

ADOPTED: 25 March 2021

doi: 10.2903/j.efsa.2021.6569

## Commodity risk assessment of *Nerium oleander* plants from Turkey

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, Philippe Lucien Reignault, Hans-Hermann Thulke, Wopke Van der Werf, Antonio Vicent Civera, Jonathan Yuen, Lucia Zappalà, Elisavet Chatzivassiliou, Jane Debode, Charles Manceau, Ciro Gardi, Olaf Mosbach-Schulz and Roel Potting

### Abstract

The European Commission requested the EFSA Panel on Plant Health to prepare and deliver risk assessments for commodities listed in Commission Implementing Regulation EU/2018/2019 as 'High risk plants, plant products and other objects'. This Scientific Opinion covers plant health risks posed by bare rooted and potted plants of *Nerium oleander* that are imported from Turkey, taking into account the available scientific information, including the technical information provided by the Turkish NPPO. The relevance of any pest for this opinion was based on evidence following defined criteria. One species, the EU non-regulated pest *Phenacoccus solenopsis*, fulfilled all relevant criteria and was selected for further evaluation. For this pest, the risk mitigation measures proposed in the technical dossier from Turkey were evaluated taking into account the possible limiting factors. For this pest, an expert judgement is given on the likelihood of pest freedom taking into consideration the risk mitigation measures acting on the pest, including uncertainties associated with the assessment. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,719 and 10,000 plants per 10,000 would be free of *P. solenopsis*.

© 2021 European Food Safety Authority. *EFSA Journal* published by John Wiley and Sons Ltd on behalf of European Food Safety Authority.

**Keywords:** oleander, plants for planting, plant health, plant pest, quarantine, European Union

**Requestor:** European Commission

**Question number:** EFSA-Q-2020-00093

**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 Civera, Jonathan Yuen and Lucia Zappalà.

**Declarations of interest:** The declarations of interest of all scientific experts active in EFSA's work are available at <https://ess.efsa.europa.eu/doi/doiweb/doisearch>.

**Acknowledgements:** EFSA wishes to acknowledge the important contribution of the trainee Laura Carotti. L. Carotti provides an essential contribute to the literature search, the compilation of the pest list and the pest datasheets and provided support in drafting and reviewing the Opinion. EFSA wishes to acknowledge the important contribution of the trainee Laura Carotti. L. Carotti provides an essential contribute to the literature search, the compilation of the pest list and the pest datasheets and provided support in drafting and reviewing the Opinion.

**Suggested citation:** EFSA PLH Panel (EFSA Panel on Plant Health), Bragard C, Dehnen-Schmutz K, Di Serio F, Gonthier P, Jacques M-A, Jaques Miret JA, Justesen AF, MacLeod A, Magnusson CS, Milonas P, Navas-Cortes JA, Parnell S, Reignault PL, Thulke H-H, Van der Werf W, Vicent Civera A, Yuen J, Zappalà L, Chatzivassiliou E, Debode J, Manceau C, Gardi C, Mosbach-Schulz O and Potting R, 2021. Scientific Opinion on the commodity risk assessment of *Nerium oleander* plants from Turkey. EFSA Journal 2021;19(5):6569, 34 pp. <https://doi.org/10.2903/j.efsa.2021.6569>

**ISSN:** 1831-4732

© 2021 European Food Safety Authority. *EFSA Journal* published by John Wiley and Sons Ltd on behalf of European Food Safety Authority.

This is an open access article under the terms of the [Creative Commons Attribution-NoDerivs](https://creativecommons.org/licenses/by/4.0/) License, which permits use and distribution in any medium, provided the original work is properly cited and no modifications or adaptations are made.



The EFSA Journal is a publication of the European Food Safety Authority, a European agency funded by the European Union.



## Table of contents

Abstract.....	1
1. Introduction.....	4
1.1. Background and Terms of Reference as provided by European Commission.....	4
1.1.1. Background.....	4
1.1.2. Terms of reference.....	4
1.2. Interpretation of the Terms of Reference.....	4
2. Data and methodologies.....	5
2.1. Data provided by the Turkish NPPO.....	5
2.2. Literature searches performed by EFSA.....	8
2.3. Methodology.....	9
2.3.1. Commodity data.....	9
2.3.2. Identification of pests potentially associated with the commodity.....	9
2.3.3. Listing and evaluation of risk mitigation measures.....	9
2.3.4. Expert Knowledge Elicitation.....	10
3. Commodity data.....	10
3.1. Description of the commodity.....	10
3.2. Description of the production areas.....	11
3.3. Production and handling processes.....	11
3.3.1. Growing conditions.....	11
3.3.2. Source of planting material.....	11
3.3.3. Production cycle.....	11
3.3.4. Pest monitoring during production.....	12
3.3.5. Post-harvest processes and export procedure.....	12
4. Identification of pests potentially associated with the commodity.....	12
4.1. Selection of relevant EU-quarantine pests associated with the commodity.....	12
4.2. Selection of other relevant pests (non-regulated in the EU) associated with the commodity.....	14
4.3. Overview of interceptions.....	14
4.4. List of potential pests not further assessed.....	14
4.5. Summary of pests selected for further evaluation.....	14
5. Risk mitigation measures.....	14
5.1. Possibility of pest presence in the export nurseries.....	15
5.2. Risk mitigation measures proposed.....	15
5.3. Evaluation of the current measures for the selected pests including uncertainties.....	15
5.3.1. Overview of the evaluation of <i>Phenacoccus solenopsis</i> .....	16
5.3.2. Outcome of Expert Knowledge Elicitation.....	16
6. Conclusions.....	19
References.....	19
Glossary.....	20
Abbreviations.....	21
Appendix A – Data sheets of pests selected for further evaluation via Expert Knowledge Elicitation.....	22
Appendix B – Web of Science All Databases Search String.....	30
Appendix C – List of pests that can potentially cause an effect not further assessed.....	33
Appendix D – Excel file with the pest list of <i>Nerium</i> .....	34

## 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<sup>1</sup>, on the protective measures against pests of plants, has been applied from 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 in (EU) 2018/2019<sup>2</sup>. 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<sup>3</sup>, 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 Act 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 *Nerium oleander* from Turkey taking into account the available scientific information, including the technical dossier provided by Turkey.

### 1.2. Interpretation of the Terms of Reference

The EFSA Panel on Plant Health (hereafter referred to as 'the Panel') was requested to conduct a commodity risk assessment of *Nerium oleander* from Turkey following the Guidance on commodity risk assessment for the evaluation of high-risk plant dossiers (EFSA PLH Panel, 2019).

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.

Annex II of Implementing Regulation (EU) 2019/2072 lists certain pests as non-European populations or isolates or species. These pests are considered regulated quarantine pests. Consequently, the respective European populations, or isolates, or species are non-regulated pests.

Annex VII of the same Regulation, in certain cases (e.g. point 32) makes reference to the following countries that are excluded from the obligation to comply with specific import requirements for those non-European populations, or isolates, or species: Albania, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canary Islands, Faeroe Islands, Georgia, Iceland, Liechtenstein, Moldova, Monaco,

<sup>1</sup> Regulation (EU) 2016/2031 of the European Parliament and 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.

<sup>2</sup> 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.

<sup>3</sup> 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.

Montenegro, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (SeveroZapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo-Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug), San Marino, Serbia, Switzerland, Turkey, Ukraine and United Kingdom (except Northern Ireland).<sup>4</sup> Those countries are historically linked to the reference to 'non-European countries' existing in the previous legal framework, Directive 2000/29/EC.

Consequently, for those countries, any pests identified, which are listed as non-European species in Annex II of Implementing Regulation (EU) 2019/2072 should be investigated as any other non-regulated pest.

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 information in the technical dossier (hereafter referred to as 'the Dossier') provided by the applicant (Republic of Turkey, Ministry of Agriculture and Forestry, National Plant Protection Organization - Turkey NPPO) was sufficient to conduct a commodity risk assessment. When necessary, additional information was requested from the applicant.
- Selected the relevant Union quarantine pests and protected zone quarantine pests (as specified in Commission Implementing Regulation (EU) 2019/2072<sup>5</sup>, hereafter referred to as 'EU quarantine pests') and other relevant pests present in *Turkey* and associated with the commodity.
- Did not assess the effectiveness of measures for 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 and/or in the relevant legislative texts for emergency measures and provided that the specific country is in the scope of those emergency measures. The assessment was restricted to whether or not the applicant country applies those measures.

Assessed the effectiveness of the measures described in the dossier 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. Risk management decisions are not within EFSA's remit. Therefore, the Panel provided a rating based on expert judgement regarding the likelihood of pest freedom for each relevant pest given the risk mitigation measures proposed by the Turkish NPPO.

## 2. Data and methodologies

### 2.1. Data provided by the Turkish NPPO

The Panel considered all the data and information (hereafter called 'the Dossier') provided by the Turkish NPPO on 14 September 2020, including the additional information provided by the Turkish NPPO on 4 December 2020, after EFSA's request. The Dossier is managed by EFSA.

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

---

<sup>4</sup> In accordance with the Agreement on the withdrawal of the United Kingdom of Great Britain and Northern Ireland from the European Union and the European Atomic Energy Community, and in particular Article 5(4) of the Protocol on Ireland/Northern Ireland in conjunction with Annex 2 to that Protocol, for the purposes of this Opinion, references to Member States include the United Kingdom in respect of Northern Ireland.

<sup>5</sup> 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.

**Table 1:** Structure and overview of the Dossier

Dossier section	Overview of contents	Filename
1.0	Technical dossier on <i>Nerium oleander</i> (complete document)	EFSA_Dossier-Q-2020-00091_Turkey_Nerium_oleander.pdf
2.0	Additional information provided by the Turkish NPPO on date 27 November 2020	EFSA_Dossier-Q-2020-00091_Turkey_Nerium_oleander - Answers to additional questions.pdf
3.0	Additional information provided by the Turkish NPPO on date 4 December 2020	EFSA_Dossier-Q-2020-00091_Turkey_Nerium_oleander - Answers to additional questions_II.pdf

The data and supporting information provided by the Turkish NPPO formed the basis of the commodity risk assessment.

The databases shown in Table 2 and the resources and references listed below are the main sources used by the Turkish NPPO to compile the Dossier (details on literature searches can be found in the Dossier Section 4):

**Table 2:** Database sources used in the literature searches by the Turkish NPPO

Acronym/ short title	Database name and service provider	URL of database	Justification for choosing database
PPTI	Name: Plant Protection Technical Instructions Provider: Turkish NPPO	<a href="https://www.tarimorman.gov.tr/TAGEM/Belgeler/Bitki%20Zarar%C4%B1lar%C4%B1%20Zirai%20M%C3%BCcadele%20Teknik%20Talimatlar%C4%B1.pdf">https://www.tarimorman.gov.tr/TAGEM/Belgeler/Bitki%20Zarar%C4%B1lar%C4%B1%20Zirai%20M%C3%BCcadele%20Teknik%20Talimatlar%C4%B1.pdf</a> <a href="https://www.tarimorman.gov.tr/TAGEM/Belgeler/Bitki%20Hastal%C4%B1klar%C4%B1%20ve%20Yabanc%C4%B1%20Ot%20Zirai%20M%C3%BCcadele%20Teknik%20Talimatlar%C4%B1.pdf">https://www.tarimorman.gov.tr/TAGEM/Belgeler/Bitki%20Hastal%C4%B1klar%C4%B1%20ve%20Yabanc%C4%B1%20Ot%20Zirai%20M%C3%BCcadele%20Teknik%20Talimatlar%C4%B1.pdf</a>	These instructions are prepared regarding pests in Turkey, which cause damages on their hosts economically. They cover total of 644 pests including bacteria, phytoplasmas, fungi, insects, viruses and viroids.
CABI ISC	CABI Invasive Species Compendium Provider: CAB International	<a href="https://www.cabi.org/ISC">https://www.cabi.org/ISC</a>	EFSA recommendation
EPPO GD	EPPO Global Database Provider: European and Mediterranean Plant Protection Organization	<a href="https://gd.eppo.int/">https://gd.eppo.int/</a>	EFSA recommendation
Plant Protection Bulletin	Plant Protection Bulletin published by the Plant Protection Central Research Institute	<a href="https://dergipark.org.tr/en/pub/bitkorb">https://dergipark.org.tr/en/pub/bitkorb</a>	The journal publishes four times per year with original research articles in English or Turkish languages on plant protection and health.
Fauna Europaea	Name: Fauna Europaea Provider: Museum für Naturkunde Leibniz-Institut für Evolutions- und Biodiversitätsforschung	<a href="https://fauna-eu.org/">https://fauna-eu.org/</a>	Fauna Europaea is Europe's main zoological taxonomic index. The database lists scientific names and distributions of all living, currently known, multicellular, European land and fresh water animal species
Plant Protection Research Annuals	Name: Plant Protection Research Annuals Provider: Ministry of Food, Agriculture and Livestock – Republic of Turkey	<a href="https://arastirma.tarimorman.gov.tr/zmmae/Menu/35/Zirai-Mucadele-Arastirma-Yilliklar">https://arastirma.tarimorman.gov.tr/zmmae/Menu/35/Zirai-Mucadele-Arastirma-Yilliklar</a>	The annuals include the abstracts of research projects carried out by General Directorate of Agricultural Research and Policy in the field of Plant



Acronym/ short title	Database name and service provider	URL of database	Justification for choosing database
			Protection in between 1970 and 1999 years. These annuals were used for the compiling of the pest list in general and D1-D2 lists.
Plant Protection Products Database Application	Name: Plant Protection Products Database Application Provider: Ministry of Food, Agriculture and Livestock – Republic of Turkey	<a href="https://bku.tarim.gov.tr/">https://bku.tarim.gov.tr/</a>	This database covers registered Plant Protection Products in Turkey. It is updated periodically online. This link was used in order to fulfil E1 table content.
IPPC Online	International Plant Protection Convention standards Provider: International Plant Protection Convention	<a href="https://www.ippc.int/en/core-activities/standards-setting/ispms/">https://www.ippc.int/en/core-activities/standards-setting/ispms/</a>	The IPPC provides an international framework for plant protection that includes developing International Standards for Phytosanitary Measures (ISPMs) for safeguarding plant resources. The related ISPM standards were used in order to fulfil D1-D2.

### Other resources used by the Turkish NPPO

- Regulation on the Registration of Plant Passport System and Operators, (<https://kms.kaysis.gov.tr/Home/Goster/40074>)
- Plant Quarantine Regulation, ([https://www.ippc.int/static/media/files/reportingobligation/2017/02/20/Regulation\\_on\\_Plant\\_Quarantine\\_-Turkey\\_2016.pdf](https://www.ippc.int/static/media/files/reportingobligation/2017/02/20/Regulation_on_Plant_Quarantine_-Turkey_2016.pdf))
- Plant Health Standards Instruction in Fruit and Grapevine Saplings and Production Materials, ([https://www.tarimorman.gov.tr/Belgeler/Mevzuat/Talimatlar/BUGEM/Bitki\\_Sa%C4%9F%C4%B1%C4%9F%C4%B1\\_Talimat%C4%B1.pdf](https://www.tarimorman.gov.tr/Belgeler/Mevzuat/Talimatlar/BUGEM/Bitki_Sa%C4%9F%C4%B1%C4%9F%C4%B1_Talimat%C4%B1.pdf))
- Implementing Regulation on Certification and Marketing of Fruit Saplings and Production Materials, (<https://www.mevzuat.gov.tr/Metin.Aspx?MevzuatKod=7.5.13182&MevzuatIliski=0&sourceXmlSearch=meyve%20fidan%C4%B1>)
- Regulation on Authorization and Inspection in Seed Services, (<https://www.mevzuat.gov.tr/Metin.Aspx?MevzuatKod=7.5.13052&MevzuatIliski=0&sourceXmlSearch=tohumculuk>)
- Seed Services Application Instruction
- Seed Export Application Circular.
- Council Directive 2000/29/EC of 8 May 2000 on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community (<https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32000L0029>)
- Instructions of sampling
- Regulation on Authorisation, Inspection and Forest Plant Passport in the Forest Plant Seed Marketing (<https://www.mevzuat.gov.tr/Metin.Aspx?MevzuatKod=7.5.22699&MevzuatIliski=0&sourceXmlSearch=orman%20bitki%20pasaportu>)
- Regulation on The Trade of Forest Growing Materials (1999/105/Ec) (<https://www.mevzuat.gov.tr/Metin.Aspx?MevzuatKod=7.5.9882&MevzuatIliski=0&sourceXmlSearch=orman%20yeti%C5%9Ftime>)

## 2.2. Literature searches performed by EFSA

Literature searches were undertaken by EFSA to complete a list of pests potentially associated with *N. oleander* in Turkey. Two searches were combined: i) a general search to identify pests of *Nerium*, particularly *N. oleander*, in different databases; and ii) a tailored search to identify whether these pests are present in Turkey. The searches were launched on the 6 March 2020 and concluded on 18 March 2020. No language, date or document type restrictions were applied in the search strategy.

The Panel used the databases indicated in Table 3 to compile the list of pests associated with *Nerium*. As for Web of Science, the literature search was performed using a specific, ad hoc established search string (see Appendix B). The search strategy used for 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 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 string was run in 'All Databases' with no range limits for time or language filters.

**Table 3:** Databases used by EFSA for the compilation of the pest list associated to the genus *Nerium*

Database	Platform/Link
Aphids on World Plants	<a href="http://www.aphidsonworldsplants.info/C_HOSTS_AAIntro.htm">http://www.aphidsonworldsplants.info/C_HOSTS_AAIntro.htm</a>
CABI Crop Protection Compendium	<a href="https://www.cabi.org/cpc/">https://www.cabi.org/cpc/</a>
Database of Insects and their Food Plants	<a href="http://www.brc.ac.uk/dbif/hosts.aspx">http://www.brc.ac.uk/dbif/hosts.aspx</a>
Database of the World's Lepidopteran Hostplants	<a href="https://www.nhm.ac.uk/our-science/data/hostplants/search/index.dsml">https://www.nhm.ac.uk/our-science/data/hostplants/search/index.dsml</a>
EPPO Global Database	<a href="https://gd.eppo.int/">https://gd.eppo.int/</a>
EUROPHYT	<a href="https://webgate.ec.europa.eu/europhyt/">https://webgate.ec.europa.eu/europhyt/</a>
Leaf-miners	<a href="http://www.leafmines.co.uk/html/plants.htm">http://www.leafmines.co.uk/html/plants.htm</a>
Nemaplex	<a href="http://nemaplex.ucdavis.edu/Nemabase2010/PlantNematodeHostStatusDDQuery.aspx">http://nemaplex.ucdavis.edu/Nemabase2010/PlantNematodeHostStatusDDQuery.aspx</a>
Plant Viruses Online	<a href="http://bio-mirror.im.ac.cn/mirrors/pvo/vid/famindex.htm">http://bio-mirror.im.ac.cn/mirrors/pvo/vid/famindex.htm</a>
International Committee on Taxonomy of Viruses (ICTV) - Master Species List	<a href="https://talk.ictvonline.org/files/master-species-lists/m/msl/9601">https://talk.ictvonline.org/files/master-species-lists/m/msl/9601</a>
Scalenet	<a href="http://scalenet.info/associates/">http://scalenet.info/associates/</a>
Spider Mites Web	<a href="https://www1.montpellier.inra.fr/CBGP/spmweb/advanced.php">https://www1.montpellier.inra.fr/CBGP/spmweb/advanced.php</a>
USDA ARS Fungi Database	<a href="https://nt.ars-grin.gov/fungaldatabases/fungushost/fungushost.cfm">https://nt.ars-grin.gov/fungaldatabases/fungushost/fungushost.cfm</a>
Index Fungorum	<a href="http://www.indexfungorum.org/Names/Names.asp">http://www.indexfungorum.org/Names/Names.asp</a>
Mycobank	<a href="https://www.mycobank.com">https://www.mycobank.com</a>
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)	<a href="https://www.webofknowledge.com">https://www.webofknowledge.com</a>
World Agroforestry	<a href="http://www.worldagroforestry.org/treedb2/speciesprofile.php?Spid=1749">http://www.worldagroforestry.org/treedb2/speciesprofile.php?Spid=1749</a>
Catalog of the Cecidomyiidae (Diptera) of the world	<a href="https://www.ars.usda.gov/ARSUserFiles/80420580/Gagne_2014_World_Cecidomyiidae_Catalog_3rd_Edition.pdf">https://www.ars.usda.gov/ARSUserFiles/80420580/Gagne_2014_World_Cecidomyiidae_Catalog_3rd_Edition.pdf</a>
Catalog of the Eriophoidea (Acarina: Prostigmata) of the world.	<a href="https://www.cabi.org/isc/abstract/19951100613">https://www.cabi.org/isc/abstract/19951100613</a>
Global Biodiversity Information Facility (GBIF)	<a href="https://www.gbif.org/">https://www.gbif.org/</a>
TRACES	<a href="https://webgate.ec.europa.eu/tracesnt/login">https://webgate.ec.europa.eu/tracesnt/login</a>

Additional searches, limited to retrieve documents, were run when developing the opinion. The available scientific information including previous EFSA opinions on the relevant pests and diseases (see pest data sheets in Appendix A) and the relevant literature and legislation (e.g. Regulation (EU) 2016/2031; Commission Implementing Regulations (EU) 2018/2019; (EU) 2018/2018 and (EU) 2019/2072) were taken into account.

### 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, 2019).



In the first step, pests potentially associated with the commodity in the country of origin (EU-regulated pests and other pests) that may require risk mitigation measures were identified. The EU non-regulated 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 plants out of 10,000 exported plants.

### 2.3.1. Commodity data

Based on the information provided by the Turkish NPPO, the characteristics of the commodity are summarised.

### 2.3.2. Identification of pests potentially associated with the commodity

To evaluate the pest risk associated with the importation of *N. oleander* plants from Turkey, a pest list was compiled. The pest list is a compilation of all identified plant pests associated with *N. oleander* based on information provided in the Dossier Section 4.0 and on searches performed by the Panel.

The pest list (see Microsoft Excel<sup>®</sup> file in Appendix D) is a document that includes pests that use the host plant at genus level (*Nerium*), retrieved from EPPO Global Database, CABI Crop Protection Compendium. Other databases were consulted at plant species level. An overview of the consulted sources is listed in Table 3.

The search strategy used for Web of Science Databases was designed combining common English 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 between 16th and 18th of March 2020.

The titles and abstracts of the scientific papers retrieved were screened and the pests associated with *Nerium* spp. were included in the pest list.

EUROPHYT and TRACES NT were investigated by searching for the interceptions associated with commodities imported from Turkey, at species and genus level, from 1995 to the present.

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

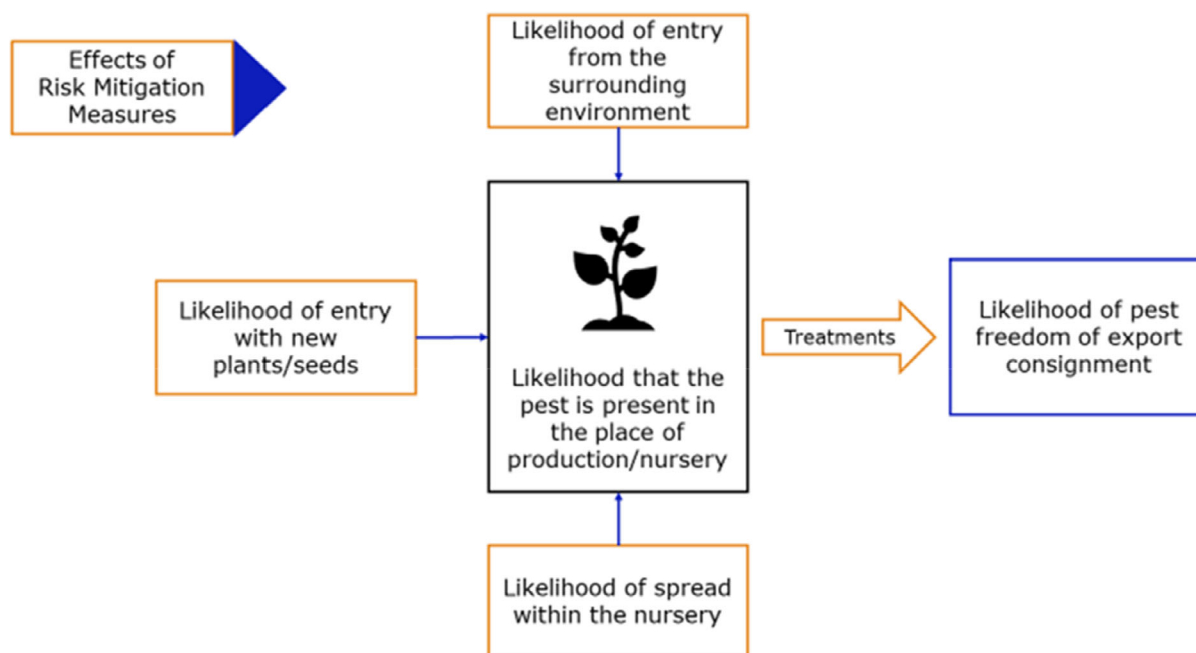
Pests for which limited information was available on one or more criteria used to identify them as relevant for this opinion, e.g. on potential impact, are listed in Appendix C (List of pests that can potentially cause an effect not further assessed).

### 2.3.3. Listing and evaluation of risk mitigation measures

The proposed risk mitigation measures were listed and evaluated. When evaluating the likelihood of pest freedom at origin, the following types of potential infection/infestation sources for *N. oleander* in 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 Turkish NPPO) were evaluated with Expert Knowledge Elicitation (EKE) according to the Guidance on uncertainty analysis in scientific assessment (EFSA Scientific Committee, 2018).



Source: EFSA PLH Panel (2019).

**Figure 1:** Conceptual framework to assess likelihood that plants are exported free from relevant pests

Information on the biology, estimates of likelihood of entry of the pest into the nursery and spread within the nursery and the effect of the measures on a specific pest is summarised in pest data sheets compiled for each pest selected for further evaluation (see Appendix A).

#### 2.3.4. Expert Knowledge Elicitation

To estimate the pest freedom of the commodities, an Expert Knowledge Elicitation (EKE) was performed following EFSA guidance (Annex B.8 of EFSA Scientific Committee, 2018). The specific question for EKE was defined as follows: 'Taking into account (i) the risk mitigation measures listed in the Dossier, and (ii) other relevant information, how many of 10,000 *N. oleander* plants (i.e. bare rooted plants or potted plants) will be infested with the relevant pest/pathogen when arriving in the EU?'

The risk assessment uses individual plants as the most suitable unit. The following reasoning is given:

- i) There is no quantitative information available regarding clustering of plants during production.
- ii) For the pests under consideration, a cross contamination during transport is not likely.
- iii) Plants will be finally distributed to final consumers by wholesaler and retailers.

The uncertainties associated with the EKE were taken into account and quantified in the probability distribution applying the semiformal method described in Section 3.5.2 of the EFSA-PLH Guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018a,b). Finally, the results were reported 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.

The EKE was performed together for bare rooted plants and plants in pots, if the biology of the pest, the production systems and the risk mitigation measures suggested the same likelihood of pest freedom for both commodities.

### 3. Commodity data

#### 3.1. Description of the commodity

The commodity to be imported are *N. oleander* (common name: oleander; family: Apocynaceae) potted plants. Plants are not grafted.

The age of the plants at the time of export is from 1 to 4 years, which corresponds to 40–200 cm height (depending on the age). The potted plants (of variable/undefined size, age and origin inside Turkey) are loaded on trucks (number of plants per truck not specified).

According to ISPM 36 (FAO, 2019), the commodities can be classified as 'rooted plants in pots'.

### 3.2. Description of the production areas

The *N. oleander* plants for export are grown in open field plant nurseries, members of the Ornamental Plants Growers Union (SÜSBİR) (<http://eng.susbir.org.tr/>).

There is no information on physical separation between areas destined to the domestic production and areas destined to export, as well as separation from other species possibly grown in the same nursery.

The main production areas of *N. oleander* plants for export are in the Mediterranean, Aegean and Marmara regions, i.e. Adana, Antalya, Aydın, Gaziantep, Izmir, Hatay, Istanbul, Kocaeli, Mersin, Muğla, Sakarya, Samsun, Trabzon, Yalova (Figure 2). Forest nurseries producing propagating materials are located in Adana, Antalya, Aydın, Balıkesir, Bursa, Çanakkale, Denizli, Eskişehir, Gaziantep, Izmir, Hatay, Istanbul, Mardin, Mersin, Muğla, Osmaniye, Sakarya, Samsun, Şanlıurfa, Sinop and Trabzon are the main provider of 1- to 2-year-old saplings to the ornamental production growers.



**Figure 2:** Main production areas (indicated in green) in Turkey of *Nerium oleander* plants for export (provided by the Turkish NPPO). Red stars indicate areas where the nurseries produce plants for both domestic use and export

### 3.3. Production and handling processes

#### 3.3.1. Growing conditions

In forest nurseries, *N. oleander* saplings are mainly produced by using seeds or semi-wooded cuttings. In production nurseries, they are grown in open fields. Plants are grown individually in pots filled with peat, on stone chips laid on a jute black base without ground soil connection.

#### 3.3.2. Source of planting material

The source of propagating material mainly originates from forest nurseries in Turkey that supply saplings to the production nurseries. Forest nurseries are located throughout Turkey.

#### 3.3.3. Production cycle

*N. oleander* saplings are produced by using seeds or semi-wooded cuttings in seedbeds. Depending on the region, production starts with seeds sown between the beginning of March and the end of April, or by rooting semi-wooded cuttings using hormones from the beginning of March to mid-April.

Saplings are transplanted in pots. No information on the period/time of transplanting is provided. Potted plants remain in the production facilities for 1–3 years.

### 3.3.4. Pest monitoring during production

Forest nurseries affiliated with the General Directorate of Forestry are not directly exporting/importing nurseries, but they are the main providers of the planting material of the production nurseries. They are inspected by forestry inspectors as a routine work (at least once a month). Forest nurseries are also inspected once a year for phytosanitary requirements by the Provincial Directorate of Agriculture.

All production nurseries are inspected at least once a year, regardless of whether they are exporting or not. In addition, producers submit a declaration every 6 months of what they produce.

In the production nurseries of ornamentals, all plants are inspected visually, and samples are taken from symptomatic plants to be analysed by authorised laboratories, if necessary. There is no information on the frequency of these inspections. Traded ornamental plants are required to be free from any kind of disease symptoms or pests. No information is provided on actions taken in case a harmful organism is identified in the nursery.

### 3.3.5. Post-harvest processes and export procedure

A preventive insecticide treatment with malathion formulations is applied before loading the plants to be transported. Plants are loaded on refrigerated trucks with controlled conditions (relative humidity range 85–95%, temperature range 2–4°C) for export. Individual pots are placed one by one in a row in the truck. The number of pots depends on the loading capacity of the truck and the age/size of the plants. Shipments can contain either only *N. oleander* plants or be mixed with other unidentified species.

The planned production for export in the EU in 2020 was estimated to be 1,935 plants. The months on which the plants are to be exported to the EU are indicated in Table 4.

**Table 4:** Scheduling of *N. oleander* plants planned to be exported (indicated in grey)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
<i>Nerium</i>												

## 4. Identification of pests potentially associated with the commodity

The search for potential pests associated with *Nerium* resulted in 399 species (see Microsoft Excel<sup>®</sup> 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.

Eight EU-quarantine species that are reported to use *Nerium* as a host plant were evaluated for their relevance of being included in this opinion (Table 5).

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

- the pest is present in Turkey;
- Nerium* is a host of the pest;
- one or more life stages of the pest can be associated with the specified commodity.

The Panel notes that *Bemisia tabaci* is a pest of *Nerium* plants and present in Turkey. All non-European populations of *B. tabaci* are regulated. However, according to the EU plant health legislation, Turkey is considered to be part of the European area (see Section 1.2); therefore, *B. tabaci* was not included for evaluation.

None of the eight EU-quarantine pest species evaluated fulfilled the criteria to be selected for further evaluation (Table 5).

**Table 5:** Overview of the evaluation of the eight EU-quarantine pest species known to use *Nerium* as a host plant for their relevance for this Opinion

Number	Pest name according to the EU legislation <sup>(a)</sup>	EPPO code	Group	<i>Nerium</i> confirmed as a host (reference)	Presence in Turkey	Pest relevant for the opinion
1	<i>Bactrocera tryoni</i>	DACUTR	Insects	CABI (online), EPPO (online)	No	No
2	<i>Homalodisca vitripennis</i>	HOMLTR	Insects	EPPO (online)	No	No
3	<i>Phymatotrichopsis omnivora</i>	PHMPOM	Fungi	USDA ARS Fungi Database	No	No
4	<i>Phytophthora ramorum</i>	PHYTRA	Fungi	EPPO (online)	No	No
5	<i>Ripersiella hibisci</i>	RHIOHI	Insects	EPPO (online)	No	No
6	<i>Spodoptera eridania</i>	PRODER	Insects	CABI (online)	No	No
7	<i>Xiphinema americanum sensu stricto</i> <sup>(c)</sup>	XIPHAA	Nematodes	CABI (online)	No	No
8	<i>Xylella fastidiosa</i>	XYLEFA	Bacteria	EPPO (online)	No	No

(a): Commission Implementing Regulation (EU) 2019/2072.

(b): The question if the pest can be associated with the commodity is evaluated if the previous two questions are answered with 'yes'.

(c): *Xiphinema americanum* is reported to be present in Turkey (CABI, online; Bora, 1970). According to the current taxonomy of the *Xiphinema americanum sensu lato* species complex (EPPO 2017; EFSA PLH Panel, 2018) the species nomen *X. americanum sensu stricto* is restricted to one of the 61 species within the complex. Older reports (e.g. Bora, 1970) referring to *X. americanum* do not consider the current classification and, therefore, there could be uncertainties about the species present. According to the Turkish NPPO, *X. americanum sensu stricto* is not present in Turkey.

## 4.2. Selection of other relevant pests (non-regulated in the EU) associated with the commodity

The information provided by the Turkish NPPO, integrated with the search EFSA performed, was evaluated in order to assess whether there are other potentially relevant pests of *Nerium*, present in the country of export. 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 non-regulated pests that are potentially associated with *Nerium* were also evaluated to determine their relevance for this opinion based on evidence that:

- the pest is present in Turkey;
- the pest (i) is absent or (ii) has a limited distribution in the EU and it is under official control at least in one of the MSs where it is present;
- Nerium* is a host of the pest;
- one or more life stages of the pest can be associated with the specified commodity;
- 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, 369 potential pests not regulated in the EU, known to be associated with *Nerium* 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 the Appendix D (Microsoft Excel<sup>®</sup> file). Of the evaluated EU non-regulated pests, one insect (*Phenacoccus solenopsis*), was selected for further evaluation, because it met all the selection criteria. More information on this pest 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 *Nerium* can provide information on some of the organisms that can be present on *Nerium* plants in trade. According to EUROPHYT online (accessed on 12 February 2020) and TRACES NT online (accessed on 22 March 2021) there were no records of interceptions for plants for planting of *Nerium* from Turkey (1995 – 22/3/2021).

## 4.4. List of potential pests not further assessed

From the *Nerium* pests not selected for further evaluation, the Panel highlighted five species that can potentially have an impact (see Appendix C), but for which the currently available evidence does not provide reasons for further evaluation in this opinion. The detailed reasoning is provided for each species in Appendix C.

## 4.5. Summary of pests selected for further evaluation

One pest that was identified to be present in Turkey and having potential for association with *N. oleander* destined for export is listed in Table 6. The efficacy of the risk mitigation measures applied to the commodity was evaluated for this selected pest.

**Table 6:** List of relevant pest selected for further evaluation

Number	Current scientific name	EPPO code	Name used in the EU legislation	Taxonomic information	Group	Regulatory status
1	<i>Phenacoccus solenopsis</i>	PHENSO	N/A	Pseudococcidae	Insects	Not regulated in the EU

## 5. Risk mitigation measures

For the selected pest (Table 6), the Panel assessed the possibility that it could be present in nurseries producing *N. oleander* plants 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 efficacy of the risk mitigation measures is summarised in a pest data sheet (see Appendix A).

### 5.1. Possibility of pest presence in the export nurseries

For the selected pest (Table 6), the Panel evaluated the likelihood that the pest could be present in a *N. oleander* nursery by evaluating the possibility that *N. oleander* plants 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 proposed

With the information provided by the Turkish NPPO (Dossier sections 3 and 5), the Panel summarised the risk mitigation measures (see Table 7) that are currently applied in the production nurseries.

**Table 7:** Overview of currently applied risk mitigation measures for *N. oleander* plants designated for export to the EU from Turkey

	Risk mitigation measure	Implementation in Turkey
1	Registration of the nursery and Phytosanitary management	Forest nurseries (producing young plants) are officially registered and inspected at least once a year with an unknown monitoring intensity. All nurseries producing ornamental plants are required to be a member of the ornamental plant grower union in Turkey and inspected at least once a year with an unknown monitoring intensity. A plant passport or export certificate is issued by the NPPO.
2	Physical protection	Some production of the early stages of plants, but not of the older ones, may take place in production places with netting.
3	Pest monitoring and inspections by the nursery staff during the production process	There are guidelines available for detection of pests in agricultural crops (technical instructions for plant pests in agricultural crops – link in Dossier, Section 1). There are no targeted inspections for <i>P. solenopsis</i> .
4	Pesticide treatment	There is a database for registered insecticides in Turkey. There are no products registered for <i>Nerium</i> . There are guidelines available for the management of pests in agricultural crops (technical instructions for plant pests in agricultural crops – link in Dossier, Section 1). In the dossier it is indicated that only malathion is used to control aphids and before loading plants for export.
5	Surveillance	There are no targeted surveys for <i>P. solenopsis</i> .

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

The relevant risk mitigation measures acting on *P. solenopsis* were identified. Any limiting factors on the efficacy of the measures were documented. 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, an expert judgement has been given for the likelihood of pest freedom of the commodity taking into consideration the risk mitigation measures acting on the pest and their combination.

An overview of the evaluation of *P. solenopsis* is given in the sections below (Sections 5.3.1). The outcome of EKE on pest freedom after the evaluation of the proposed risk mitigation measures is summarised in Section 5.3.2.

### 5.3.1. Overview of the evaluation of *Phenacoccus solenopsis*

Rating of the likelihood of pest freedom	Very frequently pest free <b>(based on the Median)</b>				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free plants	<b>9,719</b> out of 10,000 plants	<b>9,786</b> out of 10,000 plants	<b>9,855</b> out of 10,000 plants	<b>9,922</b> out of 10,000 plants	<b>9,980</b> out of 10,000 plants
Proportion of infested plants <sup>(a)</sup>	<b>20</b> out of 10,000 plants	<b>78</b> out of 10,000 plants	<b>145</b> out of 10,000 plants	<b>214</b> out of 10,000 plants	<b>281</b> out of 10,000 plants
Summary of the information used for the evaluation	<p><b>Possibility that the pest could become associate with the commodity</b>  <i>Phenacoccus solenopsis</i> is a polyphagous mealybug that can be present on all parts of <i>Nerium oleander</i> plants. The pest is known as a cotton pest and is present in Turkey since 2012 and is now reported to be present along the Mediterranean coast on many host plant species. <i>N. oleander</i> plants destined for export to the EU are produced by nurseries located in the area where <i>P. solenopsis</i> is present. Plants are grown in open fields and the pest can enter a nursery from the surrounding environment in the crawler stage or through the introduction of infested propagation material (<i>N. oleander</i> and other host plants species) originating from forest nurseries located in areas where the pest is present.</p> <p><b>Measures taken against the pest and their efficacy</b>  <i>P. solenopsis</i> has no quarantine status in Turkey and there are no targeted measures in place against this pest. Nurseries are inspected at least once per year and export consignments are inspected with unknown inspection and sampling intensities. The pest is relatively easy to detect (honeydew) and may be controlled by nurseries with standard insecticide treatments.</p> <p><b>Interception records</b>  There are no records of interceptions of <i>P. solenopsis</i> from Turkey.</p> <p><b>Shortcomings of current measures/procedures</b>  <i>P. solenopsis</i> has no quarantine status in Turkey and there are no targeted surveys, inspections and measures in place against this pest. Nurseries may be unaware of the presence of the pest in the production area.</p> <p><b>Main uncertainties</b>  The pest prevalence in the surrounding environment is unknown. No information is available regarding the presence of other host plant species of <i>P. solenopsis</i> in nurseries producing <i>Nerium</i>.</p>				

(a): The number of pest free plants per 10,000" is calculated as "10,000 - Number of infested plants per 10,000" and reordered from small to large to obtain the percentiles.

### 5.3.2. Outcome of Expert Knowledge Elicitation

Table 8 and Figure 3 show the outcome of the EKE regarding pest freedom after the evaluation of the currently proposed risk mitigation measures for the selected pests.

Figure 4 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. solenopsis* on potted plants of *N. oleander* designated for export to the EU.

**Table 8:** Assessment of the likelihood of pest freedom following evaluation of current risk mitigation measures against *Phenacoccus solenopsis* on *Nerium oleander* potted plants designated for export to the EU. In panel A, 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. The pest freedom categories are defined in panel B of the table

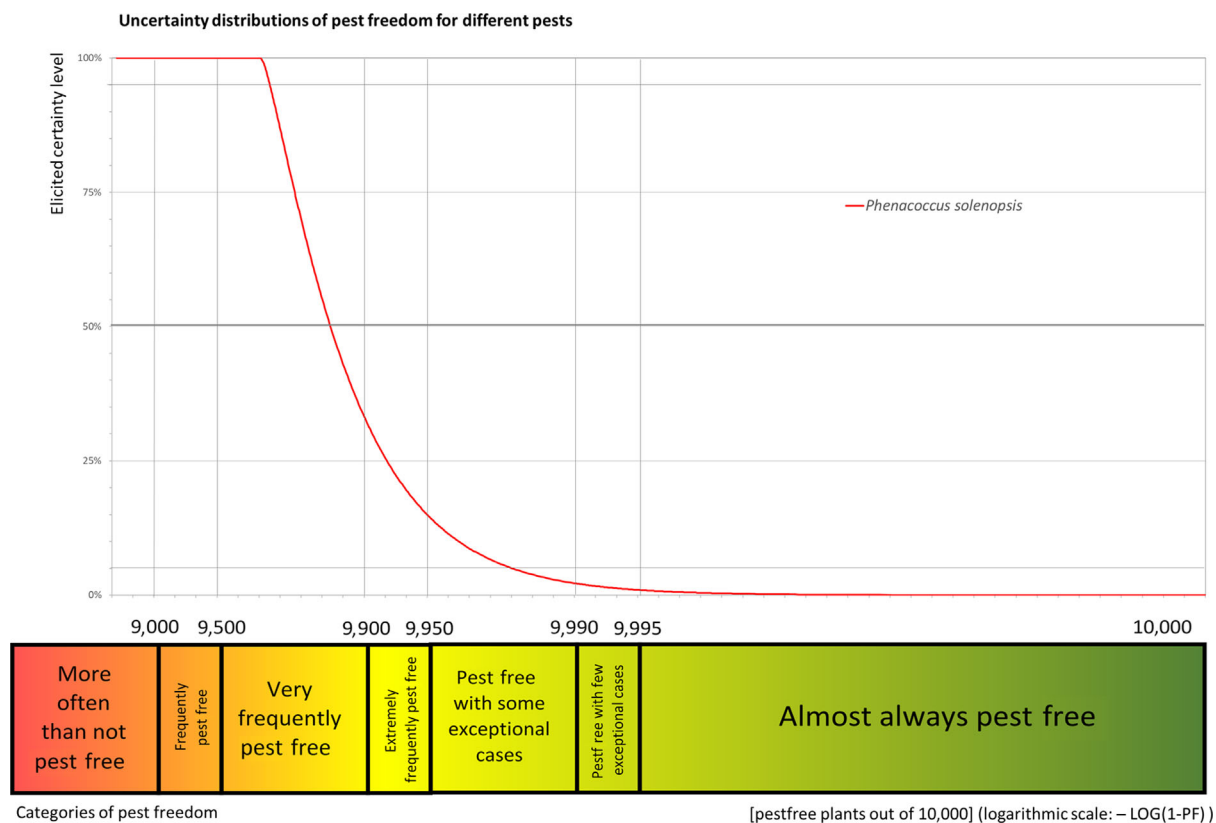
Pest species	Sometimes pest free	More often than not pest free	Frequently pest free	Very frequently pest free	Extremely frequently pest free	Pest free with some exceptional cases	Pest free with few exceptional cases	Almost always pest free
<i>Phenacoccus solenopsis</i>				LM		U		

PANEL A

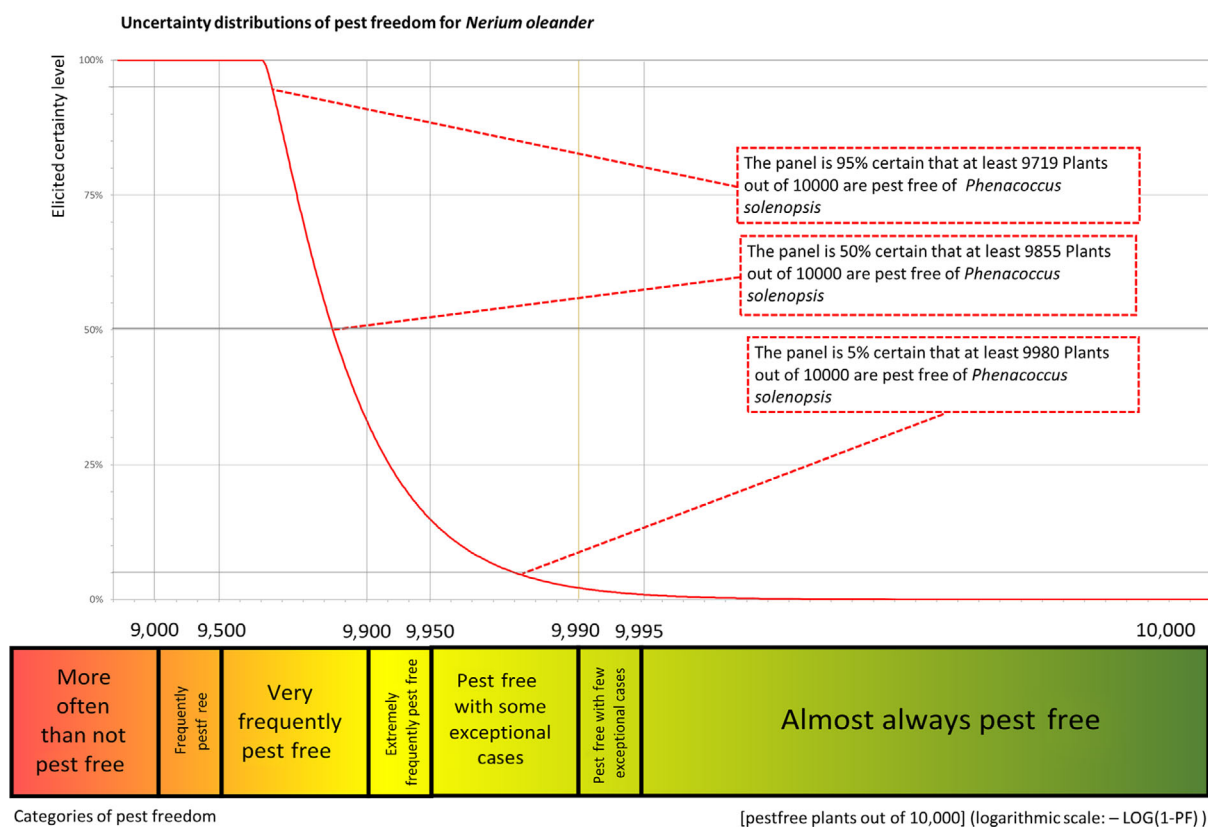
	Pest freedom category	Pest free plants out of 10,000
	Sometimes pest free	≤5,000
	More often than not pest free	5,000 - ≤9,000
	Frequently pest free	9,000 - ≤9,500
	Very frequently pest free	9,500 - ≤9,900
	Extremely frequently pest free	9,900 - ≤9,950
	Pest free with some exceptional cases	9,950 - ≤9,990
	Pest free with few exceptional cases	9,990 - ≤9,995
	Almost always pest free	9,995 - ≤10,000

PANEL B

Legend of pest freedom categories	
L	Pest freedom category includes the elicited lower bound of the 90% uncertainty range
M	Pest freedom category includes the elicited median
U	Pest freedom category includes the elicited upper bound of the 90% uncertainty range



**Figure 3:** Elicited certainty (y-axis) of the number of pest-free *N. oleander* plants (x-axis; log-scaled) out of 10,000 plants designated for export to the EU introduced from Turkey 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 9719 or more plants per 10,000 will be free from *P. solenopsis*



**Figure 4:** Explanation of the descending distribution function describing the likelihood of pest freedom after the evaluation of the currently proposed risk mitigation measures for plants designated for export to the EU based on based on the example of *P. solenopsis*

## 6. Conclusions

The cotton mealybug, *Phenacoccus solenopsis*, is identified to be present in Turkey and considered to be potentially associated with potted plants of *Nerium oleander* imported from Turkey and relevant for the EU.

The likelihood of pest freedom following evaluation of 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 9,719 and 10,000 plants per 10,000 will be free from *P. solenopsis*.

## References

- Bora A, 1970. Studies on plant-parasitic nematodes in the Black Sea region and their distribution and possibilities for chemical control. Bitki Koruma Bulteni, 10, 53–71.
- CABI (Centre for Agriculture and Bioscience International), online. CABI Crop Protection Compendium. Available online: <https://www.cabi.org/cpc/> [Accessed: 15 November 2020]
- EFSA PLH Panel (EFSA Panel on Plant Health), 2018a. 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), 2018b. Pest categorisation of *Xiphinema sensu lato*. EFSA Journal 2018;16(7):5298, 43 pp. <https://doi.org/10.2903/j.efsa.2018.5298>
- EFSA PLH Panel (EFSA Panel on Plant Health), 2019. 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), 2021. Commodity risk assessment of *Ficus carica* plants from Israel. EFSA Journal 2021;19(1):6353, 249 pp. <https://doi.org/10.2903/j.efsa.2021.6353>
- 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), 2017. PM 7/95 (2): *Xiphinema americanum sensu lato*. Bulletin OEPP/EPPO Bulletin, 47, 198–210.

- EPPO (European and Mediterranean Plant Protection Organization), online. EPPO Global Database. Available online: <https://www.eppo.int/> [Accessed: 26 October 2019]
- 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](http://ec.europa.eu/food/plant/plant_health_biosecurity/europhyt/index_en.htm) [Accessed: 14 October 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: [www.ippc.int/en/publications/614/](http://www.ippc.int/en/publications/614/)
- 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/>
- FAO (Food and Agriculture Organization of the United Nations), 2019. 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/>
- TRACES-NT, online. TRAdE Control and Expert System. Available online: <https://webgate.ec.europa.eu/tracesnt> [Accessed: 22 March 2021]

## 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)
Greenhouse	A walk-in, static, closed place of crop production with a usually translucent outer shell, which allows controlled exchange of material and energy with the surroundings and prevents release of plant protection products (PPPs) into the environment.
Impact (of a pest)	The impact of the pest on the crop output and quality and on the environment in the occupied spatial units
Introduction (of a pest)	The entry of a pest resulting in its establishment (FAO, 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

CABI	Centre for Agriculture and Bioscience International
EKE	Expert knowledge elicitation
EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization
ISPM	International Standards for Phytosanitary Measures
PPIS	Plant Protection & Inspection Services
PLH	Plant Health
PRA	Pest Risk Assessment
RNQPs	Regulated Non-Quarantine Pests

## Appendix A – Data sheets of pests selected for further evaluation via Expert Knowledge Elicitation

### A.1. Phenacoccus solenopsis

#### A.1.1. Organism information

<b>Taxonomic information</b>	<p>Current valid scientific name: <i>Phenacoccus solenopsis</i></p> <p>Synonyms: <i>Phenacoccus cevalliae</i>, <i>Phenacoccus gossypiphilous</i></p> <p>Name used in the EU legislation: –</p> <p>Order: Hemiptera</p> <p>Family: Pseudococcidae</p> <p>Common name: cotton mealybug, solenopsis mealybug</p> <p>Name used in the Dossier: <i>Phenacoccus solenopsis</i></p>
<b>Group</b>	Insects
<b>EPPO code</b>	PHENSO
<b>Regulated status</b>	<p><i>Phenacoccus solenopsis</i> is not regulated in the EU, neither listed by EPPO.</p> <p>It is a quarantine pest in Bangladesh (Islam et al., 2017).</p>
<b>Pest status in Turkey</b>	<p>Present, few occurrences (EPPO, online)</p> <p>First found in Turkey in 2012 on ornamental plants in the city centre of Adana (EPPO, online)</p>
<b>Pest status in the EU</b>	Restricted, present in Cyprus (EPPO, online) and recently in Greece (EFSA PLH Panel, 2021).
<b>Host status on <i>Nerium oleander</i></b>	<i>Nerium oleander</i> is reported as a host plant by Fallahzadeh et al. (2014) in Iran.
<b>PRA information</b>	<p>Pest Risk Assessments available for <i>Phenacoccus solenopsis</i> are</p> <ul style="list-style-type: none"> <li>– Rapid Pest Risk Analysis for <i>Phenacoccus solenopsis</i> (Cotton mealybug) and the closely related <i>P. defectus</i> and <i>P. solani</i> (Malumphy et al., 2013),</li> <li>– Pest Risk Analysis (PRA) of mealybugs spp. in Bangladesh (Islam et al., 2017).</li> </ul>

#### Other relevant information for the assessment

<b>Biology</b>	<p><i>P. solenopsis</i> originates from southern California and Nevada (Spodek et al., 2018). The life cycle of <i>P. solenopsis</i> ranges between 28 and 35 days. The pest can complete about 8–12 generations in a year (Fand and Suroshe, 2015).</p> <p>The female of <i>P. solenopsis</i> develop through an egg, three nymphal instars to an adult. The male has an additional nymphal stage, the last two are called prepupa and pupa. Males have wings and females are wingless. Reproduction is sexual and ovoviviparous. Adult females are pale yellow to orange covered by powdery, wax secretion (Hodgson et al., 2008). They mate only once and lay approximately 150–600 eggs in a white, waxy ovisac (Fand and Suroshe, 2015). Facultative parthenogenesis was observed under laboratory conditions of mealybugs collected from Nagpur, India (Vennila et al., 2010).</p> <p>The first nymphs are crawlers, which disperse to other parts of the same plant or get carried by the wind or other means (machinery, workers, animals) to other areas (Hodgson et al., 2008).</p> <p>The adult males live from few hours up to 3 days, depending on the temperature (Hodgson et al., 2008). Adult females can live for up to 3 months (Gerson and Aplebaum, online).</p> <p>In Israel, the pest was observed on roots and root collars of weeds. In winter, <i>P. solenopsis</i> populations were found on the stems, branches and root collar of hibiscus plants (Spodek et al., 2018).</p> <p>It overwinters as an adult female, on the bark, the stem and branches of woody plants. It seems that it may develop in the ground on roots of non-woody plants (Spodek et al., 2018). This mealybug has been reported to be capable of surviving temperatures ranging from 0 to 45°C, throughout the year (CABI, online).</p>
----------------	---

<b>Symptoms</b>	<b>Main type of symptoms</b>	<p><i>P. solenopsis</i> prefers the upper parts of the plants, young shoots or branches carrying fruitlets (Spodek et al., 2018). Large populations of mealybugs cause general weakening, distortion, defoliation, dieback and death of susceptible plants (Malumphy et al., 2013). Plants become covered in a sooty mould that grow on the honeydew produced by mealybugs.</p> <p>The infested plants of cotton become stunted, growth appears to stop, and most plants look dehydrated. In severe outbreaks, the bolls fail to open, and defoliation occurs (including the loss of flower buds, flowers and immature bolls) (Hodgson et al., 2008).</p> <p>On tomatoes, the pest causes foliar yellowing, leaf wrinkling, puckering and severe damage, resulting in death (Ibrahim et al., 2015).</p>
	<b>Presence of asymptomatic plants</b>	Plant damage might not be obvious in early infestation or during dormancy (due to absence of leaves), but the presence of mealybugs on the plants could be observed. During the crawler stage, infestation is difficult to be noted (Ben-Dov, 1994).
	<b>Confusion with other pathogens/pests</b>	<i>P. solenopsis</i> is very similar to other species of <i>Phenacoccus</i> . A microscope observation with the morphological key is needed for identification of the pest (Hodgson et al., 2008).
<b>Host plant range</b>	<p><i>P. solenopsis</i> is highly invasive and polyphagous pest, and it is reported from more than 200 plant species (Fand and Suroshe, 2015).</p> <p>The host plants of economic importance are: okra (<i>Abelmoschus esculentus</i>), sapota (<i>Achras zapota</i>), cashew (<i>Anacardium occidentale</i>), pigeon pea (<i>Cajanus cajan</i>), chilli (<i>Capsicum annum</i>), papaya (<i>Carica papaya</i>), watermelon (<i>Citrullus lanatus</i>), round melon (<i>Citrullus vulgaris</i>), musk melon (<i>Cucumis melo</i>), pumpkin (<i>Cucurbita moschata</i>), cluster bean (<i>Cyamopsis tetragonoloba</i>), fig (<i>Ficus carica</i>), cotton (<i>Gossypium hirsutum</i>), sunflower (<i>Helianthus annuus</i>), mesta (<i>Hibiscus cannabinus</i>), ambadi (<i>Hibiscus sabdariffa</i>), bottle gourd (<i>Lagenaria siceraria</i>), crape myrtle (<i>Lagerstroemia indica</i>), Rrdge gourd (<i>Luffa acutangula</i>), sponge gourd (<i>Luffa aegyptiaca</i>), mango (<i>Mangifera indica</i>), bitter guard (<i>Momordica charantia</i>), white mulberry (<i>Morus alba</i>), guava (<i>Psidium guajava</i>), pomegranate (<i>Punica granatum</i>), sesame (<i>Sesamum indicum</i>), tomato (<i>Solanum lycopersicum</i>), brinjal (<i>Solanum melongena</i>), potato (<i>Solanum tuberosum</i>), jowar (<i>Sorghum bicolor</i>), green gram (<i>Vigna radiata</i>), common grape vine (<i>Vitis vinifera</i>), ber (<i>Ziziphus mauritiana</i>) and many other plants (Arif et al., 2009; Fallahzadeh et al., 2014; Fand and Suroshe, 2015; García Morales et al., online). Weed species are also suitable host plants for <i>Phenacoccus solenopsis</i> (Vennila et al., 2013).</p>	
<b>Pathways</b>	<p>The pest can be present on all parts of the commodity (leaves and stem of potted plants).</p> <p>Other 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).</p>	
<b>Impact</b>	The main economic impact was reported on cotton, causing 30–60% yield losses in India and Pakistan (Fand and Suroshe, 2015).	
<b>Surveillance information</b>	No surveillance information for this pest is currently available from the Turkish NPPO. There is no information on whether the pest has ever been found in nurseries or their surrounding environment.	

## A.1.2. Possibility of pest presence in the nurseries

### A.1.2.1. Possibility of entry from the surrounding environment

In Turkey, *P. solenopsis* was detected for the first time in Adana in 2013 (Kaydan et al., 2013). Thereafter, it was recorded in Hatay and Mersin. Then, it spreads to the west being recorded in Alanya, Antalya, Muğla, Aydın, İzmir and it is now present along the Mediterranean coast. The pest is very frequent on cotton, but in İzmir, it is a very serious pest also in greenhouses (Kaydan, 2021 personal communication).

Among other host plants reported in Turkey (Kaydan et al., 2013) are: *Amaranthus retroflexus*, *Chrysanthemum morifolium*, *Vinca rosea*, *Calendula officinalis*, *Hibiscus rosa-sinensis*, *Hibiscus syriacus*, *Capsicum annuum*, *Lycopersicon esculentum*, *Solanum melongena*. According to Kaydan et al., the pest was easy to detect and present with high density on all host plant surveyed in the area.

Due to its polyphagous nature, the pest is likely to be present in the environment surrounding the nurseries producing *N. oleander* plants. It is possible that nurseries are located in areas where the pest is present. If host are present in the surroundings and pest pressure is high (e.g. cotton production), introduction into the nursery is likely.

Possible pathways of entry into the nurseries can be by movement of infested plants, wind, human and animal dispersal and irrigation water (Mani and Shivaraju, 2016). The first nymph instars (crawlers) can disperse by walking and by wind (Mani and Shivaraju, 2016).

#### Uncertainties:

- No information about the density of the population of *P. solenopsis* in the area surrounding the nurseries is available.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for the pest to enter the nursery from the surrounding area. The pest can be present in the surrounding areas and the transfer rate could be enhanced by wind and accidental transportation by humans.

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

According to the Dossier, the propagation material used by export nurseries is mainly produced in forest nurseries, located throughout the entire country. Therefore, there is a possibility for the pest to be introduced with propagation material of *Nerium* plants as well as other host plants produced in these forest nurseries.

#### Uncertainties:

- Location of forest nurseries delivering propagation material to export nurseries.
- Presence of the pest in the area where forest nurseries are located.
- Other host plant species introduced in export nurseries.

#### **A.1.2.3. Possibility of spread within the nursery**

If the pest is present in the nursery, it is likely to spread within the nursery during the production cycle of the plants.

Possible pathways of spreading within the nursery can be by movement of infested plants, wind, human and animal dispersal and irrigation water (Mani and Shivaraju, 2016). The first nymph instars (crawlers) can disperse by walking and by wind (Mani and Shivaraju, 2016).

#### Uncertainties:

- Other host plant species grown in the nurseries.

Taking into consideration the above evidence and uncertainties, the Panel considers that the spread of the pest within the nursery is possible either by wind or accidental transfer within the nursery.

#### **A.1.3. Information from interceptions**

There are no records of notification of *P. solenopsis* on *N. oleander* plants for planting neither from Turkey nor from other countries (period: 1995–2020; EUROPHYT and TRACES NT, online).

There have been multiple interceptions of *P. solenopsis* in England on fresh vegetables from West Africa, and on herbs (basil) from Israel and bell peppers from East Africa (Malumphy et al., 2013).

#### **A.1.4. Evaluation of the risk reduction options**

In the table below, all the RROs currently applied in **Turkey** are summarised and an indication of their effectiveness on *Phenacoccus solenopsis* is provided.

Number	Risk mitigation measures	Current measures in Turkey	Evaluation of the measures on <i>P. solenopsis</i>
1	Registration of the nursery and Phytosanitary management	Forest nurseries (producing young plants) are officially registered and inspected at least once a year.  All nurseries producing ornamental plants are required to be a member of the ornamental plant grower union in Turkey and inspected at least once a year. A plant passport or export certificate is issued by the NPPO.	Nurseries are registered and inspected at least once a year with unknown inspection and sampling intensities.  <i>P. solenopsis</i> has no quarantine status in Turkey.
2	Physical control	Some production of the early stages of plants, but not of the older ones, takes place in production places with netting.	Uncertainties No detailed information is provided
3	Pest monitoring and inspections by the nursery staff during the production process	There are guidelines available for detection of pests in agricultural crops (technical instructions for plant pests in agricultural crops – link in Dossier, Section 1).  There are no targeted inspections for <i>P. solenopsis</i> .	Uncertainties No detailed information is provided
4	Pesticide treatment	There is a database for registered insecticides in Turkey. There are no products registered for <i>Nerium</i> .  There are guidelines available for the management of pests in agricultural crops (technical instructions for plant pests in agricultural crops – link in Dossier, Section 1).  In the dossier, it is indicated that only malathion is used to control aphids and before loading plants for export.	Malathion is considered to be not effective against mealybugs (Mansour et al., 2018)  Uncertainties No detailed information is provided, it is unknown which insecticides are used in <i>N. oleander</i> production.
6	Surveillance	There are no targeted surveys for <i>P. solenopsis</i> .	Uncertainties No detailed information is provided

### A.1.5. Overall likelihood of the pest freedom

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

- Low abundance of the pest in the surrounding environment of the nursery.
- Transfer from sources in the surrounding environment to the nursery plants is very difficult for a crawling insect.
- There are no/not many other host plant species present in the nursery.
- The nurseries are aware of the presence of the pest in the area.
- Infestations of the mealybug are easily spotted and plants with symptoms are not exported.

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

- *P. solenopsis* is polyphagous and can be present on many host plants in the surrounding environment of the nurseries. According to Kaydan et al. (2013), the pest was present with high density on all host plant surveyed in the area.
- The young plants used for the production of *N. oleander* can originate from forest nurseries areas where *P. solenopsis* is present.
- *P. solenopsis* has no quarantine status in Turkey and nurseries are unaware of the presence of the pest in the production area.

**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 estimated based on:

- Based on the fact that the pest is relatively easy to detect, the Panel judges higher values for being more likely. Therefore, the median was placed closer to the highest scenario.

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

The main uncertainty is the population pressure in the surrounding environment, due to the lack of sufficient information in the dossier.



### A.1.5.5. Elicitation outcomes of the assessment of the pest freedom for *Phenacoccus solenopsis*

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 *Phenacoccus solenopsis* per 10,000 plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	5					75		150		210					300
EKE	5.17	11.1	19.8	35.6	55.1	78	100	145	190	214	239	262	281	292	300

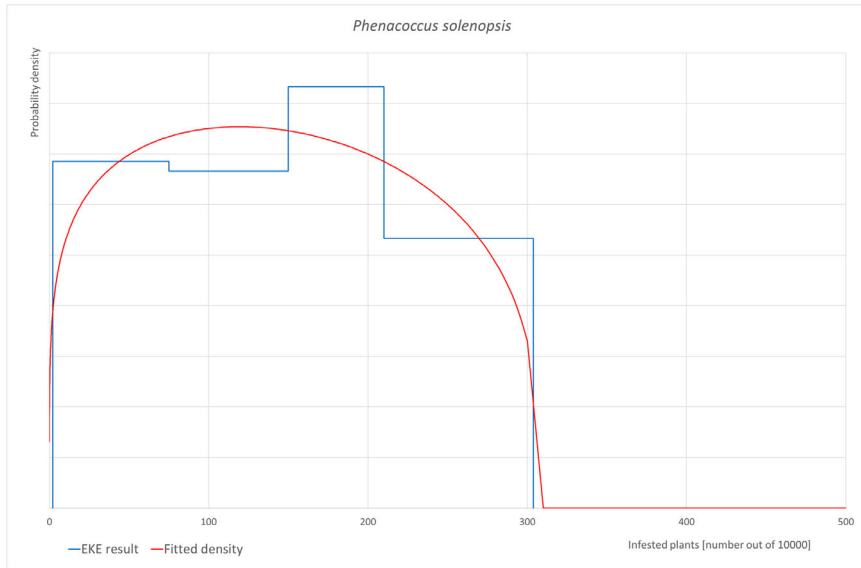
The EKE result is the Beta General distribution (1.2027, 1.3208, 0.308) fitted with @Risk version 7.5.

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

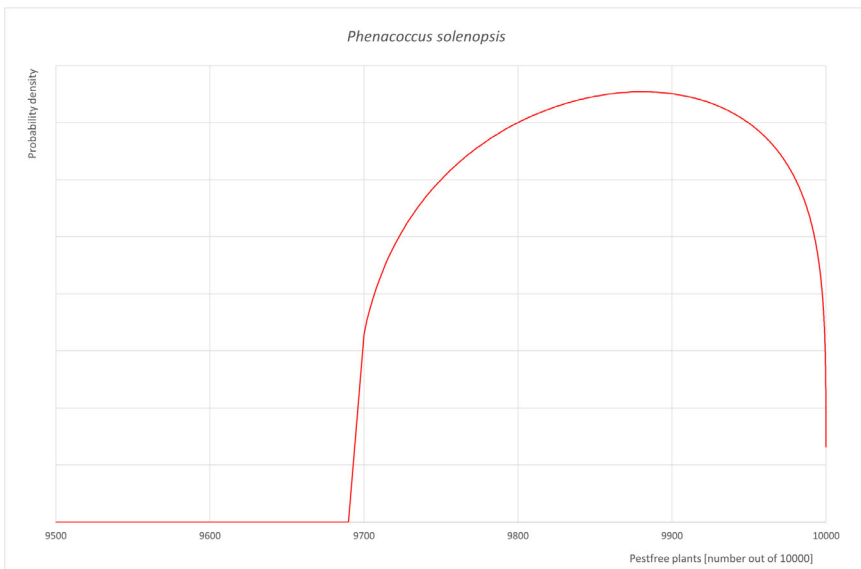
**Table A.2:** The uncertainty distribution of plants free of *Phenacoccus solenopsis* per 10,000 plants calculated by Table A.1

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,700					9,790		9,850		9,925					9,995
EKE results	9,700	9,708	9,719	9,738	9,761	9,786	9,810	9,855	9,900	9,922	9,945	9,964	9,980	9,989	9,995

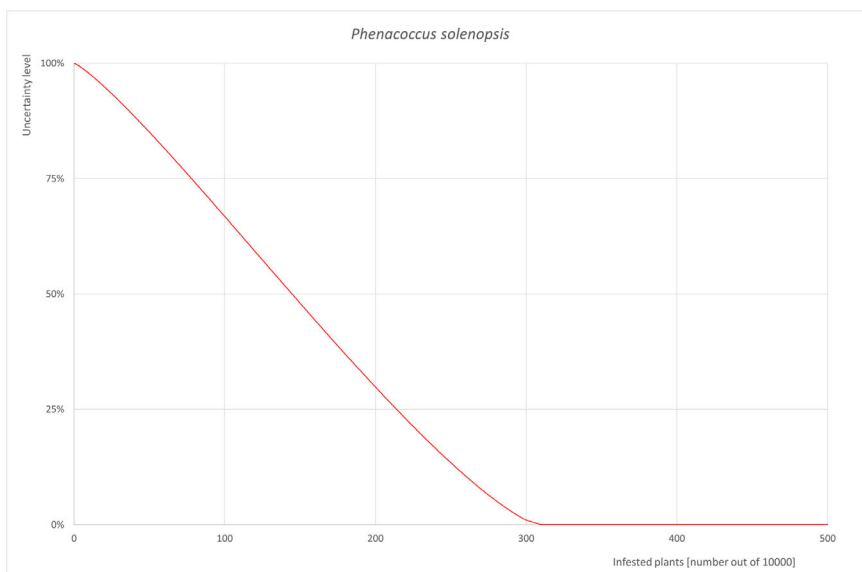
The EKE results are the fitted values.



(a)



(b)



(c)

**Figure A.1:** (a) Elicited uncertainty of pest infestation per 10,000 plants (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 plants per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 plants

### A.1.6. Reference list

- Arif MI, Rafiq M and Ghaffar A, 2009. Host plants of cotton mealybug (*Phenacoccus solenopsis*): a new menace to cotton agroecosystem of Punjab, Pakistan. *International Journal of Agriculture and Biology*, 11, 163–167.
- CABI (Centre for Agriculture and Bioscience International), online. Datasheet *Phenacoccus solenopsis* (cotton mealybug). Available online: <https://www.cabi.org/isc/datasheet/109097> [Accessed: 27 February 2020]
- EPPO (European and Mediterranean Plant Protection Organization), online. *Phenacoccus solenopsis* (PHENSO), Distribution. Available online: <https://gd.eppo.int/taxon/PHENSO/distribution> [Accessed: 27 February 2020]
- 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](http://ec.europa.eu/food/plant/plant_health_biosecurity/europhyt/index_en.htm) [Accessed: 27 February 2020]
- Fallahzadeh M, Abdimaliki R and Saghaei N, 2014. Host Plants of the Newly Invasive Mealybug Species, *Phenacoccus solenopsis* (Hemiptera: Pseudococcidae), in Hormozgan Province, Southern Iran. *Zeitschrift fur Entomologie Entomofauna* 35, 169–176.
- Fand B and Suroshe S, 2015. The invasive mealybug *Phenacoccus solenopsis* Tinsley, a threat to tropical and subtropical agricultural and horticultural production systems - a review. *Crop Protection*, 69, 34–43. <https://doi.org/10.1016/j.cropro.2014.12.001>
- García Morales M, Denno BD, Miller DR, Ben-Dov Y and Hardy NB, online. ScaleNet: A literature-based model of scale insect biology and systematics, *Phenacoccus solenopsis*. Available online: <http://scalenet.info/catalogue/Phenacoccus%20solenopsis/> [Accessed 27 February 2020]
- Gerson U and Aplebaum S, online. Plant Pests of the Middle East, *Phenacoccus solenopsis* Tinsley. Available online: [http://www.agri.huji.ac.il/mepests/pest/Phenacoccus\\_solenopsis/](http://www.agri.huji.ac.il/mepests/pest/Phenacoccus_solenopsis/) [Accessed 28 February 2020]
- Hodgson C, Abbas G, Arif MJ, Saeed S and Karar H, 2008. *Phenacoccus solenopsis* Tinsley (Sternorrhyncha: Coccoidea: Pseudococcidae), an invasive mealybug damaging cotton in Pakistan and India, with a discussion on seasonal morphological variation. *Zootaxa*, 1913, 1–35. <https://doi.org/10.11646/zootaxa.1913.1.1>
- Ibrahim SS, Moharum FA and El-Ghany NMA, 2015. The cotton mealybug *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) as a new insect pest on tomato plants in Egypt. *Journal of plant protection research*, 55, 48–51. <https://doi.org/10.1515/jppr-2015-0007>
- Islam KS, Ali R, Hossain A, Aminuzzaman FM, Ullah J, Alam F, Saha S, Abdullah-Al-Mahamud KM, 2017. Pest Risk Analysis (PRA) of Mealybug Spp. in Bangladesh. Strengthening Phytosanitary Capacity in Bangladesh Project. Plant Quarantine Wing Department of Agricultural Extension Khamarbari, Farmgate, Dhaka-1205.
- Malumphy C, Baker R and Anderson H, 2013. Rapid pest risk analysis for *Phenacoccus solenopsis* (cotton mealybug) and the closely related *P. defectus* and *P. solani*. FERA (The Food and Environment Research Agency), UK.
- Mani M and Shivaraju C, 2016. Mealybugs and their management in agricultural and horticultural crops. Berlin, Germany, Springer.
- Mansour R, Belzunces LP, Suma P, Zappalà L, Mazzeo G, Grissa-Lebdi K and Biondi A, 2018. Vine and citrus mealybug pest control based on synthetic chemicals. A review. *Agronomy for Sustainable Development*, 38, 1–20
- Spodek M, Ben-Dov Y, Mondaca L, Protasov A, Erel E and Mendel Z, 2018. The cotton mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) in Israel: pest status, host plants and natural enemies. *Phytoparasitica*, 46, 45–55. <https://doi.org/10.1007/s12600-018-0642-1>
- Vennila S, Deshmukh AJ, Pinjarkar D, Agarwal M, Ramamurthy VV, Joshi S, Kranthi KR and Bambawale OM, 2010. Biology of the mealybug, *Phenacoccus solenopsis* on cotton in the laboratory. *Journal of Insect Science*, 10, 115.
- Vennila S, Prasad YG, Prabhakar M, Agarwal M, Sreedevi G, Bambawale OM, 2013. Weed hosts of cotton mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae). *Journal of Environmental Biology*, 34, 153–158.

## Appendix B – Web of Science All Databases Search String

In the table below, the search string used in Web of Science is reported. Totally, 566 papers were retrieved. Titles and abstracts were screened, and 53 pests were added to the list of pests (see Appendix D).

Web of Science All databases	<p><b>TOPIC:</b> "Oleander" OR "Nerium oleander" OR "N. oleander" OR "Nerium sp." OR "Nerium spp." OR "Nerium odorum" OR "N. odorum" OR "Nerium indicum" OR "N. indicum"</p> <p><b>AND</b></p> <p><b>TOPIC:</b> : "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 "rots" 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"</p> <p><b>NOT</b></p> <p><b>TOPIC:</b> "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 "medicine" OR "mammal" OR "bird" OR "human disease" OR "toxicity" OR "weed control" OR "salt stress" OR "salinity" OR "cancer" OR "pharmacology" OR "glucoside" OR "metabolites" OR "cross compatibility" OR "volatile" OR "anti-inflammatory activity" OR "shelf life" OR "synthesis" OR "scent volatile" OR "biodiesel" OR "poisoning" OR "toxicity"</p> <p><b>NOT</b></p> <p><b>TOPIC:</b> "Aulacorthum solani" OR "Achatina fulica" OR "Acherontia atropos" OR "Acherontia styx" OR "Acutaspis paulista" OR "Adoxophyes perstricta" OR "Agathia" OR "Agathia hilarata" OR "Agathia laetata" OR "Agathia lycaenaria" OR "Aithaloderma setosum" OR "Alternaria nerii" OR "Alternaria tenuis" OR "Alternaria tenuissima" OR "Amauris phoedon" OR "Amorbia emigratella" OR "Anicla infecta" OR "Antherina suraka" OR "Aonidiella aurantii" OR "Aonidiella inornata" OR "Aonidiella orientalis" OR "Aonidiella simplex" OR "Aphis asclepiadis" OR "Aphis aurantii" OR "Aphis fabae" OR "Aphis gossypii" OR "Aphis nerii" OR "Aphis solanella" OR "Aphis spiraeicola" OR "Aplosporella nerii" OR "Aplosporella neriicola" OR "Armillaria luteobubalina" OR "Armillaria mellea" OR "Armillaria tabescens" OR "Armillariella tabescens" OR "Arthonia punctiformis f. populina" OR "Ascochyta oleandri" OR "Ascotis reciprocaria" OR "Ascotis selenaria" OR "Aspidiotus ligusticus" OR "Aspidiotus neri" OR "Aspidiotus nerii" OR "Aspidiotus simulans" OR "Attacus atlas" OR "Bactrocera tryoni" OR "Biston regalis" OR "Boeremia exigua var. heteromorpha" OR "Botryodiplodia nerii" OR "Botryodiplodia sp." OR "Botryodiplodia theobromae" OR "Botryosphaeria dothidea" OR "Botryosphaeria quercuum" OR "Botryosphaeria sp." OR "Botryotinia fuckeliana" OR "Botrytis cinerea" OR "Brevipalpus phoenicis" OR "Bryobia praetiosa" OR "Byssomerulius corium" OR "Cacoecimorpha pronubana" OR "Calonectria crotalariae" OR "Calonectria ilicicola" OR "Capnodium elongatum" OR "Capnodium nerii" OR "Capnodium salicinum" OR "Cercoseptoria neriella" OR "Cercospora cavarae" OR "Cercospora kurimaensis" OR "Cercospora neriella" OR "Cercospora neriicola" OR "Cercospora neri-indici" OR "Cercospora repens" OR "Ceroplastes brevicauda" OR "Ceroplastes ceriferus" OR "Ceroplastes cirripediformis" OR "Ceroplastes cistudiformis" OR "Ceroplastes dugesii" OR "Ceroplastes floridensis" OR "Ceroplastes floridensis" OR "Ceroplastes grandis" OR "Ceroplastes japonicus" OR "Ceroplastes myricae" OR "Ceroplastes pseudoceriferus" OR "Ceroplastes rubens" OR "Ceroplastes rusci" OR "Ceroplastes sinensis" OR "Chlorissa" OR "Chloropulvinaria floccifera" OR "Chondrostereum purpureum" OR "Chrysomphalus aonidium" OR "Chrysomphalus bifasciculatus" OR "Chrysomphalus dictyospermi" OR "Chrysomphalus dictyospermi" OR "Chrysomphalus pinnulifer" OR "Cladosporium"</p>
------------------------------	--

*cladosporioides*" OR "*Cladosporium fumago*" OR "*Cladosporium herbarum*" OR "*Cladosporium microsporum*" OR "*Cladosporium nerii*" OR "*Cladosporium nericola*" OR "*Cladotrichum roumegueri*" OR "*Clitocybe tabescens*" OR "*Coccidiphaga scitula*" OR "*Coccus capparidis*" OR "*Coccus hesperidum*" OR "*Coccus hesperidum hesperidum*" OR "*Coccus pseudomagnoliarum*" OR "*Coccus viridis*" OR "*Colletotrichum acutatum*" OR "*Colletotrichum alienum*" OR "*Colletotrichum capsici*" OR "*Colletotrichum gloeosporioides*" OR "*Colletotrichum nericola*" OR "*Composita fidelissima*" OR "*Comstockaspis perniciosa*" OR "*Coriolus pinsitus*" OR "*Corticium coeruleum*" OR "*Corticium galactinum*" OR "*Corticium salmonicolor*" OR "*Corticium solani*" OR "*Cryptocerya multicatrices*" OR "*Cryptoblabes gnidiella*" OR "*Cucumber mosaic virus*" OR "*Cytospora neerii*" OR "*Cytospora nerii*" OR "*Cytospora pruinosa*" OR "*Cytospora nerii*" OR "*Daedalea unicolor*" OR "*Danaus gilippus*" OR "*Daphnis nerii*" OR "*Dialeurodes citri*" OR "*Diaspidiotus africanus*" OR "*Diaspidiotus laperrinei*" OR "*Diaspidiotus perniciosus*" OR "*Diatrypella inflata*" OR "*Dicranidion fragile*" OR "*Didymella microchlamydospora*" OR "*Didymosphaeria*" OR "*Diplodia nerii*" OR "*Diplodia oleandri*" OR "*Dolichodorus heterocephalus*" OR "*Dothiora ceratoniae*" OR "*Dothiorella jaapiana*" OR "*Dothiorella*" OR "*Dysmicoccus grassii*" OR "*Earliella scabrosa*" OR "*Empyreuma affinis*" OR "*Empyreuma pugione*" OR "*Eotetranychus hirsti*" OR "*Erythrimum salmonicolor*" OR "*Estigmene acrea*" OR "*Eucalymnatus tessellatus*" OR "*Eulecanium tiliae*" OR "*Euploea alcathoe*" OR "*Euploea batesii*" OR "*Euploea core*" OR "*Euploea euphon*" OR "*Euploea lewinii*" OR "*Euploea midamus*" OR "*Euploea multicber*" OR "*Euploea tulliolus*" OR "*Eurytetranychus madagascariensis*" OR "*Eutetranychus banksi*" OR "*Eutetranychus orientalis*" OR "*Eutypa lata*" OR "*Eutypella alnifraga*" OR "*Excipularia narsapurensis*" OR "*Ferrisia malvastra*" OR "*Ferrisia virgata*" OR "*Fiorinia distinctissima*" OR "*Fiorinia neriiifolii*" OR "*Fiorinia phantasma*" OR "*Foliophoma fallens*" OR "*Fomitopsis ochroleuca*" OR "*Fumago vagans*" OR "*Furcasporea nericola*" OR "*Fusarium brachygibbosum*" OR "*Fusarium solani*" OR "*Geococcus coffeae*" OR "*Gloeosporium oleandri*" OR "*Glomerella cingulata*" OR "*Glomerella cingulata var. minor*" OR "*Glyphodes bicolor*" OR "*Gonimbrasia zambesina*" OR "*Haplosporella nerii*" OR "*Helicobasidium momba*" OR "*Hemiberlesia cyanophylli*" OR "*Hemiberlesia lataniae*" OR "*Hemiberlesia neodiffinis*" OR "*Hemiberlesia rapax*" OR "*Hemilecanium theobromae*" OR "*Hercinothrips femoralis*" OR "*Heterobasidion ochroleucum*" OR "*Heterodera mediterranea*" OR "*Homalodisca vitripennis*" OR "*Howardia biclavis*" OR "*Hypoxyton nummularium var. pseudopachyloma*" OR "*Icerya purchas*" OR "*Icerya purchasi*" OR "*Imbrasia zambesina*" OR "*Inonotus fruticum*" OR "*Insignorthezia insignis*" OR "*Ischnaspis longirostris*" OR "*Isotenes miserana*" OR "*Kentingia corticola*" OR "*Lagosinia strachani*" OR "*Lasiodiplodia theobromae*" OR "*Lepidosaphes beckii*" OR "*Lepidosaphes belutchistana*" OR "*Lepidosaphes newsteadi*" OR "*Lepidosaphes pallida*" OR "*Lepidosaphes tapleyi*" OR "*Lepidosaphes ulmi*" OR "*Leucaspiis riccae*" OR "*Lindingaspis rossi*" OR "*Luperomorpha xanthodera*" OR "*Maconellicoccus hirsutus*" OR "*Macroglossum corythus*" OR "*Macrophoma oleandri*" OR "*Macrophoma phaseoli*" OR "*Macrophomina phaseolina*" OR "*Macrophyllosticta nerii*" OR "*Macrosiphum euphorbiae*" OR "*Macrosporium nerii*" OR "*Marasmiellus scandens*" OR "*Marginaspis affinis*" OR "*Massarina polymorpha*" OR "*Melanaspis tenebricosa*" OR "*Meliola sp.*" OR "*Meloidogyne arenaria*" OR "*Meloidogyne incognita*" OR "*Meloidogyne javanica*" OR "*Meruliopsis corium*" OR "*Merulius corium*" OR "*Merulius papyrinus*" OR "*Microdiplodia nerii*" OR "*Micropeltella oleandri*" OR "*Microthyrium nerii*" OR "*Microxyphium sp.*" OR "*Mitulaspis funtumiae*" OR "*Morganella longispina*" OR "*Munkovalsaria donacina*" OR "*Mycosphaerella mediterranea*" OR "*Mycosphaerella nerii-odori*" OR "*Mycosphaerella oleandri*" OR "*Mycovellosiella nerii-indici*" OR "*Myzus persicae*" OR "*Nectria haematococca*" OR "*Neofitzroyomyces nerii*" OR "*Neomyzus circumflexus*" OR "*Neopinnaspis harperi*" OR "*Nipaecoccus viridis*" OR "*Octaspidiotus subrubescens*" OR "*Oligonychus coffeae*" OR "*Pallulaspis lantanae*" OR "*Palpita flegia*" OR "*Paracoccus burnerae*" OR "*Paracoccus marginatus*" OR "*Parasaissetia nigra*" OR "*Paratrachodorus minor*" OR "*Parlatoria chinensis*" OR "*Parlatoria longispina*" OR "*Parlatoria cinerea*" OR "*Parlatoria crypta*" OR "*Parlatoria oleae*" OR "*Parlatoria pergandii*" OR "*Passalora nerii-indici*" OR "*Peniophora cinerea*" OR "*Pericallia ricini*" OR "*Periconia byssoides*" OR "*Periconia cookei*" OR "*Pestalotia oleandri*" OR "*Pestalotia stellata var. nerii*" OR "*Pestalotia versicolor*" OR "*Pestalotiopsis maculans*" OR "*Pestalotiopsis oleandri*" OR "*Pestalotiopsis versicolor*" OR "*Phanerochaete salmonicolor*" OR "*Phellinus noxius*" OR "*Phenacoccus solenopsis*" OR "*Phoma exigua*" OR "*Phoma exigua var. exigua*" OR "*Phoma exigua var. heteromorpha*" OR "*Phoma glaucispora*" OR "*Phoma*

herbarum" OR "Phoma nerii" OR "Phoma neriicola" OR "Phomopsis neriicola" OR "Phylloporia fruticosa" OR "Phyllosticta capitalensis" OR "Phyllosticta glaucispora" OR "Phyllosticta nerii" OR "Phyllosticta neriicola" OR "Phyllosticta oleandri" OR "Phymatotrichum omnivorum" OR "Physalospora obtusa" OR "Phytophthora ramorum" OR "Pinnaspis buxi" OR "Pinnaspis strachani" OR "Planococcus citri" OR "Planococcus ficus" OR "Planococcus halli" OR "Planococcus kraunhiae" OR "Pleospora fallens" OR "Pleospora herbarum" OR "Stemphylium vesicarium" OR "Porcupinychus abutiloni" OR "Poria xylostromatoides" OR "Ceriporia xylostromatoides" OR "Potato yellow dwarf nucleorhabdovirus" OR "Praelongorthezia praelonga" OR "Pratylenchus neglectus" OR "Pratylenchus penetrans" OR "Pratylenchus vulnus" OR "Protopulvinaria pyriformis" OR "Pseudoaonidia trilobitiformis" OR "Pseudaulacaspis cockerelli" OR "Pseudaulacaspis cockerelli" OR "Pseudaulacaspis pentagona" OR "Pseudaulacaspis prunicola prunicola" OR "Pseudaulacaspis subcorticalis" OR "Pseudischnaspis bowreyi" OR "Pseudocercospora kurimensis" OR "Pseudocercospora mazandaranensis" OR "Pseudocercospora neriella" OR "Pseudocercospora nerii" OR "Pseudocercospora neriicola" OR "Pseudocercosporaneriella" OR "Pseudococcus calceolariae" OR "Pseudococcus cryptus" OR "Pseudococcus jackbeardsleyi" OR "Pseudococcus longispinus" OR "Pseudococcus occiduus" OR "Pseudococcus viburni" OR "Pseudomonas savastanoi pv. nerii" OR "Pseudomonas savastanoi pv. Savastanoi" OR "Pseudomonas savastanoi pv. savastanoi" OR "Pseudomonas syringae pv. syringae" OR "Pseudomonas tonelliana" OR "Pseudoparlatoria parlatorioides" OR "Pulvinaria aurantii" OR "Pulvinaria floccifera" OR "Pulvinaria polygonata" OR "Pulvinaria psidii" OR "Pyroderces badia" OR "Pythium irregulare" OR "Pythium splendens" OR "Pythium ultimum" OR "Radopholus similis" OR "Ramularia nerii-indici" OR "Rastrococcus invadens" OR "Rastrococcus truncatispinus" OR "Rhabdospora oleandri" OR "Rhizobium radiobacter" OR "Rhizoctonia bataticola" OR "Rhizoctonia solani" OR "Rhizoecus hibisci" OR "Rhizoecus leucosomus" OR "Ripersiella hibisci" OR "Ripersiella kondonis" OR "Rotylenchulus macrodoratus" OR "Rotylenchulus reniformis" OR "Russellaspis pustulans pustulans" OR "Saissetia coffeae" OR "Saissetia miranda" OR "Saissetia oleae" OR "Saissetia oleae" OR "Saissetia orbiculata" OR "Saissetia persimilis" OR "Sarbhomyces biguttulatus" OR "Schizophyllum commune" OR "Scutellonema brachyurum" OR "Selenaspidus articulatus" OR "Selenaspidus malzyi" OR "Senecio vulgaris" OR "Septoria cretae" OR "Septoria juliae" OR "Septoria oleandriicola" OR "Septoria oleandrina" OR "Sphaceloma oleandri" OR "Sphaceloma oleandri" OR "Sphaeropsis gouldiae" OR "Sphaeropsis tumefaciens" OR "Sphrageidus producta" OR "Spilococcus pressus" OR "Spilostethus pandurus" OR "Spodoptera eridania" OR "Sporobolomyces phaffii" OR "Sporobolomyces roseus" OR "Syntomeida epilais" OR "Tetranychus kanzawai" OR "Tetranychus turkestanii" OR "Tetranychus urticae" OR "Thanatephorus cucumeris" OR "Thecospira lateralis" OR "Thrips hawaiiensis" OR "Tomato yellow leaf curl bigeminivirus" OR "Trametes corrugata" OR "Trametes scabrosa" OR "Trametes villosa" OR "Trialeurodes vaporariorum" OR "Trybliaria pakistanica" OR "Voraspis nerii" OR "Xanthoria parietina" OR "Xiphinema americanum" OR "Xylella fastidiosa" OR "Xylella fastidiosa subsp. fastidiosa" OR "Xylella fastidiosa subsp. pauca" OR "Xylella fastidiosa subsp. Sandy"

## 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 Turkey	Present in the EU	<i>Nerium</i> confirmed as a host (reference)	Pest can be associated with the commodity	Impact	Justification for inclusion in this list
<i>Lasiodiplodia theobromae</i>	PHYORH	Fungi	Yes	Yes	Yes	Yes	Yes	Pest of several hosts with restricted distribution in the EU. No official measures in place in these MSs.
<i>Pseudocercospora neriella</i>	PSCSNE	Fungi	Yes	Yes	Yes	Yes	Uncertain	Pest of <i>N. oleander</i> with restricted distribution in the EU. Reported in <i>N. oleander</i> in Turkey. Uncertainty about impact. No official measures in place in these MSs.
<i>Colletotrichum nericola</i>		Fungi	No	Yes	Yes	Yes	Uncertain	Pathogen not reported in the EU. Reported on <i>N. oleander</i> in Turkey. Uncertainty on impact.
<i>Fusarium brachygibbosum</i>	FUSABC	Fungi	No	Yes	Yes	Uncertain	Uncertain	Pathogen not reported in the EU. Not reported on <i>N. oleander</i> in Turkey. Uncertainty about the impact on <i>N. oleander</i> . Uncertainty on <i>Nerium</i> spp. as a host
<i>Septoria oleandricola</i>		Fungi	No	Yes	Yes	Uncertain	Uncertain	Pathogen not reported in the EU. Reported as a new species on <i>N. oleander</i> in Turkey in 2002. No additional records. No data on pathogenicity on <i>Nerium</i> spp. or additional hosts. Uncertainty about impact.



## **Appendix D – Excel file with the pest list of *Nerium*.**

Appendix D can be found in the online version of this output (in the 'Supporting information' section): <https://doi.org/10.2903/j.efsa.2021.6569>