SCIENTIFIC OPINION

efsa JOURNAL

ADOPTED: 29 March 2023

doi: 10.2903/j.efsa.2023.8002

Commodity risk assessment of *Malus domestica* plants from United Kingdom

EFSA Panel on Plant Health (PLH Panel),
Claude Bragard, Paula Baptista, Elisavet Chatzivassiliou, Paolo Gonthier,
Josep Anton Jaques Miret, Annemarie Fejer Justesen, Alan MacLeod,
Christer Sven Magnusson, Panagiotis Milonas, Juan A Navas-Cortes, Stephen Parnell,
Roel Potting, Philippe Lucien Reignault, Emilio Stefani, Hans-Hermann Thulke,
Wopke Van der Werf, Antonio Vicent Civera, Lucia Zappalà, Andrea Lucchi, Pedro Gómez,
Gregor Urek, Umberto Bernardo, Giovanni Bubici, Anna Vittoria Carluccio, Michela Chiumenti,
Francesco Di Serio, Elena Fanelli, Cristina Marzachì, Agata Kaczmarek,
Olaf Mosbach-Schulz and Jonathan Yuen

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 rooted plants in pots, bundles of bare-rooted plants or trees and bundles of budwood and graftwood of *Malus domestica* imported from the United Kingdom, taking into account the available scientific information, including the technical information provided by the United Kingdom. All pests associated with the commodities were evaluated against specific criteria for their relevance for this opinion. Two quarantine pests (tobacco ringspot virus and tomato ringspot virus), one protected zone quarantine pest (*Erwinia amylovora*) and four non-regulated pests (*Colletotrichum aenigma, Meloidogyne mali, Eulecanium excrescens, Takahashia japonica*) that fulfilled all relevant criteria were selected for further evaluation. For *E. amylovora*, special requirements are specified in Commission Implementing Regulation (EU) 2019/2072. Based on the information provided in the Dossier, the specific requirements for *E. amylovora* were met. For the remaining six pests, the risk mitigation measures proposed in the technical Dossier from the UK were evaluated considering the possible limiting factors. For the selected pests, 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 degree of pest freedom varies among the pests evaluated, with scales (*E. excrescens* and *T. japonica*) being the pests most frequently expected on the imported budwood and graftwood. The Expert Knowledge Elicitation indicated with 95% certainty that between 9,976 and 10,000 bundles (consisting of 50 up to 500 plants each) per 10,000 would be free from the above-mentioned scales.

Keywords: apple, European Union, pathway risk assessment, plant health, plant pest, quarantine

Requestor: European Commission

Question number: EFSA-Q-2021-00568

Correspondence: plants@efsa.europa.eu

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

Declarations of interest: If you wish to access the declaration of interests of any expert contributing to an EFSA scientific assessment, please contact interestmanagement@efsa.europa.eu.

Suggested citation: EFSA PLH Panel (EFSA Panel on Plant Health), Bragard C, Baptista P, Chatzivassiliou E, Gonthier P, Jaques Miret JA, Justesen AF, MacLeod A, Magnusson CS, Milonas P, Navas-Cortes JA, Parnell S, Potting R, Reignault PL, Stefani E, Thulke H-H, Van der Werf W, Civera AV, Zappalà L, Lucchi A, Gómez P, Urek G, Bernardo U, Bubici G, Carluccio AV, Chiumenti M, Di Serio F, Fanelli E, Marzachì C, Kaczmarek A, Mosbach-Schulz O and Yuen J, 2023. Scientific Opinion on the commodity risk assessment of *Malus domestica* plants from United Kingdom. EFSA Journal 2023;21 (5):8002, 146 pp. https://doi.org/10.2903/j.efsa.2023.8002

ISSN: 1831-4732

Table of contents

1. Introduction

1.1. Background and terms of reference as provided by European Commission

1.1.1. Background

The new Plant Health Regulation (EU) 2016/2031[1], on the protective measures against pests of plants, has been applied 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 Regulation (EU) 2018/2019[2]. Scientific opinions are therefore needed to support the European Commission and the Member States in the work connected to Article 42 of Regulation (EU) 2016/2031, as stipulated in the terms of reference.

1.1.2. Terms of Reference

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

In particular, EFSA is expected to prepare and deliver risk assessments for commodities listed in the relevant Implementing 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 *Malus domestica* from United Kingdom (UK) taking into account the available scientific information, including the technical Dossier provided by Department for Environment, Food and Rural Affairs of United Kingdom.

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 *Malus domestica* from the UK 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 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,

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

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

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

Monaco, Montenegro, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (Severo Zapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo-Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug), San Marino, Serbia, Switzerland, Türkiye, Ukraine and United Kingdom (except Northern Ireland[4])). Most of 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,

i) 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.
ii) any pest found in a European country that belongs to the same denomination as the pests listed as non-European populations or isolates in Annex II of Implementing Regulation (EU) 2019/2072, should be considered as European populations or isolates and should not be considered in the assessment of those countries.

Pests listed as 'Regulated Non-Quarantine Pest' (RNQP)' in Annex IV of the Commission Implementing Regulation (EU) 2019/2072, and deregulated pests (i.e. pests which were listed as quarantine pests in the Council Directive 2000/29/EC and were deregulated by Commission Implementing Regulation (EU) 2019/2072) were not considered for further evaluation.

In its evaluation, the Panel:

- Checked whether the information provided by the applicant (Department for Environment, Food and Rural Affairs of the United Kingdom) in the technical Dossier (hereafter referred to as 'the Dossier') was sufficient to conduct a commodity risk assessment. When necessary, additional information was requested to the applicant.
- Selected the relevant union EU-regulated quarantine pests and protected zone quarantine pests (as specified in Commission Implementing Regulation (EU) 2019/2072[5], hereafter referred to as 'EU quarantine pests') and other relevant pests present in United Kingdom and associated with the commodity.
- Assessed whether or not the applicant country implements specific measures for Union quarantine pests for which specific measures are in place for the import of the commodity from the specific country in the relevant legislative texts for emergency measures (https://ec.europa.eu/food/plant/plant_health_biosecurity/legislation/emergency_measures_en); the assessment was restricted to whether or not the applicant country applies those measures. The effectiveness of those measures was not assessed.
- Assessed whether the applicant country implements the special requirements specified in Annex VII (points 1–101) and Annex X of the Commission Implementing Regulation (EU) 2019/2072 targeting Union quarantine pests for the commodity in question from the specific country.
- 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 claimed to be implemented by the Department for Environment, Food and Rural Affairs of United Kingdom.

[4] 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 Annex, references to Member States include the United Kingdom in respect of Northern Ireland.

[5] 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.

2. Data and methodologies

2.1. Data provided by the Department for Environment, Food and Rural Affairs of the United Kingdom

The Panel considered all the data and information (hereafter called 'the Dossier') provided by the Department for Environment, Food and Rural Affairs of the United Kingdom in September 2021, including the additional information provided by the Department for Environment, Food and Rural Affairs of the United Kingdom in November 2021, September 2022 and February 2023 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.

Table 1: Structure and overview of the Dossier

Dossier section	Overview of contents	Filename
1.0	Technical Dossier	GB Malus domestica dossier.docx
2.0	Pest list	UK_Malus_domestica_pest_list.xls
3.0	Additional information provided by the DEFRA of United Kingdom in November 2021	Defra response to EFSA - Malus domestica.docx
4.0	Additional information provided by the DEFRA of United Kingdom in September 2022	Malus domestica EFSA questions Jul 2022.docx
5.0	Additional information provided by the DEFRA of United Kingdom in February 2023	*Gymnosporangium juniperi-virginianae*_GB_response_Feb23

The data and supporting information provided by the Department for Environment, Food and Rural Affairs of the United Kingdom formed the basis of the commodity risk assessment.

2.2. Literature searches performed by EFSA

Literature searches in different databases were undertaken by EFSA to complete a list of pests potentially associated with *M. domestica*. The following searches were combined: (i) a general search to identify pests of *M. domestica* in different databases and (ii) a tailored search to identify whether these pests are present or not in, the UK and the EU. The searches were run between 17 March 2022 and 23 January 2023. No language, date or document type restrictions were applied in the search strategy.

The search strategy and search syntax were adapted to each of the databases listed in Table 2, according to the options and functionalities of the different databases and CABI keyword thesaurus.

As for Web of Science, the literature search was performed using a specific, ad hoc established search string (see Appendix B). The string was run in 'All Databases' with no range limits for time or language filters. This is further explained in Section 2.3.2.

Table 2: Databases used by EFSA for the compilation of the pest list associated to *M. domestica*

Database	Platform/Link
Aphids on World Plants	https://www.aphidsonworldsplants.info/C_HOSTS_AAIntro.htm
CABI Crop Protection Compendium	https://www.cabi.org/cpc/
Database of Insects and their Food Plants	https://www.brc.ac.uk/dbif/hosts.aspx
Database of the World's Lepidopteran Hostplants	https://www.nhm.ac.uk/our-science/data/hostplants/search/index.dsml
EPPO Global Database	https://gd.eppo.int/
EUROPHYT	https://webgate.ec.europa.eu/europhyt/
Leaf-miners	https://www.leafmines.co.uk/html/plants.htm
Nemaplex	https://nemaplex.ucdavis.edu/Nemabase2010/PlantNematodeHostStatusDDQuery.aspx

Database	Platform/Link
Plant Pest Information Network	https://www.mpi.govt.nz/news-and-resources/resources/registers-and-lists/plant-pest-information-network/
Plant Viruses Online	https://bio-mirror.im.ac.cn/mirrors/pvo/vide/famindex.htm
Scalenet	https://scalenet.info/associates/
Spider Mites Web	https://www1.montpellier.inra.fr/CBGP/spmweb/advanced.php
USDA ARS Fungal Database	https://nt.ars-grin.gov/fungaldatabases/fungushost/fungushost.cfm
Web of Science: All Databases (Web of Science Core Collection, CABI: CAB Abstracts, BIOSIS Citation Index, Chinese Science Citation Database, Current Contents Connect, Data Citation Index	Web of Science https://www.webofknowledge.com
FSTA, KCI-Korean Journal Database, Russian Science Citation Index, MEDLINE	
SciELO Citation Index, Zoological Record)	
World Agroforestry	https://www.worldagroforestry.org/treedb2/speciesprofile.php?Spid=1749
GBIF	https://www.gbif.org/
Fauna Europaea	https://fauna-eu.org/
EFSA List of Non-EU viruses and viroids of *Cydonia* Mill., *Fragaria* L., *Malus* Mill., *Prunus* L., *Pyrus* L., *Ribes* L., *Rubus* L. and *Vitis* L..	https://www.efsa.europa.eu/it/efsajournal/pub/5501

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

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

A conclusion on the likelihood of the commodity being free from each of the relevant pest was determined and uncertainties identified using expert judgements.

Pest freedom was assessed by estimating the number of infested/infected:

1) Rooted plants in pots out of 10,000 exported plants.
2) Bundles of bare-rooted plants out of 10,000 exported bundles. Each bundle contains between 5 and 50 plants.
3) Bundles of budwood or graftwood out of 10,000 exported bundles. Each bundle contains between 50 and 500 plant parts.

2.3.1. Commodity data

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

2.3.2. Identification of pests potentially associated with the commodity

To evaluate the pest risk associated with the importation of *M. domestica* from the UK, a pest list was compiled. The pest list is a compilation of all identified plant pests associated with *M. domestica* based on (1) information provided in the Malus UK Dossier, (2) additional information provided by DEFRA, (3) as well as on searches performed by the Panel. The search strategy and search syntax were adapted to each of the databases listed in Table 3, according to the options and functionalities of the different databases and CABI keyword thesaurus.

The scientific name of the host plant (i.e. *Malus domestica*) was used when searching in the EPPO Global database and CABI Crop Protection Compendium. The same strategy was applied to the other databases excluding EUROPHYT and Web of Science.

EUROPHYT was consulted by searching for the interceptions associated with commodities imported from the UK, at species level, from 1998 to May 2020 and TRACES for interceptions from June 2020 to February 2023. For the pests selected for further evaluation, a search in the EUROPHYT and/or TRACES was performed for the interceptions from the whole world, at species level.

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

The established search string is detailed in Appendix B and was run on 04 March 2022.

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

The compiled pest list (see Microsoft Excel® file in Appendix D) includes all identified pests that use *M. domestica* as host according to the Interpretation of Terms of Reference.

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).

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

2.3.3. Listing and evaluation of risk mitigation measures

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

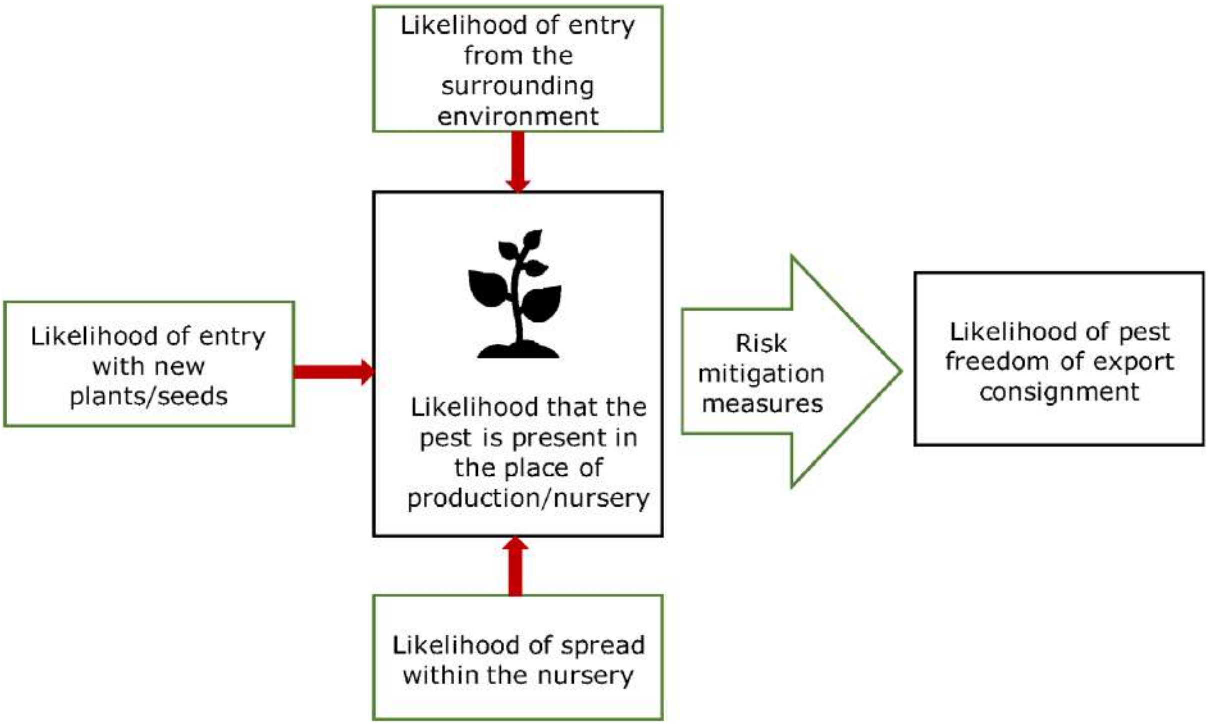


Figure 1: Conceptual framework to assess likelihood that plants are exported free from relevant pests. Source EFSA PLH Panel (2019).

Information on the pest biology, estimates of likelihood of entry of the pest to and spread within the nursery, and the effect of the measures on a specific pest were 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 commodity, an EKE was performed following EFSA guidance (Annex B.8 of EFSA Scientific Committee, 2018). The specific questions for each commodity type for EKE were:

1) 'Taking into account (i) the risk mitigation measures in place in the nurseries, and (ii) other relevant information, how many of 10,000 rooted plants in pots of *M. domestica* will be infested/infected with the relevant pest/pathogen when arriving in the EU?'.
2) 'Taking into account (i) the risk mitigation measures in place in the nurseries, and (ii) other relevant information, how many of 10,000 bundles of bare-rooted plants of *M. domestica* will be infested/infected with the relevant pest/pathogen when arriving in the EU?' A bundle can contain 5–50 plants.
3) 'Taking into account (i) the risk mitigation measures in place in the nurseries, and (ii) other relevant information, how many of 10,000 bundles of budwood/graftwood of *M. domestica* will be infested/infected with the relevant pest/pathogen when arriving in the EU?'. Each bundle contains 50–500 plant parts.

The risk assessment is based on either single plants or bundles of 5–50 bare-rooted plants or bundles of 50–500 graftwood/budwood, as the most suitable units. The EKE questions were common to all pests for which the pest freedom of the commodity was estimated, with the exception of the nematode *Meloidogyne mali*, which was excluded for budwood and graftwood.

The following reasoning is given:

i) There is no quantitative information available regarding clustering of plants during production;
ii) One commodity is handled as singular unit, and the other two commodity types plants are grouped in bundles;
iii) For the pests under consideration, a cross contamination during transport is possible;

The EKE questions were common to all pests for which the pest freedom of the commodity was estimated.

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

3. Commodity data

3.1. Description of the commodity

According to the Dossier and the integration of additional information provided, the commodities to be imported are either single plants in pots, or bare-rooted plants/trees, or budwood/graftwood of *Malus domestica* Borkh (common name: apple; family: Rosaceae).

Specifically, the planting material considered to be imported into EU from the UK is:

1) Graftwood – up to 1 year old – 50–100 plants per bundle (Figure 2).
2) Budwood – up to 1 year old – up to 500 plants per bundle.
3) Bare-rooted plants/'whips', age ranging from 1 to 2 years (whips) – 25–50 plants per bundle for bare-rooted seedlings.
4) Bare-rooted trees, age ranging from 1 to7 years – 5–10 plants per bundle for bare-rooted trees/whips and feathered trees (Figure 3).
5) Rooted plants in pots, age ranging from 1 to 7 years (Figures 4 and 5).

Plants will not bear fruit at the time of export. Leaves will be present on rooted plants in pots moved during the growing season. Bare-rooted plants and budwood/graftwood moved in the winter months will not bear leaves.

3.2. Description of the production areas

According to the Dossier and additional information provided, plants designated for export are grown in the entire United Kingdom and producers do not set aside separate areas for export production.

Plants are mainly grown outdoors, with limited production in glasshouses. All plants are grown on land which has no history of potato cultivation for the past 12 years and is therefore classed as free from potato cyst nematode (*Globodera pallida* and *G. rostochiensis*) of which *M. domestica* is not a host.

3.3. Production and handling processes

3.3.1. Growing conditions

The growing conditions include field and containers outdoors (cells, pots, tubs, etc.). Cell grown trees may be grown in greenhouses; however, most plants are grown in field and containers. For field-grown plants, the growing media will be soil and for rooted plants in pots, the media will be compost.

- In the production or procurement of plants, the use of growing media is assessed for the potential to harbour and transmit plant pests. Growers most commonly use virgin peat or peat-free compost, which is a mixture of coir, tree bark, wood fibre, etc. This compost is heat-treated by commercial suppliers during production to eliminate pests and diseases. It is supplied in sealed bulk bags or shrink-wrapped bales and stored off the ground on pallets, these are completely hygienic and free from contamination. Where delivered in bulk, compost is kept in a dedicated bunker, either indoors, or covered by tarpaulin outdoors, and with no risk of contamination with soil or other material.
- Growers must assess weeds and volunteer plants for the potential to host and transmit plant pests and have an appropriate programme of weed management in place on the nursery.
- Growers are required to assess water sources, irrigation and drainage systems used in the plant production for the potential to harbour and transmit plant pests. Water may be obtained from the mains water supply, boreholes, rivers or reservoirs/lagoons. Water is routinely sampled and sent for analysis. No quarantine pests have been found.

- General hygiene measures are undertaken as part of routine nursery production, including disinfection of tools and equipment between batches/lots.
- All residues or waste materials shall be assessed for the potential to host, harbour and transmit pests.

Figure 2: Graftwood bundled ready for despatch as provided by DEFRA

Figure 3: Bare-rooted trees ready for despatch as provided by DEFRA

Figure 4: *Malus domestica* plants growing in 2 l pots. The pots are standing in plastic trays on top of a protective membrane as provided by DEFRA

Figure 5: Containers grown trees ready for dispatch as provided by DEFRA

3.3.2. Source of planting material

According to the submitted Dossier, *M. domestica* and its hybrids are grown in Great Britain in line with the Plant Health (Amendment, etc.) (EU Exit) Regulations 2020 and the Plant Health (Phytosanitary Conditions) (Amendment) (EU Exit) Regulations 2020.

3.3.3. Production cycle

According to the Dossier, bare-rooted plants are planted from late autumn until early spring (November–March) and rooted plants in pots are planted at any time of year, with winter as the most common. Side-spliced grafting is usually undertaken in late winter or early spring before bud break, and whip and tongue grafting is normally undertaken in March or early April.

The budding process to reproduce trees is typically done in August.

Bare-rooted plants are harvested in winter to be able to lift plants from the field, as plants are into a dormant phase.

Rooted plants in pots can be moved at any time point during the year.

3.3.4. Pest monitoring during production

According to the submitted Dossier and additional information provided, UK surveillance is based on visual inspection with samples taken from symptomatic material. Sometimes, asymptomatic material (e.g. plants, tubers, soil, watercourses) is also sampled to check latent infections.

For sites with the likelihood of multiple pest and host combinations (e.g. ornamental and retail sites), standard methods for site selection and visit frequency are used, whereby clients are assessed taking into account business activity, size of business and source material, so for example a large propagator using third country material receives 10 visits per year while a small retailer selling locally sourced material is visited once every second year. Where pest specific guidelines are absent, inspectors select sufficient plants to give a 95% probability of detecting symptoms randomly distributed on 1.5% of plants in a batch/consignment. For inspections of single hosts, possibly with multiple pests, survey site selection is often directed to specific locations identified by survey planners, e.g. 0.5% of ware production land is annually sampled for potato cyst nematodes with farms randomly selected and sampled at a rate of 50 cores per hectare.

Plant monitoring is carried out by trained nursery staff via regular crop walking and records kept of this monitoring. Qualified agronomists also undertake regular crop walks to verify the producer's assessments. Curative or preventative actions are implemented together with an assessment of phytosanitary risk. Unless a pest can be immediately and definitively identified as non-quarantine growers are required to treat it as a suspect quarantine pest and notify the competent authority.

Growers designate trained or qualified personnel responsible for the plant health measures within their business. Training records of internal and external training must be maintained, and evidence of continuing professional development to maintain awareness of current plant health issues.

All nurseries have plant hygiene and housekeeping rules and practices in place, which are communicated to all relevant employees.

Incoming plant material and other goods such as packaging material and growing media, that have the potential to be infected or harbour pests, are checked on arrival. Growers have procedures in place to quarantine any suspect plant material and to report findings to the authorities. Growers keep records to allow traceability for all plant material handled. These records must allow a consignment or consignment in transit to be traced back to the original source, as well as forward to identify all trade customers to which those plants have been supplied. Crop protection is achieved using a combination of measures including approved plant protection products, biological control or physical measures. Plant protection products are only used when necessary and records of all plant protection treatments are kept.

In addition to any official inspection, growers check plant material for any plant health issues prior to dispatch.

3.3.5. Post-harvest processes and export procedure

During the post-harvest period (autumn and winter), nursery management is focused on pest and disease prevention and maintaining good levels of nursery hygiene. Leaves, prunings and weeds are all removed from the nursery to reduce the number of overwintering sites for pests and diseases.

For different commodity types, the post-harvest and export procedures are as follows:

a) For bare-rooted plants

- Lifting from the fields.
- Bundling.
- Root washing prior to export.

Bare-rooted plants are bagged and distributed on certified wooden or metal pallets.

b) For budwood and graftwood

- Bundling, wrapping in plastic and packing in cardboard boxes or Dutch crates on certified wooden or metal pallets dependant on quantity.

Rooted plants in pots are transported on Danish trolleys for smaller containers, or pallets, or individually in pots for larger containers (Figure 5). ISPM 15 compliant wood packing material is used when consignments are exported.

Plants are then transported by lorry (size dependant on load quantity). Sensitive plants are occasionally transported by temperature-controlled lorry if weather conditions during transit are likely to be very cold.

4. Identification of pests potentially associated with the commodity

The search for potential pests associated with *M. domestica* rendered 1,324 species (see Microsoft Excel® file in Appendix D).

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

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

Fifty-four EU-quarantine species that are reported to use *M. domestica* as a host plant were evaluated (Table 3) for their relevance of being included in this opinion.

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

a) The pest is present in the UK.
b) *M. domestica* is a host of the pest.
c) One or more life stages of the pest can be associated with the specified commodity.

Pests that fulfilled all criteria were selected for further evaluation.

Table 3 presents an overview of the evaluation of the 56 EU-quarantine pest species that are reported to use *M. domestica* as a host in regards of their relevance for this Opinion.

Three species, known to use *M. domestica* as host, associated with the commodity and present in the UK were selected for further evaluation.

Since special requirements or emergency measures are specified for *M. domestica* with regard to *Erwinia amylovora*, in Appendix X, item 9 of Commission Implementing Regulation (EU) 2019/2072 the evaluation for this pest consisted of checking whether or not the exporting country applies these measures.

Table 3: Overview of the evaluation of the 54 EU-quarantine pest species known to use *M. domestica* as a host plant for their relevance for this opinion

No.	Pest name according to EU legislation[(a)]	EPPO code	Group	Pest present in the UK	*Malus domestica* confirmed as a host (reference)	Pest can be associated with the commodity	Pest relevant for the opinion
1	*Acleris minuta*	ACLRMI	Insect	No	Yes (CABI, online)	NA	No
2	*Aeolesthes sarta* *Trirachys sartus*	AELSSA	Insect	No	Yes (CABI, online)	NA	No
3	*Anastrepha fraterculus* as *Anastrepha* spp.	ANSTFR	Insect	No	Yes (CABI, online)	NA	No
4	*Anastrepha ludens*	ANSTLU	Insect	No	Yes (CABI, online)	NA	No
5	*Anastrepha serpentina* as *Anastrepha* spp.	ANSTSE	Insect	No	Yes (CABI, online)	NA	No
6	*Anastrepha suspensa* as *Anastrepha* spp.	ANSTSU	Insect	No	Yes (EPPO, online)	NA	No
7	*Anoplophora chinensis*	ANOLCN	Insect	No	Yes (EPPO, online)	NA	No
8	*Anoplophora glabripennis*	ANOLGL	Insect	No	Yes (EPPO, online)	NA	No
9	*Anthonomus quadrigibbus*	TACYQU	Insect	No	Yes (EPPO, online)	NA	No
10	*Aphis citricidus*	TOXOCI	Insect	No	Yes (EPPO, online)	NA	No
11	*Apple fruit crinkle viroid*	AFCVD0	Viroid	No	Yes (EPPO, online)	NA	No
12	*Apple necrotic mosaic virus*	APNMV0	Virus	No	Yes (EPPO, online)	NA	No
13	*Apriona cinerea*	APRICI	Insect	No	Yes (CABI, online)	NA	No
14	*Apriona germari*	APRIGE	Insect	No	Yes (CABI, online)	NA	No
15	*Bactrocera cucurbitae* as *Bactrocera* spp.	DACUCU	Insect	No	Yes (EPPO, online)	NA	No
16	*Bactrocera dorsalis*	DACUDO	Insect	No	WOS (EPPO, online)	NA	No
17	*Bactrocera tryoni* as *Bactrocera* spp.	DACUTR	Insect	No	Yes (EPPO, online)	NA	No
18	*Bactrocera zonata*	DACUZO	Insect	No	Yes (CABI, online)	NA	No
19	*Botryosphaeria kuwatsukai*	PHYOPI	Fungus	No	Yes (CABI, online)	NA	No
20	*Candidatus Phytoplasma pruni-related strain* (North American grapevine yellows, NAGYIII)	PHYPPN	Bacterium	No	Yes (EPPO, online)	NA	No
21	*Carposina sasakii*	CARSSA	Insect	No	Yes (EPPO, online)	NA	No
22	*Ceratitis quilicii* as *Ceratitis* spp.	CERTQI	Insect	No	Yes (EPPO, online)	NA	No
23	*Ceratitis rosa* as *Ceratitis* spp.	CERTRO	Insect	No	Yes (EPPO, online)	NA	No
24	*Cherry rasp leaf virus*	CRLV00	Virus	No	Yes (EPPO, online)	NA	No
25	*Choristoneura rosaceana*	CHONRO	Insect	No	Yes (EPPO, online)	NA	No
26	*Conotrachelus nenuphar*	CONHNE	Insect	No	Yes (EPPO, online)	NA	No
27	*Cryphonectria parasitica*	ENDOPA	Fungus	Yes	Yes (CABI, online)	No	No

No.	Pest name according to EU legislation[(a)]	EPPO code	Group	Pest present in the UK	*Malus domestica* confirmed as a host (reference)	Pest can be associated with the commodity	Pest relevant for the opinion
28	*Erwinia amylovora*	ERWIAM	Bacterium	Yes	Yes (EPPO, online)	Yes	Yes
29	*Eurhizococcus brasiliensis*	EURHBR	Insect	No	Yes (EPPO, online)	NA	No
30	*Grapholita inopinata*	CYDIIN	Insect	No	Yes (EPPO, online)	NA	No
31	*Grapholita packardi*	LASPPA	Insect	No	Yes (EPPO, online)	NA	No
32	*Grapholita prunivora*	LASPPR	Insect	No	Yes (EPPO, online)	NA	No
33	*Gymnosporangium clavipes* as *Gymnosporangium* spp.	GYMNCL	Fungus	No	Yes (CABI, online)	NA	No
34	*Gymnosporangium globosum* as *Gymnosporangium* spp.	GYMNGL	Fungus	No	Yes (CABI, online)	NA	No
35	*Gymnosporangium juniperi-virginianae* as *Gymnosporangium* spp.	GYMNJV	Fungus	No	Yes (EPPO, online)	NA	No
36	*Gymnosporangium yamadae* as *Gymnosporangium* spp.	GYMNYA	Fungus	No	Yes (CABI, online)	NA	No
37	*Lopholeucaspis japonica*	LOPLJA	Insect	No	Yes (CABI, online)	NA	No
38	*Lycorma delicatula*	LYCMDE	Insect	No	Yes (EPPO, online)	NA	No
39	*Oemona hirta*	OEMOHI	Insect	No	Yes (EPPO, online)	NA	No
40	*Phyllosticta solitaria*	PHYSSL	Fungus	No	Yes (EPPO, online)	NA	No
41	*Phymatotrichopsis omnivora*	PHMPOM	Fungus	No	Yes (CABI, online)	NA	No
42	*Popillia japonica*	POPIJA	Insect	No	Yes (EPPO, online)	NA	No
43	*Prodiplosis longifila*	PRDILO	Insect	No	Yes (EPPO, online)	NA	No
44	*Rhagoletis pomonella*	RHAGPO	Insect	No	Yes (EPPO, online)	NA	No
45	*Saperda candida*	SAPECN	Insect	No	Yes (EPPO, online)	NA	No
46	*Scirtothrips aurantii*	SCITAU	Insect	No	Yes (EPPO, reporting service 2023)	NA	No
47	*Spodoptera eridania*	PRODER	Insect	No	Yes (CABI, online)	NA	No
48	*Spodoptera frugiperda*	LAPHFR	Insect	No	Yes (CABI, online)	NA	No
49	*Spodoptera litura*	PRODLI	Insect	No	Yes (CABI, online)	NA	No
50	Tobacco ringspot virus	TRSV00	Virus	Yes	Yes (EPPO, online)	Yes	Yes
51	Tomato ringspot virus	TORSV0	Virus	Yes	Yes (EPPO, online)	Yes	Yes
52	*Trirachys sartus*	AELSSA	Insect	No	Yes (EPPO, online)	NA	No
53	*Xiphinema americanum sensu stricto*	XIPHAA	Nematode	No	Yes (CABI, online)	NA	No

No.	Pest name according to EU legislation[(a)]	EPPO code	Group	Pest present in the UK	*Malus domestica* confirmed as a host (reference)	Pest can be associated with the commodity	Pest relevant for the opinion
54	*Xiphinema bricolense*	XIPHBC	Nematode	No Data	Yes (Xu and Zhao, 2019)	NA	No
55	*Xiphinema californicum*	XIPHCA	Nematode	No	Yes (Xu and Zhao, 2019)	NA	No
56	*Xiphinema rivesi* (non-EU populations)	XIPHRI	Nematode	No	Yes (CABI, online)	NA	No

(a): Commission Implementing Regulation (EU) 2019/2072
BAC: Bacteria and phytoplasmas; FUN: Fungi and oomycetes; INS: Insects and mites; NEM: Nematodes; VIR: Viruses and viroids.

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

The information provided by United Kingdom, integrated with the search EFSA performed, was evaluated in order to assess whether there are other potentially relevant pests of *M. domestica* present in the country of export. For these potential pests that are non-regulated in the EU, pest risk assessment information on the probability of entry, establishment, spread and impact is usually lacking. Therefore, these pests were also evaluated to determine their relevance for this opinion based on evidence that:

a) the pest is present in the UK;
b) the pest is (i) absent or (ii) has a limited distribution in the EU;
c) *M. domestica* is a host of the pest;
d) one or more life stages of the pest can be associated with the specified commodity;
e) the pest may have an impact in the EU.

Four pests fulfilled the above listed criteria were selected for further evaluation.

Pest species were excluded from further evaluation when at least one of the conditions listed above (a–e) was not met. Details can be found in Appendix D (Microsoft Excel® file).

Of the evaluated pests not regulated in the EU, four were selected for further evaluation because these met all the selection criteria. More information on these pests can be found in the pest datasheets (Appendix A).

4.3. Overview of interceptions

Data on the interception of harmful organisms on plants of *Malus domestica* can provide information on some of the organisms that can be present on *M. domestica* despite the current measures taken. According to EUROPHYT, online (accessed on June 2022 and February 2023) and TRACES online (accessed on February 2023), there were no interceptions of plants for planting of *M. domestica* from United Kingdom destined to the EU Member States due to the presence of harmful organisms between the years 1998 and February 2023.

4.4. List of potential pests not further assessed

The Panel highlighted three species (*Acanthococcus lagerstroemiae*, Clover yellow mosaic virus *Conogethes punctiferalis, Dysaphis brancoi spp. Rogersoni, Homona coffearia*) for which the taxonomy, distribution or the impact on *Malus domestica* are uncertain (Appendix C).

4.5. Summary of pests selected for further evaluation

The pests identified to be present in the UK and having potential for association with the commodities destined for export are listed in Table 4.

The effectiveness of the risk mitigation measures applied to the commodity was evaluated.

The Panel decided to group some species for the elicitations and graphical presentation of its outcome. This was the case of:

- tobacco ringspot virus and tomato ringspot virus grouped as 'viruses' due to similar biology, impact on the commodity, distribution in UK and regulatory status in EU.
- *Eulecanium excrescens* and *Takahasia japonica* grouped as 'scales' because of their similar biology, impact, taxonomy, risk mitigation measures and/or regulatory status.

Table 4: List of relevant pests selected for further evaluation

Number	Current scientific name	EPPO code	Name used in the EU legislation	Taxonomic information	Group	Regulatory status
1	*Colletotrichum aenigma*	COLLAE	NA	Phyllachorales Glomerellaceae	Fungus	Non-regulated
2	*Meloidogyne mali*	MELGMA	NA	Rhabditida Meloidogynidae	Nematodes	Non-regulated
3	*Eulecanium excrescens*		NA	Hemiptera Coccidae	Insects	Non-regulated

Number	Current scientific name	EPPO code	Name used in the EU legislation	Taxonomic information	Group	Regulatory status
4	*Takahashia japonica*	TAKAJA	NA	Hemiptera Coccidae	Insects	Non-regulated
5	Tobacco ringspot virus	TRSV00	Tobacco ringspot virus	*Picornavirales, Secoviridae*	Virus	EU Quarantine Pest according to Commission Implementing Regulation (EU) 2019/2072
6	Tomato ringspot virus	TORSV0	Tomato ringspot virus	*Picornavirales, Secoviridae*	Virus	EU Quarantine Pest according to Commission Implementing Regulation (EU) 2019/2072
7	*Erwinia amylovora*	ERWIAM	*Erwinia amylovora*	Enterobacterales Erwiniaceae	Bacteria	EU Quarantine Pest according to Commission Implementing Regulation (EU) 2019/2072

5. Risk mitigation measures

For the six selected pests (Table 4), the Panel assessed the possibility that they could be present in a *M. domestica* nursery and assessed the probability that pest freedom of a consignment is achieved by the proposed risk mitigation measures acting on the pest under evaluation.

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

5.1. Possibility of pest presence in the export nurseries and production areas

For these six pests (Table 4), the Panel evaluated the likelihood that the pest could be present in a *M. domestica* nursery by evaluating the possibility that *M. domestica* in the export nursery are infested either by:

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

5.2. Risk mitigation measures applied in the UK

- With the Dossier and additional information provided by the UK, the Panel summarised the risk mitigation measures (see Table 5) that are proposed in the production nurseries.

Table 5: Overview of proposed risk mitigation measures for *Malus domestica* plants designated for export to the EU from the UK

No.	Risk mitigation measure (name)	Implementation in the UK
1	Certified material	All nurseries are registered as professional operators with the UK NPPO, either by the Animal and Plant Health Agency (APHA) in England and Wales, or by the Scottish Government, and are authorised to issue UK plant passports.
2	Phytosanitary certificates	APHA inspectors monitor the pests and diseases during crop certification and passport policy.
3	Cleaning and disinfection of facilities, tools and machinery	General hygiene measures are undertaken as part of routine nursery production, including disinfection of tools and equipment between batches/lots.

No.	Risk mitigation measure (name)	Implementation in the UK
4	Rouging and pruning	Where necessary, leaves, prunings, weeds are all removed from the nursery to reduce the number of over wintering sites for pest and disease. No further details are available.
5	Biological and mechanical control	The nursery intending to export to the EU applies the physical isolation between containers and the soil surface in their production of containerised *Malus M. domestica* plants. The biological control used for spider mites and thrips are predatory mites of the phytoseiid family (*Neoseiulus californicus*) and for thrips predatory larvae mites (*Amblyseius* spp.), respectively). Equally through the year, habitat for beneficial predators is maintained to enhance populations (conservation biological control). For mildew control, *Bacillus amyloliquefaciens* can also be used.
6	Pesticide application	Control treatments including pesticides are only applied based on advice from members of BASIS, this qualification involves training in integrated pest management and pest and disease identification. Crop protection is achieved using a combination of approved pesticides when required (disease pest pressure, growth stage, etc., and environmental factors), together with other integrated crop protection processes such as surveillance. Specific crop protection products and records are available for all consignments, varieties. Pesticides application depends on situation (disease pest pressure, growth stage, etc., and environmental factors) at that time. Subject to this variation in pest pressure, in some seasons few, if any, pesticides are applied; in others, it is sometimes necessary to apply preventative and/or control curative applications of pesticides. In many circumstances also, biological control is also used to control outbreaks, rather than using chemical treatments. The most common pests and diseases in *M. domestica* for which treatment may be applied would be mildew, spider mites, aphids and thrips. Pesticides used for: • Mildew include products such as: Azoxystrobin, Potassium bicarbonate, sulfur • Aphids include products such as flonicamid and esfenvalerate
7	Surveillance and monitoring	Surveillance is based on visual inspection with samples taken from symptomatic material, and where appropriate, samples are also taken from asymptomatic material (e.g. plants, tubers, soil, watercourses). For sites with the likelihood of multiple pest and host combinations (e.g. ornamental and retail sites), we make use of our standard method for site selection and visit frequency, whereby clients are assessed taking into account business activity, size of business and source material, so for example a large propagator using third country material receives 10 visits per year while a small retailer selling locally sourced material is visited once every second year. Where pest specific guidelines are absent Inspectors select sufficient plants to give a 95% probability of detecting symptoms randomly distributed on 1.5% of plants in a batch/consignment. Plant material is regularly monitored for plant health issues. This monitoring is carried out by trained nursery staff via regular crop walking and records kept of this monitoring. Qualified agronomists also undertake regular crop walks to verify the producer's assessments. Curative or preventative actions are implemented together with an assessment of phytosanitary risk. Unless a pest can be immediately and definitively identified as non-quarantine growers are required to treat it as a suspect quarantine pest and notify the competent authority.

No.	Risk mitigation measure (name)	Implementation in the UK
		Inspections are targeted both at the plants or products which present the greatest risk, and also a wider range of plants and plant products which are monitored for more general risks, including those highly polyphagous pests whose range may be unknown or still increasing. UK inspectors receive comprehensive training on the full range of symptoms caused by pests and diseases, to allow them to detect any new and emerging risks, and during a visit to a nursery, they are free to inspect any plants on that nursery. Samples of pests and plants showing any suspicious symptoms are routinely sent to the laboratory for testing. Incoming plants are inspected for freedom from pests and disease before entering the nursery.
8	Sampling and laboratory testing	Assessments are normally made based on visual examinations, but samples may be taken for laboratory analysis to get a definitive diagnosis. Samples of pests and plants showing any suspicious symptoms are routinely sent to the laboratory for testing.
	Root washing	Roots are washed prior to export.
	Refrigeration	Plants are transported by lorry (size dependant on load quantity). Sensitive plants will occasionally be transported by temperature-controlled lorry if weather conditions during transit are likely to be very cold.
11	Pre-consignment inspection	Separate to any official inspection, plant material is checked by growers for plant health issues prior to dispatch.

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

For each evaluated pest, the relevant risk mitigation measures acting on the pest were identified. Any limiting factors on the effectiveness 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 data sheet provided in Appendix A.

Based on this information, for each selected relevant pest, an expert judgement is given for the likelihood of pest freedom taking into consideration the risk mitigation measures and their combination acting on the pest.

An overview of the evaluation of each relevant pest is given in the sections below (Sections 5.3.1–5.3.6). The outcome of the EKE regarding pest freedom after the evaluation of the proposed risk mitigation measures is summarised in Section 5.3.7.

5.3.1. Overview of the evaluation of *Colletotrichum aenigma* for all commodity types

Rating of the likelihood of pest freedom	**Pest free with some exceptional cases** (based on the Median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free potted plants	***9,981*** out of 10,000 bundles	***9,986*** out of 10,000 bundles	***9,991*** out of 10,000 bundles	***9,996*** out of 10,000 bundles	***9,999*** out of 10,000 bundles
Proportion of infested potted plants	***1*** out of 10,000 bundles	***4*** out of 10,000 bundles	***9*** out of 10,000 bundles	***14*** out of 10,000 bundles	***19*** out of 10,000 bundles
Proportion of pest-free bundles of bare rooted plants	***9,989*** out of 10,000 bundles	***9,992*** out of 10,000 bundles	***9,994*** out of 10,000 bundles	***9,997*** out of 10,000 bundles	***9,999*** out of 10,000 bundles
Proportion of infested bundles of bare rooted plants	***1*** out of 10,000 bundles	***3*** out of 10,000 bundles	***6*** out of 10,000 bundles	***8*** out of 10,000 bundles	***11*** out of 10,000 bundles

Proportion of pest-free bundles of graftwood/budwood	***9,995*** out of 10,000 bundles	***9,997*** out of 10,000 bundles	***9,998*** out of 10,000 bundles	***9,999*** out of 10,000 bundles	***10,000*** out of 10,000 bundles
Proportion of infested bundles of graftwood/budwood	***0*** out of 10,000 bundles	***1*** out of 10,000 bundles	***2*** out of 10,000 bundles	***3*** out of 10,000 bundles	***4*** out of 10,000 bundles
Summary of the information used for the evaluation	**Possibility that the pest could become associate with the commodity** *C. aenigma* has been reported in the UK (Baroncelli et al., 2015). *M. domestica* is a host of *C. aenigma*. **Measures taken against the pest and their efficacy** The relevant proposed measures are: (i) Inspection, certification and surveillance, (ii) Sampling and laboratory testing, (iii) Cleaning and disinfection of facilities, tools and machinery, (iv) Removal of soil from roots (washing), (v) Pesticide application and (vi) Pre-consignment inspection. **Interception records** There are no records of interceptions from UK. **Shortcomings of current measures/procedures** The undetected presence of *C. aenigma* during inspections may contribute to the spread of *C. aenigma* infection. **Main uncertainties** • Symptoms caused by *C. aenigma* may be overlooked at the onset of infestation. • Latent infections of *C. aenigma* cannot be detected. • *C. aenigma* is not under official surveillance in UK, as it does not meet criteria of quarantine pest for GB. It is uncertain how many other UK sites may be infested but undetected.					

For more details, see relevant pest data sheet on *Colletotrichum aenigma* (Section A.1 in Appendix A).

5.3.2. Overview of the evaluation of *Meloidogyne mali*

Rating of the likelihood of pest freedom	**Almost always pest free** (based on the Median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free potted plants	***9,997*** out of 10,000 bundles	***9,998*** out of 10,000 bundles	***9,999*** out of 10,000 bundles	***10,000*** out of 10,000 bundles	***10,000*** out of 10,000 bundles
Proportion of infested potted plants	***0*** out of 10,000 bundles	***0*** out of 10,000 bundles	***1*** out of 10,000 bundles	***2*** out of 10,000 bundles	***3*** out of 10,000 bundles
Proportion of pest-free bundles of bare rooted plants	***9,996*** out of 10,000 bundles	***9,997*** out of 10,000 bundles	***9,998*** out of 10,000 bundles	***9,999*** out of 10,000 bundles	***10,000*** out of 10,000 bundles
Proportion of infested bundles of bare-rooted plants	***0*** out of 10,000 bundles	***1*** out of 10,000 bundles	***2*** out of 10,000 bundles	***3*** out of 10,000 bundles	***4*** out of 10,000 bundles
Summary of the information used for the evaluation	**Possibility that the pest/pathogen could enter exporting nurseries** *M. mali* was first described in the northern part of Japan (Itoh et al., 1969), where it frequently parasitises on apple roots. It is a polyphagous nematode. Its host range includes a wide variety of tree, shrub and herbaceous plant species. *M. mali* is thought to have been introduced into the EU (to the Netherlands) with elm plants imported from Japan for breeding purposes. From the Netherlands, the nematode was shipped to 10 other European countries as part of the breeding programme against Dutch elm disease caused by *Ophiostoma ulmi*. The current range of *Meloidogyne mali* in the EU includes Austria, Belgium, Italy and the Netherlands, with few occurrences or limited distribution in all cases. However, *M. mali* is believed					

	to be more widespread in the EU than actually reported (Ahmed et al., 2013; EPPO, 2017). The nematode also occurs in the UK in southern England in at least two locations, where it was found on elms in 2018 (Prior et al., 2019). To date, there have been no reports of detection of this species on apples in the UK, and no epidemics or economic losses have been reported in the UK. However, *M. mali* is not officially monitored in the UK because the species does not meet the criteria for quarantine pests in the UK, and it is uncertain how many other sites in the UK may be infested but not detected. *M. mali* can be associated with the roots of its host plants or with the soil and can enter exporting nurseries, especially with plants intended for planting that are growing in infested soil. **Measures taken against the pest/pathogen and their efficacy** The relevant proposed measures are: (i) Inspection, certification and surveillance, (ii) Sampling and laboratory testing, (iii) Cleaning and disinfection of facilities, tools and machinery, (iv) Removal of soil from roots (washing) and (v) Pre-consignment inspection. **Interception records** There are no records of interceptions from UK. **Shortcomings of current measures/procedures** The undetected presence of *M. mali* during inspections may contribute to the spread of *M. mali* infection. Pre-export root washing does not significantly reduce the risk of nematode infestation in plants intended for planting. **Main uncertainties** • Symptoms caused by *M. mali* may be overlooked at the onset of infestation. • Early infestation of *M. mali* in the roots cannot be detected. • *M. mali* is not under official surveillance in UK, as it does not meet criteria of quarantine pest for GB. It is uncertain how many other UK sites may be infested but undetected. • Root washing does not significantly reduce the risk of nematodes associated with roots of plants intended for planting that are infected with certain endoparasitic nematodes.

For more details, see relevant pest data sheet on *Meloidogyne mali* (Section A.2 in Appendix A).

5.3.3. Overview of the evaluation of *Eulecanium excrescens* for all the commodity types

Rating of the likelihood of pest freedom	**Almost always pest free** (based on the Median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free potted plants	***9,986*** out of 10,000 bundles	***9,990*** out of 10,000 bundles	***9,994*** out of 10,000 bundles	***9,997*** out of 10,000 bundles	***9,999*** out of 10,000 bundles
Proportion of infested potted plants	***1*** out of 10,000 bundles	***3*** out of 10,000 bundles	***6*** out of 10,000 bundles	***10*** out of 10,000 bundles	***14*** out of 10,000 bundles
Proportion of pest-free bundles of bare-rooted plants	***9,982*** out of 10,000 bundles	***9,987*** out of 10,000 bundles	***9,991*** out of 10,000 bundles	***9,995*** out of 10,000 bundles	***9,998*** out of 10,000 bundles
Proportion of infested bundles of bare-rooted plants	***2*** out of 10,000 bundles	***5*** out of 10,000 bundles	***9*** out of 10,000 bundles	***13*** out of 10,000 bundles	***18*** out of 10,000 bundles
Proportion of pest-free bundles of graftwood/budwood	***9,976*** out of 10,000 bundles	***9,982*** out of 10,000 bundles	***9,988*** out of 10,000 bundles	***9,994*** out of 10,000 bundles	***9,999*** out of 10,000 bundles

Proportion of infested bundles of graftwood/ budwood	***1*** out of 10,000 bundles	***6*** out of 10,000 bundles	***12*** out of 10,000 bundles	***18*** out of 10,000 bundles	***24*** out of 10,000 bundles
Summary of the information used for the evaluation	**Possibility that the pest could become associate with the commodity** *Eulecanium excrescens* is present in the UK as introduced species with restricted distribution to the Greater London Area; outside this area, the pest has been reported only in a few localities of the neighbouring county of Hertfordshire (Salisbury et al., 2010). The organism has been found at numerous sites in London and is likely to have been present in the UK since at least 2000. *E. excrescens* may be more widespread in the PRA area than is currently known. *M. domestica* is a host of *E. excrescens* (Deng, 1985). **Measures taken against the pest and their efficacy** The relevant proposed measures are: (i) Inspection, certification and surveillance, (ii) Sampling and laboratory testing, (iii) Cleaning and disinfection of facilities, tools and machinery, (iv) Removal of soil from roots (washing) and (v) Pre-consignment inspection. **Interception records** There are no records of interceptions from UK. **Shortcomings of current measures/procedures** The undetected presence of *E. excrescens* during inspections may contribute to its spread. **Main uncertainties** • Symptoms caused by *E. excrescens* may be overlooked at the onset of infestation. • The presence of early stages (crawlers) of *E. excrescens* cannot be detected easily. • *E. excrescens* is not under official surveillance in UK, as it does not meet criteria of quarantine pest for GB. It is uncertain how many other UK sites may be infested but undetected.				

For more details, see relevant pest data sheet on *Eulecanium excrescens* (Section A.3 in Appendix A).

5.3.4. Overview of the evaluation of *Takahashia japonica* for all the commodity types

Rating of the likelihood of pest freedom	**Almost always pest free** (based on the Median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free potted plants	***9,986*** out of 10,000 bundles	***9,990*** out of 10,000 bundles	***9,994*** out of 10,000 bundles	***9,997*** out of 10,000 bundles	***9,999*** out of 10,000 bundles
Proportion of infested potted plants	***1*** out of 10,000 bundles	***3*** out of 10,000 bundles	***6*** out of 10,000 bundles	***10*** out of 10,000 bundles	***14*** out of 10,000 bundles
Proportion of pest-free bundles of bare-rooted plants	***9,982*** out of 10,000 bundles	***9,987*** out of 10,000 bundles	***9,991*** out of 10,000 bundles	***9,995*** out of 10,000 bundles	***9,998*** out of 10,000 bundles
Proportion of infested bundles of bare-rooted plants	***2*** out of 10,000 bundles	***5*** out of 10,000 bundles	***9*** out of 10,000 bundles	***13*** out of 10,000 bundles	***18*** out of 10,000 bundles
Proportion of pest-free bundles of graftwood/ budwood	***9,976*** out of 10,000 bundles	***9,982*** out of 10,000 bundles	***9,988*** out of 10,000 bundles	***9,994*** out of 10,000 bundles	***9,999*** out of 10,000 bundles

Proportion of infested bundles of graftwood/ budwood	***1*** out of 10,000 bundles	***6*** out of 10,000 bundles	***12*** out of 10,000 bundles	***18*** out of 10,000 bundles	***24*** out of 10,000 bundles
Summary of the information used for the evaluation	**Possibility that the pest could become associate with the commodity** *Takahashia japonica* is present in the UK (Tuffen et al., 2019). The pest was recorded from West Berkshire in 2018 on Magnolia in a private garden (Malumphy et al., 2019; Tuffen et al., 2019). No action was taken reflecting the low threat this pest poses to the UK. The UK NPPO have not revisited the original site to determine if it is present or not so they have no evidence to prove that it is absent (answer by DEFRA). *Malus pumila* (=*domestica*) is reported to be host for *T. japonica* (Limonta et al., 2022); however, it is not reported among the major hosts by the UK NPPO (DEFRA, online). **Measures taken against the pest and their efficacy** The relevant proposed measures are: (i) Inspection, certification and surveillance, (ii) Sampling and laboratory testing, (iii) Cleaning and disinfection of facilities, tools and machinery, (iv) Removal of soil from roots (washing) and (v) Pre-consignment inspection. **Interception records** There are no records of interceptions from UK. **Shortcomings of current measures/procedures** The undetected presence of *Takahashia japonica* during inspections may contribute to its spread. **Main uncertainties** • Symptoms caused by *T. japonica* may be overlooked at the onset of infestation. • The presence of early stages (crawlers) of *T. japonica* cannot be detected easily. • *T. japonica* is not under official surveillance in UK, as it does not meet criteria of quarantine pest for GB. It is uncertain how many other UK sites may be infested but undetected.				

For more details, see relevant pest data sheet on *Takahashia japonica* (Section A.4 in Appendix A).

5.3.5. Overview of the evaluation of tobacco ringspot virus for all the commodity types

Rating of the likelihood of pest freedom	**Almost always pest free** (based on the Median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free potted plants	***9,996*** out of 10,000 bundles	***9,997*** out of 10,000 bundles	***9,998*** out of 10,000 bundles	***9,999*** out of 10,000 bundles	***10,000*** out of 10,000 bundles
Proportion of infested potted plants	***0*** out of 10,000 bundles	***1*** out of 10,000 bundles	***2*** out of 10,000 bundles	***3*** out of 10,000 bundles	***4*** out of 10,000 bundles
Proportion of pest-free bundles of bare-rotted plants	***9,993*** out of 10,000 bundles	***9,995*** out of 10,000 bundles	***9,997*** out of 10,000 bundles	***9,998*** out of 10,000 bundles	***9,999*** out of 10,000 bundles
Proportion of infested bundles of bare-rotted plants	***1*** out of 10,000 bundles	***2*** out of 10,000 bundles	***3*** out of 10,000 bundles	***5*** out of 10,000 bundles	***7*** out of 10,000 bundles
Proportion of pest-free bundles of graftwood/ budwood	***9,987*** out of 10,000 bundles	***9,991*** out of 10,000 bundles	***9,994*** out of 10,000 bundles	***9,997*** out of 10,000 bundles	***9,999*** out of 10,000 bundles
Proportion of infested bundles of graftwood/ budwood	***1*** out of 10,000 bundles	***3*** out of 10,000 bundles	***6*** out of 10,000 bundles	***9*** out of 10,000 bundles	***13*** out of 10,000 bundles

Summary of the information used for the evaluation	**Possibility that the pest/pathogen could enter exporting nurseries** TRSV has a wide host range, including herbaceous and woody plant species. Its occurrence in the UK is restricted. The dispersal range of TRSV infection by natural processes appears to be constrained, as the nematode-vector species of the *Xiphinema americanum* group have not been reported recently in the UK. **Measures taken against the pest/pathogen and their efficacy** Only certified class plant material is used at the production areas, and quarantine practices are carried out in accordance with the 'Seedling Certification Regulation' and 'Regulation on the Registration of Plant Passports and Operators'. **Interception records** There are no records of interceptions of *M. domestica* plants for planting from the UK due to the presence of TRSV. **Shortcomings of current measures/procedures** Details on the inspections and surveillance to detect TRSV. **Main uncertainties** The certification process/status of the material. TRSV dispersal by other means (seeds or pollen to the mother plant) are unknown in woody plants. The extent of the inspections to detect TRSV infections is unknown.

For more details, see relevant pest data sheet on tobacco ringspot virus (Section A.5 in Appendix A).

5.3.6. Overview of the evaluation of tomato ringspot virus for all the commodity types

Rating of the likelihood of pest freedom	**Almost always pest free** (based on the Median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free potted plants	***9,996*** out of 10,000 bundles	***9,997*** out of 10,000 bundles	***9,998*** out of 10,000 bundles	***9,999*** out of 10,000 bundles	***10,000*** out of 10,000 bundles
Proportion of infested potted plants	***0*** out of 10,000 bundles	***1*** out of 10,000 bundles	***2*** out of 10,000 bundles	***3*** out of 10,000 bundles	***4*** out of 10,000 bundles
Proportion of pest-free bundles of bare-rooted plants	***9,993*** out of 10,000 bundles	***9,995*** out of 10,000 bundles	***9,997*** out of 10,000 bundles	***9,998*** out of 10,000 bundles	***9,999*** out of 10,000 bundles
Proportion of infested bundles of bare-rooted plants	***1*** out of 10,000 bundles	***2*** out of 10,000 bundles	***3*** out of 10,000 bundles	***5*** out of 10,000 bundles	***7*** out of 10,000 bundles
Proportion of pest-free bundles of graftwood/budwood	***9,987*** out of 10,000 bundles	***9,991*** out of 10,000 bundles	***9,994*** out of 10,000 bundles	***9,997*** out of 10,000 bundles	***9,999*** out of 10,000 bundles
Proportion of infested bundles of graftwood/budwood	***1*** out of 10,000 bundles	***3*** out of 10,000 bundles	***6*** out of 10,000 bundles	***9*** out of 10,000 bundles	***13*** out of 10,000 bundles
Summary of the information used for the evaluation	**Possibility that the pest/pathogen could enter exporting nurseries** ToRSV has a wide host range, including herbaceous and woody plant species. Its occurrence in the UK is restricted. The dispersal range of ToRSV infection by natural processes appears to be constrained, as the nematode-vector species of the *Xiphinema americanum* group have not been reported recently in the UK. **Measures taken against the pest/pathogen and their efficacy** Only certified class plant material is used at the production areas, and quarantine practices are carried out in accordance with the 'Seedling Certification Regulation' and 'Regulation on the Registration of Plant Passports and Operators'.				

	Interception records There are no records of interceptions of *M. domestica* plants for planting from the UK due to the presence of ToRSV. **Shortcomings of current measures/procedures** Details on the inspections and surveillance to detect ToRSV. **Main uncertainties** The certification process/status of the material. ToRSV dispersal by other means (seeds or pollen to the mother plant) are unknown in woody plants. The extent of the inspections to detect ToRSV infections is unknown.

For more details, see relevant pest data sheet on tomato ringspot virus (Section A.6 in Appendix A).

5.3.7. Outcome of expert knowledge elicitation

Table 6 and Figure 6 show the outcome of the EKE regarding pest freedom after the evaluation of the proposed risk mitigation measures for all the evaluated pests.

Figure 7 provides an explanation of the descending distribution function describing the likelihood of pest freedom after the evaluation of the proposed risk mitigation measures for *Malus domestica* trees designated for export to the EU for *C. aenigma, M. mali, E. excrescens, T. japonica,* tobacco ringspot virus and tomato ringspot virus.

Table 6: Assessment of the likelihood of pest freedom following evaluation of current risk mitigation measures against *Colletotrichum aenigma, Meloidogyne mali, Eulecanium excrescens, Takahashia japonica,* tobacco ringspot virus and tomato ringspot virus on *Malus domestica* 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

Number	Group	Pest species	Sometimes pest free	More often than not pest free	Frequently pest free	Very frequently pest free	Extremely frequently pest free	Pest free with some exceptional cases	Pest free with few exceptional cases	Almost always pest free
1	Fungi	*Colletotrichum aenigma*/potted						**L**	**M**	**U**
2	Fungi	*Colletotrichum aenigma*/bare rooted						**L**	**M**	**U**
3	Fungi	*Colletotrichum aenigma*/ graftwood								**LMU**
4	Nematodes	*Meloidogyne mali*/potted								**LMU**
5	Nematodes	*Meloidogyne mali*/bare rooted								**LMU**
6	Insects	*Eulecanium excrescens*/ potted						**L**	**M**	**U**
7	Insects	*Eulecanium excrescens*/bare-rooted						**L**	**M**	**U**
8	Insects	*Eulecanium excrescens*/ graftwood						**LM**		**U**
9	Insects	*Takahashia japonica*/potted						**L**	**M**	**U**
10	Insects	*Takahashia japonica*/bare-rooted						**L**	**M**	**U**
11	Insects	*Takahashia japonica*/ graftwood						**LM**		**U**

Number	Group	Pest species	Sometimes pest free	More often than not pest free	Frequently pest free	Very frequently pest free	Extremely frequently pest free	Pest free with some exceptional cases	Pest free with few exceptional cases	Almost always pest free
12	Viruses	tobacco ringspot virus/potted								LMU
13	Viruses	tobacco ringspot virus/bare-rooted							L	MU
14	Viruses	tobacco ringspot virus/graftwood						L	M	U
15	Viruses	tomato ringspot virus/potted								LMU
16	Viruses	tomato ringspot virus/bare-rooted							L	MU
17	Viruses	tomato ringspot virus/graftwood						L	M	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 to ≤ 9,000
	Frequently pest free	9,000 to ≤ 9,500
	Very frequently pest free	9,500 to ≤ 9,900
	Extremely frequently pest free	9,900 to ≤ 9,950
	Pest free with some exceptional cases	9,950 to ≤ 9,990
	Pest free with few exceptional cases	9,990 to ≤ 9,995
	Almost always pest free	9,995 to ≤ 10,000

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

PANEL B

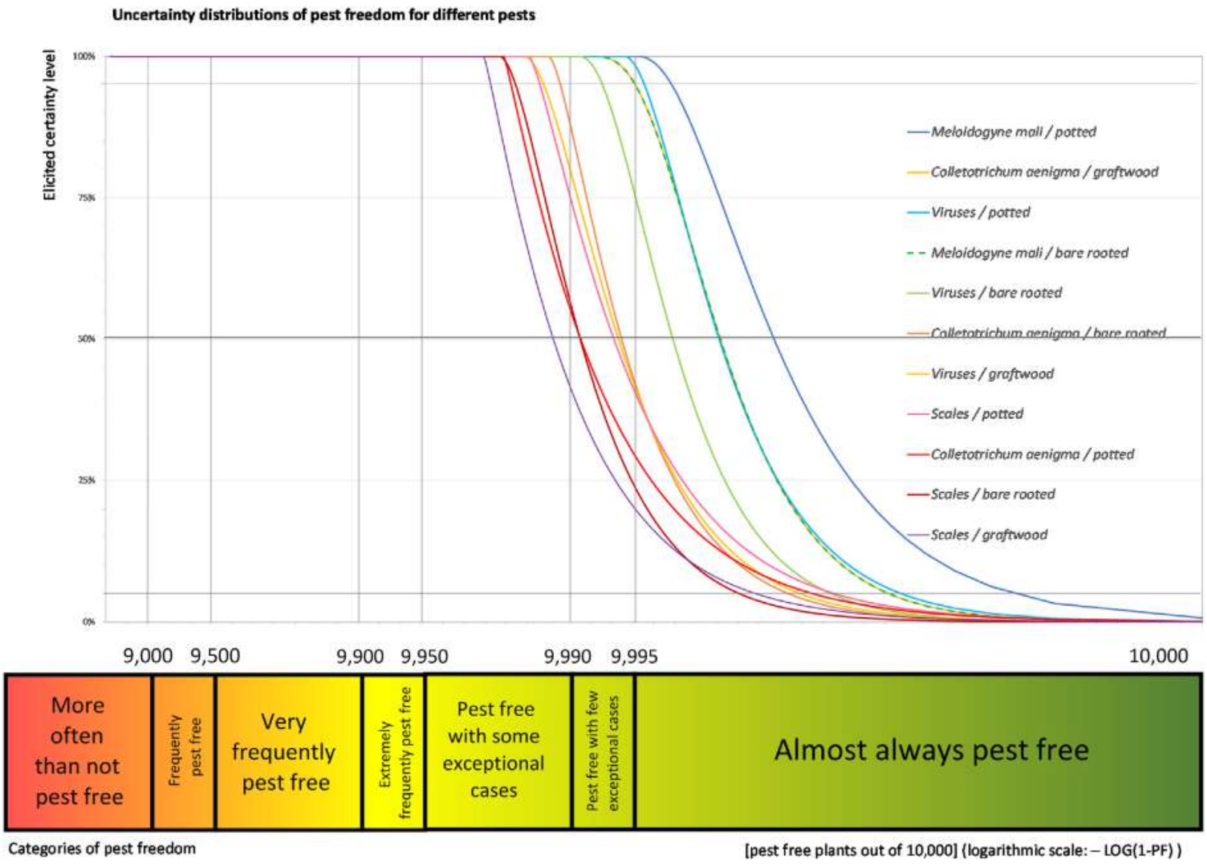


Figure 6: Elicited certainty (y-axis) of the number of pest-free *Malus domestica* commodities (x-axis; log-scaled) out of 10,000 designated for export to the EU from the UK for all evaluated pests visualised as descending distribution function. Horizontal lines indicate the percentiles (starting from the bottom 5%, 25%, 50%, 75%, 95%). The Panel is 95% confident that *9,976*, – (scales – budwood/graftwood), *9,981* (*Colletotrichum aenigma* – potted), *9,982* (scales – bare rooted), *9,986* (scales potted), *9,987* (viruses – budwood/graftwood), *9,989* (*Colletotrichum aenigma* – bare rooted), *9,993* (viruses – bare rooted), *9,995* (*Colletotrichum aenigma* – budwood/graftwood), 9*,995* (*Meloidogyne mali* – bare rooted), *9,996* (viruses – potted), 9*,997* (*Meloidogyne mali* – potted) will be pest free

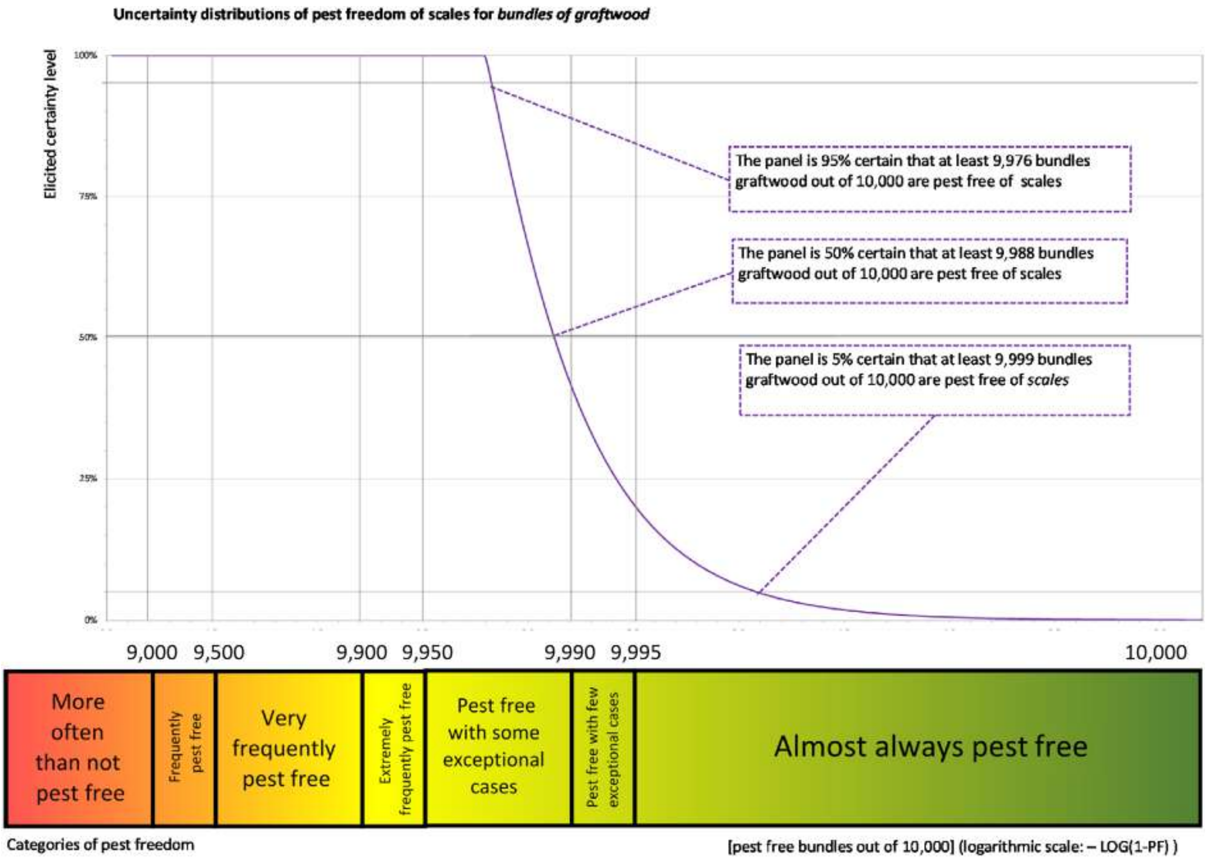


Figure 7: Explanation of the descending distribution function describing the likelihood of pest freedom after the evaluation of the proposed risk mitigation measures for plants (bundles of budwood/graftwood) designated for export to the EU based on the example of scales (*E. excrescens* and *T. japonica)*

5.4. Evaluation of the application of specific measures in the United Kingdom

Annex X of the Commission Implementing Regulation (EU) 2019/2072 specifies a list of plants, plant products and other objects, originating from third countries and the corresponding special requirements for their introduction into the Union territory or Protected Zones. According to the above-mentioned annex, special measures are required for the import of the commodity from the UK related to *Erwinia amylovora*. Based on the information provided in the Dossier, including the supplementary information, the exporting country does meet the specific requirements for a certificate regarding *E. amylovora*. There is an official pest-free area (Jersey) as well as there is a buffer zone as specified in the legislation.

6. Conclusions

There are seven pests identified to be present in the UK and considered to be potentially associated with plants in pots, bare-rooted plants, budwood and graftwood of *Malus domestica* imported from the UK and relevant for the EU.

The Panel concludes that for *Erwinia amylovora*, the exporting country does meet the specific requirements for a certificate regarding this pest.

For the remaining six pests *Colletotrichum aenigma, Meloidogyne mali*, *Eulecanium excrescens*, *Takahashia japonica*, tobacco ringspot virus and tomato ringspot virus, the likelihood of pest freedom after the evaluation of the proposed risk mitigation measures for plants in pots, bare-rooted plants, budwood and graftwood of *Malus domestica* designated for export to the EU was estimated.

For *Colletotrichum aenigma*, the likelihood of pest freedom following evaluation of current risk mitigation measures was estimated as:

a) For potted plants 'Pest free with few exceptional cases' with the 90% uncertainty range reaching from 'Pest free with some exceptional cases' to 'Almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,981 and 10,000 units per 10,000 will be free from *Colletotrichum aenigma*.
b) For bare-rooted plants, 'Pest free with few exceptional cases' with the 90% uncertainty range reaching from 'Pest free with some exceptional cases s' to 'Almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,989 and 10,000 units per 10,000 will be free from *Colletotrichum aenigma*.
c) For budwood/graftwood 'Almost always pest free' with the 90% uncertainty range reaching from 'Almost always pest free' to 'Almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,995 and 10,000 units per 10,000 will be free from *Colletotrichum aenigma*.

For *Meloidogyne mali*, the likelihood of pest freedom following evaluation of current risk mitigation measures was estimated as:

a) For potted plants 'Almost always pest free' with the 90% uncertainty range reaching from 'Almost always pest free' to 'Almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,997 and 10,000 units per 10,000 will be free from *Meloidogyne mali*.
b) For bare-rooted plants 'Almost always pest free' with the 90% uncertainty range reaching from 'Almost always pest free' to 'Almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,995 and 10,000 units per 10,000 will be free from *Meloidogyne mali*.

For the two scale species (*Eulecanium excrescens and Takahashia japonica*), the likelihood of pest freedom following evaluation of current risk mitigation measures was estimated as:

a) For potted plants 'Pest free with few exceptional cases' with the 90% uncertainty range reaching from 'Pest free with few exceptional cases' to 'Almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,986 and 10,000 units per 10,000 will be free from scales (*Eulecanium excrescens, Takahashia japonica*).
b) For bare-rooted plants, 'Pest free with few exceptional cases' with the 90% uncertainty range reaching from 'Pest free with few exceptional cases' to 'Almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,982 and 10,000 units per 10,000 will be free from scales (*Eulecanium excrescens, Takahashia japonica*).
c) For budwood/graftwood, 'Pest free with few exceptional cases' with the 90% uncertainty range reaching from 'Pest free with few exceptional cases' to 'Almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,976 and 10,000 units per 10,000 will be free from scales (*Eulecanium excrescens, Takahashia japonica*).

For the two virus species (tobacco ringspot virus and tomato ringspot virus), the likelihood of pest freedom following evaluation of current risk mitigation measures was estimated as:

a) For potted plants, 'Almost always pest free' with the 90% uncertainty range reaching from 'Pest free with few exceptional cases' to 'Almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,996 and 10,000 units per 10,000 will be free from both viruses.
b) For bare-rooted plants, 'Almost always pest free' with the 90% uncertainty range reaching from 'Pest free with few exceptional cases' to 'Almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,993 and 10,000 units per 10,000 will be free from both viruses.
c) For budwood/graftwood 'Almost always pest free' with the 90% uncertainty range reaching from 'Pest free with some exceptional cases' to 'Almost always pest free'. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9,987 and 10,000 units per 10,000 will be free from both viruses.

References

Ahmed M, van de Vossenberg BTLH, Cornelisse C and Karssen G, 2013. On the species status of the root-knot nematode *Meloidogyne ulmi* Palmisano & Ambrogioni, 2000 (Nematoda, Meloidogynidae). ZooKeys, 362, 1–27. https://doi.org/10.3897/zookeys.362.6352

Baroncelli R, Zapparata A, Sarrocco S, Sukno SA, Lane CR, Thon MR, Vannacci G, Holub E and Sreenivasaprasad S, 2015. Molecular diversity of anthracnose pathogen populations associated with UK strawberry production suggests multiple introductions of three different *Colletotrichum* species. PLoS One, 10, 21. https://doi.org/10.1371/journal.pone.0129140

CABI (Centre for Agriculture and Bioscience International), online. CABI Crop Protection Compendium. Available online: https://www.cabi.org/cpc/ [Accessed: 17 February 2023].

DEFRA (Department for Environment, Food and Rural Affairs), online. UK Risk Register Details for *Takahashia japonica*. Available online: https://planthealthportal.defra.gov.uk/pests-and-diseases/uk-plant-health-risk-register/viewPestRisks.cfm?cslref=27909 [Accessed: 7 February 2023].

Deng DL, 1985. *Anthribus niveovariegatus* (Reolofs) - a natural enemy of *Eulecanium excrescens* Ferris. Plant Protection, 11, 14–15.

EFSA PLH Panel (EFSA Panel on Plant Health), 2018. Guidance on quantitative pest risk assessment. EFSA Journal 2018;16(8):5350, 86 pp. https://doi.org/10.2903/j.efsa.2018.5350

EFSA PLH Panel (EFSA Panel on Plant Health), 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 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

EPPO (European and Mediterranean Plant Protection Organization), 2017. Pest risk analysis for *Meloidogyne Mali*. EPPO, Paris. Available online: https://www.eppo.int/QUARANTINE/Pest_Risk_Analysis/PRA_intro.htm

EPPO (European and Mediterranean Plant Protection Organization), online. EPPO Global Database. Available online: https://gd.eppo.int/ [Accessed: 17 February 2023].

EUROPHYT, online. European Union Notification System for Plant Health Interceptions – EUROPHYT. Available online: https://ec.europa.eu/food/plant/plant_health_biosecurity/europhyt/index_en.htm [Accessed: 17 February 2023].

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

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

Itoh Y, Ohshima Y and Ichinohe M, 1969. A root-knot nematode, Meloidogyne Mali n.sp. on apple-tree from Japan (Tylenchida: Heteroderidae). Applied Entomology and Zoology, 4, 104–202.

Limonta L, Porcelli F and Pellizzari G, 2022. An overview of *Takahashia japonica*: present distribution, host plants, natural enemies and life-cycle, with observations on its morphology. Bulletin of Insectology, 75, 306–314.

Malumphy C, Tuffen M and Andrew S, 2019. Plant pest factsheet: cotton stringy scale insect: *Takahashia japonica*. Department for Environment Food and Rural Affairs, 4.

Prior T, Tozer H, Yale R, Jones EP, Lawson R, Jutson L, Correia M, Stubbs J, Hockland S and Karssen G, 2019. First report of *Meloidogyne Mali* causing root galling to elm trees in the UK. New Disease Reports, 39, 10. https://doi.org/10.5197/j.2044-0588.2019.039.010

Salisbury A, Halstead A and Malumphy C, 2010. Wisteria scale, *Eulecanium excrescens* (Hemiptera: Coccidae) spreading in South East England. British Journal of Entomology and Natural History, 23, 225–228.

TRACES-NT, online. TRAde Control and Expert System. Available online: https://webgate.ec.europa.eu/tracesnt [Accessed: 17 February 2023].

Tuffen M, Salisbury A and Malumphy CP, 2019. Cotton stringy scale insect, *Takahashia japonica* (Hemiptera: Coccidae), new to Britain. British Journal of Entomology and Natural History, 32, 1–4.

Xu YM and Zhao ZQ, 2019. Longidoridae and Trichodoridae (Nematoda: Dorylaimida and Triplonchida). Fauna of New Zealand, 79, 149.

Abbreviations

CABI	Centre for Agriculture and Bioscience International
DEFRA	Department for Environment Food and Rural Affairs
EKE	Expert Knowledge Elicitation
EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization
ISPM	International Standards for Phytosanitary Measures
NPPO	National Plant Protection Organisation

PLH	Plant Health
PRA	Pest Risk Assessment
RNQPs	Regulated Non-Quarantine Pests

Glossary

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

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

A.1. *Colletotrichum aenigma*

A.1.1. Organism information

Taxonomic information	Current valid scientific name: *Colletotrichum aenigma* (Anthracnose and Glomerella leaf blight pathogen) Synonyms: *Colletotrichum populi* (Farr and Rossman, online) Name used in the EU legislation: – Order: Phyllachorales Family: Glomerellaceae Common name: – Name used in the Dossier: –
Group	Fungi
EPPO code	COLLAE
Regulated status	**EU status**: N/A **Non-EU**: N/A
Pest status in UK	*C. aenigma* has been reported in the UK (Baroncelli et al., 2015).
Pest status in the EU	*C. aenigma* has been reported in Italy from: *Pyrus communis*, *Citrus sinensis* and *Olea europaea* (Schena et al., 2014).
Host status on *Malus domestica*.	*C. aenigma* has been isolated from *M. domestica* in China (Wang et al., 2015; Zhang et al., 2021), Korea (Lee et al., 2021) and Japan (Yokosawa et al., 2017).
PRA information	Available Pest Risk Assessments: • Pest categorisation of *Colletotrichum aenigma, C. alienum, C. perseae, C. siamense and C. theobromicola* (EFSA PLH Panel, 2022). • Final report for the review of biosecurity import requirements for fresh strawberry fruit from Japan (Australian Government, 2020).

Other relevant information for the assessment		
Biology	*Colletotrichum* spp. are dispersed through asexual conidiospores which are produced on diseased plant tissue and dead leaves, but they can also, produce ascospores through sexual reproduction (Australian Government, 2020). Conidia and ascospores can be dispersed through raindrops, wind-blown rain, wind or insects. Infected nursery stock, contaminated soil, infected leaves and fruits are the main pathways. Moreover, *Colletotrichum spp*. can be distributed through asymptomatic hosts (mainly fruits) and can survive in the soil for a long period (80 days during summer, 120 days during winter) (Australian Government, 2020). *C. aenigma* mycelium can grow between 10°C and 36°C with an optimum of 28°C. *Colletotrichum spp*. development, sporulation and spread is favoured by warm, wet weather with an optimum temperature of 27°C. They can remain dormant in fruits and leaves, without causing any symptoms (quiescent period) (De Silva et al., 2017). If the sexual stage of the *Colletotrichum* spp. occurs, perithecia are formed, which can act as overwintering structures and source of inoculum.	
Symptoms	**Main type of symptoms**	Anthracnose symptoms can develop on flowers, stems, fruits, leaves and twigs (Velho et al., 2019). Leaves: – Disease on leaves referred to as Glomerella leaf spot; – Spots (from yellowish to brown discolorations); – Necrosis across or between leaf veins and at leaf tips; – Drop of leaves prematurely; – Dead or unhealthy.

		Shoots: – Brown or purplish lesions; – Dieback. Flowers: – Turn dark and die. Fruits: – Disease on fruits called 'bitter rot'; – Before harvest: Brown depressed lesions on fruit on the peel of young fruits which result in reduced fruit quality and fruit drop (Marais, 2004); – Lesions can become larger, darker and can show concentric rings of acervuli; – Pink spores on the surface; – Sectioning the fruit can reveal a v-shaped lesion.
	Presence of asymptomatic plants	Quiescent infections can occur in fruits and leaves. The fungus infects young fruits but enters a dormant phase until fruit maturity (Marais, 2004; Chen et al., 2022).
	Confusion with other pests	Due to the taxonomic re-evaluation of the *Colletotrichum* genus, the individual species can only be identified by combining morphological characters as well as DNA sequence analysis (EFSA PLH Panel, 2022).
Host plant range	*Colletotrichum aenigma* has been previously reported from wide range of hosts including *M. domestica, Camellia sinensis*, *Citrus sinensis*, *Fragaria* x *ananassa*, *Malus domestica*, *Olea europaea*, *Persea americana*, *Pyrus communis*, *Pyrus pyrifolia* and *Vitis vinifera* (Weir et al., 2012; Schena et al., 2014; Yan et al., 2015; Han et al., 2016; Wang et al., 2016; Sharma et al., 2017; Fu et al., 2019; Velho et al., 2019; EFSA PLH Panel, 2022).	
Reported evidence of impact	*Colletotrichum aenigma* has been identified in association with other *Colletotrichum* species causing anthracnose and pre- and post-harvest fruit rot in several economically important crop plants.	
Pathways and evidence that the commodity is a pathway	– Infected nursery stock, contaminated soil/substrate and fruits are the main pathways (Australian Government, 2020); – The pathogen can be dispersed through spores on dead twigs, leaves and mummified fruit; – Rain and humidity facilitate the spore production and dispersal. The pathogen can over-winter mainly on fresh/dry leaves and on fresh twigs.	
Surveillance information	According to the information provided by the NPPO – DEFRA of the UK: – *Colletotrichum aenigma* is not included in the list of pests associated with *M. domestica* in the UK. According to Baroncelli et al. (2015), *C. aenigma* has been isolated from strawberry infected tissue in the UK. However, there is no further information about the distribution within the UK.	

A.1.2. Possibility of pest presence in the nursery

A.1.2.1. Possibility of entry from the surrounding environment

Colletotrichum spp. have a wide host range. *C. aenigma* can infect a large number of plants, including fruits, vegetables, and ornamentals (EFSA PLH Panel, 2022). The major source of inoculum is from infected plant material, which can be leaves, twigs, and fruit of the affected plant species. While splash dispersal from rain or irrigation water is required to dislodge the conidia from the acervuli of the fungus, subsequent drying of the water droplets can lead to air-borne inoculum, which can be further dispersed via wind. Therefore, the presence of host species in the environment of the nurseries with *Malus M. domestica* plants is an important factor for the possible movement of inoculum into the nursery.

Uncertainties:

- There is a lack of information about the particular plant species in the surrounding area of nurseries. There may be private gardens in the surroundings containing plants that can serve as hosts e.g. *Fragaria* X *ananassa*.

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

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

The United Kingdom has regulations in place for fruit plant propagating material that are in line with those of European Union, and this equivalence has been recognised in Commission Implementing Decision (EU) 2020/2219. Thus, only material fulfilling characteristics of certified, basic, or CAC levels of certification, including the origin of the material, can be marketed.

Rootstocks are plants of *M. domestica* presumably grown from stoolbeds (this was not specifically mentioned in the Dossier) seeds and seedling from a NPPO-approved source therefore entry via this pathway is highly unlikely.

Uncertainties:

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

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

A.1.2.3. Possibility of spread within the nursery

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

Many *Colletotrichum* species can have extended hemibiotrophic or quiescent phases of their life cycles in asymptomatic plants, which can be overlooked by visual inspections and lead to an unintentional spread of the disease. (De Silva et al., 2017). Inspections are required once a year for basic 1–3 and certified materials. Trained nursery staff perform regular inspections of the material and implement relevant control measures but these apparently vary from nursery to nursery and no details were provided.

Uncertainties:

- There is uncertainty of the length of a possible dormant phase of the *Colletotrichum* species and whether this will lead to undetected presence of *Colletotrichum* species in the exported plants and scions despite the regular inspections.
- The *Colletotrichum* species have a wide host range. In the Dossier, there is no information on whether other host plant species are present within the nursery from which the *Colletotrichum* spp. could potentially spread to the *M. domestica* plants.

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

A.1.3. Information from interceptions

There are no records of interceptions of *Colletotrichum aenigma* plants for planting from the UK due to the presence of *C. aenigma* between 1998 and February 2023 (EUROPHYT, online; TRACES-NT, online).

A.1.4. Evaluation of the risk mitigation measures

In the table below, all risk mitigation measures currently applied in UK are listed and an indication of their effectiveness on *Colletotrichum aenigma* is provided. The description of the risk mitigation measures currently applied in UK is provided in Table 5.

No.	Risk mitigation measure	Effect on the pest	Evaluation and Uncertainties
1	Certified material	Yes	Uncertainties: – Due to the potential dormant phase of *Colletotrichum* spp., the visual inspection might be insufficient.
2	Phytosanitary certificates	Yes	Uncertainties: – Due to the potential dormant phase of *Colletotrichum* spp., the visual inspection might be insufficient.
3	Cleaning and disinfection of facilities, tools and machinery	Yes	Uncertainties: – Due to the potential dormant phase of *Colletotrichum* spp., the visual inspection might be insufficient.
4	Rouging and pruning	Yes	Uncertainties: – Due to the potential dormant phase of *Colletotrichum* spp., the visual inspection might be insufficient.
5	Biological and mechanical control	Yes	
6	Pesticide application	Yes	Uncertainties: – Resistance to fungicides is present in some populations of *Colletotrichum*. – The risk of fungicide resistance can vary according to the compounds (FRAC, 2020). – Fungicide treatment may not be sufficient to remove quiescent infections.
7	Surveillance and monitoring	Yes	Uncertainties: – Due to the potential dormant phase of *Colletotrichum* spp., the visual inspection might be insufficient.
8	Sampling and laboratory testing	Yes	Uncertainties: – Due to the potential dormant phase of *Colletotrichum* spp., the visual inspection might be insufficient.
9	Root washing	No	
10	Refrigeration	Yes	Uncertainties: – Reduced temperatures will only slow the growth of the fungus but not eliminate it. – The effect on latent or endophytic presence is unclear.
11	Pre-consignment inspection	Yes	Uncertainties: – Due to the potential dormant phase of *Colletotrichum* spp., the visual inspection might be insufficient.

A.1.5. Overall likelihood of pest freedom

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

- Pest pressure is very low in the UK.
- There are no other host plants present in the surroundings and within nursery.
- The use of dripping irrigation prevents and reduces the potential spread of fungal spores.
- Proper and effective application of fungicides to control fungal diseases; visual inspections are in place.
- Apple rot is not so much reported in the UK – could be rare in the UK.
- Growers and inspectors inspect plants and are effective in detecting and discarding infected materials.
- Latent infections are rare (with leaves showing symptoms of infection if present).
- Transport of the commodities is during the dormant stage.

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

- There are other host plants present in the surroundings and within nursery.
- There is no targeted survey in the UK.
- Growers are not trained and misidentification with other *Colletotrichum* species could happen.
- Latent infections could be overlooked.
- Leaves will be present in potted plants at the time of export.

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

The Panel assumes a scenario in which infections if occur would be below the estimated median value.

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 presence of latent infections.

A.1.5.5. Elicitation outcomes of the assessment of the pest freedom for *Colletotrichum aenigma*

The elicited and fitted values for *Colletotrichum aenigma* agreed by the Panel are shown in Tables A.1–A.6 and in Figures A.1–A.3.

Table A.1: Elicited and fitted values of the uncertainty distribution of pest infestation by *Colletotrichum aenigma* per 10,000 potted plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0					4		9		14					20
EKE	0.121	0.329	0.701	1.494	2.62	4.09	5.61	8.84	12.3	14.1	16.0	17.6	18.9	19.6	20.0

The EKE results are the BetaGeneral (0.9186, 1.1147, 0, 20.4) distribution fitted with @Risk version 7.6.

Based on the numbers of estimated infested plants the pest freedom was calculated (i.e. = 10,000 – the number of infested 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 *Colletotrichum aenigma* per 10,000 potted 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	9,980					9,986		9,991		9,996					10,000
EKE results	9,980	9,980	9,981	9,982	9,984	9,986	9,988	9,991	9,994	9,996	9,997	9,998.5	9,999.3	9,999.7	9,999.9

The EKE results are the fitted values.

Table A.3: Elicited and fitted values of the uncertainty distribution of pest infestation by *Colletotrichum aenigma* per 10,000 bundles of bare rooted plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0					3		6		8					12
EKE	0.272	0.541	0.913	1.55	2.31	3.17	4.01	5.66	7.4	8.3	9.3	10.2	11.0	11.6	12.0

The EKE results are BetaGeneral (1.344, 1.564, 0, 12.5) distribution fitted with @Risk version 7.6.

Based on the numbers of estimated infested bundles of bare rooted plants the pest freedom was calculated (i.e. = 10,000 – the number of infested bundles per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.4.

Table A.4: The uncertainty distribution of bundles free of *Colletotrichum aenigma* per 10,000 bundles calculated by Table A.3

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,988					9,992		9,994		9,997					10,000
EKE results	9,988	9,988	9,989	9,990	9,991	9,992	9,993	9,994	9,996	9,997	9,998	9,998	9,999.1	9,999.5	9,999.7

The EKE results are the fitted values.

Table A.5: Elicited and fitted values of the uncertainty distribution of pest infestation by *Colletotrichum aenigma* per 10,000 bundles of budwood/graftwood

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0					1		2		3					6
EKE	0.0978	0.186	0.306	0.508	0.751	1.04	1.32	1.93	2.64	3.07	3.62	4.21	4.88	5.43	6.01

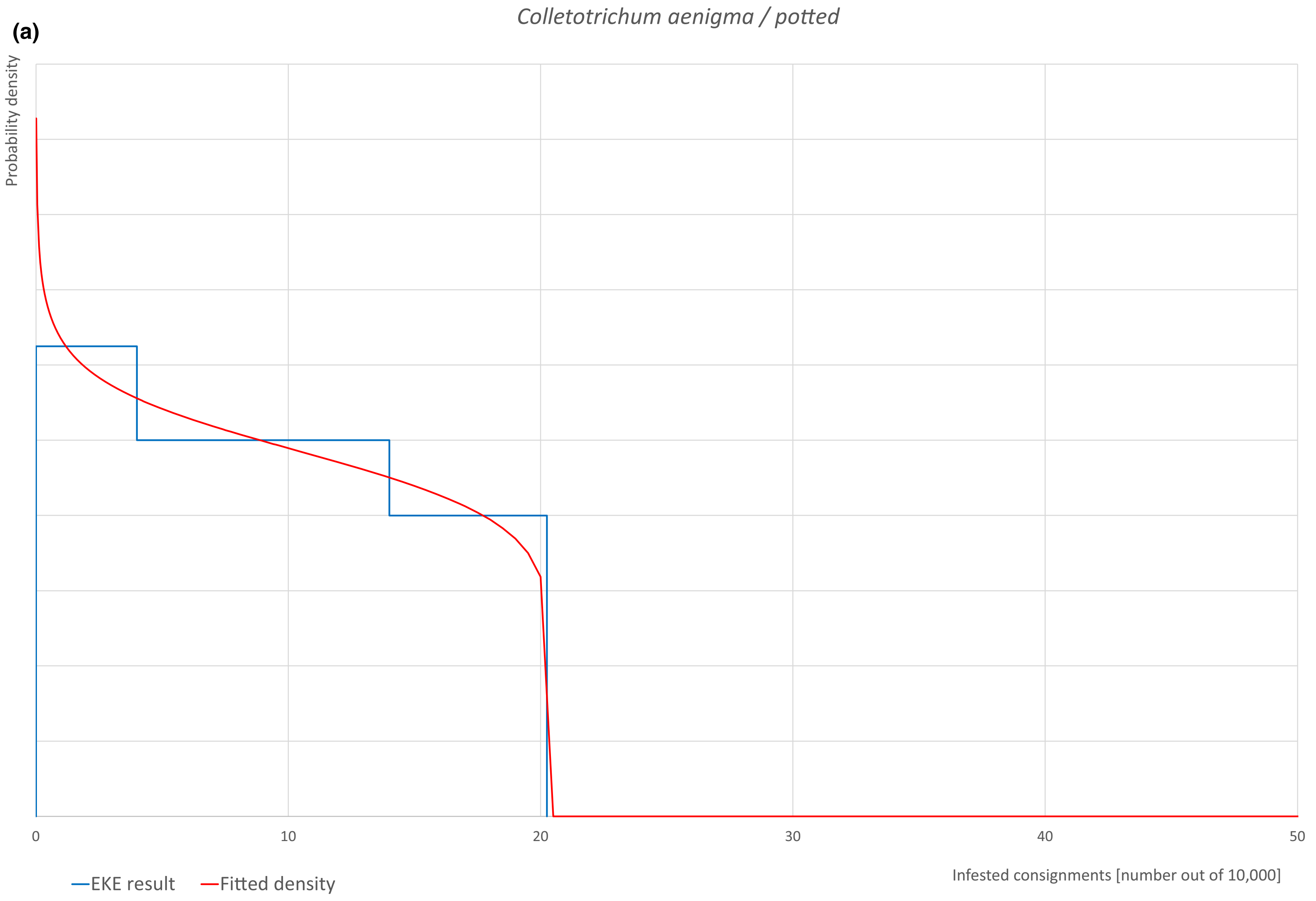
The EKE results are the BetaGeneral (1.4527, 4.0355, 0, 8.2) distribution fitted with @Risk version 7.6.

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

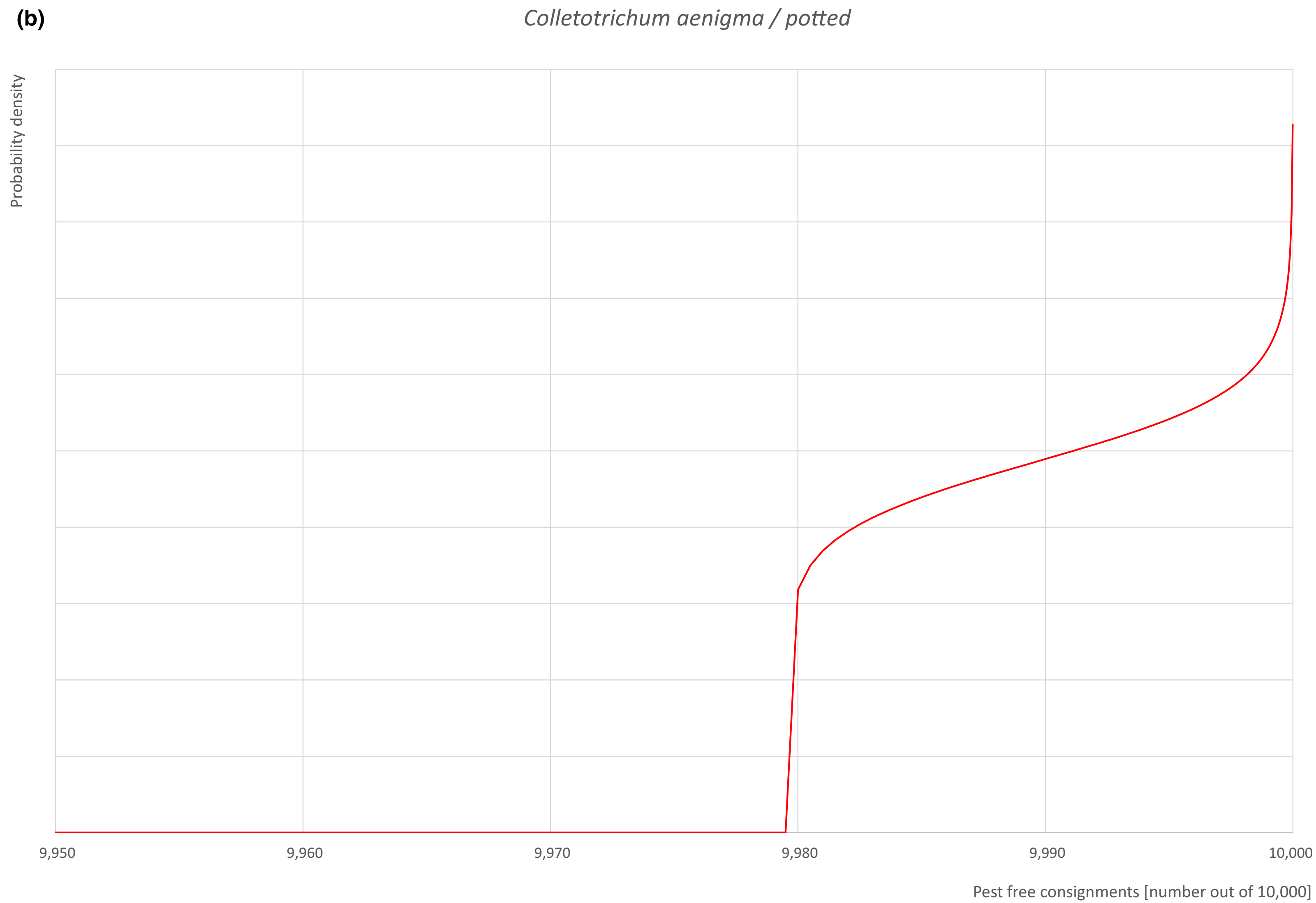
Table A.6: The uncertainty distribution of bundles free of *Colletotrichum aenigma* per 10,000 bundles of budwood/graftwood calculated by Table A.5

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,994					9,997		9,998		9,999					10,000
EKE results	9,994	9,995	9,995	9,996	9,996	9,997	9,997	9,998.1	9,998.7	9,999.0	9,999.2	9,999.5	9,999.7	9,999.8	9,999.9

The EKE results are the fitted values.


Colletotrichum aenigma / potted
(a)
Probability density
0
10
20
30
40
50
Infested consignments [number out of 10,000]
EKE result
Fitted density

(b)


Colletotrichum aenigma / potted
Probability density
9,950
9,960
9,970
9,980
9,990
10,000
Pest free consignments [number out of 10,000]

(c)

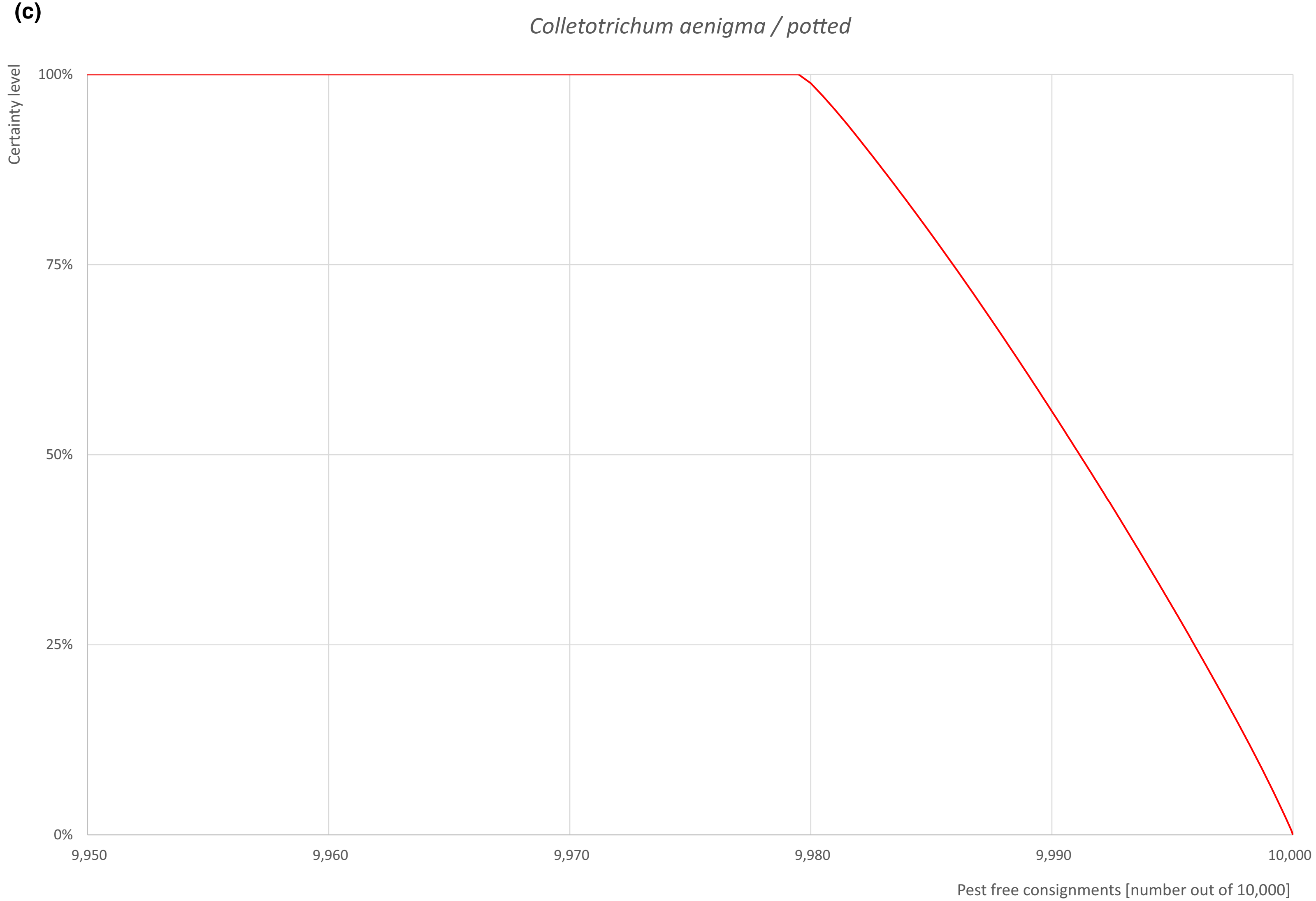
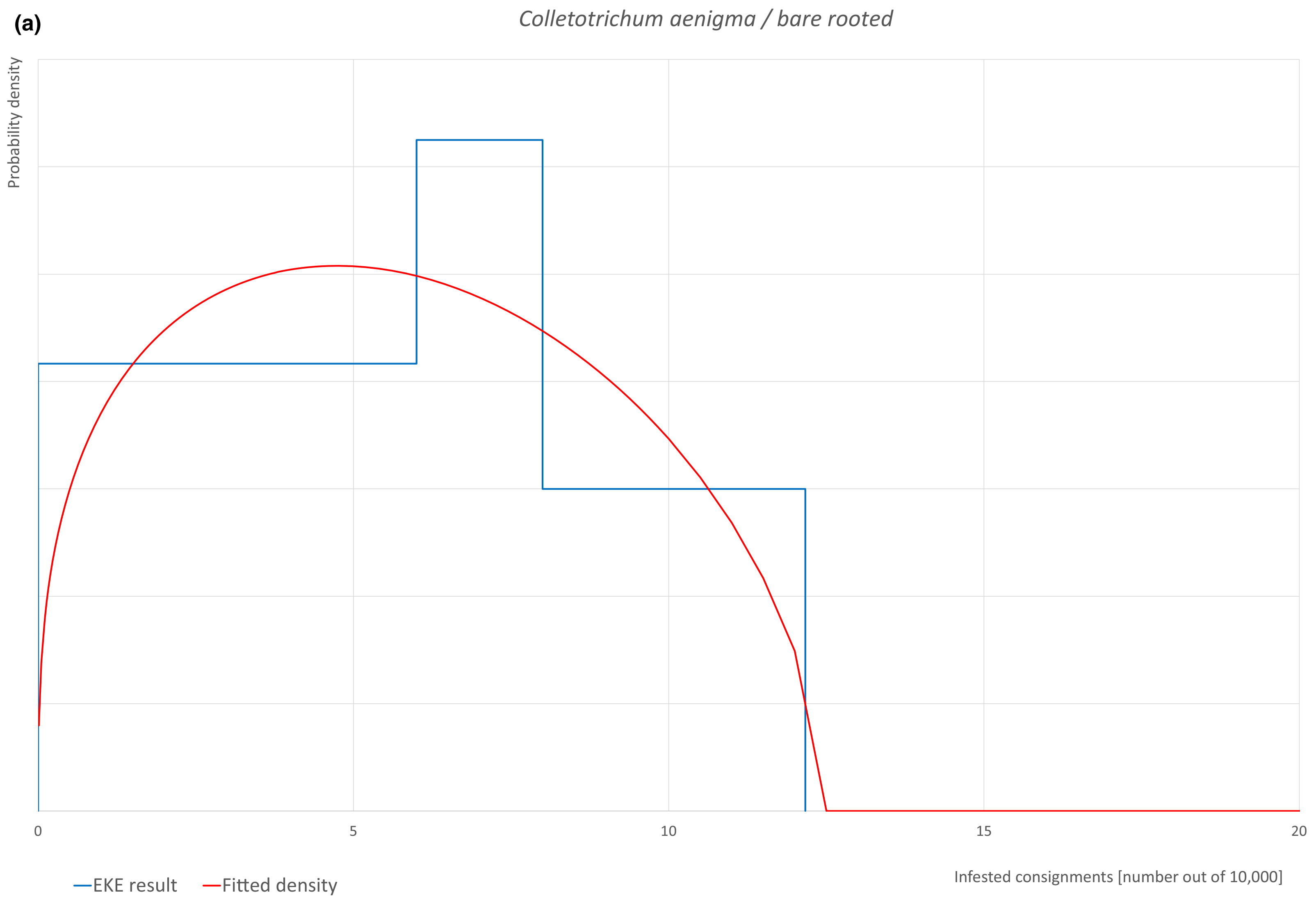
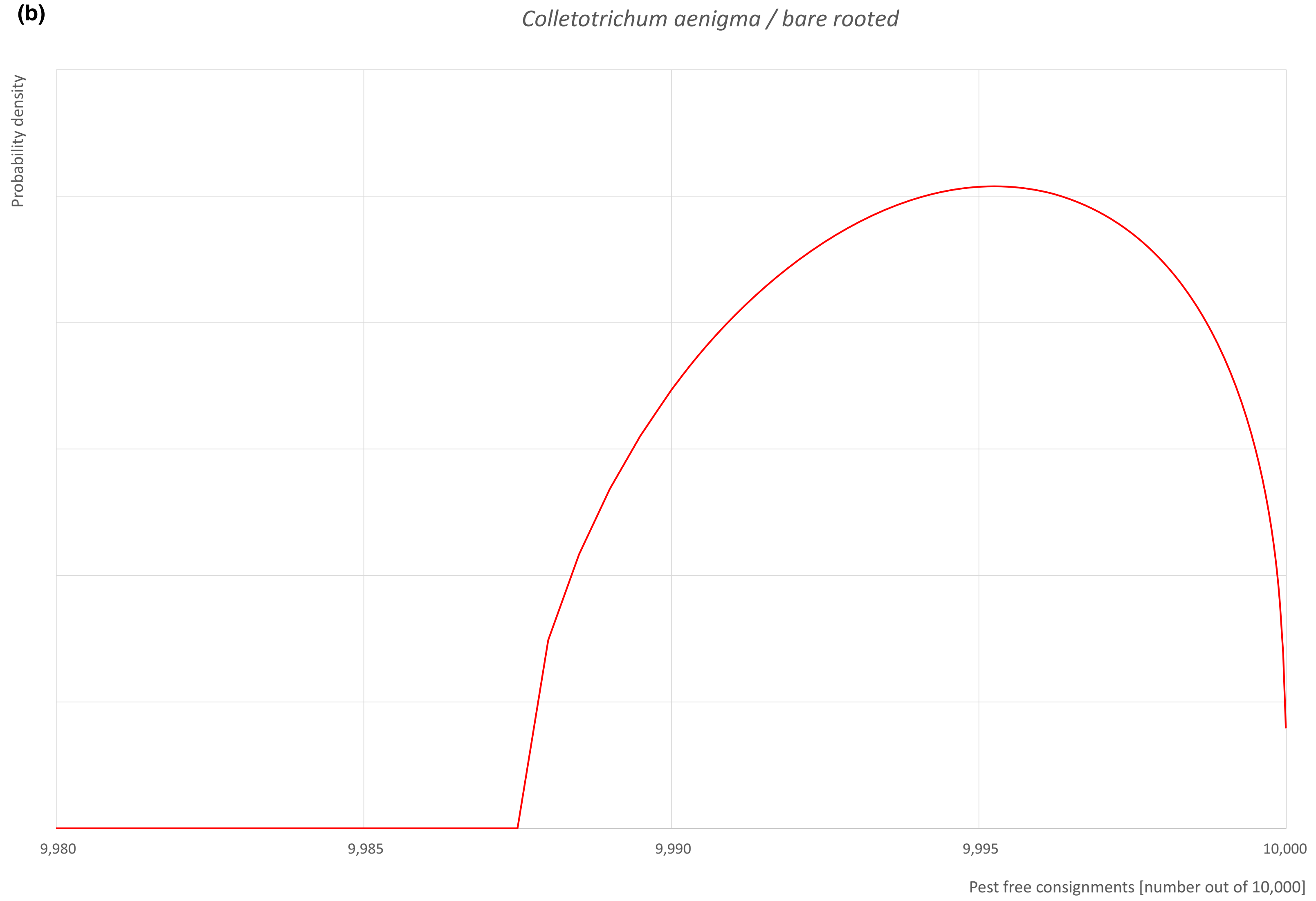


Figure A.1: (a) Elicited uncertainty of pest infestation per 10,000 potted plants (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free bundles per 10,000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


(a)
Colletotrichum aenigma / bare rooted
Probability density
0
5
10
15
20
Infested consignments [number out of 10,000]
EKE result
Fitted density

(b)


Colletotrichum aenigma / bare rooted
Probability density
9,980
9,985
9,990
9,995
10,000
Pest free consignments [number out of 10,000]

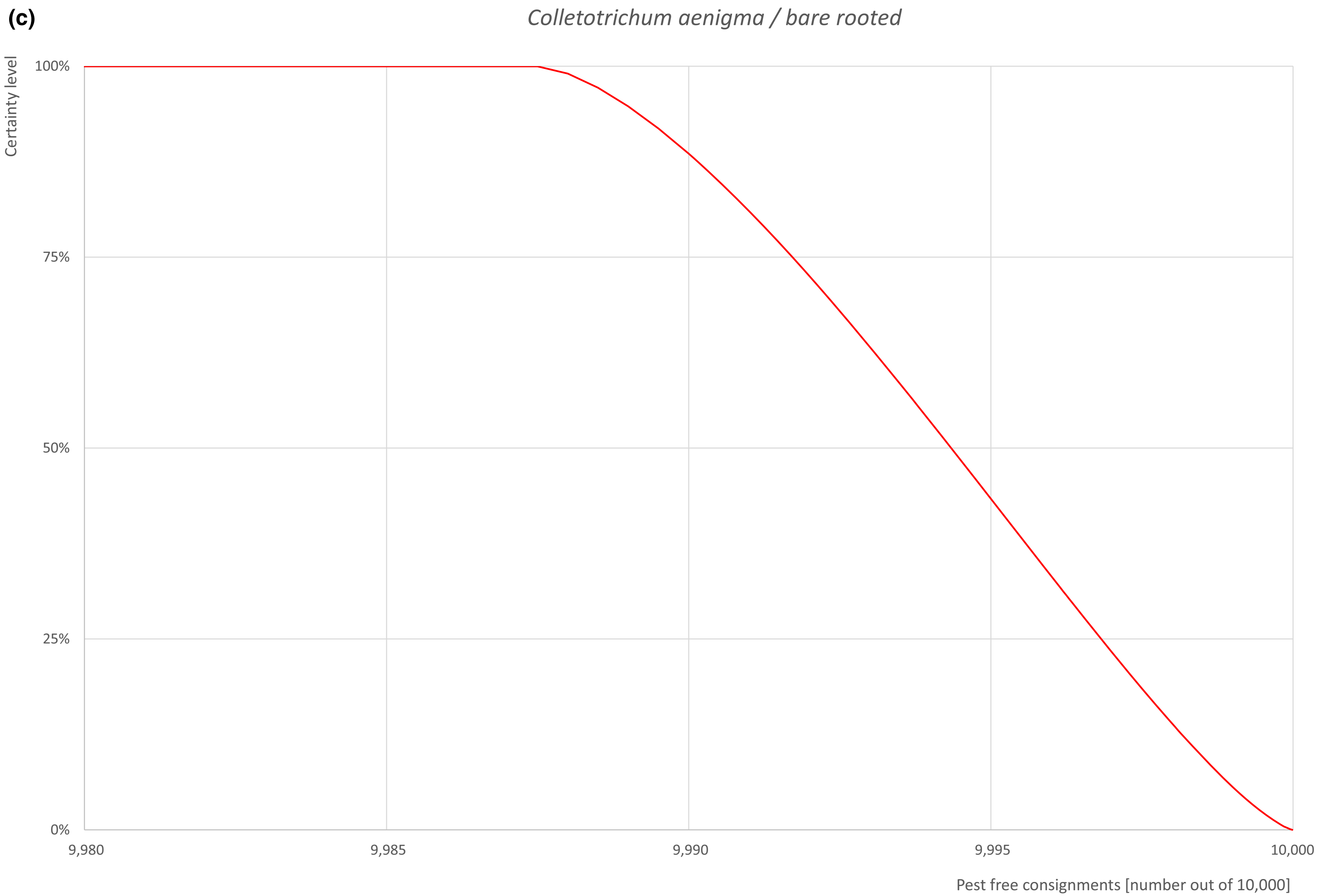
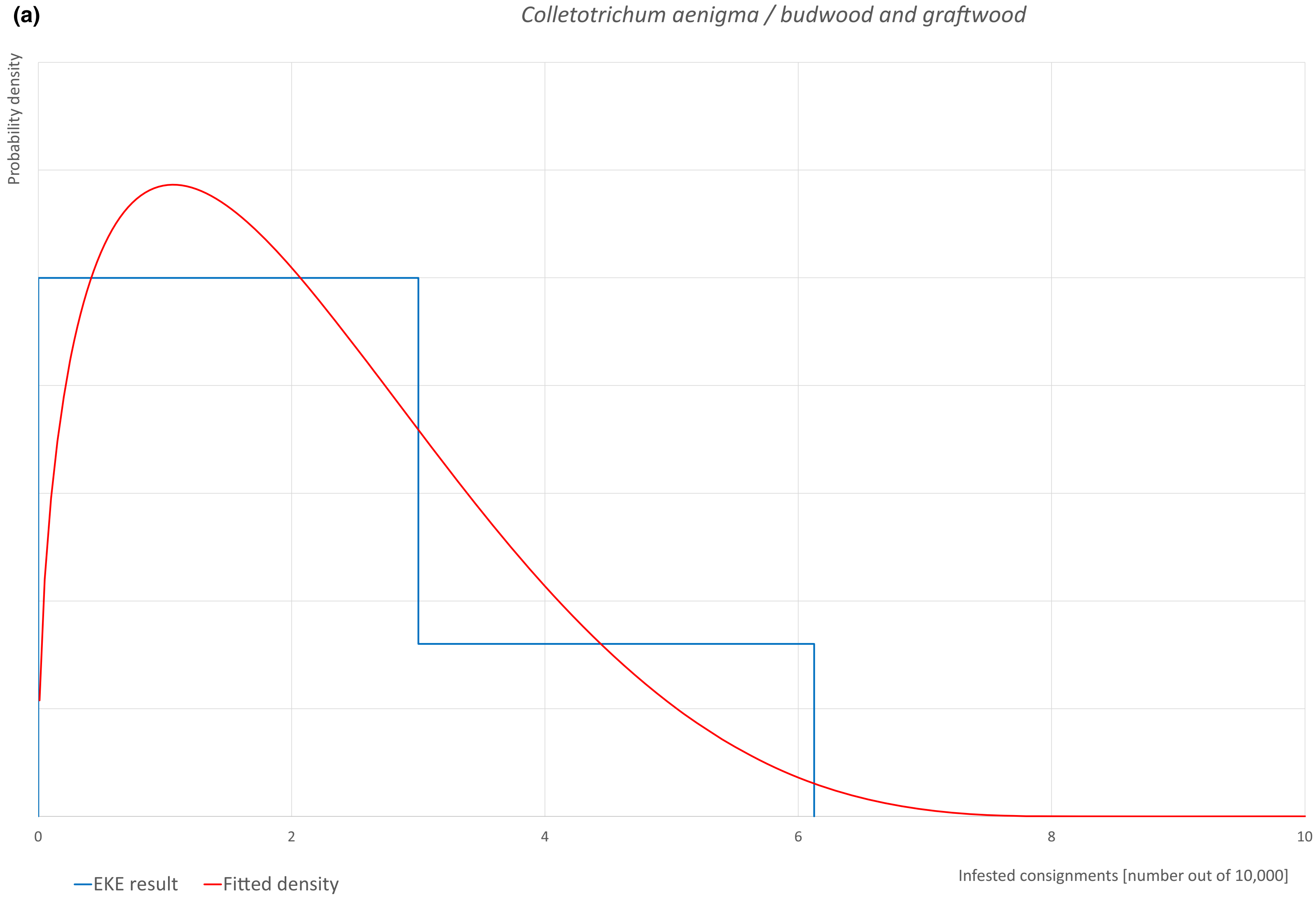
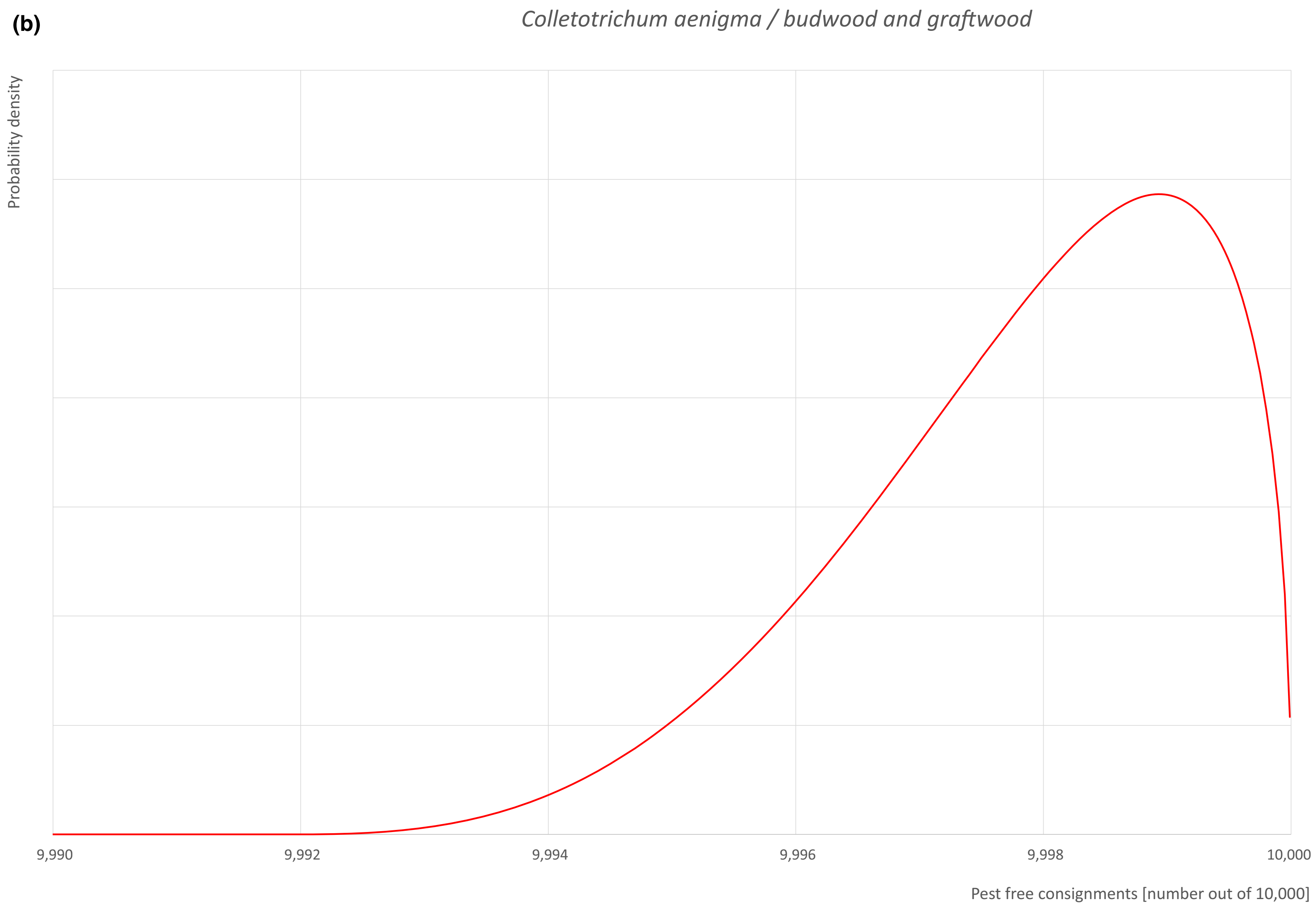


Figure A.2: (a) Elicited uncertainty of pest infestation per 10,000 bundles of bare rooted plants (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free bundles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

(a)



Colletotrichum aenigma / budwood and graftwood
Probability density
0
2
4
6
8
10
Infested consignments [number out of 10,000]
EKE result
Fitted density


(b)
Colletotrichum aenigma / budwood and graftwood
Probability density
9,990
9,992
9,994
9,996
9,998
10,000
Pest free consignments [number out of 10,000]

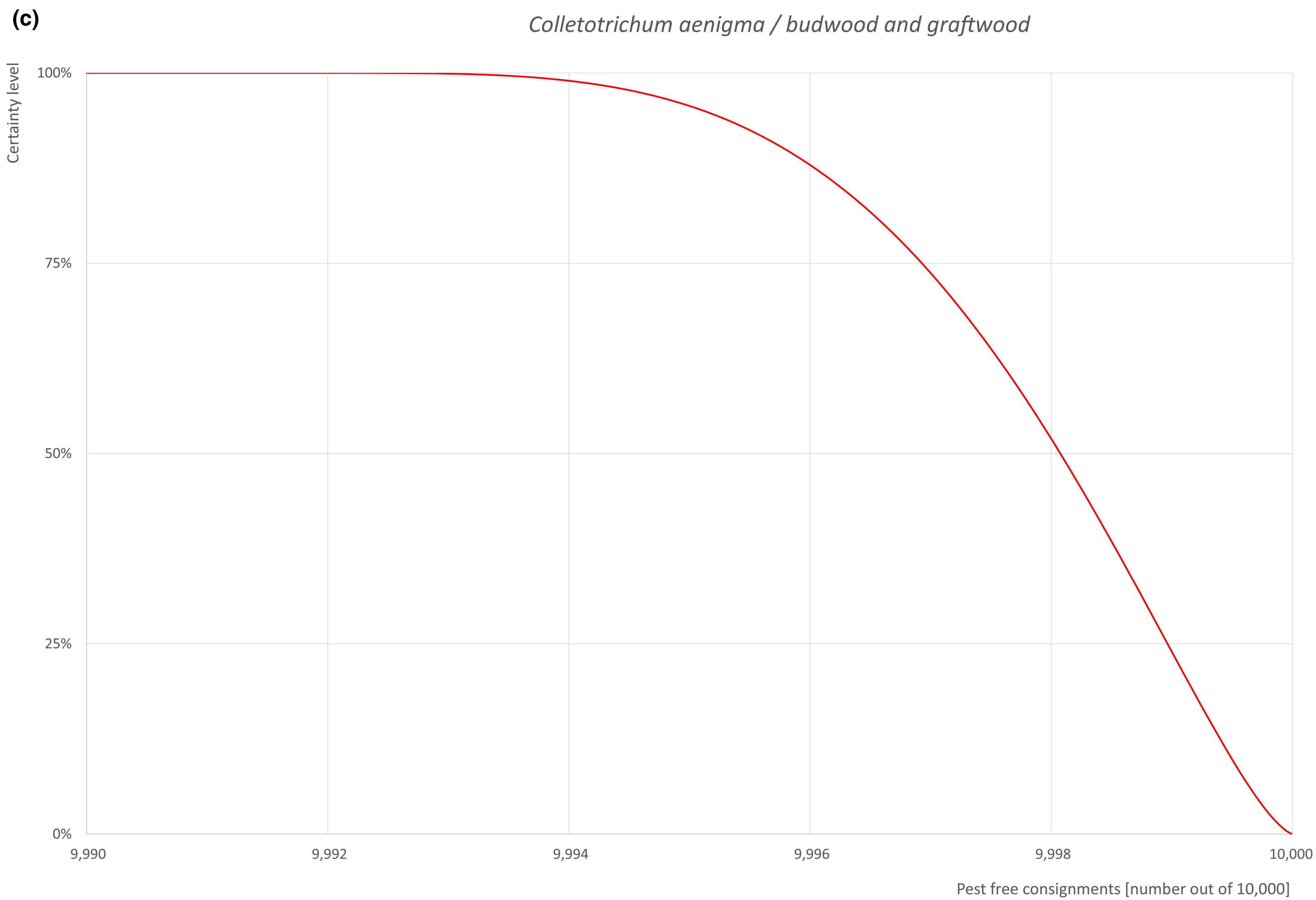


Figure A.3: (a) Elicited uncertainty of pest infestation per 10,000 bundles of graftwood/budwood (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free bundles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

A.1.6. References list

Australian Government, 2020. Final report for the review of biosecurity import requirements for fresh strawberry fruit from Japan. Department of Agriculture, Water and the Environment, Canbera. 223 pp.

Baroncelli R, Zapparata A, Sarrocco S, Sukno SA, Lane CR, Thon MR, Vannacci G, Holub E and Sreenivasaprasad S, 2015. Molecular diversity of anthracnose pathogen populations associated with UK strawberry production suggests multiple introductions of three different Colletotrichum species. PLoS One, 10, 21 pp. https://doi.org/10.1371/journal.pone.0129140

Chen Y, Fu D, Wang W, Gleason ML, Zhang R, Liang X and Sun G, 2022. Diversity of Colletotrichum species causing apple bitter rot and Glomerella leaf spot in China. Journal of Fungi, 8, 740. https://doi.org/10.3390/jof8070740

De Silva DD, Crous PW, Ades PK, Hyde KD and Taylor PW, 2017. Life styles of Colletotrichum species and implications for plant biosecurity. Fungal Biology Reviews, 31, 155–168. https://doi.org/10.1016/j.fbr.2017.05.001

EFSA PLH Panel (EFSA Panel on Plant Health), Bragard C, Baptista P, Chatzivassiliou E, Di Serio F, Gonthier P, Jaques Miret JA, Justesen AF, MacLeod A, Magnusson CS, Milonas P, Navas-Cortes JA, Parnell S, Potting R, Stefani E, Thulke H-H, Van der Werf W, Vicent Civera A, Yuen J, Zappalà L, Migheli Q, Vloutoglou I, Czwienczek E, Maiorano A, Streissl F and Reignault PL, 2022. Scientific Opinion on the pest categorisation of Colletotrichum aenigma, C. alienum, C. perseae, C. siamense and C. theobromicola. EFSA Journal 2022;20(8):7529, 80 pp. https://doi.org/10.2903/j.efsa.2022.7529

EUROPHYT, online. European Union Notification System for Plant Health Interceptions - EUROPHYT Available online: https://ec.europa.eu/food/plant/plant_health_biosecurity/europhyt/index_en.htm [Accessed: 17 February 2023].

Farr DF and Rossman AY. Fungal Databases, U.S. National Fungus Collections, ARS, USDA, online. Coniella castaneicola. Available online: https://nt.ars-grin.gov/fungaldatabases [Accessed: 17 February 2023].

Fu M, Crous PW, Bai Q, Zhang PF, Xiang J, Guo YS, Zhao FF, Yang MM, Hong N, Xu WX and Wang GP, 2019. Colletotrichum species associated with anthracnose of Pyrus spp. in China. Persoonia-Molecular Phylogeny and Evolution of Fungi, 42, 1–35. https://doi.org/10.3767/persoonia.2019.42.01

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

Lee SY, Ten LN, Ryu JJ, Kang IK and Jung HY, 2021. Colletotrichum aenigma associated with apple bitter rot on newly bred cv. RubyS Apple. Research in Plant disease, 27, 70–75. https://doi.org/10.5423/RPD.2021.27.2.70

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

Schena L, Mosca S, Cacciola SO, Faedda R, Sanzani SM, Agosteo GE, Sergeeva V and Magnano di San Lio G, 2014. Species of the Colletotrichum gloeosporioides and C. boninense complexes associated with olive anthracnose. Plant Pathology, 63, 437–446. https://doi.org/10.1111/ppa.12110

Sharma G, Maymon M and Freeman S, 2017. Epidemiology, pathology and identification of Colletotrichum including a novel species associated with avocado (Persea americana) anthracnose in Israel. Scientific Reports, 7, 16 pp. https://doi.org/10.1038/s41598-017-15946-w

TRACES-NT, online. TRADE Control and Expert System. Available online: https://webgate.ec.europa.eu/tracesnt [Accessed: 17 February 2023].

Velho AC, Stadnik MJ and Wallhead M, 2019. Unraveling Colletotrichum species associated with Glomerella leaf spot of apple. Tropical Plant Pathology, 44, 197–204. https://doi.org/10.1007/s40858-018-0261-x

Wang W, Fu DD, Zhang R and Sun GY, 2015. Etiology of apple leaf spot caused by Colletotrichum spp. Mycosystema, 34, 13–25. https://doi.org/10.13346/j.mycosystema.130273

Wang YC, Hao XY, Wang L, Xiao B, Wang XC and Yang YJ, 2016. Diverse Colletotrichum species cause anthracnose of tea plants (Camellia sinensis (L.) O. Kuntze) in China. Scientific Reports, 6, 13 pp. https://doi.org/10.1038/srep35287

Weir BS, Johnston PR and Damm U, 2012. The Colletotrichum gloeosporioides species complex. Studies in Mycology, 73, 115–180. https://doi.org/10.3114/sim0011

Yan JY, Jayawardena MMRS, Goonasekara ID, Wang Y, Zhang W, Liu M, Huang JB, Wang ZY, Shang JJ, Peng YL, Bahkali A, Hyde KD and Li XH, 2015. Diverse species of Colletotrichum associated with grapevine anthracnose in China. Fungal diversity, 71, 233–246. https://doi.org/10.1007/s13225-014-0310-9

Yokosawa S, Eguchi N, Kondo KI and Sato T, 2017. Phylogenetic relationship and fungicide sensitivity of members of the Colletotrichum gloeosporioides species complex from apple. Journal of General Plant Pathology, 83, 291–298. https://doi.org/10.1007/s10327-017-0732-9

Zhang Z, Yan M, Li W, Guo Y and Liang X, 2021. First report of Colletotrichum aenigma causing apple Glomerella leaf spot on the Granny Smith cultivar in China. Plant Disease, 105, 1563.

A.2. *Meloidogyne mali* (Apple root-knot nematode)

A.2.1. Organism information

Taxonomic information	Current valid scientific name: *Meloidogyne mali* Synonyms: *Meloidogyne ulmi* Name used in the EU legislation: – Order: Rhabditia Family: Meloidogynidae Common name: apple root-knot nematode Name used in the Dossier: *Meloidogyne mali*
Group	Nematoda
EPPO code	MELGMA
Regulated status	**EU status:** Not regulated in the EU **Non- EU:** Quarantine pest: USA (1994); Morroco (2018); EPPO A2 (2017) (EPPO, online_a); it is also regulated in Colombia, Republic of Korea, Malaysia and Uruguay (EPPO, 2017). *M. mali* is also on the list of 'pests of quarantine interest' in the Dominican Republic. All *Meloidogyne* species are quarantine pests for Türkiye (EPPO, 2017).
Pest status in UK	Present, few occurrences (EPPO, online_b). According to EPPO (online_c), only two outbreaks of *M. mali* have been reported from the UK; the nematode was detected in the rhizosphere of elms at two sites in southern England in 2018. To date, there have been no reports of detection of this species on apples in the UK and no epidemics or economic losses have been reported in the UK.
Pest status in the EU	Restricted distribution in the Netherlands, Belgium, Italy; pest status in France: absent, pest eradicated in 2021 according to French NPPO (2021–07) (EPPO, online_b). The nematode has also been reported as *M. ulmi* in Austria (de Jong et al., online). *M. mali* is believed to be more widespread in the EU than actually reported because elm plants grown in the Netherlands under the breeding programme against Dutch elm disease caused by *Ophiostoma ulmi* on plots infested with the nematode were shipped from the Netherlands to 10 other European countries (Belgium, Denmark, France, Germany, Ireland, Italy, Spain, Slovakia, Romania, and the United Kingdom) (Ahmed et al., 2013; EPPO, 2017). These programmes began in the 1980s (Prior et al., 2019).
Host status on *Malus domestica*	Apple, *M. domestica* is considered the major host (EPPO, online_d).
PRA information	Available Pest Risk Assessments: – Risks to plant health posed by EU import of soil or growing media (EFSA PLH Panel, 2015); – A quickscan pest risk analysis for the *Meloidogyne mali* (Pylypenko, 2016); – Pest risk analysis for *Meloidogyne mali* (EPPO, 2017); – UK risk register details for *Meloidogyne mali* (DEFRA, online).
Other relevant information for the assessment	
Biology	*Meloidogyne mali*, the apple root-knot nematode, belongs to the group of root knot nematodes, *Meloidogyne* spp., which includes more than 100 named species. Root-knot nematodes are at the top of the list of 10 most important nematode groups that have significant economic impacts on crops worldwide (Jones et al., 2013). Like other root knot nematodes, *M. mali* is an obligate endoparasite that invades underground plant parts. When found in Europe in 2000, the nematode was initially described as a new species, *Meloidogyne ulmi* (Palmisano and Ambrogioni, 2000) and elms remained long time the only known host plants. The synonymy with the well-known species *M. mali* was found later, after comparison in the Netherlands with living material from Japan (Ahmed et al., 2013).

	M. mali exhibits sexual dimorphism, with spherical, sedentary females and vermiform males. It reproduces sexually (amphimixis) (Subbotin et al., 2021) and has one generation per year. After mating, the female lays her eggs in the gelatinous matrix inside the root tissue (in the cortex, very close to the epidermis). This nematode hatches from the egg as a second stage juvenile (J2), and then undergoes three more moults to develop into an adult. The second stage juvenile (J2) is an infective stage that can enter the host root, create a specialised feeding site (giant cells), and begin feeding. When J2 develop, they cause root swelling and become swollen females. The females tear open the root cortex and protrude from the root surface with the egg masses for a time. J2 hatch from the egg masses and migrate into the soil (Itoh et al., 1969). The entire life cycle of *M. mali* lasts 18–22 weeks (Inagaki, 1978; Subbotin et al., 2021).	
Symptoms	**Main type of symptoms**	The above-ground symptoms of *M. mali* are not very specific and are similar to those seen in any plant with a damaged root system. Infested plants show suppressed shoot growth, nutrient deficiency symptoms, chlorosis, transient wilting during midday even with adequate soil moisture, leaf drop, and reduced plant yield. Plants infested with nematodes usually occur in patches or along the plant row. The most common and noticeable symptom of *Meloidogyne* spp. infection is the presence of root galls. On the roots of host plants, *M. mali* causes severe galls that impair water and nutrient uptake from the soil (Ahmed et al., 2013). Root galls produced by this nematode are roundish with no secondary roots emerging from them and look like a 'string of pearls'. Their size can vary depending on the species and age of the host plants and is relatively large in apples. In young roots, galls are up to 0.5 cm in diameter; in older roots, they can develop into larger galls, 1–2 cm in diameter (EPPO, 2018).
	Presence of asymptomatic plants	*M. mali* is difficult to detect. The extent of symptoms depends on the density of the nematode population in the soil and the number of second-stage (J2) juveniles that can invade and establish in the root tissue of host plants. In infected trees, symptoms may only be visible above ground when the roots are heavily infested.
	Confusion with other pests	Symptoms of host plant infestation by *M. mali* are expressed as reduced plant growth and vigour with root galling. Typical aboveground symptoms such as stunting, chlorosis and wilting result from reduced water and nutrient availability due to impaired root function. These symptoms are similar to those of other soil-borne diseases, insect damage, nutrient deficiency, or cultural and/or environmental stress. The most characteristic symptoms caused by *M. mali*, such as root galls, are also characteristic of damage caused by other *Meloidogyne* species or even other nematode genera (*Nacobbus*, *Meloidodera* and others). Laboratory tests are therefore crucial for accurate identification of nematodes. Morphologically, *M. mali* is similar and can be confused with some other root-knot nematodes such as *M. ardenensis*, *M. camelliae* and *M. suginamiensis* (EPPO, 2018).
Host plant range	*M. mali* has been reported infesting a wide range of host plants, including apple rootstocks as the main host of this species, grapes, cherries, figs, Japanese chestnuts, maples, mulberry trees, elms, beeches, roses, soybeans, tomatoes, egg plants and white clover (EPPO, online_d). **Major hosts:** *Malus domestica*, *Morus alba*, *Morus bombycis*, *Morus latifolia*, *Ulmus chenmoui*, *Ulmus glabra*.	

	Hosts: *Acer palmatum*, *Acer pseudoplatanus*, *Acer x freemanii*, *Achyranthes japonica*, *Apium graveolens*, *Castanea crenata*, *Cucumis sativus*, *Euonymus kiautschovicus, Fagus sylvatica, Ficus carica,* Geum coccineum, *Glycine max*, *Lagerstroemia indica*, *Maclura tricuspidata*, *Malus hupehensis*, *Malus prunifolia*, *Malus toringo*, *Malus x purpurea*, *Morus alba, Morus bombycis, Morus latifolia, Prunus serrula*, *Prunus x yedoensis*, *Quercus robur, Rosa*, *Rubus fruticosus*, *Rubus idaeus*, *Solanum lycopersicum*, *Solanum melongena*, *Sorbus aucuparia*, *Taxus baccata*, *Trifolium repens*, *Ulmus chenmoui, Ulmus davidiana var. japonica*, *Ulmus glabra, Ulmus parvifolia*, *Ulmus x hollandica*, *Vitis vinifera*, *Zelkova serrata*. **Wild plants/Weeds:** *Arctium lappa*, *Dryopteris carthusiana*, *Dryopteris filix-mas*, *Geranium robertianum*, *Impatiens parviflora*, *Taraxacum officinale*, *Urtica dioica*.
Reported evidence of impact	*M. mali* is a polyphagous nematode that attacks and parasitises a wide range of woody and herbaceous plants. On the roots of host plants, *M. mali* causes typical round, rootless galls that look like a 'string of pearls' (EPPO, 2017). Their size can vary on different hosts; on apple, they are relatively large compared to other known *Meloidogyne* species. Root galls caused by *M. mali* are associated with increased susceptibility and reduced tree stability due to root rot caused by secondary pathogens through openings that develop in older galls, which can cause the tree to be uprooted by strong winds (EPPO, 2017). According to EPPO (2017), this nematode pest can have a major economic impact on cultivated hosts. In heavily infested apples, the nematode can cause stunted growth and severe decline. In Japan, this nematode was reported to reduce plant growth and leaf weight of mulberry by 10–20% (Toida, 1991). In young apple trees, a growth reduction of 15–43% was found in inoculation trials only (Inagaki, 1978). According to EPPO standard PM1/002(30), *M. mali* is recommended for regulation as an A2 quarantine pest (EPPO, online_e).
Pathways and evidence that the commodity is a pathway	– Plants, plants for planting (roots), with or without growing media; – Soil and growing media as such or attached to plants; – Soil and growing media attached to machinery, tools, packaging materials, etc.
Surveillance information	Under plant passport audits or a programme of general surveillance of all registered growers, all growers in the United Kingdom are inspected by plant health inspectors. Plant health inspectors monitor plant diseases and pests as part of plant certification and plant passport audits. In addition, plant and seed health inspectors conduct a quarantine surveillance programme on registered farms and inspect plants grown and marketed in the UK. The quarantine surveillance programme is targeted and focuses on farms visited based on size, type of crop grown, origin of crop and growers with a history of pest and disease problems. The risk category assigned to the farm determines the frequency of visits. Inspections target both the plants or products that pose the greatest risk and a broader range of plants and plant products that are monitored for more general risks, including highly polyphagous pests whose incidence may be unknown or increasing. UK inspectors are extensively trained to identify new and emerging risks posed by the possible presence of pests. When pests or suspicious symptoms are detected, inspectors regularly send samples to the laboratory for testing. In addition to official controls and inspections, producers shall conduct visual health checks on a regular basis. The competent authority provides growers with regular training and information on plant diseases and pests. In nurseries, the possible presence of plant diseases and pests is also monitored by the competent nursery staff. Observations made during these inspections are documented; curative and preventive measures are implemented; and a plant health risk assessment is made.

A.2.2. Possibility of pest presence in the nursery

A.2.2.1. Possibility of entry from the surrounding environment

When *M. mali* is present in the environment, it can enter *Malus* production sites with planting material, water, soil and growing media attached to agricultural machinery, tools and footwear.

Agricultural machinery is a very important means of spreading the nematode within and between different plantations.

Root knot nematodes, *Meloidogyne* spp. can migrate from plant to plant through the roots. However, active dispersal of *Meloidogyne* species, including *M. mali*, is limited to short distances. Mobile stages (free-living second-stage juveniles) can move no more than 1–2 m per year (Tiilikkala et al., 1995). Transmission from the surrounding area to the production field is mainly passive through the spread of infected plants, contaminated soil and run-off rainwater.

Uncertainties:

- *M. mali* has recently been detected at least two sites in southern England which received elm trees from The Netherlands as part of an breeding programme against Dutch elm disease. It is uncertain how many other UK sites may be infested but undetected.
- *M. mali* is not under official surveillance in UK, as it does not meet criteria of QP for GB.

In view of the above evidence and uncertainties, the Panel considers that it is possible that the nematode is present in the environment and could enter *Malus domestica* nurseries with new plants for planting or other human activities.

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

Plants for planting (roots) are important pathway. *M. mali* attacks the roots of host plants in which it lives, feeds and reproduces.

Planting material originating from production sites where the nematode is present may be infested. However, infestation of such plants may be overlooked if the infestation is low.

Uncertainties:

- Symptoms caused by *M. mali* often go undetected initially because the nematodes are microscopic root parasites and when nematode infestation in the roots of host plants is low, symptoms are not very pronounced.
- In addition, aboveground symptoms are often general signs of root stress in the plant. Therefore, the presence of *M. mali* in apple roots cannot be detected by visual inspection.

Taking into consideration the above evidence and uncertainties, the Panel considers it is possible that the infestation could be overlooked and that the nematode could be introduced into apple nurseries/orchards with new plants.

A.2.2.3. Possibility of spread within the nursery

Root-knot nematodes (including *M. mali*) actively move only short distances. The main route of spread of this nematode within the nursery/production field is generally by human assistance. The nematode can be spread with plants for planting from infested production sites and by soil movement – with soil as such or with soil associated with tools and machinery, and with contaminated run-off rainwater and irrigation water.

Uncertainties:

- If *M. mali* is present, it is very likely that the nematode will spread within the production field. However, *M. mali* has not yet been detected in apple production fields in the UK.

In view of the above evidence and uncertainties, the Panel considers that if the nematode is present in the field, it may be transmitted from one host plant to another.

A.2.3. Information from interceptions

There are no records of interceptions of *M. domestica* plants for planting from UK due to the presence of *Meloidogyne mali* between 1998 and February 2023 (EUROPHYT, online; TRACES-NT, online).

A.2.4. Evaluation of the risk mitigation measures

In the table below, all risk mitigation measures currently applied in UK are listed and an indication of their effectiveness on *M. mali* is provided. The description of the risk mitigation measures currently applied in UK is provided in Table 5.

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
1	Certified material		Evaluation: The certification system may include freedom of place of production for certain nematodes. Uncertainties: – The pest is difficult to detect, especially when infestations in the roots of host plants are low or the symptoms caused by *M. mali* are absent or not very pronounced.
2	Phytosanitary certificates	Yes	Evaluation: Plants are visually inspected for the presence of symptoms caused by pests and diseases. Galls caused by root-knot nematodes may only be visible at high levels of infection. If suspicious symptoms are detected, samples are sent to the laboratory for examination. Uncertainties: – Above-ground symptoms of *M. mali* are not very specific and are similar to those caused by other abiotic or biotic stresses that damage the root system. Therefore, the symptoms may be overlooked. – When infestations in host plant roots are low, symptoms caused by *M. mali* are absent or not very pronounced and may not be detected.
3	Cleaning and disinfection of facilities, tools and machinery	Yes	Evaluation: Cleaning and disinfection of facilities, tools, and machinery can help reduce infestations of host plants with *M. mali*. Uncertainties: – Details on cleaning and disinfection of facilities, tools and machinery that would be effective against nematodes are not provided. Information is lacking on the efficacy and feasibility of the above options for risk reduction against *M. mali* in apples.
4	Rouging and pruning	No	–
5	Biological and mechanical control	No	–
6	Pesticide application	No	–
7	Surveillance and monitoring	Yes	Evaluation: Surveillance and monitoring of root-knot nematodes are difficult to implement in practice. *M. mali* is not under official surveillance in UK, as it does not meet criteria of QP for GB. Uncertainties: – The pest is difficult to detect, especially when infestations in the roots of host plants are low or the symptoms caused by *M. mali* are absent or not very pronounced.
8	Sampling and laboratory testing	Yes	Evaluation: Sampling and testing of soil attached to roots and roots for galls caused by nematodes are routinely performed by both, phytosanitary inspectors and growers. Uncertainties: – Symptoms caused by *M. mali* can only be detected when root galls are formed, but this is difficult when infestations are low. In addition, aboveground

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
			symptoms are often general signs of root stress in the plant. – Therefore, the presence of *M. mali* in apple roots may not be detectable by visual inspection, so samples are not sent for laboratory examination.
9	Root washing	Yes	Evaluation: Root washing does not significantly reduce the risk of nematode infestation in plants intended for planting that are infested with root knot nematodes. Uncertainties: – Because *M. mali* is present in both soil and roots, root washing does not significantly reduce the risk of nematode infestation in plants intended for planting.
10	Pre-consignment inspection	Yes	Evaluation: Growers can visually inspect roots for the presence of galls caused by root-knot nematodes. If root galls are detected, the finding is documented, and then curative and preventive measures are taken. Uncertainties: – When infestations in roots of host plants are low, galls caused by *M. mali* are not very pronounced and can be overlooked.

A.2.5. Overall likelihood of pest freedom

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

- Pest pressure is very low in the UK; the nematode has been detected in the rhizosphere of elms at only two sites in southern England.
- The pest does not occur in apple growing areas and has never been reported infesting apples in the UK.
- Regular inspections by plant health authorities are effective and further help to reduce infection pressure from this nematode.
- Root washing is an effective means of controlling this nematode.

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

- Similar pest pressure exists throughout the country; the nematode is common in apple orchards and its infestation is homogeneous.
- The pest is present in apple orchards, and apple plants are likely to be infested with nematodes.
- Visual selection of apple plants for planting and visual inspections before export without laboratory tests are not effective and result in high infestation.
- Washing the roots after harvest is not effective against this pest because it is endoparasitic.

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

- Uncertainty about pest pressure in the UK.
- Information on infections with *M. mali* on apple plants in the UK is uncertain.
- Lack of reports of problems within the apple growing area in the UK.

— The likelihood of introduction into apple production sites by natural means and human activities.

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

— The major uncertainty factor is the absence of above-ground symptoms caused by nematodes, so the presence of the nematode in apple roots may be overlooked; not detectable by visual inspection.

A.2.5.5. Elicitation outcomes of the assessment of the pest freedom for *Meloidogyne mali*

The elicited and fitted values for *Meloidogyne mali* agreed by the Panel are shown in Tables A.7–A.10 and in Figures A.4–A.5.

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

Percentile	**1%**	**2.5%**	**5%**	**10%**	**17%**	**25%**	**33%**	**50%**	**67%**	**75%**	**83%**	**90%**	**95%**	**97.5%**	**99%**
Elicited values	0.0					0.5		1.0		2.0					4.0
EKE	0.0141	0.0374	0.0785	0.166	0.292	0.461	0.645	1.07	1.61	1.94	2.35	2.80	3.28	3.65	4.00

The EKE results are the BetaGeneral (0.94432, 2.5871, 0, 4.85) distribution fitted with @Risk version 7.6.

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

Table A.8: The uncertainty distribution of plants free of *Meloidogyne mali* per 10,000 potted plants calculated by Table A.7

Percentile	**1%**	**2.5%**	**5%**	**10%**	**17%**	**25%**	**33%**	**50%**	**67%**	**75%**	**83%**	**90%**	**95%**	**97.5%**	**99%**
Values	9,996					9,998		9,999		10,000					10,000
EKE results	9,996.0	9,996.4	9,996.7	9,997.2	9,997.6	9,998.1	9,998.4	9,998.9	9,999.35	9,999.54	9,999.71	9,999.83	9,999.92	9,999.96	9,999.99

The EKE results are the fitted values.

Table A.9: Elicited and fitted values of the uncertainty distribution of pest infestation by *Meloidogyne mali* per 10,000 bundles of bare rooted plants

Percentile	**1%**	**2.5%**	**5%**	**10%**	**17%**	**25%**	**33%**	**50%**	**67%**	**75%**	**83%**	**90%**	**95%**	**97.5%**	**99%**
Elicited values	0					1		2		3					6
EKE	0.098	0.186	0.306	0.508	0.751	1.04	1.32	1.93	2.64	3.07	3.62	4.21	4.88	5.43	6.01

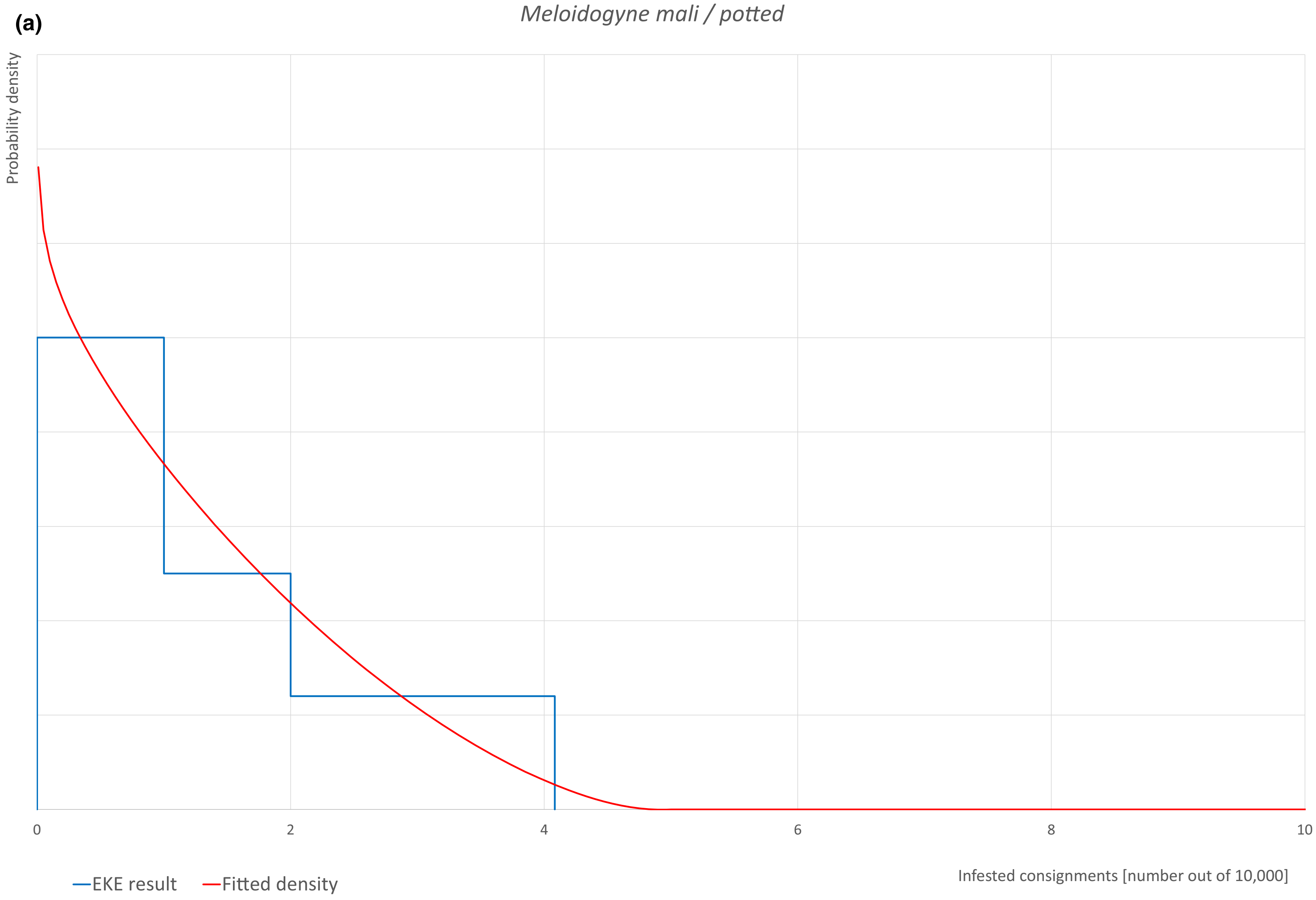
The EKE results are the BetaGeneral (1.4527, 4.0355, 0, 8.2) distribution fitted with @Risk version 7.6.

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

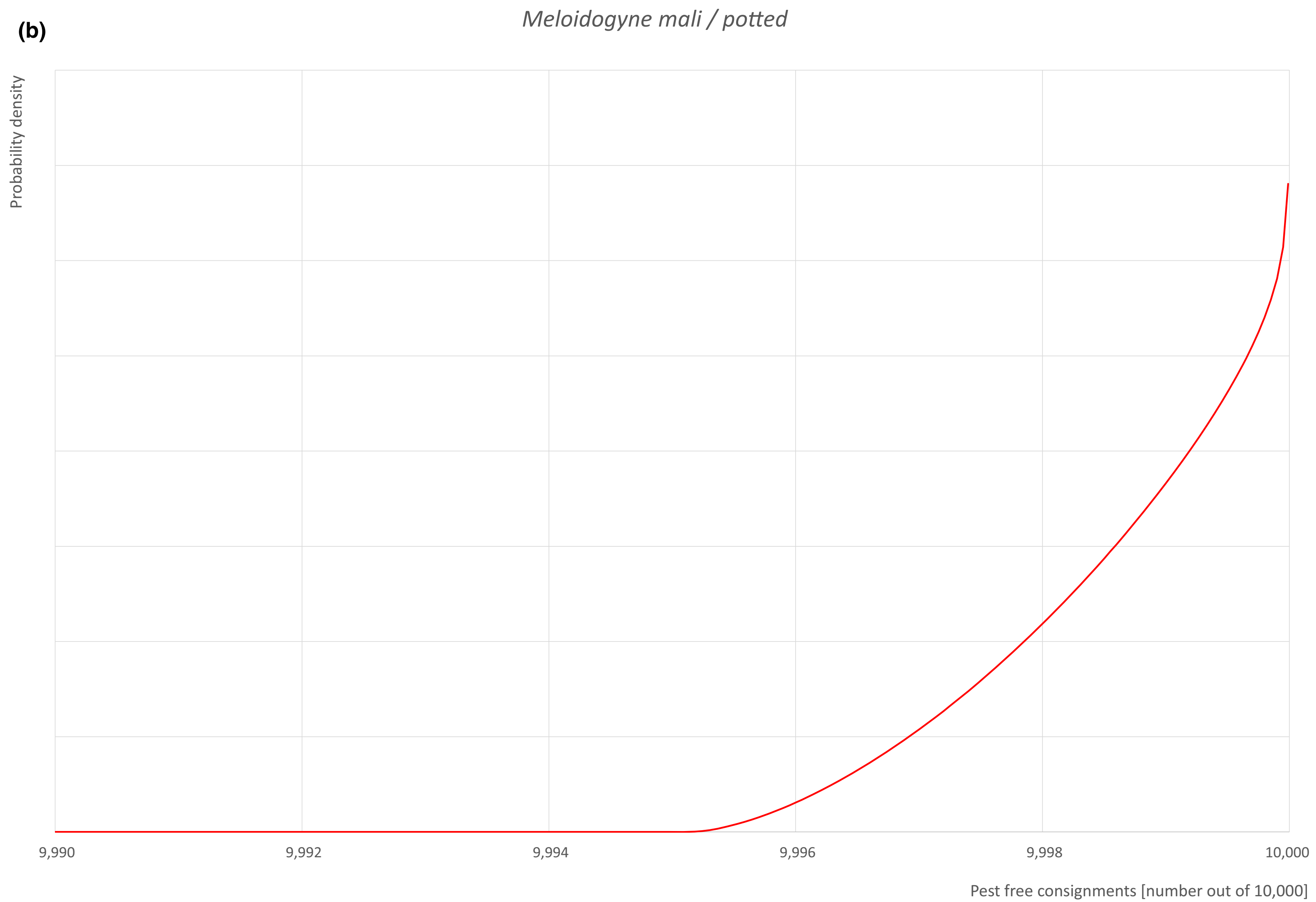
Table A.10: The uncertainty distribution of bundles free of *Meloidogyne mali* per 10,000 bundles calculated by Table A.9

Percentile	**1%**	**2.5%**	**5%**	**10%**	**17%**	**25%**	**33%**	**50%**	**67%**	**75%**	**83%**	**90%**	**95%**	**97.5%**	**99%**
Values	9,994					9,997		9,998		9,999					10,000
EKE results	9,994.0	9,994.6	9,995.1	9,995.8	9,996.4	9,996.9	9,997.4	9,998.1	9,998.7	9,999.0	9,999.2	9,999.5	9,999.7	9,999.8	9,999.9

The EKE results are the fitted values.


(a)
Meloidogyne mali / potted
Probability density
0
2
4
6
8
10
Infested consignments [number out of 10,000]
EKE result
Fitted density

(b)


Meloidogyne mali / potted
Probability density
9,990
9,992
9,994
9,996
9,998
10,000
Pest free consignments [number out of 10,000]

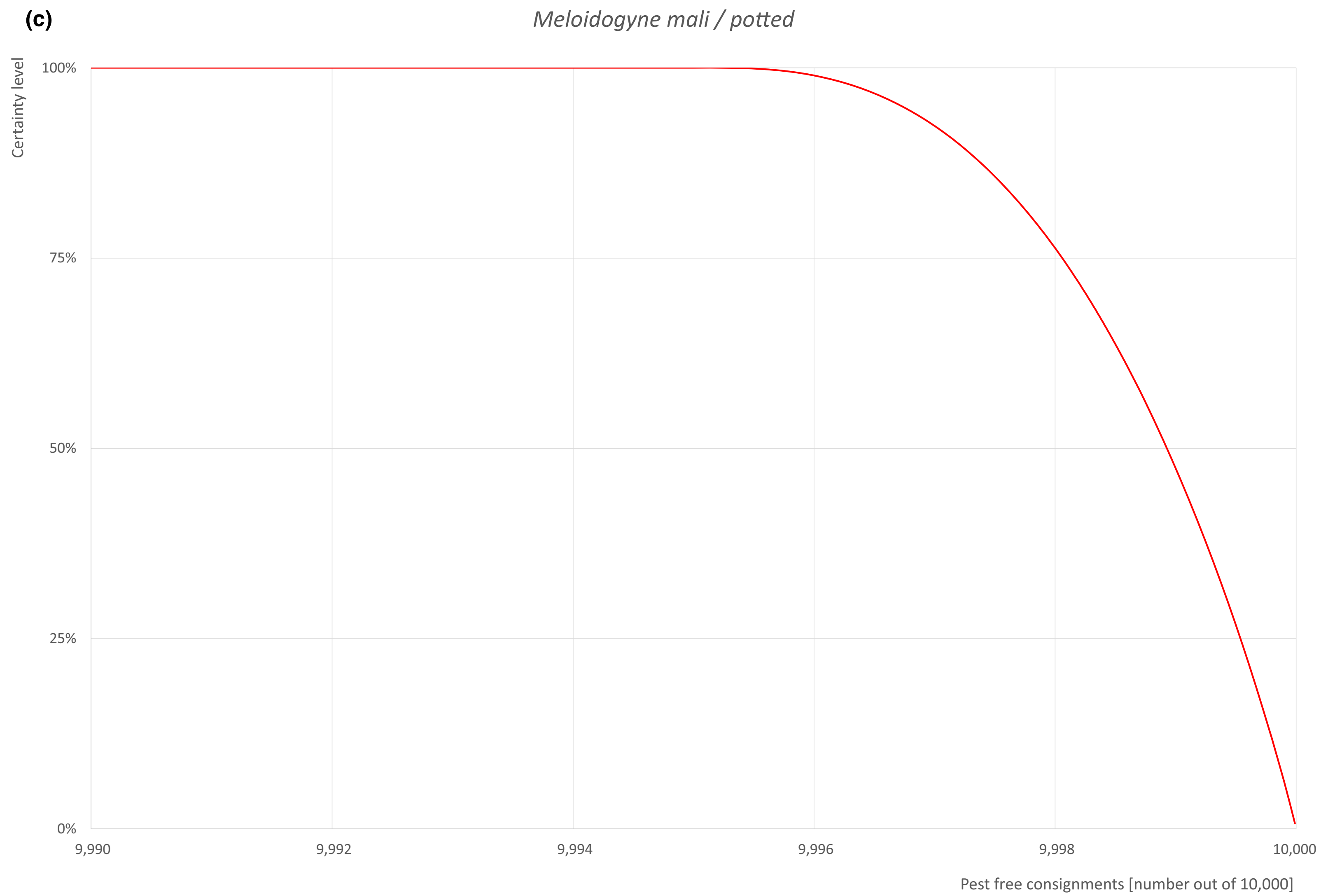
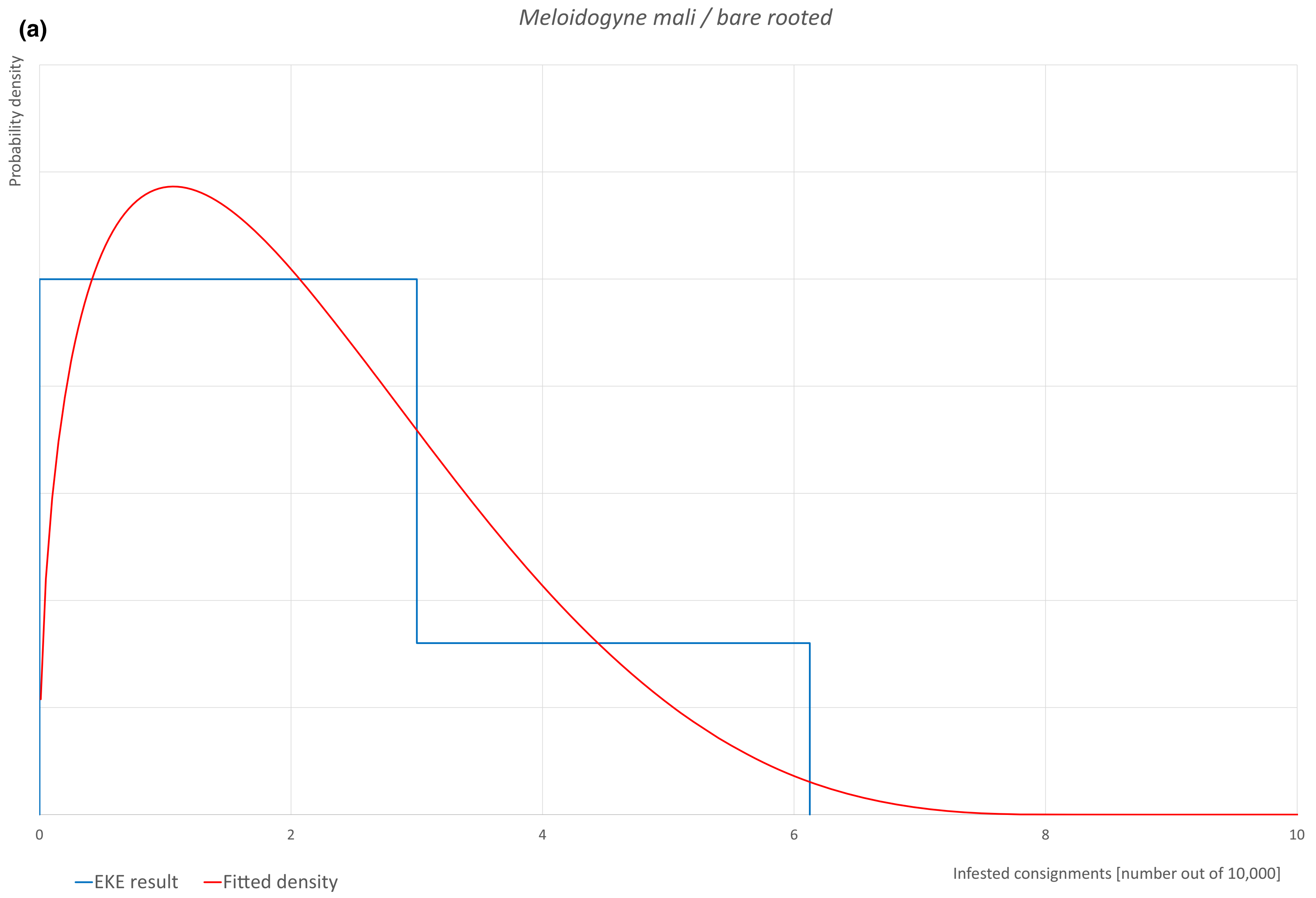
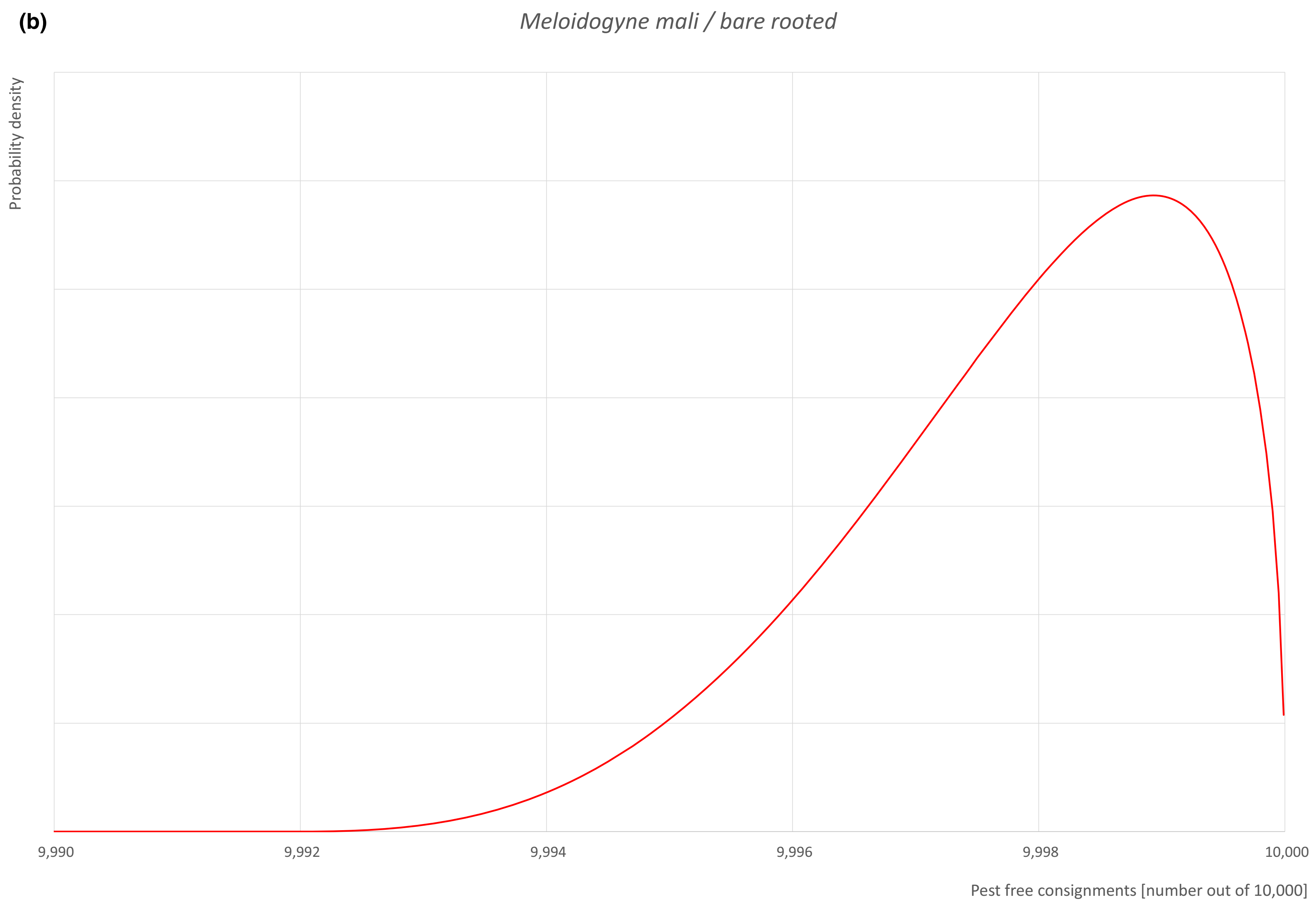


Figure A.4: (a) Elicited uncertainty of pest infestation per 10,000 potted plants (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free bundles per 10,000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


(a)
Meloidogyne mali / bare rooted
Probability density
0
2
4
6
8
10
EKE result
Fitted density
Infested consignments [number out of 10,000]

(b)


Meloidogyne mali / bare rooted
Probability density
9,990
9,992
9,994
9,996
9,998
10,000
Pest free consignments [number out of 10,000]

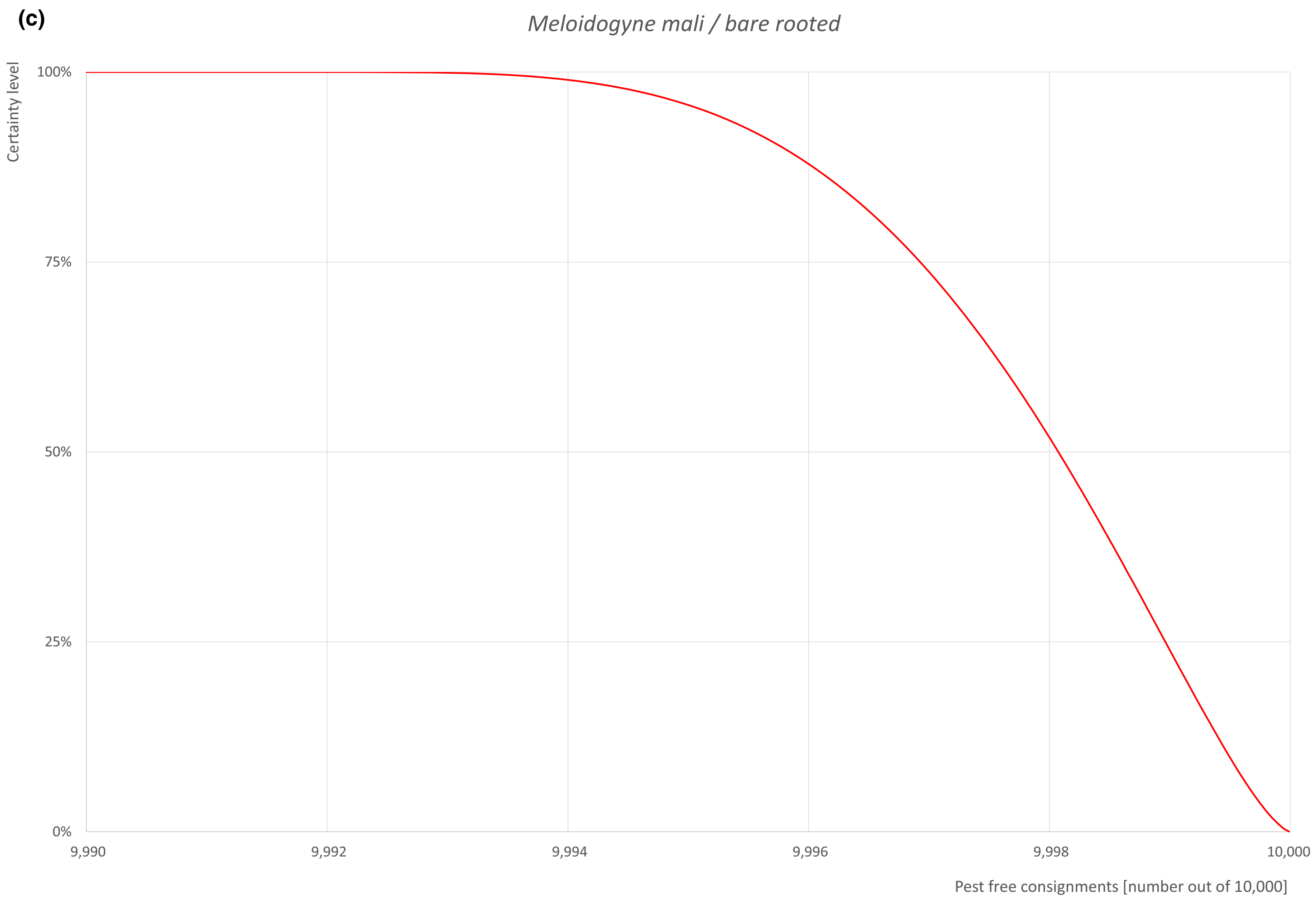


Figure A.5: (a) Elicited uncertainty of pest infestation per 10,000 bundles of bare rooted plants (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free bundles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

A.2.6. References list

Ahmed M, van de Vossenberg BTLH, Cornelisse C and Karssen G, 2013. On the species status of the root-knot nematode *Meloidogyne ulmi* Palmisano & Ambrogioni, 2000 (Nematoda, Meloidogynidae). ZooKeys, 362, 1–27. https://doi.org/10.3897/zookeys.362.6352

DEFRA (Department for Environment, Food and Rural Affairs), online. UK risk register details for *Meloidogyne mali*. Available online: https://planthealthportal.defra.gov.uk/pests-and-diseases/uk-plant-health-risk-register/viewPestRisks.cfm?cslref=16542 [Accessed: 31 January 2023].

de Jong Y, Verbeek M, Michelsen V, Bjørn Pde P, Los W, Steeman F, Bailly N, Basire C, Chylarecki P, Stloukal E, Hagedorn G, Wetzel FT, Glöckler F, Kroupa A, Korb G, Hoffmann A, Häuser C, Kohlbecker A, Müller A, Güntsch A, Stoev P and Penev L, online. Fauna Europaea - all European animal species on the web. Biodiversity Data Journal. Available online: https://fauna-eu.org/ [Accessed: 31 January 2023].

EFSA PLH Panel (EFSA Panel on Plant Health), 2015. Scientific opinion on the risks to plant health posed by EU import of soil or growing media. EFSA Journal 2015;13(6):4132, 133 pp. https://doi.org/10.2903/j.efsa.2015.4132

EPPO (European and Mediterranean Plant Protection Organization), 2017. Pest risk analysis for *Meloidogyne mali*, apple root-knot nematode. EPPO, Paris, 38 pp.

EPPO (European and Mediterranean Plant Protection Organization), 2018. Diagnostics PM 7/136 (1) *Meloidogyne mali*. Bulletin OEPP/EPPO, 48, 438–445.

EPPO (European and Mediterranean Plant Protection Organization), online_a. *Meloidogyne mali* (MELGMA), Categorization. Available online: https://gd.eppo.int/taxon/MELGMA/categorization [Accessed: 31 January 2023].

EPPO (European and Mediterranean Plant Protection Organization), online_b. *Meloidogyne mali* (MELGMA), Distribution. Available online: https://gd.eppo.int/taxon/MELGMA/distribution [Accessed: 31 January 2023].

EPPO (European and Mediterranean Plant Protection Organization), online_c. First report of *Meloidogyne mali* in the United Kingdom. Available online: https://gd.eppo.int/reporting/article-6511 [Accessed: 31 January 2023].

EPPO (European and Mediterranean Plant Protection Organization), online_d. *Meloidogyne mali* (MELGMA), Host plants. Available online: https://gd.eppo.int/taxon/MELGMA/hosts [Accessed: 31 January 2023].

EPPO (European and Mediterranean Plant Protection Organization), online_e. EPPO A2 List of pests recommended for regulation as quarantine pests, version 2022–09. Available online: https://www.eppo.int/ACTIVITIES/plant_quarantine/A2_list [Accessed: 31 January 2023].

EUROPHYT, online. European Union Notification System for Plant Health Interceptions - EUROPHYT Available online: http://ec.europa.eu/food/plant/plant_health_biosecurity/europhyt/index_en.htm [Accessed: 17 February 2023].

Inagaki H, 1978. Apple root-knot nematode, *Meloidogyne mali*, its taxonomy, ecology, damage, and control. Kasetsart Journal, 12, 25–30.

Itoh Y, Ohshima Y and Ichinohe M, 1969. A root-knot nematode, *Meloidogyne mali* n.sp. on apple-tree from Japan (Tylenchida: Heteroderidae). Applied Entomology and Zoology, 4, 104–202.

Jones JT, Haegeman A, Danchin EGJ, Gaur HS, Helder J, Jones MGK, Kikuchi T, Manzanilla-López R, Palomares-Rius JE, Wesemael WML and Perry RN, 2013. Top 10 plant-parasitic nematodes in molecular plant pathology. Molecular Plant Pathology, BSPP and John Wiley & Sons LTD, 1–16. https://doi.org/10.1111/mpp.12057

Palmisano A and Ambrogioni L, 2000. *Meloidogyne ulmi* sp. n., a root-knot nematode from elm. Nematologia Mediterranea, 28, 279–293.

Prior T, Tozer H, Yale R, Jones EP, Lawson R, Jutson L, Correia M, Stubbs J, Hockland S and Karssen G, 2019. First report of *Meloidogyne mali* causing root galling to elm trees in the UK. New Disease Reports, 39, 10. https://doi.org/10.5197/j.2044-0588.2019.039.010

Pylypenko LA, 2016. A quickscan pest risk analysis for the *Meloidogyne mali*. Interdepartmental Thematic Scientific Collection of Plant Protection and Quarantine, 62, 188–200. https://doi.org/10.36495/1606-9773.2016.62.188-200

Subbotin, SA, Rius JEP, and Castillo P, 2021. Systematics of root-knot nematodes (Nematoda: *Meloidogynidae*). Brill.

Tiilikkala K, Carter T, Heikinheimo M and Venalainen A, 1995. Pest risk analysis of *Meloidogyne chitwoodi* for Finland. Bulletin OEPP/EPPO Bulletin, 25, 419–435.

Toida Y, 1991. Mulberry damages caused by a root-knot nematode, *Meloidogyne mali* indigenous to Japan. Japan Agricultural Research Quarterly, 24, 300–305.

TRACES-NT, online. TRADE Control and Expert System. Available online: https://webgate.ec.europa.eu/tracesnt [Accessed: 17 February 2023].

A.3. Eulecanium excrescens

A.3.1. Organism information

Taxonomic information	Current valid scientific name: *Eulecanium excrescens* Synonyms: *Lecanium excrescens* Name used in the EU legislation: – Order: Hemiptera Family: Coccidae Common name: excrescent scale, wisteria scale Name used in the Dossier: *Eulecanium excrescens*
Group	Insects
EPPO code	–
Regulated status	The pest is neither regulated in the EU nor listed by EPPO. *Eulecanium excrescens* is listed in the UK Plant Health Risk Register but archived in 2020 as considered to pose a low risk to the UK (DEFRA, online).
Pest status in UK	*Eulecanium excrescens* is present in the UK as introduced species with restricted distribution to the Greater London Area; outside this area, the pest has been reported only in a few localities of the neighbouring county of Hertfordshire (Salisbury et al., 2010). The organism has been found at numerous sites in London and is likely to have been present in the UK since at least 2000. *E. excrescens* may be more widespread in the PRA area than is currently known. The species is currently considered present in the UK (Dossier Section 2.0).
Pest status in the EU	*Eulecanium excrescens* is absent from the territory of the EU (García Morales et al., online).
Host status on *Malus domestica*	*Malus domestica* is a host of *Eulecanium excrescens* (Deng, 1985).
PRA information	Pest Risk Assessments available: – UK Risk Register Details for *Eulecanium excrescens* (DEFRA, online); – CSL Pest Risk Analysis for *Eulecanium excrescens* (MacLeod and Matthews, 2005).

Other relevant information for the assessment		
Biology	According to Malumphy (2005), *E. excrescens* has one generation/year; the nymphs overwinter and reach maturity in April. The adult females lay eggs in May; crawlers emerge in May–June and settle on the leaves; in Autumn, before the leaves fall, they move from the leaves to the twigs to overwinter.	
Symptoms	**Main type of symptoms**	*E. excrescens* is a sapsucker able to damage host plants by removing large quantities of sap, so causing weakening, leaf loss and dieback; large amount of honeydew is also produced, reducing photosynthesis and disfiguring ornamental plants in parks and gardens (MacLeod and Matthews, 2005).
	Presence of asymptomatic plants	The globular, dark brown, mature adult females of *E. excrescens* can usually be distinguished from other Coccidae found in the UK by their large size, up to 13 mm long and 10 mm high (Figure 1). A grey powdery wax resembling a growth of mould usually covers the scale, although this may be lost as they mature. The immature nymphs are pale brown with rectangular whitish encrustations on their surface. Both adults and nymphs occur on the stems and branches of the host plants. A detailed description is given in Malumphy (2005) and references therein.
	Confusion with other pests	Low initial infestations may be overlooked.

Host plant range	*E. excrescens* is considered highly polyphagous and has been recorded on a wide range of deciduous orchard and ornamental trees e.g. *Malus* (apple), *Prunus* (peach/cherry) and *Pyrus* (pear) (Essig, 1958; Gill, 1988; Kosztarab, 1996). To date in the UK, *E. excrescens* has not been found on fruit trees in gardens or commercial orchards but only on ornamentals in private gardens on *Wisteria* (Fabaceae), *Prunus* (cherry) and South African trumpet vine (*Podranea ricasoliana*: Bignoniaceae). However, due to its polyphagy, this scale could be economically important for apple (*Malus* spp.), almond (*Prunus dulcis* (Mill.)), apricot (*Prunus armeniaca* L.), cherry (*Prunus* spp.), elm (*Ulmus* spp.), peach (*Prunus persica* (L.)), pear (*Pyrus communis* L.), sycamore (*Acer pseudoplatanus* L.), walnut (*Juglans regia* L.) and *Wisteria* spp. (Essig, 1958; Gill, 1988).
Reported evidence of impact	Since more records are forthcoming, it can be expected that the host list in the UK will expand in the near future (CSL, 2005). In the vast majority of cases, the host plant has been *Wisteria* spp. and this is likely to be the preferred host, as it is in the USA (Gill, 1988).
Pathways and evidence that the commodity is a pathway	The soft scale *Eulecanium excrescens* is native to Asia and introduced in the USA, where it is present in California, Connecticut, New York, Oregon and Pennsylvania (MacLeod and Matthews, 2005; Malumphy, 2005). Though as above mentioned this species mainly feeds on *Wisteria* spp., it is also known to attack other vines as *Podranea ricasoliana*, *Parthenocissus quinquefolia* and *P. tricuspidata*, and trees as *Malus, Prunus*, *Pyrus*, *Ulmus*, Zelkova (Salisbury et al., 2010).
Surveillance information	In China, this scale is regarded as a pest damaging fruit orchards (MacLeod and Matthews, 2005), i.e. *Malus*, *Prunus* and *Pyrus* (Deng, 1985). In the USA, *E. excrescens* is included in the list of pests harmful to hazelnut (*Corylus avellana*) production in Oregon (Murray and Jepson, 2018). In California, it is rare and not regarded as a pest of economic importance (Gill, 1988). There are no data from other US states. However, through feeding, *E. excrescens* does remove large quantities of sap, weakening the plant causing some leaf loss and slow dieback. Large amounts of honeydew are produced and aesthetic damage to host plants may occur. Wisterias are very high value plants, often a main feature of gardens and buildings where they climb and cover south facing walls. Although detracting from the aesthetic appearance of the host, *E. excrescens* is unlikely to kill mature plants. Young, small plants would be more susceptible and could be killed. A parasitoid species has been detected attacking *E. excrescens* on one infested plant in London (Malumphy, 2005). Thus, natural enemies may be able to limit further damage.

A.3.2. Possibility of pest presence in the nursery

A.3.2.1. Possibility of entry from the surrounding environment

If present in the surroundings, the pest can enter the nursery (as UK is producing these plants for planting outdoors). Indeed, although only reported on ornamental plants in private gardens in the Greater London Area and in a few localities of the neighbouring county of Hertfordshire, *E. excrescens* may be more widespread than is currently known. The pest could enter the nursery either by passive dispersal (e.g. wind) especially crawlers than can be easily uplifted by wind, infested plant material by nursery workers and machinery. Given that the pest is very polyphagous, it could be associated with several plant species in the nursery surroundings.

Uncertainties:

- No information on possible host plants of the pest in the nursery surroundings is available.

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

A.3.2.2. Possibility of entry with new plants/seeds

The pest can be found on the trunk, stem, branches, leaves of plants for planting (scions, grafted rootstocks). Although adults can be relatively easily spotted during visual inspections, young stages can be difficult to detect. The pest can be hidden inside bark cracks. In case of initial low populations, the species can be overlooked. Introduction of the pest with certified material is very unlikely.

Uncertainties:

- Uncertain if certified material is screened for this pest as it is not listed as *Malus* pest in the Dossier.

Taking into consideration the above evidence and uncertainties, the Panel considers it possible that the pest could enter the nursery although very unlikely.

A.3.2.3. Possibility of spread within the nursery

If the scale enters the nursery from the surroundings, it could spread within the nursery either by passive dispersal (e.g. wind), especially crawlers than can be easily uplifted by wind, infested plant material, or by nursery workers and machinery. Active dispersal is possible and movement from plant to plant by mobile young instars is possible. Given that the pest is very polyphagous it could be associated with other crops in the nursery. During the production, visual inspections are performed, with microscopic observations if needed. Chemical control is applied targeting other species but potentially effective towards *E. excrescens*. Pruning can also affect scale populations either directly by removal of infested branches and indirectly exposing the pest to biotic and abiotic control agents.

Uncertainties:

- Uncertain if other plants are grown in the nurseries.

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

A.3.3. Information from interceptions

There are no records of interceptions of *M. domestica* plants for planting from the UK due to the presence of *E. excrescens* between 1998 and February 2023 (EUROPHYT and TRACES-NT, online).

A.3.4. Evaluation of the risk mitigation measures

In the table below, all risk mitigation measures currently applied in UK are listed and an indication of their effectiveness on *E. excrescens* is provided. The description of the risk mitigation measures currently applied in UK is provided in Table 5.

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
1	Certified material	Yes	Evaluation: Potential *E. excrescens* infestations could easily be detected, though low initial infestations might be overlooked. Uncertainties: – The details of the certification process are not given (e.g. number of plants, intensity of surveys and inspections, etc.). Specific figures on the intensity of survey (sampling effort) are not provided.
2	Phytosanitary certificates	Yes	Evaluation: The procedures applied could be effective in detecting *E. excrescens* infestations, though low initial infestations might be overlooked. Uncertainties: – Specific figures on the intensity of survey (sampling effort) are not provided.
3	Cleaning and disinfection of facilities, tools and machinery	No	
4	Rouging and pruning	Yes	Evaluation: Pruning can affect scale populations either directly by removal of infested branches and indirectly exposing the pest to biotic and abiotic control agents.

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
5	Biological and mechanical control	Yes	Evaluation: Chemical applications can affect biological control agents. Uncertainties: – No details are provided on abundance and efficacy of the natural enemies.
6	Pesticide application	Yes	Evaluation: Chemicals listed in the Dossier do not target specifically this pest; however, they may be effective. Uncertainties: – No details are given on the pesticide application schedule.
7	Surveillance and monitoring	Yes	Evaluation: It can be effective Uncertainties: – Low initial infestations (crawlers) might be overlooked.
8	Sampling and laboratory testing	Yes	Evaluation: – It can be effective and useful for specific identification. Low initial infestations might be overlooked.
9	Root washing	No	
10	Pre-consignment inspection	Yes	Evaluation: It can be effective, though low initial infestations might be overlooked. Uncertainties: – There is a lack of details on the frequency and intensity of these inspections at this stage.

A.3.5. Overall likelihood of pest freedom

A.3.5.1. Reasoning for a scenario which would lead to a reasonably low number of infested consignments

- Registration and certification of propagation material ensure pest-free production.
- Most of nurseries are placed in areas where the pest is not present.
- *E. excrescens* has not been reported on *Malus* in the UK.
- No other host plants are present in the nurseries and in the surroundings.
- Visual inspections can easily detect pest presence at adult stage.

A.3.5.2. Reasoning for a scenario which would lead to a reasonably high number of infested consignments

- Registration and certification of propagation material does not target this pest and therefore does not ensure pest-freedom.
- The pest spread in the UK from its first record site.
- *Malus* is a host of *E. excrescens* and could be infested in the UK as well.
- Other host plants are present in the nurseries and in the surroundings.
- Visual inspections cannot easily detect pest presence at crawler stage.

A.3.5.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infested consignments (median)

- Uncertainty about pest pressure in the UK.
- Information on infestations on apple plants in the UK is uncertain.
- Lack of reports of infestation within the apple growing area in the UK.

A.3.5.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

- Presence of the pest in the surrounding areas is unknown.

A.3.5.5. Elicitation outcomes of the assessment of the pest freedom for *Eulecanium excrescens*

The elicited and fitted values for *Eulecanium excrescens* agreed by the Panel are shown in Tables A.11–A.16 and in Figures A.6–A.8.

Table A.11: Elicited and fitted values of the uncertainty distribution of pest infestation by *Eulecanium excrescens* per 10,000 potted plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0.00					3.00		6.00		10.00					15.00
EKE	0.11	0.27	0.55	1.12	1.91	2.91	3.95	6.15	8.57	9.90	11.34	12.66	13.80	14.48	14.98

The EKE results are the BetaGeneral (0.98508, 1.3484, 0, 15.5) distribution fitted with @Risk version 7.6.

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

Table A.12: The uncertainty distribution of plants free of *Eulecanium excrescens* per 10,000 potted plants calculated by Table A.11

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,985					9,990		9,994		9,997					10,000
EKE results	9,985.0	9,985.5	9,986.2	9,987.3	9,988.7	9,990.1	9,991.4	9,993.8	9,996.1	9,997.1	9,998.1	9,998.9	9,999.4	9,999.7	9,999.9

The EKE results are the fitted values.

Table A.13: Elicited and fitted values of the uncertainty distribution of pest infestation by *Eulecanium excrescens* per 10,000 bundles of bare rooted plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0					5		9		13					20
EKE	0.506	0.959	1.56	2.57	3.74	5.07	6.34	8.89	11.6	13.1	14.8	16.4	18.0	19.1	20.0

The EKE results are the BetaGeneral (1.4521, 1.9345, 0, 21.5) distribution fitted with @Risk version 7.6.

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

Table A.14: The uncertainty distribution of bundles free of *Eulecanium excrescens* per 10,000 bundles calculated by Table A.13

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,980					9,987		9,991		9,995					10,000
EKE results	9,980	9,981	9,982	9,984	9,985	9,987	9,988	9,991	9,994	9,995	9,996	9,997	9,998	9,999.0	9,999.5

The EKE results are the fitted values.

Table A.15: Elicited and fitted values of the uncertainty distribution of pest infestation by *Eulecanium excrescens* per 10,000 bundles of budwood/graftwood

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0.00					6.00		12.00		18.00					25.00
EKE	0.28	0.68	1.30	2.52	4.10	6.05	7.99	11.92	15.97	18.06	20.24	22.10	23.61	24.43	24.99

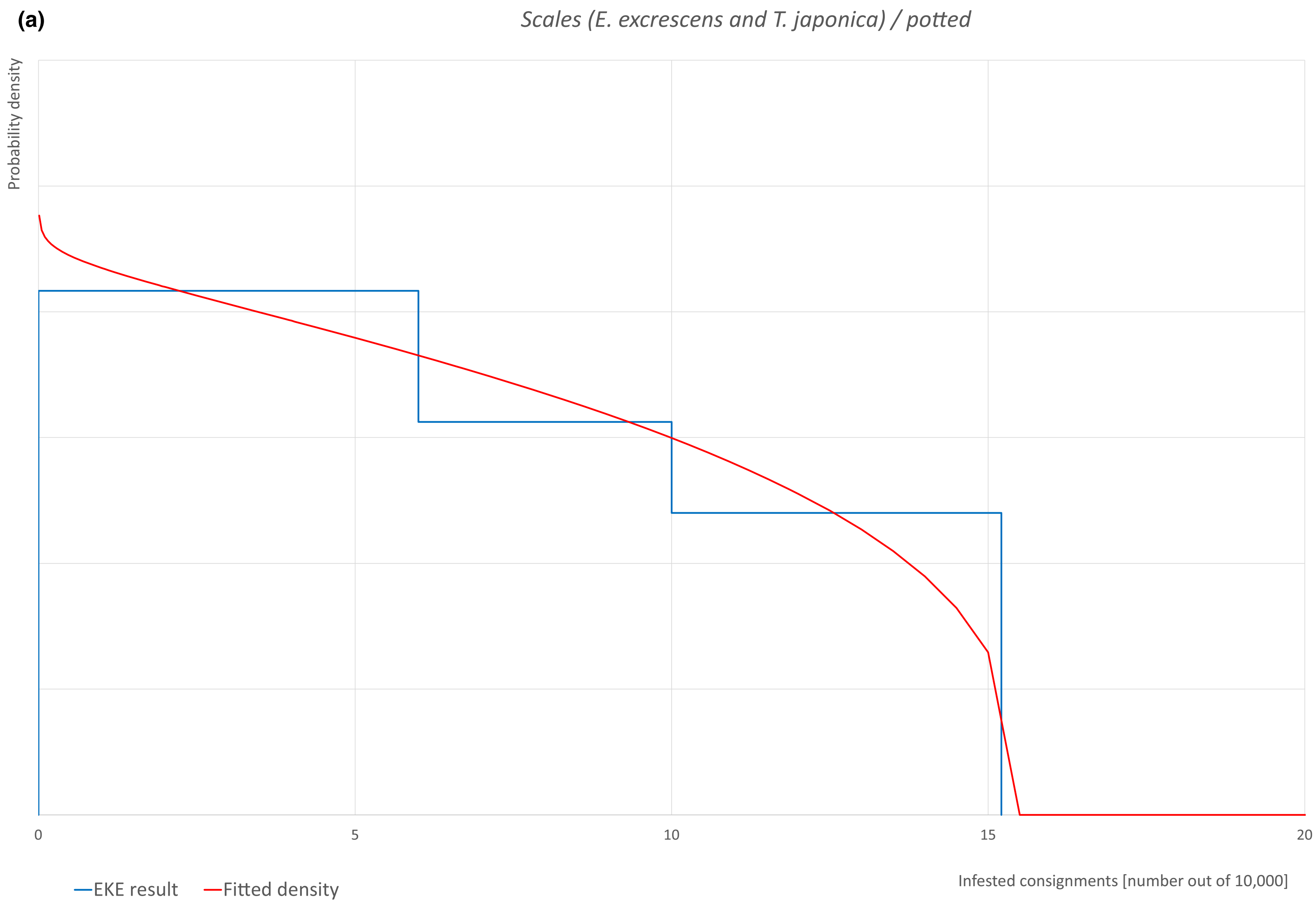
The EKE results are the BetaGeneral (1.0598, 1.1648, 0, 25.45) distribution fitted with @Risk version 7.6.

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

Table A.16: The uncertainty distribution of bundles free of *Eulecanium excrescens* per 10,000 bundles of budwood/graftwood calculated by Table A.15

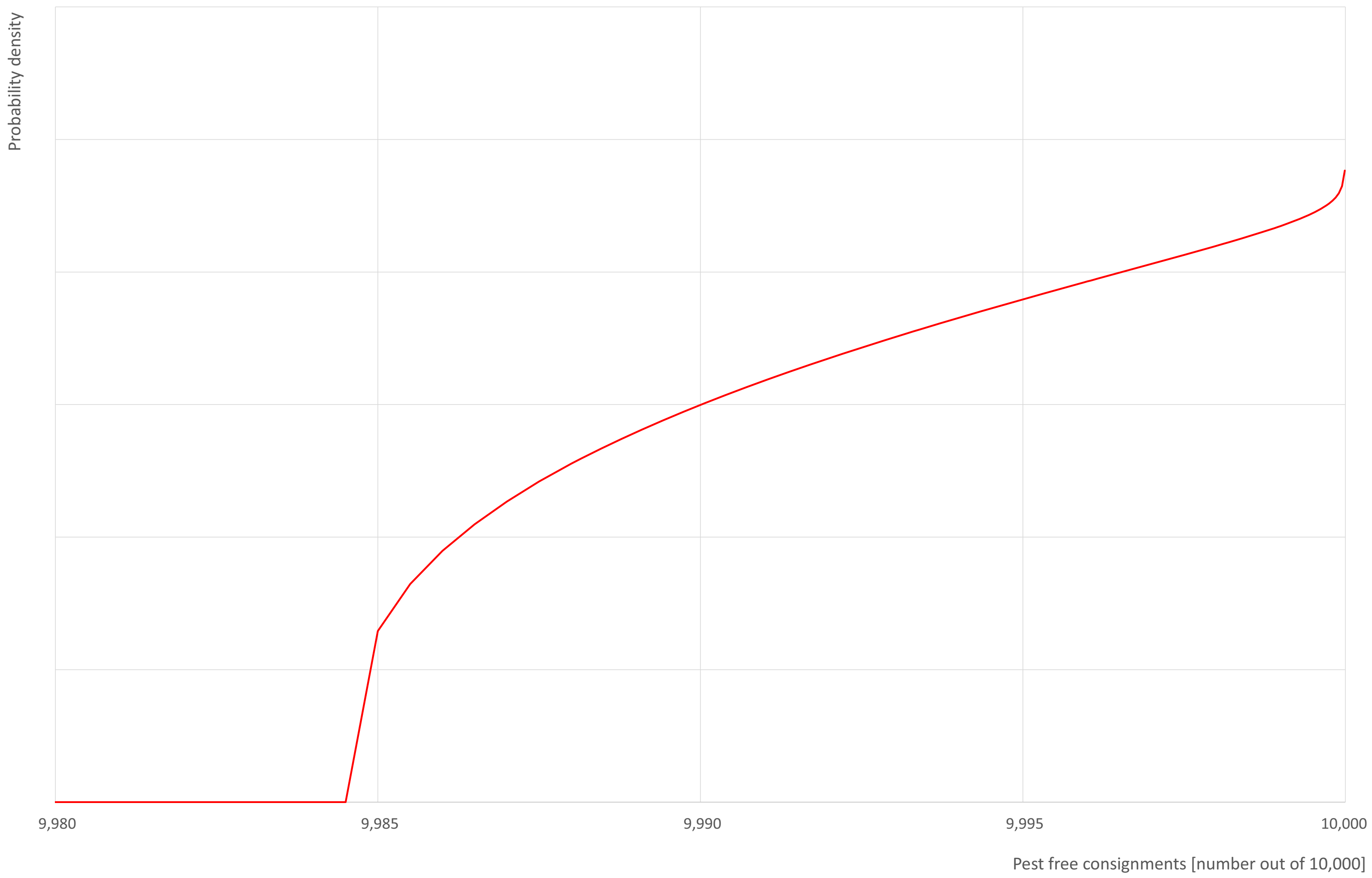
Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,975					9,982		9,988		9,994					10,000
EKE results	9,975.0	9,975.6	9,976.4	9,977.9	9,979.8	9,981.9	9,984.0	9,988.1	9,992.0	9,994.0	9,995.9	9,997.5	9,998.7	9,999.3	9,999.7

The EKE results are the fitted values.


(a)
Scales (E. excrescens and T. japonica) / potted
Probability density
0
5
10
15
20
Infested consignments [number out of 10,000]
EKE result
Fitted density

(b)

Scales (E. excrescens and T. japonica) / potted



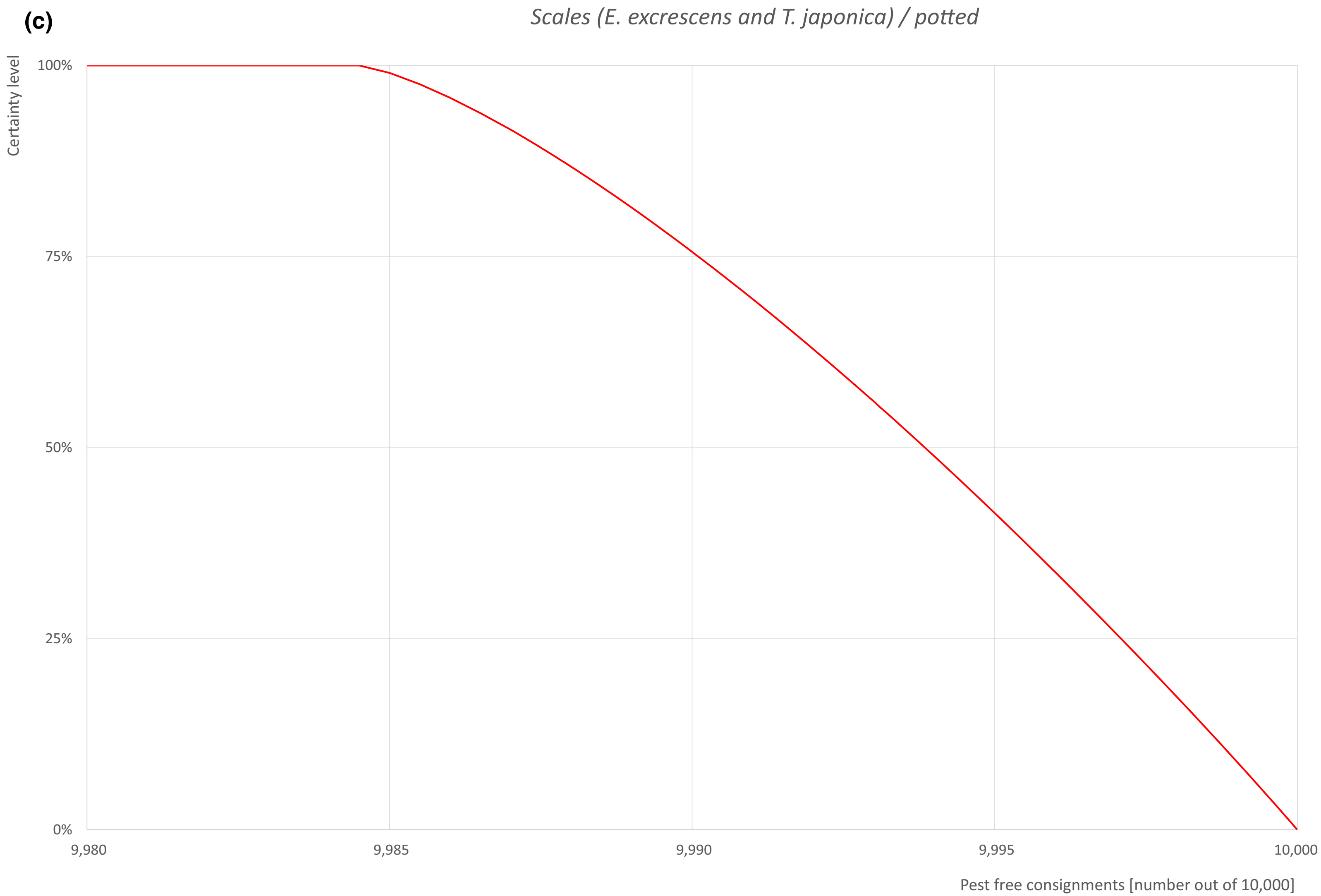
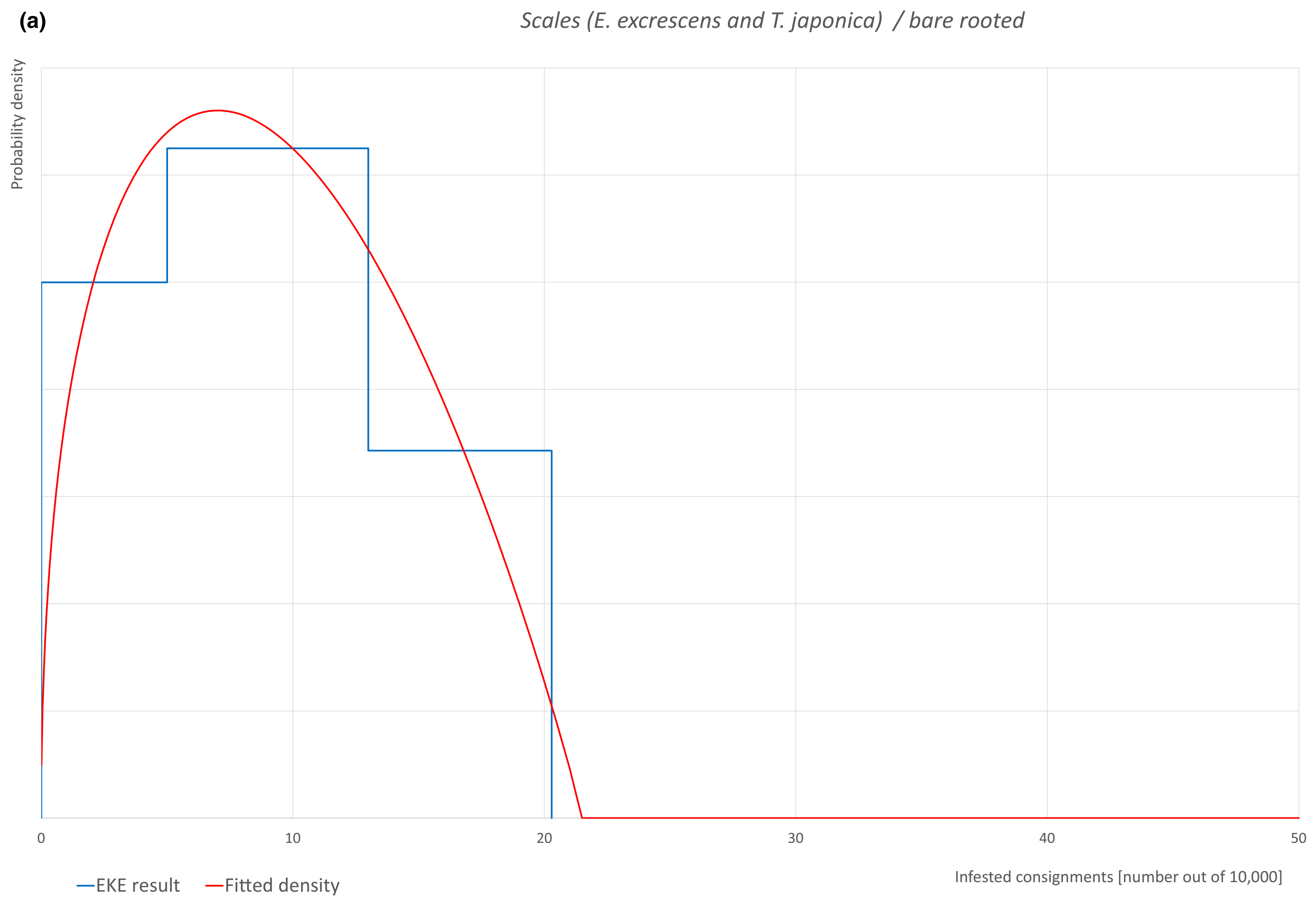
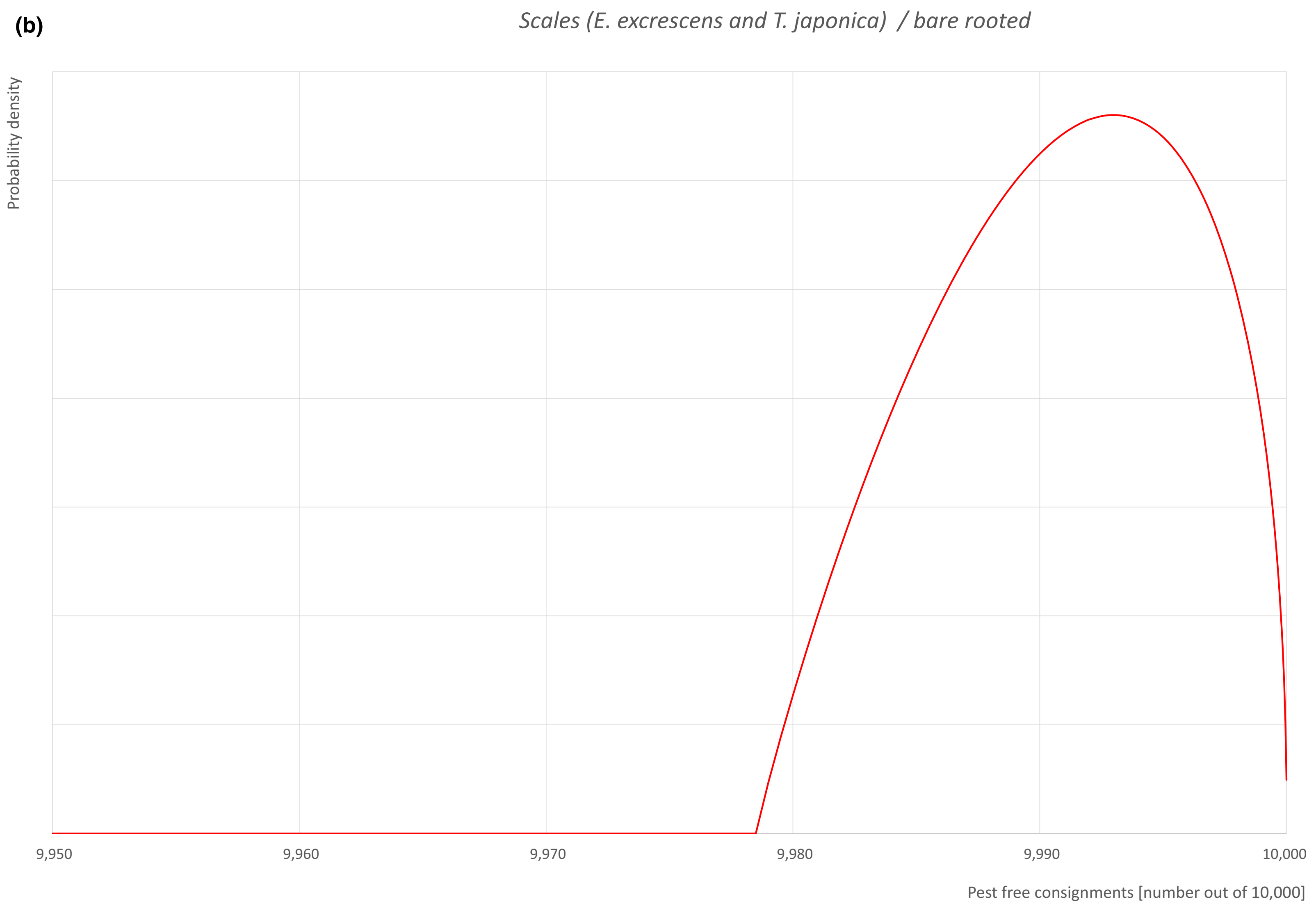


Figure A.6: (a) Elicited uncertainty of pest infestation per 10,000 potted plants (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free bundles per 10,000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


(a)
Scales (E. excrescens and T. japonica) / bare rooted
Probability density
0
10
20
30
40
50
Infested consignments [number out of 10,000]
EKE result
Fitted density


(b)
Scales (E. excrescens and T. japonica) / bare rooted
Probability density
9,950
9,960
9,970
9,980
9,990
10,000
Pest free consignments [number out of 10,000]

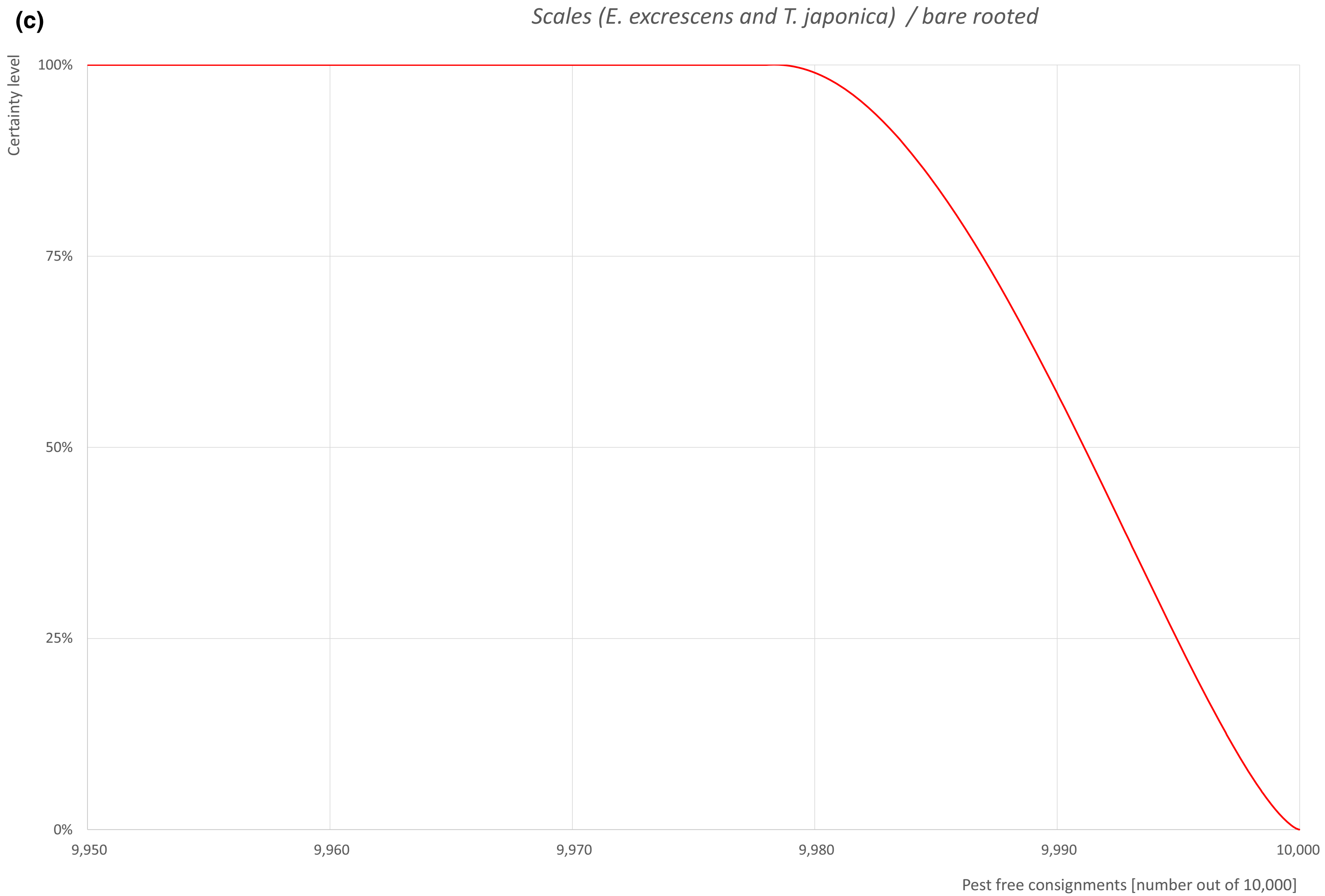
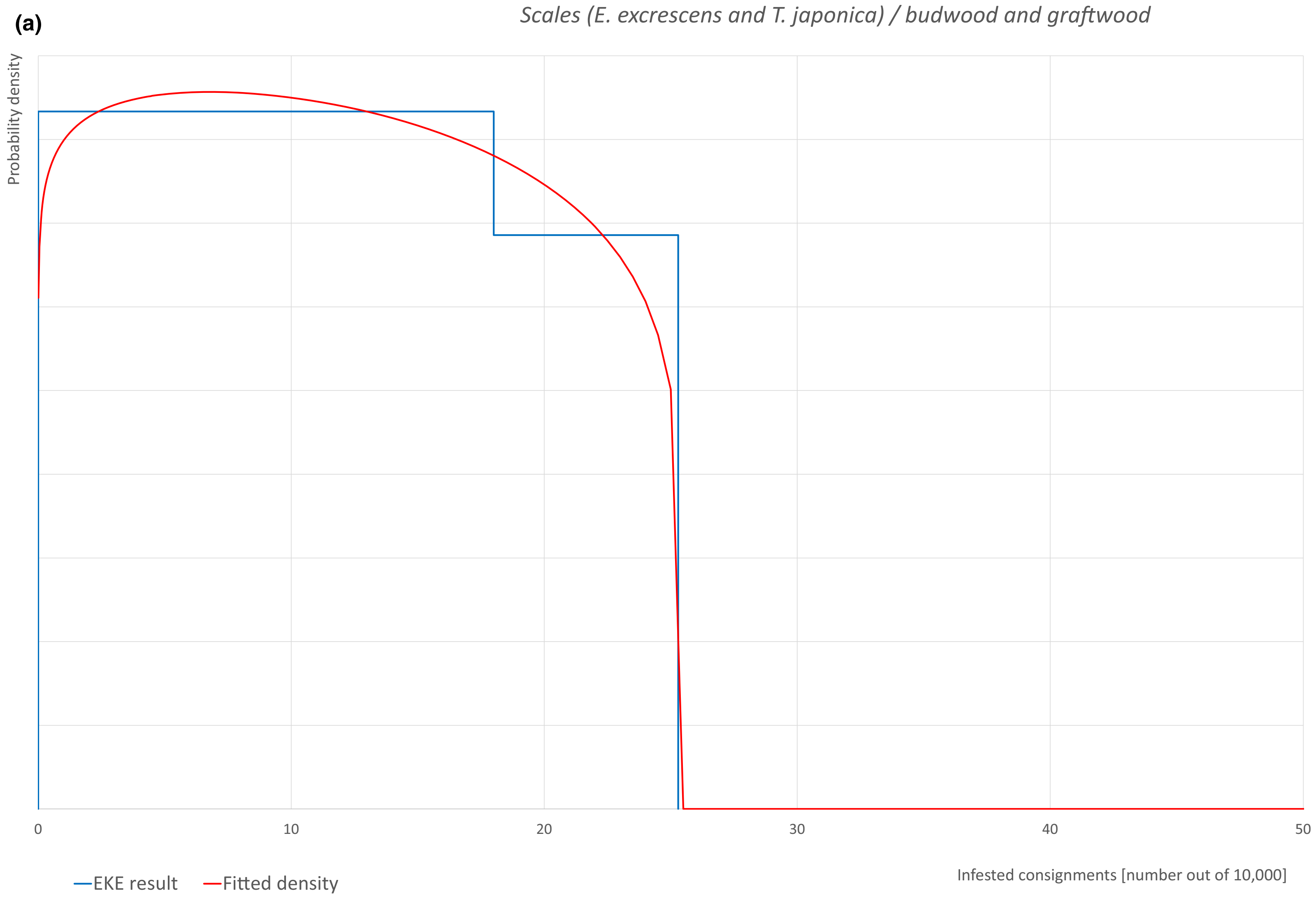
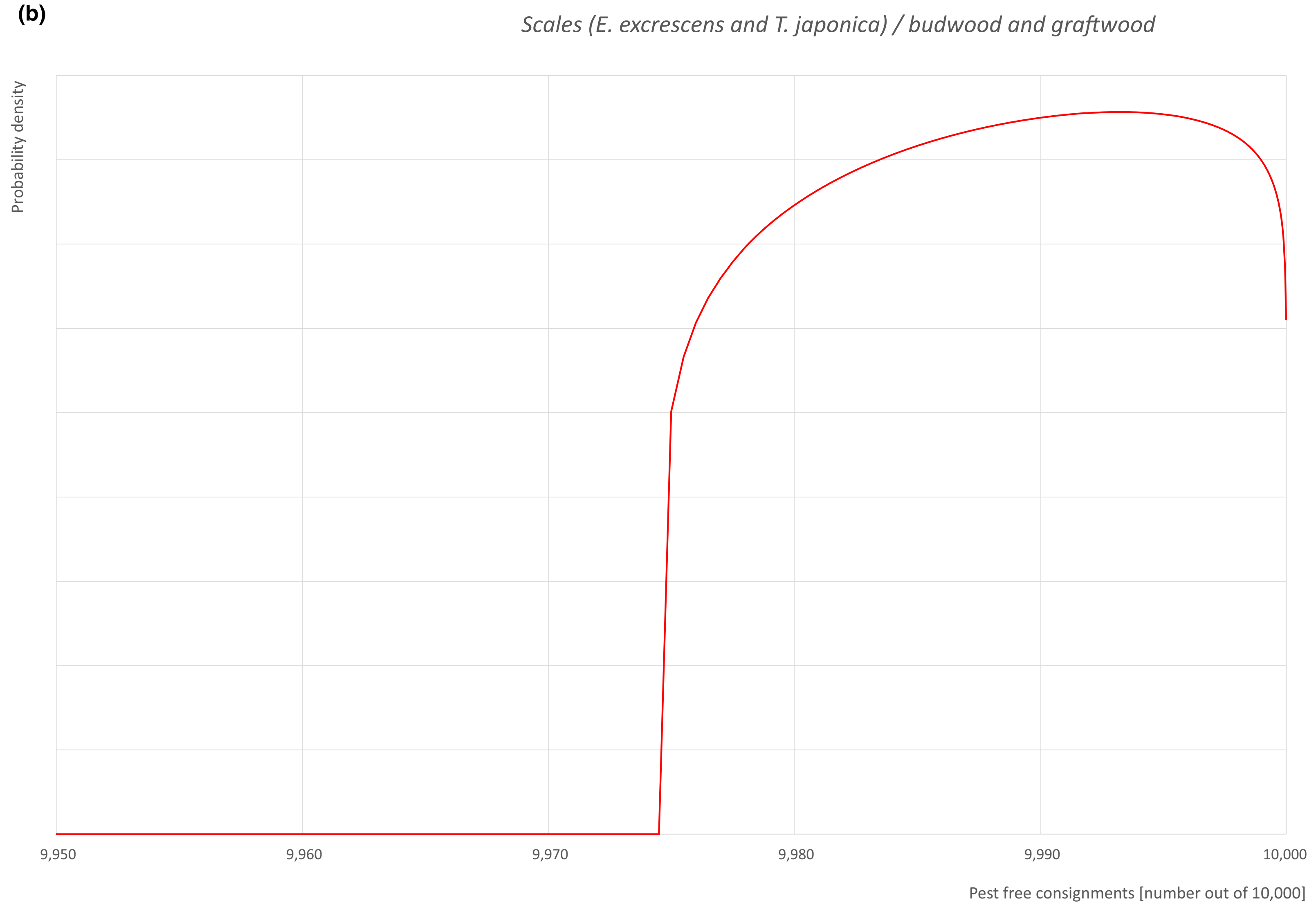


Figure A.7: (a) Elicited uncertainty of pest infestation per 10,000 bundles of bare rooted plants (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free bundles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


(a)
Scales (E. excrescens and T. japonica) / budwood and graftwood
Probability density
0
10
20
30
40
50
Infested consignments [number out of 10,000]
EKE result
Fitted density

(b)


Scales (E. excrescens and T. japonica) / budwood and graftwood
Probability density
9,950
9,960
9,970
9,980
9,990
10,000
Pest free consignments [number out of 10,000]

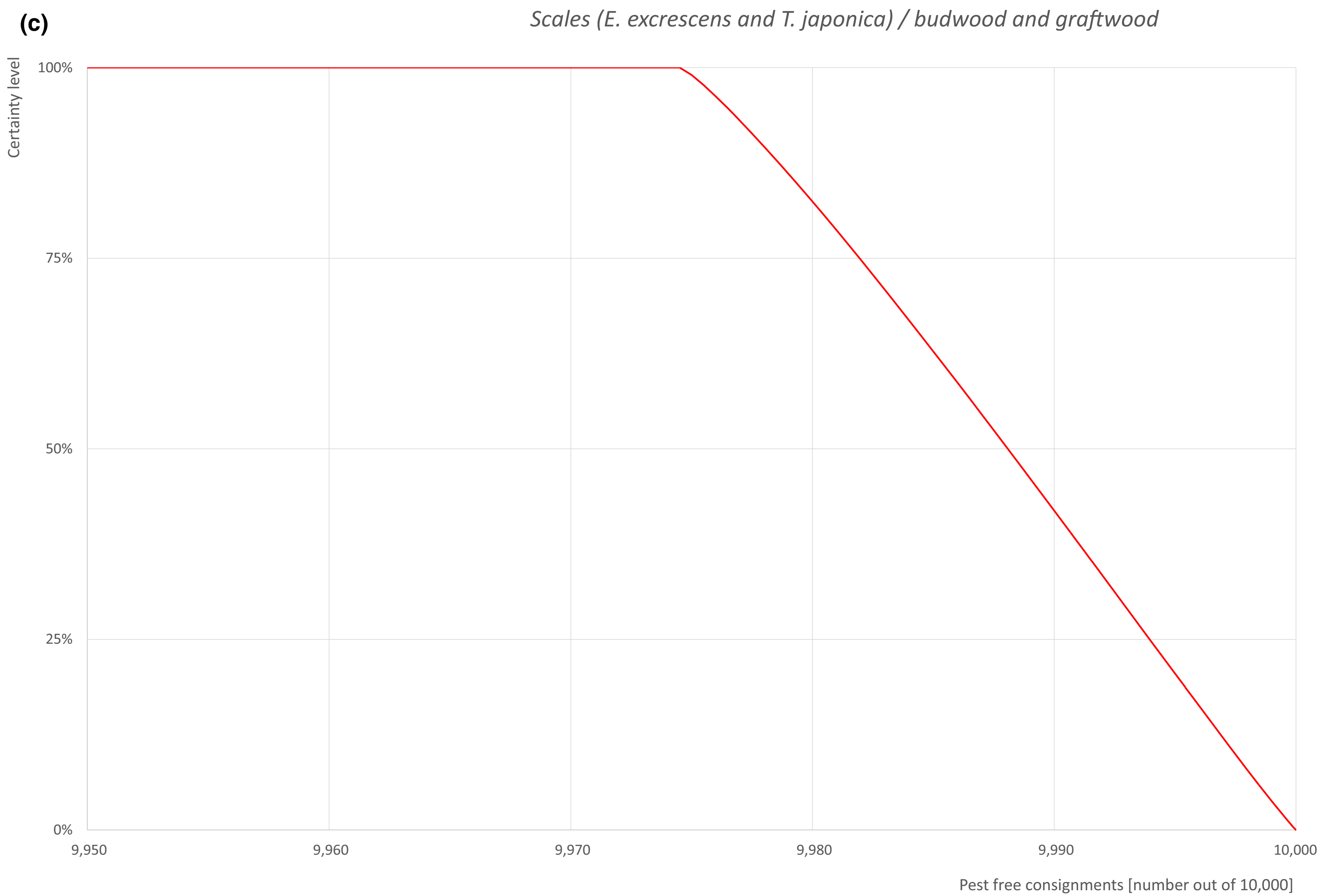


Figure A.8: (a) Elicited uncertainty of pest infestation per 10,000 bundles of graftwood/budwood (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free bundles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

A.3.6. References list

DEFRA (Department for Environment, Food and Rural Affairs), online. UK Risk Register Details for *Eulecanium excrescens*. Available online: https://secure.fera.defra.gov.uk/phiw/riskRegister/viewPestRisks.cfm?cslref=23301 [Accessed: 09 February 2023].

Deng DL, 1985. Anthribus niveovariegatus (Reolofs) - a natural enemy of Eulecanium excrescens Ferris. Plant Protection, 11, 14–15.

EUROPHYT, online. European Union Notification System for Plant Health Interceptions - EUROPHYT Available online: http://ec.europa.eu/food/plant/plant_health_biosecurity/europhyt/index_en.htm [Accessed: 17 February 2023].

García Morales M, Denno BD, Miller DR, Miller GL, Ben-Dov Y and Hardy NB, online. ScaleNet: A literature-based model of scale insect biology and systematics, *Eulecanium excrescens*. Available online: http://scalenet.info/catalogue/eulecanium%20excrescens/ [Accessed 07 February 2023].

MacLeod A and Matthews L, 2005. Pest risk analysis for *Eulecanium excrescens*. CSL, Central Science Laboratory, UK. 7 pp.

Malumphy CP, 2005. *Eulecanium excrescens* (Ferris) (Hemiptera: Coccidae), an Asian pest of woody ornamentals and fruit trees, new to Britain. British Journal of Entomology and Natural History, 18, 45–49.

Murray K and Jepson P, 2018. An Integrated Pest Management Strategic Plan for Hazelnuts in Oregon and Washington. Oregon State University, 57 pp.

Salisbury A, Halstead A and Malumphy C, 2010. Wisteria scale, *Eulecanium excrescens* (Hemiptera: Coccidae) spreading in South East England. British Journal of Entomology and Natural History, 23, 225–228.

TRACES-NT, online. TRADE Control and Expert System. Available online: https://webgate.ec.europa.eu/tracesnt [Accessed: 17 February 2023].

A.4. Takahashia japonica

A.4.1. Organism information

Taxonomic information	Current valid scientific name: *Takahashia japonica* Synonyms: *Pulvinaria japonica*, *Takahashia wuchangensis* Name used in the EU legislation: – Order: Hemiptera Family: Coccidae Common name: Asiatic string cottony scale, string cottony scale Name used in the Dossier: –
Group	Insects
EPPO code	TAKAJA
Regulated status	*Takahashia japonica* is neither regulated in the EU nor anywhere in the world.
Pest status in UK	*Takahashia japonica* is present in the UK (Tuffen et al., 2019). The pest was recorded from West Berkshire in 2018 on *Magnolia* in a private garden (Malumphy et al., 2019; Tuffen et al., 2019). No action was taken reflecting the low threat this pest poses to the UK The UK NPPO have not revisited the original site to determine if it is present or not so they have no evidence to prove that it is absent (answer by DEFRA).
Pest status in the EU	*Takahashia japonica* is native to Asia (Limonta et al., 2022), where it is reported from China, India, Japan, South Korea and Taiwan (García Morales et al., online). In the EU, it is present in Croatia and Italy (Limonta and Pellizzari, 2018; Landeka et al., 2021). In Italy, the pest was first reported in 2017 from the Northern provinces of Milano and Varese. High infestations of *T. japonica* indicated that the pest was most probably introduced some years before its detection (Limonta and Pellizzari, 2018). In Croatia, the pest was observed for the first time in 2019 from the city of Pula (Landeka et al., 2021) and eradication measures were applied by cutting down the infested branches and by applying insecticides (EPPO, online). There is no information whether the eradication was successful or not.

Host status on *Malus*	*Malus pumila* (=*domestica*) is reported to be host for *Takahashia japonica* (Limonta et al., 2022); however, it is not reported among the major hosts by the UK NPPO (DEFRA, online). *T. japonica* is a soft scale insect native to Asia (Limonta et al., 2022), where it is reported from China, India, Japan, South Korea and Taiwan (García Morales et al., online). The species has been introduced in Europe (Croatia, Italy and the UK) (García Morales et al., online). *T. japonica* is highly polyphagous species with total of 35 known host species in 17 families (Limonta et al., 2022). The hosts are *Acer negundo*, *A. buergerianum*, *A. pseudoplatanus*, *A. pseudosieboldianum*, *Albizia julibrissin*, *Alnus japonica*, *Carpinus betulus*, *Celtis australis*, *C. sinensis*, *Citrus* sp., *Cornus officinalis*, *Cydonia oblonga*, *Diospyros kaki*, *Juglans regia*, *Lespedeza* sp., *Lespedeza bicolor*, *Liquidambar styraciflua*, *Loropetalum chinense*, *Magnolia kobus*, *M. obovate*, *Malus pumila*, *Morus* sp., *M. alba*, *M. nigra*, *Parthenocissus tricuspidate*, *Prunus cerasifera*, *P. glandulosa*, *P. salicina*, *P. tomentosa*, *Pyrus serotina*, *Rhododendron schlippenbachii*, *Robinia pseudoacacia*, *Salix chaenomeloides*, *S. glandulosa*, *Styphnolobium japonicum*, *Ulmus davidiana* and *Zelkova serrata* (Limonta et al., 2022).	
PRA information	Available Pest Risk Assessments: – UK Risk Register Details for *Takahashia japonica* (DEFRA, online).	
Other relevant information for the assessment		
Biology	*T. japonica* is a monovoltine parthenogenetic species native to Asia. Its life cycle is characterised by the migrations of first instar crawlers from twigs to leaf undersides in May–June, and second instar nymphs from leaves to twigs in September–October, to overwinter. After overwintering, the nymphs resume activity from March onwards and reach the length of about 1.5 mm and 0.5 mm wide. The moult to the adult female occurs at the same overwintering site. The first moults occur in early April, and the whole population reaches the adult stage over about 10 days. The adult female's body size increases quickly from about 1.5 mm long to 6–7 mm long and 5 mm wide and becomes slightly convex in the adult reproductive female. In this growing phase, the adult preovigerous females feed and produce honeydew droplets. Oviposition starts in late April and goes on until early May. Females settled on the twigs, secrete the long egg sacs that can reach 6–7 cm in length over several days. Egg sacs produced by females kept in the laboratory were usually 2.5–4.0 cm long. Fecundity is high: about 1,200 eggs were counted in a 1 cm length of ovisac, so the estimated fecundity in the laboratory was over 4,000–5,000 eggs/female. In the environment, egg hatching occurs in early June, and the first instar nymphs or 'crawlers' are the main natural dispersal stage. Indeed, they move to the undersides of leaves, where they settle on the veins. During this migration, the crawlers can be easily carried by the wind, insects or birds to other conterminous host plants. Long distance dispersal is likely to be with infested plants being moved in trade. In late August–September, the population consists of second instar nymphs, each about 1.3 mm long. From September to October, the second-instar nymphs migrate gradually from the leaf undersides to the twigs, settling to overwinter. Overwintering second-instar nymphs are brown and covered by transparent wax plates (Limonta et al., 2022).	
Symptoms	**Main type of symptoms**	Heavy infestations of *T. japonica* on twigs cause dieback and necrosis of buds, which is mostly harmful to newly planted young trees. The production of honeydew is limited. From late April onwards (when the females start oviposition), the trees assume a striking and unsightly appearance due to the many conspicuous white ovisacs hanging from the twigs and branches, reducing their aesthetic value and causing concern among citizens. Moreover, the ovisacs persist on the plants long after the eggs have hatched and are still present in winter, so the unsightly appearance persists (Limonta et al., 2022). The early instars and young females are small and inconspicuous. It is the conspicuous ovisacs that are most likely to be detected first (Malumphy et al., 2019).

	Presence of asymptomatic plants	Low initial infestations in the absence of waxy ovisacs may be overlooked.
	Confusion with other pests	*T. japonica* can hardly be confused with other scales. Indeed, mature adult females have characteristic long, string-like, looped ovisacs, hanging from the bark (Malumphy et al., 2019).
Host plant range	*Takahashia japonica* is a highly polyphagous species reported on 35 broad-leaf trees and shrubs belonging to 17 families: *Acer negundo*, *A. buergerianum*, *A. pseudoplatanus*, *A. pseudosieboldianum*, *Albizia julibrissin*, *Alnus japonica*, *Carpinus betulus*, *Celtis australis*, *C. sinensis*, *Citrus* sp., *Cornus officinalis*, *Cydonia oblonga*, *Diospyros kaki*, *Juglans regia*, *Lespedeza* sp., *Lespedeza bicolor*, *Liquidambar styraciflua*, *Loropetalum chinense*, *Magnolia kobus*, *M. obovate, Malus pumila*, *Morus* sp., *M. alba*, *M. nigra*, *Parthenocissus tricuspidate, Prunus cerasifera*, *P. glandulosa*, *P. salicina*, *P. tomentosa*, *Pyrus serotina*, *Rhododendron schlippenbachii*, *Robinia pseudoacacia*, *Salix chaenomeloides*, *S. glandulosa*, *Styphnolobium japonicum*, *Ulmus davidiana* and *Zelkova serrata* (Limonta et al., 2022).	
Reported evidence of impact	There are no reports of economic or ecological damage induced by *T. japonica* in Asia (Malumphy et al., 2019). According to Limonta et al. (2022) in Italy its impact on urban trees has mostly involved some honeydew production and the appearance of infested trees due to long white ovisacs hanging from the branches. *T. japonica* can potentially reduce esthetical value of plants (Malumphy et al., 2019). No data about damage on *Malus domestica* are available. Three European new country records of *T. japonica* in a 4-year interval (Italy, Great Britain and Croatia) indicate that this species could expand its range in Europe, primarily due to the import and trade in ornamental trees. In Italy, 5 years after its detection, the first infested area (Lombardy region) has expanded slightly, and the level of infestation is high. Still, so far, no new infestation foci in other Italian regions have been reported. Despite some heavy infestations, no real impact on plant vigour has been noticed in fully grown trees (Limonta et al., 2022). So far, its impact on urban trees has mostly involved some honeydew production and the unsightly appearance of infested trees from the oviposition period onwards (eight or 9 months of the year). Pruning off most of the infested twigs and branches in winter, when the overwintering nymphs are clearly visible in spring (April–May), before the eggs hatch, are suggested to reduce infestations. Several natural enemies of *T. japonica* are recorded in the literature (Tuffen et al., 2019).	
Pathways and evidence that the commodity is a pathway	Possible pathways of entry for *T. japonica* are plants for planting (excluding seeds bulbs and tubers), bonsai and cut branches (Malumphy et al., 2019).	
Surveillance information	No surveillance information is currently available from the UK NPPO.	

A.4.2. Possibility of pest presence in the nursery

A.4.2.1. Possibility of entry from the surrounding environment

If present in the surroundings, the pest can enter the nursery (as UK is producing these plants for planting outdoors). However, the only official record available is from one Magnolia plant in West Berkshire in 2018, and no further information is available on its distribution and presence in the country. The pest could enter the nursery either by passive dispersal (e.g. wind) especially crawlers than can be easily uplifted by wind, infested plant material by nursery workers and machinery. Given that the pest is very polyphagous, it could be associated with several plant species in the nursery surroundings.

Uncertainties:

- The UK NPPO has not revisited the original site to determine if the pest is present or not so there is no evidence to prove that it is absent or it is spread from there.

— No information on possible host plants of the pest in the nursery surroundings is available.

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

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

The pest can be found on the trunk, stem, branches, leaves of plants for planting (scions, grafted rootstocks). Although adults can be relatively easily spotted during visual inspections, young stages can be difficult to detect. The pest can be hidden inside bark cracks. In case of initial low populations, the species can be overlooked. Introduction of the pest with certified material is very unlikely.

Uncertainties:

— Uncertain if certified material is screened for this pest as it is not listed as *Malus* pest in the Dossier.

Taking into consideration the above evidence and uncertainties, the Panel considers it possible that the pest could enter the nursery although very unlikely.

A.4.2.3. Possibility of spread within the nursery

If the scale enters the nursery from the surroundings, the pest could spread within the nursery either by passive dispersal (e.g. wind), especially crawlers than can be easily uplifted by wind, infested plant material, or by nursery workers and machinery. Active dispersal is possible and movement from plant to plant by mobile young instars is possible. Given that the pest is very polyphagous the pest could be associated with other crops in the nursery. During the production, visual inspections are performed, with microscopic observations if needed. Chemical control is applied targeting other species but potentially effective towards *T. japonica*. Pruning can also affect scale populations either directly by removal of infested branches and indirectly exposing the pest to biotic and abiotic control agents.

Uncertainties:

— Uncertain if other plants are grown in the nurseries.

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

A.4.3. Information from interceptions

There are no records of interceptions of *M. domestica* plants for planting from the UK due to the presence of T. *japonica* between 1998 and February 2023 (EUROPHYT and TRACES-NT, online).

A.4.4. Evaluation of the risk mitigation measures

In the table below, all risk mitigation measures currently applied in UK are listed and an indication of their effectiveness on *Takashia japonica* is provided. The description of the risk mitigation measures currently applied in UK is provided in Table 5.

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
1	Certified material	Yes	Evaluation: Potential *T. japonica* infestations could easily be detected, though low initial infestations might be overlooked. Uncertainties: – The details of the certification process are not given (e.g. number of plants, intensity of surveys and inspections, etc.). Specific figures on the intensity of survey (sampling effort) are not provided.
2	Phytosanitary certificates	Yes	Evaluation: The procedures applied could be effective in detecting *T. japonica* infestations though low initial infestations might be overlooked.

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
			Uncertainties: – Specific figures on the intensity of survey (sampling effort) are not provided.
3	Cleaning and disinfection of facilities, tools and machinery	No	
4	Rouging and pruning	Yes	Evaluation: Pruning can affect scale populations either directly by removal of infested branches and indirectly exposing the pest to biotic and abiotic control agents.
5	Biological and mechanical control	Yes	Evaluation: Chemical applications can affect biological control agents. Uncertainties: – No details are provided on abundance and efficacy of the natural enemies.
6	Pesticide application	Yes	Evaluation: Chemicals listed in the Dossier do not target specifically this pest, however, may be effective. Uncertainties: – No details are given on the pesticide application schedule.
7	Surveillance and monitoring	Yes	It can be effective, though low initial infestations might be overlooked.
8	Sampling and laboratory testing	Yes	It can be effective and useful for specific identification. Low initial infestations might be overlooked.
9	Root washing	No	
10	Pre-consignment inspection	Yes	Evaluation: It can be effective, though low initial infestations might be overlooked. Uncertainties: – There is a lack of details on the frequency and intensity of these inspections at this stage.

A.4.5. Overall likelihood of pest freedom

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

- Registration and certification of propagation material ensure pest-free production.
- Most of nurseries are placed in areas where the pest is not present.
- *T. japonica* has not been reported on *Malus* in the UK.
- No other host plants are present in the nurseries and in the surroundings.
- Visual inspections can easily detect pest presence at adult stage.

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

- Registration and certification of propagation material does not target this pest and therefore does not ensure pest-freedom.
- The pest spread in the UK from its first record site.
- *Malus* is a host of *T. japonica* and could be infested in the UK as well.
- Other host plants are present in the nurseries and in the surroundings.
- Visual inspections cannot easily detect pest presence at crawler stage.

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

- Uncertainty about pest pressure in the UK.
- Information on infestations on apple plants in the UK is uncertain.
- Lack of reports of infestation within the apple growing area in the UK.

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

- Presence of the pest in the surrounding areas is unknown.

A.4.5.5. Elicitation outcomes of the assessment of the pest freedom *Takashia japonica*

The elicited and fitted values for *Takashia japonica* agreed by the Panel are shown in Tables A.17–A.22 and in Figures A.9–A.11.

Table A.17: Elicited and fitted values of the uncertainty distribution of pest infestation by *Takahashia japonica* per 10,000 potted plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0.00					3.00		6.00		10.00					15.00
EKE	0.11	0.27	0.55	1.12	1.91	2.91	3.95	6.15	8.57	9.90	11.34	12.66	13.80	14.48	14.98

The EKE results are the BetaGeneral (0.98508, 1.3484, 0, 15.5) distribution fitted with @Risk version 7.6.

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

Table A.18: The uncertainty distribution of plants free of *Takahashia japonica* per 10,000 potted plants calculated by Table A.17

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,985					9,990		9,994		9,997					10,000
EKE results	9,985.0	9,985.5	9,986.2	9,987.3	9,988.7	9,990.1	9,991.4	9,993.8	9,996.1	9,997.1	9,998.1	9,998.9	9,999.4	9,999.7	9,999.9

The EKE results are the fitted values.

Table A.19: Elicited and fitted values of the uncertainty distribution of pest infestation by *Takahashia japonica* per 10,000 bundles of bare rooted plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0					5		9		13					20
EKE	0.506	0.959	1.56	2.57	3.74	5.07	6.34	8.89	11.6	13.1	14.8	16.4	18.0	19.1	20.0

The EKE results are the BetaGeneral (1.4521, 1.9345, 0, 21.5) distribution fitted with @Risk version 7.6.

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

Table A.20: The uncertainty distribution of bundles free of *Takahashia japonica* per 10,000 bundles calculated by Table A.19

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,980					9,987		9,991		9,995					10,000
EKE results	9,980	9,981	9,982	9,984	9,985	9,987	9,988	9,991	9,994	9,995	9,996	9,997	9,998	9,999.0	9,999.5

The EKE results are the fitted values.

Table A.21: Elicited and fitted values of the uncertainty distribution of pest infestation by *Takahashia japonica* per 10,000 bundles of budwood/graftwood

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0.00					6.00		12.00		18.00					25.00
EKE	0.28	0.68	1.30	2.52	4.10	6.05	7.99	11.92	15.97	18.06	20.24	22.10	23.61	24.43	24.99

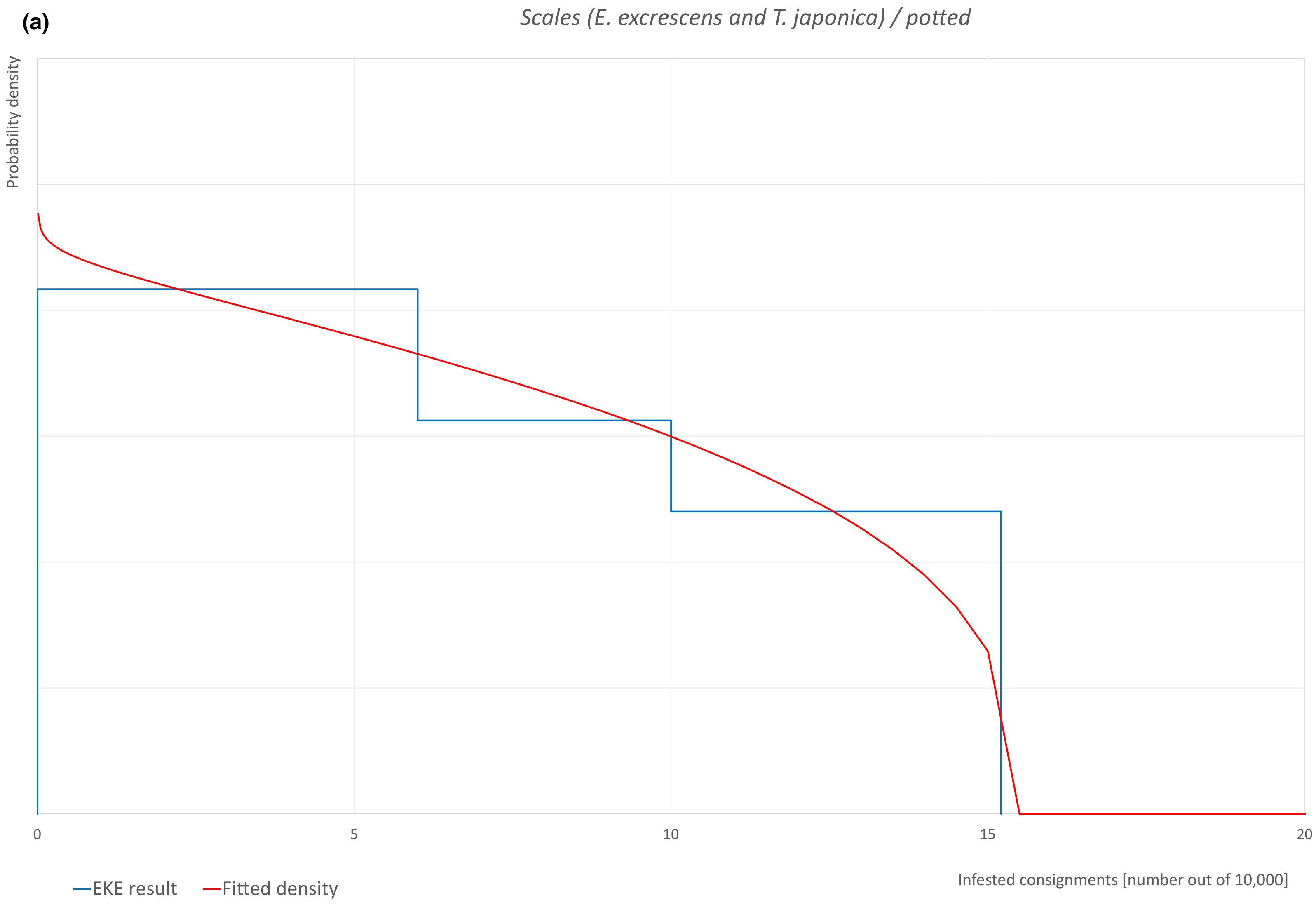
The EKE results are the BetaGeneral (1.0598, 1.1648, 0, 25.45) distribution fitted with @Risk version 7.6.

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

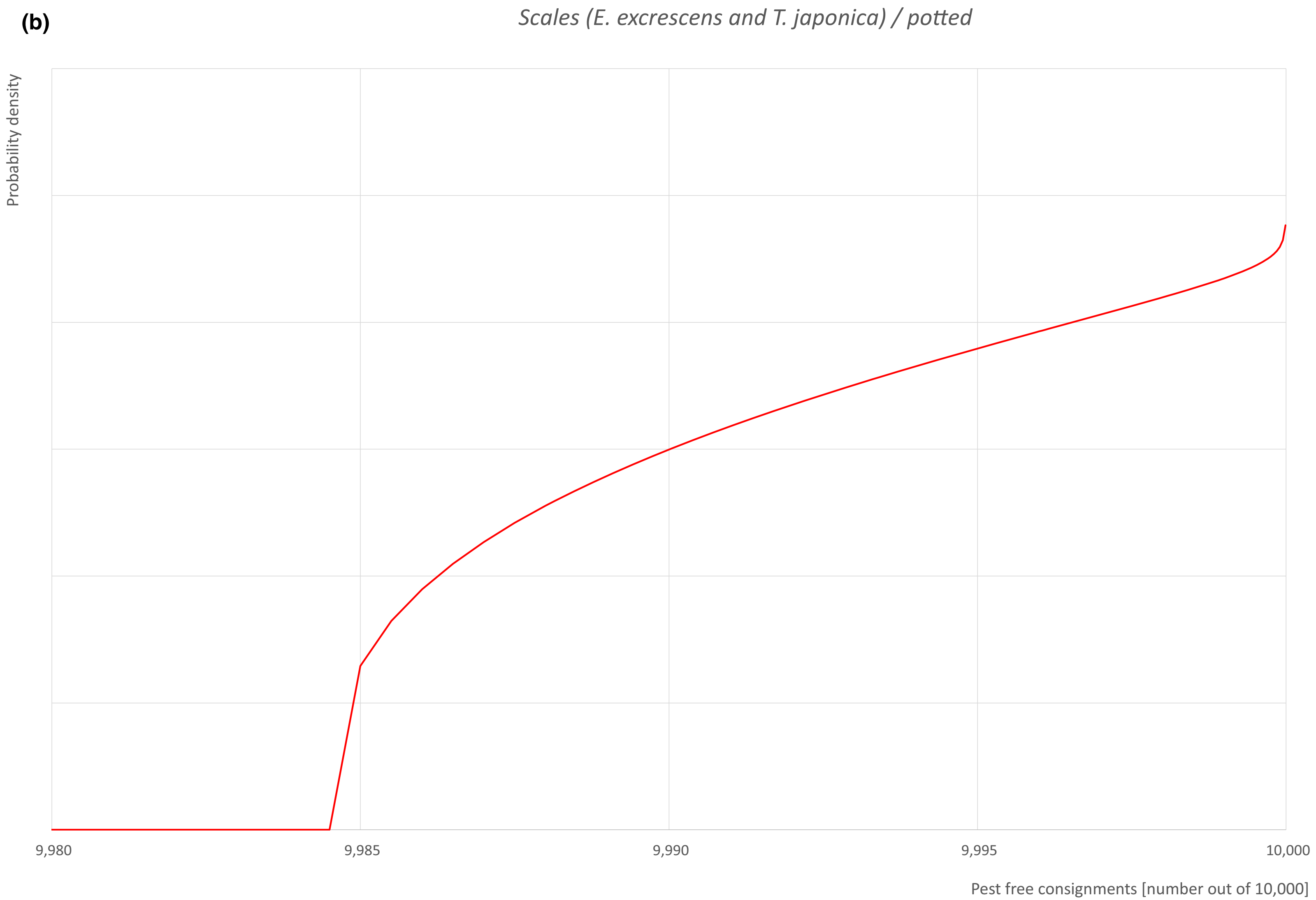
Table A.22: The uncertainty distribution of bundles free of *Takahashia japonica* per 10,000 bundles of budwood/graftwood calculated by Table A.21

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,975					9,982		9,988		9,994					10,000
EKE results	9,975.0	9,975.6	9,976.4	9,977.9	9,979.8	9,981.9	9,984.0	9,988.1	9,992.0	9,994.0	9,995.9	9,997.5	9,998.7	9,999.3	9,999.7

The EKE results are the fitted values.


(a)
Scales (E. excrescens and T. japonica) / potted
Probability density
0
5
10
15
20
EKE result
Fitted density
Infested consignments [number out of 10,000]

(b)


Scales (E. excrescens and T. japonica) / potted
Probability density
9,980
9,985
9,990
9,995
10,000
Pest free consignments [number out of 10,000]

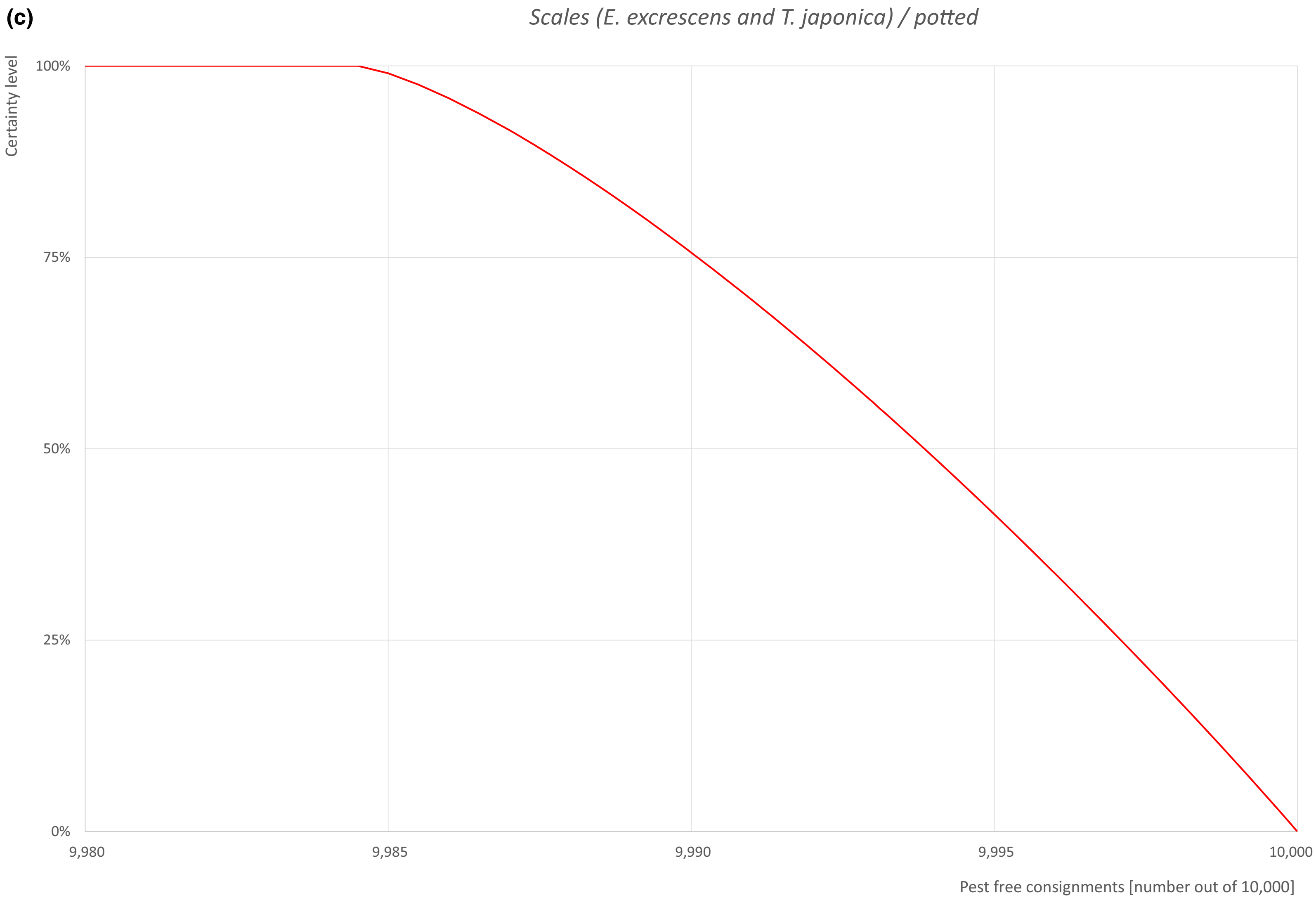
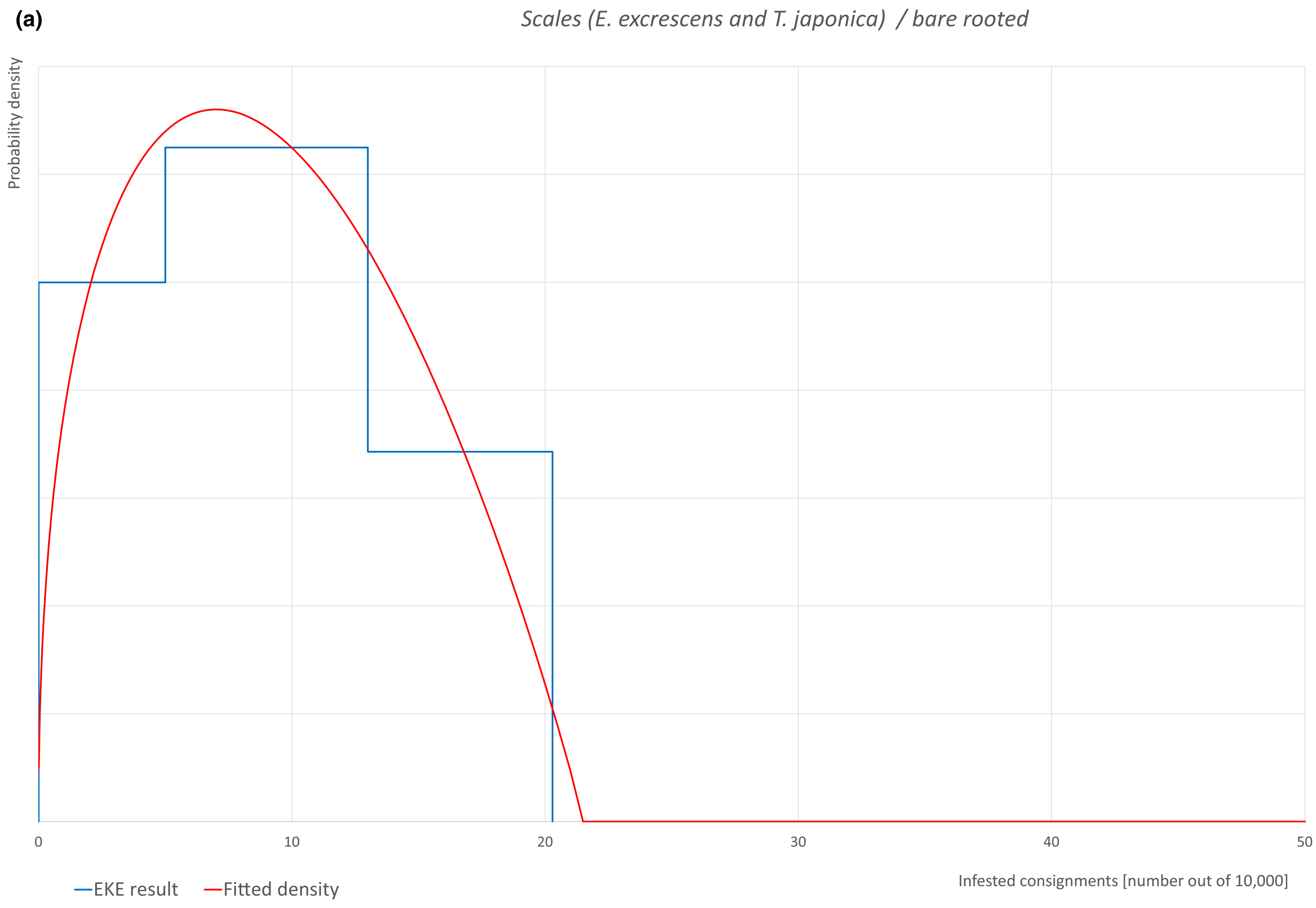
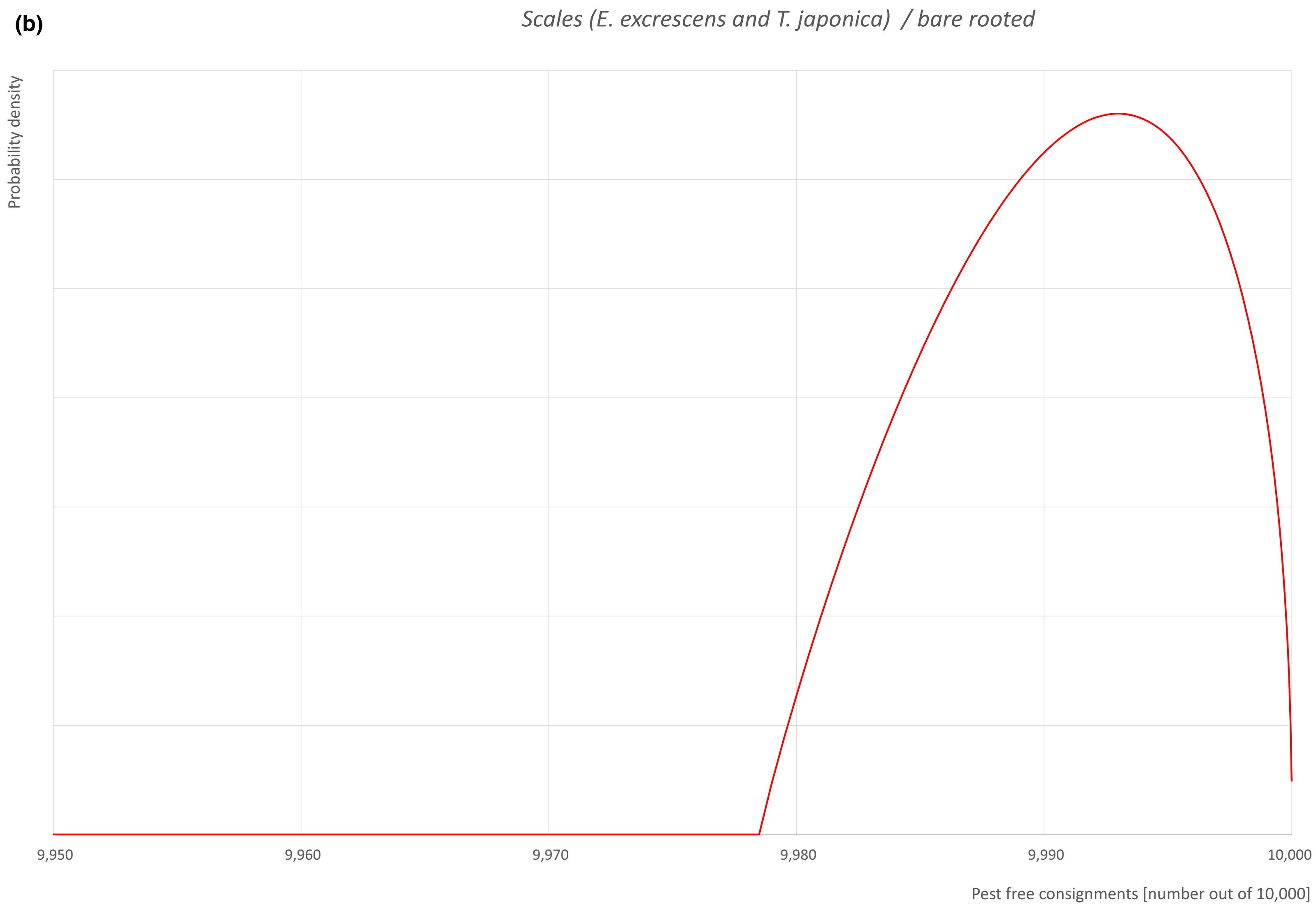


Figure A.9: (a) Elicited uncertainty of pest infestation per 10,000 potted plants (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free bundles per 10,000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


(a)
Scales (E. excrescens and T. japonica) / bare rooted
Probability density
0
10
20
30
40
50
EKE result
Fitted density
Infested consignments [number out of 10,000]

(b)


Scales (E. excrescens and T. japonica) / bare rooted
Probability density
9,950
9,960
9,970
9,980
9,990
10,000
Pest free consignments [number out of 10,000]

(c)

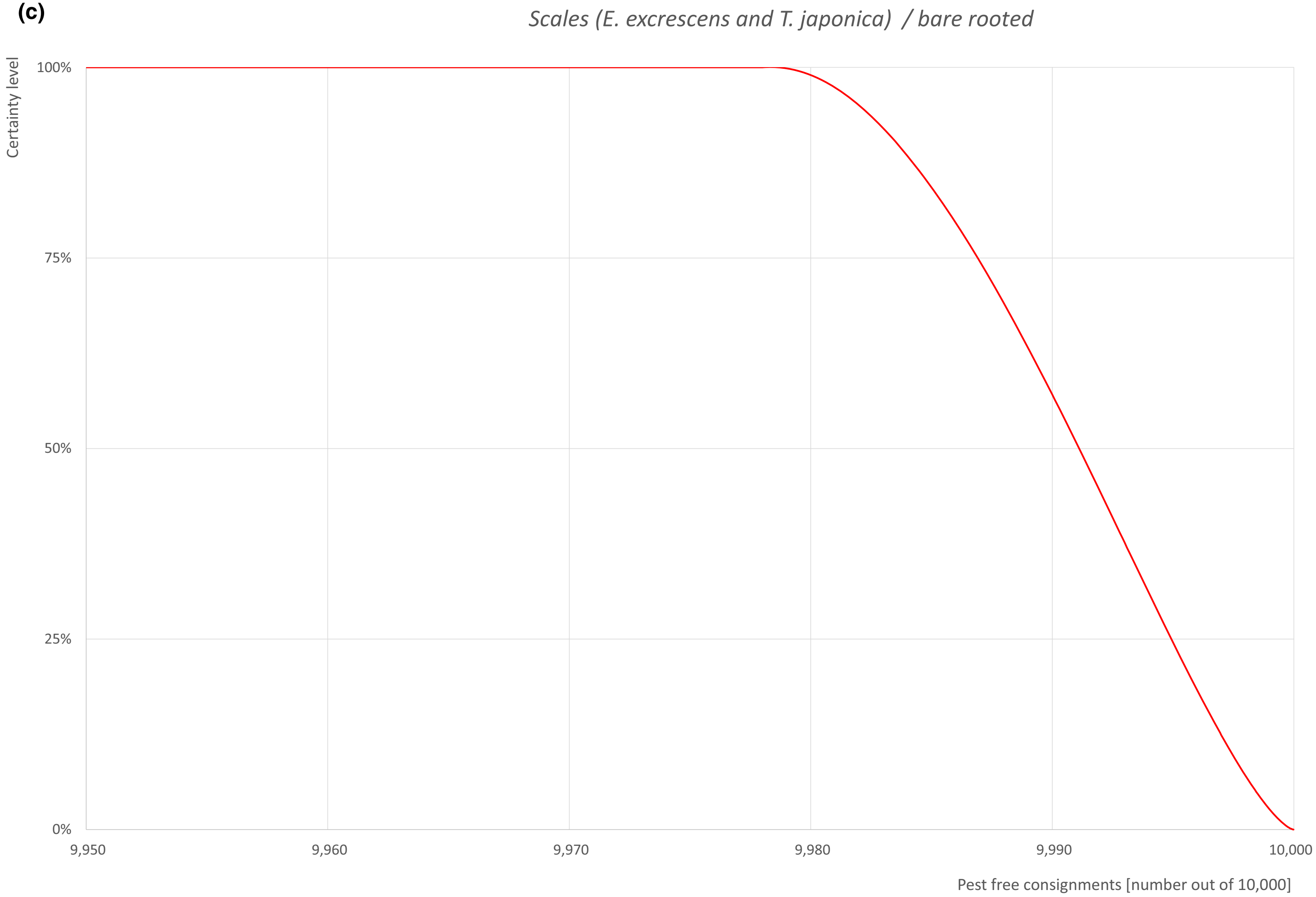
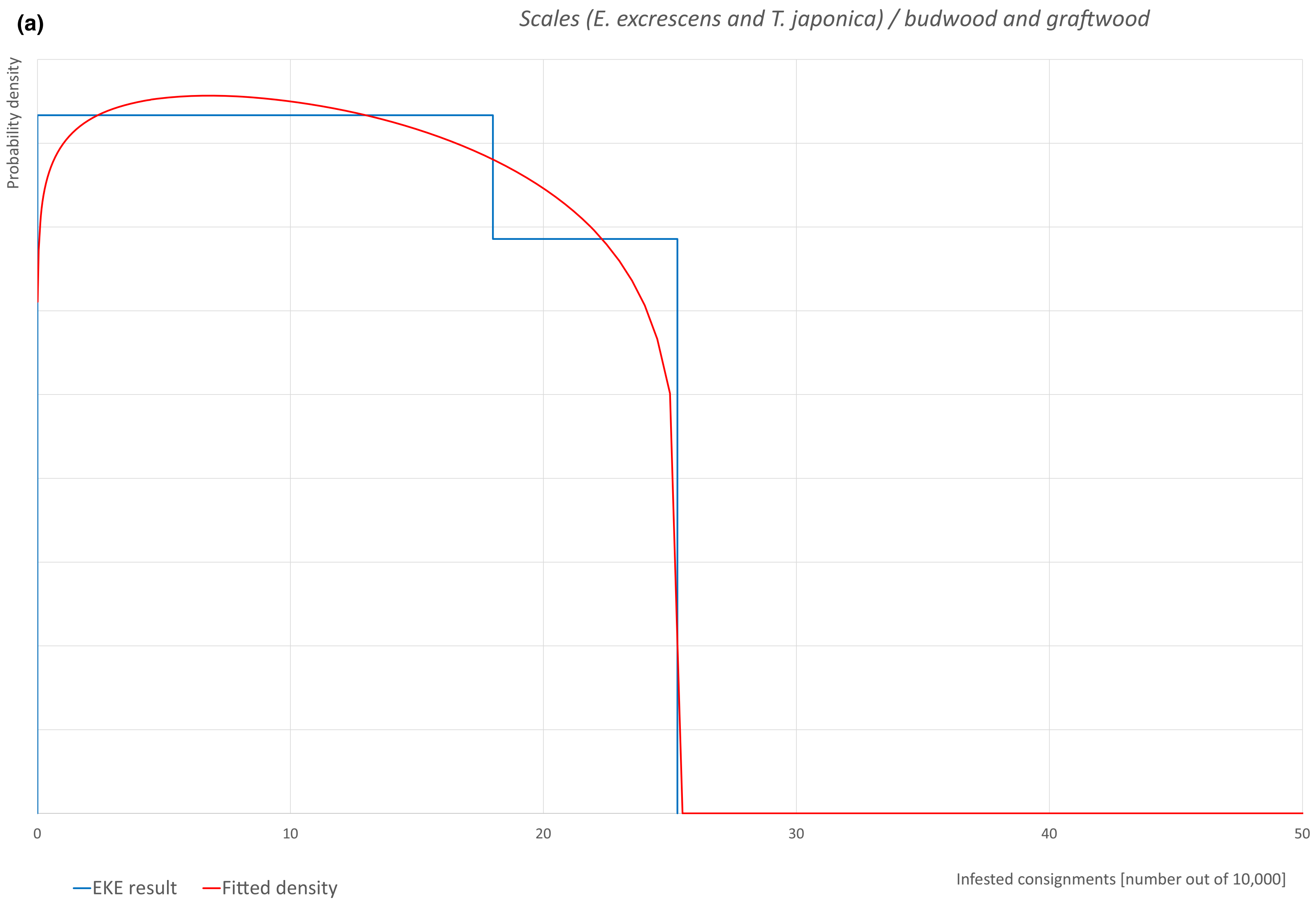
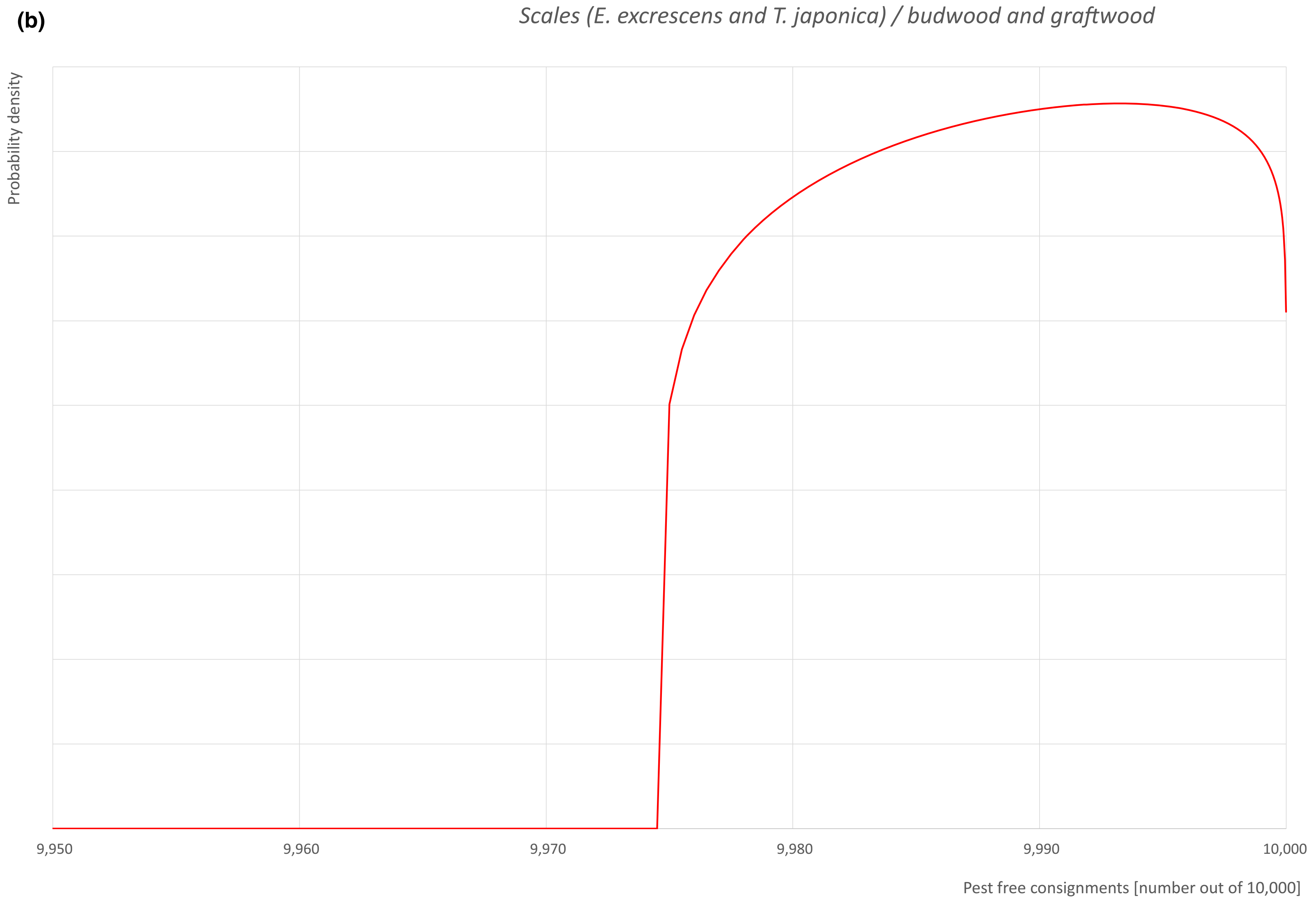


Figure A.10: (a) Elicited uncertainty of pest infestation per 10,000 bundles of bare rooted plants (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free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


(a)
Scales (E. excrescens and T. japonica) / budwood and graftwood
Probability density
0
10
20
30
40
50
Infested consignments [number out of 10,000]
EKE result
Fitted density

(b)


Scales (E. excrescens and T. japonica) / budwood and graftwood
Probability density
9,950
9,960
9,970
9,980
9,990
10,000
Pest free consignments [number out of 10,000]

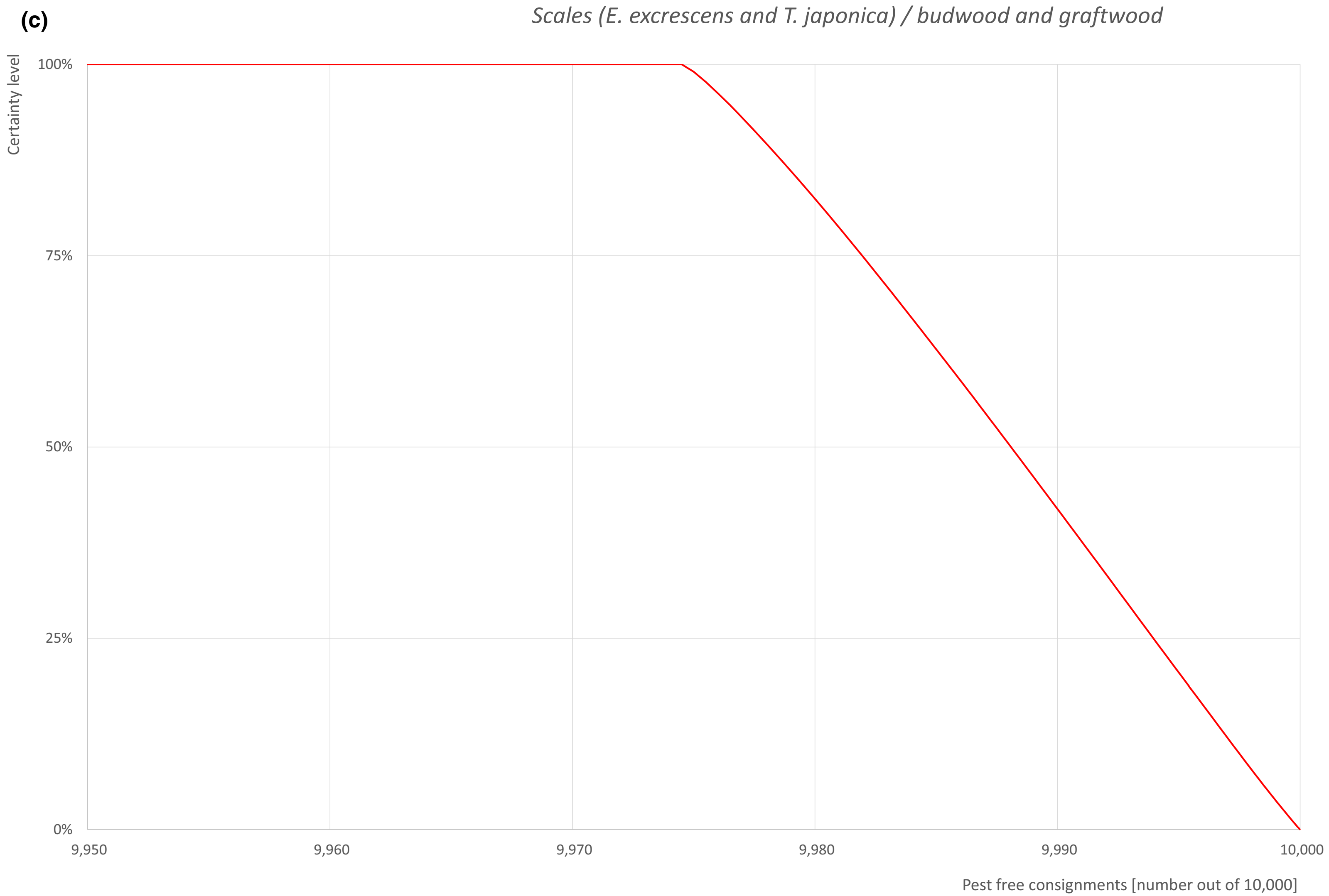


Figure A.11: (a) Elicited uncertainty of pest infestation per 10,000 bundles of graftwood/budwood (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free bundles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

A.4.6. References list

DEFRA (Department for Environment, Food and Rural Affairs), online. UK Risk Register Details for *Takahashia japonica*. Available online: https://planthealthportal.defra.gov.uk/pests-and-diseases/uk-plant-health-risk-register/viewPestRisks.cfm?cslref=27909 [Accessed: 7 February 2023].

EPPO (European and Mediterranean Plant Protection Organization), online. First report of *Takahashia japonica* in Croatia. Available online: https://gd.eppo.int/reporting/article-7127 [Accessed: 07 February 2023].

EUROPHYT, online. European Union Notification System for Plant Health Interceptions - EUROPHYT Available online: http://ec.europa.eu/food/plant/plant_health_biosecurity/europhyt/index_en.htm [Accessed: 17 February 2023].

García Morales M, Denno BD, Miller DR, Miller GL, Ben-Dov Y and Hardy NB, online. ScaleNet: a literature-based model of scale insect biology and systematics, Takahashia japonica. Available online: http://scalenet.info/catalogue/Takahashia%20japonica/ [Accessed 7 February 2023].

Landeka N, Uzelac M, Poljuha D and Sladonja B, 2021. The first record of the Asiatic string cottony scale *Takahashia japonica* in Croatia. Journal of Forestry, 145, 263–267. https://doi.org/10.31298/sl.145.5-6.5

Limonta L and Pellizzari G, 2018. First record of the string cottony scale Takahashia japonica in Europe and its establishment in Northern Italy. Bulletin of Insectology, 71, 159–160.

Limonta L, Porcelli F and Pellizzari G, 2022. An overview of *Takahashia japonica*: present distribution, host plants, natural enemies and life-cycle, with observations on its morphology. Bulletin of Insectology, 75, 306–314.

Malumphy C, Tuffen M and Andrew S, 2019. Plant Pest Factsheet: Cotton stringy scale insect: *Takahashia japonica*. Department for Environment Food and Rural Affairs. 4 pp.

Tuffen M, Salisbury A and Malumphy CP, 2019. Cotton stringy scale insect, Takahashia japonica (Hemiptera: Coccidae), new to Britain. British Journal of Entomology and Natural History, 32, 1–4.

TRACES-NT, online. TRADE Control and Expert System. Available online: https://webgate.ec.europa.eu/tracesnt [Accessed: 17 February 2023].

A.5. Tobacco ringspot virus (TRSV)

A.5.1. Organism information

Taxonomic information	Current valid scientific name: Tobacco ringspot virus Synonyms: TRSV, Tobacco ringspot, Tobacco ringspot nepovirus. Name used in the EU legislation: Tobacco ringspot virus [TRSV00] Order: *Picornavirales* Family: *Secoviridae* Common name: ringspot of tobacco Name used in the Dossier: Tobacco ringspot virus (TRSV)
Group	Virus and Viroids
EPPO code	TRSV00
Regulated status	TRSV is listed as EU Quarantine pest (Annex II, Part A of Commission Implementing Regulation (EU) 2019/2072); Pests not known to occur in the EU Union territory (2019). Quarantine pest: Morocco (2018), Tunisia (2012), Canada (2019), Mexico (2018), Israel (2009), Norway (2012). A1 list: East Africa (2001), Argentina (2019), Brazil (2018), Paraguay (1995), Jordan (2013), Kazakhstan (2017), Turkey (2016), Ukraine (2019). A2 list: Egypt (2018), China (1993), Jordan (2013), Russia (2014), APPPC (1993), EAEU (2016), EPPO (1995) (EPPO, online_a).
Pest status in UK	Present, few occurrences (EPPO, online_b). According to the NPPO (2021), TRSV is present from few reports. It has been detected in pelargonium (ornamental) and anemone (wild plant) in the UK.

Pest status in the EU	Present, no details (Georgia, Lithuania, Poland, Turkey). Few occurrences (Hungary, Italy). Transient under eradication (Netherlands) (EPPO, online_b).	
Host status on *M. domestica*	*Malus domestica* is reported as a host for TRSV in the EPPO Global Database (EPPO, online_c).	
PRA information	Available Pest Risk Assessments: – Scientific Opinion on the pest categorisation of non-EU viruses and viroids of *Cydonia* Mill., *Malus* Mill. and *Pyrus* L. (EFSA PLH Panel, 2019); – Rapid Pest Risk Analysis (PRA) for Tobacco ringspot virus (TRSV) (DEFRA, 2018).	
Other relevant information for the assessment		
Biology	TRSV is a bipartite positive-sense RNA virus with isometric particles about 28 nm in diameter. TRSV occurs in a wide range of herbaceous and woody hosts (Stace-Smith, 1985). It is naturally transmitted by nematodes; *Xiphinema americanum sensu lato, X. americanum sensu stricto* and *X. rivesi* in non-persistent manner (Brown et al., 1995; Douthit and McGuire, 1978). It has been also associated with other vectors. In soybean, by nymphs but not adults of *Thrips tabaci,* as well as spider mites of the genus *Tetranychus*, grasshoppers of the genus *Melanoplus,* the tobacco flea beetle, *Epitrix hirtipennis* (Dunleavy, 1957; Bergeson et al., 1964). It has been also reported that the aphids, *Myzus persicae* and *Aphis gossypii, as well as* honeybees, can transmit TRSV (Bristow and Martin, 1999). Additionally, TRSV can be spread through seeds in soybean, petunia, *Nicotiana glutinosa*, *Gomphrena globosa* and *Taraxacum officinale*; including tobacco, cantaloupe, cucumber, muskmelon and lettuce (Yang and Hamilton, 1974). It can be also transmitted by clonal propagation and mechanically by sap-inoculation (Yang and Hamilton, 1974), in addition to pollen transmission in some species (Card et al., 2007), but this has been poorly studied and its efficiency is unclear, in particular in woody plants.	
Symptoms	**Main type of symptoms**	TRSV mostly does not cause striking symptoms, and symptom expression varies according to the plant species. In apple plants, TRSV causes stem pitting, necrosis, and breaking or separation of scion/rootstock at the graft union. Foliage is sparse, and leaves are chlorotic and diffusely mottled (Lana et al., 1983). In grapevine, it shows symptoms of decline, whereas new growth is weak and sparse, internodes are shortened, leaves are small and distorted (Gonsalves, 1988). In soybean, it shows curved, brown coloured and necrotic buds. Brown streaks can be seen in the pith of stems and branches, and occasionally on petioles and leaf veins. Leaflets are dwarfed and rolled (Demski and Kuhn, 1989). In tobacco, it causes ring and line patterns on the foliage and stunting (Gooding, 1991). In cucurbits, leaves are mottled and stunted, and fruits are deformed (Sinclair and Walker, 1956). In cherry trees, in which the disease has only ever been seen in a few individual trees, young leaves show irregular chlorotic blotching over the whole leaf blade, and the leaf margins are deformed and lobed. These symptoms are seen in scattered leaves throughout the crown. Fruits mature late on infected trees (Stace-Smith and Hansen, 1974).

	Presence of asymptomatic plants	TRSV disease could be asymptomatic.
	Confusion with other pests	No definite symptoms have been associated with TRSV in woody plants. It might be confused with Tomato ringspot virus (ToRSV), which has a similar host range (EPPO/CABI, 1996).
Host plant range	TRSV infects a wide range of herbaceous and woody hosts and can cause significant yield loss in soybeans (*Glycine max*), tobacco (*Nicotiana tabacum*), *Vaccinium* spp., and Cucurbitaceae (Stace-Smith, 1985). In addition, many other hosts have been also found naturally infected, such as Anemone, apples (*Malus domestica*), aubergines (*Solanum melongena*), blackberries (*Rubus fruticosus*), Capsicum, cherries (*Prunus avium*), Cornus, *Fraxinus*, *Gladiolus*, grapes (*Vitis vinifera*), *Iris*, *Lupinus*, *Mentha*, *Narcissus pseudonarcissus*, pawpaws (*Carica papaya*), *Pelargonium*, *Petunia*, *Sambucus* and various weeds (Gonsalves, 1988).	
Reported evidence of impact	TRSV can cause economically important diseases of fruit crops and soybean, particularly where the nematode vectors are present. Minor damage has been reported to ornamentals and capsicum. Although, it has been also reported in grapevines (Uyemoto, 1975), the economic importance in these crops is lower than in other crops. TRSV is listed as EU Quarantine pest (Annex II, part A).	
Pathways and evidence that the commodity is a pathway	Plants for planting of *Malus, Pelargonium, Prunus* and *Rubus* are potential host commodities for TRSV (EPPO, online_c). Thus, plants for planting coming from a country where TRSV occurs can be the main pathway of entry (EFSA PLH Panel, 2019).	
Surveillance information	According to the information dated on 1984 and 2018 from CABI and EPPO, as well as information provided by the UK NPPO, TRSV has a restricted presence in UK, with only a few reported occurrences. TRSV was first reported from an outbreak of Anemone necrosis in Somerset in 1957 (Hollings, 1965). Then, it was occasionally reported in iris rhizomes and bulbs imported from other countries (Brunt, 1974). In 1981, TRSV was detected in Pelargonium in the UK (Stone et al., 1981) and also from amenity grasses (Cooper and Edwards, 1985). In 2011, during pre-export testing, TRSV was found on lettuce seeds originated from France. Several findings have been reported in Pelargonium stocks in the UK, with the most recent survey from 2018 to 2022 by a Rapid Pest Risk Analysis for TRSV indicating no evidence of eradication, despite the nematode vectors responsible for transmission are not known to occur in the UK (DEFRA, unpublished).	

A.5.2. Possibility of pest presence in the nursery

A.5.2.1. Possibility of entry from the surrounding environment

The natural host range of TRSV is wide, including herbaceous, woody plant and uncultivated plant species (EPPO, online_a). TRSV is naturally transmitted by *Xiphinema americanum sensu lato, X. americanum sensu stricto* and *X. rivesi* (Brown et al., 1995). These vectors are not known to occur in UK, although there is no evidence of TRSV eradication (DEFRA, 2018). Most of TRSV infections are associated with ornamentals and its presence within Pelargonium and possibly other ornamental hosts is very likely in the UK. Based on the Dossier information, TRSV is considered quarantine pest in the UK, and there is a set of standard precautions to ensure that no plants other than certified plants are present in the production facilities. Infected plants may not show symptoms, and TRSV can still establish via seed and pollen transmission (Scarborough and Smith, 1977; Card et al., 2007), as well as by clonal propagation of infected mother plants. There have been no other records in the UK (DEFRA, 2018), on any other hosts, including *Prunus* and *Malus* sp.

Uncertainties:

- There is a lack of information about the particular plant species in the surrounding nurseries.

- It is unknown whether there are other mechanisms of spread, and the efficiency of TRSV transmission in woody plants are unclear and poorly studied.

Taking into consideration the above evidence and uncertainties, the Panel considers that the possibility of entry into the nursery infecting apple plants from surrounding orchards may be unlikely.

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

At the nurseries, plant material is supervised and certified as virus-free. TRSV host range is wide, and despite some hosts can be symptomless carriers, symptoms expression is often severe enough to ensure its detection. There is evidence that TRSV can establish via seed/pollen transmission in some few species (Scarborough and Smith, 1977; Card et al., 2007). TRSV can also spread in clonally propagated material. However, there is scarce information of the efficiency of seed and pollen transmission, in particular in woody hosts.

Uncertainties:

- It is uncertain to what extent detection and sampling strategies are effective to detect asymptomatic infections.
- It is unclear the extent of seed and pollen transmission in *Malus* trees and mother plants.

Taking into consideration the above evidence and uncertainties, the Panel considers that the possibility of entry with either seeds or ornamental material must be considered.

A.5.2.3. Possibility of spread within the nursery

Malus fruit-tree propagating materials are produced under the certification scheme in nurseries, and the plant materials are monitored and inspected during the vegetation period. TRSV can be mechanically transmitted by sap-inoculation on herbaceous hosts (Stace-Smith, 1985), and spread by clonal propagation of infected mother ornamental plants. However, there is a paucity of data on the efficiency of mechanical and seed/pollen transmission in woody plants.

Uncertainties:

- It is unknown whether TRSV can be transmitted by seed and pollen in apple trees.

Taking into consideration the above evidence and uncertainties, the Panel considers that the spread of the pathogen within the nursery is very unlikely.

A.5.3. Information from interceptions

There are no records of interceptions of *M. domestica* plants for planting from UK due to the presence of ToRSV between 1998 and February 2023 (EUROPHYT, online; TRACES-NT, online).

A.5.4. Evaluation of the risk mitigation measures

In the table below, all risk mitigation measures currently applied in UK are listed and an indication of their effectiveness on TRSV is provided. The description of the risk mitigation measures currently applied in UK is provided in Table 5.

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
1	Certified material	Yes	Evaluation: The UK has a Fruit Propagation Certification Scheme, and practices for inspections and detections are applied according to the UK regulations and guidelines 2017. In particular, an explanatory guide on how these are applied to Malus is provided. However, TRSV is not included in the list of viruses for testing. Uncertainties: – There is a lack of details for the surveillance and monitoring process including the TRSV detection during production cycle.

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
2	Phytosanitary certificates	Yes	Evaluation: The UK has a Fruit Propagation Certification Scheme, and practices for inspections and detections are applied according to the UK regulations and guidelines 2017. Uncertainties: – There is a lack of details in the survey protocols and laboratory methodologies for the certification process.
3	Cleaning and disinfection of facilities, tools and machinery	Yes	Hygiene practices can help to prevent the spread of virus transmission.
4	Rouging and pruning	Yes	Evaluation: Identifying and removing suspicious plants could be effective to decrease the virus spread and further infections. Uncertainties: – It is unclear the effectiveness of visual inspections to detect early infections, including the presence of latent infections.
5	Biological and mechanical control	No	
6	Pesticide application	No	
7	Surveillance and monitoring	Yes	Evaluation: Visual inspections may be effective to delay viral spread. Uncertainties: – The effectiveness of visual inspections to detect early infections, including the presence of latent infections, is questionable.
8	Sampling and laboratory testing	No	
9	Root washing	No	
10	Refrigeration	Yes	Not relevant, but low temperatures may reduce the multiplication of the virus, but will not eliminate it.

A.5.5. Overall likelihood of pest freedom

A.5.5.1. Reasoning for a scenario which would lead to a reasonably low number of infested consignments

- Registration and certification of propagation material ensure virus-free production.
- Most of nurseries are placed in areas where the virus has not been reported.
- TRSV has not been reported in malus trees.
- Nematode vectors are the only efficient way to get within the nurseries, and they are absent in the production areas.
- No other vectors, human activities or plant material may spread the virus.
- Visual inspections are under official regulation, and virus symptoms seems easy to detect in diseased plants.

A.5.5.2. Reasoning for a scenario which would lead to a reasonably high number of infested consignments

- The adherence to registration and certification criteria of propagation material for this pest is inappropriate and may increase the risk of entry.
- Unidentified virus outbreaks are present in the surrounding of *M. domestica* production areas or the nurseries are places in areas close to places where the TRSV is present.

- Nematode vectors may be unidentified and present in the production areas.
- Pest can enter by unknown mechanisms.
- Visual inspection will not detect early stages of infections or asymptomatic plants.
- Increasing numbers of plants in a bundle lead to increasing risks associated to the virus presence in the bundle.

A.5.5.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infested consignments (median)

- TRSV has not been reported in Malus or other fruiting crops.
- Presence of the primary vectors is very unlikely.
- Introduction of the virus from the surrounding areas or from propagation material within the nurseries is very unlikely.

A.5.5.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

- Transmission efficiency by other potential nematode vectors species is not well documented.
- Status of the virus in the surrounding areas is unknown.

A.5.5.5. Elicitation outcomes of the assessment of the pest freedom for tobacco ringspot virus

The elicited and fitted values for tobacco ringspot virus agreed by the Panel are shown in Tables A.23–A.28 and in Figures A.12–A.14.

Table A.23: Elicited and fitted values of the uncertainty distribution of pest infestation by tobacco ringspot virus per 10,000 potted plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0					1		2		3					5
EKE	0.0733	0.153	0.267	0.472	0.725	1.03	1.33	1.95	2.65	3.04	3.50	3.96	4.41	4.73	5.01

The EKE results are the BetaGeneral (1.2604, 2.0485, 0, 5.5) distribution fitted with @Risk version 7.6.

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

Table A.24: The uncertainty distribution of plants free of tobacco ringspot virus per 10,000 potted plants calculated by Table A.23

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,995					9,997		9,998		9,999					10,000
EKE results	9,995.0	9,995.3	9,995.6	9,996.0	9,996.5	9,997.0	9,997.4	9,998.0	9,998.7	9,999.0	9,999.3	9,999.5	9,999.7	9,999.8	9,999.9

The EKE results are the fitted values.

Table A.25: Elicited and fitted values of the uncertainty distribution of pest infestation by tobacco ringspot virus per 10,000 bundles of bare rooted plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0					2		3		5					8
EKE	0.193	0.359	0.577	0.936	1.35	1.83	2.29	3.23	4.26	4.85	5.55	6.25	6.98	7.51	8.01

The EKE results are the BetaGeneral (1.5072, 2.4887, 0, 9.1) distribution fitted with @Risk version 7.6.

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

Table A26: The uncertainty distribution of bundles free of tobacco ringspot virus per 10,000 bundles calculated by Table A.25

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,992					9,995		9,997		9,998					10,000
EKE results	9,992.0	9,992.5	9,993.0	9,993.7	9,994.5	9,995.1	9,995.7	9,996.8	9,997.7	9,998.2	9,998.6	9,999.1	9,999.4	9,999.6	9,999.8

The EKE results are the fitted values.

Table A.27: Elicited and fitted values of the uncertainty distribution of pest infestation by tobacco ringspot virus per 10,000 bundles of budwood/graftwood

Percentile	**1%**	**2.5%**	**5%**	**10%**	**17%**	**25%**	**33%**	**50%**	**67%**	**75%**	**83%**	**90%**	**95%**	**97.5%**	**99%**
Elicited values	0					3		6		9					15
EKE	0.220	0.458	0.802	1.42	2.18	3.08	3.98	5.85	7.94	9.13	10.5	11.9	13.2	14.2	15.0

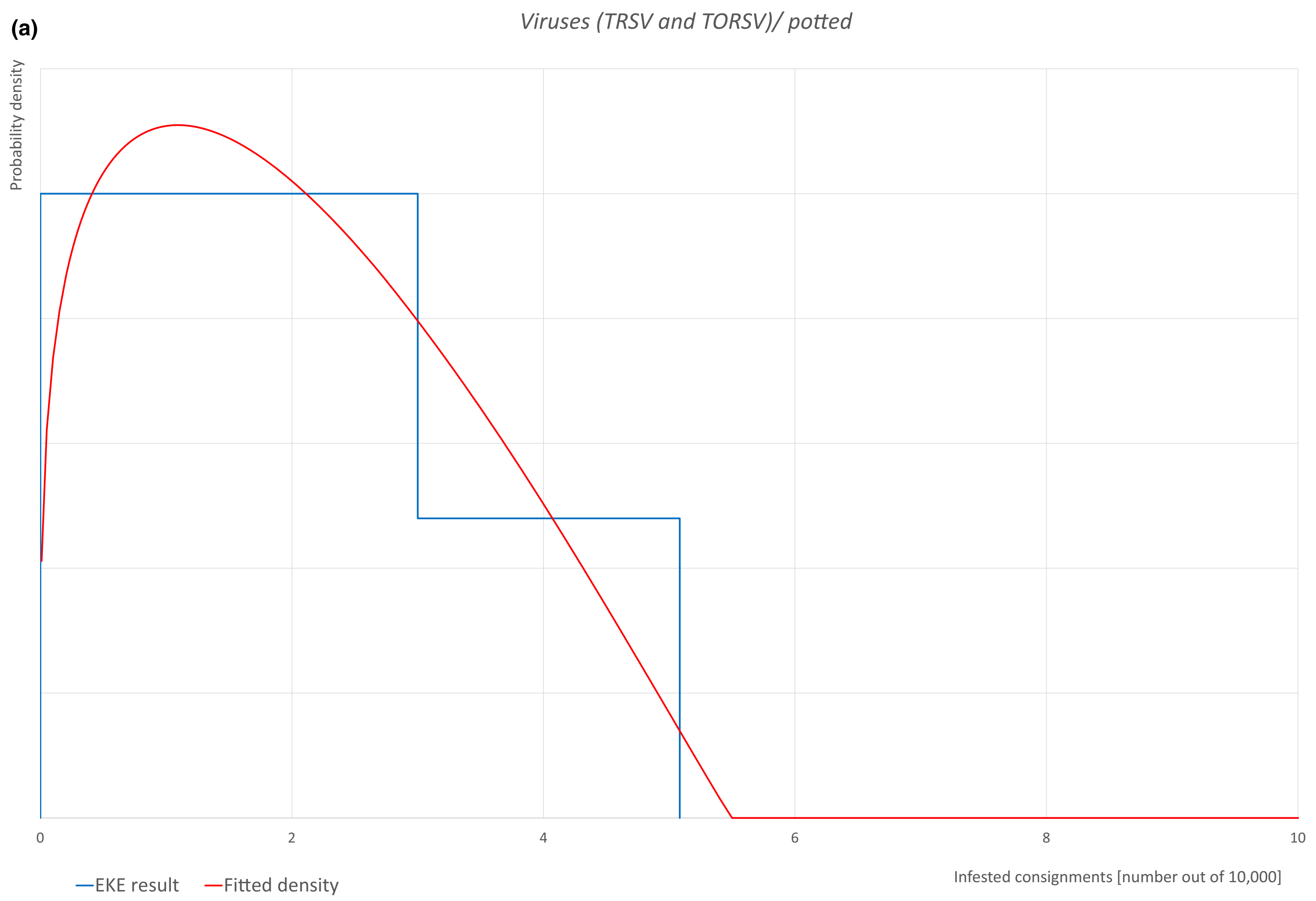
The EKE results are the BetaGeneral (1.2604, 2.0485, 0, 16.5) distribution fitted with @Risk version 7.6.

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

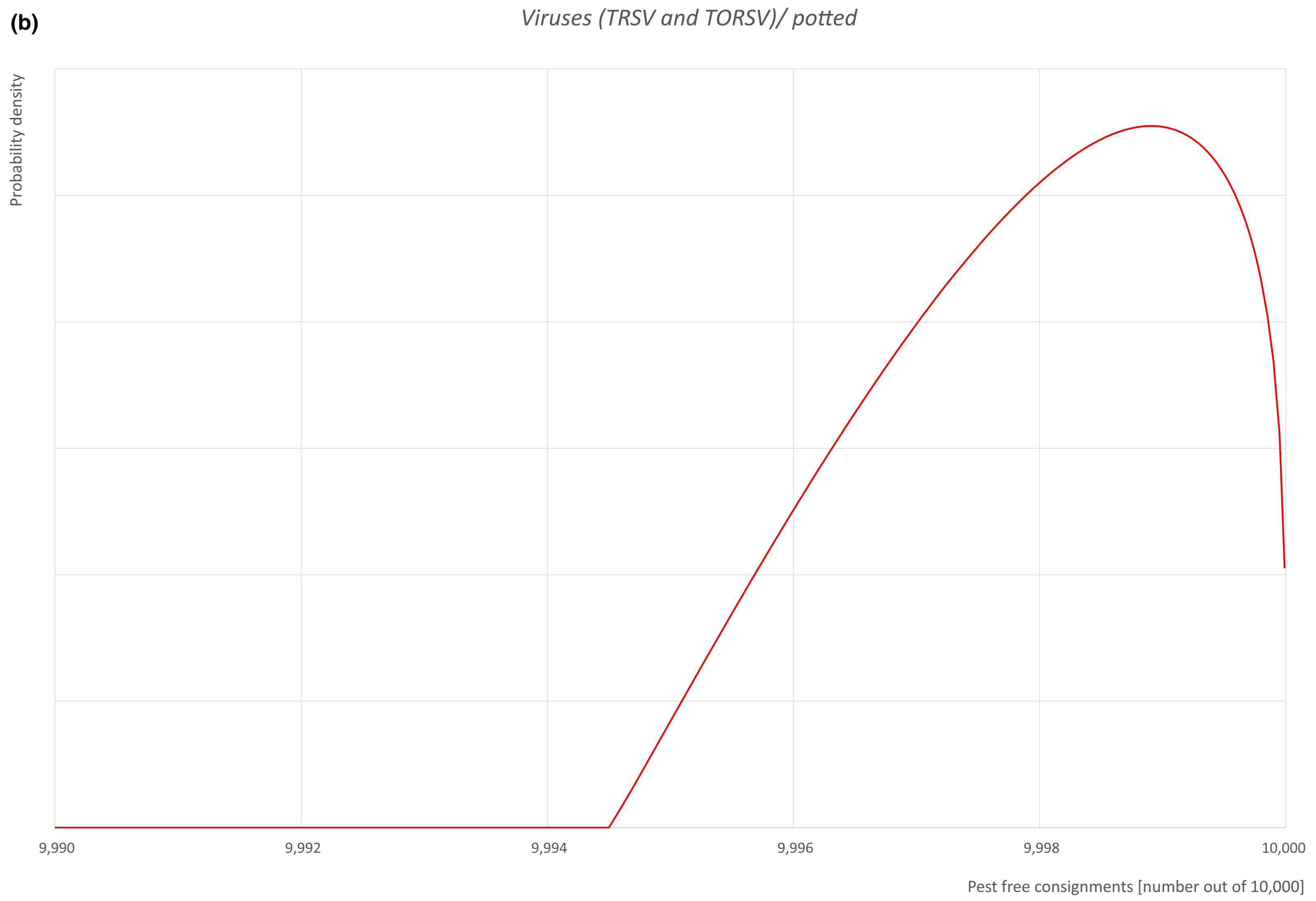
Table A.28: The uncertainty distribution of bundles free of tobacco ringspot virus per 10,000 bundles of budwood/graftwood calculated by Table A.27

Percentile	**1%**	**2.5%**	**5%**	**10%**	**17%**	**25%**	**33%**	**50%**	**67%**	**75%**	**83%**	**90%**	**95%**	**97.5%**	**99%**
Values	9,985					9,991		9,994		9,997					10,000
EKE results	9,985.0	9,985.8	9,986.8	9,988.1	9,989.5	9,990.9	9,992.1	9,994.1	9,996.0	9,996.9	9,997.8	9,998.6	9,999.2	9,999.5	9,999.8

The EKE results are the fitted values.


(a)
Viruses (TRSV and TORSV)/ potted
Probability density
0
2
4
6
8
10
Infested consignments [number out of 10,000]
EKE result
Fitted density

(b)


Viruses (TRSV and TORSV)/ potted
Probability density
9,990
9,992
9,994
9,996
9,998
10,000
Pest free consignments [number out of 10,000]

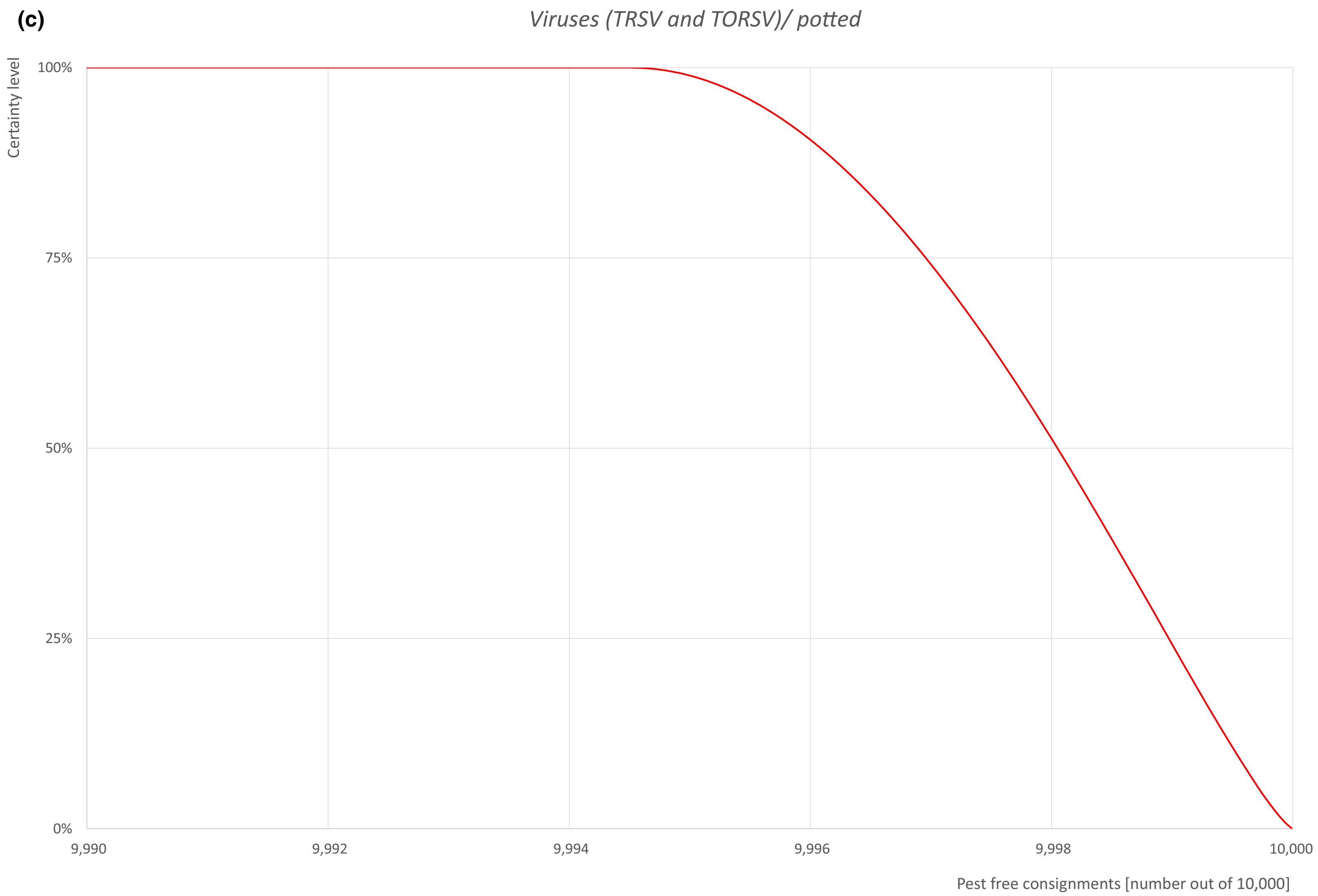
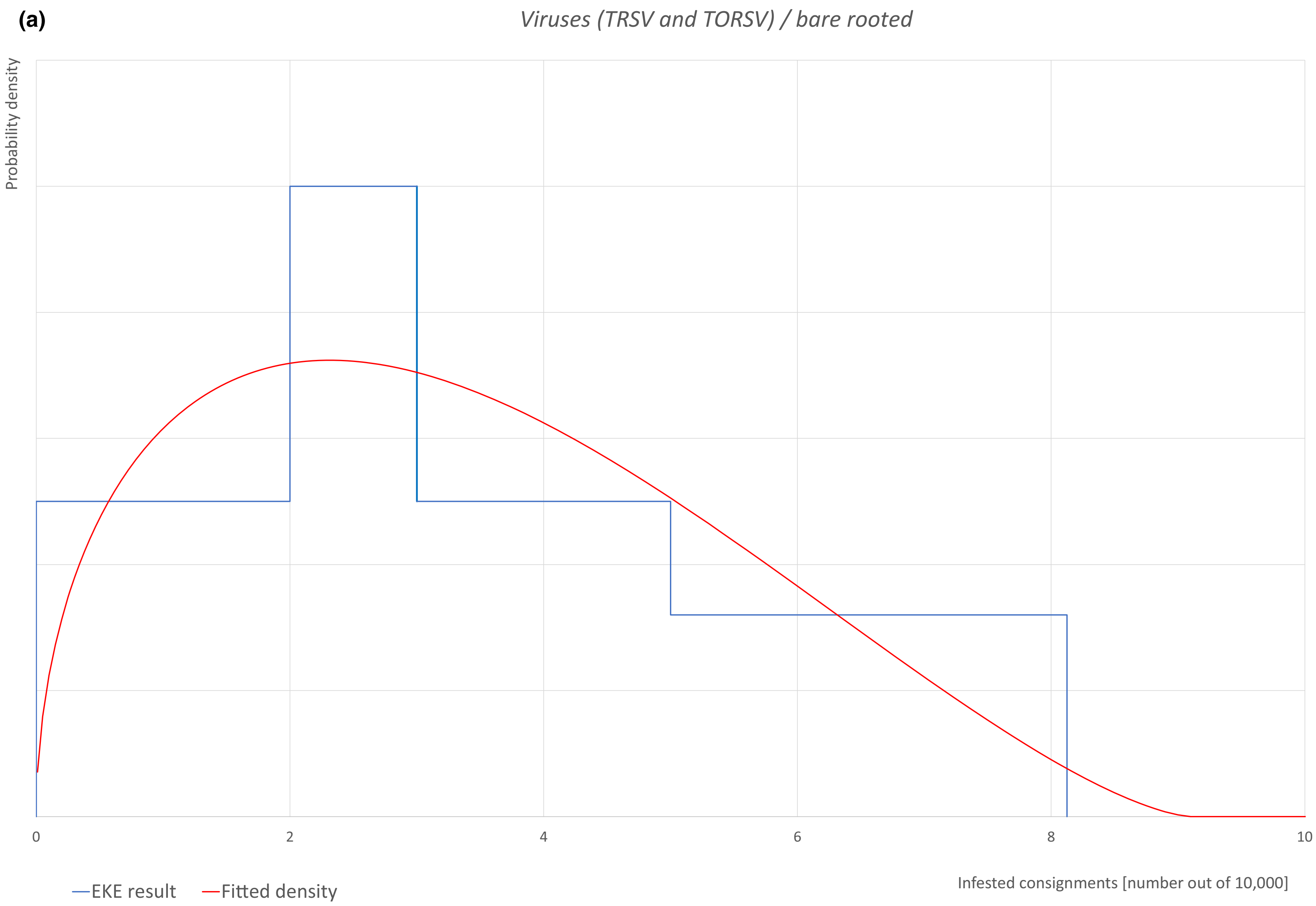
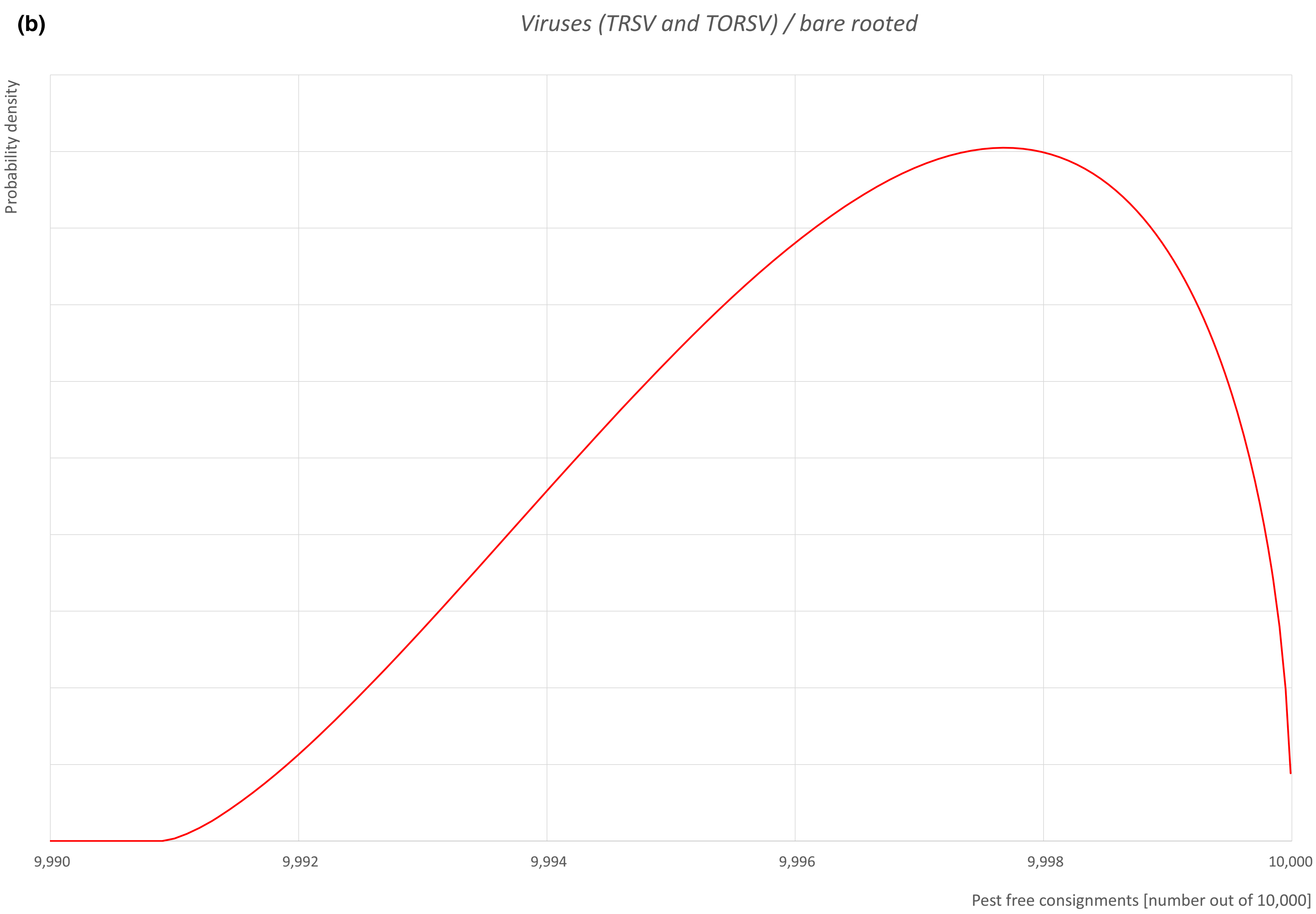


Figure A.12: (a) Elicited uncertainty of pest infestation per 10,000 potted plants (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free bundles per 10,000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



(a)
Viruses (TRSV and TORSV) / bare rooted
Probability density
0
2
4
6
8
10
EKE result
Fitted density
Infested consignments [number out of 10,000]


(b)
Viruses (TRSV and TORSV) / bare rooted
Probability density
9,990
9,992
9,994
9,996
9,998
10,000
Pest free consignments [number out of 10,000]

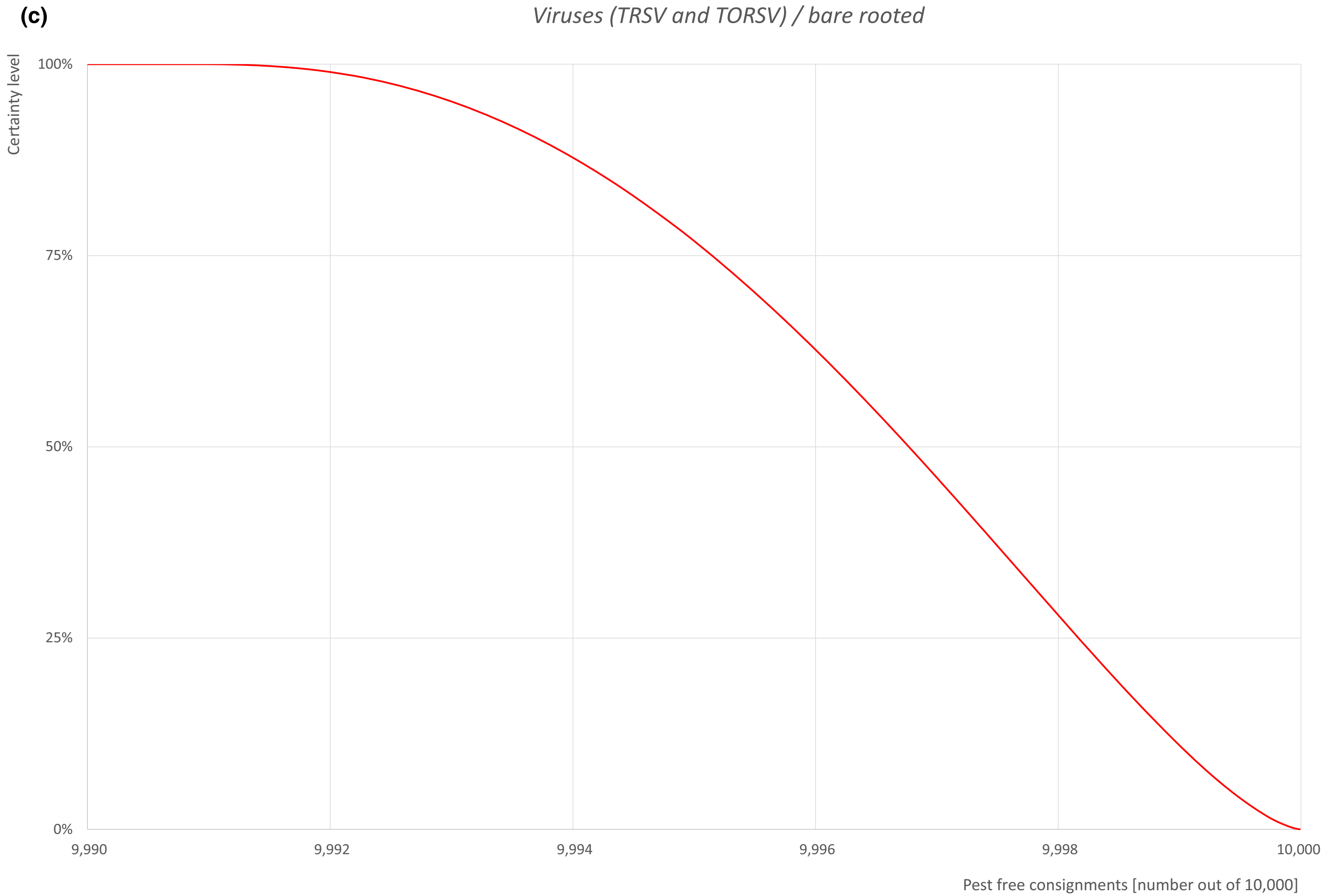
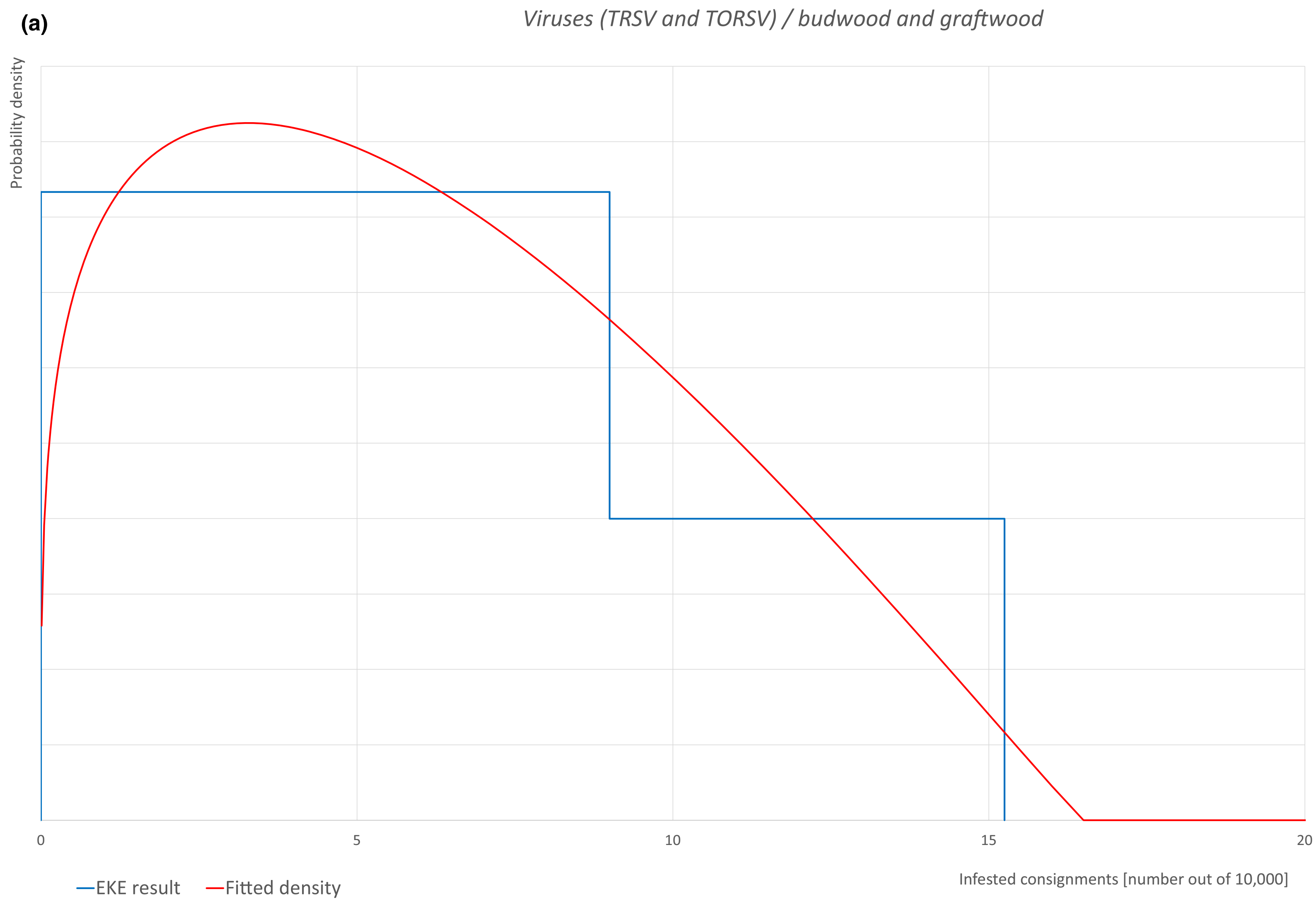
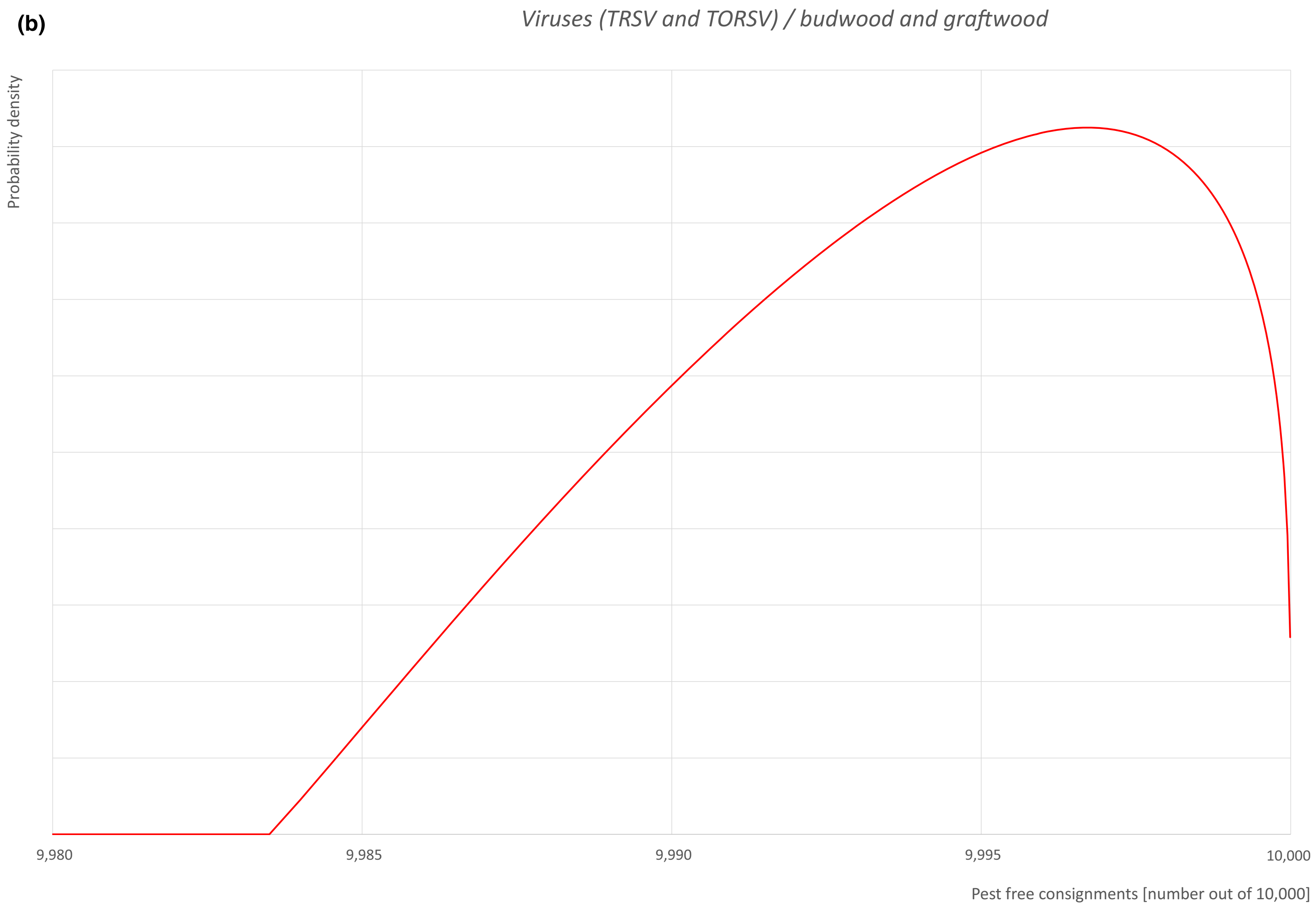


Figure A.13: (a) Elicited uncertainty of pest infestation per 10,000 bundles of bare rooted plants (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free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

(a)


Viruses (TRSV and TORSV) / budwood and graftwood
Probability density
0
5
10
15
20
Infested consignments [number out of 10,000]
EKE result
Fitted density

(b)


Viruses (TRSV and TORSV) / budwood and graftwood
Probability density
9,980
9,985
9,990
9,995
10,000
Pest free consignments [number out of 10,000]

(c)

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

A.5.6. References list

Bergeson GB, Athow KL, Laviolette FA, and Thomasine M, 1964. Transmission, movement, and vector relationships of tobacco ringspot virus in soybean. Phytopathology, 54, 723–728.

Bristow PR and Martin RR, 1999. Transmission and the role of honey bees in field spread of blueberry shock ilarvirus, a pollen-borne virus of highbush blueberry. Phytopathology, 89, 124–130. https://doi.org/10.1094/phyto.1999.89.2.124

Brown D, Robertson W and Trudgill D, 1995. Transmission of viruses by plant nematodes. Annual Review of Phytopathology, 33, 223–249.

Brunt AA, 1974. Viruses and virus diseases of irises in Britain. In II International Symposium on Flower Bulbs, 47, 45–50.

Card SD, Pearson MN and Clover GRG, 2007. Plant pathogens transmitted by pollen. Australian Plant Pathology, 36, 455–461. https://doi.org/10.1071/ap07050

Cooper JI and Edwards ML, 1985. Mitteilungen, Biologischen Bundesanstalt fur Land- und Forstwirtschaft, Berlin-Dahlem, 228, 89–91.

DEFRA (Department for Environment, Food and Rural Affairs), 2018. Rapid Pest Risk Analysis (PRA) for: Tobacco ringspot virus (TRSV). 23 pp. Available online: https://pra.eppo.int/pra/6e693e88-1a57-4e43-9bea-823b143c8a8c

Demski JW and Kuhn CW, 1989. Tobacco ringspot virus. Compendium of soybean diseases (3rd edition), American Phytopathological Society, St. Paul, USA, 57–59.

Douthit LB and McGuire JM, 1978. Transmission of tobacco ringspot virus by *Xiphinema americanum* to a wide range of hosts. Plant Disease Reporter, 62, 164–166.

Dunleavy JM, 1957. The grasshopper as a vector of tobacco ringspot virus in soybean. Phytopathology, 47, 681–682.

EFSA PLH Panel (EFSA Plant Health Panel), Bragard C, Dehnen-Schmutz K,Gonthier P, Jacques M-A, Jaques Miret JA, Justesen AF, MacLeod A, Magnusson CS, Milonas P,Navas-Cortes JA, Parnell S, Potting R, Reignault PL, Thulke H-H, Van der Werf W, Vicent Civera A, Yuen J, Zappalà L, Candresse T, Chatzivassiliou E, Finelli F, Winter S, Chiumenti M, Di Serio F, Kaluski T, Minafra A and Rubino L, 2019. Scientific Opinion on the pest categorisation of non-EU viruses and viroids of *Cydonia* Mill., *Malus* Mill. and *Pyrus* L. EFSA Journal 2019;17 (9):5590, 81 pp. https://doi.org/10.2903/j.efsa.2019.5590

EPPO/CABI, 1996. Data Sheets on Quarantine Pests: Tomato ringspot nepovirus. Available online: https://gd.eppo.int/download/file/258_datasheet_TORSV0.pdf [Accessed: 7 February 2023].

EPPO (European and Mediterranean Plant Protection Organization), online_a. Tobacco ringspot virus (TRSV00), Categorization. Available online: https://gd.eppo.int/taxon/TRSV00/categorization [Accessed: 31 January 2023].

EPPO (European and Mediterranean Plant Protection Organization), online_b. Tobacco ringspot virus (TRSV00), Distribution. Available online: https://gd.eppo.int/taxon/TRSV00/distribution [Accessed: 31 January 2023].

EPPO (European and Mediterranean Plant Protection Organization), online_c. Tobacco ringspot virus (TRSV00), Host plants. Available online: https://gd.eppo.int/taxon/TRSV00/hosts [Accessed: 31 January 2023].

EUROPHYT, online. European Union Notification System for Plant Health Interceptions - EUROPHYT Available online: http://ec.europa.eu/food/plant/plant_health_biosecurity/europhyt/index_en.htm [Accessed: 17 February 2023].

Gonsalves D, 1988. Tomato ringspot virus decline; tobacco ringspot virus decline. In: Pearson RC and Goheen AC (eds.). Compendium of grape diseases. American Phytopathological Society, St. Paul, USA, 49–51.

Gooding GV, 1991. Diseases caused by viruses. Compendium of tobacco diseases, American Phytopathological Society, St. Paul, USA, 41–46.

Hollings M, 1965. Anemone necrosis, a disease caused by a strain of Tobacco ringspot virus. Annals of Applied Biology, 55, 447–457.

Lana AF, Peterson JF, Rouselle GL and Vrain TC, 1983. Association of Tobacco ringspot virus with a union incompatibility of apple. Journal of Phytopathology, 106, 141–148.

Scarborough B and Smith S, 1977. Effects of Tobacco and Tomato ringspot viruses on the reproductive tissues of *Pelargonium* x *hortorum*. Phytopathology, 67, 292–297.

Sinclair JB and Walker JC, 1956. A survey of ringspot on cucumber in Wisconsin. Plant Disease Reporter, 40, 19–20.

Stace-Smith R, 1985. Tobacco ringspot virus. AAB Descriptions of Plant Viruses, 309.

Stace-Smith R and Hansen AJ, 1974. Occurrence of tobacco ringspot virus in sweet cherry. Canadian Journal of Botany, 52, 1647–1651.

Stone OM, Hollings and M, Barton RJ, 1981. Annual Report of the Glasshouse Crops Research Institute for 1979. Glasshouse Crops Research Institute, Littlehampton, UK, 150–151.

TRACES-NT, online. TRADE Control and Expert System. Available online: https://webgate.ec.europa.eu/tracesnt [Accessed: 17 February 2023].

Uyemoto JK, 1975. A severe outbreak of virus-induced grapevine decline in Cascade grapevines in New York. Plant Disease Reporter, 59, 98–101.

Yang AF and Hamilton RI, 1974. The mechanism of seed transmission of tobacco ringspot virus in soybean, Virology, 62, 26–37.

A.6. Tomato ringspot virus

A.6.1. Organism information

Taxonomic information	Current valid scientific name: Tomato ringspot virus Synonyms: ToRSV, Tomato ringspot, *Tomato ringspot nepovirus*. Name used in the EU legislation: *Tomato ringspot virus* [ToRSV] Category: Virus Order: *Picornavirales* Family: *Secoviridae* Common name: ringspot of tomato, union necrosis of apple, chlorosis mosaic of raspberry, chlorosis of pelargonium, stem pitting of *Prunus*, yellow vein of grapevine. Name used in the Dossier: Tomato ringspot virus (ToRSV)
Group	Virus and Viroids
EPPO code	ToRSV0
Regulated status	ToRSV is listed as EU Quarantine pest (Annex II, Part A of Commission Implementing Regulation (EU) 2019/2072); Pests not known to occur in the EU Union territory (2019). Quarantine pest: Morocco (2018), Tunisia (2012), Canada (2019), Mexico (2018), Israel (2009), Moldova (2017), Norway (2012) (EPPO, online_a). A1 list: Egypt (2018), Argentina (2019), Brazil (2018), Paraguay (1995), Uruguay (1995), Bahrain (2003), China (1993), Kazakhstan (2017), Georgia (2018), Ukraine (2019), APPPC (1993) (EPPO, online_a). A2 list: Jordan (2013), Russia (2014), UK (2016), EAEU (2016), EPPO (1975) (EPPO, online_a).
Pest status in UK	Present, few occurrences (EPPO, online_b; dated 2021) or absent, eradicated (CABI, online). According to the NPPO, ToRSV is present at very low levels, only detected in pelargonium (ornamentals).
Pest status in the EU	Present, no details (France, Lithuania, Poland). Few occurrences (Croatia). Transient under eradication (Germany and Netherlands) (EPPO, online_b).
Host status on *Malus domestica*	*Malus domestica* is reported as hosts for ToRSV in the EPPO Global Database (EPPO, online_c).
PRA information	Available Pest Risk Assessment: – Rapid Pest Risk Analysis for *Xiphinema americanum* s.l. (European populations) (FERA, 2014); – Rapid Pest Risk Analysis (PRA) for: Tomato ringspot virus (ToRSV) (DEFRA, 2018); – Pest categorisation of non-EU viruses and viroids of *Cydonia* Mill., *Malus* Mill. and *Pyrus* L. (EFSA PLH Panel, 2019a); – Pest categorisation of non-EU viruses and viroids of *Prunus* L. (EFSA PLH Panel, 2019b); – Pest categorisation of non-EU viruses and viroids of *Vitis* L. (EFSA PLH Panel, 2019c); – Pest categorisation of non-EU viruses of *Fragaria* L. (EFSA PLH Panel, 2019d); – Pest categorisation of non-EU viruses of *Ribes* L. (EFSA PLH Panel, 2019e); – Pest categorisation of non-EU viruses of *Rubus* L. (EFSA PLH Panel, 2020).

Other relevant information for the assessment		
Biology	ToRSV is a bipartite positive-sense RNA virus, with isometric particles in *Secoviridae* family, *Nepovirus* genus (Sanfaçon et al., 2006). ToRSV has a wide range of hosts, infecting primarily perennial plants such as tomato, tobacco, cucumber, pepper, peach, apple, grape, cherry, strawberry, raspberry, plum, geranium, walnut, and ornamental plants (Stace-Smith, 1984). Experimentally, its host diversity is also very high and about 35 families are susceptible to this virus (Zindović et al., 2014). ToRSV is naturally spread by different species of the nematode *Xiphinema americanum* group, and can be also transmitted via seed, pollen and vegetative propagation (Bitterlin et al., 1987; Pinkerton et al., 2008).	
Symptoms	**Main type of symptoms**	The most common symptom of ToRSV infection is the presence of annular spots on the leaves. Although symptom expression varies according to the plant species, virus isolate, the age of the plant at the time of infection and environmental conditions. In general, infected plants show typical symptoms such as a shock reaction. Plants can be seen as pale yellow and showing pale green spots on the leaves that develop along the major side veins, causing systemic chlorotic or necrotic ring stains, as well as deformation of the fruit growth. Chronically infected plants usually exhibit no obvious symptoms but show a general decline in productivity (Stace-Smith, 1984; Gonsalves, 1988; EPPO, 2013). Major diseases caused by ToRSV on fruit crops include vein yellowing in grapevines, and yellow bud mosaic in peach and almond which cause pale- green to pale-yellow blotches to develop along the main vein or large lateral veins of leaves (EPPO, 2005). In apple plants, ToRSV causes a delay in foliation; the leaves are small and sparse, showing a vein yellowing and pale green colour. Terminal shoot growth is reduced, the stem internodes are short. And commonly, there is a partial or complete separation of the graft union on severely affected trees (EPPO, 2013). In stone fruit, there can be severe pitting of the scion, rootstock, or both on either side of the graft union. The graft union can show various degrees of necrosis. Foliage symptoms slowly spread throughout the canopy as the virus moves up into scion wood and there is a general decline.
	Presence of asymptomatic plants	In certain cases, ToRSV disease could be asymptomatic.
	Confusion with other pests	Note that geographical distribution, natural host range and vector relations of ToRSV are closely parallel to Tobacco ringspot virus (TRSV) (EPPO/CABI, 1996).
Host plant range	In nature, ToRSV occurs mostly in vegetable and perennial crops, including ornamental and woody plants, such as *Lycopersicon esculentum Mill*. (tomato), *Cucumis sativus* (cucumber), *Nicotiana tabacum* (tobacco), *Solanum tuberosum* (potato), *Vitis vinifera* (grapevine), *Vaccinium corymbosum* (blueberry), *Fragaria vesca* (strawberry), *Pelargonium domesticum* (geranium), *Rubus idaeus* (raspberry), *Rubus fruticosus, Rubus sp*. (blackberry), *Malus* sp. (apple), *Hosta* sp., *Aquilegia vulgaris*, *Delphinium* sp., *Fragaria ananassa*, *Fraxina americana*, *Gladiolus* sp., *Heleborus foetidus*, *Hydrangea macrophylla*, *Iris* sp., *Punica granatum*, *Phaseolus vulgaris*, *Prunus persica*, *Prunus* sp., *Rosa* sp., *Trifolium* sp., *Vigna unguiculate* and *Viola cornuta* (Samuitienė and Navalinskienė, 2001; Sanfaçon et al., 2006; EPPO, 2013). Additionally, other uncultivated hosts, such as *Taraxacum officinale, Rumex acetosella, Stellaria* spp., among other 21 species can be infected by ToRSV (Mountain et al., 1983; Powell et al., 1984).	

Reported evidence of impact	ToRSV causes severe decline in productivity. Trees grown on peach, almond, cherry and plum rootstocks become unproductive (Uyemoto and Scott, 1992; Adaskaveg and Caprile, online). ToRSV is listed as EU Quarantine pest (Annex II, Part A of Commission Implementing Regulation (EU) 2019/2072).
Pathways and evidence that the commodity is a pathway	Plants for planting of *Malus, Pelargonium, Prunus* and *Rubus* are potential host commodities for ToRSV (EPPO, online_c). Thus, plants for planting coming from a country where ToRSV occurs can be the main pathway of entry.
Surveillance information	According to the information dated on 2021 from EPPO, as well as information provided by the UK NPPO, ToRSV has a restricted presence in UK, with only a few reported occurrences in *Pelargonium* (ornamentals). A survey in 1979–1980 found that ToRSV was distributed throughout the UK pelargonium industry, but only a small number of infected cultivars were present on individual holdings (DEFRA, additional information). Surveys conducted in the late 1990s found that the ToRSV was present in Pelargonium cultivars and was found in seven nurseries across 17 varieties (DEFRA, additional information). Surveys conducted in the early 2000s found eight positive findings for ToRSV. The most recent survey from 2018 to 2022 indicates that ToRSV has not been eradicated, since it has been found in pelargonium from old nursery stock plants, despite the nematode vectors responsible for transmission are not known to occur in the UK (DEFRA, additional information).

A.6.2. Possibility of pest presence in the nursery

A.6.2.1. Possibility of entry from the surrounding environment

ToRSV has a wide natural host range. ToRSV is naturally transmitted by nematode vectors of the *Xiphinema americanum* group (Brown et al., 1995). These vectors are not known to occur in UK, although there is no evidence of ToRSV eradication (DEFRA, 2018). Its occurrence in the UK is restricted to *Pelargonium* (ornamentals) at very low levels (NPPO, 2021). Based on the Dossier information, ToRSV is considered Regulated non-quarantine pest with 0% tolerance on findings on propagating material of ornamental plants and fruit propagating material and fruit plants intended for fruit production. Thus, there is a set of standard precautions to ensure that no plants other than certified plants are present in the production facilities. Seed transmission has been also reported in a range of test species (soybean, strawberry, raspberry and pelargonium) and pollen transmission in pelargonium (Kahn, 1956; Mellor and Stace-Smith, 1963; Braun and Keplinger, 1973; Scarborough and Smith, 1977; Card et al., 2007), with unknown factors associated to its transmission. Infected plants may not show symptoms, and ToRSV can be established by clonal propagation of infected mother plants. There have been no other records in the UK, on any other hosts, including *Prunus* and *Malus* sp.

Uncertainties:

- There is a lack of information about the particular plant species in the surrounding nurseries.
- It is unknown whether there are other mechanisms of spread, and the efficiency of ToRSV transmission in woody plants are unclear and poorly studied.

Taking into consideration the above evidence and uncertainties, the Panel considers that the possibility of entry into the nursery infecting apple plants from surrounding orchards may be unlikely.

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

At the nurseries, plant material is supervised and certified as virus-free. ToRSV host range is wide, and despite some hosts can be symptomless carriers, symptoms expression is often severe enough to ensure its detection. There is evidence that ToRSV can establish via seed/pollen transmission in some few species (Scarborough and Smith, 1977; Card et al., 2007). ToRSV can also spread in clonally propagated material. However, there is scarce information of the efficiency of seed and pollen transmission, in particular in woody hosts.

Uncertainties:

- It is uncertain to what extent detection and sampling strategies are effective to detect asymptomatic infections.
- It is unclear the extent of seed and pollen transmission in Malus trees and mother plants.

Taking into consideration the above evidence and uncertainties, the Panel considers that the possibility of entry with either seeds or ornamental material must be considered.

A.6.2.3. Possibility of spread within the nursery

Malus fruit-tree propagating materials are produced under the certification scheme in nurseries, and the plant materials are monitored and inspected during the vegetation period. ToRSV can be mechanically transmitted by sap-inoculation on herbaceous hosts (Stace-Smith, 1985), and spread by clonal propagation of infected mother ornamental plants. However, there is a paucity of data on the efficiency of mechanical and seed/pollen transmission in woody plants.

Uncertainties:

- It is unknown whether ToRSV can be transmitted by seed and pollen in apple trees.

Taking into consideration the above evidence and uncertainties, the Panel considers that the spread of the pathogen within the nursery is very unlikely.

A.6.3. Information from interceptions

There are no records of interceptions of *M. domestica* plants for planting from UK due to the presence of ToRSV between 1998 and February 2023 (EUROPHYT, online; TRACES-NT, online).

A.6.4. Evaluation of the risk mitigation measures

In the table below, all risk mitigation measures currently applied in UK are listed and an indication of their effectiveness on ToRSV is provided. The description of the risk mitigation measures currently applied in UK is provided in Table 5.

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
1	Certified material	Yes	The UK has a Fruit Propagation Certification Scheme, and practices for inspections and detections are applied according to the UK regulations and guidelines 2017. In particular, an explanatory guide on how these are applied to Malus is provided. However, ToRSV is not included in the list of viruses for testing. Uncertainties: – There is a lack of details for the surveillance and monitoring process including the ToRSV detection during production cycle.
2	Phytosanitary certificates	Yes	The UK has a Fruit Propagation Certification Scheme, and practices for inspections and detections are applied according to the UK regulations and guidelines 2017. Uncertainties: – There is a lack of details in the survey protocols and laboratory methodologies for the certification process.
3	Cleaning and disinfection of facilities, tools and machinery	Yes	Hygiene practices can help to prevent the spread of virus transmission.
4	Rouging and pruning	Yes	Identifying and removing suspicious plants could be effective to decrease the virus spread and further infections.

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
			Uncertainties: – It is unclear the effectiveness of visual inspections to detect early infections, including the presence of latent infections.
5	Biological and mechanical control	No	
6	Pesticide application	No	
7	Surveillance and monitoring	Yes	Visual inspections may be effective to delay viral spread. Uncertainties: – The effectiveness of visual inspections to detect early infections, including the presence of latent infections is questionable.
8	Sampling and laboratory testing	No	
9	Root washing	No	
10	Refrigeration	Yes	Not relevant, but low temperatures may reduce the multiplication of the virus, but will not eliminate it.

A.6.5. Overall likelihood of pest freedom

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

- Registration and certification of propagation material ensure virus-free production.
- Most of nurseries are placed in areas where the virus has not been reported.
- ToRSV has not been reported in peach trees in UK.
- Nematode vectors are the only efficient way to get within the nurseries, and they are absent in the production areas.
- No other vectors, human activities or plant material may spread the virus.
- Visual inspections are under official regulation, and virus symptoms seems easy to detect in diseased plants.

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

- The adherence to registration and certification criteria of propagation material for this pest is inappropriate and may increase the risk of entry.
- Unidentified virus outbreaks are present in the surrounding of *Malus* production areas, or the nurseries are places in areas close to places where the ToRSV is present.
- Nematode vectors may be unidentified and present in the production areas.
- Pest can enter by unknown mechanisms.
- Visual inspection will not detect early stages of infections or asymptomatic plants.
- Increasing numbers of plants in a bundle lead to increasing risks associated to the virus presence in the bundle.

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

- ToRSV has been reported in Malus and other plant host species.
- Presence of the primary vectors is very unlikely.
- Introduction of the virus from the surrounding areas or from propagation material within the nurseries is very unlikely.

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

- Transmission efficiency by other potential nematode vectors species is not well documented.
- Status of the virus in the surrounding areas is unknown.

A.6.5.5. Elicitation outcomes of the assessment of the pest freedom for tomato ringspot virus

The elicited and fitted values for tomato ringspot virus agreed by the Panel are shown in Tables A.29–A.34 and in Figures A.15–A.17.

Table A.29: Elicited and fitted values of the uncertainty distribution of pest infestation by tomato ringspot per 10,000 potted plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0					1		2		3					5
EKE	0.0733	0.153	0.267	0.472	0.725	1.03	1.33	1.95	2.65	3.04	3.50	3.96	4.41	4.73	5.01

The EKE results are the BetaGeneral (1.2604, 2.0485, 0, 5.5) distribution fitted with @Risk version 7.6.

Based on the numbers of estimated infested plants the pest freedom was calculated (i.e. = 10,000 – the number of infested plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.30.

Table A.30: The uncertainty distribution of plants free of tomato ringspot per 10,000 potted plants calculated by Table A.29

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,995					9,997		9,998		9,999					10,000
EKE results	9,995.0	9,995.3	9,995.6	9,996.0	9,996.5	9,997.0	9,997.4	9,998.0	9,998.7	9,999.0	9,999.3	9,999.5	9,999.7	9,999.8	9,999.9

The EKE results are the fitted values.

Table A31: Elicited and fitted values of the uncertainty distribution of pest infestation by tomato ringspot per 10,000 bundles of bare rooted plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0					2		3		5					8
EKE	0.193	0.359	0.577	0.936	1.35	1.83	2.29	3.23	4.26	4.85	5.55	6.25	6.98	7.51	8.01

The EKE results are the BetaGeneral (1.5072, 2.4887, 0, 9.1) distribution fitted with @Risk version 7.6.

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

Table A.32: The uncertainty distribution of bundles free of tomato ringspot virus per 10,000 bundles calculated by Table A.31

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,992					9,995		9,997		9,998					10,000
EKE results	9,992.0	9,992.5	9,993.0	9,993.7	9,994.5	9,995.1	9,995.7	9,996.8	9,997.7	9,998.2	9,998.6	9,999.1	9,999.4	9,999.6	9,999.8

The EKE results are the fitted values.

Table A.33: Elicited and fitted values of the uncertainty distribution of pest infestation by tomato ringspot virus per 10,000 bundles of budwood/graftwood

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0					3		6		9					15
EKE	0.220	0.458	0.802	1.42	2.18	3.08	3.98	5.85	7.94	9.13	10.5	11.9	13.2	14.2	15.0

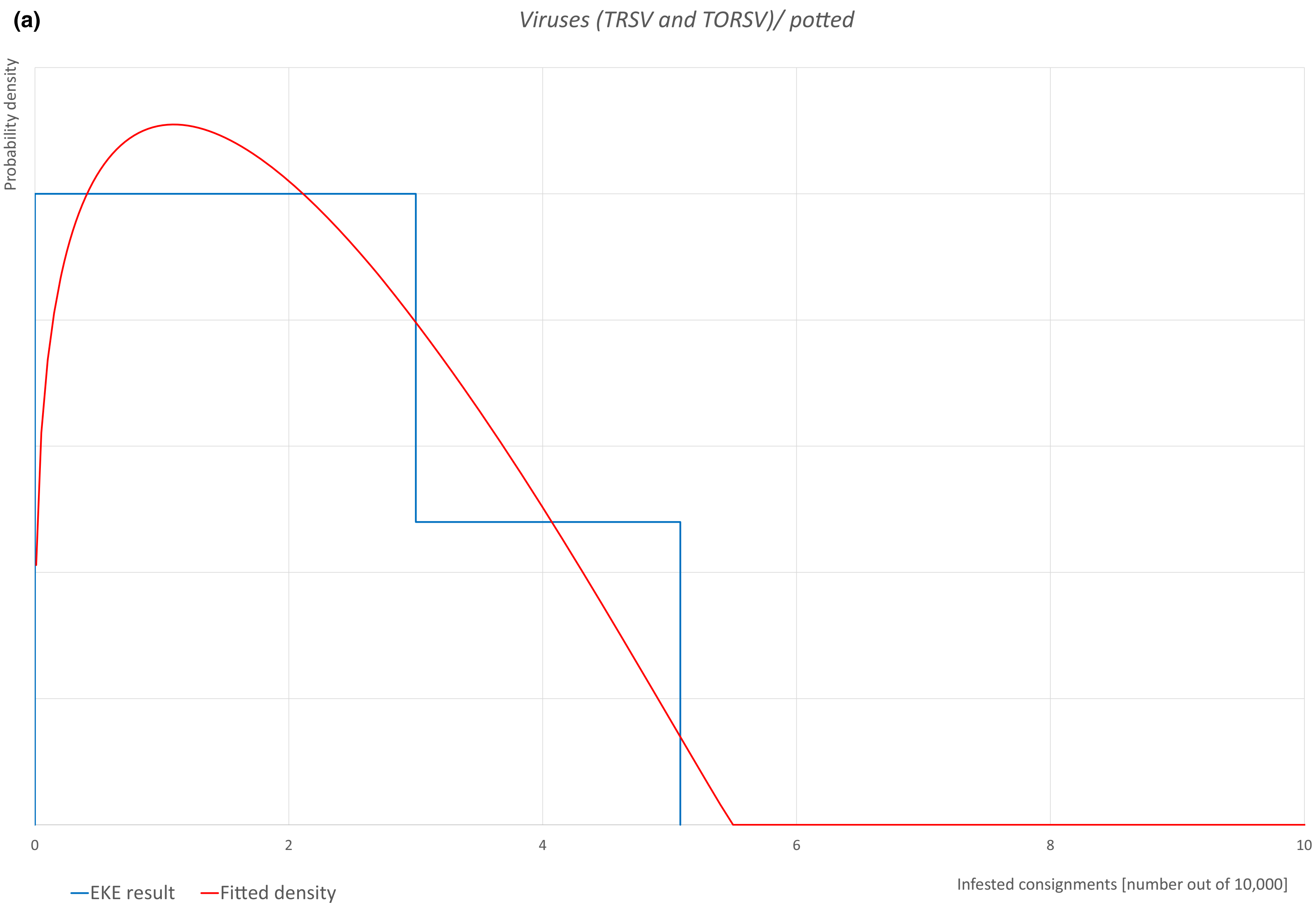
The EKE results are the BetaGeneral (1.2604, 2.0485, 0, 16.5) distribution fitted with @Risk version 7.6.

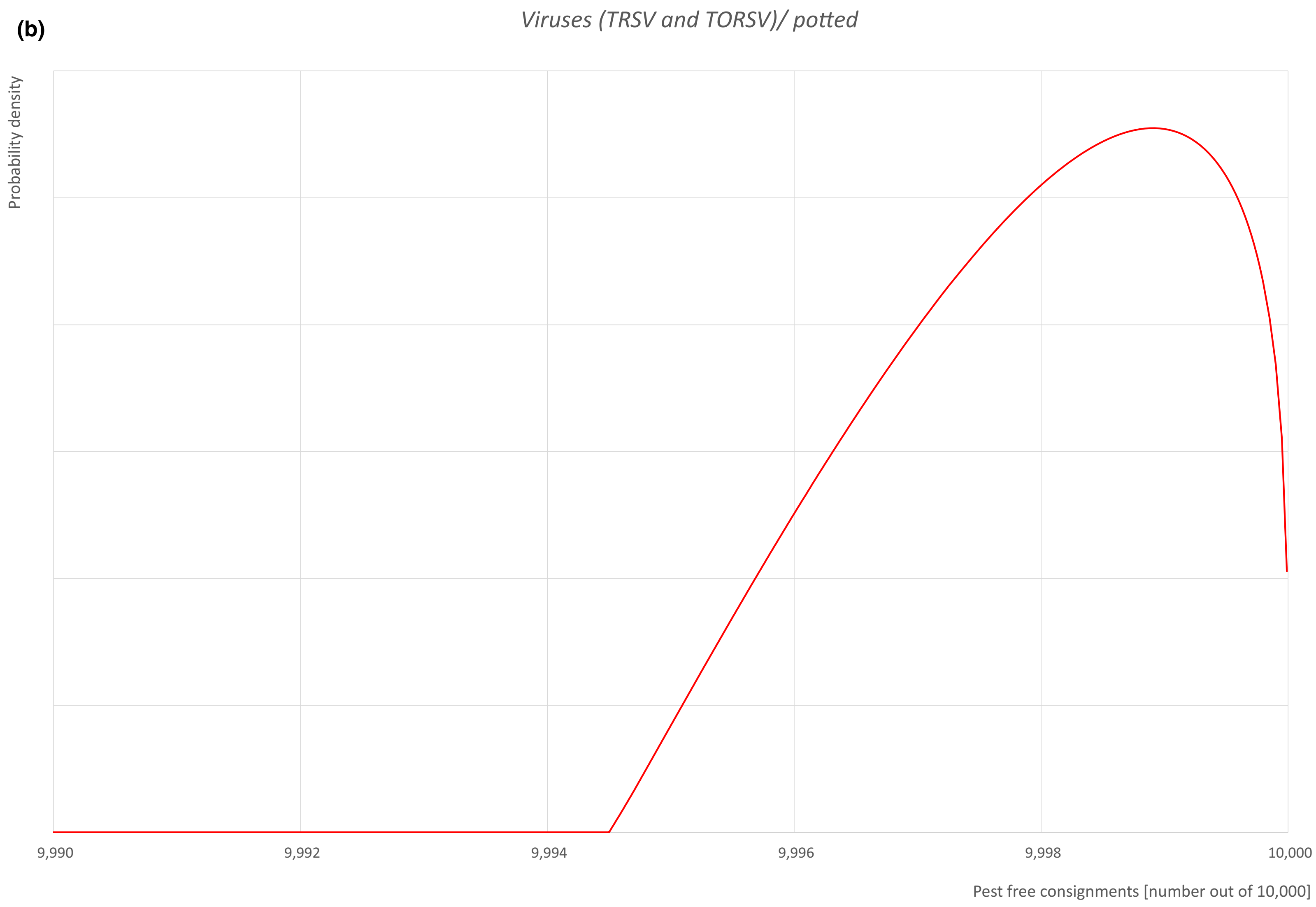
Based on the numbers of estimated infested bundles the pest freedom was calculated (i.e. = 10,000 – the number of infested bundles per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.28.

Table A.34: The uncertainty distribution of bundles free of tomato ringspot virus per 10,000 bundles of budwood/graftwood calculated by Table A.33

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,985					9,991		9,994		9,997					10,000
EKE results	9,985.0	9,985.8	9,986.8	9,988.1	9,989.5	9,990.9	9,992.1	9,994.1	9,996.0	9,996.9	9,997.8	9,998.6	9,999.2	9,999.5	9,999.8

The EKE results are the fitted values.


(a)
Viruses (TRSV and TORSV)/ potted
Probability density
0
2
4
6
8
10
Infested consignments [number out of 10,000]
EKE result
Fitted density


(b)
Viruses (TRSV and TORSV)/ potted
Probability density
9,990
9,992
9,994
9,996
9,998
10,000
Pest free consignments [number out of 10,000]

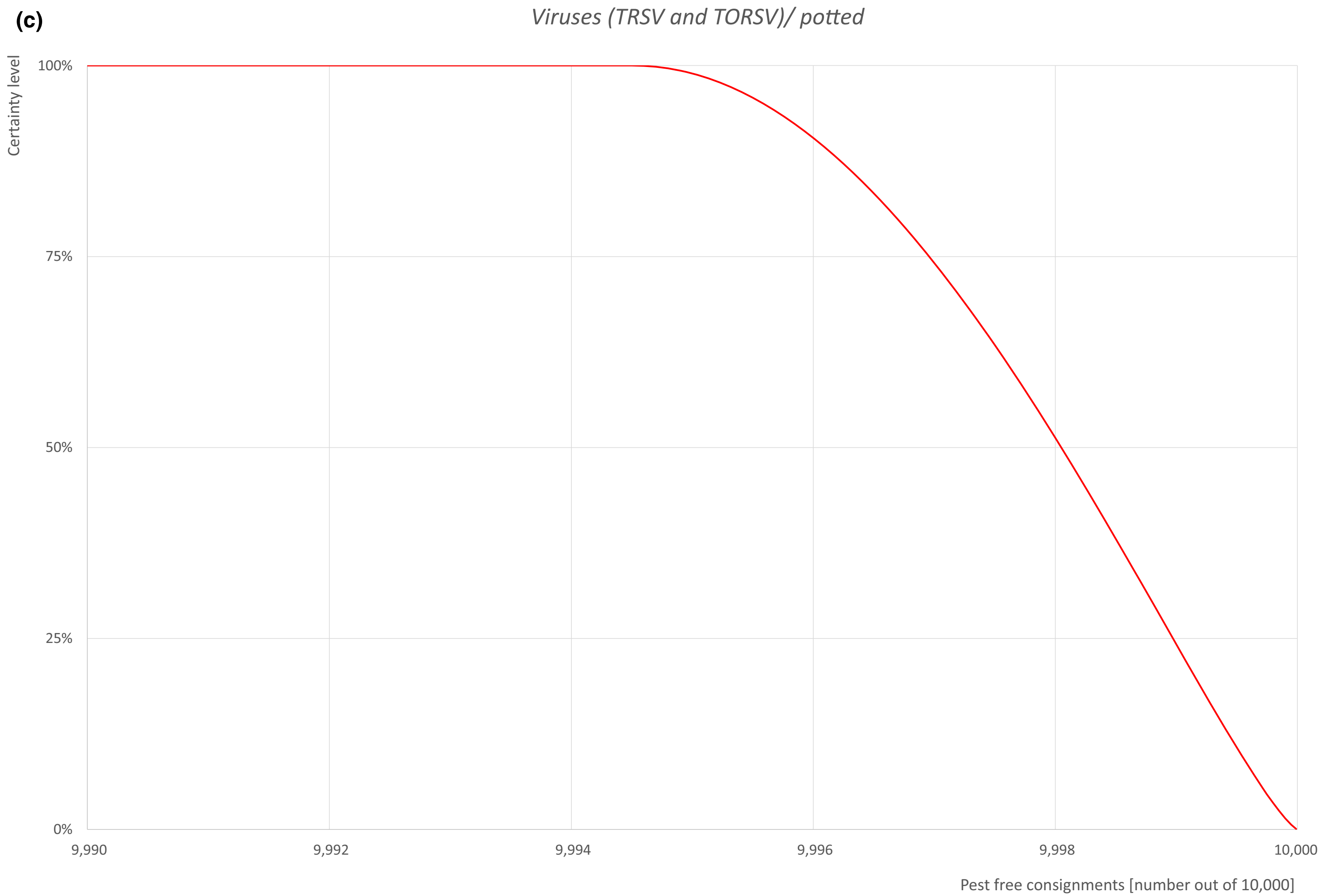
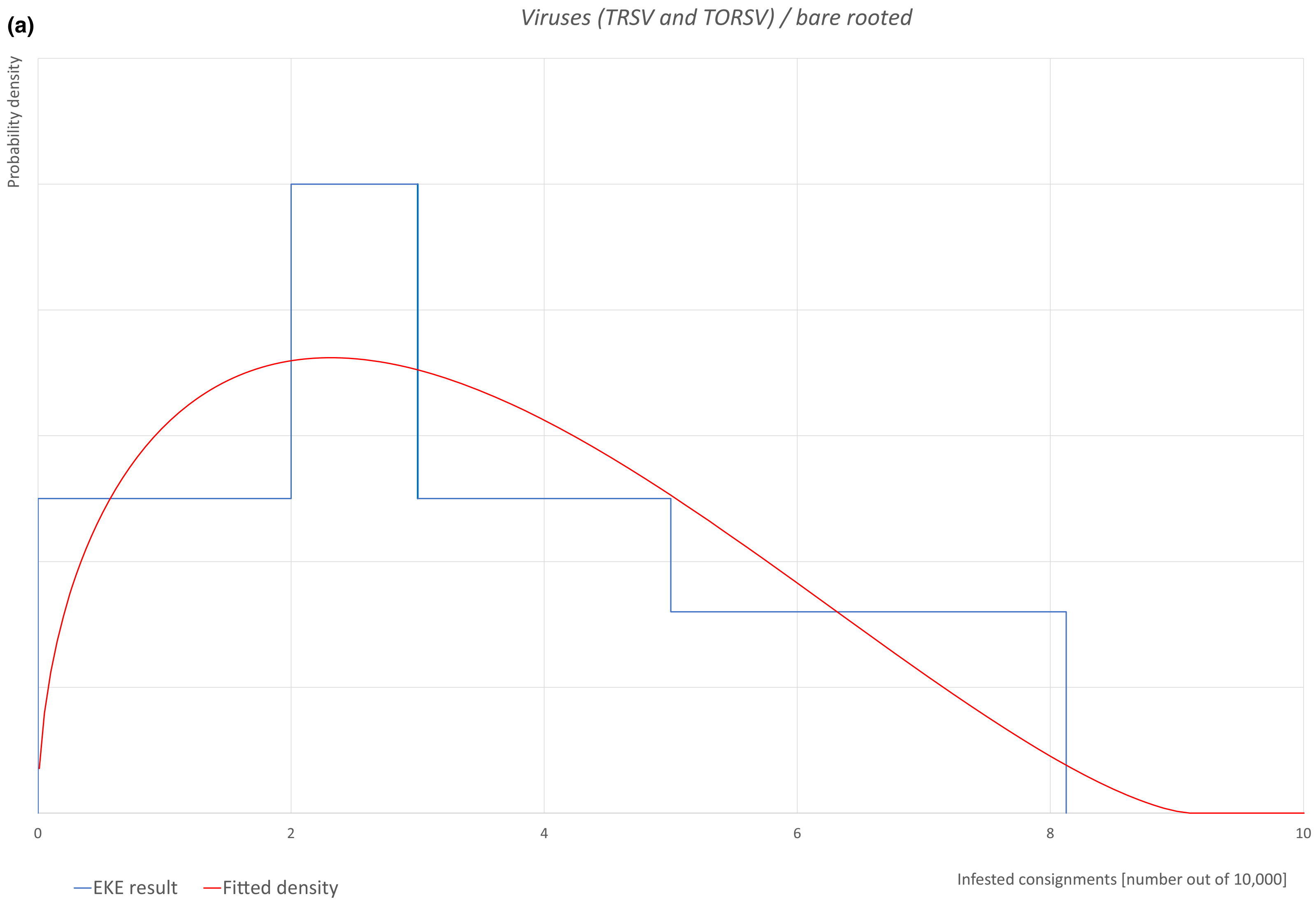
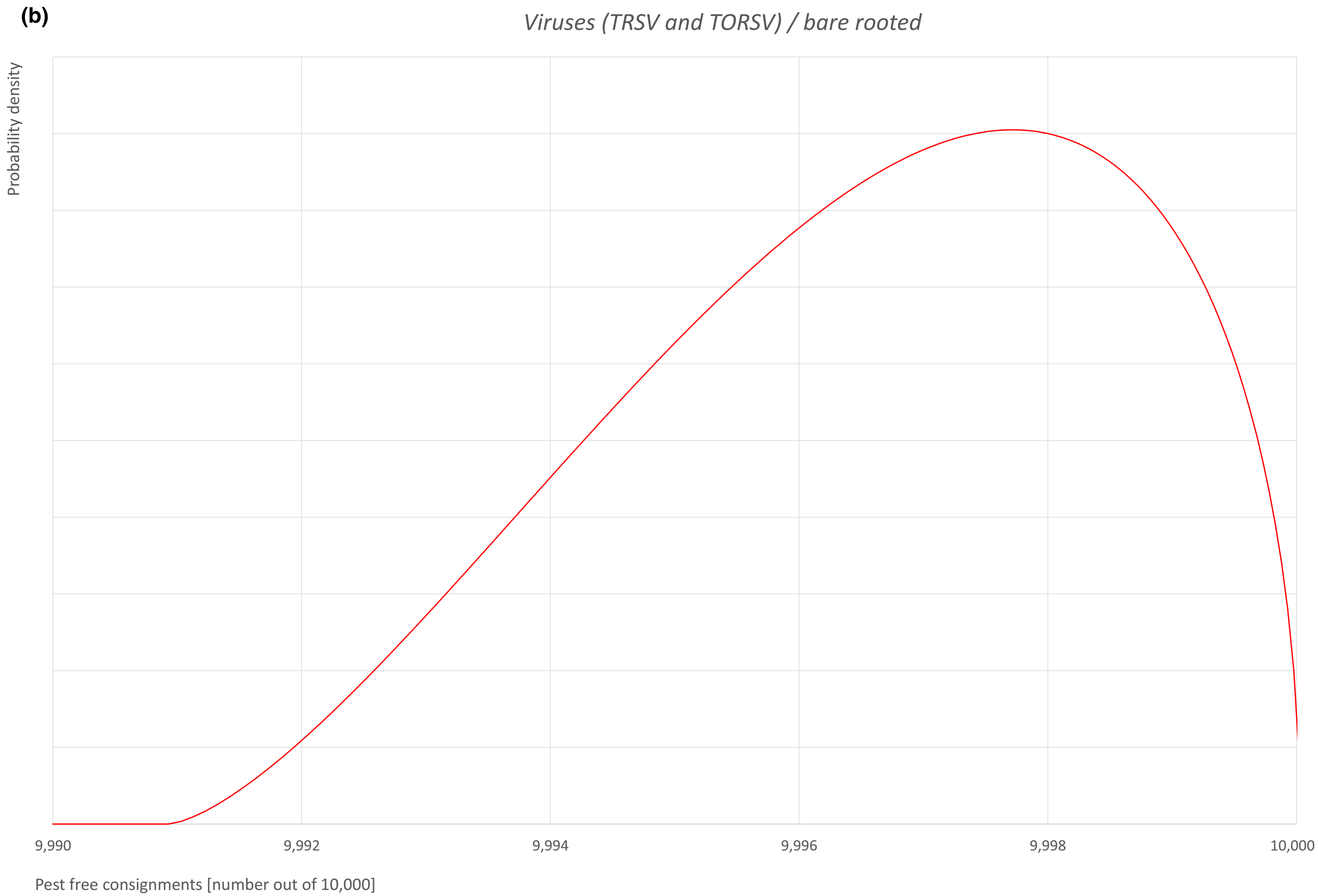


Figure A.15: (a) Elicited uncertainty of pest infestation per 10,000 potted plants (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free bundles per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 plants

(a)


Viruses (TRSV and TORSV) / bare rooted
Probability density
0
2
4
6
8
10
EKE result
Fitted density
Infested consignments [number out of 10,000]


(b)
Viruses (TRSV and TORSV) / bare rooted
Probability density
9,990
9,992
9,994
9,996
9,998
10,000
Pest free consignments [number out of 10,000]

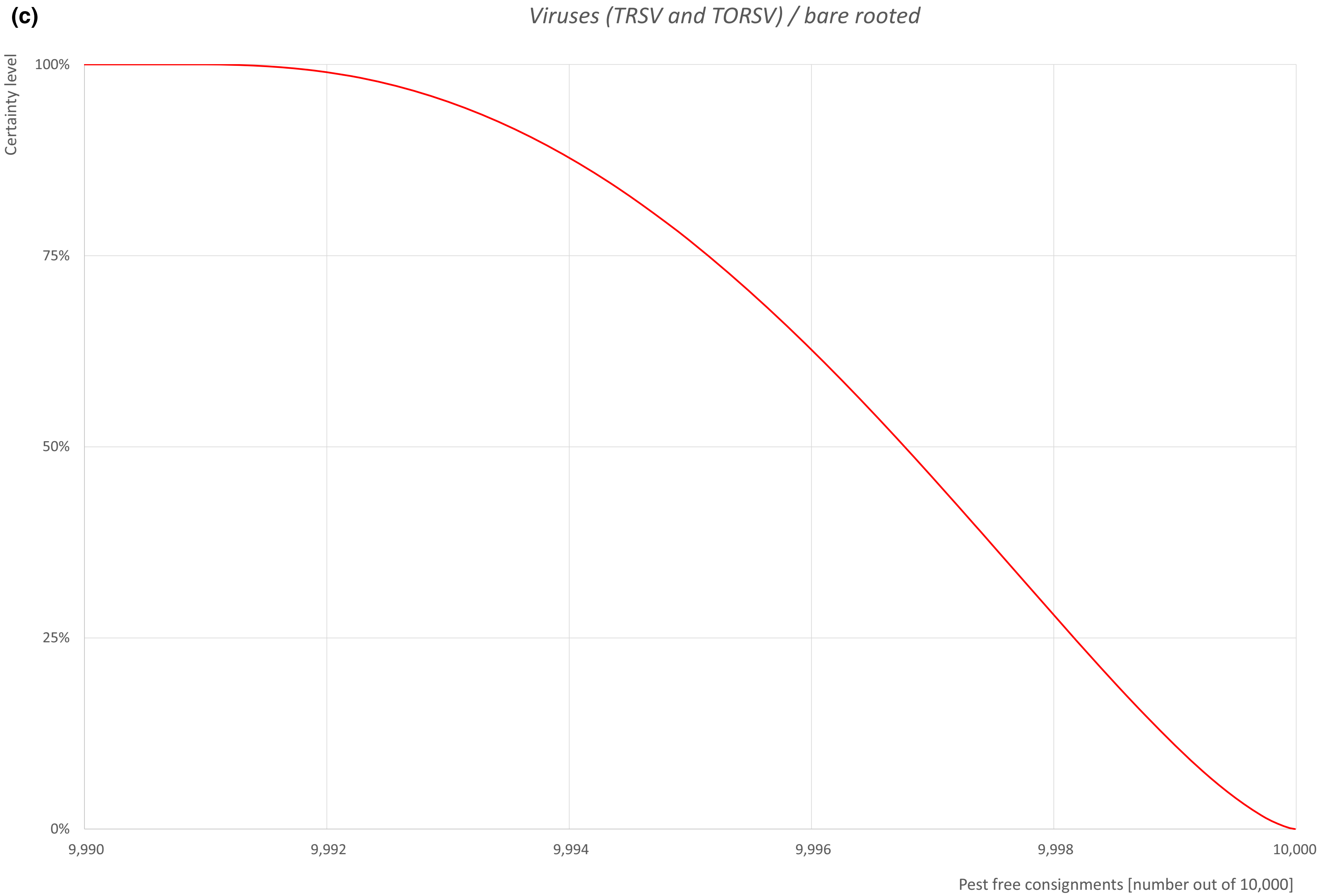
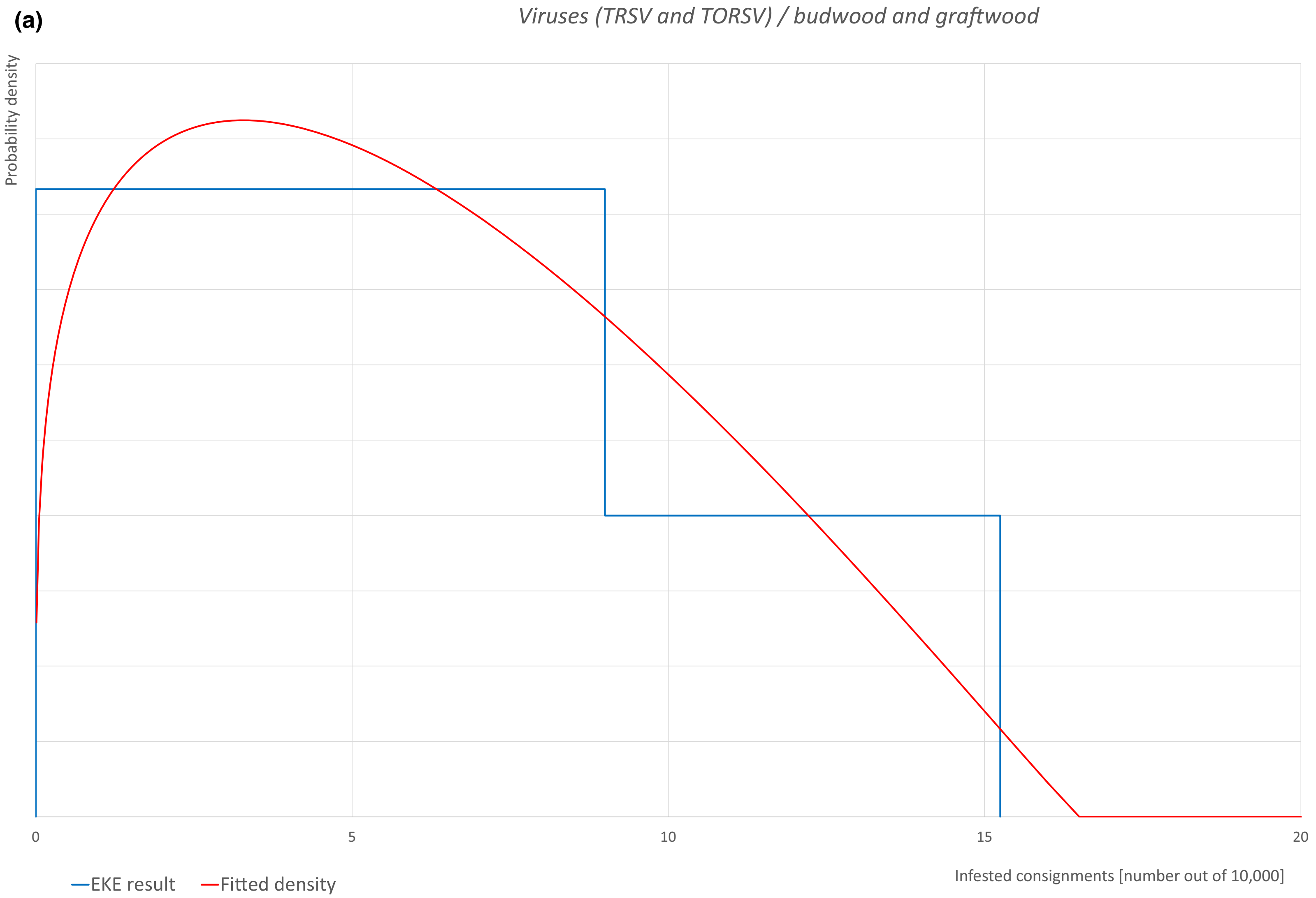
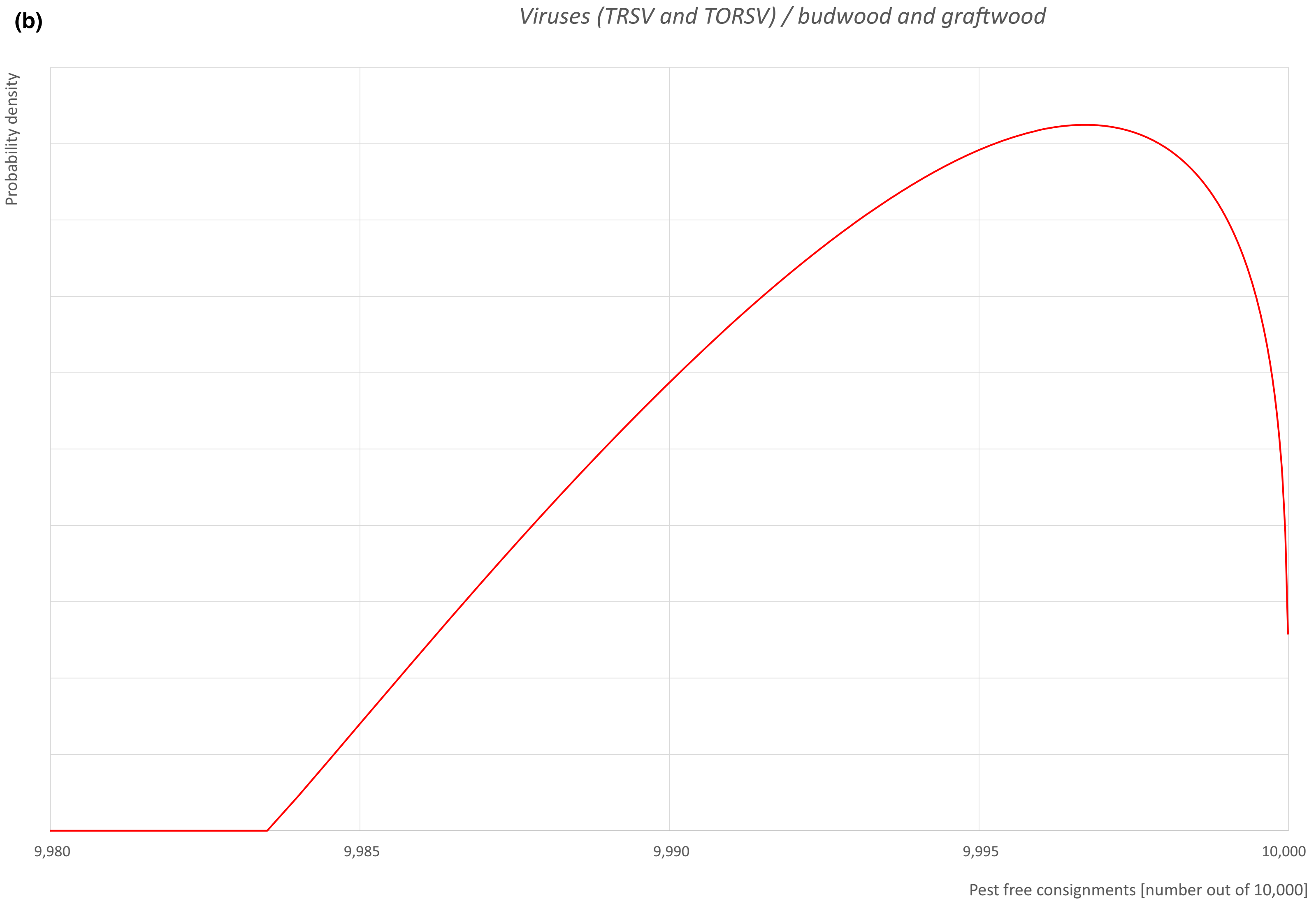


Figure A.16: (a) Elicited uncertainty of pest infestation per 10,000 bundles of bare rooted plants (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free bundles per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 bundles


(a)
Viruses (TRSV and TORSV) / budwood and graftwood
Probability density
0
5
10
15
20
Infested consignments [number out of 10,000]
EKE result
Fitted density


(b)
Viruses (TRSV and TORSV) / budwood and graftwood
Probability density
9,980
9,985
9,990
9,995
10,000
Pest free consignments [number out of 10,000]

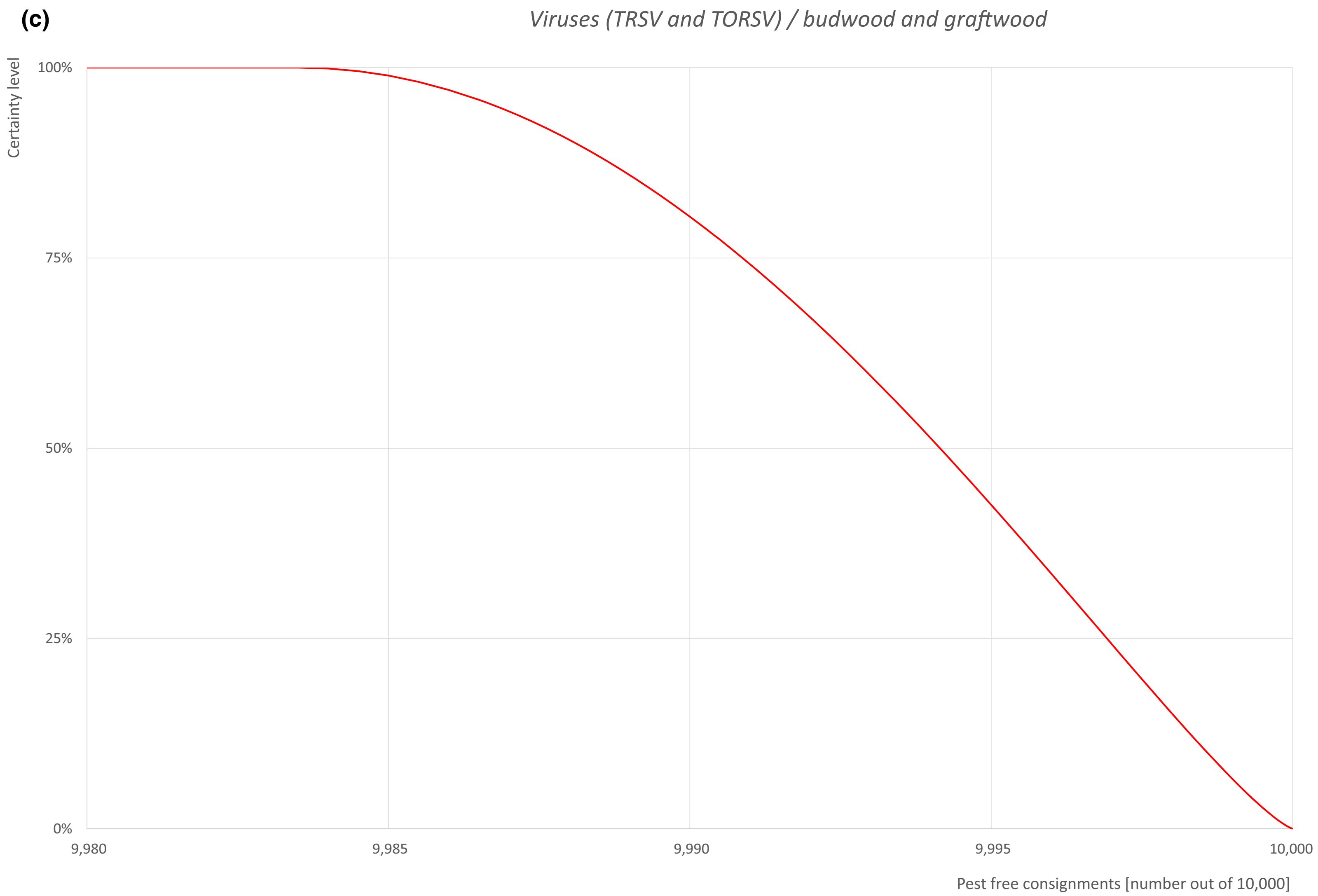


Figure A.17: (a) Elicited uncertainty of pest infestation per 10,000 bundles of graftwood/budwood (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest free bundles per 10,000 (i.e. = 1 – pest infestation proportion expressed as percentage); (c) descending uncertainty distribution function of pest infestation per 10,000 bundles

A.6.6. References list

Adaskaveg JE and Caprile JL, online. UC Pest Management Guidelines. Tomato Ringspot Virus. Available online: http://ipm.ucanr.edu/PMG/r105102811.html [Accessed: 11 October 2022].

Bitterlin MW, Gonsalves D and Scorza R, 1987. Improved mechanical transmission of tomato ringspot virus to *Prunus* seedlings. Phytopathology, 77, 560–563. https://doi.org/10.1094/phyto-77-560

Braun AJ and Keplinger JA, 1973. Seed transmission of tomato ringspot virus in raspberry. Plant Disease Reporter, 57, 431–432.

CABI (Centre for Agriculture and Bioscience International), online. Tomato ringspot virus (ringspot of tomato). Available online: https://www.cabidigitallibrary.org/doi/10.1079/cabicompendium.54076 [Accessed: 11 October 2022].

Card S, Pearson M and Clover G, 2007. Plant pathogens transmitted by pollen. Australasian Plant Pathology, 36, 455–461.

DEFRA (Department for Environment, Food and Rural Affairs), 2018. Rapid Pest Risk Analysis (PRA) for: Tomato ringspot virus (ToRSV). Available online: https://planthealthportal.defra.gov.uk/assets/pras/ToRSV-PRA4.pdf [Accessed: 7 February 2023].

EFSA PLH Panel (EFSA Plant Health Panel), Bragard C, Dehnen-Schmutz K, Gonthier P, Jacques M-A, Jaques Miret JA, Justesen AF, MacLeod A, Magnusson CS, Milonas P, Navas-Cortes JA, Parnell S, Potting R, Reignault PL, Thulke H-H, Van der Werf W, Vicent Civera A, Yuen J, Zappalà L, Candresse T, Chatzivassiliou E, Finelli F, Winter S, Chiumenti M, Di Serio F, Kaluski T, Minafra A and Rubino L, 2019a. Scientific Opinion on the pest categorisation of non-EU viruses and viroids of *Cydonia* Mill., *Malus* Mill. and *Pyrus* L. EFSA Journal 2019;17 (9):5590, 81 pp. https://doi.org/10.2903/j.efsa.2019.5590

EFSA PLH Panel (EFSA Plant Health Panel), Bragard C, Dehnen-Schmutz K, Gonthier P, Jacques M-A, Jaques Miret JA, Justesen AF, MacLeod A, Magnusson CS, Milonas P, Navas-Cortes JA, Parnell S, Potting R, Reignault PL, Thulke H-H, Van der Werf W, Vicent Civera A, Yuen J, Zappalà L, Candresse T, Chatzivassiliou E, Finelli F, Winter S, Bosco D, Chiumenti M, Di Serio F, Kaluski T, Minafra A and Rubino L, 2019b. Pest categorisation of non-EU viruses and viroids of *Prunus* L. EFSA Journal 2019;17(9):5735, 84 pp. https://doi.org/10.2903/j.efsa.2019.5735

EFSA PLH Panel (EFSA Plant Health Panel), Bragard C, Dehnen-Schmutz K, Gonthier P, Jacques M-A, Jaques Miret JA, Justesen AF, MacLeod A, Magnusson CS, Milonas P, Navas-Cortes JA, Parnell S, Potting R, Reignault PL, Thulke H-H, Van der Werf W, Vicent Civera A, Yuen J, Zappalà L, Candresse T, Chatzivassiliou E, Finelli F, Martelli GP, Winter S, Bosco D, Chiumenti M, Di Serio F, Kaluski T, Minafra A and Rubino L, 2019c. Scientific Opinion on the pest categorisation of non-EU viruses and viroids of *Vitis* L. EFSA Journal 2019;17(9):5669, 94 pp. https://doi.org/10.2903/j.efsa.2019.5669

EFSA PLH Panel (EFSA Panel on Plant Health) Bragard C, Dehnen-Schmutz K, Gonthier P, Jacques M-A, Jaques Miret JA, Justesen AF, MacLeod A, Magnusson CS, Milonas P, Navas-Cortes JA, Parnell S, Potting R, Reignault PL, Thulke H-H, Van der Werf W, Vicent Civera A, Yuen J, Zappalà L, Candresse T, Chatzivassiliou E, Finelli F, Winter S, Bosco D, Chiumenti M, Di Serio F, Kaluski T, Minafra A and Rubino L, 2019d. Scientific Opinion on the pest categorisation of non-EU viruses of *Fragaria* L. EFSA Journal 2019;17(9):5766, 69 pp. https://doi.org/10.2903/j.efsa.2019.5766

EFSA PLH Panel (EFSA Panel on Plant Health), Bragard C, Dehnen-Schmutz K, Gonthier P, Jacques M-A, Jaques Miret JA, Justesen AF, MacLeod A, Magnusson CS, Milonas P, Navas-Cortes JA, Parnell S, Potting R, Reignault PL, Thulke H-H, Van der Werf W, Civera AV, Yuen J, Zappalà L, Candresse T, Chatzivassiliou E, Finelli F, Winter S, Bosco D, Chiumenti M, Di Serio F, Ferilli F, Kaluski T, Minafra A and Rubino L, 2019e. Scientific Opinion on the pest categorisation of non-EU viruses of *Ribes* L. EFSA Journal 2019;17(11):5859, 48 pp. https://doi.org/10.2903/j.efsa.2019.5859

EFSA PLH Panel (EFSA Panel on Plant Health), Bragard C, Dehnen-Schmutz K, Gonthier P, Jacques M-A, Jaques Miret JA, Justesen AF, MacLeod A, Magnusson CS, Milonas P, Navas-Cortes JA, Parnell S, Potting R, Reignault PL, Thulke H-H, Van der Werf W, Vicent Civera A, Yuen J, Zappalà L, Candresse T, Chatzivassiliou E, Finelli F, Winter S, Bosco D, Chiumenti M, Di Serio F, Ferilli F, Kaluski T, Minafra A and Rubino L, 2020. Scientific Opinion on the pest categorisation of non-EU viruses of *Rubus* L. EFSA Journal 2020;18(1):5928, 69 pp. https://doi.org/10.2903/j.efsa.2020.5928

EPPO (European and Mediterranean Plant Protection Organization), 2005. Tomato ringspot nepovirus. PM 7/49(1). Bulletin OEPP/EPPO Bulletin, 35, 313–318. https://doi.org/10.1111/j.1365-2338.2005.00831.x

EPPO (European and Mediterranean Plant Protection Organization), 2013. Tomato ringspot virus in fruit trees and grapevine: inspection. Phytosanitary procedures. PM3/32 (2). Bulletin OEPP/EPPO Bulletin 43, 397. https://doi.org/10.1111/epp.12073

EPPO (European and Mediterranean Plant Protection Organization), online_a. Tomato ringspot virus (TORSV0), Categorization. Available online: https://gd.eppo.int/taxon/TORSV0/categorization [Accessed: 11 October 2022].

EPPO (European and Mediterranean Plant Protection Organization), online_b. Tomato ringspot virus (TORSV0), Distribution. Available online: https://gd.eppo.int/taxon/TORSV0/distribution [Accessed: 11 October 2022].

EPPO (European and Mediterranean Plant Protection Organization), online_c. Tomato ringspot virus (TORSV0), Host plants. Available online: https://gd.eppo.int/taxon/TORSV0/hosts [Accessed: 11 October 2022].

EPPO/CABI, 1996. Data Sheets on Quarantine Pests: Tobacco ringspot nepovirus. Available online: https://gd.eppo.int/download/file/714_datasheet_TRSV00.pdf [Accessed: 11 October 2022].

EUROPHYT, online. European Union Notification System for Plant Health Interceptions - EUROPHYT Available online: http://ec.europa.eu/food/plant/plant_health_biosecurity/europhyt/index_en.htm [Accessed: 17 February 2023].

FERA (The Food and Environment Research Agency), 2014. Rapid pest risk analysis for *Xiphinema americanum s.l.* (European populations). Available online: https://planthealthportal.defra.gov.uk/pests-and-diseases/uk-plant-health-risk-register/downloadExternalPra.cfm?id=4175 [Accessed: 11 October 2022].

Gonsalves D, 1988. Tomato ringspot virus decline; tobacco ringspot virus decline. In: Pearson RC and Goheen AC (eds.). Compendium of grape diseases. American Phytopathological Society, St. Paul, USA, 49–51.

Kahn RP, 1956. Seed transmission of the tomato ringspot virus in the Lincoln variety of soybeans. Phytopathology, 46, 295.

Mellor FC and Stace-Smith R, 1963. Reaction of strawberry to a ringspot virus from raspberry. Canadian Journal of Botany, 41, 865–870.

Mountain W, Powell C, Forer L and Stouffer R, 1983. Transmission of Tomato ringspot virus from dandelion via seed and dagger nematodes. Plant Disease, 67, 867–868. https://doi.org/10.1094/pd-67-867

Pinkerton JN, Kraus J, Martin RR and Schreiner RP, 2008. Epidemiology of *Xiphinema americanum* and Tomato ringspot virus on red raspberry, *Rubus idaeus*. Plant Disease, 92, 364–371. https://doi.org/10.1094/pdis-92-3-0364

Powell C, Forer L, Stouffer R, Cummins J, Gonsalves D, Rosenberger D, Hoffman J and Lister R, 1984. Orchard weeds as hosts of Tomato ringspot and Tobacco ringspot viruses. Plant Disease, 68, 242–244. https://doi.org/10.1094/pd-69-242

Samuitienė M and Navalinskienė M, 2001. Nepoviruses and their influence on field floriculture. Biologija, 4, 43–45.

Sanfaçon H, Zhang G, Chisholm J, Jafarpour B and Jovel J, 2006. Molecular biology of Tomato ringspot nepovirus, a pathogen of ornamentals, small fruits and fruit trees. Floriculture, Ornamental and Plant Biotechnology, 540–547.

Scarborough BA and Smith SH, 1977. Effects of tobacco- and tomato ringspot viruses on the reproductive tissues of *Pelargonium* X *hortorum*. Phytopathology, 67, 292–297. https://doi.org/10.1094/phyto-67-292

Stace-Smith R, 1984. Tomato ringspot virus. CMI/AAB Descriptions of Plant Viruses, AAB, Wellesbourne (GB), 290.

TRACES-NT, online. TRADE Control and Expert System. Available online: https://webgate.ec.europa.eu/tracesnt [Accessed: 17 February 2023].

Uyemoto JK and Scott SW, 1992. Important diseases of *Prunus* caused by viruses and other graft- transmissible pathogens in California and South Carolina. Plant Disease, 76, 5–11. https://doi.org/10.1094/pd-76-0005

Zindović J, Marn VM and Pleško IM, 2014. Phytosanitary status of grapevine in Montenegro. EPPO Bulletin, 44, 60–64. https://doi.org/10.1111/epp.12084

Appendix B – Web of Science All Databases Search String.

In the table below, the search string used in Web of Science is reported. In total, 777 papers were retrieved. Titles and abstracts were screened, and 13 pests were added to the list of pests (see Appendix D).

Web of Science All databases	TOPIC: ("Malus domestica" OR "M. Domestica" OR "apple tree$") AND TOPIC: ("pathogen* OR pathogenic bacteria OR fung* OR oomycet* OR myce* OR bacteri* OR virus* OR viroid* OR insect$ OR mite$ OR phytoplasm* OR arthropod* OR nematod* OR disease$ OR infecti* OR damag* OR symptom* OR pest$ OR vector OR hostplant$ OR "host plant$" OR host OR "root lesion$" OR decline$ OR infestation$ OR damage$ OR symptom$ OR dieback* OR "die back*" OR malaise OR aphid$ OR curculio OR thrip$ OR cicad$ OR miner$ OR borer$ OR weevil$ OR "plant bug$" OR spittlebug$ OR moth$ OR mealybug$ OR cutworm$ OR pillbug$ OR "root feeder$" OR caterpillar$ OR "foliar feeder$" OR virosis OR viruses OR blight$ 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 rootkit OR cyst$ OR "dagger" OR "plant parasitic" OR "parasitic plant" OR "plant$parasitic" OR "root feeding" OR "root $feeding") NOT TOPIC: ("heavy metal$" OR "pollut*" OR "weather" OR "propert*" OR probes OR "spectr*" OR "antioxidant$" OR "transformation" OR musca OR RNA OR "musca domestica" OR peel OR resistance OR gene OR DNA OR "Secondary plant metabolite$" OR metabolite$ OR Catechin OR "Epicatechin" OR "Rutin" OR "Phloridzin" OR "Chlorogenic acid" OR "Caffeic acid" OR "Phenolic compounds" OR "Quality" OR "Appearance" OR Postharvest OR Antibacterial OR Abiotic OR Storage OR Pollin* OR Ethylene OR Thinning OR fertil* OR Mulching OR Nutrient$ OR Pruning 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$") NOT TOPIC: ("Acetobacter aceti" OR "Acetobacter pasteurianus" OR "Acleris comariana" OR "Acleris fimbriana" OR "Acleris minuta" OR "Acleris rhombana" OR "Acleris sparsana" OR "Acleris variegana" OR "Acremonium charticola" OR "Acremonium mali" OR "Acremonium sclerotigenum" OR "Acronicta alni" OR "Acronicta psi" OR "Acronicta rumicis" OR "Acronicta tridens" OR "Aculus malus" OR "Aculus schlechtendali" OR "Adoretus versutus" OR "Adoxophyes orana" OR "Adoxophyes orana fasciata" OR "Aenetus virescens" OR "Aeolesthes holosericea" OR "Aeolesthes sarta" OR "Agapeta hamana" OR "Agrilus mali" OR "Agriopis aurantiaria" OR "Agriopis bajaria" OR "Agriopis marginaria" OR "Agrobacterium tumefaciens" OR "Agrotis ipsilon" OR "Agrotis ipsilon aneituma" OR "Allocotaphis quaestionis" OR "Allophyes oxyacanthae" OR "Allothyes oxyacanthae" OR "Alnetoidea alneti" OR "Alnetoidia alneti" OR "Alsophila aescularia" OR "Alternaria alternata" OR "Alternaria alternata f. sp. mali" OR "Alternaria arborescens" OR "Alternaria dumosa" OR "Alternaria eureka" OR "Alternaria frumenti" OR "Alternaria infectoria" OR "Alternaria kordkuyana" OR "Alternaria mali" OR "Alternaria malicola" OR "Alternaria tenuissima" OR "Amara eurynota" OR "Amblyseius andersoni" OR "Ametastegia glabrata" OR "Amitermes wahrmani" OR "Amphipyra pyramidea" OR "Amphitetranychus viennensis" OR "Amylostereum sacratum" OR "Anarsia lineatella" OR "Anastrepha fraterculus" OR "Anastrepha ludens" OR "Anastrepha serpentina" OR "Anastrepha suspensa" OR "Ancylis achatana" OR "Anisandrus dispar" OR "Anoplophora chinensis" OR "Anoplophora glabripennis-U" OR "Anthonomus piri" OR "Anthonomus pomorum" OR "Anthonomus quadrigibbus" OR "Antrodia serialis" OR "Anuraphis

	farfarae" OR "Anystis baccarum" OR "Aonidiella aurantii" OR "Apate monachus" OR "Aphelinus mali" OR "Aphidounguis mali" OR "Aphis craccivora" OR "Aphis eugeniae" OR "Aphis fabae" OR "Aphis gossypii" OR "Aphis odinae" OR "Aphis pomi" OR "Aphis spiraecola" OR "Aphis spiraephaga" OR "Aphthona euphorbiae" OR "Apion apricans" OR "Apion dichroum" OR "Apion nigritarse" OR "Aploneura ampelina" OR "Apocheima cinerarium" OR "Apomyelois ceratoniae" OR "Aporia crataegi" OR "Apple associated luteovirus" OR "Apple chat fruit agent" OR "Apple chat fruit disease" OR "Apple chlorotic fruit spot viroid" OR "Apple chlorotic leaf spot virus" OR "Apple flat limb agent" OR "Apple fruit crinkle viroid" OR "Apple geminivirus" OR "Apple green crinkle associated virus" OR "Apple green crinkle disease" OR "Apple hammerhead viroid" OR "Apple latent spherical virus" OR "Apple leaf pucker agent" OR "Apple mosaic virus" OR "Apple necrotic mosaic virus" OR "Apple ringspot disease" OR "Apple rough skin agent" OR "Apple rubbery wood phytoplasma" OR "Apple rubbery wood-associated virus 1" OR "Apple rubbery wood-associated virus 2" OR "Apple russet wart virus-like disease" OR "Apple scar skin viroid" OR "Apple sessile leaf phytoplasma" OR "Apple star crack agent" OR "Apple star crack virus-like disease" OR "Apple stem grooving virus" OR "Apple stem pitting virus" OR "Apriona cinerea" OR "Apriona germari" OR "Apterygothrips collyerae" OR "Archips argyrospilus" OR "Archips breviplicanus" OR "Archips crataegana" OR "Archips fuscocupreanus" OR "Archips podana" OR "Archips rosana" OR "Archips subsidiaria" OR "Archips termias" OR "Archips xylosteana" OR "Archips xylosteanus" OR "Arcyria oerstedtii" OR "Argolamprotes micella" OR "Argyresthia conjugella" OR "Argyresthia cornella" OR "Argyresthia curvella" OR "Argyroploce umbrosana" OR "Argyrotaenia citrana" OR "Argyrotaenia ljungiana" OR "Argyrotaenia velutinana" OR "Aridius nodifer" OR "Armillaria limonea" OR "Armillaria luteobubalina" OR "Armillaria mellea" OR "Armillaria novae-zelandiae" OR "Armillaria tabescens" OR "Ascochyta pirina" OR "Ascochyta pyricola" OR "Aspergillus flavus" OR "Aspergillus niger" OR "Aspergillus ustus" OR "Aspergillus versicolor" OR "Aspidiotus nerii" OR "Asteromella mali" OR "Asymmetrasca decedens" OR "Athelia rolfsii" OR "Atractotomus mali" OR "Atrichatus aeneicollis" OR "Aulacaspis rosae" OR "Aulacorthum solani" OR "Auriculariopsis ampla" OR "Automeris io" OR "Automeris zephyria" OR "Bacchisa fortunei" OR "Bacillus subtilis" OR "Bactrocera aquilonis" OR "Bactrocera cucurbitae" OR "Bactrocera dorsalis" OR "Bactrocera tryoni" OR "Bactrocera zonata" OR "Biscogniauxia marginata" OR "Biston betularia" OR "Bjerkandera adusta" OR "Blackberry chlorotic ringspot virus" OR "Blastobasis decolorella" OR "Blastodacna atra" OR "Blattella germanica" OR "Boeremia exigua var. exigua" OR "Bohemannia pulverosella" OR "Bonagota cranaodes" OR "Bonagota salubricola" OR "Botryosphaeria berengeriana" OR "Botryosphaeria dothidea" OR "Botryosphaeria kuwatsukai" OR "Botryosphaeria lutea" OR "Botryosphaeria quercuum" OR "Botryosphaeria ribis" OR "Botryosphaeria sinensis" OR "Botryosphaeria stevensii" OR "Botrytis cinerea" OR "Botrytis mali" OR "Brachycaudus cardui" OR "Brachycaudus helichrysi" OR "Brahmina coriacea" OR "Brevipalpus noranae" OR "Brevipalpus obovatus" OR "Brevipalpus phoenicis sensu lato" OR "Brevipalpus phoenicis sensu stricto" OR "Bryobia giannitsensis" OR "Bryobia graminum" OR "Bryobia macedonica" OR "Bryobia piliensis" OR "Bryobia praetiosa" OR "Bryobia rubrioculus" OR "Bryobia vasiljevi" OR "Bucculatrix bechsteinella" OR "Burkholderia cepacia" OR "Byctiscus betulae" OR "Byturus tomentosus" OR "Cacoecimorpha pronubana" OR "Cacopsylla melanoneura" OR "Cacopsylla picta" OR "Cacopsylla pulchella" OR "Cacopsylla pulchra" OR "Cactodera chaubattia" OR "Caecilius flavus" OR "Calepitrimerus baileyi" OR "Caliroa cerasi" OR "Callisto coffeella" OR "Callisto denticulella" OR "Calliteara horsfieldii" OR "Calliteara pudibunda" OR "Calocoris norvegicus" OR "Calonectria kyotensis" OR "Camarosporium karstenii" OR "Camarosporium multiforme" OR "Campaea margaritata" OR "Campylomma verbasci" OR "Candidatus liberibacter europaeus" OR "Candidatus Phytoplasma asteris" OR "Candidatus Phytoplasma aurantifolia-related strain" OR "Candidatus phytoplasma mali" OR "Candidatus Phytoplasma pyri" OR "Candidatus Phytoplasma solani" OR "Candidatus Phytoplasma pruni" OR "Candidatus Phytoplasma ziziphi" OR "Candidula intersecta" OR "Cantharis obscura" OR "Capnodium citri" OR "Capua semiferana" OR "Carcina quercana" OR "Carnation ring spot virus" OR "Carnation ringspot virus" OR "Carpophilus gaveni" OR "Carpophilus mutilatus" OR "Carposina sasakii" OR "Catoptes coronatus" OR "Cecidophyes malifoliae" OR "Celypha lacunana" OR "Cenopalpus irani" OR "Cenopalpus pulcher" OR "Cerambyx dux" OR "Ceratitis capitata" OR "Ceratitis quilicii" OR "Cercopis vulnerata" OR "Ceresa alta" OR "Ceroplastes ceriferus" OR "Ceroplastes sinensis" OR "Chaetocnema confinis" OR

	"Cheiroseius samani" OR "Cherry leaf roll virus" OR "Cherry necrotic rusty mottle virus" OR "Cherry rasp leaf virus" OR "Chinavia hilaris" OR "Chionaspis salicis" OR "Chloroclystis rectangulata" OR "Chloroclystis v-ata" OR "Chondrostereum purpureum" OR "Choreutis pariana" OR "Choristineura hebenstreitella" OR "Choristoneura diversana" OR "Choristoneura hebenstreitella" OR "Choristoneura lafauryana" OR "Choristoneura rosaceana" OR "Chrysobothris mali" OR "Chrysomphalus aonidum" OR "Chymomyza amoena" OR "Cicadatra persica" OR "Cilix glaucata" OR "Citrus coguvirus" OR "Cladosporium cladosporioides" OR "Cladosporium fumago" OR "Cladosporium herbarum" OR "Clarkeulia bourquini" OR "Clepsis spectrana" OR "Clonostachys rosea" OR "Clover yelllow mosaic virus" OR "Cnephasia asseclana" OR "Cnephasia incertana" OR "Cnephasia longana" OR "Cnephasia stephensiana" OR "Coccus hesperidum" OR "Cochlicopa lubrica" OR "Cochliobolus cynodontis" OR "Colaspis brunnea" OR "Coleophora anatipennella" OR "Coleophora coracipennella" OR "Coleophora currucipennella" OR "Coleophora hemerobiella" OR "Coleophora potentillae" OR "Coleophora prunifoliae" OR "Coleophora serratella" OR "Coleophora siccifolia" OR "Coleophora spinella" OR "Coleophora trigeminella" OR "Coleophora violacea" OR "Colletotrichum acerbum" OR "Colletotrichum acutatum" OR "Colletotrichum aenigma" OR "Colletotrichum alienum" OR "Colletotrichum fioriniae" OR "Colletotrichum fragariae" OR "Colletotrichum gloeosporioides" OR "Colletotrichum godetiae" OR "Colletotrichum kahawae" OR "Colletotrichum kahawae subsp. ciggaro" OR "Colletotrichum karsti" OR "Colletotrichum karstii" OR "Colletotrichum limetticola" OR "Colletotrichum melonis" OR "Colletotrichum noveboracense" OR "Colletotrichum nymphaeae" OR "Colletotrichum paranaense" OR "Colletotrichum salicis" OR "Colletotrichum siamense" OR "Colletotrichum theobromicola" OR "Colletotrichum tropicale" OR "Collybia drucei" OR "Colocasia coryli" OR "Comstockaspis perniciosa" OR "Coniothecium chomatosporum" OR "Coniothyrium armeniacae" OR "Coniothyrium pirinum" OR "Conistra rubiginosa" OR "Conogethes punctiferalis" OR "Conotrachelus nenuphar" OR "Cordana musae" OR "Coriolus velutinus" OR "Coriolus zonatus" OR "Cornu aspersum" OR "Corticium centrifugum" OR "Corticium koleroga" OR "Corticium utriculicum" OR "Coryneum foliicola" OR "Cosmia trapezina" OR "Cossus cossus" OR "Cossus insularis" OR "Costelytra zealandica" OR "Cotinis nitida" OR "Croesia holmiana" OR "Cryphonectria parasitica" OR "Cryptocoryneum condensatum" OR "Cryptosporiopsis corticola" OR "Ctenopseustis obliquana" OR "Cucumber mosaic virus" OR "Cydia janthinana" OR "Cydia pomonella" OR "Cydia pyrivora" OR "Cylindrocarpon album" OR "Cylindrocarpon candidum" OR "Cylindrocarpon macrodidymum" OR "Cylindrocarpon obtusiusculum" OR "Cylindrocarpon pauciseptatum" OR "Cyphellophora sessilis" OR "Cytospora calvillae" OR "Cytospora carphosperma" OR "Cytospora ceratosperma" OR "Cytospora chrysosperma" OR "Cytospora leucostoma" OR "Cytospora mali" OR "Cytospora melnikii" OR "Cytospora nivea" OR "Cytospora parasitica" OR "Cytospora schulzeri" OR "Dactylonectria pauciseptata" OR "Daldinia concentrica" OR "Daldinia vernicosa" OR "Dasineura mali" OR "Deltinea bourquini" OR "Dendrothele tetracornis" OR "Dendryphiella vinosa" OR "Dermestes laniarius" OR "Devriesia pseudoamericana" OR "Diabrotica speciosa" OR "Diaphora mendica" OR "Diaporthe actinidiae" OR "Diaporthe ambigua" OR "Diaporthe cotoneastri" OR "Diaporthe foeniculina" OR "Diaporthe infecunda" OR "Diaporthe malorum" OR "Diaporthe oxe" OR "Diaporthe serafiniae" OR "Diaspidiotus ancylus" OR "Diaspidiotus ostreaeformis" OR "Diaspidiotus pyri" OR "Dickeya dadantii" OR "Diderma asteroides" OR "Didymella aliena" OR "Didymella glomerata" OR "Didymella macrostoma" OR "Didymella pomorum" OR "Diloba caeruleocephala" OR "Diplocarpon coronariae" OR "Diplocarpon mali" OR "Diplocarpon mespili" OR "Diplococcium asperum" OR "Diplodia bulgarica" OR "Diplodia griffoni" OR "Diplodia intermedia" OR "Diplodia pseudoseriata" OR "Diplodia seriata" OR "Dipodascus geotrichum" OR "Diptacus gigantorhynchus" OR "Discostroma corticola" OR "Dissoconium aciculare" OR "Ditula angustiorana" OR "Diurnea fagella" OR "Dorysthenes huegelii" OR "Dothiorella sarmentorum" OR "Drosophila immigrans" OR "Drosophila lativittata" OR "Drosophila melanogaster" OR "Drosophila simulans" OR "Drosophila suzukii" OR "Dysaphis affinis" OR "Dysaphis anthrisci" OR "Dysaphis anthrisci majkopica" OR "Dysaphis armeniaca" OR "Dysaphis brachycyclica" OR "Dysaphis brancoi" OR "Dysaphis brancoi spp. malina" OR "Dysaphis brancoi spp. rogersoni" OR "Dysaphis brunii" OR "Dysaphis chaerophylii" OR "Dysaphis chaerophylli" OR "Dysaphis chaerophyllina" OR "Dysaphis devecta" OR "Dysaphis gallica" OR "Dysaphis malidauci" OR "Dysaphis meridialis" OR "Dysaphis mordvilkoi" OR "Dysaphis orientalis" OR "Dysaphis physocaulis" OR "Dysaphis plantaginea" OR "Dysaphis pyri"

	OR "Dysaphis radicola" OR "Dysaphis radicola group" OR "Dysaphis sibirica" OR "Dysaphis zini" OR "Dysaphys flava" OR "Dysmicoccus brevipes" OR "Eccopisa effractella" OR "Ectoedemia atricollis" OR "Edwardsiana crataegi" OR "Edwardsiana lamellaris" OR "Edwardsiana prunicola" OR "Edwardsiana rosae" OR "Elsinoë pyri" OR "Ematurga atomaria" OR "Empoasca decipiens" OR "Empoasca fabae" OR "Empoasca vitis" OR "Enarmonia formosana" OR "Eotetranychus ancora" OR "Eotetranychus carpini" OR "Eotetranychus clitus" OR "Eotetranychus frosti" OR "Eotetranychus pruni" OR "Eotetranychus prunicola" OR "Eotetranychus sexmaculatus" OR "Eotetranychus smithi" OR "Eotetranychus tiliarium" OR "Eotetranychus uncatus" OR "Eotetranychus willamettei" OR "Epiblema foenella" OR "Epicoccum nigrum" OR "Epidiaspis leperii" OR "Epiphyas postvittana" OR "Epirrita dilutata" OR "Epitrimerus pyri" OR "Epuraea imperialis" OR "Erannis defoliaria" OR "Eriococcus coccineus" OR "Eriogaster lanestris" OR "Eriophyes mali" OR "Eriophyes pyri" OR "Eriosoma lanigerum" OR "Eriosoma lanuginosum" OR "Erwinia amylovora" OR "Erysiphe heraclei" OR "Erythricium salmonicolor" OR "Eulecanium ciliatum" OR "Eulecanium excrescens" OR "Eulecanium tiliae" OR "Eupithecia insigniata" OR "Euproctis chrysorrhoea" OR "Euproctis similis" OR "Eupsilia transversa" OR "Eurhizococcus brasiliensis" OR "Eurytetranychus ulmi" OR "Eurytoma schreineri" OR "Eutetranychus africanus" OR "Eutetranychus orientalis" OR "Eutromula pariana" OR "Eutypa lata" OR "Euzophera bigella" OR "Euzophera pinguis" OR "Exapate congelatella" OR "Fabraea maculata" OR "Fagocyba cruenta" OR "Fibulorhizoctonia psychrophila" OR "Fieberiella florii" OR "Flammulina velutipes" OR "Fomitopsis pinicola" OR "Forficula auricularia" OR "Frankliniella occidentalis" OR "Fumago graminis" OR "Fusarium acuminatum" OR "Fusarium apiogenum" OR "Fusarium avenaceum" OR "Fusarium compactum" OR "Fusarium crookwellense" OR "Fusarium culmorum" OR "Fusarium gibbosum" OR "Fusarium incarnatum" OR "Fusarium lateritium" OR "Fusarium oxysporum" OR "Fusarium oxysporum f. sp. batatas" OR "Fusarium proliferatum" OR "Fusarium pseudograminearum" OR "Fusarium solani" OR "Fusarium stilboides" OR "Fusarium tricinctum" OR "Ganoderma applanatum" OR "Gastropacha quercifolia" OR "Geastrumia polystigmatis" OR "Gelechia rhombella" OR "Geotrichum candidum" OR "Globisporangium heterothallicum" OR "Globisporangium irregulare" OR "Globisporangium paroecandrum" OR "Globisporangium rostratum" OR "Globisporangium sylvaticum" OR "Globisporangium ultimum" OR "Globodera pallida" OR "Gloeocystidiellum sacratum" OR "Gloeodes pomigena" OR "Gloeopeniophorella sacrata" OR "Glomerella cingulata" OR "Glonium parvulum" OR "Gluconobacter oxydans" OR "Gonipterus scutellatus" OR "Gracilacus peperpotti" OR "Graphania mutans" OR "Graphiphora augur" OR "Graphium album" OR "Grapholita dimorpha" OR "Grapholita funebrana" OR "Grapholita inopinata" OR "Grapholita lobarzewskii" OR "Grapholita molesta" OR "Grapholita packardi" OR "Grapholita prunivora" OR "Gryllotalpa gryllotalpa" OR "Gymnobathra parca" OR "Gymnoscelis pumilata" OR "Gymnosporangium clavipes" OR "Gymnosporangium confusum" OR "Gymnosporangium globosum" OR "Gymnosporangium juniperi" OR "Gymnosporangium juniperi-virginiae" OR "Gymnosporangium juniperi-virginianae" OR "Gymnosporangium tremelloides" OR "Gymnosporangium yamadae" OR "Gypsonoma minutana" OR "Hadrotrichum populi" OR "Halyomorpha halys" OR "Haplothrips kurdjumovi" OR "Haplothrips niger" OR "Haptoncus luteolus" OR "Harmonia axyridis" OR "Hedya nubiferana" OR "Hedya pruniana" OR "Helicobasidium mompa" OR "Helicobasidium purpureum" OR "Helicotylenchus digonicus" OR "Helicotylenchus multicinctus" OR "Helicotylenchus pseudorobustus" OR "Helicoverpa armigera" OR "Heliothrips haemorrhoidalis" OR "Hemiberlesia cyanophylli" OR "Hemiberlesia lataniae" OR "Hemiberlesia rapax" OR "Hemicriconemoides gaddi" OR "Hendersonia lignicola" OR "Hendersonia mali" OR "Hendersonia piricola" OR "Hesperophanes sericeus" OR "Heterobasidion annosum sensu lato" OR "Heteroporus biennis" OR "Hirneola auricula-judae" OR "Holcocerus arenicolus" OR "Holotrichia longipennis" OR "Homeopronematus cf. staercki" OR "Homona coffearia" OR "Homona magnanima" OR "Hop stunt viroid" OR "Hoplocampa minuta" OR "Hoplocampa testudinea" OR "Hoplolaimus galeatus" OR "Houjia yanglingensis" OR "Hyalomyzus eriobotryae" OR "Hyalophora cecropia" OR "Hyalopterus pruni" OR "Hyalopus pruinosus" OR "Hylastes ater" OR "Hymenobacter metalli" OR "Hyphantria cunea" OR "Hyphodontia gossypina" OR "Hypholoma incertum" OR "Hypoaspis myrmophila" OR "Hypoxylon serpens" OR "Icerya aegyptiaca" OR "Icerya purchasi" OR "Ilyonectria liriodendri" OR "Ilyonectria radicicola" OR "Incurvaria oehlmanniella" OR "Incurvaria pectinea" OR "Inonotus hispidus" OR "Involvulus caeruleus" OR "Janus compressus" OR "Lacanobia oleracea" OR "Lacanobia subjuncta"

	OR "Lachnella anomala" OR "Lambertella corni-maris" OR "Lasiodiplodia brasiliense" OR "Lasiodiplodia brasiliensis" OR "Lasiodiplodia theobromae" OR "Lepidosaphes ulmi" OR "Lepidosaphes ussuriensis" OR "Lepiota naucina" OR "Leptodontidium elatius" OR "Leptodontium elatius" OR "Leptosphaeria coniothyrium" OR "Leucoptera malifoliella" OR "Leucostoma personii" OR "Leucothyreus marginicollis" OR "Limothrips cerealium" OR "Liothula omnivora" OR "Little cherry virus 1" OR "Little cherry virus 2" OR "Longidorus caespiticola" OR "Longidorus danuvii" OR "Longidorus elongatus" OR "Longidorus euonymus" OR "Longidorus iranicus" OR "Longidorus nanus" OR "Longidorus profundorum" OR "Longidorus rubi" OR "Longidorus sturhani" OR "Longistigma xizangensis" OR "Longitarsus fuliginosus" OR "Longitarsus parvulus" OR "Lophiostoma compressum" OR "Lophium mytilinum" OR "Lopholeucaspis japonica" OR "Lorryia palpsetosa" OR "Lycorma delicatula" OR "Lygocoris communis" OR "Lygocoris pabulinus" OR "Lygocoris rugicollis" OR "Lygus lineolaris" OR "Lymantria dispar" OR "Lymantria mathura" OR "Lymantria monacha" OR "Lymantria obfuscata" OR "Lyonetia clerkella" OR "Lyonetia prunifoliella" OR "Lyonetia prunifoliella malinella" OR "Maconellicoccus hirsutus" OR "Macrodactylus subspinosus" OR "Macrolabis mali" OR "Macrophthalmothrips argus" OR "Macrosiphum chukotense" OR "Macrosiphum euphorbiae" OR "Macrosiphum rosae" OR "Macrothylacia rubi" OR "Magdalis barbicornis" OR "Magdalis armigera" OR "Magdalis cerasi" OR "Magdalis ruficornis" OR "Malacosoma americana" OR "Malacosoma disstria" OR "Malacosoma indicum" OR "Malacosoma neuestria" OR "Malacosoma neustria" OR "Malacosoma parallela" OR "Malenchus bryophilus" OR "Malus domestica virus A" OR "Mamestra brassicae" OR "Mecinus pyraster" OR "Mediolata chanti" OR "Megalometis chiliensis" OR "Megaplatypus mutatus" OR "Melanchra persicariae" OR "Melanopsamma pomiformis" OR "Meloidogyne arenaria" OR "Meloidogyne ethiopica" OR "Meloidogyne hapla" OR "Meloidogyne incognita" OR "Meloidogyne javanica" OR "Meloidogyne mali" OR "Meloidogyne nataliei" OR "Melolontha melolontha" OR "Merothrips brunneus" OR "Metaseiulus occidentalis" OR "Metcalfa pruinosa" OR "Meyernychus emeticae" OR "Micrambina rutila" OR "Microcerotermes diversus" OR "Microcyclospora malicola" OR "Microcyclospora pomicola" OR "Microcyclospora tardicrescens" OR "Microcyclosporella mali" OR "Microdiplodia microsporella" OR "Micromus tasmaniae" OR "Microsphaeropsis ochracea" OR "Monilinia fructicola" OR "Monilinia fructigena" OR "Monilinia laxa" OR "Monilinia laxa f.sp. mali" OR "Monilinia mali" OR "Monilinia mumeicola" OR "Monilinia polystroma" OR "Monilinia yunnanensis" OR "Mucor piriformis" OR "Mycosphaerella pomi" OR "Mycosphaerella punctiformis" OR "Mycosphaerella pyri" OR "Mycosphaerella sentina" OR "Myzus ornatus" OR "Myzus persicae" OR "Naenia typica" OR "Nanidorus minor" OR "Nattrassia mangiferae" OR "Naupactus godmanni" OR "Naupactus xanthographus" OR "Nearctaphis bakeri" OR "Nectria cinnabarina" OR "Nectria discophora" OR "Nectria haematococca" OR "Nectria peziza" OR "Nectria pseudotrichia" OR "Nemania serpens" OR "Nematoloma fasciculare" OR "Neocoenorrhinus pauxillus" OR "Neocucurbitaria cava" OR "Neodelphax fuscoterminata" OR "Neofabraea actinidiae" OR "Neofabraea brasiliensis" OR "Neofabraea kienholzii" OR "Neofabraea malicorticis" OR "Neofabraea perennans" OR "Neofabraea vagabunda" OR "Neofusicoccum algeriense" OR "Neofusicoccum australe" OR "Neofusicoccum italicum" OR "Neofusicoccum luteum" OR "Neofusicoccum nonquaesitum" OR "Neofusicoccum parvum" OR "Neofusicoccum ribis" OR "Neonectria ditissima" OR "Neosphaleroptera nubilana" OR "Nesothrips propinquus" OR "Nezara viridula" OR "Nilotaspis halli" OR "Nippolachnus piri" OR "Nola cucullatella" OR "Notocelia cynosbatella" OR "Nummularia discreta" OR "Nyctemera annulata" OR "Nysius huttoni" OR "Ochrospora ariae" OR "Oemona hirta" OR "Olethreutes lacunana" OR "Oligonychus biharensis" OR "Oligonychus litchii" OR "Oligonychus newcomeri" OR "Oligonychus sayedi" OR "Oligonychus yothersi" OR "Oncopodiella robusta" OR "Oospora mali" OR "Opatrum sabulosum" OR "Operophtera bruceata" OR "Operophtera brumata" OR "Ophiostoma quercus" OR "Ophiostoma roboris" OR "Opodiphthera eucalypti" OR "Opogona omoscopa" OR "Orchestes fagi" OR "Orgyia antiqua" OR "Orgyia leucostigma" OR "Orgyia recens" OR "Oribius destructor" OR "Oribius inimicus" OR "Orthosia cerasi" OR "Orthosia cruda" OR "Orthosia gothica" OR "Orthosia gracilis" OR "Orthosia hibisci" OR "Orthosia incerta" OR "Orthotydeus californicus" OR "Orthotylus marginalis" OR "Osmia cornifrons" OR "Osmoderma eremita" OR "Ostrinia nubilalis" OR "Otiorhynchus clavipes" OR "Otiorhynchus cribricollis" OR "Otiorhynchus meridionalis" OR "Otiorhynchus singularis" OR "Otiorhynchus sulcatus" OR "Otthia spiraeae" OR "Ovatus crataegarius" OR "Ovatus insitus" OR "Ovatus malisuctus" OR "Pachyseius humeralis"

	OR "Pachysphinx modesta" OR "Paecilomyces niveus" OR "Palaeolecanium bituberculatum" OR "Pammene argyrana" OR "Pammene rhediella" OR "Pandemis cerasana" OR "Pandemis cinnamomeana" OR "Pandemis heparana" OR "Pandemis pyrusana" OR "Panonychus citri" OR "Panonychus inca" OR "Panonychus lishanensis" OR "Panonychus turkestani" OR "Panonychus ulmi" OR "Pappia fissilis" OR "Parachronistis albiceps" OR "Paracoccus marginatus" OR "Paradevriesia pseudoamericana" OR "Paraphloeostiba gayndahensis" OR "Paratrichodorus allius" OR "Paratrichodorus porosus" OR "Paratrichodorus tunisiensis" OR "Paratylenchus curvitatus" OR "Paratylenchus nainianus" OR "Paratylenchus variabilis" OR "Parlatoria crypta" OR "Parlatoria oleae" OR "Parlatoria pergandii" OR "Parlatoria pittospori" OR "Paropsis charybdis" OR "Parornix geminatella" OR "Parornix scoticella" OR "Parthenolecanium corni" OR "Parthenolecanium persicae" OR "Pasiphila rectangulata" OR "Peach latent mosaic viroid" OR "Pear blister canker viroid" OR "Peltaster cerophilus" OR "Peltaster fructicola" OR "Peltaster gemmifer" OR "Peltosphaeria pustulans" OR "Penicillium biourgeianum" OR "Penicillium brevicompactum" OR "Penicillium carneum" OR "Penicillium chrysogenum" OR "Penicillium commune" OR "Penicillium digitatum" OR "Penicillium expansum" OR "Penicillium glabrum" OR "Penicillium griseofulvum" OR "Penicillium novae-zelandiae" OR "Penicillium paneum" OR "Penicillium polonicum" OR "Penicillium ramulosum" OR "Penicillium rugulosum" OR "Penicillium solitum" OR "Penicillium viridicatum" OR "Peniophora lycii" OR "Pentatoma rufipes" OR "Perichaena corticalis" OR "Perichaena depressa" OR "Peridroma saucia" OR "Peritelus sphaeroides" OR "Pesotum piceae" OR "Pestalotia hartigii" OR "Pestalotiopsis maculans" OR "Petrobia harti" OR "Petrobia latens" OR "Petunia asteroid mosaic virus" OR "Pezicula corticola" OR "Phacidiopycnis washingtonensis" OR "Phacidium lacerum" OR "Phaeoacremonium australiense" OR "Phaeoacremonium fraxinopennsylvanicum" OR "Phaeoacremonium geminum" OR "Phaeoacremonium inflatipes" OR "Phaeoacremonium iranianum" OR "Phaeoacremonium italicum" OR "Phaeoacremonium minimum" OR "Phaeoacremonium mortoniae" OR "Phaeoacremonium parasiticum" OR "Phaeoacremonium proliferatum" OR "Phaeoacremonium scolyti" OR "Phaeoacremonium subulatum" OR "Phalera bucephala" OR "Phellinus alni" OR "Phenacoccus aceris" OR "Phialophora sessilis" OR "Phigalia pilosaria" OR "Philaenus spumarius" OR "Phlyctinus callosus" OR "Pholiata squarrosa" OR "Pholiota aurivella" OR "Pholiota squarrosa" OR "Phoma enteroleuca" OR "Phoma glomerata" OR "Phoma herbarum" OR "Phoma pyrina" OR "Phomopsis fukushii" OR "Phomopsis mali" OR "Phomopsis perniciosa" OR "Phomopsis prunorum" OR "Phomopsis velata" OR "Phorodon humuli" OR "Phyllactinia mali" OR "Phyllobius argentatus" OR "Phyllobius maculicornis" OR "Phyllobius oblongus" OR "Phyllobius pyri" OR "Phyllocoptes mali" OR "Phyllocoptes malinus" OR "Phyllonorycter blancardella" OR "Phyllonorycter corylifoliella" OR "Phyllonorycter crataegella" OR "Phyllonorycter cydoniella" OR "Phyllonorycter elmaella" OR "Phyllonorycter gerasimowi" OR "Phyllonorycter hostis" OR "Phyllonorycter leucographella" OR "Phyllonorycter mespilella" OR "Phyllonorycter messaniella" OR "Phyllonorycter oxyacanthae" OR "Phyllonorycter ringoniella" OR "Phyllonorycter sorbi" OR "Phyllopertha horticola" OR "Phyllosticta angulata" OR "Phyllosticta briardi" OR "Phyllosticta briardii" OR "Phyllosticta solitaria" OR "Phyllotreta nemorum" OR "Phyllotreta nigripes" OR "Phymatotrichopsis omnivora" OR "Physalospora malorum" OR "Physalospora mutila" OR "Physocleora dimidiaria" OR "Phytomyza heringiana" OR "Phytophthora cactorum" OR "Phytophthora cambivora" OR "Phytophthora citricola" OR "Phytophthora cryptogea" OR "Phytophthora drechsleri" OR "Phytophthora fragariae" OR "Phytophthora gonapodyides" OR "Phytophthora megasperma" OR "Phytophthora nicotianae" OR "Phytophthora plurivora" OR "Phytophthora rosacearum" OR "Phytophthora syringae" OR "Phytoptus pyri" OR "Phytopythium vexans" OR "Piezodorus guildinii" OR "Planococcus citri" OR "Planotortrix excessana" OR "Platynota flavedana" OR "Platynota idaeusalis" OR "Platynota stultana" OR "Pleochaeta mali" OR "Pleomassaria mali" OR "Pleospora herbarum" OR "Pleospora scrophulariae" OR "Pleospora tarda" OR "Plesiocoris rugicollis" OR "Plocamaphis gyirongensis" OR "Plum pox virus" OR "Plutella xylostella" OR "Podosphaera clandestina" OR "Podosphaera leucotricha" OR "Podosphaera pannosa" OR "Poecilocampa populi" OR "Poecilopachys australasia" OR "Polydrusus marginatus" OR "Polyopeus pomi" OR "Polyopeus purpureus" OR "Polyphylla fullo" OR "Polyporus admirabilis" OR "Polyporus adustus" OR "Polyporus hispidus" OR "Polyporus sulphureus" OR "Popillia japonica" OR "Poria ferruginosa" OR "Potebniamyces pyri" OR "Pratylenchoides erzurumensis" OR "Pratylenchoides laticauda" OR "Pratylenchoides

	leiocauda" OR “Pratylenchoides ritteri” OR “Pratylenchus coffeae” OR “Pratylenchus curviatus” OR “Pratylenchus hippeastri” OR “Pratylenchus loosi” OR “Pratylenchus manaliensis” OR “Pratylenchus neglectus” OR “Pratylenchus penetrans” OR “Pratylenchus scribneri” OR “Pratylenchus thornei” OR “Pratylenchus vulnus” OR “Prociphilus caryae ssp. fitchii” OR “Prociphilus kuwanai” OR “Prociphilus oriens” OR “Prociphilus pini” OR “Prociphilus sasakii” OR “Prodiplosis longifila" OR “Proeulia auraria" OR “Proeulia chrysopteris” OR “Protapion apricans” OR “Protapion fulvipes” OR “Protapion nigritarse” OR “Prunus necrotic ringspot virus” OR “Psallus ambiguus” OR “Pseudaulacaspis pentagona" OR “Pseudexentera mali” OR “Pseudocercospora mali” OR “Pseudococcus calceolariae” OR “Pseudococcus comstocki” OR “Pseudococcus longispinus” OR “Pseudococcus maritimus” OR “Pseudococcus viburni” OR “Pseudocoremia suavis” OR “Pseudomonas cichorii” OR “Pseudomonas fluorescens” OR “Pseudomonas syringae” OR “Pseudomonas syringae pv. papulans” OR “Pseudomonas syringae pv. syringae” OR “Pseudomonas syringae pv. tomato” OR “Pseudomonas viridiflava" OR “Pseudoveronaea ellipsoidea" OR “Pseudoveronaea obclavata" OR “Psilenchus iranicus” OR “Psychoda surcoufi” OR “Psylla mali” OR “Pterandrus rosa" OR “Pterochloroides persicae” OR “Ptycholoma lecheana" OR “Pulvinaria hydrangeae” OR “Pulvinaria vitis” OR “Pyrenochaeta furfuracea" OR “Pyrolachnus pyri” OR “Pythium abappressorium” OR “Pythium arrhenomanes” OR “Pythium debaryanum” OR “Pythium indigoferae” OR “Pythium sylvaticum” OR “Quadraspidiotus ostreaeformis” OR “Quadraspidiotus pyri” OR “Ramichloridium apiculatum” OR “Ramichloridium luteum” OR “Ramularia eucalypti” OR “Ramularia mali” OR “Recurvaria leucatella" OR “Recurvaria nanella" OR “Resseliella oculiperda" OR “Reticulitermes lucifugus” OR “Retithrips syriacus” OR “Rhagoletis pomonella" OR “Rhagoletis tabellaria" OR “Rhamphus oxyacanthae” OR “Rhinotergum schestovici” OR “Rhizobium rhizogenes” OR “Rhizoctonia solani” OR “Rhizopus stolonifer” OR “Rhopalosiphum oxyacanthae” OR “Rhopalosiphum padi” OR “Rhopobota naevana" OR “Rhopobota unipunctana" OR “Rhynchaenus pallicornis” OR “Rhynchites bacchus” OR “Rhynchites caeruleus” OR “Ribautiana debilis” OR “Ribautiana tenerrima" OR “Ricania speculum” OR “Rosellinia necatrix” OR “Rosellinia radiciperda" OR “Rotylenchus incultus” OR “Rotylenchus quartus” OR “Saissetia oleae oleae” OR “Saperda candida" OR “Sarcodontia crocea" OR “Sarocladium liquanensis” OR “Sarocladium mali” OR “Saturnia pavonia" OR “Saturnia pavonia`” OR “Saturnia pyri” OR “Scelodonta strigicolis” OR “Schizoneurella indica" OR “Schizophyllum alneum” OR “Schizophyllum commune” OR “Schizotetranychus smirnovi” OR “Schizothyrium jamaicense” OR “Schizothyrium pomi” OR “Scleroramularia abundans” OR “Sclerotinia fruticola" OR “Sclerotinia sclerotiorum” OR “Sclerotium delphinii” OR “Scolypopa australis” OR “Scolytus amygdali” OR “Scolytus mali” OR “Scolytus nitidus” OR “Scolytus rugulosus” OR “Scutylenchus baluchiensis” OR “Scutylenchus lenorus” OR “Scythropia crataegella" OR “Seimatosporium fusisporum” OR “Seimatosporium lichenicola" OR “Selenia dentaria" OR “Septocylindrium aderholdii” OR “Sigmothrips aotearoana" OR “Siphanta acuta" OR “Sitobion avenae” OR “Sitona lineatus” OR “Smerinthus ocellata" OR “Somena scintillans” OR “Spencermartinsia plurivora" OR “Sperchia intractana" OR “Sphaeria microtheca" OR “Sphaeropsis mali” OR “Sphaeropsis pyriputrescens” OR “Sphaeropsis sapinea" OR “Sphinx perelegans” OR “Spilonota ocellana" OR “Spilosoma lutea" OR “Spodoptera eridania" OR “Spodoptera frugiperda" OR “Spodoptera littoralis” OR “Spodoptera litura" OR “Sporidesmajora pennsylvaniensis” OR “Sporobolomyces roseus” OR “Stemphylium botryosum” OR “Stemphylium graminis” OR “Stemphylium ilicis” OR “Stemphylium vesicarium” OR “Stenostola ferrea" OR “Stephanitis pyri” OR “Stethorus bifidus” OR “Stictocephala bisonia" OR “Stigmella desperatella" OR “Stigmella incognitella" OR “Stigmella magdalenae” OR “Stigmella malella" OR “Stigmella minusculella" OR “Stigmella oxyacanthella" OR “Stigmella plagicolella" OR “Stigmella pyri” OR “Stigmella sorbi” OR “Stigmina carpophila" OR “Strasseria carpophila" OR “Strelitziana mali” OR “Strickeria obducens” OR “Swammerdamia pyrella" OR “Synanthedon hector” OR “Synanthedon loranthi” OR “Synanthedon myopaeformis” OR “Synanthedon scitula" OR “Syndemis musculana" OR “Taenothrips inconsequens” OR “Takahashia japonica" OR “Tapinoma nigerrimum” OR “Tarsonemus nodosus” OR “Tatianaerhynchites aequatus” OR “Tebenna micalis” OR “Technomyrmex albipes” OR “Teleiodes vulgella" OR “Temperate fruit decay associated virus” OR “Tetranychus arabicus” OR “Tetranychus canadensis” OR “Tetranychus cinnabarinus” OR “Tetranychus desertorum” OR “Tetranychus frater” OR “Tetranychus kanzawai” OR “Tetranychus lambi” OR “Tetranychus ludeni” OR “Tetranychus mcdanieli” OR “Tetranychus mexicanus” OR “Tetranychus neocaledonicus”

	OR "Tetranychus pacificus" OR "Tetranychus schoenei" OR "Tetranychus turkestani" OR "Tetranychus urticae" OR "Tetrops praeusta" OR "Thelonectria lucida" OR "Theocolax formiciformis" OR "Thrips australis" OR "Thrips hawaiiensis" OR "Thrips imaginis" OR "Thrips italicus" OR "Thrips obscuratus" OR "Thrips tabaci" OR "Tiracola grandirena" OR "Tischeria malifoliella" OR "Tobacco mosaic virus" OR "Tobacco necrosis virus" OR "Tobacco ringspot virus" OR "Tomato bushy stunt virus" OR "Tomato ringspot virus" OR "Torula herbarum" OR "Torymus druparum" OR "Toxoptera aurantii" OR "Trachys minutus" OR "Trametes pubescens" OR "Trametes versicolor" OR "Trametes zonata" OR "Trematosphaeria communis" OR "Trichia botrytis" OR "Trichoderma harzianum" OR "Trichodorus similis" OR "Trichodorus viruliferus" OR "Trichoferus campestris" OR "Trichothecium roseum" OR "Trioza urticae" OR "Tripospermum acerinum" OR "Tripospermum camelopardus" OR "Tripospermum myrti" OR "Tropinota hirta" OR "Tropinota squalida" OR "Trypodendron domesticum" OR "Trypodendron signatum" OR "Tulare apple mosaic virus" OR "Tydeus dorothyae" OR "Tydeus plumosus" OR "Tydeus shabestariensis" OR "Tydeus unguis" OR "Tylenchorhynchus mashhoodi" OR "Tympanis conspersa" OR "Typhlocyba pomaria" OR "Typhlocyba quercus" OR "Typhlodromus khosrovensis" OR "Typhlodromus pyri" OR "Typhlodromus vulgaris" OR "Tyrophagus curvipenis" OR "Urophorus humeralis" OR "Uwebraunia commune" OR "Uwebraunia dekkeri" OR "Valsa ambiens" OR "Valsa amphibola" OR "Valsa ceratosperma" OR "Valsa mali var. mali" OR "Valsa mali var. pyri" OR "Valsaria insitiva" OR "Valsella melastoma" OR "Venturia asperata" OR "Venturia inaequalis" OR "Venturia pyrina" OR "Verticillium albo-atrum" OR "Verticillium dahliae" OR "Watabura nishiyae" OR "Xenotemna pallorana" OR "Xestia c-nigrum" OR "Xiphinema americanum sensu stricto" OR "Xiphinema belmontense" OR "Xiphinema bricolense" OR "Xiphinema browni" OR "Xiphinema californicum" OR "Xiphinema diversicaudatum" OR "Xiphinema index" OR "Xiphinema luci" OR "Xiphinema mali" OR "Xiphinema meridianum" OR "Xiphinema pachtaicum" OR "Xiphinema paramonovi" OR "Xiphinema parvistilus" OR "Xiphinema radicicola" OR "Xiphinema rivesi" OR "Xiphinema vuittenezi" OR "Xyleborinus saxeseni" OR "Xyleborinus saxesenii" OR "Xyleborus dispar" OR "Xyleborus saxeseni" OR "Xylinophorus strigifrons" OR "Xylosandrus crassiusculus" OR "Xylosandrus germanus" OR "Xylotoles laetus" OR "Xylotrechus namanganensis" OR "Yponomeuta malinella" OR "Yponomeuta padella" OR "Ypsolopha horridella" OR "Ypsolopha scabrella" OR "Zasmidium angulare" OR "Zetiasplozna thuemenii" OR "Zeuzera coffeae" OR "Zeuzera pyrina" OR "Zygina flammigera" OR "Zygina zealandica" OR "Zygophiala cryptogama" OR "Zygophiala cylindrica" OR "Zygophiala emperorae" OR "Zygophiala qianensis" OR "Zygophiala tardicrescens" OR "Zygophiala wisconsinensis")

Appendix C – List of pests that can potentially cause an effect not further assessed

Table C.1: List of potential pests not further assessed

N.	Pest name	EPPO Code	Group	Pest present in the UK	Present in the EU	Pest can be associated with the commodity	Impact	Justification for inclusion in this list
1	*Conogethes punctiferalis*	DICHPU	Insect	Intercepted	No	Yes	Uncertain	Presence in UK is uncertain.
2	*Homona coffearia*	HOMOCO	Insect	Yes	No	Yes	Uncertain	Distribution in UK is uncertain. Impact on *Malus* spp. is uncertain.
3	*Dysaphis brancoi* spp. *rogersoni*		Insect	Yes	Restricted	Yes	Uncertain	Taxonomy is uncertain
4	*Acanthococcus lagerstroemiae*		Insect	Intercepted	No	Yes	Uncertain	Presence in UK is uncertain
5	Clover yellow mosaic virus	CLYMV0	Virus	Intercepted	Restricted	Yes	Uncertain	Presence in UK is uncertain

Appendix D – Excel file with the pest list of *Malus domestica*

Appendix D can be found in the online version of this output (in the 'Supporting information'section).