoorthy A, 1996. Bionomics and management of oriental yellow scale, Aonidiella orientalis (Newstead) (Homoptera: Diaspididae): an over view. Agricultural Reviews (Karnal), 17, 139–146.

Wagner MR, Cobbinah JR and Bosu PP, 2008. Sap-feeding insects. Forest Entomology in West Tropical Africa: Forests Insects of Ghana, 41–57.

Waterhouse DF and Sands DPA, 2001. Classical biological control of arthropods in Australia (No. 435-2016-33696).

Williams DJ and Watson GW, 1988. The scale insects of the tropical South Pacific region. Part 1. The armoured scales (Diaspididae). CAB International.

Wysoki M, Ben-Dov Y, Swirski E and Izhar Y, 1992. The arthropod pests of mango in Israel. In IV International Mango Symposium 341 (pp. 452–466).

A.8. *Tetraleurodes perseae*

A.8.1. Organism information

Taxonomic information	Current valid scientific name: *Tetraleurodes perseae* (Nakahara) Synonyms: – Name used in the EU legislation: – Order: Hemiptera Family: Aleyrodidae Common name: red-banded whitefly Name used in the Dossier: *Tetraleurodes perseae*

Group	Insects	
EPPO code	TETLPE	
Regulated status	EPPO Alert list (formerly) in 2003	
Pest status in Israel	Present (widespread) (EPPO, Online). *T. perseae* invaded Israel in 2001, most probably through illegally imported avocado foliage from California (Hoddle, 2006).	
Pest status in the EU	Absent (EPPO, Online).	
Host status on *Persea americana*	*P. americana* is reported as a major host plant of *T. perseae* (EPPO, Online).	
PRA information	No Pest Risk Analysis is available for *T. perseae*.	
Other relevant information for the assessment		
Biology	According to the Israeli PPIS, eggs are laid on the undersides of immature avocado leaves, where the young stages develop. It is not likely to be present in budwood and may be present in pot plants. According to Hoddle (2006), in California, *T. perseae* population is highly increased during mid- to late summer on succulent young leaves of avocado, which are ideal for feed and oviposition.	
Symptoms	**Main type of symptoms**	– Black sooty mold can be developed on leaves due to honeydew production by feeding larvae. – Deformation of immature leaves due to adult whiteflies feeding (Hoddle, 2006). – Premature leaf drop (EPPO, 2016).
	Presence of asymptomatic plants	No data available.
	Confusion with other pests	*T. perseae* can be confused easily with *T. confusa*. Both species are the only ones in Tetraleurodes with a posterior median notch on the operculum. The pupal case of *T. confusa* is difficult to differentiate from that of *T. perseae* (Nakahara, 1995).
Host plant range	Other hosts plants, only from the Lauraceae family, have been reported (EPPO, 2006) These are: *Laurus nobilis L., Litsea sp., Persea spp.,* and *Umbellularia californica* (Hook and Arn.) Nutt. (Hoddle, 2006).	
Pathways	Natural dispersal occurs by flying adults. Over long distances, *T. perseae* can spread through infested plants for planting. Movement with fruits is less likely (EPPO, 2016).	
Surveillance information	According to the PPIS, a treatment scheme in avocado has not been required as it is very rare in avocado and its damage is negligible. • All plants for planting exported from Israel originate from nurseries that are approved by PPIS and are under PPIS inspection. • In nurseries that export trees, PPIS inspection is carried out every 45 days. • Further to the PPIS inspection, the producers carry out regular comprehensive self-inspections, once a week. This inspection is performed by the nurseries agronomists and according to the PPIS inspector's instructions. The results are recorded in the nursery logbook and every adverse finding is reported immediately to the inspector. The logbook is regularly reviewed during the inspector visits to the site. • Whenever a harmful organism of interest is found at any production site, the grower is required to inform PPIS and to treat the site as appropriate. During consecutive inspections, if there is no further evidence to the presence of the pest, the PPIS considers the site of production to be free from this harmful organism. • Further diagnostic procedures may be performed according to requirements of the importing country and in the case of inspection findings that necessitate identification of a causative agent (Dossier).	

A.8.2. Possibility of pest presence in the nursery

A.8.2.1. Possibility of entry from the surrounding environment

T. perseae can spread through flying adults (EPPO, 2006), originated from other host plants (like *Laurus nobilis*) that might be present in the surrounding environment.

Uncertainties:

It is not certain if there are other host plants present in the surrounding environment apart from *P. americana.*

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for the pest to enter the nursery.

A.8.2.2. Possibility of entry with new plants/seeds

T. perseae can spread through infested plants for planting and less likely through fruits (EPPO, 2006).

Stocks used for grafted plants in 750 cc pot or 1 L bag are cultivated from seed in a greenhouse (from a PPIS-approved source) and grown in a sterilised substrate made by coconut fibre, peat and polystyrene) whereas scions are harvested from approved mother plants in PPIS-supervised orchards (dossier, Section 3.2).

Uncertainties:

Not possible to completely exclude that juveniles or adults of these species can enter into the nursery by movement of mother plant material where juveniles and/or adults can be hidden in a protected site on stems or leaves.

Taking into consideration the above evidence and uncertainties, the Panel considers it possible that the pest could enter the nursery with new plants.

A.8.2.3. Possibility of spread within the nursery

No other means of spread have been reported, other than flying adults, concerning possible means of spread within the nursery.

Uncertainties:

Taking into consideration the above evidence and uncertainties, the Panel considers that the transfer of the pest within the nursery is possible.

A.8.3. Information from interceptions

Considering imports of *P. americana* plants from Israel to the EU, between 1995 and 2020, there are no records of interceptions of *T. perseae* (EUROPHYT, online, Accessed: 6 April 2020).

A.8.4. Evaluation of the risk mitigation options

In the table below, all risk mitigation measures currently applied in Israel are listed and an indication of their effectiveness on *T. perseae* is provided.

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties of grafted plants
12	Storage conditions The plants are transferred from the storage rooms directly to a reefer container which maintains 2–4°C.	Yes	Uncertainties: These temperatures could only slow down the life cycle without killing the pests but uncertain to what extent.
10	Pesticide treatment/Insecticide applications	Yes	The active ingredients listed (Tau-fluvalinate, Imidacloprid,

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties of grafted plants
			Mineral oil, Spirotetramat, Spirodiclofen, Chlorpyrifos, Acetamiprid) could be effective in controlling *T. perseae*. Uncertainties: These pesticides are applied only in case of infestation.
5	Surveillance & Monitoring In nurseries that export trees, PPIS inspection is carried out every 45 days. • Further to the PPIS inspection, the producers carry out regular comprehensive self-inspections, once a week. This inspection is performed by the nurseries agronomists and according to the PPIS inspector's instructions. The results are recorded in the nursery logbook and every adverse finding is reported immediately to the inspector. The logbook is regularly reviewed during the inspector visits to the site. • Whenever a harmful organism of interest is found at any production site, the grower is required to inform PPIS and to treat the site as appropriate. During consecutive inspections, if there is no further evidence to the presence of the pest, the PPIS considers the site of production to be free from this harmful organism. • Further diagnostic procedures may be performed according to requirements of the importing country and in the case of inspection findings that necessitate identification of a causative agent. • Regular monitoring of the production sites by the grower – at least twice a week.	Yes	Surveillance and monitoring of pest presence allow timely insecticide applications which could be effective against pests.

A.8.5. Overall likelihood of pest freedom

A.8.5.1. Reasoning for a scenario which would lead to a reasonably low number of infested consignments

Surveillance takes place in the surroundings of cultivation areas. Visual inspections are effective to detect the pest. There are only a few alternative hosts of Lauraceae including avocado trees in the surrounding. Cultivation density is not dense and hampers the spread of the pest . Continuous and synchronic generations throughout the cultivation period that can be detected. Mother plants are sufficiently and efficiently screened and render pest-free material. Management practices prevent the introduction and spread of the pest. Natural biological control agents keep pests under control. Plants cultivated in protected areas which are not easily reachable by pests. Young plants are protected and little exposed to pests from the surrounding. Mineral oils come in contact with the pests and are somewhat effective against scale insects. Young plants present limited canopy where pesticides are more effective after application and abiotic factors limiting population growth have a stronger effect. Use of insecticide appropriate and timely prevents the occurrence of the pest. Storage temperature slows the cycle of the pest, affect its vitality and prevents movement during shipping. Pest does not survive on the scions after defoliation. Fungicide and pre-shipping treatments on the scions may have some detrimental effects on the pest.

A.8.5.2. Reasoning for a scenario which would lead to a reasonably high number of infested consignments

Surveillance does not take place or is not effective in the surroundings of cultivation areas. Visual inspections fail to detect the pest. Many avocado plants in orchards or other Lauraceae in the surroundings. Cultivation density is very dense so facilitates the spread of the pest. Life-cycle of the pest falls in periods difficult to be detected during inspections. Infestations are possible due infested mother material that is poorly screened during inspections. Management practices do not prevent the introduction and spread of the pest. Insecticides are not effective or not applied properly for the management of the pest. Biological control agents are not effective or not present. Plants cultivated in open areas that are easily infested. Plants are not protected and therefore exposed to the natural dispersal of the pest from the surrounding. Mineral oil treatments are not effective against these insects. Adult plants with more developed canopy and leaves are more difficult to be treated with contact pesticides and where abiotic factors limiting population growth have a reduced effect (temperature, humidity, radiation). Storage temperature does not stop the cycle of the pest, vitality or movement. Screening of rooted plants before shipping is not effective in pest detection.

A.8.5.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infested consignments (Median)

This is a strictly leaf-bound species, symptoms of deformation are observable in leaves when there is an infestation. It has a reduced host spectrum (only Lauraceae) Avocado is the preferred host. Eggs are on the adabaxial side of leaves. Infestations are easy to spot. Infestations are unllikely to occur in defoliated sciones or plant material therefore, scions were not considered to be a pathway. Based on the described scenarios, if infestation occurs in grafted plants, expected values will be near or below the estimated median.

A.8.5.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

No information on population pressure in the field.

A.8.5.5. Elicitation outcomes of the assessment of the pest freedom for *T. perseae*

The following tables show the elicited and fitted values for pest infestation/infection (Table A.27) and pest freedom (Table A.28).

Table A.27: Elicited and fitted values of the uncertainty distribution of pest infestation by *T. perseae* per 10,000 grafted plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	3.00					20.0		35.0		50.0					100
EKE	3.00	5.09	7.64	11.6	15.9	20.6	25.0	34.1	44.5	50.8	58.8	68.0	79.1	89.1	101

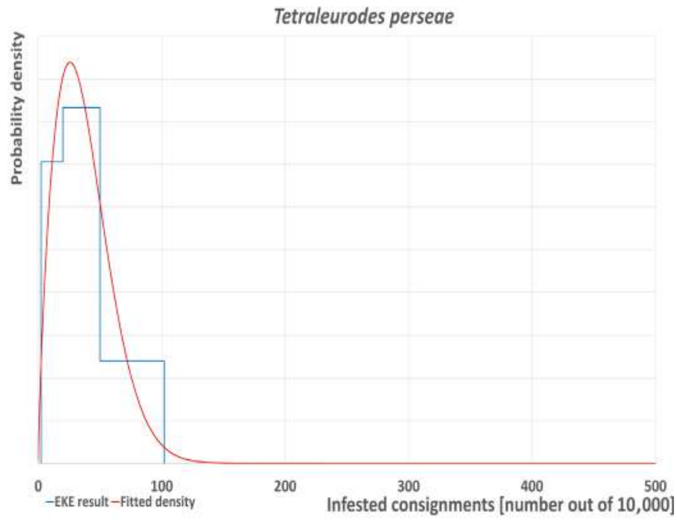
The EKE results are *Weibull (1.7409, 42.095)* fitted with @Risk version 7.6.

Based on the numbers of estimated infested grafted plants the pest freedom was calculated (i.e. = 10,000 – the number of infested grafted plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.28.

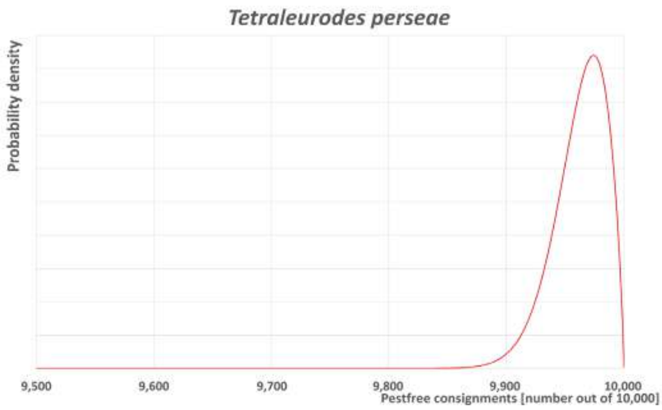
Table A.28: The uncertainty distribution of plants free of *T. perseae* per 10,000 grafted plants calculated by Table A.27

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,900					9,950		9,965		9,980					9,997
EKE results	9,899	9,911	9,921	9,932	9,941	9,949	9,956	9,966	9,975	9,979	9,984	9,988	9,992.4	9,994.9	9,997.0

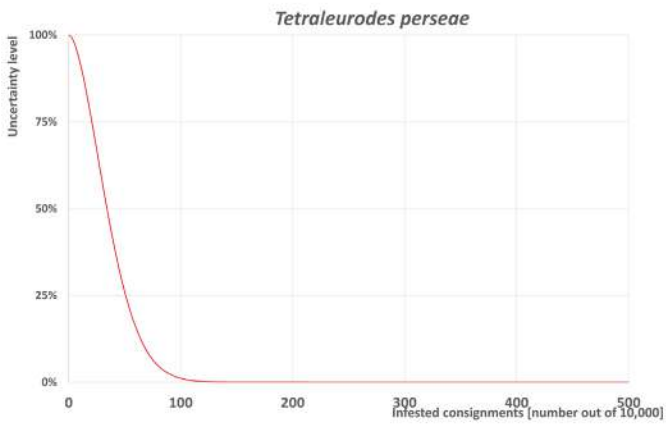
The EKE results are the fitted values.



(a)



(b)



(c)

Figure A.14: (a) Elicited uncertainty of pest infestation per 10,000 grafted plants for *T. perseae* (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free grafted plants per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 grafted plants

A.8.6. Reference list

EPPO (European and Mediterranean Plant Protection Organization), 2006. Mini data sheet on Tetraleurodes perseae. Available online: https://gd.eppo.int/taxon/TETLPE/documents [Accessed: 11 July 2020].
EPPO (European and Mediterranean Plant Protection Organization), online. EPPO Global Database: Tetraleurodes perseae. Available online: https://gd.eppo.int/taxon/TETLPE [Accessed: 11 July 2020].
Hoddle MS, 2006. Phenology, life tables, and reproductive biology of Tetraleurodes perseae (Hemiptera: Aleyrodidae) on California avocados. Annals of the Entomological Society of America, 99, 553–559.
Nakahara S, 1995. Taxonomic studies of the genus Tetraleurodes (Homoptera: Aleyrodidae). Insecta mundi, 153.

A.9. Thrips (*Scirtothrips dorsalis* and *Retithrips syriacus*)

A.9.1. Organism information

A.9.1.1. *Scirtothrips dorsalis*

Taxonomic information	Current valid scientific name: *Scirtothrips dorsalis* Synonyms: *Anaphothrips andreae, Anaphothrips dorsalis, Anaphothrips fragariae, Heliothrips minutissimus, Neophysopus fragariae, Scirtothrips andreae, Scirtothrips dorsalis padmae, Scirtothrips fragariae, Scirtothrips minutissimus, Scirtothrips padmae* Name used in the EU legislation: *Scirtothrips dorsalis Hood [SCITDO]* Order: Thysanoptera Family: Thripidae Common name: Assam thrips, chilli thrips, flower thrips, strawberry thrips, yellow tea thrips, castor thrips Name used in the Dossier*: Scirtothrips dorsalis*
Group	Insects
EPPO code	SCITDO
Regulated status	*S. dorsalis* is listed in Annex II/A of Regulation (EU) 2019/2072 as *Scirtothrips dorsalis Hood [SCITDO].* *Scirtothrips dorsalis* is included in the EPPO A2 list (EPPO, online_a). The pest is quarantine in Israel, Mexico and Morocco (EPPO, online_b).
Pest status in Israel	Present, widespread in Israel (EPPO, online_c).
Pest status in the EU	Present in Netherlands (few occurrences), Spain (restricted distribution) and the United Kingdom (few occurrences) (EPPO, online_c). *Scirtothrips dorsalis* was intercepted in the Netherlands up to 60 times each year from 1997 to 2009 on cut flowers, fruits and vegetables (Vierbergen and van der Gaag, 2009).
Host status on *Persea americana*	*Scirtothrips dorsalis* is polyphagous and it has been collected from *P. americana* plants (Plant Pests of the Middle East, online). According to the PPIS, it has been rarely found on avocado in Israel (however not known to cause damage in this crop, as well as in other commercial crops in Israel). Might be present externally on budwood as well as in pot plants (Dossier, Table D.1).
PRA information	Available Pest Risk Assessments: CSL Pest Risk Analysis for *Scirtothrips dorsalis* (MacLeod and Collins, 2006). Pest Risk Assessment *Scirtothrips dorsalis* (Vierbergen and van der Gaag, 2009). Scientific Opinion on the pest categorisation of *Scirtothrips dorsalis* (EFSA PLH Panel, 2014).
Other relevant information for the assessment	
Biology	*Scirtothrips dorsalis* is native to the Indian subcontinent. The pest can have annually up to 8 generations in temperate regions and up to 18 generations in warm subtropical and tropical areas (Kumar et al., 2013). According to the pest-sheet provided by Israel, on each host plant species, *S. dorsalis* density fluctuated over time with peaks in the late spring-summer and fall, but populations were consistently low in the late winter and early spring. The stages of the life cycle include egg, first and second instar larva, prepupa, pupa and adult (Kumar et al., 2013). They can be found on all the aboveground plant parts

	(Kumar et al., 2014). Temperature threshold for development is 9.7°C and 32°C, with 265 degree-days required for development from egg to adult (Tatara, 1994). The adult can live up to 13 to 15 days (Kumar et al., 2013). Females can lay between 60 and 200 eggs in lifetime (Seal and Klassen, 2012). Females develop from fertilised and males from unfertilised eggs (Kumar et al., 2013). The eggs are inserted into soft plant tissues, above the soil surface, and hatch between two to seven days (Kumar et al., 2014). Larvae and adults tend to gather near the mid-vein or near the damaged part of leaf tissue. Pupae are found in the leaf litter, on the axils of the leaves, in curled leaves or under the calyx of flowers and fruits (Kumar et al., 2013; MacLeod and Collins, 2006). The pest cannot overwinter, if the temperature remains below −4°C for five or more days (Nietschke et al., 2008). Adults fly actively for short distances and passively on wind currents, which enables long-distance spread (EFSA PLH Panel, 2014).	
Symptoms	**Main type of symptoms**	The pest damages young leaves, buds, tender stems and fruits by puncturing tender tissues with their stylets (Kumar et al., 2013) Main symptoms are: • 'sandy paper lines' on the epidermis of the leaves, • leaf crinkling and upwards leaf curling, • leaf size reduction, • discoloration of buds, flowers and young fruits, • silvering of the leaf surface, • linear thickenings of the leaf lamina, • brown frass markings on the leaves and fruits, • fruits develop corky tissues, • grey to black markings on fruits, • fruit distortion and early senescence of leaves, • defoliation (Kumar et al., 2013, 2014). When the population is high, thrips may feed on the upper surfaces of leaves and cause defoliation and yield loss (Kumar et al., 2013). *Scirtothrips dorsalis* is a vector of plant viruses including chilli leaf curl virus (CLC), peanut necrosis virus (PBNV), peanut yellow spot virus (PYSV), tobacco streak virus (TSV), watermelon silver mottle virus (WsMoV), capsicum chlorosis virus (CaCV), melon yellow spot virus (MYSV) (Kumar et al., 2013), Groundnut chlorotic fan-spot virus, Groundnut yellow spot virus (CABI; Rao et al. 2003), Tomato spotted wilt virus on peanut (Amin et al. 1981), and peanut chlorotic fan virus (PCFV) (Campbell et al. 2005) (Dossier, pest-sheet).
	Presence of asymptomatic plants	No data available
	Confusion with other pests	Plants infested by *Scirtothrips dorsalis* appear similar to plants damaged by the feeding of broad mites (Kumar et al., 2013). Due to small size and morphological similarities within the genus, the identification of *Scirtothrips dorsalis,* using traditional taxonomic keys, is difficult. The most precise identification of the pest is combination of molecular and morphological methods (Kumar et al., 2013).
Host plant range	*Scirtothrips dorsalis* is a polyphagous pest with more than 100 reported hosts (Kumar et al., 2013). The pest can infect many more plant species, but they are not considered to be true hosts, since the pest cannot reproduce on all of them (EFSA PLH Panel, 2014). The hosts of the pest are kiwi (Actinidia deliciosa), peanut (*Arachis hypogaea*), tea (*Camellia sinensis*), pepper (*Capsicum annuum*), chilli pepper (*Capsicum frutescens*), citrus (*Citrus* spp.), muskmelon (*Cucumis melo*), cucumber (*Cucumis sativus*), pumpkin (*Cucurbita pepo*), fig (*Ficus carica*), Burgundy rubber tree (*Ficus elástica* 'Burgundy'), strawberry (*Fragaria* spp.), cotton (*Gossypium hirsutum*), litchi (*Litchi chinensis*), mango (*Mangifera indica*), tobacco (*Nicotiana tabacum*), avocado (*Persea americana*), poplar (*Populus deltoids*), castor (*Ricinus communis*), rose (*Rose* spp.), eggplant (*Solanum melongena*), grapevine (*Vitis vinifera*), corn (*Zea mays*) and other plants (Hodges et al., 2005; Kumar et al., 2014).	

	Scirtothrips dorsalis causes economic losses to chilli pepper, mango, grapevine, citrus, vegetables and tea (Kumar et al., 2013). There is no evidence that *S. dorsalis* causes any damage in Israel, including species in which has been reported, such as avocado, citrus, mango and fig (Dossier, pest-sheet).
Pathways (EPPO GD)	Plants for planting, cut flowers, fruits and vegetables, soil and growing media are pathways for introduction and spread of *Scirtothrips dorsalis* (EFSA PLH Panel, 2014).
Surveillance information	According to the Dossier, all plants for planting exported from Israel originate from nurseries that are approved by PPIS and are under PPIS inspection. • In nurseries that export trees, PPIS inspection is carried out every 45 days. • Further to the PPIS inspection, the producers carry out regular comprehensive self-inspections, once a week. This inspection is performed by the nurseries agronomists and according to the PPIS inspector's instructions. The results are recorded in the nursery logbook and every adverse finding is reported immediately to the inspector. The logbook is regularly reviewed during the inspector visits to the site. • Whenever a harmful organism of interest is found at any production site, the grower is required to inform PPIS and to treat the site as appropriate. During consecutive inspections, if there is no further evidence to the presence of the pest, the PPIS considers the site of production to be free from this harmful organism. • Further diagnostic procedures may be performed according to requirements of the importing country and in the case of inspection findings that necessitate identification of a causative agent. • Pest or disease problems are very rare in the nursery cultivation of Avocado plants in Israel, as seen in regular monitoring of the production sites by the grower – at least twice a week. • No economic damage by *S. dorsalis* has been reported in avocado nurseries in Israel

A.9.1.2. *Retithrips syriacus*

Taxonomic information	Current valid scientific name: *Retithrips syriacus* Synonyms: *Dictyothrips zanoniana, Dictyothrips aegyptiacus, Heliothrips syriacus, Retithrips aegyptiaca, Retithrips aegyptiacus, Stylothrips bondari* Name used in the EU legislation: – Order: Thysanoptera Family: Thripidae Common name: black vine thrips, castor thrips, grape thrips Name used in the Dossier: *Retithrips syriacus*
Group	Insects
EPPO code	RETTSY
Regulated status	*R. syriacus* is not regulated in the EU neither is listed by EPPO. The pest is quarantine in Mexico (EPPO, online).
Pest status in Israel	Present (CABI, online; Hamon and Edwards, 1994), widespread in North and Center of Israel (Dossier Section 6.0). The cultivation sites of avocado for export, as listed hereinabove, are not in pest free areas. However, this pest is rarely seen in avocado in Israel and is not known to cause damage in this crop. It has been reported to cause damage in a small range of crops, primarily ornamentals such as lisianthus and roses, and rarely, in Capsicum or Citrus (Reply n. 34).
Pest status in the EU	Absent in the EU (CABI, online).
Host status on *Persea americana*	*Persea americana* is a host of *Retithrips syriacus* (CABI CPC, Online).
PRA information	Available Pest Risk Assessments for *Retithrips syriacus*: Final Import Policy: Fresh persimmon fruit from Japan, Korea and Israel (Australian Government Department of Agriculture, Fisheries and Forestry, 2004), final group pest risk analysis for thrips and orthotospoviruses on fresh fruit, vegetable, cut-flower and foliage imports (Australian Government Department of Agriculture and Water Resources, 2017).

Other relevant information for the assessment		
Biology	This thrips probably originates from Central Africa (Elimem et al., 2011). Adults usually mate on the day of emergence and females start laying eggs 3 days after. *R. syriacus* can be sometimes parthenogenic (CABI, online). During winter *R. syriacus* is very rarely on plants, the adults overwinter in the soil (Ben-Yakir, 2012). A complete life cycle can take between 15 to 30 days under open air conditions and less in greenhouses. *R. syriacus* can produce several annual generations (Gerson and Aplebaum, online), up to seven per year (CABI, online). In India on castor (*Ricinus communis*), a generation cycle is completed in 15–20 days (Sujatha et al., 2011). Females lay eggs in the leaf tissue or less frequently on the leaf surface (Medina-Gaud and Franqui, 2001). Each female lays around 40–60 eggs in 5–10 days. Eggs hatch in 4 to 5 days (Sujatha et al., 2011). Oviposition stops when temperatures drop below 17°C or rise above 37°C. Only males emerge from unfertilised eggs. The emerging nymphs feed immediately. The adults also feed, usually on the lower side of leaves. Nymphs and pupa have a bright red colour (Medina-Gaud and Franqui, 2001). Nymphs become fully grown in 7–9 days. Then they drop down, enter into the soil and pupate. The pupal stage lasts for 2–3 days (Sujatha et al., 2011). The most rapid development in this pest occurs between 27 and 30°C; above this temperature, egg development is again delayed. Egg mortality is still low at 30°C, but increases rapidly with rising temperature. At 37°C larvae fail to hatch. There are two nymphal instars, development taking from 6 to 35 days with the most rapid development at 28–30°C. The nymph is less sensitive than the egg to extremes in climatic conditions, though mortality increases when the temperature rises above 33°C. Above 37°C no nymph attain pupation. The majority of nymphs also die when the temperature drops below 14°C. Nymphs are resistant, however, to low air humidity as long as the host leaf is water-saturated. In hot weather, the prepupal phase takes only one day, and the pupal stage 2 days. Development at lower temperatures takes longer, and may last, for example, 21 days at 15°C. Pupae are resistant to low humidity, but are also extremely sensitive to high air humidity approaching 100% RH. Cold air (15°C and less) and also high temperatures (37°C) are lethal to most of the pupae. Under favourable climatic conditions the adults live from 10 to 20 days, whereas at lower temperatures longevity may reach 40 days. In summer the female starts to lay about 3 days after emergence, though in colder seasons there is a pre-oviposition period of 8–18 days. Adults generally mate on the day of emergence. In autumn the numbers of the sexes are equal, whereas in other seasons, females far out-number males. At times the females even comprise 70–80% of the total adult population. When temperatures drop below 17°C or rise above 37°C, oviposition is arrested. Only males emerge from unfertilised eggs. Females usually out-number males, only in autumn the numbers of sexes are equal (CABI, online). Adults can fly and live for more than one month (Gerson and Aplebaum, online).	
Symptoms	**Main type of symptoms**	*Retithrips syriacus* adults and nymphs damage foliage (especially the lower leaf surface), fruits and flower sepals. When infestation is heavy, the upper surfaces of leaves are also attacked and fruits fail to develop normally (CABI, online). The main symptoms are: • grey dots on leaves (from insertions of the stylets), • shiny black dots on leaves (excrements), • fruits turn grey (at feeding sites), • crinkling of the terminal leaves with a silvery appearance, • stunted growth of plants, • fruit discoloration, • fruit size deformation, • defoliation (CABI, online; Hamon and Edwards, 1994; Sujatha et al., 2011).
	Presence of asymptomatic plants	Plant damage might not be obvious in early infestation or during dormancy (due to absence of leaves). The presence of *R. syriacus* on the plants could hardly be observed.
	Confusion with other pests	The most precise identification of the pest is combination of molecular and morphological methods.

Host plant range	It is a polyphagous pest and has over 50 host species (Gerson and Aplebaum, online). It is a pest of avocado (*P. americana*), Brazil pepper tree (*Schinus molle*), cotton (*Gossypium hirsitum*), grapevine (*Vitis vinifera*), kaki (*Diospyros kaki*), myrtle (*Myrtus communis*), peppervine (*Ampelopsis orientale*), rose (*Rosa* spp.), walnut (*Juglans regia*), wild apple (*Malus sylvestris*) (Doganlaw and Yigit, 2002), apple (*Malus domestica*), banana (*Musa* spp.), coconut (*Cocos nucifera*), coffee (*Coffea* spp.), European pear (*Pyrus communis*), Japanese plum (*Prunus salicina*), poplar (*Populus* spp.) and other plants (CABI, online). The economic damage of *R. syriacus* in Israel is mainly reported on persimmon and avocado plants. It commonly infests grapevine, myrtle, rose, and cotton (Ben-Yakir, 2012) and *Ficus carica* (Avidov and Harpaz, 1969).
Pathways (EPPO GD)	Fruits and plants for planting are the main pathways for introduction and spread of this thrips (Wistermann et al., 2016). As *R. syriacus* can be associated with soil (Ben-Yakir, 2012), soil is also considered as pathway.
Surveillance information	No surveillance information for these pests is currently available from PPIS. There is no information on whether the pests have ever been found in the nurseries or their surrounding environment.

A.9.2. Possibility of pest presence in the nursery

A.9.2.1. Possibility of entry from the surrounding environment

As from the Dossier (Section 3.2), scions used in all product types (grafted plants grown in 750 cc pots, in 1 L and 6 L bags) are harvested from approved mother plants in PPIS-supervised orchards. Scions are then treated prior to grafting with suitable fungicides (Dossier, Section 3.8).

The plants in the 1 L bags are grown through the spring season in the greenhouse from April to June.

The plants in the 6 L bags are cultivated from the 1 L bag plants that are transferred to the larger bags during April to June. Growing the plants to a height of 0.8 m takes approximately three months, until July to September. These plants are cultivated either in an open field or in a roofless net house.

Adults of both pest species fly actively in short distances and can be passively dispersed by wind currents, which facilitates long-distance spread.

Sensitivity to population density and intraspecific competition may be increased by conditions affecting host quality, resulting in mass dispersal to relieve population pressures. It may be that reduced host quality triggers the thrips to disperse, causing additional outbreaks. There is some evidence supporting this hypothesis with regard to *S. dorsalis* (Derksen, 2009). Given the high polyphagy of both pests, many wild plant species can serve as a reservoir for dispersal to cultivated plants (Seal et al., 2010). The availability of the host plants significantly increases the success of dispersal (EFSA PLH Panel, 2014).

Distribution of *S. dorsalis* in Israel is not restricted. The cultivation sites of avocado for export are not in pest free areas. However, this pest is rarely found on avocado in Israel and is not known to cause damage in this crop. It has been reported to cause damage in a small range of crops, primarily ornamentals such as lisianthus and roses, and rarely, in Capsicum or Citrus.

Retithrips syriacus is mainly present in North and central Israel. The species has been reported in avocado orchards (Swirski and Wysoki 1995 and Swirski et al. 2002).

Management of both species includes use of 50 mesh nets, double doors entrance to the greenhouses, routine inspection by hired staff as well as by PPIS.

Uncertainties:

- Though orchards and grafted plants are supervised by PPIS, we cannot exclude that these highly polyphagous pests, possibly present on Avocado mother plants or other host plants occurring in the surrounding environment, can infest the commodity for natural and human assisted spread.
- Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for the pest to enter the nursery.

A.9.2.2. Possibility of entry with new plants/seeds

Stocks used for grafted plants in 750 cc pot or 1 L bag are cultivated from seed in a greenhouse (from a PPIS-approved source) and grown in a sterilised substrate made by coconut fibre, peat and polystyrene) whereas scions are harvested from approved mother plants in PPIS-supervised orchards (dossier, Section 3.2).

Plants for planting and cuttings are considered as a pathway for introduction and spread of both pests. However, all kinds of host plant material can also act as a pathway.

The difficulty of detecting both species when they are present in low numbers increases the probability of them remaining undetected during transport, and this in turn influences the probability of spread. This is particularly the case for eggs, which can be overlooked when inserted into leaves. In addition, pupae can be hidden in leaf axils, in leaf curls and under the calyces of flowers and fruits, as well as in the soil (MacLeod and Collins, 2006; Sujatha et al. 2011). During transport, the host plant provides a controlled environment with moisture and nutrients, protecting the thrips from extreme temperatures, topical pesticides and vigorous washes that do not penetrate the tight folds of buds to remove or exterminate the thrips (Derksen, 2009). These aspects can be regarded as factors that increase the survival of the pests during transport (EFSA PLH Panel, 2014).

<u>Uncertainties</u>:

Not possible to completely exclude that juveniles or adults of these species can enter into the nursery by movement of mother plant material or soil where juveniles and/or adults can be hidden in a protected site as well as natural spread by flying adults.

Taking into consideration the above evidence and uncertainties, the Panel considers it possible that the pests could enter the nursery though the use of 50 mesh nets and double doors entrance can prevent flying adults entrance.

A.9.2.3. Possibility of spread within the nursery

Grafted plants contained in 750 cc pots or in 1 L bag are grown continuously in greenhouse. As mentioned in Section A.1.2.3, natural spread by flying adults is likely.

<u>Uncertainties:</u>

However, although the plants are grown under protected conditions with nets and double doors being used to prevent pest entrance, it is not possible to totally exclude that the transfer of the pest within the nursery can occur by movement of plants, soil, human assisted and natural spread (i.e. adult flight).

Taking into consideration the above evidence and uncertainties, the Panel considers that the transfer of the pest within the nursery is possible.

A.9.3. Information from interceptions

Considering imports of *P. americana* plants from Israel to the EU, between 1995 and 2020, there are no records of interceptions of *S. dorsalis* and *R. syriacus* (EUROPHYT, online, Accessed: 6 April 2020).

A.9.4. Evaluation of the risk mitigation options

In the dossier and in the replies by the applicant country, it is reported that insecticide treatments (Tau-fluvalinate, Imidacloprid, Mineral oil, Spirotetramat, Spirodiclofen, Chlorpyrifos, Acetamiprid) are carried out after planting or during growth only when the pest is present and damage is recorded.

No specific chemical treatments are carried out against these species because no economic damage by these pests has been reported in avocado nurseries in Israel.

<u>Uncertainties:</u>

Being the insecticide treatments dependent on the presence and on the harmfulness of the pests, it is not possible to evaluate the efficacy of the mitigation measures carried out in the nurseries.

In the table below, all risk mitigation measures currently applied in Israel (Table 6) are listed and an indication of their effectiveness on thrips is provided.

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties for scions	Evaluation and uncertainties for grafted plants
5	Storage conditions The plants are transferred from the storage rooms directly to a reefer container which maintains 2–4°C.	Yes	Uncertainties: These temperatures could only slow down the life cycle without killing the pests.	Idem
10	Pesticide treatment Insecticide applications	Yes	The a.i. listed (Tau-fluvalinate, Imidacloprid, Mineral oil, Spirotetramat, Spirodiclofen, Chlorpyrifos, Acetamiprid) could be effective in controlling thrips. Uncertainties: These pesticides are applied only in case of infestation.	Idem
5	Surveillance and monitoring In nurseries that export trees, PPIS inspection is carried out every 45 days. • Further to the PPIS inspection, the producers carry out regular comprehensive self-inspections, once a week. This inspection is performed by the nurseries agronomists and according to the PPIS inspector's instructions. The results are recorded in the nursery logbook and every adverse finding is reported immediately to the inspector. The logbook is regularly reviewed during the inspector visits to the site. • Whenever a harmful organism of interest is found at any production site, the grower is required to inform PPIS and to treat the site as appropriate. During consecutive inspections, if there is no further evidence to the presence of the pest, the PPIS considers the site of production to be free from this harmful organism. • Further diagnostic procedures may be performed according to requirements of the importing country and in the case of inspection findings that necessitate identification of a causative agent. • Regular monitoring of the production sites by the grower – at least twice a week.	Yes	Surveillance and monitoring of pest presence allow timely insecticide applications which could be effective against pests.	Idem

A.9.5. Reasoning for a scenario which would lead to a reasonably high number of infested consignments

Surveillance takes place in the surroundings of cultivation areas. Visual inspections are effective to detect the pests. There are only a few alternative hosts in the surrounding. Plants show symptoms of infestation. Cultivation density is not dense and prevents the spread of the pest. Continuous and synchronic generations throughout favour the detection of the pests. Mother plants are sufficiently and efficiently screened and render pest-free material. Management practices prevent the introduction and spread of the pest. Natural biological control agents keep pests controlled. Plants are mainly cultivated in protected areas and are not exposed to pests. Mineral oils come in contact with the pests and are somewhat effective against the pests. Young plants show limited canopy where pesticides are more effective and abiotic factors limiting population growth have effect. Temperature during storage slows the cycle of the pest, affects its vitality and prevents movement during shipping. Pest does not survive on the scions after defoliation. Fungicide and pre-shipping treatments on the scions may have some detrimental effects on the pest. Screening of rooted plants before shipping is effective in detecting pests. Only assisted dispersal, environmental conditions do not favour long-distance dispersal of the thrips. Artificial substrate in potted plants does not favour the survival of the thrips (pupae) Nets protecting plants prevent the spread and infestation. Chemical treatment is effective against thrips species.

A.9.6. Reasoning for a scenario which would lead to a reasonably high number of infested consignments

Surveillance does not take place or is not effective in the surroundings of cultivation areas. Visual inspections fail to detect the pests. Species are polyphagous and therefore, there are many potential hosts in the surroundings. Only juveniles are present and these are difficult to be detected during visual inspections. Cultivation density is very dense so it facilitates the spread of the pest. Life-cycle of the pest falls in periods that make difficult detection during inspections. Infestations are possible due to infested mother material which is poorly screened. Management practices do not prevent the introduction and spread of the pests. Insecticides are not effective or not applied properly for the management of the pests. Natural occurring biological control agents do not have any effect because of insecticide applications or due to inappropriate management. Plants are cultivated in open areas more prone to be infested. Plants are not protected and therefore exposed to the natural dispersal of the pest from the surrounding. Mineral oil treatments are not effective against these insects. Adult plants with more developed canopy and leaves are more difficult to be treated with contact pesticides and where abiotic factors limiting population growth have a reduced effect (temperature, humidity, radiation). Temperature during storage does not stop the cycle of the pest; nor affect vitality or movement. Pests survive on the scions even if defoliated. Fungicide and pre shipping-treatments on scions before shipping have no effect on the pest. Screening of rooted plants before shipping is not effective in detecting pests. Active flying of thrips results in the spread of the pest from outside and within nurseries, environmental conditions favour long distance dispersal. Artificial substrate favours survival and hiding of pupae. Nets are not effective in preventing pest introductions and spread. Chemical treatment is not effective because of resistant populations.

A.9.7. Reasoning for a central scenario equally likely to over- or underestimate the number of infested consignments (Median)

Pests are very inconspicuous and do not produce honeydew and/or wax, so they are more difficult to detect during inspections. Many fruit species hosting these pests may be grown inside and outside production sites. The species can also be present in leaves, stems. Based on the described scenarios, the pests are more likely to be present in grafted plants than in scions. Nonetheless there is little information available so similar chances to have infestation levels below or above the estimated median. If infestation occurs in scions, expected values will be near or below the estimated median given the fact that scions are defoliated so only leaf buds are potential sites for the pest to survive.

A.9.8. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

Pest pressure and distribution in the field unknown. Effectiveness of treatments and detection threshold during inspections unknown.

A.9.9. Elicitation outcomes of the assessment of the pest freedom for thrips (*S. dorsalis, R. syriacus*)

The following tables show the elicited and fitted values for pest infestation/infection (Tables A.29 and A.31) and pest freedom (Tables A.30 and A.32).

Table A.29: Elicited and fitted values of the uncertainty distribution of pest infestation by thrips per 10,000 grafted plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	10.0					70.0		130		190					250
EKE	10.3	14.3	20.7	33.2	49.7	69.9	90.0	130	170	190	210	227	239	246	250

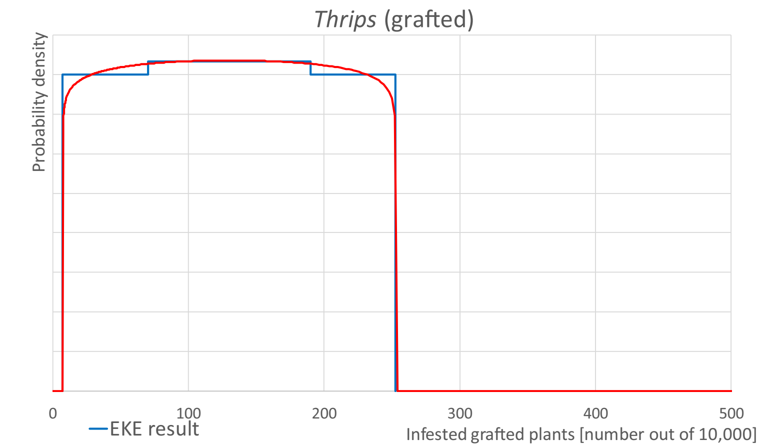
The EKE results are *BetaGeneral (1.0379, 1.0379, 7.5, 252.5) fitted* with @Risk version 7.6.

Based on the numbers of estimated infested grafted plants the pest freedom was calculated (i.e. = 10,000 – the number of infested grafted plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.30.

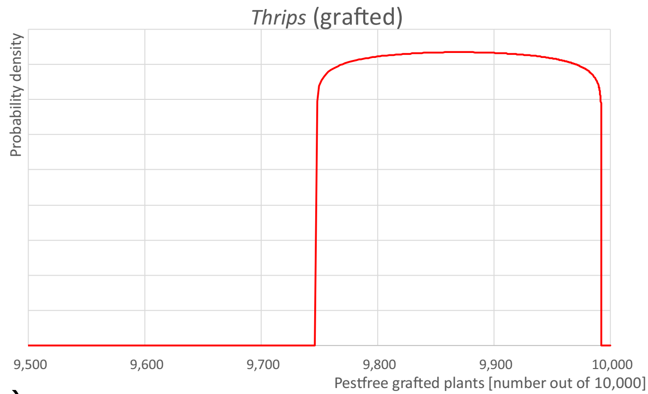
Table A.30: The uncertainty distribution of plants free of thrips per 10,000 grafted plants calculated by Table A.29

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,750					9,810		9,870		9,930					9,990
EKE results	9,750	9,754	9,761	9,773	9,790	9,810	9,830	9,870	9,910	9,930	9,950	9,967	9,979	9,986	9,989.7

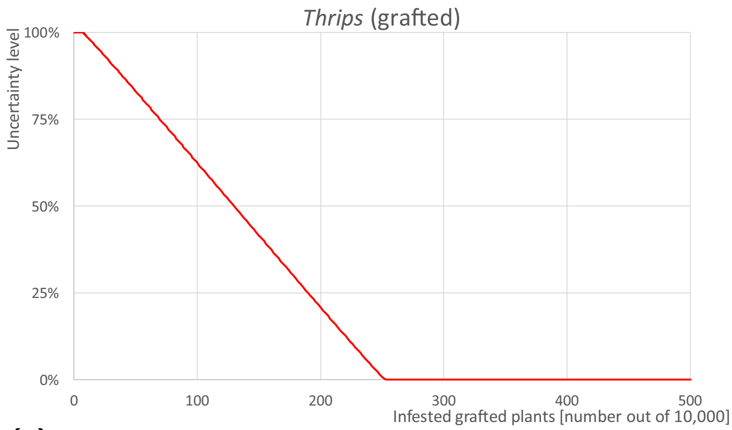
The EKE results are the fitted values.



(a)



(b)



(c)

Figure A.15: (a) Elicited uncertainty of pest infestation per 10,000 grafted plants for thrips (*S. dorsalis* and *R. syriacus*) (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free grafted plants per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 grafted plants

Table A.31: Elicited and fitted values of the uncertainty distribution of pest infestation by thrips per 10,000 bundles of scions

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	2.00					10.0		25.0		50.0					100
EKE	1.88	2.09	2.59	3.93	6.30	9.95	14.3	25.4	40.2	49.5	60.8	72.5	84.2	92.4	99.4

The EKE results are *BetaGeneral (0.69739, 1.7797, 1.8, 110) fitted* with @Risk version 7.6.

Based on the numbers of estimated infested bundles of scions the pest freedom was calculated (i.e. = 10,000 – the number of infested bundles of scions per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.32.

Table A.32: The uncertainty distribution of plants free of thrips per 10,000 bundles of scions calculated by Table A.31

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,900					9,950		9,975		9,990					9,998
EKE results	9,901	9,908	9,916	9,928	9,939	9,951	9,960	9,975	9,986	9,990.1	9,993.7	9,996.1	9,997.4	9,997.9	9,998.1

The EKE results are the fitted values.

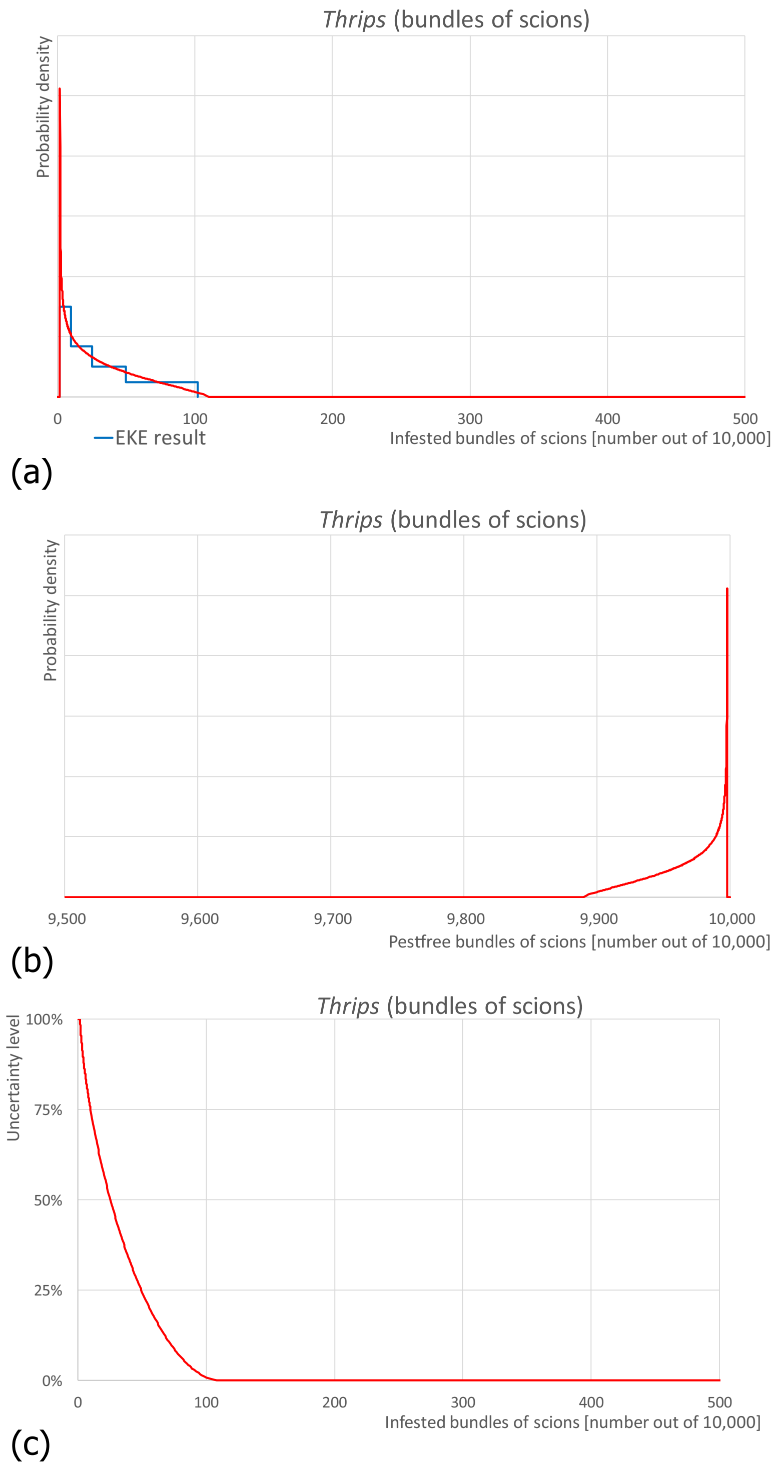


Figure A.16: (a) Elicited uncertainty of pest infestation per 10,000 bundles of scions for thrips (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free bundles of scions per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 bundles of scions

A.9.10. References

CABI (Centre for Agriculture and Bioscience International), online. Available online: *Scirtothrips dorsalis*, *Retithrips syriacus* Available online: https://www.cabi.org/cpc/datasheet/46972, https://www.cabi.org/cpc/datasheet/49065. [Accessed: 16 July 2020].

Derksen AI, 2009. Host susceptibility and population dynamics of *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) on select ornamental hosts in southern Florida (Doctoral dissertation, University of Florida).

EFSA PLH Panel (EFSA Panel on Plant Health), 2014. Scientific Opinion on the pest categorisation of *Scirtothrips dorsalis*. EFSA Journal 2014;12(12):3915, 29 pp. https://doi.org/10.2903/j.efsa.2014.3915

Elimem M, Navarro-Campos C and Chermiti B, 2011. First record of black vine thrips, *Retithrips syriacus* Mayet, in Tunisia. EPPO Bulletin, 41, 174–177.

EPPO (European and Mediterranean Plant Protection Organization), onlinea. EPPO A2 List of pests recommended for regulation as quarantine pests, version 2019-09. Available online: https://www.eppo.int/ACTIVITIES/plant_quarantine/A2_list [Accessed: 09 March 2020].

EPPO (European and Mediterranean Plant Protection Organization), onlineb. *Scirtothrips dorsalis* (SCITDO), Categorization. Available online: https://gd.eppo.int/taxon/SCITDO/categorization [Accessed: 9 March 2020].

EPPO (European and Mediterranean Plant Protection Organization), online_c. *Scirtothrips dorsalis* (SCITDO), Distribution. Available online: https://gd.eppo.int/taxon/SCITDO/distribution [Accessed: 9 March 2020].

Hodges G, Edwards GB and Dixon W, 2005. Chilli thrips *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) A new pest thrips for Florida. Florida Department of Agriculture and Consumer Service, Department of Primary Industries. Available on: http://www.doacs.state.fl.us/pi/enpp/ento/chillithrips

Kumar V, Kakkar G, McKenzie CL, Seal DR and Osborne LS, 2013. An overview of chilli thrips, *Scirtothrips dorsalis* (Thysanoptera: Thripidae) biology, distribution and management. Weed and pest control-Conventional and new challenges, 53–77. https://doi.org/10.5772/55045

Kumar V, Seal DR and Kakkar G, 2014. Chilli thrips *Scirtothrips dorsalis* Hood (Insecta: Thysanoptera: Thripidae). University of Florida IFAS Extension publication EENY463. Gainesville, Florida: University of Florida. https://doi.org/10.1007/springerreference_85820

MacLeod A and Collins D, 2006. CSL pest risk analysis for *Scirtothrips dorsalis*. CSL (Central Science Laboratory), 8 pp.

Plant Pests of the Middle East, online, *Retithrips syriacus*. Available online: http://www.agri.huji.ac.il/mepests/pest/Scirtothrips_dorsalis/ [Accessed: 10 July 2020].

Seal DR and Klassen W, 2012. Chilli thrips (castor thrips, Assam thrips, yellow tea thrips, strawberry thrips), *Scirtothrips dorsalis* Hood, provisional management guidelines. University of Florida, Gainesville, FL, 3 pp.

Tatara A, 1994. Effect of temperature and host plant on the development, fertility and longevity of Scirtothrips dorsalis Hood (Thysanoptera: Thripidae). Applied Entomology and Zoology, 29, 31–37. https://doi.org/10.1303/aez.29.31

Vierbergen B and van der Gaag DJ, 2009. Pest Risk Assessment *Scirtothrips dorsalis*. Plant Protection Service, the Netherlands. pp. 9. Available online: https://pra.eppo.int/getfile/ddcf51cf-df6d-40f9-9d28-46f447652ed7

A.10. *Penthimiola bella*

A.10.1. Organism information

Taxonomic information	*Penthimiola bella* Hemiptera (1HEMIO) Suborder Auchenorrhyncha (1AUCHR) Family Cicadellidae (1CICDF) Genus Penthimiola (1PETHG) Species Penthimiola bella (PETHBE) (Zahniser, 2007, online) **Penthimiola bella (Stål, 1855)** *Penthimia bella* Stål, 1855a:98 *Neodartus bella* Evans, 1954a:111 *Penthimiola fasciolata* Lindberg, 1958a:208 *Neodartus bellus* Metcalf, 1962b:206 *Penthimiola bella uranos* Linnavuori, 1977a:39 (n.subsp. of bella) *Penthimiola fascicolata* (Missp.)

Group	Insects	
EPPO code	PETHBE	
Regulated status	Not regulated. A1 list in Chile in 2019 (EPPO, online)	
Pest status in Israel	Present. Native to the Afrotropical region, where it is widespread (Liberia, Ivory Coast, Upper Volta, Nigeria, Cameroon, Central African Republic, Sudan, Zaire, Uganda and South Africa), *P. bella* is also known from the Cape Verde islands and Madagascar, having expanded its presence to Argentina in the Neotropics, and to Israel and Lebanon in the Palaearctic region (Lindberg 1958; Linnavuori 1977; Medler 1980; Abdul Nour, pers. commun; Raccah & Bar-Joseph 1975). Detected in 2019 on avocado in Morocco. The impact of the pest on avocado and other important crops, such as citrus, remains to be further studied in Morocco (EPPO b, online).	
Pest status in the EU	Present, Portugal.	
Host status on *Persea americana*	Avocado is one of the main hosts. Not likely to be present on budwood, might be found in pot plants (see Israeli dossier, section D.2).	
PRA information	No info	
Other relevant information for the assessment		
Biology	*Penthimiola bella* is a plant sap feeder belonging to the Deltocephalinae, a highly diverse and economically important subfamily of leafhoppers. *P. bella* is a polyphagous species that can be found in mountain and rain forests and in various trees and bushes in savannahs, as well as in agricultural ecosystems. *P. bella* has been found infesting sweet orange, grape fruit and avocado in South Africa (Annecke1964; Begemann & Schoeman 2000; Dupont & Dennill1996) and, quite recently, also avocado in the Lebanon (Abdul Nour, pers. commun.). In South Africa, this leafhopper has become an economically important pest of citrus since the use of the organophosphorus insecticides triazophos and isofenphos for the control of thrips was restricted (Bedford et al. 1998). Adult females may mate within 24 h after emergence and then pass through a 7–15-day period of pre-oviposition. They can lay more than 30 eggs, each inserted in a superficial envelope formed by the tissue of either leaves or fruits. Under temperatures of 20–27°C, development time of the eggs and five nymphal stages was 9–20 days and 35–63 days, respectively; and adult longevity was up to 59 days (Bedford et al. 1998). There are five nymphal instars. The first instar is distinctively coloured, easily differentiated from other instars by having the head, thorax and two basal segments of the abdomen largely black, with the remaining parts of the body creamy white. Adults exhibit a yellowish or brownish grey colour, mottled with brown spots. Face is dark-brown, but greyish on upper margin. Crown is irrorated with an approximately V-shaped dark brown area in the middle and a few fulvous spots on the sides. Pronotum shows a pair of dark-brown spots behind eyes, disk with brown stripes and irrorated. Elytrae are yellow-grey, densely irrorated with dark brown. Ventral surface of head, thorax and basal segments of legs is dark brown. The eggs of *P. bella* are parasitised by seven Chalcidoidea species (Annecke, 1965) resulting in 50% parasitism (Annecke, 1964).	
Symptoms	**Main type of symptoms**	Damage is due to *P. bella* nymphs and adults when feeding and ovipositing (Bedfordet al.1998) Prolonged feeding on leaves may produce a mottled chlorosis on the leaf surface, while heavy infestations in orchards carrying green fruits may result in chlorotic spots, protrusions and dark spots on the surface of maturing fruits, rendering them unacceptable for export (Bedfordet al.1998; Dupont & Dennill1996). However, in some cases injuries become less conspicuous in mature fruits (Begemann & Schoeman2000). In controlled experiments, Du Toit et al. (1993) observed that when avocado was exposed to *P. bella*, approximately 40% of the fruits developed typical lesions, including dark spots with white excreta, watermarks, as well as protrusions. Similar lesions were also observed on the leaves and twigs. *P. bella* is probably one of the causative agents of protrusions, especially on 'Hass' avocado fruits from old trees (Du Tait et al., 1993; Bruwer, 1996), rendering them unacceptable for export.

		In a study in South Africa it was found that the incidence of protrusions of Hass avocados (10%) was 5 times greater than on Fuerte (2%) avocados.
	Presence of asymptomatic plants	No data available
	Confusion with other pests	*P. bella* is easily differentiated from other green-coloured citrus leafhoppers present in the Mediterranean basin such as *Empoasca* spp. and *Asymmetrasca decedens* (Paoli), and also from its congenus *Penthimiola variabilis*, which is predominantly black (Garcia-Marí 2012; Linnavuori 1977).
Host plant range	Mainly on *Citrus* spp. and *Persea americana*.	
Pathways (EPPO GD)	Fruits and plants for planting. *Penthimiola bella* was first detected in the Mediterranean basin in Israel, in 1974 (Raccah & Bar-Joseph 1975), and more recently in Lebanon (Abdul Nour, pers. commun.), and it is not known from other Mediterranean countries. Therefore, and considering that *P. bella* oviposits mainly on fruits (Bedford et al. 1998), and leafhopper eggs can survive transport even over long distances and time (Mifsud et al. 2010), fruits are probably the main pathway of introduction. Nonetheless, the importation of plants for planting of suitable hosts from outside of the EU may be also a pathway for introduction (Suffert et al., 2018).	

A.10.2. Possibility of pest presence in the nursery

Penthimiola bella is present in Israel since the 70s. It is mainly reported associated to Citrus, but avocado is also an important host (Ministry of Agriculture of Israel, online). The species therefore can be present in avocado nurseries, especially if there is fruit production in the area.

A.10.2.1. Possibility of entry from the surrounding environment

In Israel avocado nurseries are surrounded by *Citrus* cultivation areas, so the presence of the pest is likely. Although the species prefers fruits of citrus and avocado for feeding and oviposition, it can also attack leaves, so therefore the presence in areas of avocado production surrounded by Citrus or other citric may result on the spread to avocado sites.

The occurrence of reproducing populations of *P. bella* in Portugal and its dispersion in a relatively large area of at least 70 km length within Algarve, between Silves and Tavira municipalities, suggests that this species became established and has been expanding its distribution in the region for several years since its arrival. Although it is considered a highly mobile species (Dupont & Dennill 1996), there is no information on the rate of spread of *P. bella*. Estimates for other Hemiptera indicate rates of spread from 8 to 15 km per year for the hemlock woolly adelgid, *Adelges tsugae* Annand (Adelgidae) and the beech scale, *Cryptococcus fagisuga* Lindinger (Eriococcidae), respectively (Liebhold & Tobin 2008). Leafhoppers can migrate but usually they are short-distance flyers. Nevertheless, some species are able to migrate over long distances (Mifsud et al. 2010). For example, *Balclutha pauxilla* Lindberg has invaded Ascension Island in the Atlantic, probably arriving from Africa, more than 2,000 km away from that island (Ghauri 1983).

A.10.2.2. Possibility of entry with new plants/seeds

The female can oviposit on leaves, so infested leaves can be a source of infestation.

A.10.2.3. Possibility of spread within the nursery (or production places in case of fruits/vegetables/wood)

A.10.3. Information from interceptions

Considering imports of *P. americana* plants from Israel to the EU, between 1995 and 2020, there are no records of interceptions of *P. bella* (Europhyt/TRACES, online, Accessed: 26 October 2020).

A.10.4. Evaluation of the risk mitigation options

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties for grafted plants
5	Storage conditions The plants are transferred from the storage rooms directly to a reefer container which maintains 2–4°C.	Yes	Uncertainties: These temperatures could only slow down the life cycle without killing the pests.
10	Pesticide treatment Insecticide applications.	Yes	The a.i. listed (Acetamiprid, Imidacloprid and summer oil) could be effective in controlling *P. bella*. Uncertainties: These pesticides are applied only in case of infestation.
5	Surveillance and monitoring In nurseries that export trees, PPIS inspection is carried out every 45 days. • Further to the PPIS inspection, the producers carry out regular comprehensive self-inspections, once a week. This inspection is performed by the nurseries agronomists and according to the PPIS inspector's instructions. The results are recorded in the nursery logbook and every adverse finding is reported immediately to the inspector. The logbook is regularly reviewed during the inspector visits to the site. • Whenever a harmful organism of interest is found at any production site, the grower is required to inform PPIS and to treat the site as appropriate. During consecutive inspections, if there is no further evidence to the presence of the pest, the PPIS considers the site of production to be free from this harmful organism. • Further diagnostic procedures may be performed according to requirements of the importing country and in the case of inspection findings that necessitate identification of a causative agent. • Regular monitoring of the production sites by the grower – at least twice a week.	Yes	Surveillance and monitoring of pest presence allow timely insecticide applications which could be effective against pests.

A.10.5. Overall likelihood of pest freedom

A.10.5.1. Reasoning for a scenario which would lead to a reasonably low number of infested consignments

Species mainly associated to Citrus and not occurring in avocado in Israel. Pest has at most one generation per year. Females mainly oviposit eggs on fruits. There are natural occurring enemies of the leafhoppers. Symptoms of the presence of the pest are clear and detectable during visual inspections. Pesticides are used with the right frequency and applied properly and also affect eggs. Eggs do not survive storage and transport.

A.10.5.2. Reasoning for a scenario which would lead to a reasonably high number of infested consignments

Species is both prevalent in avocado and citrus producing areas. Pest has up to three generations per year. Females oviposit mainly on leaves. There are no or few natural enemies of the pest. The pest remains unnoticed during inspections. Pesticides are not used with the right frequency and applied properly and do not affect eggs survival. Eggs survive packaging and transport.

A.10.5.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infested consignments (Median)

Citrus is very important and around avocado production areas. Easy species to detect based on symptoms. Pest species prefers fruits rather than leaves on plants. Based on the biology of the species, the preference for fruits (or leaves if fruits are not available), the pests is only likely to be occurring in grafted plants and not in scions. There is little information available so similar chances to have infestation levels below or above the estimated median.

A.10.5.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

Pest pressure and distribution in the field unknown. Effectiveness of treatments and detection threshold during inspections unknown. Dispersal range unknown. Number of generations per year and total duration of the life cycle unknown.

A.10.5.5. Elicitation outcomes of the assessment of the pest freedom for *P. bella*

The following tables show the elicited and fitted values for pest infestation/infection (Table A.33) and pest freedom (Table A.34).

Table A.33: Elicited and fitted values of the uncertainty distribution of pest infestation by *P. bella* per 10,000 grafted plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	3.00					40.0		70.0		110					150
EKE	3.35	5.81	9.68	17.1	26.6	38.1	49.6	72.7	96.3	109	121	132	141	146	149

The EKE results are *BetaGeneral (1.0865, 1.1786, 1.5, 152) fitted* with @Risk version 7.6.

Based on the numbers of estimated infested grafted plants the pest freedom was calculated (i.e. = 10,000 – the number of infested grafted plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.34.

Table A.34: The uncertainty distribution of plants free of *P. bella* per 10,000 grafted plants calculated by Table A.33

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,850					9,890		9,930		9,960					9,997
EKE results	9,851	9,854	9,859	9,868	9,879	9,891	9,904	9,927	9,950	9,962	9,973	9,983	9,990.3	9,994.2	9,996.6

The EKE results are the fitted values.

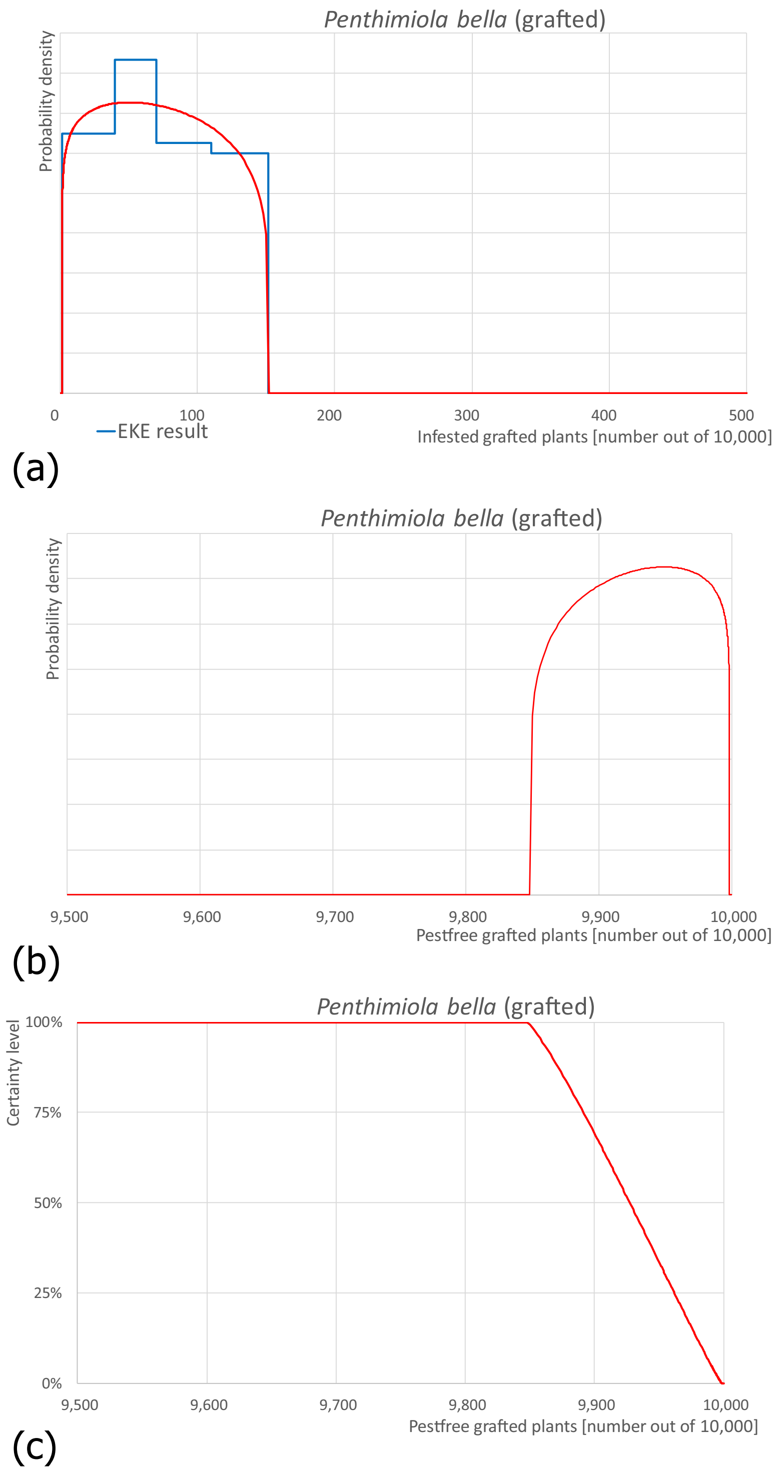


Figure A.17: (a) Elicited uncertainty of pest infestation per 10,000 grafted plants for *P. bella* (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free grafted plants per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 grafted plants

A.10.6. References

Annecke DP, 1964. Injury to citrus by leafhoppers in the Western Transvaal. Southern African Citrus Journal, 370, 9–13.

Annecke DP, 1965. A new species of Centrodora Foerster (Hymenoptera: Aphelinidae) parasitic in the eggs of a cicadellid injurious to citrus in South Africa. South African Journal of Agricultural Science, 8, 1133–1138.

Bedford ECG, Van Den Berg MA and De Villiers EA, 1998. Citrus pests in the Republic of South Africa. Nelspruit, South Africa: Institute for Tropical and Subtropical Crops, Dynamic AD.

Begemann GJ and Schoeman AS, 2000. The citrus leafhopper, *Penthimiola bella* Stål (Homoptera: Cicadellidae) in central Northern Province orchards. Deciduous Fruit Grower, 50, 1–6.

Dupont FMA and Dennill GB, 1996. An ecological study of the damage done to avocado fruits by citrus leafhopper *Penthimiola bella* (Cicadellidae) and coconut bug *Pseudotheraptus wayi* (Coreidae) in South Africa. International Journal of Pest Management, 42, 107–112.

Du Toit WJ, Steyn WP and De Beer MS, 1993. Occurrence of protusions on avocado fruit and the causative agent. South African Avocado Growers' Association Yearbook, 16, 100–102.

EPPO (European and Mediterranean Plant Protection Organization), onlinea. *Penthimiola bella* (PETHBE), EPPO Reporting Service no. 02 - 2019 Num. article: 2019/033. Available online: https://gd.eppo.int/reporting/article-6463 [Accessed: 10 October 2020].

EPPO (European and Mediterranean Plant Protection Organization), onlineb. *Penthimiola bella* (PETHBE),. Available online: https://gd.eppo.int/taxon/PETHBE [Accessed: 10 October 2020].

Garcia-Marí F, 2012. Citrus pests: integrated pest management in Mediterranean countries. Valencia, Spain: Phytoma España (in Spanish).

Ghauri MSK, 1983. A case of long-distance dispersal of a leafhopper. pp. 249–255. In Knight WJ, Pant NC, Robertson TS and Wilson MR (eds.). Proceedings of the 1st International Workshop on Leafhoppers and Planthoppers of Economic Importance. London, UK: CIE.

Liebhold AM and Tobin PC, 2008. Population ecology of insect invasions and their management. Annual Review of Entomology, 53, 387–408.

Lindberg H, 1958. Hemiptera Insularum Caboverdensium. Commentationes Biologicae, 19.

Linnavuori R, 1977. Revision of the Ethiopian Cicadellidae (Hemiptera – Homoptera): Penthimiinae. Études du Continent Africain, fasc. 4. Bruxelles, Belgium: Fondation pour Favoroser les Recherches Scientifiques en Afrique.

Medler JT, 1980. Insects of Nigeria. Checklist and bibliography. Memoirs of the American Entomological Institute No. 30.

Mifsud D, Cocquempot C, Mühlethaler R, Wilson R and Streito JC, 2010. Other Hemiptera Sternorrhyncha (Aleyrodidae, Phylloxeroidea, and Psylloidea) and Hemiptera Auchenorrhyncha. Chapter 9.4. In Roques A, Kenis M, Lees D, Lopez-Vaamonde C, Rabitsch W, Rasplus JY et al. (eds.). Alien terrestrial arthropods of Europe. BioRisk, 4, 511– 552. https://doi.org/10.3897/biorisk.4.63

Ministry of Agriculture & Rural Development of Israel, Database of the pests and diseases. Penthimia bella, Available online: https://www.moag.gov.il/en/Pages/nega.aspx?negaid=11415 [Accessed: 15 October 2020].

Raccah B and Bar-Joseph M, 1975. The leafhopper Penthimia bella Stäl, a new pest in citrus groves in Israel. Hassadeh, 55, 937–939. in Hebrew.

Suffert M, Wilstermann A, Petter F, Schrader G and Grousset F, 2018. Identification of new pests likely to be introduced into Europe with the fruit trade. EPPO Bulletin, 48, 144–154.

Zahniser JN, 2007-present. An online interactive key and searchable database of Deltocephalinae (Hemiptera: Cicadellidae). Available online: http://zahniser.speciesfile.org/ [Accessed: 10 October 2020].

A.11. *Oligonychus perseae*

A.11.1. Organism information

Taxonomic information	Current valid scientific name: *Oligonychus perseae* Tuttle, Baker and Abbatiello Synonyms: N/A Name used in the EU legislation: N/A Order: Acari Family: Tetranychidae Common name: persea mite Name used in the Dossier: *Oligonychus perseae*
Group	Insects and mites
EPPO code	OLIGPA
Regulated status	A1 list: Chile (2019)

<table>
<tr><td>Pest status in Israel</td><td colspan="2">Present, widespread (EPPO, CABI CPC, Online).</td></tr>
<tr><td>Pest status in the EU</td><td colspan="2">Present, restricted distribution: Italy, Portugal, Spain (present in all avocado-growing regions).
Present, no details: Portugal (Madeira), Spain (Canary Islands) (EPPO, CABI CPC, Online).</td></tr>
<tr><td>Host status on P. americana</td><td colspan="2">P. americana is reported as a major host plant for O. perseae.</td></tr>
<tr><td>PRA information</td><td colspan="2">No pest risk assessments/pest categorisations are available.</td></tr>
<tr><td colspan="3">Other relevant information for the assessment</td></tr>
<tr><td>Biology</td><td colspan="2">All life-stages are mainly found in nests where feeding, mating, reproduction, and development occur. Sex ratio is generally two females to one male. The life cycle duration varies in function of temperature and ranges from 34.89 days (at 15°C) to 9.81 days (at 30°C) (Aponte and McMurtry 1997a), while no significant influence of the cultivar on the development has been recorded (Kerguelen and Hoddle 2000). Populations tend to exponentially grow at the beginning of summer followed by a rapid decline at the end of summer (Kerguelen and Hoddle 1999; Hoddle et al. 1999, 2000; Montserrat et al. 2013). Each female lays about 2–4 dozen eggs during her life. Female longevity and fecundity are significantly influenced by the intrinsic quality of the leaves, considering that the chemical composition of sap and leaves of avocados varies both with time of year and cultivar (Kerguelen and Hoddle 2000; Zappalà et al. 2015).
Control measures (removal of weeds and of fallen leaves, use of predators (Neoseiulus californicus, Galendromus annectens, G. helveolus), applications of acaricides) are available but may not be very easy to apply in practice. In Israel, official control measures are being implemented to prevent any further spread of O. perseae.</td></tr>
<tr><td rowspan="3">Symptoms</td><td>Main type of symptoms</td><td>The mites feed beneath protective web nests along midribs and veins on the undersides of leaves. Feeding damage produces characteristic circular necrotic spots (of about 1–5 mm^2). High populations (> 500 mites per leaf) can cause partial or total tree defoliation, and as a consequence increase the risk of sunburn to young fruit and exposed tree trunks. Premature fruit drop may occur. In California, O. perseae is considered as a serious pest of economic importance. More data is needed on the biology of the pest. (EPPO datasheet). Partial or severe defoliation can be caused by high mite densities, especially on the cultivars Hass and Gwen that are the most susceptible ones (Kerguelen and Hoddle 2000). Significant impact on leaf damage and on average yield (20% decreases in yield at the infestation rate of 250 mites/leaf) was recorded in Israel (Maoz et al. 2011).</td></tr>
<tr><td>Presence of asymptomatic plants</td><td>No data available</td></tr>
<tr><td>Confusion with other pests</td><td>The closely related avocado brown mite, Oligonychus punicae (Hirst), feeds on upper leaf surfaces and its feeding damage results in bronzing of upper leaf surfaces. Six-spotted mite, Eotetranychus sexmaculatus (Riley), is very similar in appearance to Persea Mite and it also feeds on undersides of leaves. However, it does not produce circular feeding colonies covered with dense webbing and necrotic spotting is purplish and irregular in appearance (Zappalà et al. 2015).</td></tr>
<tr><td>Host plant range</td><td colspan="2">Apart from Persea americana (avocado), O. perseae can also feed on a wide range of fruit species (e.g. Ceratonia siliqua (carob), Diospyros virginiana (persimmon), Prunus, and Vitis), ornamentals (e.g. Acacia, Bambusa, Bixa orellana (annatto), Rhus, Rosa, Salix) and weeds (e.g. Asclepias fascicularis, Chenopodium album, Sonchus spp.) (EPPO, minidatasheet).</td></tr>
</table>

Pathways	The mites can move over short distances. Over long distances, movements of infested avocado plants, and other hosts can ensure dissemination. The risk associated with movements of fruits appears very low (EPPO datasheet). The major means of inter plant dispersal of *O. perseae* is by spinning down from the foliage on a silk strand of webbing and wafting through the air in the wind. The intra-plant dispersal of *O. perseae* also occurs by crawling to various portions of the plants, particularly to the new leaves. The mite can also be dispersed on the equipment and clothing of farm workers. Kennedy and Smitley (1985) found that spider mites can be spread both between and within orchards on farm machinery (Aponte and Mac Murtry 1997b).
Surveillance information	• All plants for planting exported from Israel originate from nurseries that are approved by PPIS and are under PPIS inspection. • In nurseries that export trees, PPIS inspection is carried out every 45 days. • Further to the PPIS inspection, the producers carry out regular comprehensive self-inspections, once a week. This inspection is performed by the nurseries agronomists and according to the PPIS inspector's instructions. The results are recorded in the nursery logbook and every adverse finding is reported immediately to the inspector. The logbook is regularly reviewed during the inspector visits to the site. • Whenever a harmful organism of interest is found at any production site, the grower is required to inform PPIS and to treat the site as appropriate. During consecutive inspections, if there is no further evidence to the presence of the pest, the PPIS considers the site of production to be free from this harmful organism**.** • Further diagnostic procedures may be performed according to requirements of the importing country and in the case of inspection findings that necessitate identification of a causative agent.

A.11.2. Possibility of pest presence in the nursery

A.11.2.1. Possibility of entry from the surrounding environment

Besides avocado, *O. perseae* can infest several weeds (e.g. *Asclepias fascicularis*, *Chenopodium album, Sonchus* spp.), wild, ornamental (e.g. *Acacia, Bambusa, Bixa orellana* (annatto), *Rhus, Rosa, Salix*) and fruit plants (e.g. *Ceratonia siliqua* (carob), *Diospyros virginiana* (persimmon), *Prunus,* and *Vitis*). The mites can move over short distances. Over long distances, movements of infested avocado plants, and other hosts can ensure dissemination. The major means of inter plant dispersal of *O. perseae* is by spinning down from the foliage on a silk strand of webbing and wafting through the air in the wind. The intra-plant dispersal of *O. perseae* also occurs by crawling to various portions of the plants, particularly to the new leaves. The mite can also be dispersed on the equipment and clothing of farm workers. Kennedy and Smitley (1985) found that spider mites can be spread both between and within orchards on farm machinery (Aponte and Mac Murtry 1997b).

Uncertainties: N/A

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for the pest to enter the nursery.

A.11.2.2. Possibility of entry with new plants/seeds

Movements of infested avocado plants, and other hosts can ensure dissemination.

Uncertainties: N/A

Taking into consideration the above evidence and uncertainties, the Panel considers it possible that the pest could enter the nursery with new plants/seeds or soil growing media, due to its capacity to be transported on plants.

A.11.2.3. Possibility of spread within the nursery

O. perseae can move from one plant to the other by spinning down from the foliage on a silk strand of webbing and wafting through the air in the wind. The intra-plant dispersal of *O. perseae* also occurs by crawling to various portions of the plants, particularly to the new leaves. The mite can also be dispersed on the equipment and clothing of farm workers. Kennedy and Smitley (1985) found that spider mites can be spread both between and within orchards on farm machinery (Aponte and Mac Murtry 1997b).

Uncertainties: N/A

Taking into consideration the above evidence and uncertainties, the Panel considers that the transfer of the pest within the nursery is possible both by natural spread and by human-assisted movements.

A.11.3. Information from interceptions

Considering imports of *P. americana* plants from Israel to the EU, between 1995 and 2020, there are no records of interceptions of *O. perseae* (EUROPHYT/TRACES, online, Accessed: 10 October 2020).

A.11.4. Evaluation of the risk mitigation options

In the table below, all risk mitigation measures currently applied in Israel (Table 6) are listed and an indication of their effectiveness on *O. perseae* is provided.

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties for scions	Evaluation and uncertainties for grafted plants
12	Storage conditions The plants are transferred from the storage rooms directly to a reefer container which maintains 2–4°C.	Yes	Uncertainties: These temperatures could only slow down the life cycle without killing the pests.	Idem
10	Acaricide treatments	Yes	The a.i. listed (Mineral oil, Summer oil, Spirotetramat, Abamectin, Spirodiclofen, Chlorpyrifos, Acetamiprid) could be effective in controlling this mite. Uncertainties: These pesticides are applied only in case of infestation.	Idem
5	Surveillance & Monitoring In nurseries that export trees, PPIS inspection is carried out every 45 days • Further to the PPIS inspection, the producers carry out regular comprehensive self-inspections, once a week. This inspection is performed by the nurseries agronomists and according to the PPIS inspector's instructions. The results are recorded in the nursery logbook and every adverse finding is reported immediately to the inspector. The logbook is regularly reviewed during the inspector visits to the site. • Whenever a harmful organism of interest is found at any production site, the grower is required to inform PPIS and to treat the site as appropriate. During consecutive inspections, if there is no further	Yes	Surveillance and monitoring of pest presence allow timely pesticide applications which could be effective in controlling its populations.	Idem

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties for scions	Evaluation and uncertainties for grafted plants
	evidence to the presence of the pest, the PPIS considers the site of production to be free from this harmful organism. • Further diagnostic procedures may be performed according to requirements of the importing country and in the case of inspection findings that necessitate identification of a causative agent. • Regular monitoring of the production sites by the grower – at least twice a week.			

A.11.5. Overall likelihood of pest freedom

A.11.5.1. Reasoning for a scenario which would lead to a reasonably low number of infested consignments

Surveillance takes place in the surroundings of cultivation areas. Visual inspections are effective to detect the pest. There are *P. americana* trees and orchards in the surrounding. Infestation shows clear symptoms in infested plants. Cultivation density is not dense and the spread of the pest is difficult. Continuous and synchronic generations throughout the cultivation period help detection and control. Mother plants are sufficiently and efficiently screened and render pest-free material. Management practices prevent the introduction and spread of the pest. Acaricides applied during production are effective against these pests Natural biological control agents keep pests controlled. Plants are cultivated in protected areas. Young plants are protected and less exposed to natural dispersal by wind or other agents. Mineral oils and other pesticides come in contact with the pests and are somewhat effective against the mites. Young plants show limited canopy development where pesticides are more effective and abiotic factors limiting population growth have a stronger effect. Storage temperature slows the cycle of the pest, affects its vitality and prevents movement during shipping. Pest does not survive on the scions after defoliation. Fungicide and pre-shipping treatments on the scions may have some detrimental effects on the pest. Inspections detect the pest on grafted material easily.

A.11.5.2. Reasoning for a scenario which would lead to a reasonably high number of infested consignments

Surveillance does not take place or is not effective in the surroundings of cultivation areas. Visual inspections fail to detect the pest. Cultivation density is very dense so facilitates the spread of the pest. Life-cycle of the pest falls in periods difficult to be detected during inspections. Infestations are possible due to infested mother material that is poorly screened. Screening of rooted plants before shipping is not effective. Management practices do not prevent the introduction and spread of the pest. Acaricides are not effective or not applied properly. Biological control agents because of insecticide application are not effective or not present. Older plants are mainly used so are cultivated in open areas that are more easily infested. Plants are not protected and therefore exposed to the natural dispersal of the pest from the surrounding. Mineral oils and other pesticides treatments are not effective against these insects. Adult plants with more developed canopy and leaves are more difficult to be treated with contact pesticides and abiotic factors limiting population growth have a reduced effect. Temperature does not stop the cycle of the pest, nor affect vitality or movement. Pest survive on the scions even if defoliated. Fungicide and pre shipping-treatments on scions before shipping have no effect on the pest.

A.11.5.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infested consignments (Median)

Pest is widespread in avocado production areas. Small size but easily detectable because of the symptoms on infested leaves. Potentially present in scions even if defoliated. Individuals at high densities could hide in leaf buds and potentially at very high densities even in stems. There are natural occurring biological control agents in the region (Mediterranean regions). Pest species easily controllable. Pest if present more likely to be found on grafted plants than in scions. if infestation occurs in grafted plants probably above the estimated median. If infestation occurs in scions, expected values will be near or below the estimated median given the fact that scions are defoliated and only leaf buds are potential sites for the pest to survive.

A.11.5.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

No information on pest pressure in Israel and effectiveness of acaricide or other pesticides on the pest.

A.11.5.5. Elicitation outcomes of the assessment of the pest freedom for *O. perseae*

The following tables show the elicited and fitted values for pest infestation/infection (Tables A.35 and A.37) and pest freedom (Tables A.36 and A.38).

Table A.35: Elicited and fitted values of the uncertainty distribution of pest infestation by *O. perseae* per 10,000 grafted plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	10.0					55.0		80.0		120					200
EKE	9.73	15.5	22.2	31.9	42.2	53.0	63.1	82.8	105	118	134	152	173	193	216

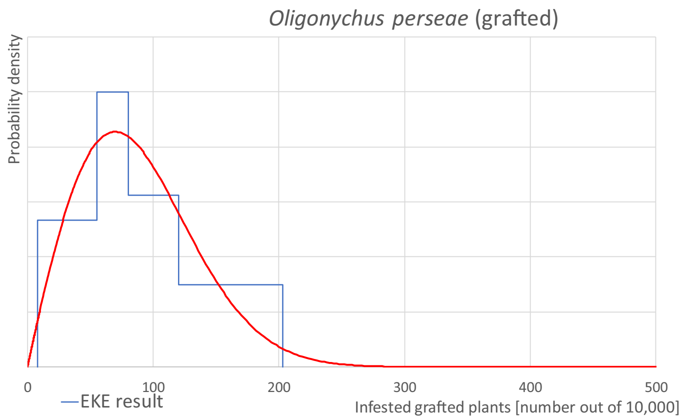
The EKE results are *Weibull (1.9773, 99.612) fitted* with @Risk version 7.6.

Based on the numbers of estimated infested grafted plants the pest freedom was calculated (i.e. = 10,000 – the number of infested grafted plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.36.

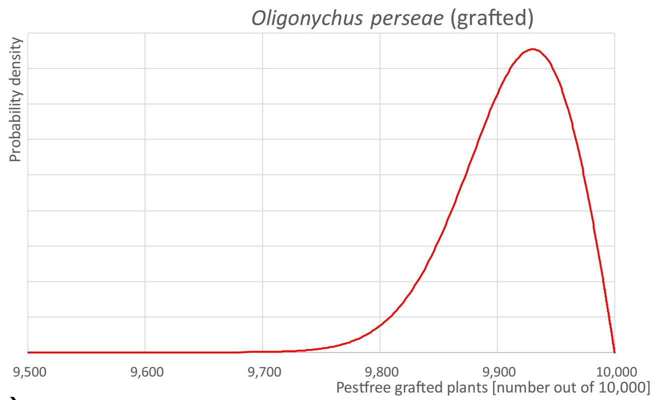
Table A.36: The uncertainty distribution of plants free of *O. perseae* per 10,000 grafted plants calculated by Table A.35

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,800					9,880		9,920		9,945					9,990
EKE results	9,784	9,807	9,827	9,848	9,866	9,882	9,895	9,917	9,937	9,947	9,958	9,968	9,978	9,984	9,990.3

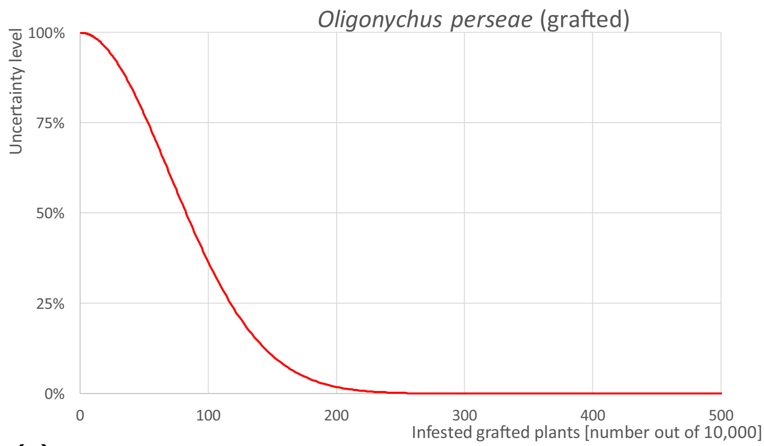
The EKE results are the fitted values.



(a)



(b)



(c)

Figure A.18: (a) Elicited uncertainty of pest infestation per 10,000 grafted plants for *O. perseae* (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free grafted plants per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 grafted plants

Table A.37: Elicited and fitted values of the uncertainty distribution of pest infestation by *O. perseae* per 10,000 bundles of scions

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	2.00					10.0		25.0		50.0					100
EKE	1.88	2.09	2.59	3.93	6.30	9.95	14.3	25.4	40.2	49.5	60.8	72.5	84.2	92.4	99.4

The EKE results are *BetaGeneral (0.69739, 1.7797, 1.8, 110) fitted* with @Risk version 7.6.

Based on the numbers of estimated infested bundles of scions the pest freedom was calculated (i.e. = 10,000 – the number of infested bundles of scions per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.38.

Table A.38: The uncertainty distribution of plants free of *O. perseae* per 10,000 bundles of scions calculated by Table A.37

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,900					9,950		9,975		9,990					9,998
EKE results	9,901	9,908	9,916	9,928	9,939	9,951	9,960	9,975	9,986	9,990.1	9,993.7	9,996.1	9,997.4	9,997.9	9,998.1

The EKE results are the fitted values.

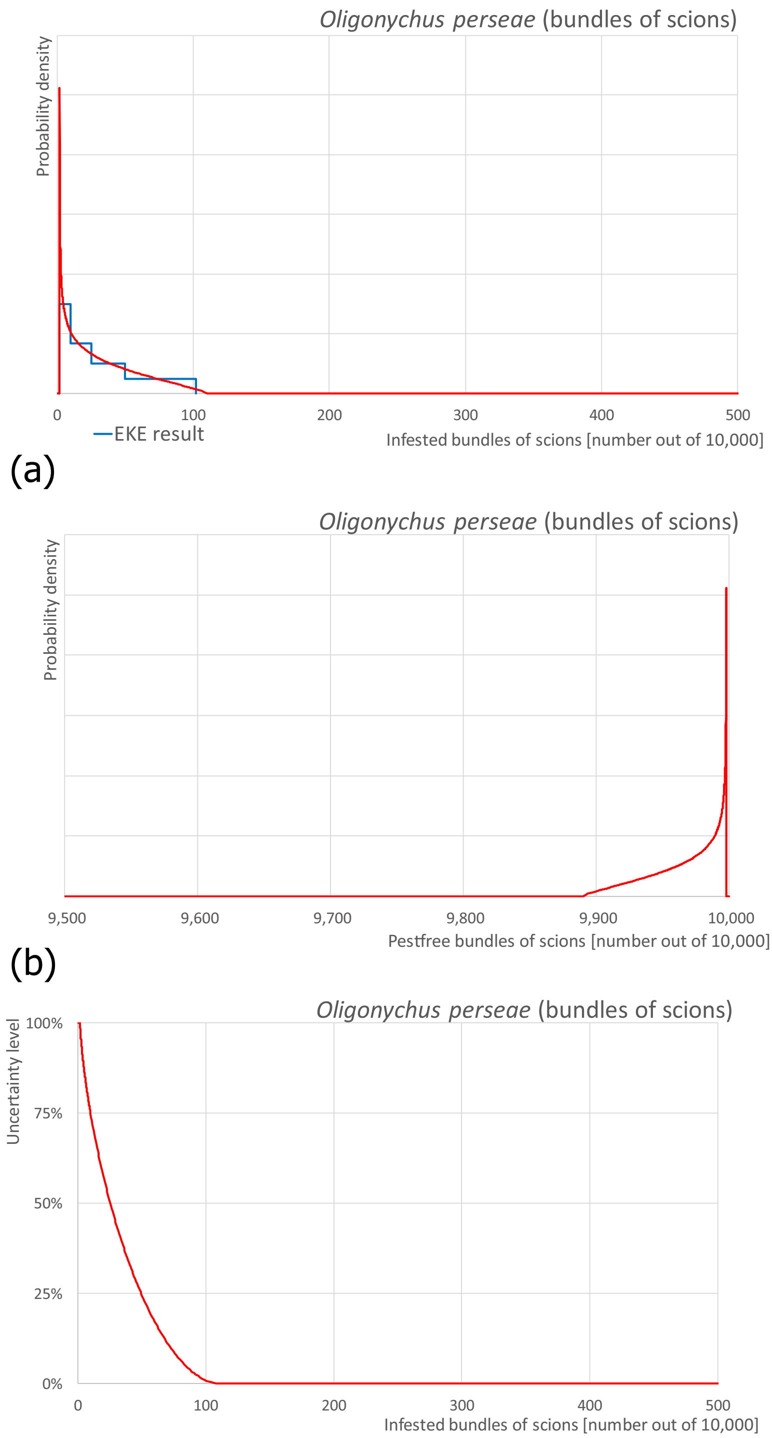


Figure A.19: (a) Elicited uncertainty of pest infestation per 10,000 bundles of scions for *O. perseae* (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free bundles of scions per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 bundles of scions

A.11.6. Reference list

Aponte O and McMurtry JA, 1997. Damage on'Hass' avocado leaves, webbing and nesting behaviour of Oligonychus perseae (Acari: Tetranychidae). Experimental & Applied Acarology, 21, 265–272.

CABI (Centre for Agriculture and Bioscience International), online. Oligonychus perseae. Available online: https://www.cabi.org/cpc/datasheet/37284 [Accessed: 20 October 2020].

EPPO (European and Mediterranean Plant Protection Organization), online._Oligonychus perseae (OLIGPA), Datasheet. Available online: https://gd.eppo.int/taxon/OLIGPA [Accessed: 20 October 2020].

Hoddle MS, Aponte O, Kerguelen V and Heraty J, 1999. Biological control of Oligonychus perseae (Acari: Tetranychidae) on avocado: I. Evaluating release timings, recovery and efficacy of six commercially available phytoseiids. International Journal of Acarology, 25, 211–219.

Hoddle MS, Robinson L, and Virzi J, 2000. Biological control of Oligonychus perseae (Acari: Tetranychidae) on avocado: III. Evaluating the efficacy of varying release rates and release frequency of Neoseiulus californicus (Acari: Phytoseiidae). International Journal of Acarology, 26, 203–214.

Kerguelen V and Hoddle MS, 1999. Biological control of Oligonychus perseae (Acari: Tetranychidae) on avocado: II. Evaluating the efficacy of Galendromus helveolus and Neoseiulus californicus (Acari: Phytoseiidae). International Journal of Acarology, 25, 221–229.

Kerguelen V and Hoddle MS, 2000. Comparison of the susceptibility of several cultivars of avocado to the persea mite, Oligonychus perseae (Acari: Tetranychidae). Scientia Horticulturae, 84, 101–114.

Maoz Y, Gal S, Argov Y, Coll M and Palevsky E, 2011. Biocontrol of persea mite, Oligonychus perseae, with an exotic spider mite predator and an indigenous pollen feeder. Biological Control, 59, 147–157.

Montserrat M, Guzmán C, Sahún RM, Belda JE and Hormaza JI, 2013. Pollen supply promotes, but high temperatures demote, predatory mite abundance in avocado orchards. Agriculture, ecosystems & environment, 164, 155–161.

Smitley DR and Kennedy GG, 1985. Photo-oriented aerial-dispersal behavior of Tetranychus urticae (Acari: Tetranychidae) enhances escape from the leaf surface. Annals of the Entomological Society of America, 78, 609–614.

Zappalà L, Kreiter S, Russo A, Tropea Garzia G and Auger P, 2015. First record of the persea mite Oligonychus perseae (Acari: Tetranychidae) in Italy with a review of the literature. International Journal of Acarology, 41, 97–99.

A.12. *Bemisia tabaci*

A.12.1. Organism information

Taxonomic information	Current valid scientific name: *Bemisia tabaci* (Gennadius, 1889) Synonyms: *Aleurodes inconspicua*, *Aleurodes tabaci*, *Bemisia achyranthes*, *Bemisia bahiana*, *Bemisia costa-limai*, *Bemisia emiliae*, *Bemisia goldingi*, *Bemisia gossypiperda*, *Bemisia gossypiperda mosaicivectura*, *Bemisia hibisci*, *Bemisia inconspicua*, *Bemisia longispina*, *Bemisia lonicerae*, *Bemisia manihotis*, *Bemisia minima*, *Bemisia minuscula*, *Bemisia nigeriensis*, *Bemisia rhodesiaensis*, *Bemisia signata*, *Bemisia vayssieri* Name used in the EU legislation: *Bemisia tabaci* Genn. (non-European populations) known to be vector of viruses [BEMITA] Order: Hemiptera Family: Aleyrodidae Common name: tobacco whitefly Name used in the Dossier: *Bemisia tabaci*
Group	Insects
EPPO code	BEMITA
Regulated status	The pest is listed in Annex II/A of Regulation (EU) 2019/2072 as *Bemisia tabaci* Genn. (non-European populations) known to be vector of viruses [BEMITA]. The pest is included in the EPPO Alert list 2 (EPPO, online_a). It is a quarantine pest in Belarus, Norway and New Zealand (EPPO, online_b).
Pest status in Israel	Widespread (EPPO global database), Biotypes B and Q are present in Israel, now species considered as MEAM1 and MED (EFSA, 2013).
Pest status in the EU	Twenty-six morphocryptic species belonging to the *Bemisia tabaci* complex, are not known to occur in the Union territory (EFSA PLH Panel, 2013; Regulation (EU) 2019/2072).
Host status on *Persea americana*	*Persea americana* is reported as a field-verified host plant for *B. tabaci* (Bayhan et al. 2006; EFSA, 2013). In Israel it is reported as a minor pest of avocado, mainly during major outbreaks (Mendel, pers. comm.; Swirskyi et al. 2002). EPPO does not mention *P. americana* as host. CABI mentions that some Lauraceae are host of the species. Israel in the dossiers considers it as a potential pest of *P. americana.*

<table>
<tr><td>PRA information</td><td colspan="2">Scientific Opinion on the risks to plant health posed by Bemisia tabaci species complex and viruses it transmits for the EU territory (EFSA PLH Panel, 2013).</td></tr>
<tr><td colspan="3">Other relevant information for the assessment
B. tabaci is a complex of at least 28 indistinguishable morphocryptic species. Twenty-six of them, endemic in countries around the world, are so far not reported in the EU (EFSA PLH Panel, 2013). The terms ‘European populations’ and ‘non-European populations’ of B. tabaci used in the Regulation (EU) 2019/2072 do not refer to specific populations or taxonomic entities but stipulate a geographic origin of B. tabaci, from in- and outside the EU.
B. tabaci is a complex of at least 28 indistinguishable morphocryptic species of which four occur in the EU (EFSA, 2013).</td></tr>
<tr><td>Biology</td><td colspan="2">Females during oviposition insert eggs with pedicel directly into a leaf tissue (Paulson and Beardsley, 1985). B. tabaci has a high reproductive potential and each female can lay an average of 80 to more than 300 eggs during her lifetime. The number of eggs laid depends on temperature and the host plant, but generally under favourable conditions (e.g. tomato production in greenhouses) even the introduction of only a very few founding insects will lead to a massive upsurge in insect densities (Arnó et al., 2009). Under these conditions, up to 15 generations per year can develop (EFSA, 2013). It has four instars. The first instar with legs called crawler finds a permanent spot on a leaf and stays there for the rest of its nymphal development (Walker et al., 2009). It is very polyphagous.
The pest is phloem-feeder and can be found mainly on leaves (Cohen et al., 1996).</td></tr>
<tr><td rowspan="3">Symptoms</td><td>Main type of symptoms</td><td>Wide range of symptoms can occur on plants due to direct feeding of the pest, contamination of honeydew and sooty moulds, transmitted viruses and phytotoxic responses.
Plants exhibit one or more of these symptoms: chlorotic spotting, vein yellowing, intervein yellowing, leaf yellowing, yellow blotching of leaves, yellow mosaic of leaves, leaf curling, leaf crumpling, leaf vein thickening, leaf enations, leaf cupping, stem twisting, plant stunting, wilting, leaf loss and silvering of leaves (CABI, online; EPPO, 2004).</td></tr>
<tr><td>Presence of asymptomatic plants</td><td>No asymptomatic period is known to occur in the infested plants. Symptoms for the presence of the insect are visible.
However, it has to be noted that Bemisia tabaci is a vector for several viruses, which infection might be asymptomatic.</td></tr>
<tr><td>Confusion with other pathogens/pests</td><td>B. tabaci can be easily confused with other species such as glasshouse whitefly Trialeurodes vaporariorum, B. afer, T. lauri, T. packardi, T. ricini and T. variabilis. A microscopic slide is needed for morphological identification (EPPO, 2004). Moreover, B. tabaci is a complex of at least 28 indistinguishable morphocryptic species of which four occur in the EU.
According to De Barro et al. (2011) different groups of B. tabaci have been established relying on host association, spread capacity, transmission of begomoviruses and resistance to insecticides. The species within the B. tabaci complex can be defined by comparisons against consensus sequences and delimited by 3.5% mtCO1 (mitochondrial cytochrome oxidase 1) sequence pairwise genetic distance divergence (De Barro et al., 2011).</td></tr>
<tr><td>Host plant range</td><td colspan="2">B. tabaci is a polyphagous pest with a wide host range, including more than 1000 different plant species (Abd-Rabou and Simmons, 2010). Some species of Lauraceae and P. americanum are considered as minor hosts.</td></tr>
<tr><td>Pathways</td><td colspan="2">Plants for planting including cuttings and rooted ornamental plants; cut flowers and branches with foliage; fruits and vegetables; human-assisted spread; natural spread such as wind (EFSA PLH Panel, 2013).</td></tr>
<tr><td>Surveillance information</td><td colspan="2">No surveillance information for this pest is currently available from New Zealand. There is no information assessing whether the pest has ever been found in the nurseries or surrounding environment of the nurseries, nevertheless preventive insecticide applications are performed due to possible presence of whitefly (Dossier Section 5.0).</td></tr>
</table>

A.12.2. Possibility of pest presence in the nursery

A.12.2.1. Possibility of entry from the surrounding environment

Flying adults of *Bemisia tabaci* can come from other host plants that might be present in the surrounding environment. *Bemisia tabaci* is a widespread species in Israel and reported occurring in many horticultural crops.

Uncertainties:

It is not certain to what extent there are other host plants present in the surrounding environment apart from *P. americana.*

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for the pest to enter the nursery.

A.12.2.2. Possibility of entry with new plants/seeds

Bemisia tabaci can spread through infested plants for planting and less likely through fruits (EPPO, 2006).

Stocks used for grafted plants in 750 cc pot or 1 L bag are cultivated from seed in a greenhouse (from a PPIS-approved source) and grown in a sterilised substrate made by coconut fibre, peat and polystyrene whereas scions are harvested from approved mother plants in PPIS-supervised orchards (dossier, Section 3.2).

Uncertainties:

Not possible to completely exclude that juveniles or adults of these species can enter into the nursery by movement of mother plant material where juveniles and/or adults can be hidden in a protected site on stems or leaves.

Taking into consideration the above evidence and uncertainties, the Panel considers it possible that the pest could enter the nursery with new plants.

A.12.2.3. Possibility of spread within the nursery

No other means of spread have been reported, other than flying adults, concerning possible means of spread within the nursery.

Uncertainties:

Taking into consideration the above evidence and uncertainties, the Panel considers that the transfer of the pest within the nursery is possible.

A.12.3. Information from interceptions

Considering imports of *P. americana* plants from Israel to the EU, between 1995 and 2020, there are no records of interceptions of *B. tabaci* complex (EUROPHYT/TRACES, online, [Accessed: 20 October 2020]).

A.12.4. Evaluation of the risk mitigation options

In the table below, all risk mitigation measures currently applied in Israel (Table 7) are listed and an indication of their effectiveness on *B. tabaci* complex is provided.

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties for grafted plants
12	Storage conditions The plants are transferred from the storage rooms directly to a reefer container which maintains 2–4°C.	Yes	Uncertainties: These temperatures could only slow down the life cycle without killing the pests.
10	Insecticide applications	Yes	The a.i. listed (Tau-fluvalinate, Imidacloprid, Mineral oil, Spirotetramat, Spirodiclofen,

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties for grafted plants
			Chlorpyrifos, Acetamiprid) could be effective in controlling *B. tabaci* complex. Uncertainties: These pesticides are applied only in case of infestation.
5	Surveillance & Monitoring In nurseries that export trees, PPIS inspection is carried out every 45 days • Further to the PPIS inspection, the producers carry out regular comprehensive self-inspections, once a week. This inspection is performed by the nurseries agronomists and according to the PPIS inspector's instructions. The results are recorded in the nursery logbook and every adverse finding is reported immediately to the inspector. The logbook is regularly reviewed during the inspector visits to the site. • Whenever a harmful organism of interest is found at any production site, the grower is required to inform PPIS and to treat the site as appropriate. During consecutive inspections, if there is no further evidence to the presence of the pest, the PPIS considers the site of production to be free from this harmful organism. • Further diagnostic procedures may be performed according to requirements of the importing country and in the case of inspection findings that necessitate identification of a causative agent. • Regular monitoring of the production sites by the grower – at least twice a week.	Yes	Surveillance and monitoring of pest presence allow timely insecticide applications which could be effective against pests.

A.12.5. Overall likelihood of pest freedom

A.12.5.1. Reasoning for a scenario which would lead to a reasonably low number of infested consignments

Surveillance takes place in the surroundings of cultivation areas. Visual inspections are effective to detect the pest. Avocado is not a host or an incidental one. Pest attacks mainly horticultural crops and does not prefer avocado plants. Cultivation density is not dense and hampers the spread of the pest. Continuous and synchronic generations throughout the cultivation period that can be detected. Mother plants are sufficiently and efficiently screened and render pest-free material. Management practices prevent the introduction and spread of the pest. Natural biological control agents keep pests under control. Plants cultivated in protected areas which are not easily reachable by pests. Young plants are protected and little exposed to pests from the surrounding. Mineral oils come in contact with the pests and are somewhat effective against scale insects. Young plants present limited canopy where pesticides are more effective after application and abiotic factors limiting population growth have a stronger effect. Use of insecticide appropriate and timely prevents the occurrence of the pest. Storage temperature slows the cycle of the pest, affect its vitality and prevents movement during shipping. Pest does not survive on the scions after defoliation. Fungicide and pre-shipping treatments on the scions may have some detrimental effects on the pest.

A.12.5.2. Reasoning for a scenario which would lead to a reasonably high number of infested consignments

Surveillance does not take place or is not effective in the surroundings of cultivation areas. Avocado is often a host. Whitefly densities in horticultural crops is very high and therefore there is a spill-over effect on minor hosts as avocado plants. Cultivation density is very dense so facilitates the spread of the pest. Life-cycle of the pest falls in periods difficult to be detected during inspections. Infestations are possible due to infested mother material that is poorly screened during inspections. Management practices do not prevent the introduction and spread of the pest. Insecticides are not effective or not applied properly for the management of the pest. Biological control agents are not effective or not present. Plants cultivated in open areas that are easily infested. Plants are not protected and therefore exposed to the natural dispersal of the pest from the surrounding. Mineral oil treatments are not effective against these insects. Adult plants with more developed canopy and leaves are more difficult to be treated with contact pesticides and where abiotic factors limiting population growth have a reduced effect (temperature, humidity, radiation). Storage temperature does not stop the cycle of the pest, vitality or movement. Screening of rooted plants before shipping is not effective in detection pests.

A.12.5.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infested consignments (Median)

This is mainly a leaf-bound species. Avocado is not a preferred host but is a widespread species in the Mediterranean and occurs in many horticultural producing sites and therefore potentially present in area of avocado production. If there is an infestation, they are easy to spot. it is unlikely to be found in defoliated scions, therefore scions were not considered to be pathway. Based on the described scenarios, if infestation occurs in grafted plants, expected values will be near or below the estimated median as avocado is very minor host.

A.12.5.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

Degree of preference for avocado plants is uncertain.

A.12.6. Elicitation outcomes of the assessment of the pest freedom for *B. tabaci* complex

The following tables show the elicited and fitted values for pest infestation/infection (Table A.39) and pest freedom (Table A.40).

Table A.39: Elicited and fitted values of the uncertainty distribution of pest infestation by *B. tabaci* complex per 10,000 grafted plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	3.00					25.0		50.0		75.0					150
EKE	2.77	5.16	8.30	13.5	19.5	26.5	33.4	47.9	65.3	76.3	90.7	107.4	128.2	147.5	171

The EKE results are *Weibull (1.4861, 61.273) fitted* with @Risk version 7.6.

Based on the numbers of estimated infested grafted plants the pest freedom was calculated (i.e. = 10,000 – the number of infested grafted plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.40.

Table A.40: The uncertainty distribution of plants free of *B. tabaci* complex per 10,000 grafted plants calculated by Table A.39

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,850					9,925		9,950		9,975					9,997
EKE results	9,829	9,853	9,872	9,893	9,909	9,924	9,935	9,952	9,967	9,974	9,980	9,987	9,991.7	9,994.8	9,997.2

The EKE results are the fitted values.

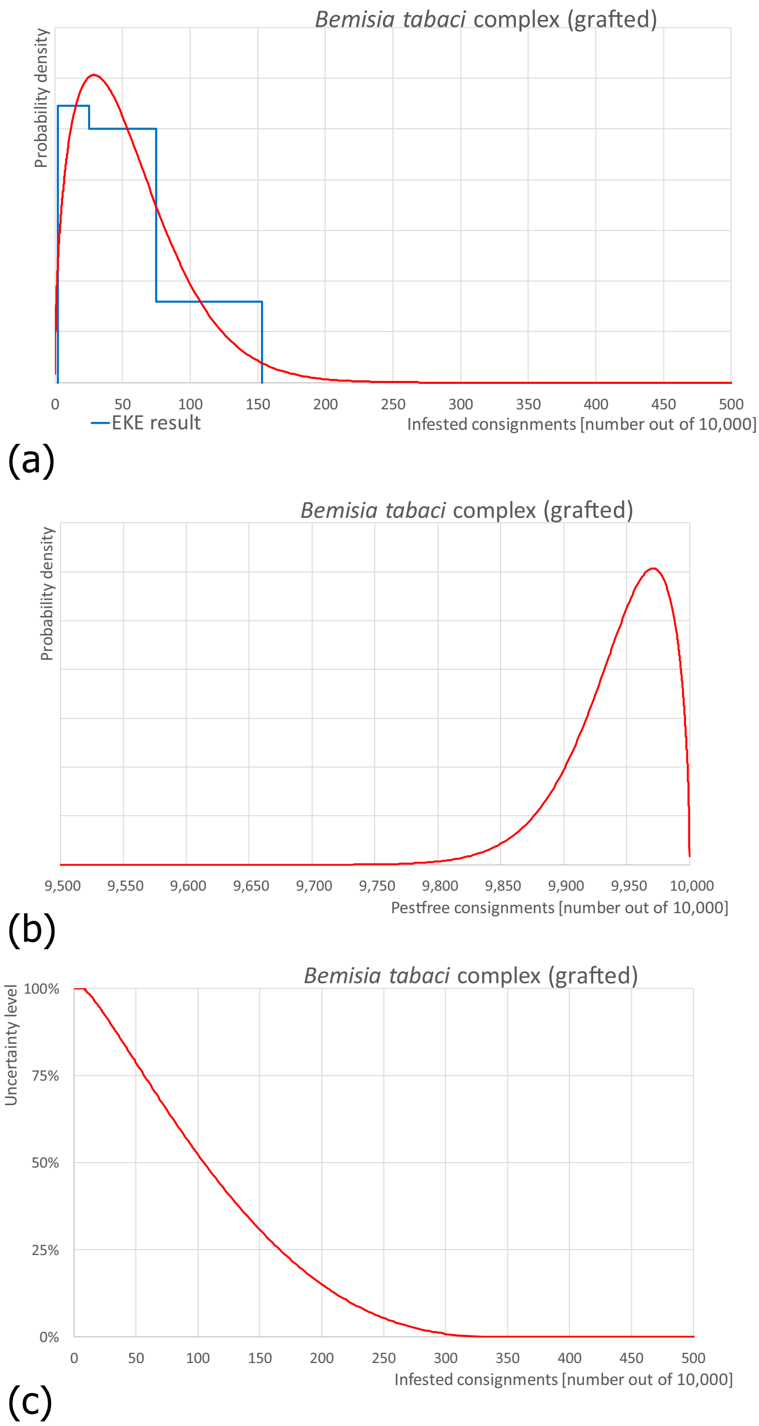


Figure A.20: (a) Elicited uncertainty of pest infestation per 10,000 grafted plants for *B. tabaci* complex (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free grafted plants per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 grafted plants

A.12.7. Reference list

Abd-Rabou S and Simmons AM, 2010. Survey of reproductive host plants of *Bemisia tabaci* (Hemiptera: Aleyrodidae) in Egypt, including new host records. Entomological news, 121, 456–465. https://doi.org/10.3157/021.121.0507

CABI (Centre for Agriculture and Bioscience International), online. Datasheet *Bemisia tabaci* (tobacco whitefly). Available online: https://www.cabi.org/cpc/datasheet/8927 [Accessed: 7 November 2019].

CABI (Centre for Agriculture and Bioscience International), online. Datasheet *Bemisia tabaci* MEAM10 (silverleaf whitefly). Available online: https://www.cabi.org/cpc/datasheet/8925 [Accessed: 7 November 2019].

Cohen S, Kern J, Harpaz I and Ben-Joseph R, 1988. Epidemiological studies of the tomato yellow leaf curl virus (TYLCV) in the Jordan Valley, Israel. Phytoparasitica, 16, 259. https://doi.org/10.1007/bf02979527

Cohen AC, Henneberry TJ and Chu CC, 1996. Geometric relationships between whitefly feeding behavior and vascular bundle arrangements. Entomologia experimentalis et applicata, 78, 135–142. https://doi.org/10.1111/j.1570-7458.1996.tb00774.x

De Barro PJ, Liu S-s, Boykin LM and Dinsdale AB, 2011. Bemisia tabaci: a Statement of Species Status. Annual Review of Entomology, 56, 1–19. https://doi.org/10.1146/annurev-ento-112408-085504

EFSA PLH Panel (EFSA Panel on Plant Health), 2013. Scientific Opinion on the risks to plant health posed by Bemisia tabaci species complex and viruses it transmits for the EU territory. EFSA Journal 2013; 11(4):3162. https://doi.org/10.2903/j.efsa.2013.3162

EPPO (European and Mediterranean Plant Protection Organization), onlinea. EPPO A2 List of pests recommended for regulation as quarantine pests, version 2019-09. Available online: https://www.eppo.int/ACTIVITIES/plant_quarantine/A2_list [Accessed: 7 November 2019].

EPPO (European and Mediterranean Plant Protection Organization), onlineb. Bemisia tabaci (BEMITA). Available online: https://gd.eppo.int/taxon/BEMITA [Accessed: 7 November 2019].

EPPO (European and Mediterranean Plant Protection Organization), onlinec. *Bemisia tabaci* (BEMITA), Distribution details in New Zealand. Available online: https://gd.eppo.int/taxon/BEMITA/distribution/NZ [Accessed: 7 November 2019].

EPPO (European and Mediterranean Plant Protection Organization), 2004. PM 7/35. *Bemisia tabaci*. OEPP/EPPO Bulletin, 34, 155–157.

EUROPHYT, online. European Union Notification System for Plant Health Interceptions - EUROPHYT Available online: http://ec.europa.eu/food/plant/plant_health_biosecurity/europhyt/index_en.htm [Accessed: 4 October 2019].

Li SJ, Xue X, Ahmed MZ, Ren SX, Du YZ, Wu JH, Cuthbertson AGS and Qiu BL, 2011. Host plants and natural enemies of *Bemisia tabaci* (Hemiptera: Aleyrodidae) in China. Insect Science, 18, 101–120. https://doi.org/10.1111/j.1744-7917.2010.01395.x

Oliveira MRV, Henneberry TE and Anderson P, 2001. History, current status, and collaborative research projects for *Bemisia tabaci*. Crop protection, 20, 709–723. https://doi.org/10.1016/s0261-2194(01)00108-9

Paulson GS and Beardsley JW, 1985. Whitefly (Hemiptera: Aleyrodidae) egg pedicel insertion into host plant stomata. Annals of the Entomological Society of America, 78, 506–508. https://doi.org/10.1093/aesa/78.4.506

Price JF and Taborsky D, 1992. Movement of immature *Bemisia tabaci* (Homoptera: Aleyrodidae) on poinsettia leaves. The Florida Entomologist, 75, 151–153. https://doi.org/10.2307/3495495

Scott IA, Workman PJ, Drayton GM and Burnip GM, 2007. First record of *Bemisia tabaci* biotype Q in New Zealand. New Zealand Plant Protection, 60, 264–270. https://doi.org/10.30843/nzpp.2007.60.4601

Summers CG, Newton Jr AS and Estrada D, 1996. Intraplant and interplant movement of *Bemisia argentifolii* (Homoptera: Aleyrodidae) crawlers. Environmental entomology, 25, 1360–1364. https://doi.org/10.1093/ee/25.6.1360

Yassin MA and Bendixen LE, 1982. Weed hosts of the cotton whitefly (*Bemisia tabaci* (Genn.)) Homoptera Aleyrodidae. Research Bulletin 1144. The Ohio State University – Ohio Agricultural Research and Development Center. Available online: https://kb.osu.edu/bitstream/handle/1811/62967/1/OARDC_research_bulletin_n1144.pdf

Walker GP, Perring TM and Freeman TP, 2009. Life history, functional anatomy, feeding and mating behavior. In Stansly PA, Naranjo SE (eds.). *Bemisia*: Bionomics and management of a global pest. Springer, Dordrecht, Netherlands. pp. 109–160. https://doi.org/10.1007/978-90-481-2460-2_4

Appendix B – Web of Science All Databases Search String

In the table below the search string used in Web of Science is reported. In total, 803 papers were retrieved. Titles and abstracts were screened, and 456 pests were added to the list of pests (see Appendix D).

Web of Science All databases	**TOPIC:** "Persea" OR "Persea americana" OR "P. americana" OR "P. drymifolia" OR "P. gratissima" OR "P. persea" OR "avocado pear" **AND** **TOPIC:** pathogen* OR "pathogenic bacteria" OR fung* OR oomycet* OR myce* OR bacteri* OR virus* OR viroid* OR insect$ OR mite$ OR phytoplasm* OR arthropod* OR nematod* OR disease$ OR infecti* OR damag* OR symptom* OR pest$ OR vector OR hostplant$ OR "host plant$" OR host OR "root lesion$" OR decline$ OR infestation$ OR damage$ OR symptom$ OR dieback* OR die back* OR malaise OR aphid$ OR curculio OR thrip$ OR cicad$ OR miner$ OR borer$ OR weevil$ OR "plant bug$" OR spittlebug$ OR moth$ OR mealybug$ OR cutworm$ OR pillbug$ OR "root feeder$" OR caterpillar$ OR "foliar feeder$" OR virosis OR viroses OR blight$ OR wilt$ OR wilted OR canker OR scab$ OR rot$ OR "rotten" OR "damping off" OR "damping-off" OR blister$ OR smut OR mould OR "mold" OR "damping syndrome$" OR mildew OR scald$ OR "root knot" OR "root-knot" OR rootknot OR cyst$ OR dagger OR "plant parasitic" OR "parasitic plant" OR "plant$parasitic" OR "root feeding" OR "root$feeding" OR "ambrosia beetle$" OR gall$ OR "bark beetle$" **NOT** **TOPIC:** "fertil* OR Mulching OR Nutrient* OR Pruning OR drought OR "human virus" OR "animal disease*" OR "plant extracts" OR "immunological" OR "purified fraction" OR "traditional medicine" OR medic* OR mammal* OR bird* OR "human disease*" OR *toxicity OR "weed control" OR "salt stress" OR salinity OR photosynthesis OR "human health" OR medicine OR "bioactive compound$" OR "health benefit$" OR "water supply" OR water OR frost OR "dietary stress" OR camel OR "microRNA" OR "Periplaneta americana" OR carotenoid$ OR Pollinat* OR chromatography OR financial OR "controlled atmosphere" OR "sensory quality" OR "fruit juice$" OR "Phymata americana" OR "Prunus americana" OR "Pilularia americana" OR refrigeration OR packaging OR "enzymatic browning" OR pesticide OR "pesticide residue" OR "cold storage" OR storage OR "vacuum fumigation" OR allerg* OR "immunodiffusion" OR dair* OR "rat*" OR consum* OR kinetic* OR firm* OR diet* OR electric* OR antibrown* OR "fish" OR hurricane OR oil* OR bruis* OR antioxid* OR urban* OR pectin* OR biodiesel$ OR storm* OR "cryopreservation" OR industry* OR "PAP-I gene" OR biochem* OR "anaerobisis" OR "PaKRP" OR "glucosylation" OR lipid* OR market* OR "trade policy" OR "auto-octoploidy" OR "heavy metals" OR "glucosylating" OR "burial depth" OR landscap* OR tradition* **NOT** **TOPIC: "**Oligonychus perseae" OR "Brevipalpus yothersi" OR "Tetranychus mexicanus" OR "Oligonychus peruvianus" OR "Polyphagotarsonemus latus" OR "Oligonychus mangiferus" OR "Oligonychus punicae" OR "Tuckerella pavoniformis" OR "Oligonychus vitis" OR "Tetranychus gloveri" OR "Tetranychus neocaledonicus" OR "Tetranychus urticae" OR "Oligonychus yothersi" OR "Marasmiellus scandens" OR "Armillaria mellea" OR "Armillaria novae-zelandiae" OR "Armillariella tabescens" OR "Clitocybe tabescens" OR "Coprinus sp." OR "Marasmiellus scandens" OR "Pestalotiopsis clavispora" OR "Pestalotiopsis versicolor" OR "Monochaetia sp." OR "Pestalotia sp." OR "Pestalotia versicolor" OR "Pestalotiopsis clavispora" OR "Pestalotiopsis disseminata" OR "Pestalotiopsis guepinii" OR "Pestalotiopsis phoenicis" OR "Pestalotiopsis sp." OR "Pestalotiopsis theae" OR "Pestalotiopsis versicolor" OR "Ageratina adenophora" OR "Tridax procumbens" OR "Pellicularia rolfsii" OR "Sclerotium rolfsii" OR "Bacillus licheniformis" OR "Bacillus subtilis" OR "Lasiodiplodia theobromae" OR "Dothiorella aromatica" OR "Lasiodiplodia theobromae" OR "Botryosphaeria parva" OR "Neofusicoccum australe" OR "Sphaeropsis tumefaciens" OR "Botryodiplodia theobromae" OR "Botryosphaeria dothidea" OR "Botryosphaeria parva" OR "Botryosphaeria quercuum" OR "Botryosphaeria rhodina" OR "Botryosphaeria ribis" OR "Diplodia mutila" OR "Diplodia natalensis" OR "Diplodia seriata" OR "Diplodia sp." OR

	"Diplodia theobromae" OR "Dothiorella gregaria" OR "Dothiorella sp." OR "Fusicoccum aesculi" OR "Fusicoccum luteum" OR "Guignardia mangiferae" OR "Lasiodiplodia sp." OR "Macrophomina phaseoli" OR "Neofusicoccum luteum" OR "Neofusicoccum mangiferae" OR "Neofusicoccum parvum" OR "Neofusicoccum sp." OR "Phyllosticta sp." OR "Physalospora obtusa" OR "Physalospora rhodina" OR "Pseudocercospora purpurea" OR "Mycosphaerella tassiana" OR "Capnodium citri" OR "Capnodium sp." OR "Cercospora purpurea" OR "Cercospora sp." OR "Cladosporium cladosporioides" OR "Cladosporium herbarum" OR "Cladosporium sp." OR "Mycosphaerella sp." OR "Ovularia sp." OR "Pseudocercospora purpurea" OR "Septoria sp." OR "Oncobasidium theobromae" OR "Rhizoctonia solani" OR "Rhizoctonia sp." OR "Thanatephorus cucumeris" OR "Rhynchophorus palmarum" OR "Conotrachelus aguacatae" OR "Conotrachelus perseae" OR "Heilipus lauri" OR "Xylosandrus morigerus" OR "Diaprepes abbreviatus" OR "Euwallacea fornicatus" OR "Megaplatypus mutatus" OR "Xylosandrus compactus" OR "Naupactus xanthographus" OR "Xyleborus glabratus" OR "Xyleborus neivai" OR "Xyleborus perforans" OR "Araecerus fasciculatus" OR "Conotrachelus aguacatae" OR "Conotrachelus perseae" OR "Copturus aguacatae" OR "Hypomeces squamosus" OR "Lagocheirus araneiformis" OR "Naupactus xanthographus" OR "Xyleborus glabratus" OR "Xyleborus immaturus" OR "Adoretus versutus" OR "Batocera rufomaculata" OR "Caulophilus oryzae" OR "Diaprepes abbreviatus" OR "Diaprepes spengleri" OR "Euwallacea fornicatus" OR "Pantomorus cervinus" OR "Rhynchophorus palmarum" OR "Sinoxylon conigerum" OR "Xyleborinus saxesenii" OR "Xyleborus perforans" OR "Xyleborus volvulus" OR "Xylosandrus compactus" OR "Xylosandrus crassiusculus" OR "Xylosandrus morigerus" OR "Monolepta australis" OR "Protaetia fusca" OR "Xyleborus ferrugineus" OR "Xylosandrus" OR "Pellicularia koleroga" OR "Phanerochaete salmonicolor" OR "Botryodiplodia sp." OR "Diaporthe australafricana" OR "Diaporthe rudis" OR "Diaporthe sp." OR "Diaporthe sterilis" OR "Endothia havanensis" OR "Gnomonia sp." OR "Phomopsis sp." OR "Anastrepha ludens" OR "Ceratitis cosyra" OR "Bactrocera dorsalis" OR "Bactrocera tryoni" OR "Ceratitis capitata" OR "Ceratitis rosa" OR "Anastrepha serpentina" OR "Ceratitis anonae" OR "Ceratitis fasciventris" OR "Ceratitis quilicii" OR "Prodiplosis longifila" OR "Zaprionus indianus" OR "Bactrocera aquilonis" OR "Bactrocera carambolae" OR "Bactrocera dorsalis" OR "Bactrocera kandiensis" OR "Bactrocera passiflorae" OR "Anastrepha fraterculus" OR "Anastrepha ludens" OR "Anastrepha serpentina" OR "Anastrepha striata" OR "Bactrocera cucurbitae" OR "Bactrocera facialis" OR "Bactrocera jarvisi" OR "Bactrocera tryoni" OR "Ceratitis capitata" OR "Ceratitis cosyra" OR "Ceratitis rosa" OR "Atherigona orientalis" OR "Longidorus" OR "Trichodorus" OR "Paratrichodorus porosus" OR "Xiphinema" OR "Xiphinema brasiliense" OR "Xiphinema brevicolle" OR "Xiphinema californicum" OR "Xiphinema diffusum" OR "Xiphinema diversicaudatum" OR "Paratrichodorus minor" OR "Xiphinema insigne" OR "Longidorus laevicapitatus" OR "Xiphinema vuittenezi" OR "Longidorus africanus" OR "Trichodorus porosus" OR "Xiphinema americanum" OR "Aureobasidium pullulans" OR "Aureobasidium sp." OR "Erysiphe sp." OR "Oidium sp." OR "Sphaerotheca sp." OR "Aspergillus niger" OR "Aspergillus sp." OR "Penicillium chrysogenum" OR "Penicillium expansum" OR "Penicillium italicum" OR "Penicillium janthinellum" OR "Penicillium sp." OR "Sclerotinia sclerotiorum" OR "Grovesinia pyramidalis" OR "Botrytis cinerea" OR "Botrytis sp." OR "Cristulariella pyramidalis" OR "Gloeosporium sp." OR "Marssonina sp." OR "Phymatotrichum sp." OR "Sclerotinia sclerotiorum" OR "Sclerotinia sp." OR "Aleurothrixus trachoides" OR "Amblypelta lutescens" OR "Homalodisca vitripennis" OR "Parabemisia myricae" OR "Paraleyrodes minei" OR "Pseudacysta perseae" OR "Tetraleurodes perseae" OR "Aleurocanthus woglumi" OR "Helopeltis antonii" OR "Maconellicoccus hirsutus" OR "Parasaissetia nigra" OR "Pseudacysta perseae" OR "Aleurodicus dispersus" OR "Aleurodicus dugesii" OR "Ceroplastes ceriferus" OR "Ceroplastes destructor" OR "Ceroplastes stellifer" OR "Penthimiola bella" OR "Aleurodicus dispersus" OR "Amblypelta lutescens" OR "Amblypelta nitida" OR "Chrysomphalus dictyospermi" OR "Dysmicoccus brevipes" OR "Hemiberlesia lataniae" OR "Icerya seychellarum" OR "Maconellicoccus hirsutus" OR "Melanaspis obscura" OR "Milviscutulus mangiferae" OR "Nipaecoccus nipae" OR "Nipaecoccus viridis" OR "Paracoccus marginatus" OR "Paraleyrodes goyabae" OR "Parasaissetia nigra" OR "Parthenolecanium persicae" OR "Planococcoides njalensis" OR "Protopulvinaria pyriformis" OR "Pseudaonidia trilobitiformis" OR "Pseudococcus longispinus" OR "Saissetia coffeae" OR "Saissetia oleae" OR "Selenaspidus articulatus" OR "Trialeurodes vaporariorum" OR "Aleurocanthus woglumi" OR "Aleurodicus cocois" OR "Aleurodicus

	pulvinatus" OR "Aonidiella aurantii" OR "Aonidiella orientalis" OR "Aphis gossypii" OR "Aphis spiraecola" OR "Aspidiotus destructor" OR "Aulacaspis tubercularis" OR "Cerataphis lataniae" OR "Ceroplastes ceriferus" OR "Ceroplastes destructor" OR "Ceroplastes rubens" OR "Ceroplastes rusci" OR "Coccus hesperidum" OR "Ferrisia virgata" OR "Helopeltis antonii" OR "Icerya aegyptiaca" OR "Leptoglossus zonatus" OR "Myzus persicae" OR "Nezara viridula" OR "Parabemisia myricae" OR "Pinnaspis strachani" OR "Planococcus citri" OR "Pseudococcus jackbeardsleyi" OR "Pseudotheraptus devastans" OR "Pseudotheraptus wayi" OR "Pulvinaria psidii" OR "Sophonia orientalis" OR "Dysmicoccus grassii" OR "Oxycarenus hyalinipennis" OR "Puto barberi" OR "Aphis craccivora" OR "Aphis fabae" OR "Sinomegoura citricola" OR "Coccus hesperidum" OR "Coccus longulus" OR "Eucalymnatus tessellatus" OR "Protopulvinaria pyriformis" OR "Aspidiotus hederae" OR "Chrysomphalus dictyospermi" OR "Fiorinia fioriniae" OR "Hemiberlesia lataniae" OR "Hemiberlesia palmae" OR "Mycetaspis personata" OR "Abgrallaspis cyanophylli" OR "Parlatoria proteus" OR "Pinnaspis buxi" OR "Selenaspidus articulatus" OR "Icerya seychellarum" OR "Acutaspis albopicta" OR "Acutaspis perseae" OR "Aonidiella aurantii" OR "Aonidiella citrina" OR "Aspidiotus destructor" OR "Aspidiotus nerii" OR "Aulacaspis tubercularis" OR "Bambusaspis bambusae" OR "Ceroplastes floridensis" OR "Ceroplastes pseudoceriferus" OR "Ceroplastes rubens" OR "Ceroplastes rusci" OR "Ceroplastes sinensis" OR "Chrysomphalus aonidum" OR "Chrysomphalus pinnulifer" OR "Clavaspis perseae" OR "Coccus formicarii" OR "Coccus viridis" OR "Crypticerya montserratensis" OR "Davidsonaspis aguacatae" OR "Diaspis boisduvalii" OR "Drosicha contrahens" OR "Dysmicoccus brevipes" OR "Dysmicoccus nesophilus" OR "Ferrisia malvastra" OR "Ferrisia virgata" OR "Hemiberlesia cyanophylli" OR "Hemiberlesia latastei" OR "Hemiberlesia musae" OR "Hemiberlesia rapax" OR "Howardia biclavis" OR "Ischnaspis longirostris" OR "Kilifia acuminata" OR "Lindingaspis rossi" OR "Lopholeucaspis cockerelli" OR "Milviscutulus spiculatus" OR "Neopinnaspis harperi" OR "Nipaecoccus nipae" OR "Nipaecoccus viridis" OR "Oceanaspidiotus spinosus" OR "Paracoccus marginatus" OR "Paratachardina pseudolobata" OR "Parthenolecanium persicae" OR "Phalacrococcus howertoni" OR "Pinnaspis strachani" OR "Planococcus citri" OR "Planococcus ficus" OR "Planococcus lilacinus" OR "Planococcus lindingeri" OR "Planococcus minor" OR "Protopulvinaria longivalvata" OR "Pseudaonidia trilobitiformis" OR "Pseudaulacaspis cockerelli" OR "Pseudischnaspis bowreyi" OR "Pseudococcus cryptus" OR "Pseudococcus jackbeardsleyi" OR "Pseudococcus landoi" OR "Pseudococcus longispinus" OR "Pseudococcus viburni" OR "Pseudoparlatoria parlatorioides" OR "Pulvinaria mammeae" OR "Rastrococcus invadens" OR "Saissetia coffeae" OR "Saissetia miranda" OR "Saissetia neglecta" OR "Udinia catori" OR "Unaspis citri" OR "Phellinus noxius" OR "Acromyrmex octospinosus" OR "Atta" OR "Atta cephalotes" OR "Solenopsis geminata" OR "Neocomospora euwallaceae" OR "Albonectria rigidiuscula" OR "Calonectria ilicicola" OR "Gibberella avenacea" OR "Nectria pseudotrichia" OR "Neonectria macrodidyma" OR "Neonectria radicicola" OR "Paecilomyces lilacinus" OR "Trichoderma harzianum" OR "Trichothecium roseum" OR "Fusarium oxysporum" OR "Acremonium sp." OR "Calonectria ilicicola" OR "Cephalosporium lecanii" OR "Cylindrocladiella parva" OR "Cylindrocladium scoparium" OR "Cylindrocladium sp." OR "Fusarium avenaceum" OR "Fusarium crookwellense" OR "Fusarium equiseti" OR "Fusarium graminearum" OR "Fusarium kuroshium" OR "Fusarium lateritium" OR "Fusarium moniliforme" OR "Fusarium oxysporum" OR "Fusarium pallidoroseum" OR "Fusarium sambucinum" OR "Fusarium semitectum" OR "Fusarium solani" OR "Fusarium sp." OR "Gibberella pulicaris" OR "Gibberella sp." OR "Ilyonectria sp." OR "Nectria haematococca" OR "Nectria rigidiuscula" OR "Nectria rugulosa" OR "Nectria sp." OR "Sphaerostilbe repens" OR "Stilbella sp." OR "Trichoderma harzianum" OR "Trichoderma koningii" OR "Trichoderma lignorum" OR "Trichothecium roseum" OR "Trichothecium sp." OR "Cassytha filiformis" OR "Stenoma catenifer" OR "Thaumatotibia leucotreta" OR "Platynota stultana" OR "Cryptoblabes gnidiella" OR "Zeuzera coffeae" OR "Attacus atlas" OR "Cricula trifenestrata" OR "Cryptoblabes gnidiella" OR "Epiphyas postvittana" OR "Spodoptera littoralis" OR "Stenoma catenifer" OR "Thaumatotibia leucotreta" OR "Zeuzera coffeae" OR "Argyrotaenia citrana" OR "Cacoecimorpha pronubana" OR "Chrysodeixis includens" OR "Peridroma saucia" OR "Platynota stultana" OR "Spodoptera eridania" OR "Amorbia cuneana" OR "Ascotis selenaria" OR "Sabulodes aegrotata" OR "Hypercompe indecisa" OR "Saurita cassandra" OR "Ascotis selenaria" OR "Sabulodes aegrotata" OR "Sabulodes caberata" OR "Acrocercops" OR "Acrocercops ordinatella" OR "Caloptilia

	perseae" OR "Pyrrhopyge chalybea" OR "Pachypasa sericeofasciata" OR "Sibine nesea" OR "Lymantria dispar" OR "Megalopyge lanata" OR "Megalopyge urens" OR "Helicoverpa zea" OR "Peridroma saucia" OR "Pseudoplusia includens" OR "Spodoptera eridania" OR "Schizura concinna" OR "Stenoma" OR "Stenoma vacans" OR "Timocratica albella" OR "Papilio rutulus" OR "Oiketicus" OR "Oiketicus kirbyi" OR "Attacus atlas" OR "Automeris io" OR "Copaxa multifenestrata" OR "Cricula trifenestrata" OR "Eacles imperialis" OR "Rothschildia orizaba" OR "Amorbia cuneanum" OR "Amorbia emigratella" OR "Archips machlopis" OR "Archips micaceana" OR "Argyrotaenia amatana" OR "Argyrotaenia citrana" OR "Cryptoptila immersana" OR "Isotenes miserana" OR "Platynota rostrana" OR "Atteva punctella" OR "Xylella fastidiosa" OR "Xylella fastidiosa" OR "Xanthomonas campestris" OR "Clasterosporium sp." OR "Ceratocystis fimbriata" OR "Ceratocystis sp." OR "Graphium kuroshium" OR "Graphium sp." OR "Thielaviopsis sp." OR "Mucor sp." OR "Rhizopus nigricans" OR "Rhizopus sp." OR "Rhizopus stolonifer" OR "Elsinoë perseae" OR "Sphaceloma perseae" OR "Elsinoe perseae" OR "Sphaceloma sp." OR "Raffaelea lauricola" OR "Raffaelea lauricola" OR "Raffaelea sp." OR "Zonocerus elegans" OR "Zonocerus variegatus" OR "Graphis sp." OR "Phytophthora cinnamomi" OR "Phytophthora cactorum" OR "Phytophthora cinnamomi" OR "Phytophthora cryptogea" OR "Phytophthora cambivora" OR "Phytophthora citricola" OR "Phytophthora heveae" OR "Phytophthora nicotianae" OR "Phytophthora megakarya" OR "Phytophthora boehmeriae" OR "Phytophthora cactorum" OR "Phytophthora cambivora" OR "Phytophthora capsici" OR "Phytophthora citricola" OR "Phytophthora citrophthora" OR "Phytophthora heveae" OR "Phytophthora megasperma" OR "Phytophthora mengei" OR "Phytophthora nicotianae" OR "Phytophthora nicotianae var. nicotianae" OR "Phytophthora palmivora" OR "Phytophthora parasitica" OR "Phytophthora sp." OR "Phymatotrichopsis omnivora" OR "Phymatotrichum omnivorum" OR "Colletotrichum acutatum" OR "Glomerella cingulata" OR "Colletotrichum acutatum" OR "Colletotrichum boninense" OR "Colletotrichum godetiae" OR "Verticillium dahliae" OR "Colletotrichum fructicola" OR "Colletotrichum aenigma" OR "Colletotrichum alienum" OR "Colletotrichum dematium" OR "Colletotrichum fioriniae" OR "Colletotrichum gigasporum" OR "Colletotrichum gloeosporioides" OR "Colletotrichum kahawae subsp. ciggaro" OR "Colletotrichum karstii" OR "Colletotrichum queenslandicum" OR "Colletotrichum siamense" OR "Colletotrichum simmondsii" OR "Colletotrichum sp." OR "Glomerella acutata" OR "Glomerella sp." OR "Phyllachora gratissima" OR "Phyllachora sp." OR "Verticillium albo-atrum" OR "Verticillium dahliae" OR "Verticillium sp." OR "Alternaria alternata" OR "Cochliobolus setariae" OR "Pithomyces graminicola" OR "Acrothecium lunatum" OR "Alternaria alternata" OR "Alternaria citri" OR "Alternaria sp." OR "Clasterosporium maydicum" OR "Corynespora cassiicola" OR "Curvularia senegalensis" OR "Curvularia sp." OR "Epicoccum purpurascens" OR "Helminthosporium sp." OR "Hendersonia sp." OR "Phoma sp." OR "Pithomyces chartarum" OR "Pithomyces maydicus" OR "Pseudoplea trifolii" OR "Stemphylium sp." OR "Setaria pumila" OR "Pennisetum clandestinum" OR "Megathyrsus maximus" OR "Ganoderma lucidum" OR "Ganoderma lucidum" OR "Polyporus sp." OR "Rigidoporus microporus" OR "Trametes versicolor" OR "Pseudomonas syringae pv. syringae" OR "Pseudomonas syringae" OR "Pseudomonas syringae" OR "Pythium vexans" OR "Trachysphaera fructigena" OR "Pythium afertile" OR "Pythium coloratum" OR "Pythium debaryanum" OR "Pythium deliense" OR "Pythium irregulare" OR "Pythium oligandrum" OR "Pythium rostratum" OR "Pythium sp." OR "Pythium splendens" OR "Pythium torulosum" OR "Pythium ultimum" OR "Trachysphaera fructigena" OR "Rhizobium radiobacter" OR "Rhizobium rhizogenes" OR "Cornu aspersum" OR "Arthrinium phaeospermum" OR "Chaetomium sp." OR "Humicola sp." OR "Papularia sphaerosperma" OR "Trichocladium sp." OR "Scirtothrips perseae" OR "Heliothrips haemorrhoidalis" OR "Scirtothrips perseae" OR "Selenothrips rubrocinctus" OR "Thrips palmi" OR "Frankliniella schultzei" OR "Retithrips syriacus" OR "Selenothrips rubrocinctus" OR "Cephaleuros virescens" OR "Cephaleuros mycoidea" OR "Cephaleuros virescens" OR "Khuskia oryzae" OR "Nigrospora oryzae" OR "Nigrospora sp." OR "Nigrospora sphaerica" OR "Radopholus similis" OR "Radopholus similis citrus race" OR "Helicotylenchus dihystera" OR "Pratylenchus brachyurus" OR "Pratylenchus vulnus" OR "Radopholus similis" OR "Helicotylenchus multicinctus" OR "Helicotylenchus pseudorobustus" OR "Hemicriconemoides mangiferae" OR "Pratylenchus penetrans" OR "Rotylenchulus reniformis" OR "Meloidogyne javanica" OR "Tylenchorhynchus claytoni" OR "Rotylenchus brevicaudatus" OR "Pratylenchus neglectus" OR "Pratylenchus thornei" OR "Pratylenchus vulnus" OR "Tylenchorhynchus sp." OR "Criconema mutabile" OR

	"Rotylenchus uniformis" OR "Paratylenchus hamatus" OR "Meloidogyne sp." OR "Criconema sp." OR "Criconemoides sp." OR "Tylenchulus semipenetrans" OR "Heterodera zeae" OR "Scutellonema clathricaudatum" OR "Pratylenchus penetrans" OR "Meloidogyne enterolobii" OR "Ditylenchus sp." OR "Pratylenchus brachyurus" OR "Merlinius brevidens" OR "Tylenchorhynchus clarus" OR "Helicotylenchus dihystera" OR "Helicotylenchus erythrinae" OR "Helicotylenchus microcephalus" OR "Rotylenchulus reniformis" OR "Pratylenchus goodeyi" OR "Papaya mosaic virus" OR "Rosellinia bunodes" OR "Rosellinia necatrix" OR "Rosellinia pepo" OR "Rosellinia bunodes" OR "Rosellinia necatrix" OR "Rosellinia sp." OR "Avocado sunblotch viroid" OR "Aleurodicus neglectus" OR "Avocado sunblotch viroid" OR "Cryptaspasma perseana" OR "Diabrotica fucata" OR "Dinurothrips hookeri" OR "Heilipus lauri" OR "Neotermes holmgreni" OR "Niphonoclea spp." OR "Persea americana endornavirus" OR "Phyllocnistis hyperpersea" OR "Phyllocnistis perseafolia" OR "Potato spindle tuber viroid" OR "Pseudocaecilius citricola" OR "Sphaceloma purea" OR "Stericta albifasciata" OR "Suana concolor" OR "Trioza aguacate" OR "Xyleutes punctifer" OR "Crypticerya multicicatrices" OR "Haematonectria haematococca" OR "Neofusicoccum nonquaesitum" OR "Podosphaera perseae-americanae" OR "Raffaelea canadensis" OR "Schizoneuraphis himalayensis" OR "Aspergillus candidus" OR "Candidatus Phytoplasma solani" OR "Cladis nitidula" OR "Homona spargotis" OR "Oribius destructor" OR "Oribius inimicus" OR "Xyleborus ferrugineus (black twig borer)" OR "Aphis aurantii" OR "Acutaspis scutiformis" OR "Acutaspis subnigra" OR "Antecerococcus badius" OR "Austrotachardiella colombiana" OR "Bombacoccus aguacatae" OR "Ceroplastes reunionensis" OR "Ceroplastes toddaliae" OR "Chrysomphalus diversicolor" OR "Coccus hesperidum hesperidum" OR "Coccus moestus" OR "Crypticerya multicicatrices" OR "Diaspis miranda" OR "Dysmicoccus imparilis" OR "Eurhizococcus colombianus" OR "Ferrisia cristinae" OR "Ferrisia kondoi" OR "Ferrisia williamsi" OR "Formicococcus njalensis" OR "Laurencella colombiana" OR "Melanaspis deklei" OR "Melanaspis nigropunctata" OR "Melanaspis squamea" OR "Nipaecoccus annonae" OR "Nipaecoccus jonmartini" OR "Parastictococcus gowdeyi" OR "Philephedra lutea" OR "Philephedra tuberculosa" OR "Prococcus acutissimus" OR "Pseudischnaspis acephala" OR "Pseudocribrolecanium andersoni" OR "Pseudocribrolecanium colae" OR "Pulvinaria ficus" OR "Saissetia oleae oleae" OR "Saissetia zanzibarensis" OR "Rotylenchus breviglans" OR "Xiphinema elongatum" OR "Scutellonema brachyurum" OR "Xiphinema turcicum" OR "Helicotylenchus cavenessi" OR "Hemicriconemoides strictathecatus" OR "Hypercompe scribonia" OR "Xyleutes punctifera" OR "Cleora repetita" OR "Epimecis detexta" OR "Caloptilia burserella" OR "Caloptilia violacella" OR "Gibbovalva quadrifasciata" OR "Endoclita spp." OR "Zera tetrastigma" OR "Euglyphis fibra" OR "Euglyphis ornata" OR "Euglyphis plana" OR "Euglyphis rivulosa" OR "Labedera" OR "Metanastria" OR "Pachypasa bilinea" OR "Philotherma rosa" OR "Sibine geyeri" OR "Euproctis albina" OR "Orgyia detrita" OR "Hysterocladia corallocera" OR "Gonodonta uxor" OR "Danaus erippus" OR "Prepona demophon" OR "Prepona meander" OR "Anadasmus ischioptila" OR "Arctopoda maculosa" OR "Lethata psidii" OR "Stenoma invulgata?" OR "Papilio palamedes" OR "Papilio scamander" OR "Papilio victorinus" OR "Cryptothelea gloverii" OR "Cryptothelea surinamensis" OR "Metura elongata" OR "Naevipenna cruttwelli" OR "Oiketicus abbotii" OR "Oiketicus gigantea" OR "Thanatopsyche chilensis" OR "Accinctapubes albifasciata" OR "Aglossa caprealis" OR "Deuterollyta majuscula" OR "Jocara perseella" OR "Attacus caesar" OR "Attacus lorquinii" OR "Automeris melanops" OR "Copaxa adensis" OR "Copaxa decrescens" OR "Copaxa denda" OR "Copaxa denhezi" OR "Copaxa escalantei" OR "Copaxa evelynae" OR "Copaxa lavendera" OR "Copaxa mazaorum" OR "Copaxa rufinans" OR "Copaxa simson" OR "Hylesia continua" OR "Polythysana apollina" OR "Bembecia chrysidiformis" OR "Synanthedon resplendens" OR "Adhemarius gannascus" OR "Deltinea dimorpha" OR "Sorolopha phyllochlora" OR "Sorolopha semiculta" OR "Avocado 3 (?) alphacryptovirus" OR "Allonychus braziliensis" OR "Allonychus littoralis" OR "Eotetranychus queenslandicus" OR "Eotetranychus sexmaculatus" OR "Eotetranychus tremae" OR "Eutetranychus orientalis" OR "Oligonychus anonae" OR "Oligonychus bicolor" OR "Oligonychus biharensis" OR "Oligonychus chiapensis" OR "Oligonychus coffeae" OR "Oligonychus cubensis" OR "Oligonychus litchii" OR "Oligonychus mangiferus" OR "Oligonychus mcgregori" OR "Oligonychus megandrosoma" OR "Oligonychus peruvianus" OR "Oligonychus platani" OR "Oligonychus punicae" OR "Oligonychus thelytokus" OR "Oligonychus viridis" OR "Oligonychus yothersi" OR "Panonychus citri" OR "Tetranychus mexicanus" OR "Acrodontium crateriforme" OR "Acrosporium sp." OR "Acrostalagmus

	cinnabarinus" OR "Akaropeltopsis sp." OR "Armillaria limonea" OR "Armillaria sp." OR "Asteridiella perseae" OR "Asteridiella perseae var. major" OR "Asteromella gratissima" OR "Bionectria pseudochroleuca" OR "Botryosphaeria australis" OR "Botryosphaeria disrupta" OR "Botryosphaeria lutea" OR "Botryosphaeria ribis f. chromogena" OR "Botryosphaeria ribis var. chromogena" OR "Calonectria insularis" OR "Calonectria pauciramosa" OR "Cephalothecium sp." OR "Ceriporia purpurea" OR "Chaetomium spirale" OR "Cladosporium citri" OR "Cochliobolus intermedius" OR "Colletotrichum crassipes" OR "Colletotrichum gloeosporioides var. minor" OR "Cryphonectria havanensis" OR "Cylindrocarpon tenue" OR "Cylindrocladiella pseudoinfestans" OR "Dactylonectria anthuriicola" OR "Dactylonectria macrodidyma" OR "Dactylonectria novozelandica" OR "Dactylonectria pauciseptata" OR "Daedalea palisotii" OR "Diaporthe foeniculacea" OR "Diaporthe pascoei" OR "Diplodia cacaoicola" OR "Diplodia perseana" OR "Diplodia pseudoseriata" OR "Dothichiza sp." OR "Dothiorella iberica" OR "Flavodon cervinogilvum" OR "Fomitopsis nivosa" OR "Fracchiaea heterogenea" OR "Fusarium compactum" OR "Fusarium expansum" OR "Fusarium moniliforme var. minus" OR "Fusarium scirpi" OR "Fusicladium caryophila" OR "Fusicoccum parvum" OR "Ganoderma sulcatum" OR "Gliocladiopsis curvata" OR "Gliocladiopsis forsbergii" OR "Gliocladiopsis peggii" OR "Gliocladiopsis whileyi" OR "Gloeosporium magnoliae" OR "Glomerella cingulata var. minor" OR "Graphium euwallaceae" OR "Graphium rhodophaeum" OR "Guignardia perseae" OR "Haplotrichum perseae" OR "Hexagonia rigida" OR "Irene perseae" OR "Lasiodiplodia mahajangana" OR "Lasiodiplodia pseudotheobromae" OR "Lentinus stuppeus" OR "Leptosphaeria gratissima" OR "Leptosphaeria gratissima var. longispora" OR "Macrophoma perseae" OR "Macrosporium sp." OR "Melanops perseae" OR "Microporus flabelliformis" OR "Monilia sp." OR "Mycoacia kurilensis" OR "Mycosphaerella perseae" OR "Neocosmospora perseae" OR "Neofusicoccum cryptoaustrale" OR "Neofusicoccum mediterraneum" OR "Ochroconis musae" OR "Oidium perseae-americanae" OR "Oidium persicae" OR "Paracremonium pembeum" OR "Parencoelia myriostylidis" OR "Periconia byssoides" OR "Periconia combrens" OR "Periconiella perseae" OR "Pestalotia adusta" OR "Pestalotia eriobotryae-japonicae" OR "Pestalotiopsis aloes" OR "Pestalotiopsis gracilis" OR "Pestalotiopsis longiseta" OR "Pestalozzia leprogena" OR "Phanerochaete australis" OR "Phellinus gilvus" OR "Phellinus grenadensis" OR "Phlebia acanthocystis" OR "Phlebiella tulasnelloidea" OR "Phoma persicae" OR "Phomopsis perseae" OR "Phyllosticta micropuncta" OR "Phyllosticta perseae" OR "Physalospora perseae" OR "Phytophthora cinnamomi var. cinnamomi" OR "Phytophthora palmivora var. palmivora" OR "Pionnotes capillacea" OR "Plagiostoma perseae" OR "Polyporus sanguineus" OR "Polystictus occidentalis" OR "Prathigada sp." OR "Pseudoidium persea-americanae" OR "Puccinia scimitriformis" OR "Raffaelea aguacate" OR "Raffaelea campbellii" OR "Sclerostagonospora sp." OR "Sesquicillium sp." OR "Sphaerostilbe cinnabarina" OR "Stomiopeltis citri" OR "Stomiopeltis sp." OR "Strigula elegans" OR "Teratosperma anacardii" OR "Thyronectria pseudotrichia" OR "Trichomerium ornatum" OR "Tripospermum roupalae" OR "Ulocladium chlamydosporum" OR "Venturia caryophila" OR "Xenosporium berkeleyi" OR "Zygosporium sp." OR "Acysta perseae"
Web of Science All databases	**TOPIC:** "Persea" OR "Persea americana" OR "P. americana" OR "P. drymifolia" OR "P. gratissima" OR "P. persea" OR "avocado pear" **AND** **TOPIC:** pathogen* OR "pathogenic bacteria" OR fung* OR oomycet* OR myce* OR bacteri* OR virus* OR viroid* OR insect$ OR mite$ OR phytoplasm* OR arthropod* OR nematod* OR disease$ OR infecti* OR damag* OR symptom* OR pest$ OR vector OR hostplant$ OR "host plant$" OR host OR "root lesion$" OR decline$ OR infestation$ OR damage$ OR symptom$ OR dieback* OR die back* OR malaise OR aphid$ OR curculio OR thrip$ OR cicad$ OR miner$ OR borer$ OR weevil$ OR "plant bug$" OR spittlebug$ OR moth$ OR mealybug$ OR cutworm$ OR pillbug$ OR "root feeder$" OR caterpillar$ OR "foliar feeder$" OR virosis OR viroses OR blight$ OR wilt$ OR wilted OR canker OR scab$ OR rot$ OR "rotten" OR "damping off" OR "damping-off" OR blister$ OR smut OR mould OR "mold" OR "damping syndrome$" OR mildew OR scald$ OR "root knot" OR "root-knot" OR rootknot OR cyst$ OR dagger OR "plant parasitic" OR "parasitic plant" OR "plant$parasitic" OR "root feeding" OR "root$feeding" OR "ambrosia beetle$" OR gall$ OR "bark beetle$" **NOT**

	TOPIC: "fertil* OR Mulching OR Nutrient* OR Pruning OR drought OR "human virus" OR "animal disease*" OR "plant extracts" OR "immunological" OR "purified fraction" OR "traditional medicine" OR medic* OR mammal* OR bird* OR "human disease*" OR *toxicity OR "weed control" OR "salt stress" OR salinity OR photosynthesis OR "human health" OR medicine OR "bioactive compound$" OR "health benefit$" OR "water supply" OR water OR frost OR "dietary stress" OR camel OR "microRNA" OR "Periplaneta americana" OR carotenoid$ OR Pollinat* OR chromatography OR financial OR "controlled atmosphere" OR "sensory quality" OR "fruit juice$" OR "Phymata americana" OR "Prunus americana" OR "Pilularia americana" OR refrigeration OR packaging OR "enzymatic browning" OR pesticide OR "pesticide residue" OR "cold storage" OR storage OR "vacuum fumigation" OR allerg* OR "immunodiffusion" OR dair* OR "rat*" OR consum* OR kinetic* OR firm* OR diet* OR electric* OR antibrown* OR "fish" OR hurricane OR oil* OR bruis* OR antioxid* OR urban* OR pectin* OR biodiesel$ OR storm* OR "cryopreservation" OR industry* OR "PAP-I gene" OR biochem* OR "anaerobisis" OR "PaKRP" OR "glucosylation" OR lipid* OR market* OR "trade policy" OR "auto-octoploidy" OR "heavy metals" OR "glucosylating" OR "burial depth" OR landscap* OR tradition* **NOT** **TOPIC: "**Oligonychus perseae" OR "Brevipalpus yothersi" OR "Tetranychus mexicanus" OR "Oligonychus peruvianus" OR "Polyphagotarsonemus latus" OR "Oligonychus mangiferus" OR "Oligonychus punicae" OR "Tuckerella pavoniformis" OR "Oligonychus vitis" OR "Tetranychus gloveri" OR "Tetranychus neocaledonicus" OR "Tetranychus urticae" OR "Oligonychus yothersi" OR "Marasmiellus scandens" OR "Armillaria mellea" OR "Armillaria novae-zelandiae" OR "Armillariella tabescens" OR "Clitocybe tabescens" OR "Coprinus sp." OR "Marasmiellus scandens" OR "Pestalotiopsis clavispora" OR "Pestalotiopsis versicolor" OR "Monochaetia sp." OR "Pestalotia sp." OR "Pestalotia versicolor" OR "Pestalotiopsis clavispora" OR "Pestalotiopsis disseminata" OR "Pestalotiopsis guepinii" OR "Pestalotiopsis phoenicis" OR "Pestalotiopsis sp." OR "Pestalotiopsis theae" OR "Pestalotiopsis versicolor" OR "Ageratina adenophora" OR "Tridax procumbens" OR "Pellicularia rolfsii" OR "Sclerotium rolfsii" OR "Bacillus licheniformis" OR "Bacillus subtilis" OR "Lasiodiplodia theobromae" OR "Dothiorella aromatica" OR "Lasiodiplodia theobromae" OR "Botryosphaeria parva" OR "Neofusicoccum australe" OR "Sphaeropsis tumefaciens" OR "Botryodiplodia theobromae" OR "Botryosphaeria dothidea" OR "Botryosphaeria parva" OR "Botryosphaeria quercuum" OR "Botryosphaeria rhodina" OR "Botryosphaeria ribis" OR "Diplodia mutila" OR "Diplodia natalensis" OR "Diplodia seriata" OR "Diplodia sp." OR "Diplodia theobromae" OR "Dothiorella gregaria" OR "Dothiorella sp." OR "Fusicoccum aesculi" OR "Fusicoccum luteum" OR "Guignardia mangiferae" OR "Lasiodiplodia sp." OR "Macrophomina phaseoli" OR "Neofusicoccum luteum" OR "Neofusicoccum mangiferae" OR "Neofusicoccum parvum" OR "Neofusicoccum sp." OR "Phyllosticta sp." OR "Physalospora obtusa" OR "Physalospora rhodina" OR "Pseudocercospora purpurea" OR "Mycosphaerella tassiana" OR "Capnodium citri" OR "Capnodium sp." OR "Cercospora purpurea" OR "Cercospora sp." OR "Cladosporium cladosporioides" OR "Cladosporium herbarum" OR "Cladosporium sp." OR "Mycosphaerella sp." OR "Ovularia sp." OR "Pseudocercospora purpurea" OR "Septoria sp." OR "Oncobasidium theobromae" OR "Rhizoctonia solani" OR "Rhizoctonia sp." OR "Thanatephorus cucumeris" OR "Rhynchophorus palmarum" OR "Conotrachelus aguacatae" OR "Conotrachelus perseae" OR "Heilipus lauri" OR "Xylosandrus morigerus" OR "Diaprepes abbreviatus" OR "Euwallacea fornicatus" OR "Megaplatypus mutatus" OR "Xylosandrus compactus" OR "Naupactus xanthographus" OR "Xyleborus glabratus" OR "Xyleborus neivai" OR "Xyleborus perforans" OR "Araecerus fasciculatus" OR "Conotrachelus aguacatae" OR "Conotrachelus perseae" OR "Copturus aguacatae" OR "Hypomeces squamosus" OR "Lagocheirus araneiformis" OR "Naupactus xanthographus" OR "Xyleborus glabratus" OR "Xyleborus immaturus" OR "Adoretus versutus" OR "Batocera rufomaculata" OR "Caulophilus oryzae" OR "Diaprepes abbreviatus" OR "Diaprepes spengleri" OR "Euwallacea fornicatus" OR "Pantomorus cervinus" OR "Rhynchophorus palmarum" OR "Sinoxylon conigerum" OR "Xyleborinus saxesenii" OR "Xyleborus perforans" OR "Xyleborus volvulus" OR "Xylosandrus compactus" OR "Xylosandrus crassiusculus" OR "Xylosandrus morigerus" OR "Monolepta australis" OR "Protaetia fusca" OR "Xyleborus ferrugineus" OR "Xylosandrus" OR "Pellicularia koleroga" OR

	"Phanerochaete salmonicolor" OR "Botryodiplodia sp." OR "Diaporthe australafricana" OR "Diaporthe rudis" OR "Diaporthe sp." OR "Diaporthe sterilis" OR "Endothia havanensis" OR "Gnomonia sp." OR "Phomopsis sp." OR "Anastrepha ludens" OR "Ceratitis cosyra" OR "Bactrocera dorsalis" OR "Bactrocera tryoni" OR "Ceratitis capitata" OR "Ceratitis rosa" OR "Anastrepha serpentina" OR "Ceratitis anonae" OR "Ceratitis fasciventris" OR "Ceratitis quilicii" OR "Prodiplosis longifila" OR "Zaprionus indianus" OR "Bactrocera aquilonis" OR "Bactrocera carambolae" OR "Bactrocera dorsalis" OR "Bactrocera kandiensis" OR "Bactrocera passiflorae" OR "Anastrepha fraterculus" OR "Anastrepha ludens" OR "Anastrepha serpentina" OR "Anastrepha striata" OR "Bactrocera cucurbitae" OR "Bactrocera facialis" OR "Bactrocera jarvisi" OR "Bactrocera tryoni" OR "Ceratitis capitata" OR "Ceratitis cosyra" OR "Ceratitis rosa" OR "Atherigona orientalis" OR "Longidorus" OR "Trichodorus" OR "Paratrichodorus porosus" OR "Xiphinema" OR "Xiphinema brasiliense" OR "Xiphinema brevicolle" OR "Xiphinema californicum" OR "Xiphinema diffusum" OR "Xiphinema diversicaudatum" OR "Paratrichodorus minor" OR "Xiphinema insigne" OR "Longidorus laevicapitatus" OR "Xiphinema vuittenezi" OR "Longidorus africanus" OR "Trichodorus porosus" OR "Xiphinema americanum" OR "Aureobasidium pullulans" OR "Aureobasidium sp." OR "Erysiphe sp." OR "Oidium sp." OR "Sphaerotheca sp." OR "Aspergillus niger" OR "Aspergillus sp." OR "Penicillium chrysogenum" OR "Penicillium expansum" OR "Penicillium italicum" OR "Penicillium janthinellum" OR "Penicillium sp." OR "Sclerotinia sclerotiorum" OR "Grovesinia pyramidalis" OR "Botrytis cinerea" OR "Botrytis sp." OR "Cristulariella pyramidalis" OR "Gloeosporium sp." OR "Marssonina sp." OR "Phymatotrichum sp." OR "Sclerotinia sclerotiorum" OR "Sclerotinia sp." OR "Aleurothrixus trachoides" OR "Amblypelta lutescens" OR "Homalodisca vitripennis" OR "Parabemisia myricae" OR "Paraleyrodes minei" OR "Pseudacysta perseae" OR "Tetraleurodes perseae" OR "Aleurocanthus woglumi" OR "Helopeltis antonii" OR "Maconellicoccus hirsutus" OR "Parasaissetia nigra" OR "Pseudacysta perseae" OR "Aleurodicus dispersus" OR "Aleurodicus dugesii" OR "Ceroplastes ceriferus" OR "Ceroplastes destructor" OR "Ceroplastes stellifer" OR "Penthimiola bella" OR "Aleurodicus dispersus" OR "Amblypelta lutescens" OR "Amblypelta nitida" OR "Chrysomphalus dictyospermi" OR "Dysmicoccus brevipes" OR "Hemiberlesia lataniae" OR "Icerya seychellarum" OR "Maconellicoccus hirsutus" OR "Melanaspis obscura" OR "Milviscutulus mangiferae" OR "Nipaecoccus nipae" OR "Nipaecoccus viridis" OR "Paracoccus marginatus" OR "Paraleyrodes goyabae" OR "Parasaissetia nigra" OR "Parthenolecanium persicae" OR "Planococcoides njalensis" OR "Protopulvinaria pyriformis" OR "Pseudaonidia trilobitiformis" OR "Pseudococcus longispinus" OR "Saissetia coffeae" OR "Saissetia oleae" OR "Selenaspidus articulatus" OR "Trialeurodes vaporariorum" OR "Aleurocanthus woglumi" OR "Aleurodicus cocois" OR "Aleurodicus pulvinatus" OR "Aonidiella aurantii" OR "Aonidiella orientalis" OR "Aphis gossypii" OR "Aphis spiraecola" OR "Aspidiotus destructor" OR "Aulacaspis tubercularis" OR "Cerataphis lataniae" OR "Ceroplastes ceriferus" OR "Ceroplastes destructor" OR "Ceroplastes rubens" OR "Ceroplastes rusci" OR "Coccus hesperidum" OR "Ferrisia virgata" OR "Helopeltis antonii" OR "Icerya aegyptiaca" OR "Leptoglossus zonatus" OR "Myzus persicae" OR "Nezara viridula" OR "Parabemisia myricae" OR "Pinnaspis strachani" OR "Planococcus citri" OR "Pseudococcus jackbeardsleyi" OR "Pseudotheraptus devastans" OR "Pseudotheraptus wayi" OR "Pulvinaria psidii" OR "Sophonia orientalis" OR "Dysmicoccus grassii" OR "Oxycarenus hyalinipennis" OR "Puto barberi" OR "Aphis craccivora" OR "Aphis fabae" OR "Sinomegoura citricola" OR "Coccus hesperidum" OR "Coccus longulus" OR "Eucalymnatus tessellatus" OR "Protopulvinaria pyriformis" OR "Aspidiotus hederae" OR "Chrysomphalus dictyospermi" OR "Fiorinia fioriniae" OR "Hemiberlesia lataniae" OR "Hemiberlesia palmae" OR "Mycetaspis personata" OR "Abgrallaspis cyanophylli" OR "Parlatoria proteus" OR "Pinnaspis buxi" OR "Selenaspidus articulatus" OR "Icerya seychellarum" OR "Acutaspis albopicta" OR "Acutaspis perseae" OR "Aonidiella aurantii" OR "Aonidiella citrina" OR "Aspidiotus destructor" OR "Aspidiotus nerii" OR "Aulacaspis tubercularis" OR "Bambusaspis bambusae" OR "Ceroplastes floridensis" OR "Ceroplastes pseudoceriferus" OR "Ceroplastes rubens" OR "Ceroplastes rusci" OR "Ceroplastes sinensis" OR "Chrysomphalus aonidum" OR "Chrysomphalus pinnulifer" OR "Clavaspis perseae" OR "Coccus formicarii" OR "Coccus viridis" OR "Crypticerya montserratensis" OR "Davidsonaspis aguacatae" OR "Diaspis boisduvalii" OR "Drosicha contrahens" OR "Dysmicoccus brevipes" OR "Dysmicoccus nesophilus" OR "Ferrisia malvastra" OR "Ferrisia virgata" OR "Hemiberlesia cyanophylli" OR "Hemiberlesia latastei" OR

	"Hemiberlesia musae" OR "Hemiberlesia rapax" OR "Howardia biclavis" OR "Ischnaspis longirostris" OR "Kilifia acuminata" OR "Lindingaspis rossi" OR "Lopholeucaspis cockerelli" OR "Milviscutulus spiculatus" OR "Neopinnaspis harperi" OR "Nipaecoccus nipae" OR "Nipaecoccus viridis" OR "Oceanaspidiotus spinosus" OR "Paracoccus marginatus" OR "Paratachardina pseudolobata" OR "Parthenolecanium persicae" OR "Phalacrococcus howertoni" OR "Pinnaspis strachani" OR "Planococcus citri" OR "Planococcus ficus" OR "Planococcus lilacinus" OR "Planococcus lindingeri" OR "Planococcus minor" OR "Protopulvinaria longivalvata" OR "Pseudaonidia trilobitiformis" OR "Pseudaulacaspis cockerelli" OR "Pseudischnaspis bowreyi" OR "Pseudococcus cryptus" OR "Pseudococcus jackbeardsleyi" OR "Pseudococcus landoi" OR "Pseudococcus longispinus" OR "Pseudococcus viburni" OR "Pseudoparlatoria parlatorioides" OR "Pulvinaria mammeae" OR "Rastrococcus invadens" OR "Saissetia coffeae" OR "Saissetia miranda" OR "Saissetia neglecta" OR "Udinia catori" OR "Unaspis citri" OR "Phellinus noxius" OR "Acromyrmex octospinosus" OR "Atta" OR "Atta cephalotes" OR "Solenopsis geminata" OR "Neocomospora euwallaceae" OR "Albonectria rigidiuscula" OR "Calonectria ilicicola" OR "Gibberella avenacea" OR "Nectria pseudotrichia" OR "Neonectria macrodidyma" OR "Neonectria radicicola" OR "Paecilomyces lilacinus" OR "Trichoderma harzianum" OR "Trichothecium roseum" OR "Fusarium oxysporum" OR "Acremonium sp." OR "Calonectria ilicicola" OR "Cephalosporium lecanii" OR "Cylindrocladiella parva" OR "Cylindrocladium scoparium" OR "Cylindrocladium sp." OR "Fusarium avenaceum" OR "Fusarium crookwellense" OR "Fusarium equiseti" OR "Fusarium graminearum" OR "Fusarium kuroshium" OR "Fusarium lateritium" OR "Fusarium moniliforme" OR "Fusarium oxysporum" OR "Fusarium pallidoroseum" OR "Fusarium sambucinum" OR "Fusarium semitectum" OR "Fusarium solani" OR "Fusarium sp." OR "Gibberella pulicaris" OR "Gibberella sp." OR "Ilyonectria sp." OR "Nectria haematococca" OR "Nectria rigidiuscula" OR "Nectria rugulosa" OR "Nectria sp." OR "Sphaerostilbe repens" OR "Stilbella sp." OR "Trichoderma harzianum" OR "Trichoderma koningii" OR "Trichoderma lignorum" OR "Trichothecium roseum" OR "Trichothecium sp." OR "Cassytha filiformis" OR "Stenoma catenifer" OR "Thaumatotibia leucotreta" OR "Platynota stultana" OR "Cryptoblabes gnidiella" OR "Zeuzera coffeae" OR "Attacus atlas" OR "Cricula trifenestrata" OR "Cryptoblabes gnidiella" OR "Epiphyas postvittana" OR "Spodoptera littoralis" OR "Stenoma catenifer" OR "Thaumatotibia leucotreta" OR "Zeuzera coffeae" OR "Argyrotaenia citrana" OR "Cacoecimorpha pronubana" OR "Chrysodeixis includens" OR "Peridroma saucia" OR "Platynota stultana" OR "Spodoptera eridania" OR "Amorbia cuneana" OR "Ascotis selenaria" OR "Sabulodes aegrotata" OR "Hypercompe indecisa" OR "Saurita cassandra" OR "Ascotis selenaria" OR "Sabulodes aegrotata" OR "Sabulodes caberata" OR "Acrocercops" OR "Acrocercops ordinatella" OR "Caloptilia perseae" OR "Pyrrhopyge chalybea" OR "Pachypasa sericeofasciata" OR "Sibine nesea" OR "Lymantria dispar" OR "Megalopyge lanata" OR "Megalopyge urens" OR "Helicoverpa zea" OR "Peridroma saucia" OR "Pseudoplusia includens" OR "Spodoptera eridania" OR "Schizura concinna" OR "Stenoma" OR "Stenoma vacans" OR "Timocratica albella" OR "Papilio rutulus" OR "Oiketicus" OR "Oiketicus kirbyi" OR "Attacus atlas" OR "Automeris io" OR "Copaxa multifenestrata" OR "Cricula trifenestrata" OR "Eacles imperialis" OR "Rothschildia orizaba" OR "Amorbia cuneanum" OR "Amorbia emigratella" OR "Archips machlopis" OR "Archips micaceana" OR "Argyrotaenia amatana" OR "Argyrotaenia citrana" OR "Cryptoptila immersana" OR "Isotenes miserana" OR "Platynota rostrana" OR "Atteva punctella" OR "Xylella fastidiosa" OR "Xylella fastidiosa" OR "Xanthomonas campestris" OR "Clasterosporium sp." OR "Ceratocystis fimbriata" OR "Ceratocystis sp." OR "Graphium kuroshium" OR "Graphium sp." OR "Thielaviopsis sp." OR "Mucor sp." OR "Rhizopus nigricans" OR "Rhizopus sp." OR "Rhizopus stolonifer" OR "Elsinoë perseae" OR "Sphaceloma perseae" OR "Elsinoe perseae" OR "Sphaceloma sp." OR "Raffaelea lauricola" OR "Raffaelea lauricola" OR "Raffaelea sp." OR "Zonocerus elegans" OR "Zonocerus variegatus" OR "Graphis sp." OR "Phytophthora cinnamomi" OR "Phytophthora cactorum" OR "Phytophthora cinnamomi" OR "Phytophthora cryptogea" OR "Phytophthora cambivora" OR "Phytophthora citricola" OR "Phytophthora heveae" OR "Phytophthora nicotianae" OR "Phytophthora megakarya" OR "Phytophthora boehmeriae" OR "Phytophthora cactorum" OR "Phytophthora cambivora" OR "Phytophthora capsici" OR "Phytophthora citricola" OR "Phytophthora citrophthora" OR "Phytophthora heveae" OR "Phytophthora megasperma" OR "Phytophthora mengei" OR "Phytophthora nicotianae" OR "Phytophthora nicotianae var. nicotianae" OR "Phytophthora palmivora" OR

	"Phytophthora parasitica" OR "Phytophthora sp." OR "Phymatotrichopsis omnivora" OR "Phymatotrichum omnivorum" OR "Colletotrichum acutatum" OR "Glomerella cingulata" OR "Colletotrichum acutatum" OR "Colletotrichum boninense" OR "Colletotrichum godetiae" OR "Verticillium dahliae" OR "Colletotrichum fructicola" OR "Colletotrichum aenigma" OR "Colletotrichum alienum" OR "Colletotrichum dematium" OR "Colletotrichum fioriniae" OR "Colletotrichum gigasporum" OR "Colletotrichum gloeosporioides" OR "Colletotrichum kahawae subsp. ciggaro" OR "Colletotrichum karstii" OR "Colletotrichum queenslandicum" OR "Colletotrichum siamense" OR "Colletotrichum simmondsii" OR "Colletotrichum sp." OR "Glomerella acutata" OR "Glomerella sp." OR "Phyllachora gratissima" OR "Phyllachora sp." OR "Verticillium albo-atrum" OR "Verticillium dahliae" OR "Verticillium sp." OR "Alternaria alternata" OR "Cochliobolus setariae" OR "Pithomyces graminicola" OR "Acrothecium lunatum" OR "Alternaria alternata" OR "Alternaria citri" OR "Alternaria sp." OR "Clasterosporium maydicum" OR "Corynespora cassiicola" OR "Curvularia senegalensis" OR "Curvularia sp." OR "Epicoccum purpurascens" OR "Helminthosporium sp." OR "Hendersonia sp." OR "Phoma sp." OR "Pithomyces chartarum" OR "Pithomyces maydicus" OR "Pseudoplea trifolii" OR "Stemphylium sp." OR "Setaria pumila" OR "Pennisetum clandestinum" OR "Megathyrsus maximus" OR "Ganoderma lucidum" OR "Ganoderma lucidum" OR "Polyporus sp." OR "Rigidoporus microporus" OR "Trametes versicolor" OR "Pseudomonas syringae pv. syringae" OR "Pseudomonas syringae" OR "Pseudomonas syringae" OR "Pythium vexans" OR "Trachysphaera fructigena" OR "Pythium afertile" OR "Pythium coloratum" OR "Pythium debaryanum" OR "Pythium deliense" OR "Pythium irregulare" OR "Pythium oligandrum" OR "Pythium rostratum" OR "Pythium sp." OR "Pythium splendens" OR "Pythium torulosum" OR "Pythium ultimum" OR "Trachysphaera fructigena" OR "Rhizobium radiobacter" OR "Rhizobium rhizogenes" OR "Cornu aspersum" OR "Arthrinium phaeospermum" OR "Chaetomium sp." OR "Humicola sp." OR "Papularia sphaerosperma" OR "Trichocladium sp." OR "Scirtothrips perseae" OR "Heliothrips haemorrhoidalis" OR "Scirtothrips perseae" OR "Selenothrips rubrocinctus" OR "Thrips palmi" OR "Frankliniella schultzei" OR "Retithrips syriacus" OR "Selenothrips rubrocinctus" OR "Cephaleuros virescens" OR "Cephaleuros mycoidea" OR "Cephaleuros virescens" OR "Khuskia oryzae" OR "Nigrospora oryzae" OR "Nigrospora sp." OR "Nigrospora sphaerica" OR "Radopholus similis" OR "Radopholus similis citrus race" OR "Helicotylenchus dihystera" OR "Pratylenchus brachyurus" OR "Pratylenchus vulnus" OR "Radopholus similis" OR "Helicotylenchus multicinctus" OR "Helicotylenchus pseudorobustus" OR "Hemicriconemoides mangiferae" OR "Pratylenchus penetrans" OR "Rotylenchulus reniformis" OR "Meloidogyne javanica" OR "Tylenchorhynchus claytoni" OR "Rotylenchus brevicaudatus" OR "Pratylenchus neglectus" OR "Pratylenchus thornei" OR "Pratylenchus vulnus" OR "Tylenchorhynchus sp." OR "Criconema mutabile" OR "Rotylenchus uniformis" OR "Paratylenchus hamatus" OR "Meloidogyne sp." OR "Criconema sp." OR "Criconemoides sp." OR "Tylenchulus semipenetrans" OR "Heterodera zeae" OR "Scutellonema clathricaudatum" OR "Pratylenchus penetrans" OR "Meloidogyne enterolobii" OR "Ditylenchus sp." OR "Pratylenchus brachyurus" OR "Merlinius brevidens" OR "Tylenchorhynchus clarus" OR "Helicotylenchus dihystera" OR "Helicotylenchus erythrinae" OR "Helicotylenchus microcephalus" OR "Rotylenchulus reniformis" OR "Pratylenchus goodeyi" OR "Papaya mosaic virus" OR "Rosellinia bunodes" OR "Rosellinia necatrix" OR "Rosellinia pepo" OR "Rosellinia bunodes" OR "Rosellinia necatrix" OR "Rosellinia sp." OR "Avocado sunblotch viroid" OR "Aleurodicus neglectus" OR "Avocado sunblotch viroid" OR "Cryptaspasma perseana" OR "Diabrotica fucata" OR "Dinurothrips hookeri" OR" Heilipus lauri" OR "Neotermes holmgreni" OR "Niphonoclea spp." OR "Persea americana endornavirus" OR "Phyllocnistis hyperpersea" OR "Phyllocnistis perseafolia" OR "Potato spindle tuber viroid" OR "Pseudocaecilius citricola" OR "Sphaceloma purea" OR "Stericta albifasciata" OR "Suana concolor" OR "Trioza aguacate" OR "Xyleutes punctifer" OR "Crypticerya multicicatrices" OR "Haematonectria haematococca" OR "Neofusicoccum nonquaesitum" OR "Podosphaera perseae-americanae" OR "Raffaelea canadensis" OR "Schizoneuraphis himalayensis" OR "Aspergillus candidus" OR "Candidatus Phytoplasma solani" OR "Cladis nitidula" OR "Homona spargotis" OR "Oribius destructor" OR "Oribius inimicus" OR "Xyleborus ferrugineus (black twig borer)" OR "Aphis aurantii" OR "Acutaspis scutiformis" OR "Acutaspis subnigra" OR "Antecerococcus badius" OR "Austrotachardiella colombiana" OR "Bombacoccus aguacatae" OR "Ceroplastes reunionensis" OR "Ceroplastes toddaliae" OR "Chrysomphalus diversicolor" OR "Coccus hesperidum hesperidum" OR "Coccus moestus" OR "Crypticerya multicicatrices" OR "Diaspis miranda" OR

	"Dysmicoccus imparilis" OR "Eurhizococcus colombianus" OR "Ferrisia cristinae" OR "Ferrisia kondoi" OR "Ferrisia williamsi" OR "Formicococcus njalensis" OR "Laurencella colombiana" OR "Melanaspis deklei" OR "Melanaspis nigropunctata" OR "Melanaspis squamea" OR "Nipaecoccus annonae" OR "Nipaecoccus jonmartini" OR "Parastictococcus gowdeyi" OR "Philephedra lutea" OR "Philephedra tuberculosa" OR "Prococcus acutissimus" OR "Pseudischnaspis acephala" OR "Pseudocribrolecanium andersoni" OR "Pseudocribrolecanium colae" OR "Pulvinaria ficus" OR "Saissetia oleae oleae" OR "Saissetia zanzibarensis" OR "Rotylenchus breviglans" OR "Xiphinema elongatum" OR "Scutellonema brachyurum" OR "Xiphinema turcicum" OR "Helicotylenchus cavenessi" OR "Hemicriconemoides strictathecatus" OR "Hypercompe scribonia" OR "Xyleutes punctifera" OR "Cleora repetita" OR "Epimecis detexta" OR "Caloptilia burserella" OR "Caloptilia violacella" OR "Gibbovalva quadrifasciata" OR "Endoclita spp." OR "Zera tetrastigma" OR "Euglyphis fibra" OR "Euglyphis ornata" OR "Euglyphis plana" OR "Euglyphis rivulosa" OR "Labedera" OR "Metanastria" OR "Pachypasa bilinea" OR "Philotherma rosa" OR "Sibine geyeri" OR "Euproctis albina" OR "Orgyia detrita" OR "Hysterocladia corallocera" OR "Gonodonta uxor" OR "Danaus erippus" OR "Prepona demophon" OR "Prepona meander" OR "Anadasmus ischioptila" OR "Arctopoda maculosa" OR "Lethata psidii" OR "Stenoma invulgata?" OR "Papilio palamedes" OR "Papilio scamander" OR "Papilio victorinus" OR "Cryptothelea gloverii" OR "Cryptothelea surinamensis" OR "Metura elongata" OR "Naevipenna cruttwelli" OR "Oiketicus abbotii" OR "Oiketicus gigantea" OR "Thanatopsyche chilensis" OR "Accinctapubes albifasciata" OR "Aglossa caprealis" OR "Deuterollyta majuscula" OR "Jocara perseella" OR "Attacus caesar" OR "Attacus lorquinii" OR "Automeris melanops" OR "Copaxa adensis" OR "Copaxa decrescens" OR "Copaxa denda" OR "Copaxa denhezi" OR "Copaxa escalantei" OR "Copaxa evelynae" OR "Copaxa lavendera" OR "Copaxa mazaorum" OR "Copaxa rufinans" OR "Copaxa simson" OR "Hylesia continua" OR "Polythysana apollina" OR "Bembecia chrysidiformis" OR "Synanthedon resplendens" OR "Adhemarius gannascus" OR "Deltinea dimorpha" OR "Sorolopha phyllochlora" OR "Sorolopha semiculta" OR "Avocado 3 (?) alphacryptovirus" OR "Allonychus braziliensis" OR "Allonychus littoralis" OR "Eotetranychus queenslandicus" OR "Eotetranychus sexmaculatus" OR "Eotetranychus tremae" OR "Eutetranychus orientalis" OR "Oligonychus anonae" OR "Oligonychus bicolor" OR "Oligonychus biharensis" OR "Oligonychus chiapensis" OR "Oligonychus coffeae" OR "Oligonychus cubensis" OR "Oligonychus litchii" OR "Oligonychus mangiferus" OR "Oligonychus mcgregori" OR "Oligonychus megandrosoma" OR "Oligonychus peruvianus" OR "Oligonychus platani" OR "Oligonychus punicae" OR "Oligonychus thelytokus" OR "Oligonychus viridis" OR "Oligonychus yothersi" OR "Panonychus citri" OR "Tetranychus mexicanus" OR "Acrodontium crateriforme" OR "Acrosporium sp." OR "Acrostalagmus cinnabarinus" OR "Akaropeltopsis sp." OR "Armillaria limonea" OR "Armillaria sp." OR "Asteridiella perseae" OR "Asteridiella perseae var. major" OR "Asteromella gratissima" OR "Bionectria pseudochroleuca" OR "Botryosphaeria australis" OR "Botryosphaeria disrupta" OR "Botryosphaeria lutea" OR "Botryosphaeria ribis f. chromogena" OR "Botryosphaeria ribis var. chromogena" OR "Calonectria insularis" OR "Calonectria pauciramosa" OR "Cephalothecium sp." OR "Ceriporia purpurea" OR "Chaetomium spirale" OR "Cladosporium citri" OR "Cochliobolus intermedius" OR "Colletotrichum crassipes" OR "Colletotrichum gloeosporioides var. minor" OR "Cryphonectria havanensis" OR "Cylindrocarpon tenue" OR "Cylindrocladiella pseudoinfestans" OR "Dactylonectria anthuriicola" OR "Dactylonectria macrodidyma" OR "Dactylonectria novozelandica" OR "Dactylonectria pauciseptata" OR "Daedalea palisotii" OR "Diaporthe foeniculacea" OR "Diaporthe pascoei" OR "Diplodia cacaoicola" OR "Diplodia perseana" OR "Diplodia pseudoseriata" OR "Dothichiza sp." OR "Dothiorella iberica" OR "Flavodon cervinogilvum" OR "Fomitopsis nivosa" OR "Fracchiaea heterogenea" OR "Fusarium compactum" OR "Fusarium expansum" OR "Fusarium moniliforme var. minus" OR "Fusarium scirpi" OR "Fusicladium caryophila" OR "Fusicoccum parvum" OR "Ganoderma sulcatum" OR "Gliocladiopsis curvata" OR "Gliocladiopsis forsbergii" OR "Gliocladiopsis peggii" OR "Gliocladiopsis whileyi" OR "Gloeosporium magnoliae" OR "Glomerella cingulata var. minor" OR "Graphium euwallaceae" OR "Graphium rhodophaeum" OR "Guignardia perseae" OR "Haplotrichum perseae" OR "Hexagonia rigida" OR "Irene perseae" OR "Lasiodiplodia mahajangana" OR "Lasiodiplodia pseudotheobromae" OR "Lentinus stuppeus" OR "Leptosphaeria gratissima" OR "Leptosphaeria gratissima var. longispora" OR "Macrophoma perseae" OR "Macrosporium sp." OR "Melanops perseae" OR "Microporus flabelliformis" OR "Monilia

	sp." OR "Mycoacia kurilensis" OR "Mycosphaerella perseae" OR "Neocosmospora perseae" OR "Neofusicoccum cryptoaustrale" OR "Neofusicoccum mediterraneum" OR "Ochroconis musae" OR "Oidium perseae-americanae" OR "Oidium persicae" OR "Paracremonium pembeum" OR "Parencoelia myriostylidis" OR "Periconia byssoides" OR "Periconia combrens" OR "Periconiella perseae" OR "Pestalotia adusta" OR "Pestalotia eriobotryae-japonicae" OR "Pestalotiopsis aloes" OR "Pestalotiopsis gracilis" OR "Pestalotiopsis longiseta" OR "Pestalozzia leprogena" OR "Phanerochaete australis" OR "Phellinus gilvus" OR "Phellinus grenadensis" OR "Phlebia acanthocystis" OR "Phlebiella tulasnelloidea" OR "Phoma persicae" OR "Phomopsis perseae" OR "Phyllosticta micropuncta" OR "Phyllosticta perseae" OR "Physalospora perseae" OR "Phytophthora cinnamomi var. cinnamomi" OR "Phytophthora palmivora var. palmivora" OR "Pionnotes capillacea" OR "Plagiostoma perseae" OR "Polyporus sanguineus" OR "Polystictus occidentalis" OR "Prathigada sp." OR "Pseudoidium persea-americanae" OR "Puccinia scimitriformis" OR "Raffaelea aguacate" OR "Raffaelea campbellii" OR "Sclerostagonospora sp." OR "Sesquicillium sp." OR "Sphaerostilbe cinnabarina" OR "Stomiopeltis citri" OR "Stomiopeltis sp." OR "Strigula elegans" OR "Teratosperma anacardii" OR "Thyronectria pseudotrichia" OR "Trichomerium ornatum" OR "Tripospermum roupalae" OR "Ulocladium chlamydosporum" OR "Venturia caryophila" OR "Xenosporium berkeleyi" OR "Zygosporium sp." OR "Acysta perseae"

Appendix C – List of pests that can potentially cause an effect not further assessed

Table C.1: List of potential pests not further assessed

	Pest name	EPPO Code	Group	Pest present in Israel	Present in the EU	*P. americana* confirmed as a host (reference)	Pest can be associated with the commodity	Impact	Justification for inclusion in this list
1.	*Frankliniella fusca*	FRANFU	Insects	Yes	Limited	Yes (Martínez et al., 2011)	Uncertain		Polyphagous and vector of *Tomato spotted wilt virus* (TSWV). However, uncertainty *if P. americana* is a host and the commodity is pathway.
2.	*Planococcus lindingeri*	PSECLI	Insects	Yes	No	Cox and Ben-Dov (1986)	Yes	Uncertain (no report)	It is a root-feeding species, recorded mainly on grasses but also in Israel on roots of avocado seedlings in nurseries, there is no evidence to suggest that this species is injurious. Uncertainty if the commodity is a pathway and impact.
3.	*Xyleborus affinis*		Insects	Yes	No	Yes	Uncertain		Uncertainty if the commodity is a pathway; *X. perforans* preferentially colonises larger and very moist pieces of wood that died recently, Confirmed records of *Xyleborus affinis* attacking healthy trees are rare. The associated fungi: *Raffaelea lauricola* (laurel wilt) and *Diplodia corticola* which can be associated with avocado are not present in Israel (Kostovick et al. 2015).
4.	*Xyleborus perforans*		Insects	Uncertain	No	Yes	Uncertain		Uncertainty if the pest is present in Israel and if the commodity is a pathway. It is not size-selective, and will infest branches and poles of about 5 cm. diameter as well as the largest logs, but it does not attack small shoots and twigs (Browne, 1961).
5.	*Graphium euwallaceae*		Fungi	Yes	No	Yes	Yes	Uncertain	Fungus part of the complex potentially associated with the beetle Ewallacea fornicatus, Although the fungus have been able to be isolated from avocado plants it is uncertain their degree of pathogenicity.

	Pest name	EPPO Code	Group	Pest present in Israel	Present in the EU	*P. americana* confirmed as a host (reference)	Pest can be associated with the commodity	Impact	Justification for inclusion in this list
6.	*Paracremonium pembeum*		Fungi	Yes	No	Yes	Yes	Uncertain	Fungus part of the complex potentially associated with the beetle Ewallacea fornicatus, Although the two fungi have been able to be isolated from avocado plants it is uncertain their degree of pathogenicity.

Appendix D – Excel file with the pest list of *P. americana*

Appendix D can be found in the online version of this output (in the 'Supporting information' section): https://doi.org/10.2903/j.efsa.2021.6354