SCIENTIFIC OPINION

efsa JOURNAL

ADOPTED: 27 June 2023

doi: 10.2903/j.efsa.2023.8118

Commodity risk assessment of *Fagus sylvatica* plants from the UK

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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 plants of *Fagus sylvatica* imported from the United Kingdom (UK) as: (a) 1- to 7-year-old bare root plants for planting, (b) < 1- to 15-year-old plants in pots and (c) bundles of 1- to 2-year-old whips and seedlings, taking into account the available scientific information, including the technical information provided by the UK. All pests associated with the commodity were evaluated against specific criteria for their relevance for this opinion. Two EU quarantine pests, *Phytophthora ramorum* (non-EU isolates) and *Thaumetopoea processionea*, and two pests not regulated in the EU, *Meloidogyne mali* and *Phytophthora kernoviae*, fulfilled all relevant criteria and were selected for further evaluation. For the selected pests, the risk mitigation measures implemented in the technical dossier from the UK were evaluated taking into account the possible limiting factors. For these pests an expert judgement is given on the likelihood of pest freedom taking into consideration the risk mitigation measures acting on the pest, including uncertainties associated with the assessment. In the assessment of risk, the age of the plants was considered, reasoning that older trees are more likely to be infested mainly due to longer exposure time and larger size. The degree of pest freedom varies among the pests evaluated, with *M. mali* being the pest most frequently expected on the imported plants. The expert knowledge elicitation (EKE) indicated with 95% certainty that between 9,793 and 10,000 plants in pots up to 15 years old per 10,000 will be free from *M. mali*.

Keywords: beech, European Union, commodity risk assessment, plant health, plant pest

Requestor: European Commission

Question number: EFSA-Q-2022-00459

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Declaration 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.

Acknowledgements: The Scientific Opinion was prepared in cooperation with the Università degli studi di Padova, Dipartimento Agronomia, Animali, Alimenti, Risorse Naturali e Ambiente (Italy) under the EFSA Art. 36 Framework Partnership Agreement 'GP/EFSA/ALPHA/2019/01' – Lot 3 - taxa traded mostly as plants for planting for forestry purposes.

Suggested citation: EFSA PLH Panel (EFSA Panel on Plant Health), Bragard, C., Baptista, P., Chatzivassiliou, E., Di Serio, F., Jaques Miret, J. A., Justesen, A. F., MacLeod, A., Magnusson, C. S., Milonas, P., Navas-Cortes, J. A., Parnell, S., Potting, R., Reignault, P. L., Stefani, E., Thulke, H.-H., Van der Werf, W., Vicent Civera, A., Yuen, J., ... Gonthier, P. (2023). Commodity risk assessment of *Fagus sylvatica* plants from the UK. *EFSA Journal, 21*(7), 1–151. https://doi.org/10.2903/j.efsa.2023.8118

ISSN: 1831-4732

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1. Introduction

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

1.1.1. Background

The 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 *Fagus sylvatica* from the UK taking into account the available scientific information, including the technical dossier provided by the UK.

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 *Fagus sylvatica* from the UK following the Guidance on commodity risk assessment for the evaluation of high-risk plant dossiers (EFSA PLH Panel, 2019), taking into account the available scientific information, including the technical information provided by the UK.

In accordance with the Agreement on the withdrawal of the United Kingdom of Great Britain and Northern Ireland from the European Union and the European Atomic Energy Community, and in particular Article 5(4) of the Protocol on Ireland/Northern Ireland in conjunction with Annex 2 to that Protocol, for the purposes of this Opinion, references to the United Kingdom do not include Northern Ireland.

[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.

The EU quarantine pests that are regulated as a group in the Commission Implementing Regulation (EU) 2019/2072[4] 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, Monaco, Montenegro, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (SeveroZapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo-Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug), San Marino, Serbia, Switzerland, Türkiye, Ukraine and the United Kingdom (except Northern Ireland[5])).

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. pest 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 case a pest is at the same time regulated as a RNQP and as a Protected Zone quarantine pest, in this Opinion it should be evaluated as quarantine pest.

In its evaluation the Panel:

- Checked whether the provided information in the technical dossier (hereafter referred to as 'the Dossier') provided by the applicant (United Kingdom, Department for Environment Food and Rural Affairs – hereafter referred to as 'DEFRA') was sufficient to conduct a commodity risk assessment. When necessary, additional information was requested to the applicant.
- Selected the relevant Union quarantine pests and protected zone quarantine pests (as specified in Commission Implementing Regulation (EU) 2019/2072, hereafter referred to as 'EU quarantine pests') and other relevant pests present in the UK and associated with the commodity.
- Did not assess the effectiveness of measures for Union quarantine pests for which specific measures are in place for the import of the commodity from the UK in Commission Implementing Regulation (EU) 2019/2072 and/or in the relevant legislative texts for emergency measures and if the specific country is in the scope of those emergency measures. The assessment was restricted to whether or not the applicant country implements those measures.
- Assessed the effectiveness of the measures described in the Dossier for those Union quarantine pests for which no specific measures are in place for the importation of the commodity from the UK and other relevant pests present in the UK and associated with the commodity.

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

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

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

2. Data and Methodologies

2.1. Data provided by DEFRA of the UK

The Panel considered all the data and information (hereafter called 'the Dossier') provided by DEFRA of the United Kingdom (UK) in June 2022 including the additional information provided by DEFRA of the UK in January 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	Fagus sylvatica commodity information final
2.0	Pest list	Fagus_Pest_List_Final
3.0	Additional information: answers	Fagus sylvatica additional information 1 Dec 2022
4.0	Additional information: distribution of *Fagus sylvatica* plants	Fagus_sylvatica_distribution (1)
5.0	Additional information: Pest details	Fagus_sylvatica-EFSA_pest_detail_request_Jan23
6.0	Additional information: producers sample product list	Fagus_sylvatica_producers_sample_product_list

The data and supporting information provided by DEFRA of the UK formed the basis of the commodity risk assessment. Table 2 shows the main data sources used by DEFRA of the UK to compile the Dossier (Dossier Sections 1.0 and 2.0).

Table 2: Databases used in the literature searches by DEFRA of the UK

Database	Platform/Link
Aphid Species File	http://aphid.speciesfile.org/HomePage/Aphid/HomePage.aspx
APS (The American Phytopathological Society)	https://www.apsnet.org/Pages/default.aspx
Bark and Ambrosia Beetles of the Americas	https://www.barkbeetles.info/
Biological Records Centre	https://www.brc.ac.uk/
British Bugs	https://www.britishbugs.org.uk/
British Leafminers	https://www.leafmines.co.uk/
CABI Crop Protection Compendium	https://www.cabi.org/cpc/
CABI Plantwise Knowledge Bank	https://www.plantwise.org/knowledgebank/
Checklist of Aphids of Britain	https://www.influentialpoints.com/aphid/Checklist_of_aphids_in_Britain.htm
Checklist of Diptera of the British Isles	https://www.dipterists.org.uk/checklist
Database of the World's Lepidopteran Host Plants	https://www.nhm.ac.uk/our-science/data/hostplants/
EPPO Global Database	https://gd.eppo.int/
GBIF (Global Biodiversity Information Facility)	https://www.gbif.org/
HANTSMOTHS - The Lepidoptera (Moths and Butterflies) of Hampshire and Isle of Wight	https://www.hantsmoths.org.uk/
Index Fungorum	https://www.indexfungorum.org/
Lepiforum e. V.	https://www.lepiforum.org/
Mycobank	https://www.mycobank.org/
Moth Dissection UK	https://mothdissection.co.uk/
Nature Spot recording the wildlife of Leicestershire and Rutland	https://www.naturespot.org.uk/
NBN Atlas	https://nbnatlas.org/
Norfolk moths	https://www.norfolkmoths.co.uk/
Plant Parasites of Europe	https://www.bladmineerders.nl/

Database	Platform/Link
Scalenet	http://scalenet.info/associates/
Spider Mites Web	https://www1.montpellier.inra.fr/CBGP/spmweb/advanced.php
Thaer-Institut für Agrar- und Gartenbauwissenschaften	https://www.agrar.hu-berlin.de/de
The British Plant Gall Society	https://www.britishplantgallsociety.org/
The leaf and stem mines of British flies and other insects	https://www.ukflymines.co.uk/index.php
The Sawflies (Symphyta) of Britain and Ireland	https://www.sawflies.org.uk/
UK Beetle Recording	https://www.coleoptera.org.uk/
UK Beetles	https://www.ukbeetles.co.uk/
UK Moths	https://www.ukmoths.org.uk/
UK Plant Health Risk Register	https://planthealthportal.defra.gov.uk/pests-and-diseases/uk-plant-health-risk-register/
USDA fungal database	https://data.nal.usda.gov/dataset/united-states-national-fungus-collections-fungus-host-dataset

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 *F. sylvatica*. The following searches were combined: (i) a general search to identify pests reported on *F. sylvatica* in the databases and subsequently (ii) a tailored search to identify whether the above pests are present or not in the UK. The searches were run between August and October 2022. No language, date or document type restrictions were applied in the search strategy.

The Panel used the databases indicated in Table 3 to compile the list of pests associated with *F. sylvatica*. 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 3: Databases used by EFSA for the compilation of the pest list associated with *Fagus sylvatica*

Database	Platform/Link
Aphids on World Plants	http://www.aphidsonworldsplants.info/C_HOSTS_AAIntro.htm?LMCL=ZcODD7
BIOTA of New Zealand	https://biotanz.landcareresearch.co.nz/
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://ec.europa.eu/food/plants/plant-health-and-biosecurity/European-union-notification-system-plant-healthinterceptionsen
Leaf-miners	https://www.leafmines.co.uk/html/plants.htm
Nemaplex	http://nemaplex.ucdavis.edu/Nemabase2010/PlantNematodeHostStatusDDQuery.aspx
Plant Pest Information Network	https://www.mpi.govt.nz/news-and-resources/resources/registers-and-lists/plant-pest-information-network/
Plant Viruses Online	https://www1.biologie.uni-hamburg.de/b-online/e35/35tmv.htm#Range
Scalenet	http://scalenet.info/associates/
Spider Mites Web	https://www1.montpellier.inra.fr/CBGP/spmweb/advanced.php
USDA ARS Fungal Database	https://data.nal.usda.gov/dataset/united-states-national-fungus-collections-fungus-host-dataset

Database	Platform/Link
Web of Science: All Databases (Web of Science Core Collection, CABI: CAB Abstracts, BIOSIS Citation Index, Chinese Science Citation Database, Current Contents Connect, Data Citation Index, FSTA, KCI-Korean Journal Database, Russian Science Citation Index, MEDLINE, SciELO Citation Index, Zoological Record)	Web of Science https://www.webofknowledge.com
World Agroforestry	https://www.worldagroforestry.org/treedb2/speciesprofile.php?Spid=1749

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

In the second step, the implemented risk mitigation measures for each relevant pest were evaluated.

A conclusion on the pest freedom status of the commodity for each of the relevant pests was determined and uncertainties identified using expert judgements.

Pest freedom was assessed by estimating the number of infested/infected units out of 10,000 exported units. Further details on the methodology used to estimate the likelihood of pest freedom are provided in Section 2.3.4.

2.3.1. Commodity data

Based on the information provided by DEFRA of 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 the commodity from the UK, a pest list was compiled. The pest list is a compilation of all identified plant pests reported as associated with *F. sylvatica* based on information provided in the Dossier Sections 1.0, 2.0, 3.0, 4.0, 5.0 and 6.0 and 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 names of the host plant (i.e. *Fagus sylvatica*) were 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 investigated by searching for the interceptions associated with *F. sylvatica* imported from the whole world from 1995 to May 2020 and TRACES-NT from May 2020 to 22 December 2022, respectively. For the pests selected for further evaluation, a search in the EUROPHYT and/or TRACES-NT was performed for the years between 1995 and December 2022 for the interceptions from the whole world, at species level.

The search strategy used for Web of Science Databases was designed combining English common names for pests and diseases, terms describing symptoms of plant diseases and the scientific and English common names of the commodity and excluding pests which were identified using searches in other databases. The established search strings are detailed in Appendix B and they were run on 22 August 2022.

The titles and abstracts of the scientific papers retrieved were screened and the pests associated with *F. sylvatica* 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® in Appendix F) includes all identified pests that use as host *F. sylvatica*.

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 E (List of pests that can potentially cause an effect not further assessed).

2.3.3. Listing and evaluation of risk mitigation measures

All implemented risk mitigation measures were listed and evaluated. When evaluating the likelihood of pest freedom of the commodity, the following types of potential infection/infestation sources for *F. sylvatica* in export nursery were considered (see also Figure 1):

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

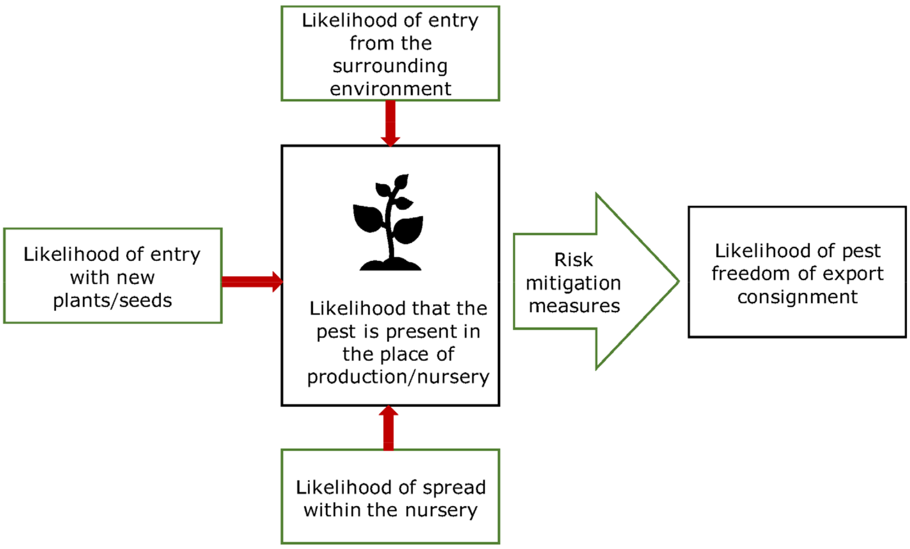

Figure 1: Conceptual framework to assess likelihood that plants are exported free from relevant pests (Source: EFSA PLH Panel, 2019)

The risk mitigation measures proposed by DEFRA of the UK were evaluated with expert knowledge elicitation (EKE) according to the Guidance on uncertainty analysis in scientific assessment (EFSA Scientific Committee, 2018).

Information on the biology, likelihood of entry of the pest to the export nursery, of its spread inside the nursery and the effect of measures on the specific pests were summarised in data sheets of pests selected for further evaluation (see Appendix A).

2.3.4. Expert knowledge elicitation

To estimate the pest freedom of the commodities an EKE was performed following EFSA guidance (Annex B.8 of EFSA Scientific Committee, 2018). The specific question for EKE was: 'Taking into account (i) the risk mitigation measures in place in the nurseries and (ii) other relevant information, how many of 10,000 commodity units, either single plants or bundles of plants will be infested with the relevant pest when arriving in the EU?

The risk assessment considers bundles of 5–15 for bare root whips and bundles of 25–50 for 1- to 2-year-old seedlings, 1- to 7-year-old bare root single plants and < 1- to 15-year-old single plants in pots.

The following reasoning is given for considering bundles of whips and seedlings:

i) There is no quantitative information available regarding clustering of plants during production;
ii) Plants are grouped in bundles of 5, 10, 15, 25 or 50 after sorting;
iii) For the pests under consideration, a cross-contamination during transport is possible.

The following reasoning is given for considering single plants (bare root or in pots):

i) The inspections before export are targeted on individual plants.
ii) It is assumed that the product will be distributed in the EU as individual plants to the consumer.

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

The commodities of *F. sylvatica* (common name: European beech; family: Fagaceae) to be imported from the UK to the EU are whips, bare root plants and rooted plants in pots (Dossier Sections 1.0 and 3.0). According to the Dossier Section 3.0, none of the nurseries expected to export to the EU are using grafting in the production of *F. sylvatica*.

The commodities are as follows:

- Whips and seedlings: the age of plants is between 1 and 2 years (Dossier Section 1.0). The diameter is between 4 and 10 mm. Whips are slender, unbranched trees. Whips can be bare root or containerised. Whips may have some leaves at the time of export, particularly when exported in November (Dossier Section 3.0). Seedlings are defined here as smaller plants which are grouped in larger bundles (see Section 3.3.6).
- Bare root plants: the age of plants is between 1 and 7 years (Dossier Section 1.0). The diameter is between 30 and 40 mm for 7-year-old plants. Bare root plants may have some leaves at the time of export, particularly when exported in November (Dossier Section 3.0).
- Rooted plants in pots: the age of plants is from less than 1 year to 15 years (Dossier Section 1.0). The diameter is between < 4 and 80 mm. The plants in pots may be exported with leaves, depending on the timing of the export (Dossier Section 3.0).

The growing media is virgin peat or peat-free compost (a mixture of coir, tree bark, wood fibre, etc.) (Dossier Sections 1.0 and 3.0) complying with the requirements for growing media as specified in the Annex VII of the Commission Implementing Regulation 2019/2072.

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

According to the Dossier Section 1.0, the trade volume is up to 350,000 bare root plants and 100,000 rooted plants in pots per year. The trade of these plants will mainly be to Northern Ireland and the Republic of Ireland.

According to the Dossier Section 1.0 the intended use of the commodities: plants are supplied directly to professional operators and traders. Uses may include propagation, growing-on, onward trading or direct sales to final consumers but will generally fall into two categories:

- Tree production and further growing-on by professional operators or
- Direct sales to final users as ornamental plants.
- Landscapers and garden centres, mainly for hedging but also some woodland and ornamental/landscape planting.

3.2. Description of the production areas

There are four known nurseries in the UK that are producing *F. sylvatica* plants for the export to the EU (Dossier Section 3.0). The nurseries are shown in Figure 2.

Figure 2: Nurseries in the UK of *Fagus sylvatica* plants for the export to the EU (Source: Dossier Section 3.0)

Fagus species are grown in Great Britain in line with the Plant Health (Amendment etc.) (EU Exit) Regulations 2020[6] and the Plant Health (Phytosanitary Conditions) (Amendment) (EU Exit) Regulations 2020[7]. These regulations are broadly similar to the EU phytosanitary regulations (Dossier Section 1.0). Producers do not set aside separate areas for export production. All plants within the UK nurseries are grown under the same phytosanitary measures, meeting the requirements of the UK Plant Passporting regime (Dossier Section 1.0).

The size of the nurseries is between 8 and 150 ha for container stock (plants in pots) and up to 325 ha for field grown stock (Dossier Section 3.0).

The nurseries also grow other plant species as shown in the Appendix C. The minimum and maximum proportion of *F. sylvatica* compared to the other plant species grown in the nurseries is

[6] Plant Health (Amendment etc.) (EU Exit) Regulations 2020 of 14 December 2020, No. 1482, 80 pp. Available online: https://www.legislation.gov.uk/uksi/2020/1482/contents/made

[7] Plant Health (Phytosanitary Conditions) (Amendment) (EU Exit) Regulations 2020, No. 1527, 276 pp. Available online: https://www.legislation.gov.uk/uksi/2020/1527/contents/made

between 1% and 6%. The majority of the nurseries also produce plants for the local market, and there is no distancing between production areas for the export and the local market (Dossier Section 3.0).

The nurseries are kept clear of non-cultivated herbaceous plants. In access areas, non-cultivated herbaceous plants are kept to a minimum and only exist at nursery boundaries. Non-cultivated herbaceous plants grow on less than 1% of the nursery area. The predominant species is rye grass (*Lolium* sp.). Other identified species include dandelions (*Taraxacum officinale*), hairy bittercress (*Cardamine hirsute*), common daisy (*Bellis perennis*), creeping cinquefoil (*Potentilla reptans*) and bluebells (*Hyacinthoides non-scripta*). These are all extremely low in number (Dossier Section 3.0).

There are hedges surrounding the export nurseries made up of a range of species including hazel (*Corylus avellana*), yew (*Taxus baccata*), holly (*Ilex* sp.), ivy (*Hedera* sp.), alder (*Alnus glutinosa*), cherry laurel (*Prunus laurocerasus*), hawthorn (*Crataegus* sp.), blackthorn (*Prunus spinosa*) and leylandii (*Cupressus* × *leylandii*) (Dossier Section 3.0).

The closest *Fagus* plants grown in the surroundings are 5 m away from the nurseries (Dossier Section 3.0).

Nurseries are predominately situated in the rural areas. The surrounding land would tend to be arable farmland with some pasture for animals and small areas of woodland. Hedges are often used to define field boundaries and grown along roadsides (Dossier Section 3.0).

Arable crops within a radius of 2 km from the nurseries are rotated in line with good farming practice and could include oilseed rape (*Brassica napus*), wheat (*Triticum* sp.), barley (*Hordeum vulgare*), turnips (*Brassica rapa* subsp. *rapa*), potatoes (*Solanum tuberosum*) and maize (*Zea mays*) (Dossier Section 3.0).

Pastures are present within a radius of 2 km from the nurseries and are predominantly ryegrass (*Lolium* sp.) (Dossier Section 3.0).

Woodland is present within a radius of 2 km from the nurseries. Woodlands tend to be a standard UK mixed woodland, with a range of the UK native trees such as oak (*Quercus robur*), pine (*Pinus* sp.), poplar (*Populus* sp.), ash (*Fraxinus* sp.), sycamore (*Acer pseudoplatanus*), holly (*Ilex* sp.), Norway maple (*Acer platanus*) and field maple (*Acer campestre*). The nearest woodland in one of the nurseries borders the boundary fence (Dossier Section 3.0).

It is not possible to identify the plant species growing within the gardens of private dwellings within a radius of 2 km from the nurseries (Dossier Section 3.0).

Other plants likely to be present in the surroundings of the nurseries (within 2 km radius) are: *Abies* spp., *Acer* spp., *Aesculus* spp., *Camellia* spp., *Capsicum annuum*, *Carpinus betulus*, *Castanea* spp., *Daucus carota*, *Larix* spp., *Larix kaempferi, Larix decidua, Magnolia* spp., *Malus* spp., *Morus* spp., *Prunus* spp., *Quercus* spp., *Rhododendron* spp., *Rosa* spp., *Rubus* spp., *Solanum laciniatum*, *Solanum melongena*, *Solanum lycopersicum*, *Solanum tuberosum*, *Sorbus* spp., *Syringa* spp., *Taraxacum officinale*, *Ulmus* spp., *Vaccinium vitis-idaea, Vaccinium myrtillus* and *Viburnum* spp. (Dossier Section 3.0).

Based on the global Köppen–Geiger climate zone classification (Kottek et al., 2006), the climate of the production areas of *F. sylvatica* in the UK is classified as Cfb, i.e. main climate (C): warm temperate; precipitation (f): fully humid; temperature (b): warm summer.

3.3. Production and handling processes

3.3.1. Source of planting material

The starting material of the commodities is a mix of seeds and seedlings depending on the nursery (Dossier Section 3.0).

Seeds purchased in the UK are certified under The Forest Reproductive Material (Great Britain) Regulations 2002. Seedlings sourced in the UK are certified with the UK Plant Passports. Seedlings from the EU countries are certified with phytosanitary certificates. Some plants are obtained from the EU (the Netherlands and France) (Dossier Section 3.0).

None of the nurseries expected to export to the EU produce plants from grafting, they use only seed and seedlings; therefore, there are no mother plants of *F. sylvatica* present in the nurseries (Dossier Section 3.0).

3.3.2. Production cycle

Plants are either grown in containers (cells, pots, tubes, etc.) or in field. Cell grown trees may be grown in greenhouses, however most plants will be field grown, or field grown in containers (Dossier

Section 1.0). Plants grown under protection are maintained in plastic polytunnels, or in glasshouses which typically consist of a metal or wood frame construction and glass panels. As the plants are intended for outdoor cultivation it is normally only certain growth stages that are maintained under protection, such as young or seedling plants where there is an increased vulnerability due to climatic conditions including frost (Dossier Section 3.0). The PLH Panel assumes that plants in pots could be cultivated for the whole period in pots or grown in the field and then transplanted in pots at a later stage. In this last case, it is assumed that the roots will be washed before potting and soil removed as required by the legislation for a commodity to be exported to the EU.

Bare root plants are planted from autumn until spring (October to April); rooted plants in pots can be planted at any time of year, though winter is most common (Dossier Section 1.0).

According to the Dossier Section 1.0, bare root plants are harvested from late autumn until early spring to be able to lift plants from the field and because this is the best time to move dormant plants. Rooted plants in pots can be moved at any point in the year to fulfil consumer demand.

The growing media is virgin peat or peat-free compost. 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 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 (Dossier Section 1.0).

The irrigation is done on the need basis and could be overhead, sub irrigation or drip irrigation. Water used for irrigation can be drawn from several sources, the mains supply, bore holes or from rainwater collection or watercourses (Dossier Section 3.0). Additional information on water used for irrigation is provided in the Appendix D. Regardless of the source of the water used to irrigate, none of the nurseries have experienced the introduction of a pest/disease as a result of contamination of the water supply (Dossier Section 3.0).

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 is routinely sampled and sent for analysis (Dossier Section 1.0).

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 (Dossier Section 1.0).

General hygiene measures are undertaken as part of routine nursery production, including disinfection of tools and equipment between batches/lots and different plant species (Dossier Sections 1.0 and 3.0). The tools are dipped in a disinfectant solution and wiped with a clean cloth between trees to reduce the risk of virus and bacterial transfer between subjects. There are various disinfectants available, with Virkon S (active substance: potassium peroxymonosulfate and sodium chloride) being a common example (Dossier Section 3.0).

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 (Dossier Section 1.0).

3.3.3. Pest monitoring during production

All producers are registered as professional operators with the UK Competent Authority via the Animal and Plant Health Agency (APHA) for England and Wales, or with the Science and Advice for Scottish Agriculture (SASA) for Scotland, and are authorised to issue the UK plant passports, verifying they meet the required national sanitary standards. The Competent Authority inspect crops at least once a year to check they meet the standards set out in the guides. Assessments are normally made based on visual examinations, but samples may be taken for laboratory analysis to get a definitive diagnosis (Dossier Section 1.0).

The Plant Health and Seeds Inspectorate (PHSI), part of APHA, execute plant health policy, except forestry matters, in England and Wales under a Memorandum of Understanding with DEFRA and with the Welsh Government. In Scotland, this role is carried out by inspectors in the Rural Payments and Inspections Division and the Horticulture and Marketing Unit, in SASA. PHSI and Scottish inspectors carry out import, export, monitoring and survey inspections, issue phytosanitary certificates and oversee import controls, issuing of plant passports and eradication campaigns (Dossier Section 1.0).

The sanitary status of production areas is controlled by the producers as part of these schemes, as well as via official inspections by APHA PHSI or with SASA (Scotland) (Dossier Section 1.0).

All producers are subject to regular inspections by plant health inspectors as part of either Plant Passporting audits, or a programme of general surveillance of all registered producers (Dossier Section 1.0).

The UK plant health inspectors monitor for pests and diseases during crop certification and passporting inspections. In addition, the PHSI (in England and Wales) carry out a programme of Quarantine Surveillance in registered premises, inspecting plants grown and moving within the UK market. Similar arrangements operate in Scotland (Dossier Section 1.0).

According to the Dossier Section 1.0 the objective of the quarantine surveillance is to ensure that:

- the plant passport regime is being operated effectively.
- quarantine organisms are not spread on plants and plant produce which are not subject to plant passporting.
- the UK plant health authorities have early warning of any new threat from a previously unknown pest or disease which has become established within the UK.
- plant health authorities can take informed decisions on the scope and operation of the plant passport regime.

According to the Dossier Section 1.0, the quarantine surveillance programme centres on a risk-based selection of premises to visit, based on size, types of plants grown, source of plants and the producer's track record of pest and disease issues. Guidance on visit frequency is given to inspectors to ensure that those sites which present the greatest risk are visited more frequently than those of lower risk. The risk category assigned to a premise determines the frequency of visit:

- very high risk (multiple visits per year);
- high risk (two/three visits per year);
- medium risk (annual visit);
- low risk (once every 3 years).

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. The 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 (Dossier Section 1.0).

In the last 3 years, there has been a substantial level of inspection of registered *Fagus* producers, both in support of the Plant Passporting scheme (checks are consistent with the EU legislation, with a minimum of one a year for authorised operators) and as part of the Quarantine Surveillance programme (Great Britain uses the same framework for its surveillance programme as the EU) (Dossier Section 1.0).

Plant material is regularly monitored for plant health issues. Pest monitoring is carried out by trained nursery staff via crop walking and records kept of this monitoring. Qualified agronomists also undertake 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 (Dossier Section 1.0).

The crops are inspected visually on a regular basis by competent nursery staff as part of the growing process. All plants are also carefully inspected by nurseries on arrival and dispatch for any plant health issues (Dossier Section 3.0).

It is a legal requirement under the UK Plant Health law for any person in charge of a premise to notify the Competent Authority of the presence, or suspected presence, of a plant pest. The requirement is not limited to those organisms listed in the UK legislation but is also required for any organism not normally present in the UK which is likely to be injurious to plants (Dossier Section 1.0).

The nurseries follow the Plant Health Management Standard issued by the Plant Healthy Certification Scheme of which DEFRA, the Royal Horticultural Society and others contribute to via The Plant Health Alliance Steering Group (Dossier Section 3.0).

The UK surveillance is based on visual inspection with samples taken from symptomatic material, and where appropriate, samples taken from asymptomatic material (e.g. plants, tubers, soil, watercourses). According to the Dossier Section 3.0, for sites with the likelihood of multiple pest and host combinations (e.g. ornamental and retail sites) standard methods are used 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. For inspections of single hosts, possibly with multiple pests, survey site selection is often directed to specific locations identified by survey planners, for example 0.5% of ware production land is annually sampled for potato cyst nematode (PCN) with farms randomly selected and sampled at a rate of 50 cores per hectare (Dossier Section 3.0).

During production, in addition to the general health monitoring of the plants by the nurseries, official growing season inspections are undertaken by the UK Plant Health Service at an appropriate time, taking into consideration factors such as the likelihood of pest presence and growth stage of the crop. Where appropriate this could include sampling and laboratory analysis. Official sampling and analysis could also be undertaken nearer to the point of export depending on the type of analysis and the import requirements of the country being exported to. Samples are generally taken on a representative sample of plants, in some cases however where the consignment size is quite small all plants are sampled. Magnification equipment is provided to all inspectors as part of their standard equipment and is used during inspections when appropriate (Dossier Section 3.0).

All residues or waste materials shall be assessed for the potential to host, harbour and transmit pests (Dossier Section 1.0).

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 (Dossier Section 1.0).

3.3.4. Pest management during production

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 (Dossier Section 1.0).

Pest and disease pressure varies from season to season. Product application takes place only when required and depends on situation (disease 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 applications of pesticides. In many circumstances also, biological control is used to control outbreaks, rather than using chemical treatments (Dossier Section 3.0).

Examples of typical treatments used against mildew, *Botrytis*, spider mites, aphids and thrips are detailed in the Dossier Section 3. These would be applied at the manufacturers recommended rate and intervals (Dossier Section 3.0).

There are no specific measures/treatments against the soil pests. However, containerised plants are grown in trays on top of protective plastic membranes to prevent contact with soil. Membranes are regularly refreshed when needed. Alternatively, plants may be grown on raised galvanised steel benches stood on gravel as a barrier between the soil and bench feet and/or concreted surfaces (Dossier Section 3.0).

Post-harvest and through the autumn and winter, nursery management is centred on pest and disease prevention and maintaining good levels of nursery hygiene. Leaves, pruning residues and weeds are all removed from the nursery to reduce the number of over wintering sites for pests and diseases (Dossier Section 1.0).

3.3.5. Inspections before export

The UK NPPO carries out inspections and testing where required by the country of destination's plant health legislation, to ensure all requirements are fulfilled and a valid phytosanitary certificate with the correct additional declarations is issued (Dossier Section 1.0).

Separate to any official inspection, plant material is checked by growers for plant health issues prior to dispatch (Dossier Section 1.0).

A final pre-export inspection is undertaken as part of the process of issuing a phytosanitary certificate. These inspections are generally undertaken as near to the time of export as possible, usually within 1–2 days, and not more than 2 weeks before export. Phytosanitary certificates are only issued if the commodity meets the required plant health standards after inspection and/or testing according to appropriate official procedures (Dossier Section 3.0).

The protocol for plants infested by pests during inspections before export is to treat the plants, if they are on site for a sufficient period of time, or to destroy any plants infested by pests otherwise. All other host plants in the nursery would be treated. The phytosanitary certificate for export will not be issued until the UK Plant Health inspectors confirm that the plants are free from pests (Dossier Section 3.0).

3.3.6. Export procedure

Bare root plants are lifted from late autumn until early spring (October–April) to be able to lift plants from the field and because this is the best time to move dormant plants (Dossier Section 1.0). Bare root plants are lifted, washed free from soil with a low-pressure washer in the outdoors nursery area away from packing/cold store area (Dossier Section 3.0).

Rooted plants in pots can be moved at any point in the year to fulfil consumer demand, but more usually September to May. These will likely be destined for amenity or garden centre trade rather than nurseries.

The maximum time from the harvesting of bare root plants to the export is up to 5 months. Plants are stored in cold store or heeled into soil (but before export they would be washed to ensure freedom from soil). Most plants for export would be kept in cold store (Dossier Section 3.0).

The preparation of the commodities for export is carried out inside the nurseries in a closed environment, e.g. packing shed (Dossier Section 3.0).

The commodities are sent by lorry and can be exported either between November and April or any time of the year, depending on the type of the commodity. Bare root plants are exported from November and April, while rooted plants in pots are mainly exported between September and May, although these can be moved at any point in the year to fulfil consumer demand. Sensitive plants are occasionally transported by temperature-controlled lorry if weather conditions during transit are likely to be very cold (Dossier Section 1.0).

According to the Dossier Section 3.0, the commodities are dispatched as single bare root trees or in bundles as follows:

- 25 or 50 for seedlings or transplants;
- 5, 10 or 15 for whips.

Bare root plants are placed in bundles, wrapped in polythene and packed and distributed on ISPM 15 certified wooden pallets or metal pallets. Alternatively, they may be placed in pallets which are then wrapped in polythene. Small volume orders may be packed in waxed cardboard cartons or polythene bags and dispatched via courier (Dossier Sections 1.0 and 3.0).

Rooted plants in pots are transported on Danish trolleys for smaller containers, or on ISPM 15 certified wooden pallets or crates/metal pallets, or individually, for larger containers (Dossier Section 1.0).

4. Identification of pests potentially associated with the commodity

The search for potential pests associated with the commodity rendered 1,395 species (see Microsoft Excel® file in Appendix F).

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.

Twelve EU-quarantine species that are reported to use commodity as a host plant were evaluated (Table 4) 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) the commodity is host of the pest;
c) one or more life stages of the pest can be associated with the specified commodity.

Pests that fulfilled all criteria were selected for further evaluation.

Table 4 presents an overview of the evaluation of the 12 EU-quarantine pest species that are reported as associated with the commodity.

Of these 12 EU-quarantine pest species evaluated, 4 species are present in the UK and 2 species (*Phytophthora ramorum* (non-EU isolates) and *Thaumetopoea processionea*) can be associated with the commodity and hence were selected for further evaluation.

Table 4: Overview of the evaluation of the 12 EU-quarantine pest species known to use *Fagus sylvatica* as a host plant for their relevance for this opinion

No.	Pest name according to the EU legislation[(a)]	EPPO code	Group	Pest present in the UK	*Fagus sylvatica* confirmed as a host (reference)	Pest can be associated with the commodity	Pest relevant for the Opinion
1	*Anoplophora chinensis*	ANOLCN	Insects	No	*F. sylvatica* (EPPO, online)	Not assessed	No
2	*Anoplophora glabripennis*	ANOLGL	Insects	No	*F. sylvatica* (EPPO, online)	Not assessed	No
3	*Apriona rugicollis*	APRIJA	Insects	No	*Fagus* (EPPO Bulletin, 2018)	Not assessed	No
4	*Arrhenodes minutus*	ARRHMI	Insects	No	*Fagus* (EPPO, online)	Not assessed	No
5	*Bursaphelenchus xylophilus*	BURSXY	Nematodes	No	*F. sylvatica* (Ferris, online)	Not assessed	No
6	*Cryphonectria parasitica*	ENDOPA	Fungi	Yes	*F. sylvatica* (Farr and Rossman, online)	No[(b)]	No
7	*Euwallacea fornicatus* sensu lato (including: *Euwallacea fornicatus* sensu stricto, *Euwallacea fornicatior*, *Euwallacea kuroshio* and *Euwallacea perbrevis*)	XYLBFO	Insects	No	*F. sylvatica* (EPPO, online)	Not assessed	No
		EUWAWH					
		EUWAFO					
		EUWAKU					
		EUWAPE					
8	*Oemona hirta*	OEMOHI	Insects	No	*F. sylvatica* (EPPO, online)	Not assessed	No
9a	*Phytophthora ramorum* (EU isolates)	PHYTRA	Oomycetes	No	*F. sylvatica* (EPPO, online)	Not assessed	No
9b	*Phytophthora ramorum* (non-EU isolates)	PHYTRA	Oomycetes	Yes	*F. sylvatica* (EPPO, online)	Yes	Yes
10	*Popillia japonica*	POPIJA	Insects	No	*F. sylvatica* (CABI, online)	Not assessed	No
11	*Thaumetopoea processionea*	THAUPR	Insects	Yes	*Fagus* (EPPO, online)	Yes	Yes
12	*Xiphinema rivesi* (non-EU populations)	XIPHRI	Nematodes	No	*Fagus* (Dossier)	Not assessed	No

(a): Commission Implementing Regulation (EU) 2019/2072.
(b): Reports only from artificial inoculation (Dennert et al., 2020).

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

The information provided by the UK, integrated with the search performed by EFSA, was evaluated in order to assess whether there are other potentially relevant pests potentially associated with the commodity species 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) commodity 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.

For non-regulated species with a limited distribution (i.e. present in one or a few EU MSs) and fulfilling the other criteria (i.e. c, d and e), either one of the following conditions should be additionally fulfilled for the pest to be further evaluated:

- official phytosanitary measures have been adopted in at least one EU MS;
- any other reason justified by the working group (e.g. recent evidence of presence).

Pests that fulfilled the above listed criteria were selected for further evaluation.

Based on the information collected, 1,383 potential pests known to be associated with the species commodity were evaluated for their relevance to this Opinion. Species were excluded from further evaluation when at least one of the conditions listed above (a–e) was not met. Details can be found in the Appendix F (Microsoft Excel® file). Of the evaluated EU non-quarantine pests, two pests (*Meloidogyne mali* and *Phytophthora kernoviae*) were selected for further evaluation because they met all of the selection criteria. More information on these two 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 *F. sylvatica* can provide information on some of the organisms that can be present on *F. sylvatica* despite the current measures taken. According to EUROPHYT, online (accessed on 22 December 2022) and TRACES-NT, online (accessed on 22 December 2022), there were no interceptions of plants for planting of *F. sylvatica* from the UK destined to the EU Member States due to the presence of harmful organisms between the years 1995 and 22 December 2022.

4.4. List of potential pests not further assessed

From the list of pests not selected for further evaluation, the Panel highlighted three species (see Appendix E) for which currently available evidence provides no reason to select these species for further evaluation in this Opinion. A specific justification of the inclusion in this list is provided for each species in Appendix E.

4.5. Summary of pests selected for further evaluation

The four pests satisfying all the relevant criteria listed above in the Sections 4.1 and 4.2 are included in Table 5. The effectiveness of the risk mitigation measures applied to the commodity was evaluated for these selected pests.

Table 5: 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	*Meloidogyne mali*	MELGMA	–	Rhabditida Meloidogynidae	Nematodes	Not regulated in the EU
2	*Phytophthora kernoviae*	PHYTKE	–	Peronosporales Peronosporaceae	Oomycetes	Not regulated in the EU
3	*Phytophthora ramorum* (non-EU isolates)	PHYTRA	*Phytophthora ramorum* (non-EU isolates) Werres, De Cock & Man in 't Veld	Peronosporales Peronosporaceae	Oomycetes	EU Quarantine Pest according to Commission Implementing Regulation (EU) 2019/2072
4	*Thaumetopoea processionea*	THAUPR	*Thaumetopoea processionea* L.	Lepidoptera Notodontidae	Insects	EU Protected Zone Quarantine Pest according to Commission Implementing Regulation (EU) 2019/2072

5. Risk mitigation measures

For the selected pests (Table 5), the Panel evaluated the likelihood that it could be present in the *F. sylvatica* nurseries by evaluating the possibility that the commodity in the export nurseries is 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.

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

5.1. Risk mitigation measures applied in the UK

With the information provided by the UK (Dossier Sections 1.0, 2.0, 3.0 and 4.0), the Panel summarised the risk mitigation measures (see Table 6) that are implemented in the production nursery.

Table 6: Overview of implemented risk mitigation measures for *Fagus sylvatica* plants designated for export to the EU from the UK

Number	Risk mitigation measure	Implementation in the UK
1	Registration of production sites	All producers are registered as professional operators with the UK Competent Authority via APHA for England and Wales, or SASA for Scotland, and are authorised to issue the UK plant passports, verifying they meet the required national sanitary standards (Dossier Section 1.0).
2	Physical separation	Producers do not set aside separate areas for export production. All plants within the UK nurseries are grown under the same phytosanitary measures, meeting the requirements of the UK Plant Passporting regime (Dossier Section 1.0).
3	Certified plant material	Seeds purchased in the UK are certified under The Forest Reproductive Material (Great Britain) Regulations 2002. Seedlings sourced in the UK are certified with the UK Plant Passports. Seedlings from the EU countries are certified with phytosanitary certificates. Some plants are obtained from the EU (the Netherlands and France) (Dossier Section 3.0).

Number	Risk mitigation measure	Implementation in the UK
4	Growing media	The growing media is virgin peat or peat-free compost. 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 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 (Dossier Section 1.0).
5	Surveillance, monitoring and sampling	For additional information, see Section 3.3.3 Pest monitoring during production.
6	Hygiene measures	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 (Dossier Section 1.0). General hygiene measures are undertaken as part of routine nursery production, including disinfection of tools and equipment between batches/lots (Dossier Section 1.0) and different plant species (Dossier Sections 1.0 and 3.0). The tools are dipped and wiped with a clean cloth between trees to reduce the risk of virus and bacterial transfer between subjects. There are various disinfectants available, with Virkon S being a common example (Dossier Section 3.0).
7	Removal of infested plant material	Post-harvest and through the autumn and winter, nursery management is centred on pest and disease prevention and maintaining good levels of nursery hygiene. Leaves, pruning and weeds are all removed from the nursery to reduce the number of over wintering sites for pests and diseases (Dossier Section 1.0).
8	Irrigation water	Water for irrigation is routinely sampled and sent for analysis (Dossier Section 1.0).
9	Application of pest control products	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 (Dossier Section 1.0). Examples of typical treatments used against mildew, *Botrytis*, spider mites, aphids and thrips are detailed in the Dossier Section 3. These would be applied at the manufacturers recommended rate and intervals (Dossier Section 3.0).
10	Measures against soil pests	There are no specific measures/treatments against the soil pests. However, containerised plants are grown in trays on top of protective plastic membranes to prevent contact with soil. Membranes are regularly refreshed when needed. Alternatively, plants may be grown on raised galvanised steel benches stood on gravel as a barrier between the soil and bench feet and/or concreted surfaces (Dossier Section 3.0).
11	Inspections and management of plants before export	The UK NPPO carries out inspections and testing where required by the country of destination's plant health legislation, to ensure all requirements are fulfilled and a valid phytosanitary certificate with the correct additional declarations is issued (Dossier Section 1.0). Separate to any official inspection, plant material is checked by growers for plant health issues prior to dispatch (Dossier Section 1.0). A final pre-export inspection is undertaken as part of the process of issuing a phytosanitary certificate. These inspections are generally undertaken as near to the time of export as possible, usually within 1–2 days, and not more than 2 weeks before export. Phytosanitary certificates are only issued if the commodity meets the required plant health standards after inspection and/or testing according to appropriate official procedures (Dossier Section 3.0). The protocol for plants infested by pests during inspections before export is to treat the plants, if they are on site for a sufficient period of time, or to destroy any plants infested by pests otherwise. All other host plants in the nursery would be treated. The phytosanitary certificate for export will not be issued until the UK Plant Health inspectors confirm that the plants are free from pests (Dossier Section 3.0).

Number	Risk mitigation measure	Implementation in the UK
12	Separation during transport to the destination	According to the Dossier Section 3.0, the commodities are dispatched as single bare root trees or in bundles as follows: – 25 or 50 for seedlings or transplants; – 5, 10 or 15 for whips. Bare root plants are placed in bundles, wrapped in polythene, and packed and distributed on ISPM 15 certified wooden pallets, or metal pallets. Alternatively, they may be placed in pallets which are then wrapped in polythene. Small volume orders may be packed in waxed cardboard cartons or polythene bags and dispatched via courier (Dossier Sections 1.0 and 3.0). Rooted plants in pots are transported on Danish trolleys for smaller containers, or on ISPM 15 certified wooden pallets or crates/metal pallets, or individually, for larger containers (Dossier Section 1.0).

5.2. 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 5.2.1–5.2.4). The outcome of the EKE regarding pest freedom after the evaluation of the currently proposed risk mitigation measures is summarised in Section 5.2.5.

5.2.1. Overview of the evaluation of *Meloidogyne mali* (Rhabditida; Meloidogynidae)

Overview of the evaluation of *Meloidogyne mali* for bundles of whips and seedlings					
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 bundles	**9,901** out of 10,000 bundles	**9,940** out of 10,000 bundles	**9,960** out of 10,000 bundles	**9,975** out of 10,000 bundles	**9,989** out of 10,000 bundles
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of infected bundles	**11** out of 10,000 bundles	**25** out of 10,000 bundles	**40** out of 10,000 bundles	**60** out of 10,000 bundles	**99** out of 10,000 bundles
Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity** *Meloidogyne mali* is present in the UK with restricted distribution. Suitable hosts are present both in the nurseries and in the surroundings. *Fagus sylvatica* is a host for *M. mali*. The pest can enter into the nurseries and spread within the nurseries with infected plant material and movement of soil attached to machinery and shoes. The plants could become infected during the growth in the soil in the fields.				

	Measures taken against the pest and their efficacy General measures taken by the nurseries are effective against the nematode. These measures include (a) the use of certified plant material; (b) the use of heat-treated growing media; (c) inspections, surveillance, monitoring, sampling and laboratory testing; (d) hygiene measures; and (e) separation of the pots from soil. **Interception records** In the EUROPHYT/TRACES-NT database, there are no records of notification of *F. sylvatica* plants for planting neither from the UK nor from other countries due to the presence of *M. mali* between the years 1995 and December 2022 (EUROPHYT, online; TRACES-NT, online). **Shortcomings of current measures/procedures** Low pressure water is used for washing roots before export. This washing may not be as effective as using high-pressure water in removing the soil, thereby making symptoms less visible. **Main uncertainties** – Whether symptoms may be promptly detected. – Level of susceptibility of *F. sylvatica*. – Pest pressure of the nematode in the nurseries and in the surrounding areas. – The level to which the low-pressure water can remove the soil.

Overview of the evaluation of *Meloidogyne mali* for bare root plants/trees up to 7 years old					
Rating of the likelihood of pest freedom	Extremely frequently pest free (based on the Median).				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free plants	**9,792** out of 10,000 plants	**9,873** out of 10,000 plants	**9,927** out of 10,000 plants	**9,967** out of 10,000 plants	**9,994** out of 10,000 plants
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of infected plants	**6** out of 10,000 plants	**33** out of 10,000 plants	**73** out of 10,000 plants	**127** out of 10,000 plants	**208** out of 10,000 plants
Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity** *Meloidogyne mali* are present in the UK with restricted distribution. Suitable hosts are present both in the nurseries and in the surroundings. *Fagus sylvatica* is a host for *M. mali*. The pest can enter into the nurseries and spread within the nurseries with infected plant material and movement of soil attached to machinery and shoes. The plants could become infected during the growth in the soil in the fields. **Measures taken against the pest and their efficacy** General measures taken by the nurseries are effective against the nematode. These measures include (a) the use of certified plant material; (b) the use of heat-treated growing media; (c) inspections, surveillance, monitoring, sampling and laboratory testing; (d) hygiene measures; and (e) separation of the pots from soil. **Interception records** In the EUROPHYT/TRACES-NT database, there are no records of notification of *F. sylvatica* plants for planting neither from the UK nor from other countries due to the presence of *M. mali* between the years 1995 and December 2022 (EUROPHYT, online; TRACES-NT, online). **Shortcomings of current measures/procedures** Low pressure water is used for washing roots before export. This washing may not be as effective as using high-pressure water in removing the soil, thereby making symptoms less visible.				

	Main uncertainties – Whether symptoms may be promptly detected. – Level of susceptibility of *F. sylvatica*. – Pest pressure of the nematode in the nurseries and in the surrounding areas. – The level to which the low-pressure water can remove the soil of bare root plants.

Overview of the evaluation of *Meloidogyne mali* for plants in pots up to 15 years old					
Rating of the likelihood of pest freedom	Extremely frequently pest free (based on the Median).				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free plants	**9,793** out of 10,000 plants	**9,866** out of 10,000 plants	**9,914** out of 10,000 plants	**9,953** out of 10,000 plants	**9,986** out of 10,000 plants
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of infected plants	**14** out of 10,000 plants	**47** out of 10,000 plants	**86** out of 10,000 plants	**134** out of 10,000 plants	**207** out of 10,000 plants
Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity** *Meloidogyne mali* is present in the UK with restricted distribution. Suitable hosts are present both in the nurseries and in the surroundings. *Fagus sylvatica* is a host for *M. mali*. The pest can enter into the nurseries and spread within the nurseries with infected plant material and movement of soil attached to machinery and shoes. The plants could become infected during the growth in the soil in the fields. **Measures taken against the pest and their efficacy** General measures taken by the nurseries are effective against the nematode. These measures include (a) the use of certified plant material; (b) the use of heat-treated growing media; (c) inspections, surveillance, monitoring, sampling and laboratory testing; (d) hygiene measures; and (e) separation of the pots from soil. **Interception records** In the EUROPHYT/TRACES-NT database, there are no records of notification of *F. sylvatica* plants for planting neither from the UK nor from other countries due to the presence of *M. mali* between the years 1995 and December 2022 (EUROPHYT, online; TRACES-NT, online). **Shortcomings of current measures/procedures** None **Main uncertainties** – Whether symptoms may be promptly detected. – Level of susceptibility of *F. sylvatica*. – Pest pressure of the nematode in the nurseries and in the surrounding areas. – Whether and to which extent plants transplanted to the pots before export have undergone a cleaning of roots.					

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

5.2.2. Overview of the evaluation of *Phytophthora kernoviae* (Peronosporales; Peronosporaceae)

Overview of the evaluation of *Phytophthora kernoviae* for bundles of whips and seedlings					
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 bundles	**9,930** out of 10,000 bundles	**9,962** out of 10,000 bundles	**9,980** out of 10,000 bundles	**9,992** out of 10,000 bundles	**9,998.1** out of 10,000 bundles
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of infected bundles	**1.9** out of 10,000 bundles	**8** out of 10,000 bundles	**20** out of 10,000 bundles	**38** out of 10,000 bundles	**70** out of 10,000 bundles
Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity** *Phytophthora kernoviae* is present in the UK with a restricted distribution. The pathogen has a wide host range including *Fagus sylvatica*. The main host (e.g. *Rhododendron* spp.) can be present in the surroundings of the nurseries. Aerial inoculum could be produced on these host plants and cause bark infections on the commodity. **Measures taken against the pest and their efficacy** *P. kernoviae* is a provisional quarantine pest in the UK and under official control. General measures taken by the nurseries are effective against the pathogen. These measures include (a) the use of certified plant material and growing media; (b) inspections, surveillance, monitoring, sampling and laboratory testing; and (c) application of pest control products. **Interception records** In the EUROPHYT/TRACES-NT database, there are no records of notification of *F. sylvatica* plants for planting neither from the UK nor from other countries due to the presence of *P. kernoviae* between the years 1995 and December 2022 (EUROPHYT, online; TRACES-NT, online). **Shortcomings of current measures/procedures** None observed. **Main uncertainties** – Whether symptoms may be promptly detected. – The presence/abundance of the pathogen in the area where the nurseries are located. – Effect of fungicide treatments against the pathogen.				

Overview of the evaluation of *Phytophthora kernoviae* for bare root plants/trees up to 7 years old					
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 plants	**9,944** out of 10,000 plants	**9,972** out of 10,000 plants	**9,986** out of 10,000 plants	**9,994** out of 10,000 plants	**9,998.5** out of 10,000 plants
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of infected plants	**1.5** out of 10,000 plants	**6** out of 10,000 plants	**14** out of 10,000 plants	**28** out of 10,000 plants	**56** out of 10,000 plants

Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity** *Phytophthora kernoviae* is present in the UK with a restricted distribution. The pathogen has a wide host range including *Fagus sylvatica*. The main host (e.g. *Rhododendron* spp.) can be present in the surroundings of the nurseries. Aerial inoculum could be produced on these host plants and cause bark infections on the commodity. **Measures taken against the pest and their efficacy** *P. kernoviae* is a provisional quarantine pest in the UK and under official control. General measures taken by the nurseries are effective against the pathogen. These measures include (a) the use of certified plant material and growing media; (b) inspections, surveillance, monitoring, sampling and laboratory testing; and (c) application of pest control products. **Interception records** In the EUROPHYT/TRACES-NT database, there are no records of notification of *F. sylvatica* plants for planting neither from the UK nor from other countries due to the presence of *P. kernoviae* between the years 1995 and December 2022 (EUROPHYT, online; TRACES-NT, online). **Shortcomings of current measures/procedures** None observed. **Main uncertainties** – Whether symptoms may be promptly detected. – The practicability of inspections of older trees. – The presence/abundance of the pathogen in the areas where the nurseries are located. – Effect of fungicide treatments against the pathogen.

Overview of the evaluation of *Phytophthora kernoviae* for plants in pots up to 15 years old					
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 plants	**9,922** out of 10,000 plants	**9,962** out of 10,000 plants	**9,980** out of 10,000 plants	**9,991** out of 10,000 plants	**9,997.9** out of 10,000 plants
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of infected plants	**2.1** out of 10,000 plants	**9** out of 10,000 plants	**20** out of 10,000 plants	**38** out of 10,000 plants	**78** out of 10,000 plants
Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity** *Phytophthora kernoviae* is present in the UK with a restricted distribution. The pathogen has a wide host range including *Fagus sylvatica*. The main host (e.g. *Rhododendron* spp.) can be present in the surroundings of the nurseries. Aerial inoculum could be produced on these host plants and cause bark infections on the commodity. **Measures taken against the pest and their efficacy** *P. kernoviae* is a provisional quarantine pest in the UK and under official control. General measures taken by the nurseries are effective against the pathogen. These measures include (a) the use of certified plant material and growing media; (b) inspections, surveillance, monitoring, sampling and laboratory testing; and (c) application of pest control products. **Interception records** In the EUROPHYT/TRACES-NT database, there are no records of notification of *F. sylvatica* plants for planting neither from the UK nor from other countries due to the presence of *P. kernoviae* between the years 1995 and December 2022 (EUROPHYT, online; TRACES-NT, online).				

	Shortcomings of current measures/procedures None observed. **Main uncertainties** – Whether symptoms may be promptly detected. – The practicability of inspections of older trees. – The presence/abundance of the pathogen in the area where the nurseries is located. – Effect of fungicide treatments against the pathogen. – Whether and to which extent plants transplanted to the pots before export have undergone a cleaning of roots.

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

5.2.3. Overview of the evaluation of *Phytophthora ramorum* (non-EU isolates) (Peronosporales; Peronosporaceae)

Overview of the evaluation of *Phytophthora ramorum* for bundles of whips and seedlings					
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 bundles	**9,902** out of 10,000 bundles	**9,942** out of 10,000 bundles	**9,968** out of 10,000 bundles	**9,985** out of 10,000 bundles	**9,996** out of 10,000 bundles
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of infected bundles	**4** out of 10,000 bundles	**15** out of 10,000 bundles	**32** out of 10,000 bundles	**58** out of 10,000 bundles	**98** out of 10,000 bundles
Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity** *Phytophthora ramorum* is present in the UK with a restricted distribution. The pathogen has a wide host range including *Fagus sylvatica*. The main hosts (e.g. *Rhododendron* spp., *Larix* spp., *Viburnum* spp. etc.) can be present either inside or in the surroundings of the nurseries. Aerial inoculum could be produced on these host plants and cause bark infections on the commodity. **Measures taken against the pest and their efficacy** *P. ramorum* is a quarantine pest in the UK and under official control. General measures taken by the nurseries are effective against the pathogen. These measures include (a) the use of certified plant material and growing media; (b) inspections, surveillance, monitoring, sampling and laboratory testing; and (c) application of pest control products. **Interception records** In the EUROPHYT/TRACES-NT database, there are no records of notification of *F. sylvatica* plants for planting neither from the UK nor from other countries due to the presence of *P. ramorum* between the years 1995 and December 2022 (EUROPHYT, online; TRACES-NT, online). **Shortcomings of current measures/procedures** None observed. **Main uncertainties** – The level of susceptibility of *F. sylvatica* to the pathogen. – Whether symptoms may be promptly detected. – The presence/abundance of the pathogen in the area where the nurseries are located. – Effect of fungicide treatments against the pathogen.					

Overview of the evaluation of *Phytophthora ramorum* for bare root plants/trees up to 7 years old					
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 plants	**9,921** out of 10,000 plants	**9,957** out of 10,000 plants	**9,978** out of 10,000 plants	**9,990** out of 10,000 plants	**9,997.1** out of 10,000 plants
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of infected plants	**2.9** out of 10,000 plants	**10** out of 10,000 plants	**22** out of 10,000 plants	**43** out of 10,000 plants	**79** out of 10,000 plants
Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity** *Phytophthora ramorum* is present in the UK with a restricted distribution. The pathogen has a wide host range including *Fagus sylvatica*. The main hosts (e.g. *Rhododendron* spp., *Larix* spp., *Viburnum* spp. etc.) can be present either inside or in the surroundings of the nurseries. Aerial inoculum could be produced on these host plants and cause bark infections on the commodity. **Measures taken against the pest and their efficacy** *P. ramorum* is a quarantine pest in the UK and under official control. General measures taken by the nurseries are effective against the pathogen. These measures include (a) the use of certified plant material and growing media; (b) inspections, surveillance, monitoring, sampling and laboratory testing; and (c) application of pest control products. **Interception records** In the EUROPHYT/TRACES-NT database, there are no records of notification of *F. sylvatica* plants for planting neither from the UK nor from other countries due to the presence of *P. ramorum* between the years 1995 and December 2022 (EUROPHYT, online; TRACES-NT, online). **Shortcomings of current measures/procedures** None observed. **Main uncertainties** – The level of susceptibility of *F. sylvatica* to the pathogen. – Whether symptoms may be promptly detected. – The practicability of inspections of older trees. – The presence/abundance of the pathogen in the area where the nurseries are located. – Effect of fungicide treatments against the pathogen. – Whether and to which extent plants transplanted to the pots before export have undergone a cleaning of roots.				

Overview of the evaluation of *Phytophthora ramorum* for plants in pots up to 15 years old					
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 plants	**9,891** out of 10,000 plants	**9,942** out of 10,000 plants	**9,968** out of 10,000 plants	**9,985** out of 10,000 plants	**9,996** out of 10,000 plants
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of infected plants	**4** out of 10,000 plants	**15** out of 10,000 plants	**32** out of 10,000 plants	**58** out of 10,000 plants	**109** out of 10,000 plants

Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity** *Phytophthora ramorum* is present in the UK with a restricted distribution. The pathogen has a wide host range including *Fagus sylvatica*. The main hosts (e.g. *Rhododendron* spp., *Larix* spp., *Viburnum spp*., etc.) can be present either inside or in the surroundings of the nurseries. Aerial inoculum could be produced on these host plants and cause bark and leaf infections on the commodity. **Measures taken against the pest and their efficacy** *P. ramorum* is a quarantine pest in the UK and under official control. General measures taken by the nurseries are effective against the pathogen. These measures include (a) the use of certified plant material and growing media; (b) inspections, surveillance, monitoring, sampling and laboratory testing; and (c) application of pest control products. **Interception records** In the EUROPHYT/TRACES-NT database, there are no records of notification of *F. sylvatica* plants for planting neither from the UK nor from other countries due to the presence of *P. ramorum* between the years 1995 and December 2022 (EUROPHYT, online; TRACES-NT, online). **Shortcomings of current measures/procedures** None observed. **Main uncertainties** – The level of susceptibility of *F. sylvatica* to the pathogen. – Whether symptoms may be promptly detected. – The practicability of inspections of older trees. – The presence/abundance of the pathogen in the area where the nurseries is located. – Effect of fungicide treatments against the pathogen. – The accuracy of the removal of leaf debris of foliar hosts from pots. – Whether and to which extent plants transplanted to the pots before export have undergone a cleaning of roots.

For more details, see relevant pest data sheet on *Phytophthora ramorum* (non-EU isolates) (Section A.3 in Appendix A).

5.2.4. Overview of the evaluation of *Thaumetopoea processionea* (Lepidoptera; Notodontidae)

Overview of the evaluation of *Thaumetopoea processionea* for bundles of whips and seedlings					
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 bundles	**9,992** out of 10,000 bundles	**9,995** out of 10,000 bundles	**9,997** out of 10,000 bundles	**9,998.5** out of 10,000 bundles	**9,999.6** out of 10,000 bundles
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of infested bundles	**0.4** out of 10,000 bundles	**1.5** out of 10,000 bundles	**3** out of 10,000 bundles	**5** out of 10,000 bundles	**8** out of 10,000 bundles
Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity** The pest is present in the UK territory because of an introduction from the EU with infested plants in early 2000. The species is established in the Greater London area and a buffer zone is delimited each year around the infestation points that are going through eradication. Several eradications of newly found spots were carried out successfully in the whole country while eradication is not considered any longer possible in the establishment area. One of the production nurseries is included in the 2022 buffer zone. In the documents provided by the applicant there is no mention of *Fagus* as host of the pest. *Fagus* has been found to host the pest only occasionally in the Netherlands,				

	because of spill over from heavily infested oak trees. The pest, however, can develop from mature larva to moth on *Fagus*. Egg masses and young larvae were never found on *Fagus* either in the EU or in the UK. **Measures taken against the pest and their efficacy** Nursery staff is trained to identify the development stages of the pest and regular inspections are carried out in the nurseries. The pest was never detected so no specific measures were adopted. **Interception records** The pest was intercepted frequently on plants for planting of *Quercus* from the EU to the UK, never on *Fagus*. **Shortcomings of current measures/procedures** Although the nursery staff is trained, the frequent interceptions of the pest on nursery material indicates that the pest is very difficult to detect, especially at the egg stage because the egg masses have the same colour of the twigs on which they are laid. The detection of the pest at the egg stage is difficult on large plants because of the high number of twigs to check, and especially when they are carrying leaves. **Main uncertainties** – The possibility for the moth to lay egg masses on *Fagus*. – The possibility for the young larvae to feed on *Fagus* leaves.

Overview of the evaluation of *Thaumetopoea processionea* for bare root plants/trees up to 7 years old					
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 plants	**9,992** out of 10,000 plants	**9,995** out of 10,000 plants	**9,997** out of 10,000 plants	**9,998.5** out of 10,000 plants	**9,999.6** out of 10,000 plants
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of infested plants	**0.4** out of 10,000 plants	**1.5** out of 10,000 plants	**3** out of 10,000 plants	**5** out of 10,000 plants	**8** out of 10,000 plants
Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity** The pest is present in the UK territory because of an introduction from the EU with infested plants in early 2000. The species is established in the Greater London area and a buffer zone is delimited each year around the infestation points that are going through eradication. Several eradications of newly found spots were carried out successfully in the whole country while eradication is not considered any longer possible in the establishment area. One of the production nurseries is included in the 2022 buffer zone. In the documents provided by the applicant there is no mention of *Fagus* as host of the pest. *Fagus* has been found to host the pest only occasionally in the Netherlands, because of spill over from heavily infested oak trees. The pest, however, can develop from mature larva to moth on *Fagus*. Egg masses and young larvae were never found on *Fagus* either in the EU or in the UK. **Measures taken against the pest and their efficacy** Nursery staff is trained to identify the development stages of the pest and regular inspections are carried out in the nurseries. The pest was never detected so no specific measures were adopted. **Interception records** The pest was intercepted frequently on plants for planting of *Quercus* from the EU to the UK, never on *Fagus*.				

	Shortcomings of current measures/procedures Although the nursery staff is trained, the frequent interceptions of the pest on nursery material indicates that the pest is very difficult to detect, especially at the egg stage because the egg masses have the same colour of the twigs on which they are laid. The detection of the pest at the egg stage is difficult on large plants because of the high number of twigs to check, and especially when they are carrying leaves. **Main uncertainties** – The possibility for the moth to lay egg masses on *Fagus*. – The possibility for the young larvae to feed on *Fagus* leaves.

Overview of the evaluation of *Thaumetopoea processionea* for plants in pots up to 15 years old					
Rating of the likelihood of pest freedom	Pest free with few exceptional cases (based on the Median).				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free plants	**9,971** out of 10,000 plants	**9,984** out of 10,000 plants	**9,992** out of 10,000 plants	**9,996** out of 10,000 plants	**9,999.2** out of 10,000 plants
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of infested plants	**0.8** out of 10,000 plants	**4** out of 10,000 plants	**8** out of 10,000 plants	**16** out of 10,000 plants	**29** out of 10,000 plants
Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity** The pest is present in the UK territory because of an introduction from the EU with infested plants in early 2000. The species is established in the Greater London area and a buffer zone is delimited each year around the infestation points that are going through eradication. Several eradications of newly found spots were carried out successfully in the whole country while eradication is not considered any longer possible in the establishment area. One of the production nurseries is included in the 2022 buffer zone. In the documents provided by the applicant there is no mention of *Fagus* as host of the pest. *Fagus* has been found to host the pest only occasionally in the Netherlands, because of spill over from heavily infested oak trees. The pest, however, can develop from mature larva to moth on *Fagus*. Egg masses and young larvae were never found on *Fagus* either in the EU or in the UK. **Measures taken against the pest and their efficacy** Nursery staff is trained to identify the development stages of the pest and regular inspections are carried out in the nurseries. The pest was never detected so no specific measures were adopted. **Interception records** The pest was intercepted frequently on plants for planting of *Quercus* from the EU to the UK, never on *Fagus*. **Shortcomings of current measures/procedures** Although the nursery staff is trained, the frequent interceptions of the pest on nursery material indicates that the pest is very difficult to detect, especially at the egg stage because the egg masses have the same colour of the twigs on which they are laid. The detection of the pest at the egg stage is difficult on large plants because of the high number of twigs to check, and especially when they are carrying leaves. **Main uncertainties** – The possibility for the moth to lay egg masses on *Fagus*. – The possibility for the young larvae to feed on *Fagus* leaves. – Whether and to which extent plants transplanted to the pots before export have undergone a cleaning of roots.				

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

5.2.5. Outcome of expert knowledge elicitation

Table 7 and Figure 3, 4 and 5 show the outcome of the EKE regarding pest freedom after the evaluation of the implemented risk mitigation measures for all the evaluated pests.

Figure 6 provides an explanation of the descending distribution function describing the likelihood of pest freedom after the evaluation of the implemented risk mitigation measures for *F. sylvatica* plants in pots up to 15 years old designated for export to the EU for *Meloidogyne mali.*

Table 7: Assessment of the likelihood of pest freedom following evaluation of current risk mitigation measures against pests and pathogens on *Fagus sylvatica* 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	Nematodes	*Meloidogyne mali*/whips in bundles					L	MU		
2	Oomycetes	*Phytophthora kernoviae*/ whips in bundles					L	M		U
3	Oomycetes	*Phytophthora ramorum*/ whips in bundles					L	M		U
4	Insects	*Thaumetopoea processionea*/whips in bundles							L	MU
5	Nematodes	*Meloidogyne mali*/bare root plants				L	M		U	
6	Oomycetes	*Phytophthora kernoviae*/ bare root plants					L	M		U
7	Oomycetes	*Phytophthora ramorum*/ bare root plants					L	M		U
8	Insects	*Thaumetopoea processionea*/bare root plants							L	MU
9	Nematodes	*Meloidogyne mali*/plants in pots				L	M	U		
10	Oomycetes	*Phytophthora kernoviae*/ plants in pots					L	M		U
11	Oomycetes	*Phytophthora ramorum*/ plants in pots				L		M		U
12	Insects	*Thaumetopoea processionea*/plants in pots						L	M	U

PANEL A

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

PANEL B

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

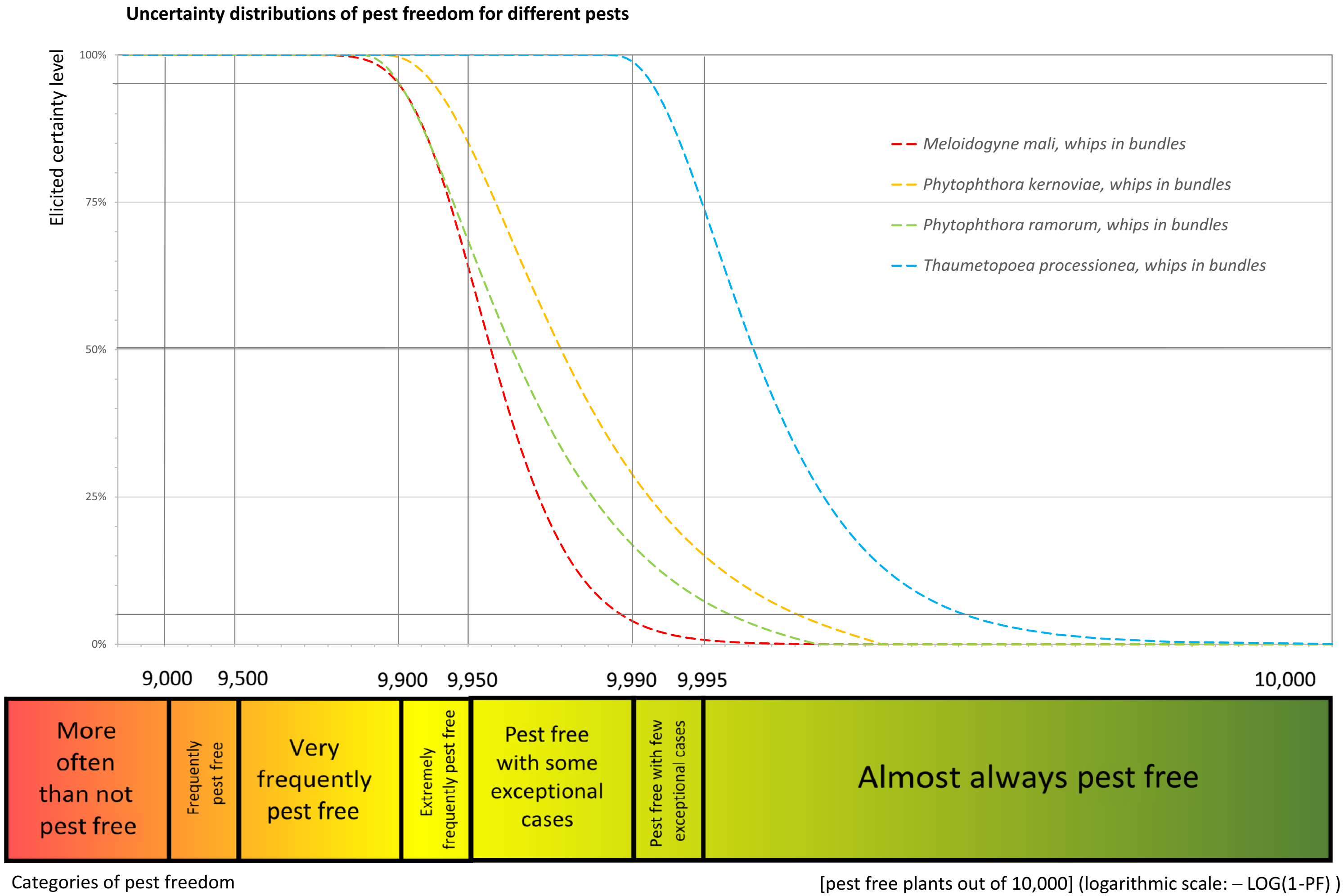

Figure 3: Elicited certainty (y-axis) of the number of pest-free *Fagus sylvatica* whips and seedlings (x-axis; log-scaled) out of 10,000 bundles designated for export to the EU from the UK for all evaluated pests visualised as descending distribution function. Horizontal lines indicate the percentiles (starting from the bottom 5%, 25%, 50%, 75%, 95%)

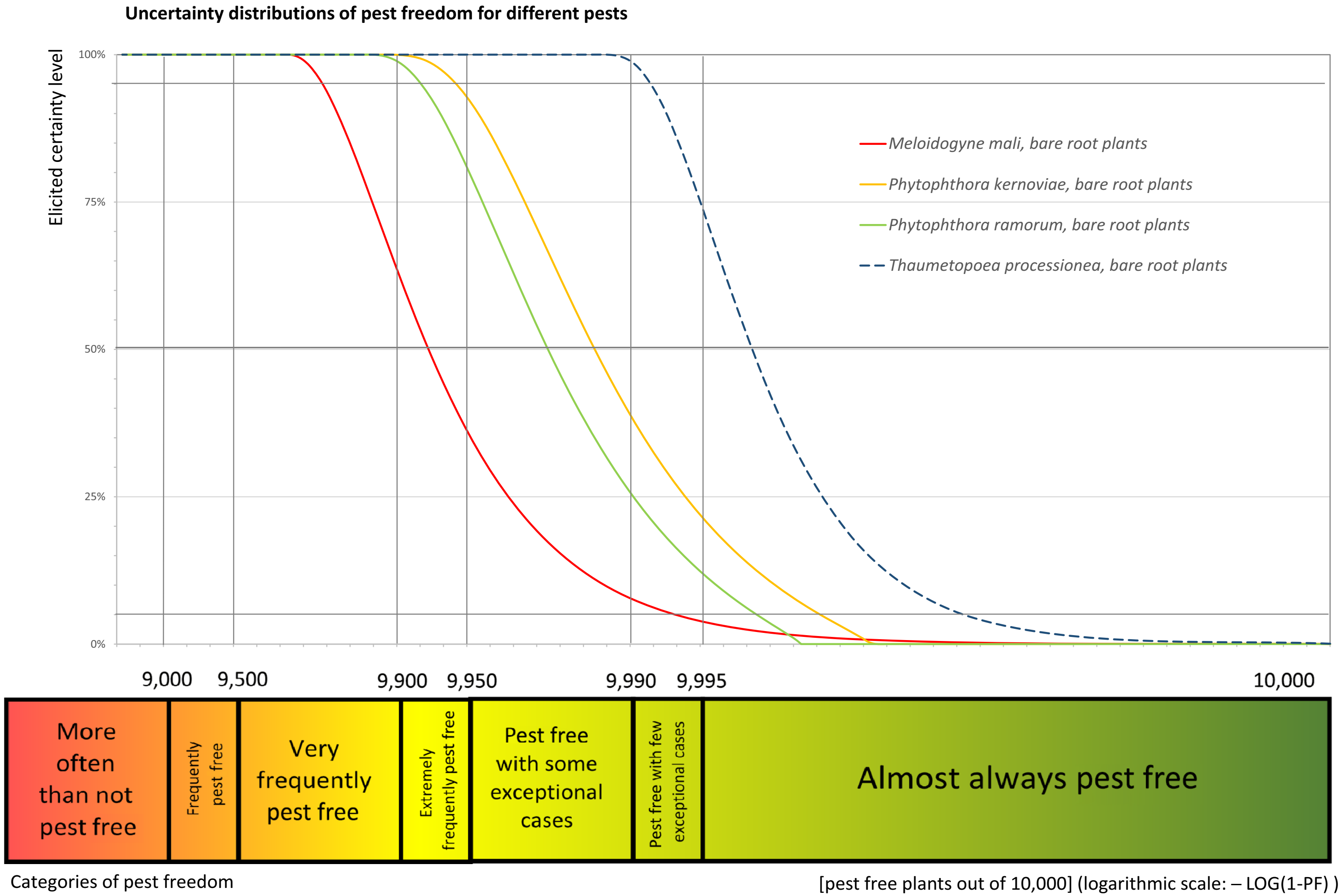

Figure 4: Elicited certainty (y-axis) of the number of pest-free *Fagus sylvatica* bare root plants up to 7 years old (x-axis; log-scaled) out of 10,000 plants designated for export to the EU from the UK for all evaluated pests visualised as descending distribution function. Horizontal lines indicate the percentiles (starting from the bottom 5%, 25%, 50%, 75%, 95%)

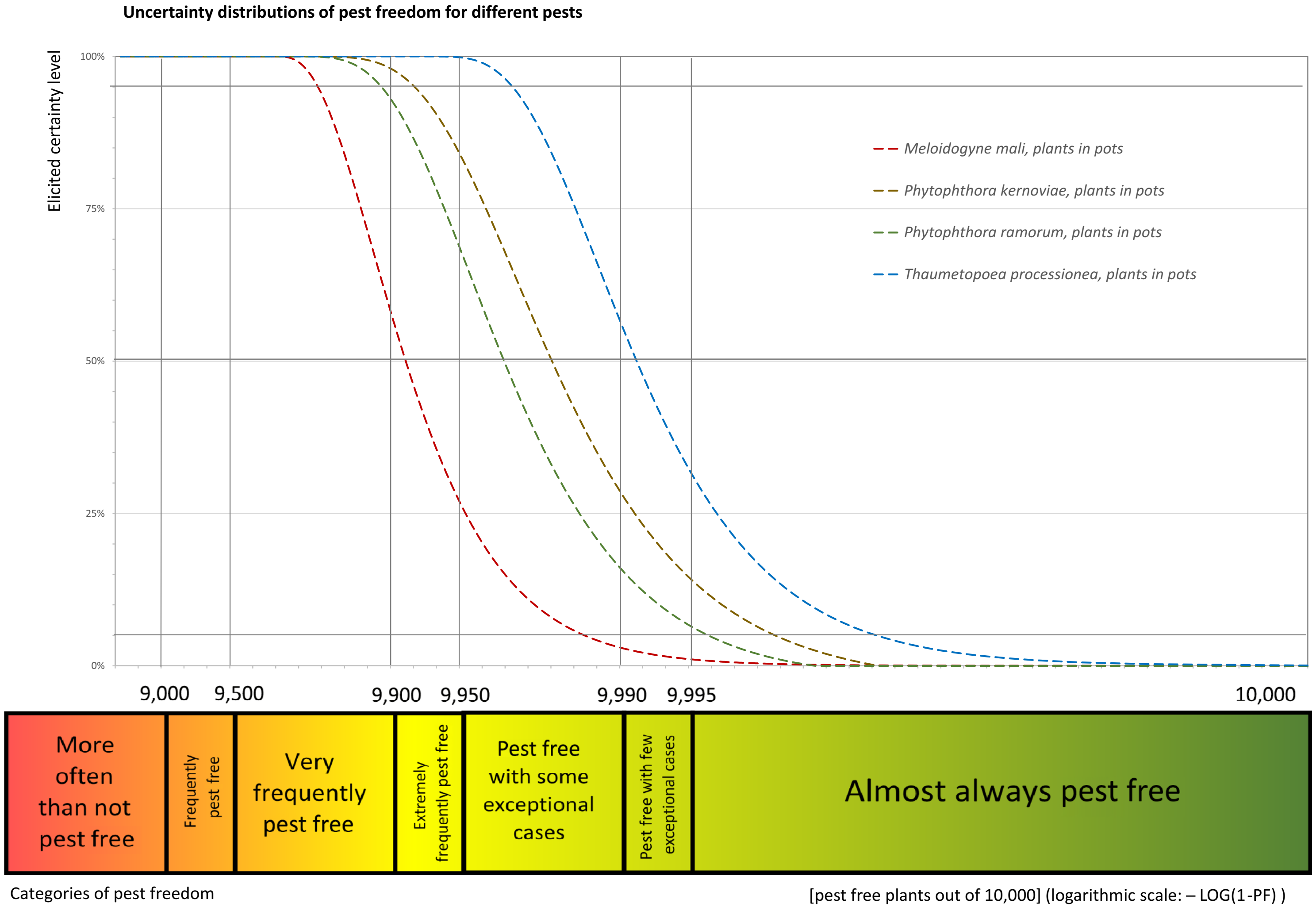

Figure 5: Elicited certainty (y-axis) of the number of pest-free *Fagus sylvatica* plants in pots up to 15 years old (x-axis; log-scaled) out of 10,000 plants designated for export to the EU from the UK for all evaluated pests visualised as descending distribution function. Horizontal lines indicate the percentiles (starting from the bottom 5%, 25%, 50%, 75%, 95%)

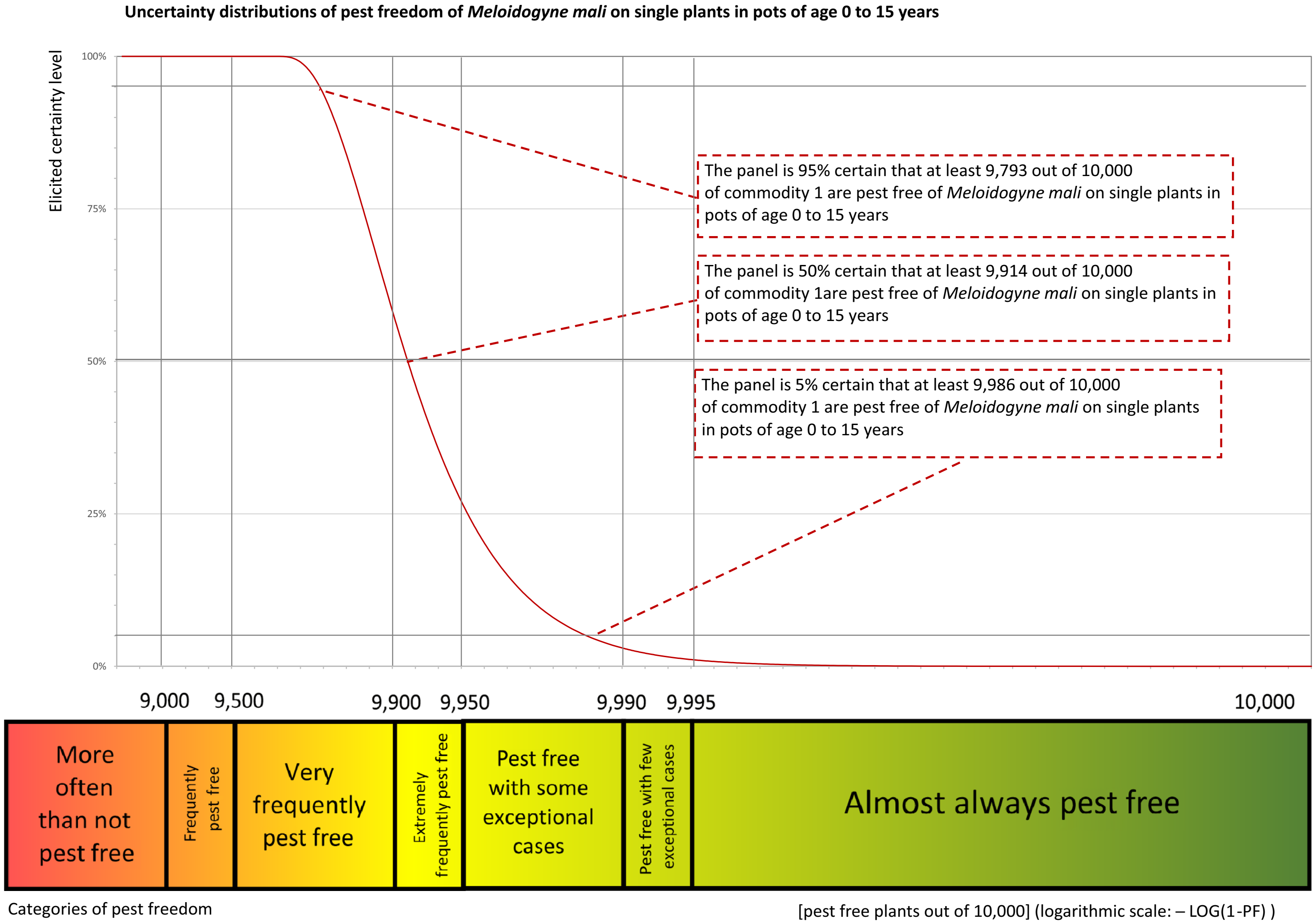

Figure 6: Explanation of the descending distribution function describing the likelihood of pest freedom after the evaluation of the implemented risk mitigation measures for plants designated for export to the EU based on based on the example of *Meloidogyne mali* on *Fagus sylvatica* plants in pots of age up to 15 years

6. Conclusions

There are four pests identified to be present in the UK and considered to be potentially associated with the plants of *F. sylvatica* imported from the UK and relevant for the EU.

These pests are *Meloidogyne mali*, *Phytophthora kernoviae*, *Phytophthora ramorum* (non-EU isolates) and *Thaumetopoea processionea*. The likelihood of the pest freedom after the evaluation of the implemented risk mitigation measures for the commodities designated for export to the EU was estimated. The likelihood of the pest freedom after the evaluation of the implemented risk mitigation measures for the commodities designated for export to the EU was estimated. In the assessment of risk, the age of the plants was considered, reasoning that older trees are more likely to be infested mainly due to longer exposure time and larger size.

For *M. mali* the likelihood of pest freedom for bundles of whips and seedlings following evaluation of current risk mitigation measures was estimated as 'pest free with some exceptional cases' with the 90% uncertainty range reaching from 'extremely frequently pest free' to 'pest free with some exceptional cases'. The EKE indicated, with 95% certainty, that between 9,901 and 10,000 bundles of whips and seedlings per 10,000 will be free from *M. mali*. The likelihood of pest freedom for bare root plants/trees up to 7 years old was estimated as 'extremely frequently pest free' with the 90% uncertainty range spanning from 'very frequently pest free' to 'pest free with few exceptional cases'. The EKE indicated, with 95% certainty, that between 9,792 and 10,000 bare root plants/trees up to 7 years old per 10,000 will be free from *M. mali*. The likelihood of pest freedom for plants in pots up to 15 years old was estimated as 'extremely frequently pest free' with the 90% uncertainty range spanning from 'very frequently pest free' to 'pest free with some exceptional cases'. The EKE indicated, with 95% certainty, that between 9,793 and 10,000 plants in pots up to 15 years old per 10,000 will be free from *M. mali*.

For *P. kernoviae* the likelihood of pest freedom for bundles of whips and seedlings following evaluation of current risk mitigation measures was estimated as 'pest free with some exceptional cases' with the 90% uncertainty range reaching from 'extremely frequently pest free' to 'almost always pest free´. The EKE indicated, with 95% certainty, that between 9,930 and 10,000 bundles of whips and seedlings per 10,000 will be free from *P. kernoviae*. The likelihood of pest freedom for bare root plants/trees up to 7 years old was estimated 'pest free with some exceptional cases' with the 90% uncertainty range reaching from 'extremely frequently pest free' to 'almost always pest free'. The EKE indicated, with 95% certainty, that between 9,944 and 10,000 bare root plants/trees up to 7 years old per 10,000 will be free from *P. kernoviae*. The likelihood of pest freedom for plants in pots up to 15 years old was estimated as 'pest free with some exceptional cases' with the 90% uncertainty range reaching from 'extremely frequently pest free' to 'almost always pest free'. The EKE indicated, with 95% certainty, that between 9,922 and 10,000 plants in pots up to 15 years old per 10,000 will be free from *P. kernoviae*.

For *P. ramorum* the likelihood of pest freedom for bundles of whips and seedlings following evaluation of current risk mitigation measures was estimated as 'pest free with some exceptional cases' with the 90% uncertainty range reaching from 'extremely frequently pest free' to 'almost always pest free´. The EKE indicated, with 95% certainty, that between 9,902 and 10,000 bundles of whips and seedlings per 10,000 will be free from *P. ramorum*. The likelihood of pest freedom for bare root plants/trees up to 7 years old was estimated 'pest free with some exceptional cases' with the 90% uncertainty range reaching from 'extremely frequently pest free' to 'almost always pest free'. The EKE indicated, with 95% certainty, that between 9,921 and 10,000 bare root plants/trees up to 7 years old per 10,000 will be free from *P. ramorum*. The likelihood of pest freedom for plants in pots up to 15 years old was estimated as 'pest free with some exceptional cases' with the 90% uncertainty range reaching from 'very frequently pest free' to 'almost always pest free'. The EKE indicated, with 95% certainty, that between 9,981 and 10,000 plants in pots up to 15 years old per 10,000 will be free from *P. ramorum*.

For *T. processionea* the likelihood of pest freedom for bundles of whips and seedlings following evaluation of current risk mitigation measures was estimated as 'almost always pest free' with the 90% uncertainty range reaching from 'pest free with few exceptional cases' to 'almost always pest free´. The EKE indicated, with 95% certainty, that between 9,992 and 10,000 bundles of whips and seedlings per 10,000 will be free from *T. processionea*. The likelihood of pest freedom for bare root plants/trees up to 7 years old was estimated 'almost always pest free' with the 90% uncertainty range reaching from 'pest free with few exceptional cases' to 'almost always pest free'. The EKE indicated, with 95% certainty, that between 9,921 and 10,000 bare root plants/trees up to 7 years old per 10,000 will be free from *T. processionea*. The likelihood of pest freedom for plants in pots up to

15 years old was estimated as '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 EKE indicated, with 95% certainty, that between 9,971 and 10,000 plants in pots up to 15 years old per 10,000 will be free from *T. processionea*.

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Abbreviations

APHA	Animal and Plant Health Agency
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 Organization
PHSI	Plant Health and Seeds Inspectorate
PLH	Plant Health
PRA	pest risk assessment
RNQPs	Regulated Non-Quarantine Pests
SASA	Science and Advice for Scottish Agriculture

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 the 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

A.1 *Meloidogyne mali*

A.1.1. 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	Nematodes
EPPO code	MELGMA
Regulated status	*Meloidogyne mali* is included in the EPPO A2 list (EPPO, online_a) and was recently recommended for regulation as a quarantine pest (EPPO, online_b). *Meloidogyne mali* is a quarantine pest in the USA and Morocco (EPPO, online_a) and listed as a 'pest of quarantine interest' in the Dominican Republic (EPPO, 2017); it is also regulated in Colombia, the Republic of Korea, Malaysia and Uruguay (EPPO, 2017). All *Meloidogyne* species are quarantine pests for Türkiye (EPPO, 2017).
Pest status in the UK	*Meloidogyne mali* is present in the UK in Southern England – two sites in Farnham and Surrey (Dossier Section 3.0) where it was found on elm trees in 2018, as consequence of introduction in the past of infected elms from the Netherlands (Prior, 2019). According to the Dossier Section 5.0 the nematode is present in the UK: not widely distributed and not under official control.
Pest status in the EU	*Meloidogyne mali* is currently present in the EU in Austria (de Jong et al., online), in Belgium (Suwanngam and Wesemael, 2019), Italy (Palmisano and Ambrogioni, 2000) and the Netherlands (Ahmed et al., 2013), in all cases with few occurrences or restricted distribution (EPPO, online_c). *M. mali* was detected in France (Ile de France) in 2016, but it was eradicated in 2021 (EPPO, online_c). According to Ahmed et al. (2013) and EPPO (2017) *M. mali* may have a wider distribution in Europe, since elm plants growing in plots infested by the nematode in the Netherlands have been sent to other countries (Belgium, Denmark, France, Germany, Ireland, Italy, Spain, Slovakia, Romania, the UK) to carry out resistance tests against the Dutch Elm Disease (DED). These programmes started from the 1980s of the last century (Prior et al., 2019).
Host status on *Fagus sylvatica*	According to Ahmed et al. (2013) *F. sylvatica* is a host for *M. mali*.
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*, apple root-knot nematode (EPPO, 2017); – Scientific Opinion on the commodity risk assessment of *Malus domestica* plants from United Kingdom (EFSA PLH Panel, 2023a); – Scientific Opinion on the commodity risk assessment of *Malus sylvestris* plants from United Kingdom (EFSA PLH Panel, 2023b); – Scientific Opinion on the commodity risk assessment of *Acer campestre* plants from the UK (EFSA PLH Panel, 2023c); – Scientific Opinion on the commodity risk assessment of *Acer palmatum* plants from the UK (EFSA PLH Panel, 2023d); – Scientific Opinion on the commodity risk assessment of *Acer platanoides* plants from the UK (EFSA PLH Panel, 2023e);

	– Scientific Opinion on the commodity risk assessment of *Acer pseudoplatanus* plants from the UK (EFSA PLH Panel, 2023f); – UK Risk Register Details for *Meloidogyne mali* (DEFRA, online).	
Other relevant information for the assessment		
Biology	*Meloidogyne mali* is a root-knot nematode inducing root galls on host plants; it is native to Asia (Japan), introduced decades ago to Europe and more recently also to the USA (Eisenback et al., 2017; EPPO, 2017) and to the Republic of Korea (Kang et al., 2021). 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). *Meloidogyne mali* develops through three stages: eggs, juveniles (four stages) and adults, all living in the root galls. Adult males, second stage juveniles and eggs can live also free in the soil (EPPO, 2017). Information on *M. mali* biology mainly come from *Malus* sp. in Japan where the nematode and has one generation per year and the life cycle lasts 18–22 weeks. However, it is known that *Meloidogyne* species can frequently have more generations per year depending on the temperature and the feeding on perennial plants. Only few specific information on the life cycle of *M. mali* is available. Unlike similar species as *M. chitwoodi* and *M. fallax* which are parthenogenetic, *M. mali* reproduces sexually. Like all *Meloidogyne* root-knot nematodes it deposits eggs in gelatinous sacs on the surface of galls or within them (EPPO, 2017; EFSA, 2019); in Japan the minimum hatching temperature range of *M. mali* eggs is 10–15°C (optimal 20–33°C) (EPPO, 2017). As usual in *Meloidogyne* species, the infective second-stage juveniles move in the soil and attack the roots penetrating behind the root cap. They start to feed on cortical tissues inducing the formation of giant cells that cause swelling and finally root galls. After moulting, adults develop from the last juvenile stage; females remain into the roots where they lay eggs in a gelatinous matrix, while males leave the galls (EFSA, 2019). It is not clear in what extent the nematode can survive frost conditions during winter. *Meloidogyne mali* can probably overwinter in the roots of plants growing outdoors, possibly as young females, given that egg-laying females have been observed in early March (EPPO, 2017). In the USA the nematode seems able to survive at minimum winter temperature of −6°C (Pylypenko, 2016). Although *Meloidogyne* species are known not forming cysts to resist to the absence of host plants for long-time, *M. mali* can survive for at least 2 years in root fragments in the soil after removal of infected trees; it is not known, however, if the nematode can also have a diapause period (EPPO, 2017). All *Meloidogyne* are strictly associated with the roots of plants and are known to be sedentary species, moving in the soil 1–2 m maximum per year, and spread through the roots depending on their size, type of soil, water availability and other parameters (EFSA, 2019). As other species of root-knot nematodes, the spread on medium-long distance of *M. mali* is by passive transport, and possible pathways are mainly plants for planting with infected roots, soil and growing media and also contaminated tools and machinery (EPPO, 2017).	
Symptoms	**Main type of symptoms**	Plants infected by *M. mali* show root-knot galls on roots. The galls can be of different size also depending on the hosts and are always visible to the naked eye (0.5–2 cm in diameter) (EPPO, 2018). When a severe root infection occurs, as consequence of the developing of large number of galls the root system can be damaged, reducing uptake of water and minerals and causing symptoms on above-ground part of plants. Common symptoms are little growth of primary shoots and increase of secondary shoots, leaf fall and general reduction of growth. No specific information about symptoms on *F. sylvatica* was found.

	Presence of asymptomatic plants	Plants infected by *M. mali* can remain asymptomatic. Damage on above-ground part of plants goes often unnoticed in early infection stage or when underground attack on roots is light. 30-year-old elms gravely infected in the root system were uprooted by wind without any symptom on the crown or foliage (EPPO, 2017).
	Confusion with other pests	Plants infected by *M. mali* appear similar to plants infected by other nematode species or root pathogens living in the soil. The identification of the nematode is not possible on the basis of sole galls. *Meloidogyne mali* juveniles and adults are morphologically similar to other *Meloidogyne* nematodes. For identification to species level, laboratory tests on morphometric characters, electrophoresis or sequencing/DNA barcoding are needed (EPPO, 2018).
Host plant range	*Meloidogyne mali* is a polyphagous nematode feeding on roots of several species of trees, shrubs and herbaceous plants. Some important woody hosts of *M. mali* are *Acer x freemani, A. palmatum. A. pseudoplatanus, Castanea crenata, Euonymus kiautschovicus, E. fortunei, Fagus sylvatica, Lagerstroemia indica, Malus pumila, Morus alba, Prunus serrulata, Quercus robur, Sorbus aucuparia, Taxus baccata, Ulmus glabra, U. parvifolia, Vitis vinifera* and *Zelkova serrata* (EPPO, 2017; DEFRA, online; Ferris, online). Common herbaceous hosts are: *Dryopteris filix-mas, D. carthusiana, Geranium robertianum, Geum coccineum, Impatiens parviflora, Rosa* sp., *Rubus fruticosus, Taraxacum officinale, Trifolium repens* and *Urtica dioica* (EPPO, 2017; DEFRA, online). For a complete list of hosts see EPPO (2017) and DEFRA (online).	
Reported evidence of impact	Only poor information on economic impact caused by *M. mali* is available. In Japan, damage on *Malus* and *Morus* (15–43% growth reduction) was reported only following inoculation experiments. In Italy, slowly declining elms were observed (Palmisano and Ambrogioni, 2000). In the UK, *M. mali* was only found in elms killed by DED (Prior et al., 2019). Roots damaged by *M. mali* may be also attacked by secondary pathogen agents. On elm trees in the Netherlands the infection by *M. mali* caused detriment of stability with uprooting by wind in urban areas (EPPO, 2017). No specific data about damage on *F. sylvatica* was found.	
Evidence that the commodity is a pathway	*Meloidogyne mali* can travel with plants for planting, although no specific evidence about *F. sylvatica* plants is found. There have been several interceptions of *Meloidogyne* species in the EU from Japan, mostly on bonsais, including on hosts of *M. mali* as *Acer palmatum*, although in these hosts the nematode was never identified at species level (EUROPHYT, online; TRACES-NT, online).	
Surveillance information	According to the Dossier Section 5.0, *M. mali* is not under official surveillance, as does not meet criteria of QP for GB. A survey was conducted to determine the extent of *M. mali* presence in Surrey; all of the samples outside the two sites where the nematode was found in 2018 were negative, indicating that it has not spread off the sites (Dossier Section 3.0). A containment approach is being implemented in the two sites. No movement of soil from the sites is allowed. No movement of host plants from the sites is allowed. Staff and contractors coming into contact with host plants or soil on sites must remove soil from footwear and equipment before leaving the sites. Only non-hosts should be planted at the sites (Dossier Section 3.0).	

A.1.2. Possibility of pest presence in the nursery

A.1.2.1. Possibility of entry from the surrounding environment

Meloidogyne mali is eradicated from the outbreak locations on *Ulmus* sp. in the two sites in Southern England (Farnham, Surrey) (Prior, 2019; Dossier Sections 3.0 and 5.0). The pest is not regulated in the UK. No presence of the nematode outside the two known sites is reported and a containment approach has been implemented (Dossier Section 3.0).

The nematode can only spread by passive transport with plants for planting with infected roots, infected soil and growing media and possibly via contaminated tools and machinery. No other possibility of entry in the nurseries is known.

Meloidogyne mali can infect *Castanea* spp., *Fagus* spp., *Malus* spp., *Morus* spp., *Prunus* spp., *Quercus robur, Rosa* spp., *Solanum lycopersicum, Taxus baccata* and *Ulmus* spp. which are present within 2 km from the nurseries (Dossier Section 3.0).

Uncertainties:

- Pest presence and pressure in the surroundings.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for *M. mali* to enter the nurseries from surrounding environment by infested machinery. In the surrounding area, suitable hosts are present, but the nematode cannot enter by other way than human assisted spread.

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

The starting materials are only seeds and seedlings. Seeds are certified and coming from the UK. Seedlings are either from the UK, the EU (the Netherlands and France) (Dossier Section 3.0). Seeds are not a pathway for the nematode.

In addition to *F. sylvatica*, the nurseries also produce other plants (Dossier Section 6.0). Out of them, there are many suitable hosts for the nematode (such as *Acer* spp., *Castanea* spp., *Fagus* spp., *Malus* spp., *Prunus* spp., *Quercus* spp., *Rosa* spp., *Sorbus* spp., *Taxus baccata, Ulmus* spp.). However, there is no information on how and where the plants are produced. Therefore, if the plants are first produced in another nursery, the nematode could possibly travel with them.

The nurseries are using virgin peat or peat-free compost (a mixture of coir, tree bark, wood fibre, etc.) as a growing media (Dossier Section 1.0). *Meloidogyne mali* is able to survive both in the soil and in root fragments in the soil for 2 years (EPPO, 2007) and therefore could potentially enter with infested soil/growing media. However, the growing media is certified and heat-treated by commercial suppliers during production to eliminate pests and diseases (Dossier Section 3.0).

Uncertainties:

- No information is available on the provenance of plants other than *F. sylvatica* plant production in the nurseries.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for the nematode to enter the nurseries via infected roots of new seedlings of *F. sylvatica* and plants of other species used for plant production in the area. The entry of the nematode with seeds and the growing media the Panel considers as not possible.

A.1.2.3. Possibility of spread within the nursery

Fagus sylvatica plants are either grown in containers (cells, pots, tubes, etc.) outdoors in the open air or in field. Cell grown trees may be grown in greenhouses, however most plants will be field grown, or field grown in containers (Dossier Section 1.0). There are no mother plants present in the nurseries (Dossier Section 3.0).

The nematode can infect other suitable plants (such as *Acer* spp., *Fagus* spp., *Quercus* spp., *Ulmus* spp. etc.) present within the nurseries (Dossier Sections 3.0 and 6.0).

Meloidogyne mali can spread within the nurseries by movement of soil, water, infested plant material and infected tools and machinery (EPPO, 2017). However, tools used in the nurseries are disinfected after operation on a stock and before being used on a different plant species (Dossier Section 3.0).

Uncertainties:

– None.

Taking into consideration the above evidence and uncertainties, the Panel considers that the spread of the nematode within the nurseries is possible either by movement of infested soil, water and plant material.

A.1.3. Information from interceptions

In the EUROPHYT/TRACES-NT database there are no records of notification of *Fagus sylvatica* plants for planting neither from the UK nor from other countries due to the presence of *Meloidogyne mali* between the years 1995 and December 2022 (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 the UK are listed and an indication of their effectiveness on *Meloidogyne mali* is provided. The description of the risk mitigation measures currently applied in the UK is provided in the Table 6.

N	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
1	Registration of production sites	Yes	As the plant passport is very similar to the EU one, the plants shall be free from quarantine and RNQP pests. This could include *Meloidogyne* spp., and so should reveal infections by *M. mali*, although this nematode is not regulated in the EU and the UK. Uncertainties: – The degree to which roots and growing substrates are inspected for nematodes.
2	Physical separation	No	Not relevant.
3	Certified plant material	Yes	Seedlings could be a pathway for the nematode. The certification could have an effect on preventing the nematode to enter into the nurseries. Uncertainties: – None.
4	Growing media	Yes	Heat treatment and protection of the treated growing media is effective against the nematode. Uncertainties: – None.
5	Surveillance, monitoring and sampling	Yes	This assessment can have some effect against the nematode. Uncertainties: – The capability of detecting infections by the pest, especially in the case of early infections.
6	Hygiene measures	Yes	Hygiene measures can have some effect against the nematode. Uncertainties: – The degree to which roots of weeds are examined for the pest. – The degree to which symptom development occurs.
7	Removal of infested plant material	Yes	This measure can have some effect against the nematode. Uncertainties: – The degree to which roots of weeds are examined for the pest. – The degree to which symptom development occurs.

N	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
8	Irrigation water	Yes	This measure can have some effect against the nematode. Uncertainties: – None.
9	Application of pest control products	No	Not relevant. No nematicides are used in the nurseries.
10	Measures against soil pests	Yes	Separation of the pots from soil is effective against the nematode. Uncertainties: – None. – The possibility to reveal infections in plans with large root systems and much soil.
11	Inspections and management of plants before export	Yes	This measure can have some effect against the nematode. Uncertainties: – The capability of detecting root infections by the pest, especially in the case of early infections.
12	Separation during transport to the destination	No	Not relevant. The nematode cannot spread between the roots of the plants when transported to the EU.

A.1.5. Overall likelihood of pest freedom for bundles of whips and seedlings

A.1.5.1. Reasoning for a scenario which would lead to a reasonably low number of infected bundles of whips and seedlings

The scenario assumes a low pressure of the pest in the nurseries and in the surroundings. The plants are exposed to the nematode for only short period of time. The scenario also assumes that root galls are visible while inspecting plants before export and that the second juvenile stage are washed away during the root washing.

A.1.5.2. Reasoning for a scenario which would lead to a reasonably high number of infected bundles of whips and seedlings

The scenario assumes a high pressure of the pest in the nurseries and in the surroundings as many potential hosts are present. The scenario also assumes that root galls are not easily recognisable while inspecting plants before export and that the low-pressure washing is not effective in removing the second juvenile stage before export.

A.1.5.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infected bundles of whips and seedlings (Median)

The scenario assumes a limited presence of the pest in the nurseries and the surroundings and that the plants are exposed to the nematode for only short period of time. The movement of soil from the surrounding into the nurseries is not expected to be significant.

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

The limited information on occurrence of the pests in the UK including the nurseries and the surroundings results in high level of uncertainties for infection rates below the median. Otherwise, the pest pressure from the surroundings is expected to be low giving less uncertainties for rates above the median.

A.1.5.5. Elicitation outcomes of the assessment of the pest freedom for *Meloidogyne mali* on bundles of whips and seedlings

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

Table A.1: Elicited and fitted values of the uncertainty distribution of pest infection by *Meloidogyne mali* per 10,000 bundles

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	3					25		40		60					150
EKE	5.51	8.12	11.0	15.3	19.9	25.0	29.8	40.0	52.2	60.1	70.5	83.0	99.1	114	134

The EKE results is the BetaGeneral (2.6372, 576.47, 0, 10,000) distribution fitted with @Risk version 7.6.

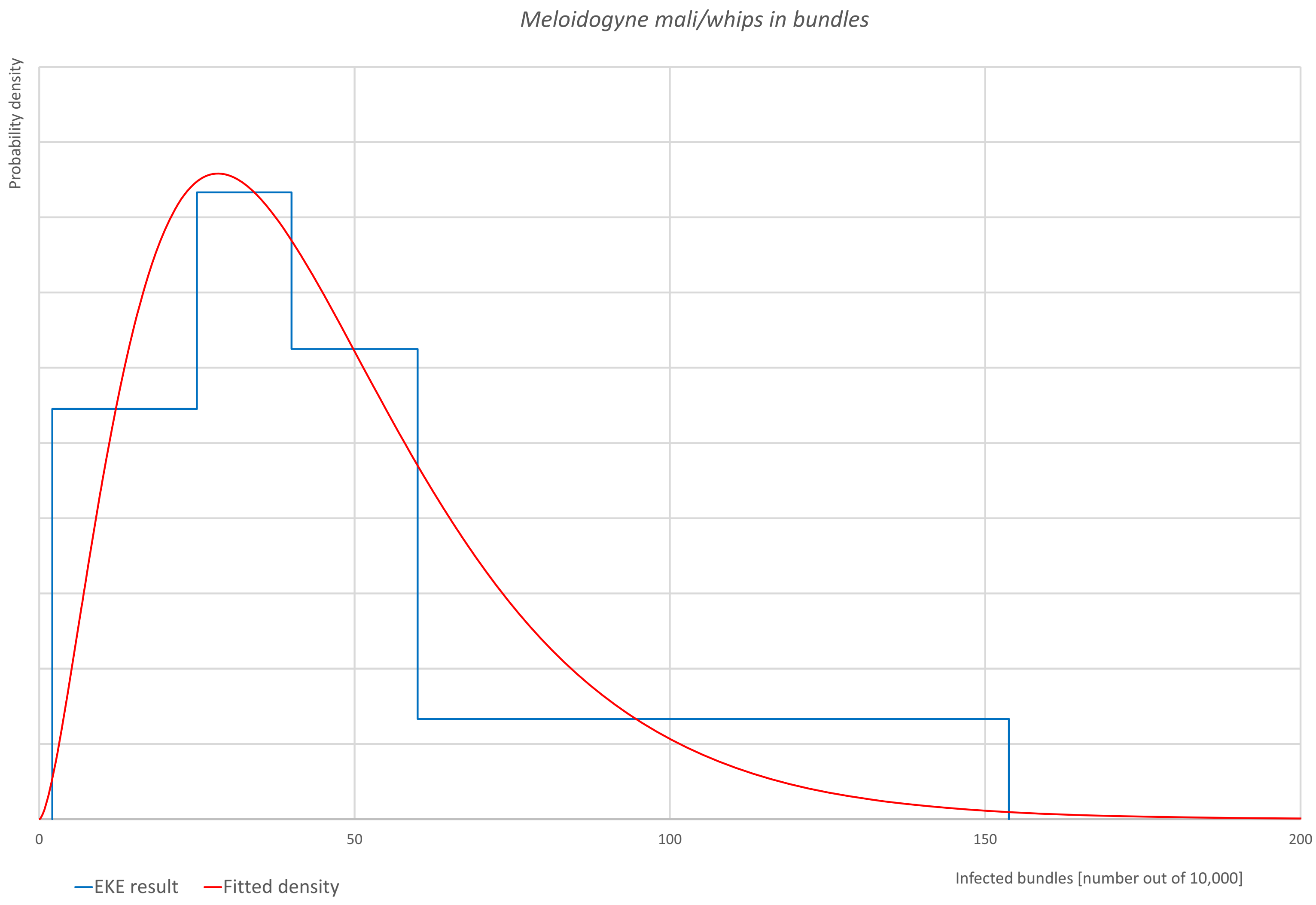
Based on the numbers of estimated infected bundles the pest freedom was calculated (i.e. = 10,000 – number of infected bundles per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.2.

Table A.2: The uncertainty distribution of bundles free of *Meloidogyne mali* per 10,000 bundles calculated by Table A.1

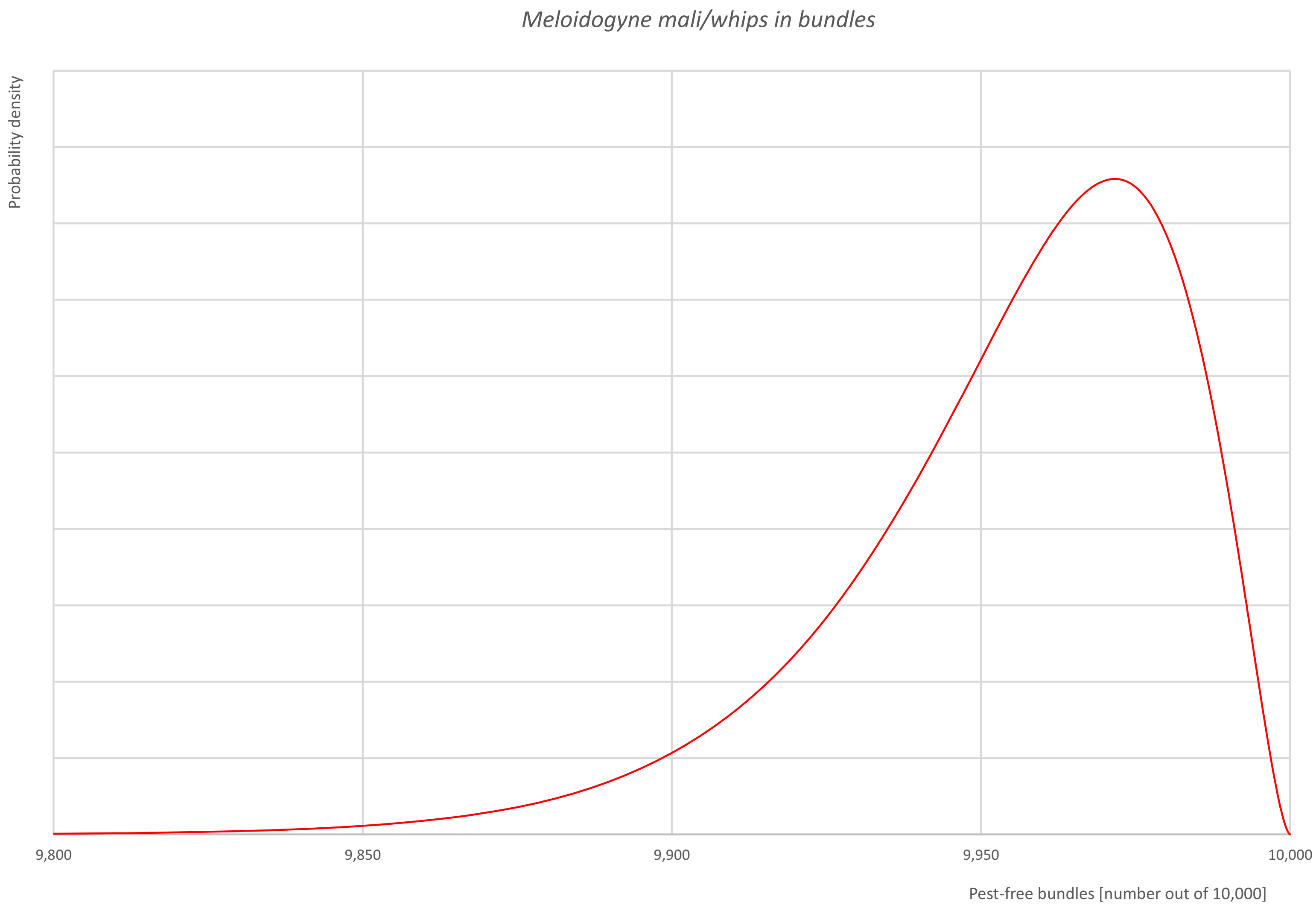
Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,850					9,940		9,960		9,975					9,997
EKE results	9,866	9,886	9,901	9,917	9,929	9,940	9,948	9,960	9,970	9,975	9,980	9,985	9,989	9,992	9,994

The EKE results are the fitted values.

(a)


Meloidogyne mali/whips in bundles
Probability density
0
50
100
150
200
Infected bundles [number out of 10,000]
EKE result
Fitted density

(b)



Meloidogyne mali/whips in bundles
Probability density
9,800
9,850
9,900
9,950
10,000
Pest-free bundles [number out of 10,000]

(c)

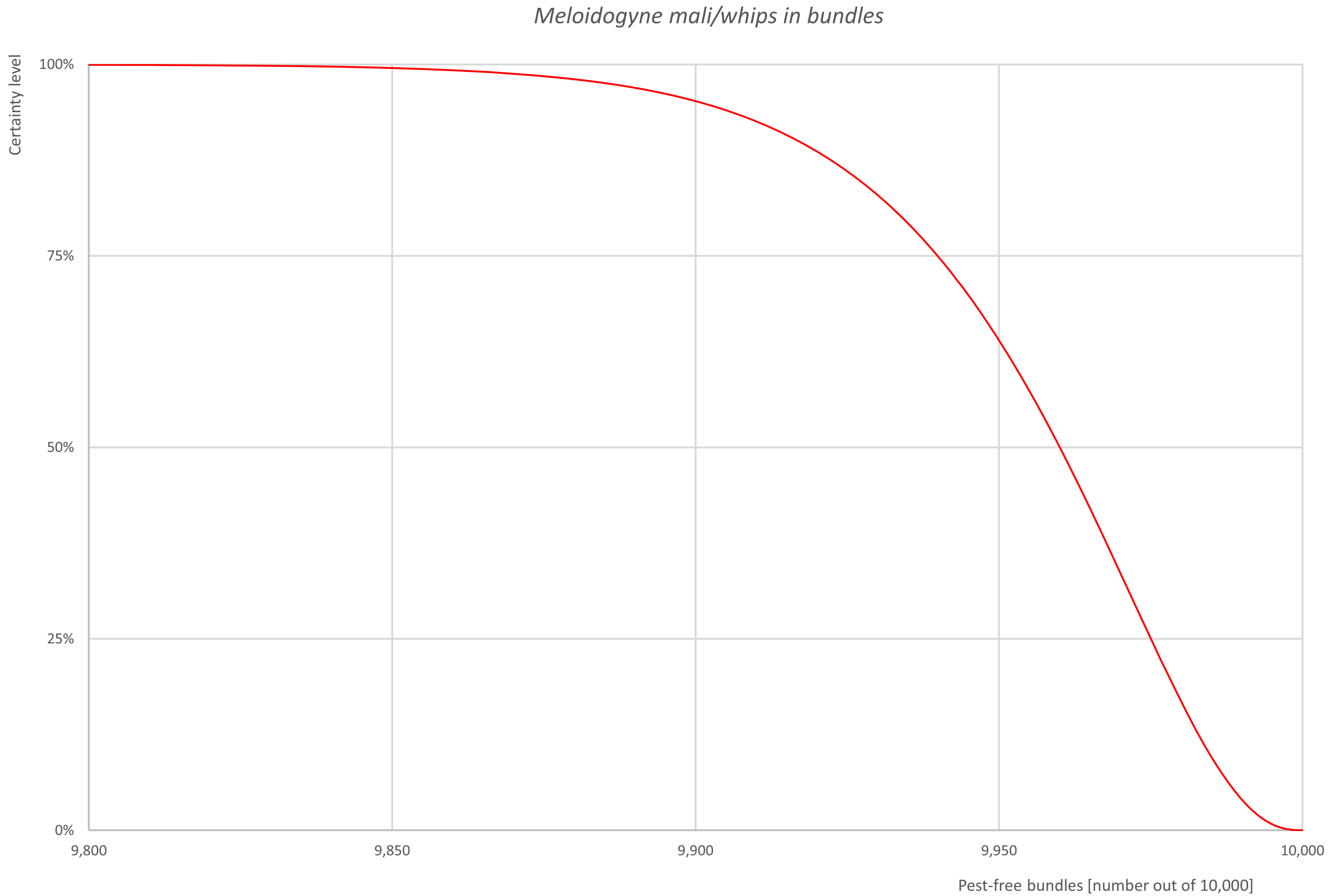


Figure A.1: (a) Elicited uncertainty of pest infection per 10,000 bundles (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free bundles per 10,000 (i.e.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

A.1.6. Overall likelihood of pest freedom for bare root plants/trees up to 7 years old

A.1.6.1. Reasoning for a scenario which would lead to a reasonably low number of infected bare root plants/trees up to 7 years old

The scenario assumes a low pressure of the pest in the nurseries and in the surroundings. Younger plants are exposed to the nematode for only short period of time. The scenario also assumes that root galls are visible while inspecting plants before export and that the second juvenile stage are washed away during the root washing.

A.1.6.2. Reasoning for a scenario which would lead to a reasonably high number of infected bare root plants/trees up to 7 years old

The scenario assumes a high pressure of the pest in the nurseries and in the surroundings as many potential hosts are present. Older plants are exposed to the nematode for longer period of time. The scenario also assumes that root galls are not easily recognisable while inspecting plants before export and that the low-pressure washing is not effective in removing second juvenile stages before export.

A.1.6.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infected bare root plants/trees up to 7 years old (Median)

The scenario assumes a limited presence of the pest in the nurseries and the surroundings and that the plants are exposed to the nematode for a sufficient period of time for infection to occur. The movement of soil from the surrounding into the nurseries is not expected to be significant.

A.1.6.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

The limited information on occurrence of the pests in the UK including the nurseries and the surroundings results in high level of uncertainties for infection rates below the median. Otherwise, the pest pressure from the surroundings is expected to be low giving less uncertainties for rates above the median.

A.1.6.5. Elicitation outcomes of the assessment of the pest freedom for *Meloidogyne mali* on bare root plants/trees up to 7 years old

The following Tables show the elicited and fitted values for pest infection (Table A.3) and pest freedom (Table A.4).

Table A3: Elicited and fitted values of the uncertainty distribution of pest infection by *Meloidogyne mali* per 10,000 plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	1					35		70		130					250
EKE	1.31	3.22	6.41	12.8	21.7	33.2	45.5	73.1	107	127	153	179	208	229	250

The EKE results is the BetaGeneral (1.0205, 2.5146, 0, 297) distribution fitted with @Risk version 7.6.

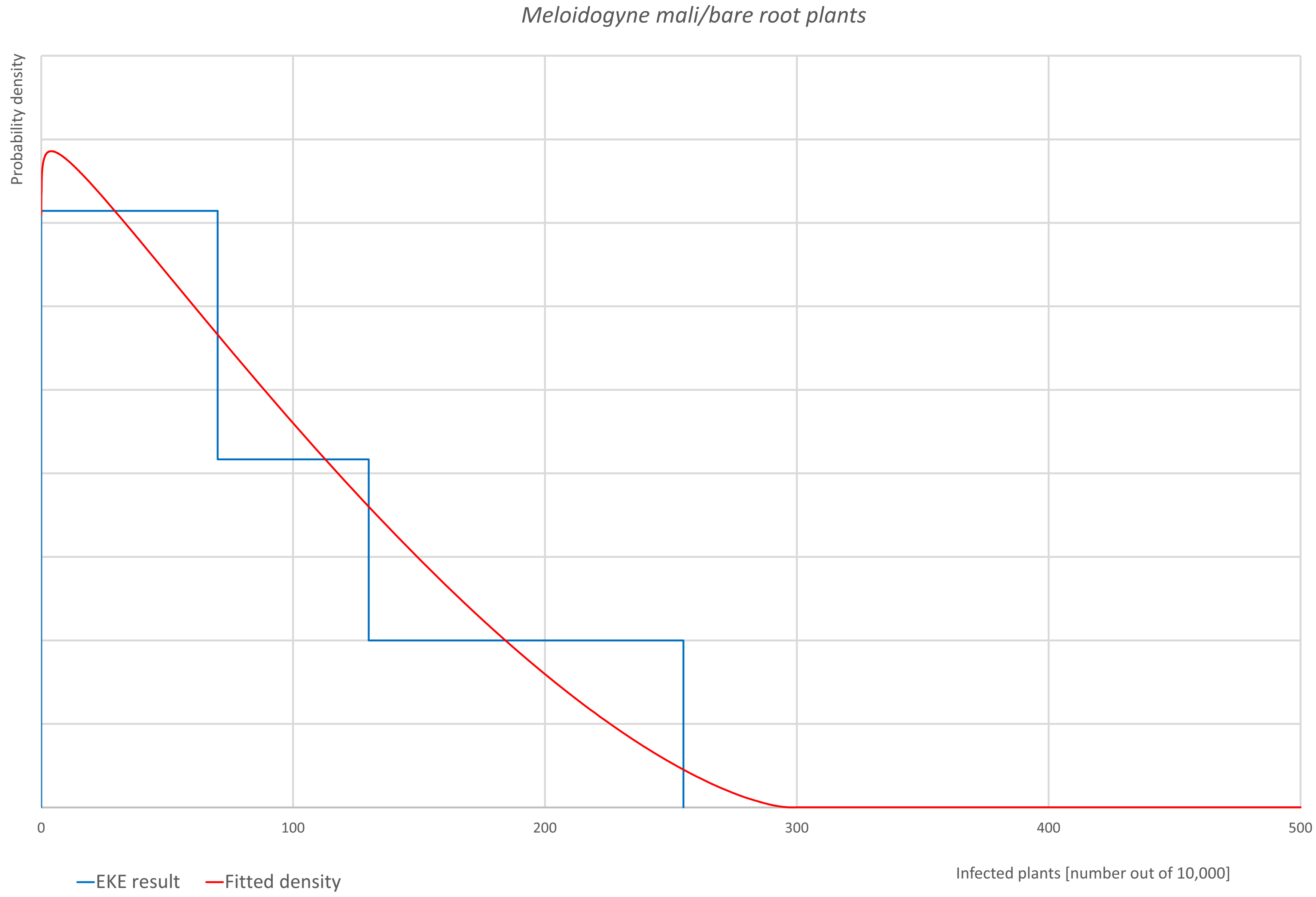
Based on the numbers of estimated infected plants the pest freedom was calculated (i.e. = 10,000 – number of infected plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.4.

Table A.4: The uncertainty distribution of plants free of *Meloidogyne mali* per 10,000 plants calculated by Table A.3

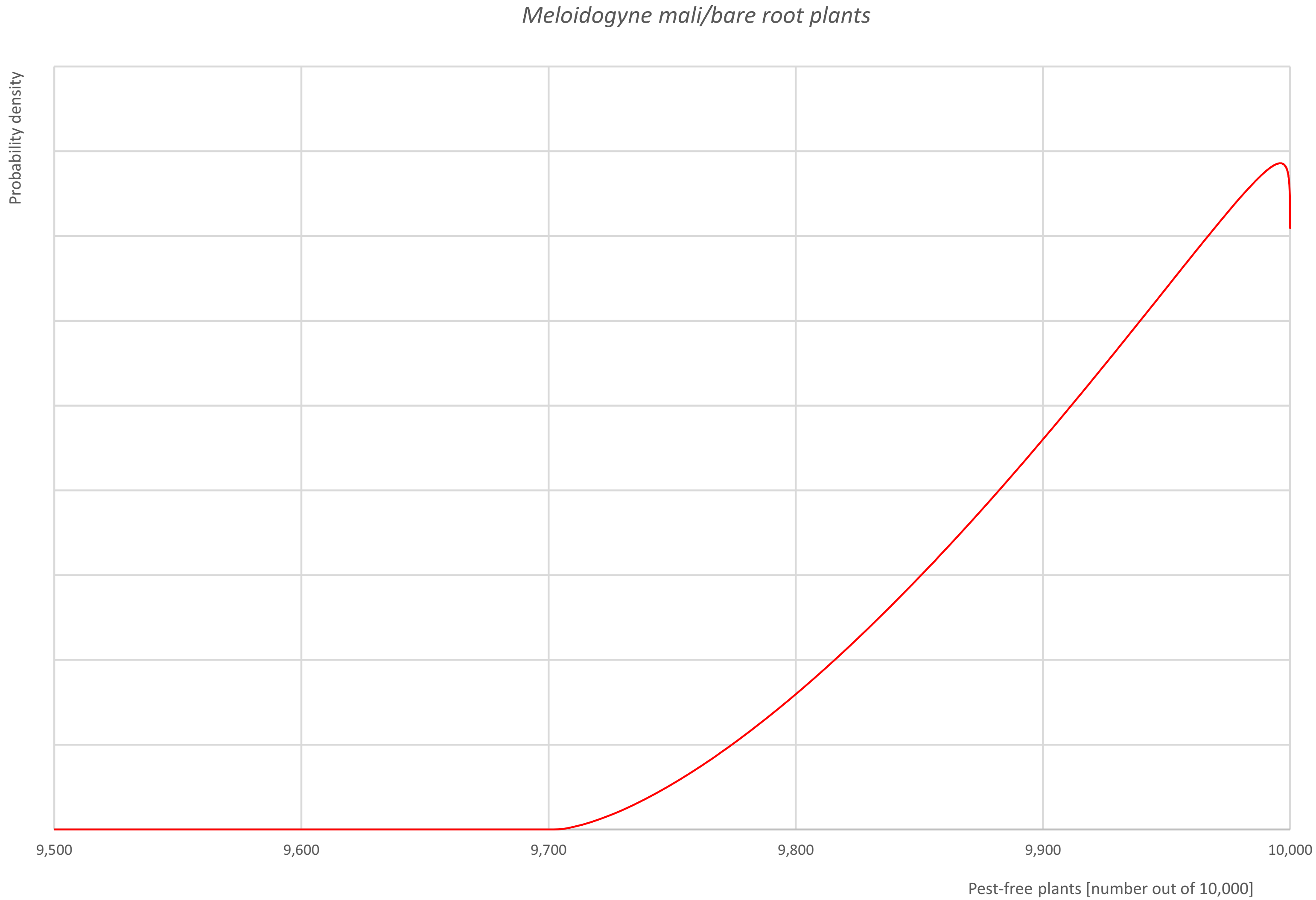
Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,750					9,870		9,930		9,965					9,999
EKE results	9,750	9,771	9,792	9,821	9,847	9,873	9,893	9,927	9,955	9,967	9,978	9,987	9,994	9,997	9,999

The EKE results are the fitted values.

(a)


Meloidogyne mali/bare root plants
Probability density
0
100
200
300
400
500
Infected plants [number out of 10,000]
EKE result
Fitted density

(b)


Meloidogyne mali/bare root plants
Probability density
9,500
9,600
9,700
9,800
9,900
10,000
Pest-free plants [number out of 10,000]

(c)

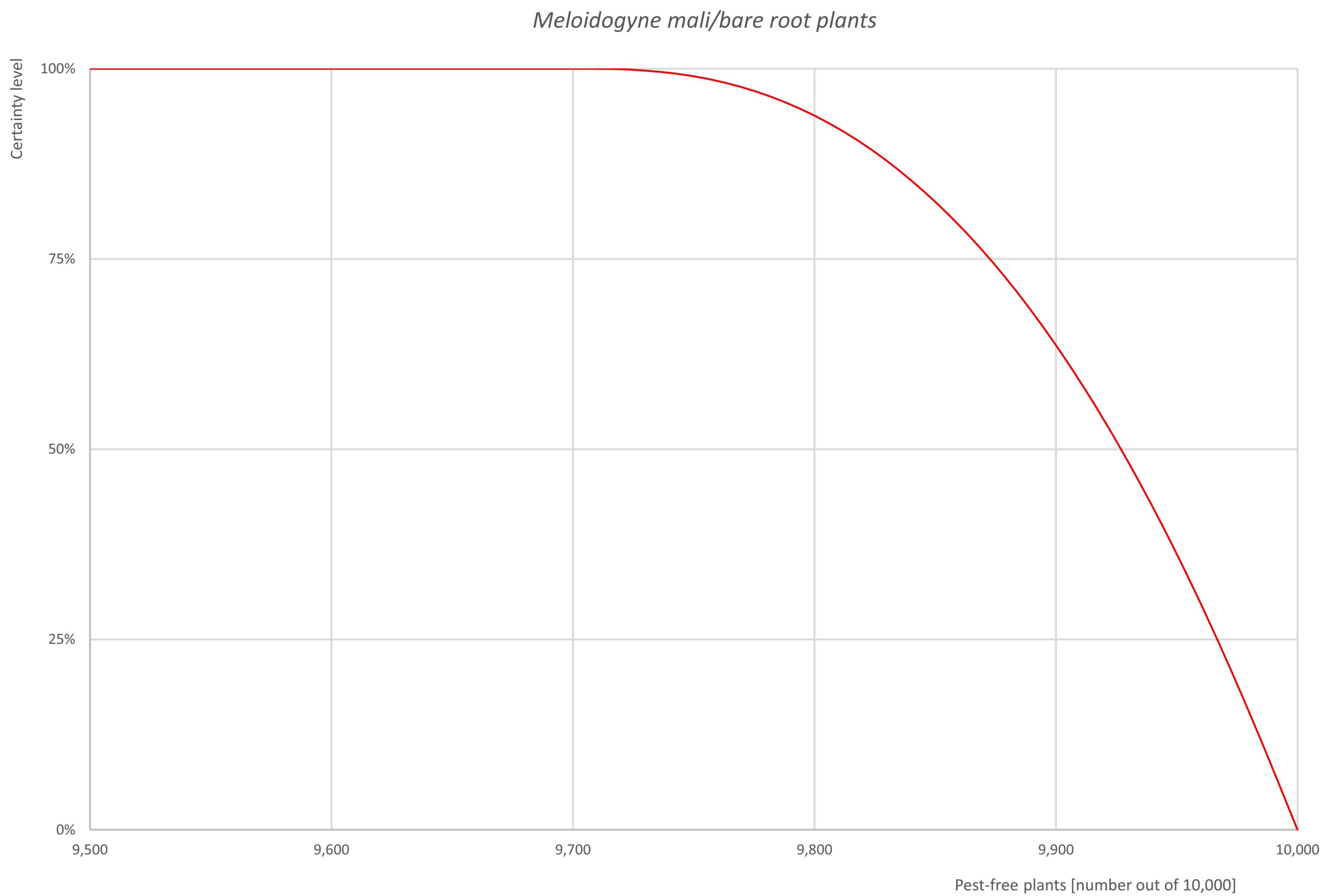


Figure A.2: (a) Elicited uncertainty of pest infection per 10,000 plants (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free plants per 10,000 (i.e.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

A.1.7. Overall likelihood of pest freedom for plants in pots up to 15 years old

A.1.7.1. Reasoning for a scenario which would lead to a reasonably low number of infected plants in pots up to 15 years old

The scenario assumes a low pressure of the pest in the nurseries and in the surroundings. Younger plants are exposed to the nematode for only short period of time. The scenario also assumes that root galls are visible while inspecting plants before export and that the root systems of plants have undergone washing and inspection before being transplanted in pots.

A.1.7.2. Reasoning for a scenario which would lead to a reasonably high number of infected plants in pots up to 15 years old

The scenario assumes a high pressure of the pest in the nurseries and in the surroundings as many potential hosts are present. Older plants are exposed to the nematode for longer period of time. The scenario also assumes that root galls are not easily recognisable while inspecting plants before export and that the root systems of plants did not undergone washing and inspection before being transplanted in pots.

A.1.7.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infected plants in pots up to 15 years old (Median)

The scenario assumes a limited presence of the pest in the nurseries and the surroundings and that the plants are exposed to the nematode for a sufficient period of time for infection to occur. The movement of soil from the surrounding into the nurseries is not expected to be significant.

A.1.7.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

The limited information on occurrence of the pests in the UK including the nurseries and the surroundings results in high level of uncertainties for infection rates below the median. Otherwise, the pest pressure from the surroundings is expected to be low giving less uncertainties for rates above the median.

A.1.7.5. Elicitation outcomes of the assessment of the pest freedom for *Meloidogyne mali* on plants in pots up to 15 years old

The following Tables show the elicited and fitted values for pest infection (Table A.5) and pest freedom (Table A.6).

Table A.5: Elicited and fitted values of the uncertainty distribution of pest infection by *Meloidogyne mali* per 10,000 plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	1					45		90		130					250
EKE	4.68	8.79	14.3	23.5	34.3	47.0	59.5	85.7	116	134	157	181	207	228	250

The EKE results is the BetaGeneral (1.4846, 3.5229, 0, 320) distribution fitted with @Risk version 7.6.

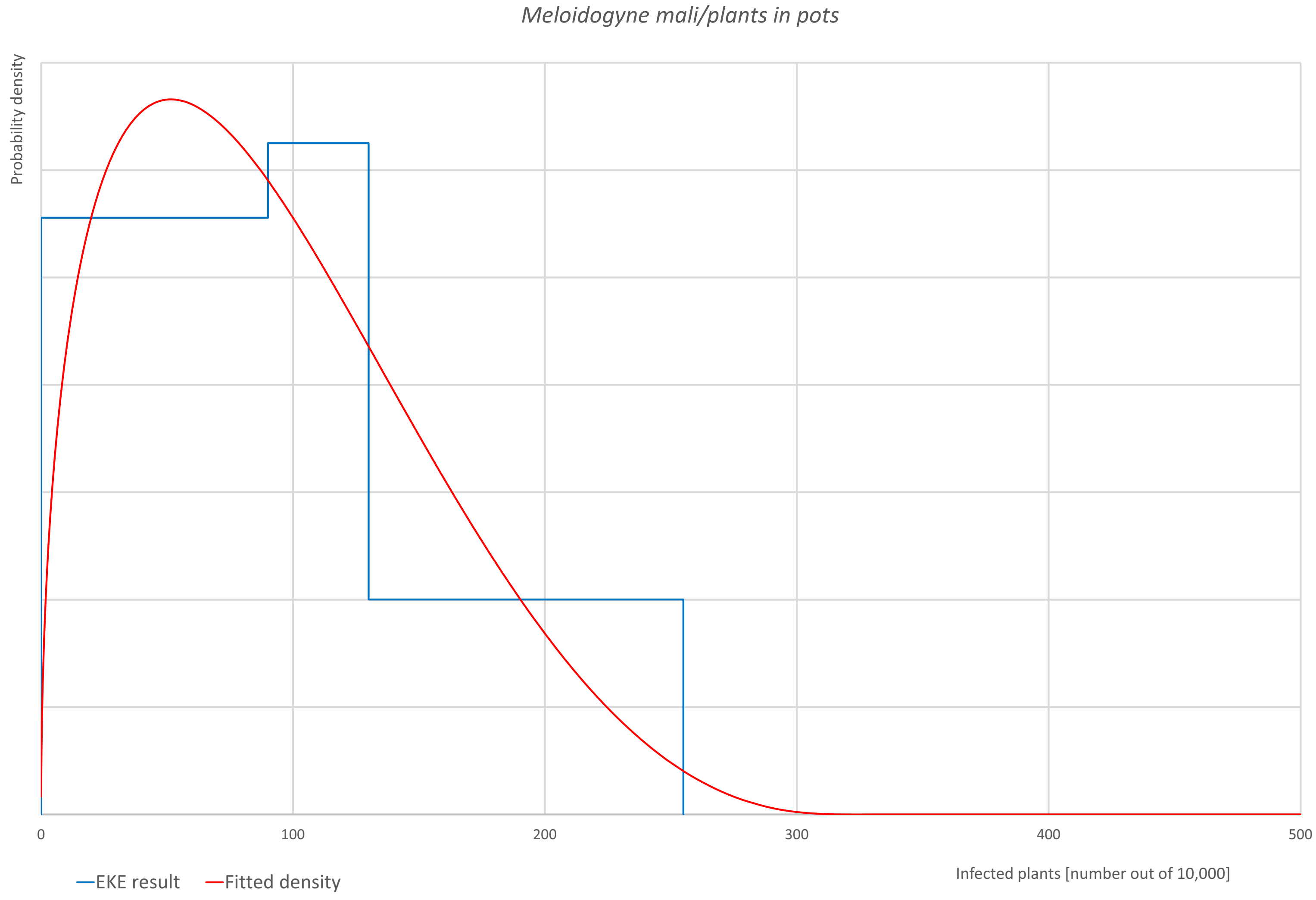
Based on the numbers of estimated infected plants the pest freedom was calculated (i.e. = 10,000 – number of infected plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.6.

Table A.6: The uncertainty distribution of plants free of *Meloidogyne mali* per 10,000 plants calculated by Table A.5

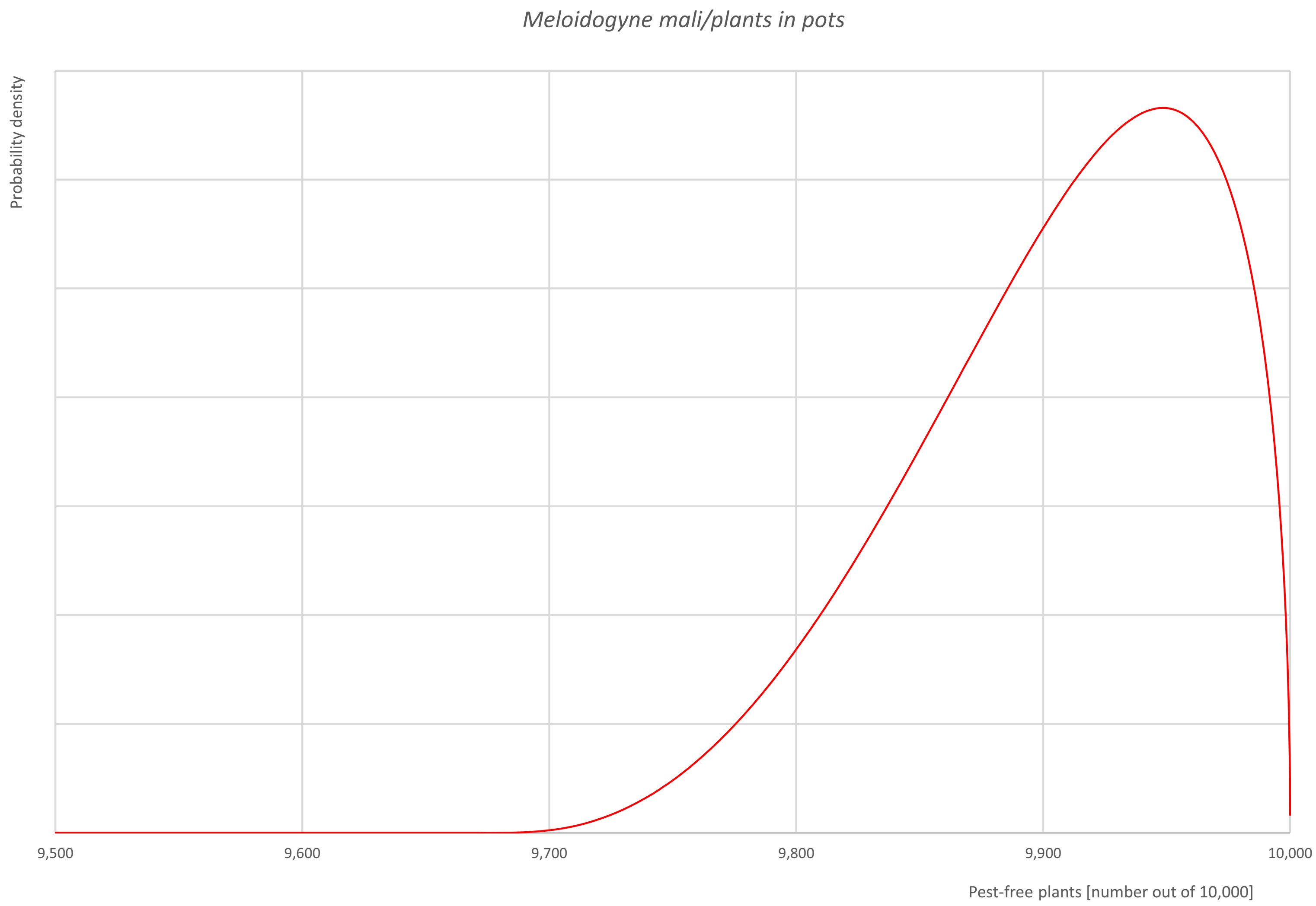
Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,750					9,870		9,910		9,955					9,999
EKE results	9,750	9,772	9,793	9,819	9,843	9,866	9,884	9,914	9,940	9,953	9,966	9,977	9,986	9,991	9,995

The EKE results are the fitted values.

(a)


Meloidogyne mali/plants in pots
Probability density
0
100
200
300
400
500
Infected plants [number out of 10,000]
EKE result
Fitted density

(b)


Meloidogyne mali/plants in pots
Probability density
9,500
9,600
9,700
9,800
9,900
10,000
Pest-free plants [number out of 10,000]

(c)

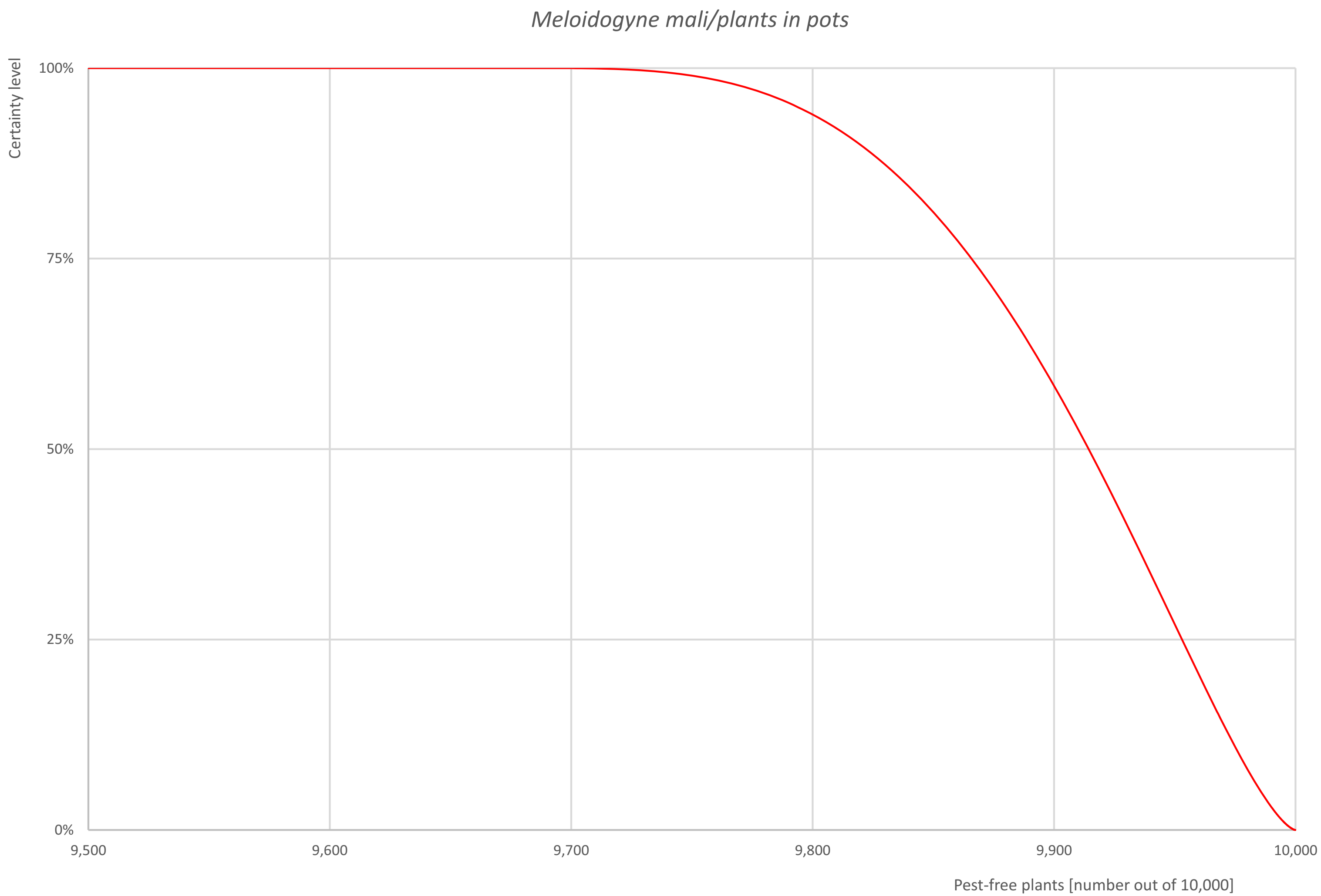


Figure A.3: (a) Elicited uncertainty of pest infection per 10,000 plants (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free plants per 10,000 (i.e.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

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A.2. *Phytophthora kernoviae*

A.2.1. Organism information

Taxonomic information	Current valid scientific name: *Phytophthora kernoviae* Synonyms: – Name used in the EU legislation: – Order: Peronosporales Family: Peronosporaceae Common name: – Name used in the Dossier: *Phytophthora kernoviae*
Group	Oomycetes
EPPO code	PHYTKE
Regulated status	*Phytophthora kernoviae* is not regulated in the EU. The pathogen is included in the EPPO A2 list (EPPO, online_a). *Phytophthora kernoviae* is a quarantine pest in Morocco. It is on A1 list of Chile, Egypt, Kazakhstan and EAEU (=Eurasian Economic Union: Armenia, Belarus, Kazakhstan, Kyrgyzstan and Russia) and on A2 list of the United Kingdom (EPPO, online_b).
Pest status in the UK	*Phytophthora kernoviae* is present in the UK: England, Scotland and Wales (Brasier et al., 2005; Webber, 2008; Elliot et al., 2013; EPPO, online_c; Farr and Rossman, online). From 2003 till January 2008 the pathogen was found mainly in the wild and only reported in 3 nurseries. In May 2008, it was found on imported plant material in a nursery in Kent (DEFRA, 2008). According to the Dossier Section 5.0 *Phytophthora kernoviae* is present not widely distributed, is a UK provisional quarantine pest and it is under official control in Great Britain. In the North Ireland the pathogen is not recorded.
Pest status in the EU	*Phytophthora kernoviae* is present in Ireland (O'Hanlon et al., 2016; EPPO, online_c). It was first found on *Rhododendron ponticum* in woodlands in county Cork (South coast of Ireland) in 2008 (EPPO, online_d).
Host status on *Fagus sylvatica*	*Fagus sylvatica* is a reported host of *P. kernoviae* in the UK (Brasier et al., 2005; EPPO, online_e; Farr and Rossman, online). *Phytophthora kernoviae* is a pathogen of other *Fagus* species such as *F. grandiflora* (Farr and Rossman, online).
PRA information	Pest Risk Assessments available: – Pest risk management for *Phytophthora kernoviae* and *Phytophthora ramorum* (EPPO, 2013); – UK Risk Register Details for *Phytophthora kernoviae* (DEFRA, online).
Other relevant information for the assessment	
Biology	*Phytophthora kernoviae* is present in Europe (Ireland, the United Kingdom), Oceania (New Zealand) and South America (Argentina, Chile) (EPPO, online_c; Farr and Rossman, online). The pathogen was first found on *Fagus sylvatica* and *R. ponticum* in Cornwall, south-west England in 2003 during official surveillance activities for *P. ramorum*. Its origin is unclear (Brasier et al., 2005), but it is suggested to be native to New Zealand (Studholme et al., 2019). *Phytophthora* species generally reproduce through a) dormant (resting) spores which can be either sexual (oospores) or asexual (chlamydospores); and b) fruiting structures (sporangia) which contain zoospores (Erwin and Ribeiro, 1996). *Phytophthora kernoviae* belongs to clade 10 of a genus wide phylogeny of *Phytophthora* (Blair et al., 2008; Jung et al., 2022). The pathogen is self-fertile (homothallic) and produces oogonia, oospores and highly caducous sporangia. Chlamydospores were not observed. The sporangia are either splash or wind dispersed over short distances (Brasier et al., 2005; DEFRA, 2008).

	Sporangia are only formed on hosts with susceptible foliage. *Rhododendron* is the most abundant sporulating host in Great Britain woodlands. Trunk cankers (e.g. on *Fagus sylvatica*) are not known to support sporulation and therefore do not transmit the pathogen. This appears to be a dead end for the pathogen (DEFRA, 2008). Optimum conditions for growth require temperatures between 18 and 26°C (Brasier et al., 2005) and moisture (DEFRA, 2008). Optimum temperature for infection on *R. ponticum* was observed to be between 15°C and 20°C (Shelley et al., 2018). Oospore germination was optimal at 18°C and 20°C. Germination was higher when oospores were exposed to continuous light compared to those in the dark, although not significantly for all isolates (Widmer, 2010). *Phytophthora kernoviae* infects leaves, shoots, stems, buds (DEFRA, 2008) and also roots (Fichtner et al., 2011). Osswald et al. 2014 reports infection of roots and movement of the pathogen to the trunk in *F. sylvatica*. According to Brown and Brasier (2007), *P. kernoviae* commonly occupies xylem beneath phloem lesions and may spread within xylem and possibly recolonise the phloem from the xylem. *Phytophthora kernoviae* can remain viable within xylem for 2 or more years after the overlying phloem had been excised. *Phytophthora kernoviae* can be found in soil, leaf litter and water streams (DEFRA, 2008). According to Widmer (2011), oospores of *P. kernoviae* buried in a sand can survive for long periods of time at temperatures of 30°C and below. In the west of Scotland, inoculum of *P. kernoviae* persisted in soil for at least 2 years after its hosts were removed (Elliot et al., 2013). In Chile, *P. kernoviae* was common to small forest streams (Jung et al., 2018). *Phytophthora kernoviae* can disperse by soil containing propagules on people's shoes, feet of animals and wheels of machinery (DEFRA, 2008; Brasier, 2008). Possible pathways of entry for *P. kernoviae* are plants for planting (excluding seed and fruit) of known susceptible hosts; plants for planting (excluding seed and fruit) of non-host plant species accompanied by contaminated attached growing media; soil/ growing medium (with organic matter) as a commodity; soil as a contaminant; foliage or cut branches; susceptible (isolated) bark and susceptible wood (EPPO, 2013).	
Symptoms	**Main type of symptoms**	According to DEFRA (2008) *P. kernoviae* causes three different types of disease: a) 'Kernoviae bleeding canker' – cankers on trunks of trees, which emit a dark ooze. As they increase in size, they can lead to tree death. b) 'Kernoviae leaf blight' – infection of the foliage, leading to discoloured lesions on the leaves. c) 'Kernoviae dieback' – shoot and bud infections which result in wilting, discolouration and dying back of affected parts. *Phytophthora kernoviae* causes bark necrosis and bleeding stem lesions above ground level on *F. sylvatica* (Brasier et al., 2005). There is an uncertainty whether such symptoms develop on young plants and plants for planting. The pathogen was also observed to infect roots of *F. sylvatica* (Fichtner et al., 2012, citing others). On *R. ponticum* the pathogen causes shoot dieback, foliar necrosis, wilting, cankers, defoliation and death (Brasier et al., 2005; Beales et al., 2006). Symptoms on *Drimys winteri* in native forest of southern Chile showed necrosis around the midrib of leaves (Sanfuentes et al., 2016) and bleeding canker in the UK (EPPO, online_f).

	Presence of asymptomatic plants	*Phytophthora kernoviae* was observed causing symptomless infections of leaves on *Rhododendron* 'Cunninghams White' and *Quercus ilex* (Denman et al., 2009) and symptomless infections of roots on *R. ponticum* (Fichtner et al., 2011). Application of some fungicides may reduce symptoms and therefore mask infection, making it more difficult to determine whether the plant is pathogen-free (DEFRA, 2008).
	Confusion with other pests	*Phytophthora kernoviae* can be easily distinguished from other *Phytophthora* species based on morphology (Brasier et al., 2005) and molecular tests (Beales et al., 2006; Hughes et al., 2011).
Host plant range	*Phytophthora kernoviae* has quite wide host range. Main host plants include *F. sylvatica* and *R. ponticum* (EPPO, online_e). Other hosts are *Aesculus hippocastanum*, *Agathis australis*, *Annona cherimola*, *Berberis*, *Castanea sativa*, *Drimys winteri*, *Fagus grandiflora*, *Gevuina avellana*, *Hedera helix*, *Ilex aquifolium*, *Leucothoe fontanesiana*, *Liriodendron tulipifera*, *Lomatia myricoides*, *Magnolia amoena*, *M. cylindrica*, *M. delavayi*, *M. doltsopa*, *M. kobus*, *M. liliiflora*, *M. salicifolia*, *M. sargentiana*, *M. sprengeri*, *M. stellata*, *M. wilsonii*, *M.* x *brooklynensis*, *M.* x *soulangeana*, *Michelia doltsopa*, *Photinia* sp., *Pieris formosa*, *P. japonica*, *Pinus radiata*, *Podocarpus salignus*, *Prumnopitys ferruginea*, *Prunus laurocerasus*, *Quercus ilex*, *Q. robur*, *Sequoiadendron giganteum* and *Vaccinium myrtillus* (Brasier et al., 2005; Dick et al., 2014; O'Hanlon et al., 2016; EPPO, online_e; Farr and Rosmann, online). Experimental hosts are *Rhododendron macrophyllum*, *R. occidentale* and *Umbellularia californica* (Fichtner et al., 2012; EPPO, online_e). Some of the hosts which have susceptible leaves and can produce infective sporangia are *Drimys* spp., *Gevuina avellana*, *Ilex*, *Liriodendron tulipifera*, *Magnolia*, *Michelia*, *Prunus laurocerasus, Quercus ilex* and *Rhododendron ponticum* (DEFRA, 2008).	
Reported evidence of impact	There is no data available on the actual impact that *P. kernoviae* has caused so far in the world. In the UK *P. kernoviae* appears to be a serious foliar pathogen on *Rhododendron* species (Webber, 2008). According to Beales et al. (2009) *P. kernoviae* has caused significant impact on ornamental plants and tree species since 2003 mainly in south-west England. In New Zealand, the pathogen together with *Phytophthora pluvialis* is connected to red needle cast disease (Dick et al., 2014) or needle blight of *Pinus radiata* (McDougal and Ganley, 2021). However, it has rarely been associated with plant disease (Scott and Williams, 2014).	
Evidence that the commodity is a pathway	According to EPPO (2013), *P. kernoviae* can travel with plants for planting. Therefore, the commodity is a possible pathway of entry for *P. kernoviae*.	
Surveillance information	This pathogen is a UK provisional quarantine pest. It has been found in all three countries of Great Britain, with the highest concentration of confirmed cases in the counties of Devon and Cornwall in South-West England. It has not been recorded in Northern Ireland (Dossier Section 5.0). As part of an annual survey at ornamental retail and production sites (frequency of visits determined by a decision matrix), *P. kernoviae* is inspected for on common hosts plants (Dossier Section 5.0).	

A.2.2. Possibility of pest presence in the nursery

A.2.2.1. Possibility of entry from the surrounding environment

Phytophthora kernoviae is present in the UK, it has been found in England, Scotland and Wales (Brasier et al., 2005; Webber, 2008; Elliot et al., 2013; EPPO, online_c; Farr and Rossman, online).

The possible entry of *P. kernoviae* from surrounding environment to the nurseries may occur through wind and rain (Brasier et al., 2005), water (Jung et al., 2018), people, animals and machinery entering the nursery with infested soil (Brasier, 2008).

Phytophthora kernoviae has wide host range and can infect number of different plants. Suitable hosts of *P. kernoviae* like *Aesculus* spp., *Castanea* spp., *Magnolia* spp., *Pinus* spp., *Prunus* spp., *Quercus* spp., *Rhododendron* spp. and *Vaccinium* spp. are present within 2 km from the nurseries (Dossier Section 3.0).

Uncertainties:

- The dispersal range of *P. kernoviae* sporangia.
- Possibility of the pathogen to enter nursery with irrigation water.
- No information available on the distance of the nurseries to sources of pathogen in the surrounding environment.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for the pathogen to enter the nurseries from surrounding environment. In the surrounding area, suitable hosts are present and the pathogen can spread by wind, rain, water and infested soil propagules on machinery and feet of animals and humans entering the nurseries.

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

The starting materials are either seeds or seedlings. Seeds are certified and coming from the UK. Seedlings are either from the UK or the EU (the Netherlands and France) (Dossier Section 3.0). Seeds are not a pathway for the pathogen.

In addition to *Fagus* plants, the nurseries also produce other plants (Dossier Section 6.0). Out of them, there are many suitable hosts for the pathogen (such as *Aesculus* spp., *Berberis* spp., *Castanea* spp., *Liriodendron tulipifera*, *Pinus* spp., *Prunus* spp., *Quercus* spp., etc.). However, there is no information on how and where the plants are produced. Therefore, if the plants are first produced in another nursery, the pathogen could possibly travel with them.

The nurseries are using virgin peat or peat-free compost (a mixture of coir, tree bark, wood fibre, etc.) as a growing media (Dossier Section 1.0). *Phytophthora kernoviae* is able to survive in soil (Elliot et al., 2013) and therefore could potentially enter with infested soil/growing media. However, the growing media is certified and heat-treated by commercial suppliers during production to eliminate pests and diseases (Dossier Section 3.0).

Uncertainties:

- No information is available on the provenance of plants other than *F. sylvatica* used for plant production in the nurseries.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for the pathogen to enter the nurseries with new seedlings of *Fagus* and new plants of other species used for plant production in the area. The entry of the pathogen with seeds and the growing media the Panel considers as not possible.

A.2.2.3. Possibility of spread within the nursery

Fagus plants are either grown in containers (cells, pots, tubes, etc.) or in field. Cell grown trees may be grown in greenhouses, however most plants will be field grown, or field grown in containers (Dossier Section 1.0). There are no mother plants present in the nurseries (Dossier Section 3.0).

The pathogen can infect other suitable plants (such as *Aesculus* spp., *Berberis* spp., *Castanea* spp., *L. tulipifera*, *Pinus* spp., *Prunus* spp., *Quercus* spp., etc.) present within the nurseries and hedges surrounding the nurseries (*Ilex* spp. and *Prunus* spp.) (Dossier Sections 3.0 and 6.0).

Phytophthora kernoviae can spread within the nurseries by wind, rain, soil, water, movement of infested plant material, humans and animals (Davidson et al., 2002).

Uncertainties:

- None.

Taking into consideration the above evidence and uncertainties, the Panel considers that the spread of the pathogen within the nurseries is possible by wind, rain, soil, water, movement of infested plant material, humans and animals.

A.2.3. Information from interceptions

In the EUROPHYT/TRACES-NT database, there are no records of notification of *F. sylvatica* plants for planting neither from the UK nor from other countries due to the presence of *P. kernoviae* between the years 1995 and December 2022 (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 the UK are listed and an indication of their effectiveness on *P. kernoviae* is provided. The description of the risk mitigation measures currently applied in the UK is provided in the Table 6.

N	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
1	Registration of production sites	Yes	*Phytophthora kernoviae* is a UK provisional quarantine pest targeted by this measure. Uncertainties: – Whether disease symptoms on *F. sylvatica* and other potential host plants are recognisable, particularly at an early stage of infection.
2	Physical separation	No	Not relevant.
3	Certified plant material	Yes	*Phytophthora kernoviae* is a UK provisional quarantine pest targeted by this measure. Uncertainties: – Whether disease symptoms on *F. sylvatica* and other potential host plants are recognisable, particularly at an early stage of infection.
4	Growing media	Yes	This measure should ensure pest-free growing media and is expected to prevent the introduction of the pathogen into the nurseries with growing media. Uncertainties: – None.
5	Surveillance, monitoring and sampling	Yes	This measure has an effect as the pathogen would be detected on nursery-grown plants, as well as on incoming plant material and growing media, and suspected plant material quarantined. Uncertainties: – Whether disease symptoms on *F. sylvatica* and other potential host plants are recognisable, particularly at an early stage of infection.
6	Hygiene measures	Yes	General hygiene measures will reduce the likelihood of the pathogen being spread by tools and equipment, although this is not a major pathway for the pest. Uncertainties: – None.
7	Removal of infested plant material	Yes	This measure could have some effect by removing potentially infested plant material, thus reducing the spread of the pathogen within the nursery. Uncertainties: – None.
8	Irrigation water	Yes	Testing of irrigation water would detect the pathogen, which can spread by water. Overhead irrigation could favour the spread of the pathogen by water splash.

N	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
			Uncertainties: – Whether irrigation water is tested for *P. kernoviae*.
9	Application of pest control products	Yes	Some fungicides could reduce the likelihood of infection by the pathogen. However, some fungicides may reduce symptoms and therefore mask infection, making it more difficult to determine whether the plant is pathogen-free (DEFRA, 2008). Uncertainties: – No specific information on the fungicides used. – The level of efficacy of fungicides in reducing infection of *P. kernoviae* on *F. sylvatica*.
10	Measures against soil pests	Yes	This measure could have some effect by preventing root contact with soil where the pathogen may be present. Uncertainties: – None.
11	Inspections and management of plants before export	Yes	*Phytophthora kernoviae* is a UK provisional quarantine pest targeted by this measure. Uncertainties: – Whether disease symptoms on *F. sylvatica* are recognisable, particularly at an early stage of infection.
12	Separation during transport to the destination	No	Not relevant.

A.2.5. Overall likelihood of pest freedom for bundles of whips and seedlings

A.2.5.1. Reasoning for a scenario which would lead to a reasonably low number of infected bundles of whips and seedlings

The scenario assumes a low pressure of the pathogen in the nurseries and in the surroundings. The plants are exposed to the pathogen for only short period of time. The scenario also assumes that symptoms of the disease are visible and promptly detected during inspections.

A.2.5.2. Reasoning for a scenario which would lead to a reasonably high number of infected bundles of whips and seedlings

The scenario assumes a high pressure of the pathogen in the surroundings as suitable hosts are present. The scenario also assumes that symptoms of the disease are not easily recognisable during inspections.

A.2.5.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infected bundles of whips and seedlings (Median)

The scenario assumes a limited presence of the pathogen in the nurseries and the surroundings. The pathogen is a provisional quarantine pest in the UK and under official control.

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

The limited information on the occurrence of the pathogen in the nurseries and the surroundings results in high level of uncertainties for infestation rates below the median. Otherwise, the pest pressure from the surroundings is expected to be low giving less uncertainties for rates above the median.

A.2.5.5. Elicitation outcomes of the assessment of the pest freedom for *Phytophthora kernoviae* on bundles of whips and seedlings

The following Tables show the elicited and fitted values for pest infection (Table A.7) and pest freedom (Table A.8).

Table A.7: Elicited and fitted values of the uncertainty distribution of pest infection by *Phytophthora kernoviae* per 10,000 bundles

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	1					10		18		40					90
EKE	1.01	1.33	1.93	3.31	5.43	8.4	11.8	20.0	31.0	38.3	47.6	58.1	70.2	80.2	90.7

The EKE results is the BetaGeneral (0.85714, 3.3774, 0.85, 125) distribution fitted with @Risk version 7.6.

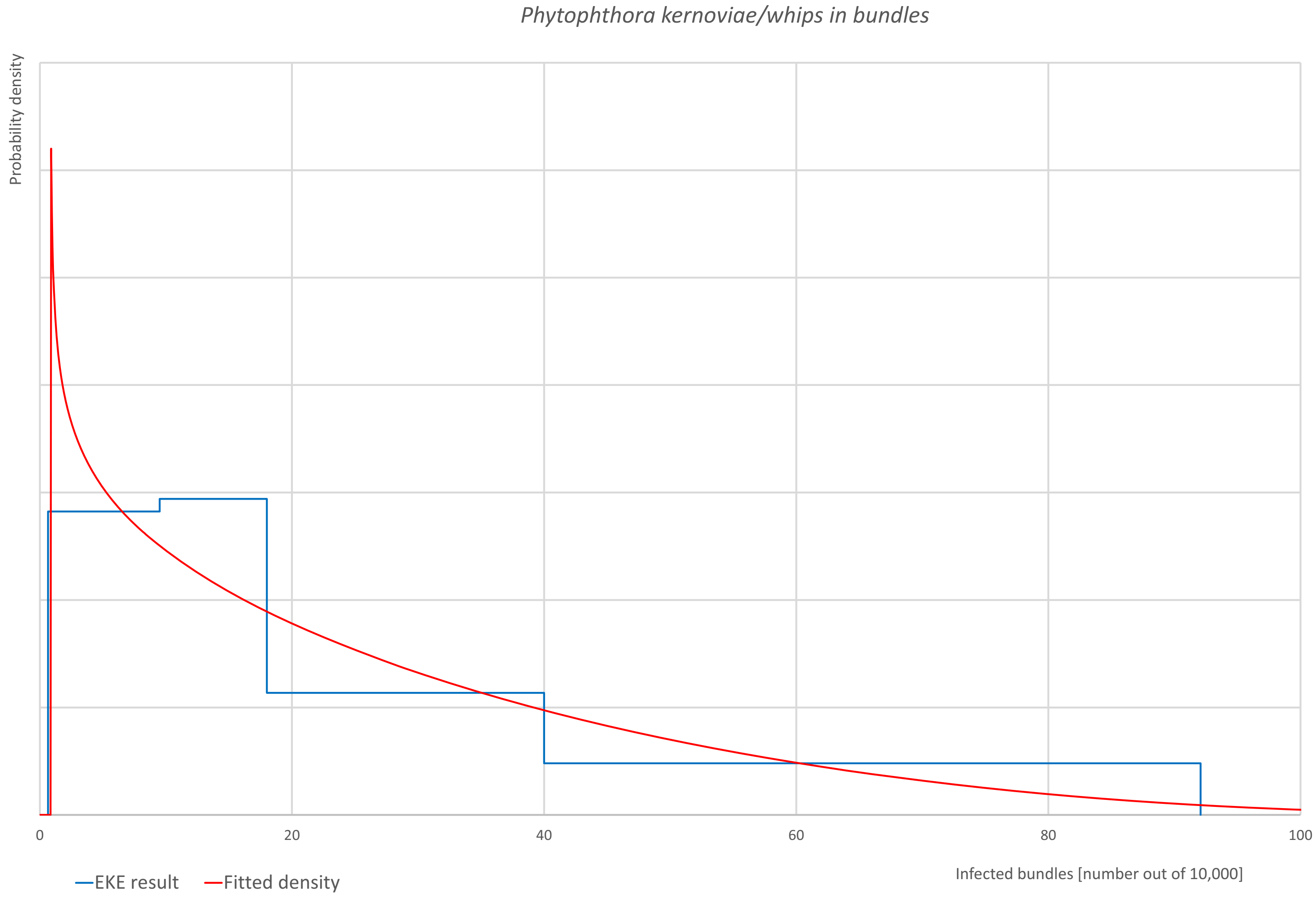
Based on the numbers of estimated infected bundles the pest freedom was calculated (i.e. = 10,000 – number of infected bundles per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.8.

Table A.8: The uncertainty distribution of bundles free of *Phytophthora kernoviae* per 10,000 bundles calculated by Table A.7

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,910					9,960		9,982		9,991					9,999
EKE results	9,909	9,920	9,930	9,942	9,952	9,962	9,969	9,980	9,988	9,992	9,995	9,997	9,998.1	9,998.7	9,999.0

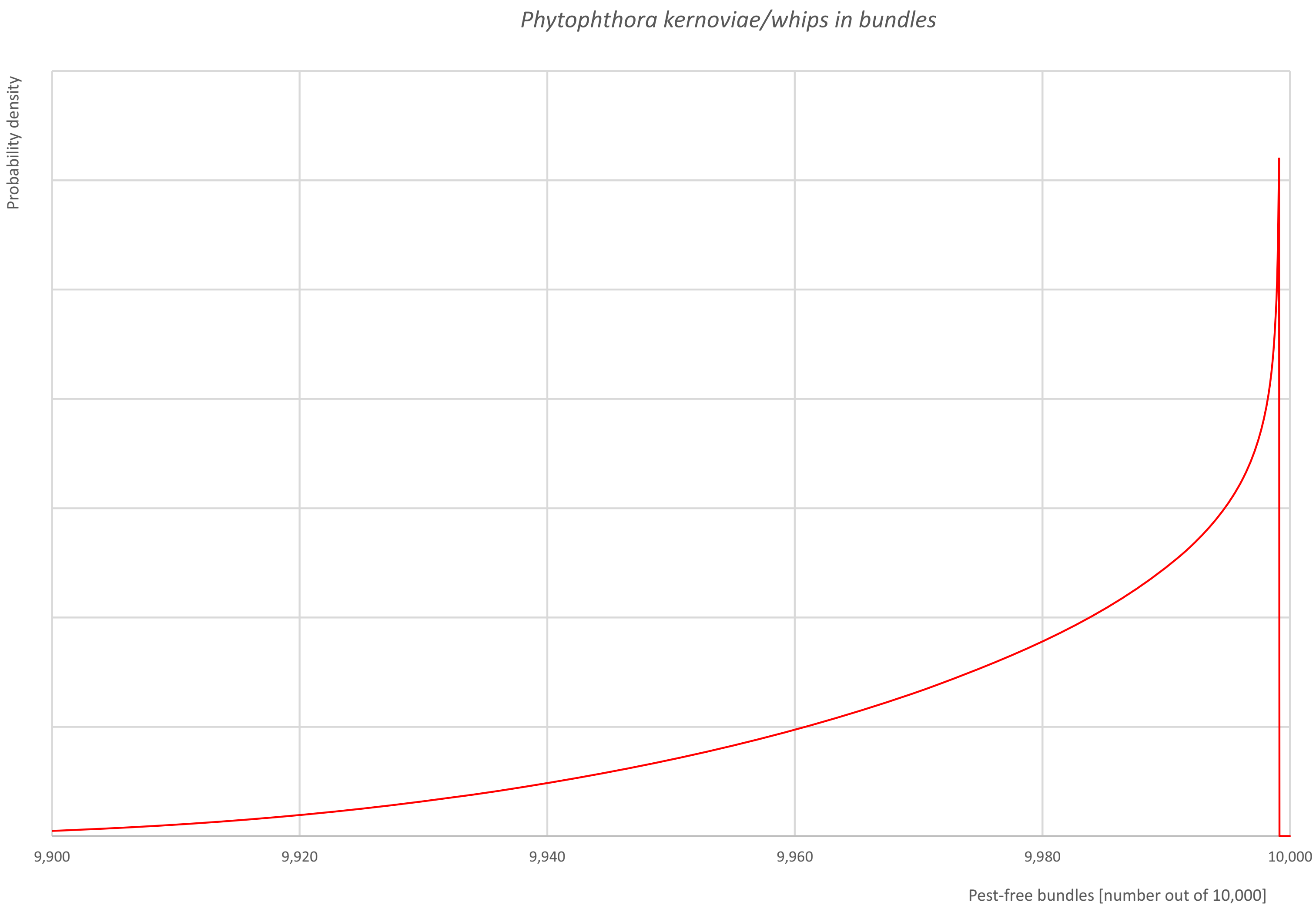
The EKE results are the fitted values.

(a)



Phytophthora kernoviae/whips in bundles
Probability density
0
20
40
60
80
100
Infected bundles [number out of 10,000]
EKE result
Fitted density

(b)


Phytophthora kernoviae/whips in bundles
Probability density
9,900
9,920
9,940
9,960
9,980
10,000
Pest-free bundles [number out of 10,000]

(c)

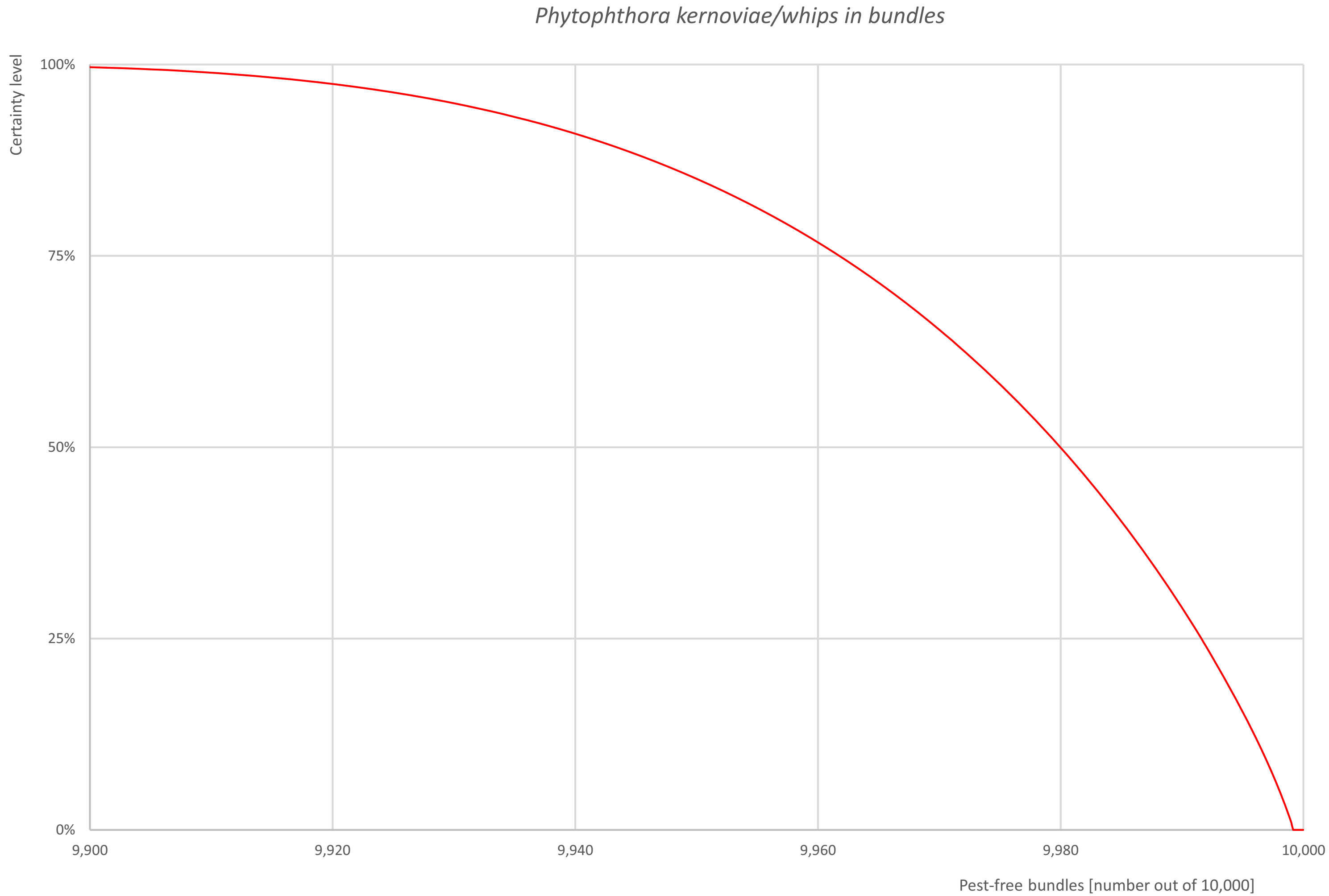


Figure A.4: (a) Elicited uncertainty of pest infection per 10,000 bundles (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free bundles per 10,000 (i.e.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

A.2.6. Overall likelihood of pest freedom for bare root plants/trees up to 7 years old

A.2.6.1. Reasoning for a scenario which would lead to a reasonably low number of infected bare root plants/trees up to 7 years old

The scenario assumes a low pressure of the pathogen in the nurseries and in the surroundings. Younger plants are exposed to the pathogen for only short period of time. The scenario also assumes that symptoms of the disease are visible and promptly detected during inspections.

A.2.6.2. Reasoning for a scenario which would lead to a reasonably high number of infected bare root plants/trees up to 7 years old

The scenario assumes a high pressure of the pathogen in the nurseries and in the surroundings as suitable hosts are present. Older trees are more likely to become infected due to longer exposure time and larger size. The scenario also assumes that symptoms of the disease are not easily recognisable during inspections.

A.2.6.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infected bare root plants/trees up to 7 years old (Median)

The scenario assumes a limited presence of the pathogen in the nurseries and the surroundings. The pathogen is a provisional quarantine pest in the UK and under official control.

A.2.6.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

The limited information on the occurrence of the pathogen in the nurseries and the surroundings results in high level of uncertainties for infestation rates below the median. Otherwise, the pest pressure from the surroundings is expected to be low giving less uncertainties for rates above the median.

A.2.6.5. Elicitation outcomes of the assessment of the pest freedom for *Phytophthora kernoviae* on bare root plants/trees up to 7 years old

The following Tables show the elicited and fitted values for pest infection (Table A.9) and pest freedom (Table A.10).

Table A.9: Elicited and fitted values of the uncertainty distribution of pest infection by *Phytophthora kernoviae* per 10,000 plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	1					7		12		30					75
EKE	1.01	1.18	1.53	2.39	3.77	5.80	8.17	14.2	22.6	28.3	35.9	44.8	55.5	64.8	75.1

The EKE results is the BetaGeneral (0.79525, 4.31, 0.93, 120) distribution fitted with @Risk version 7.6.

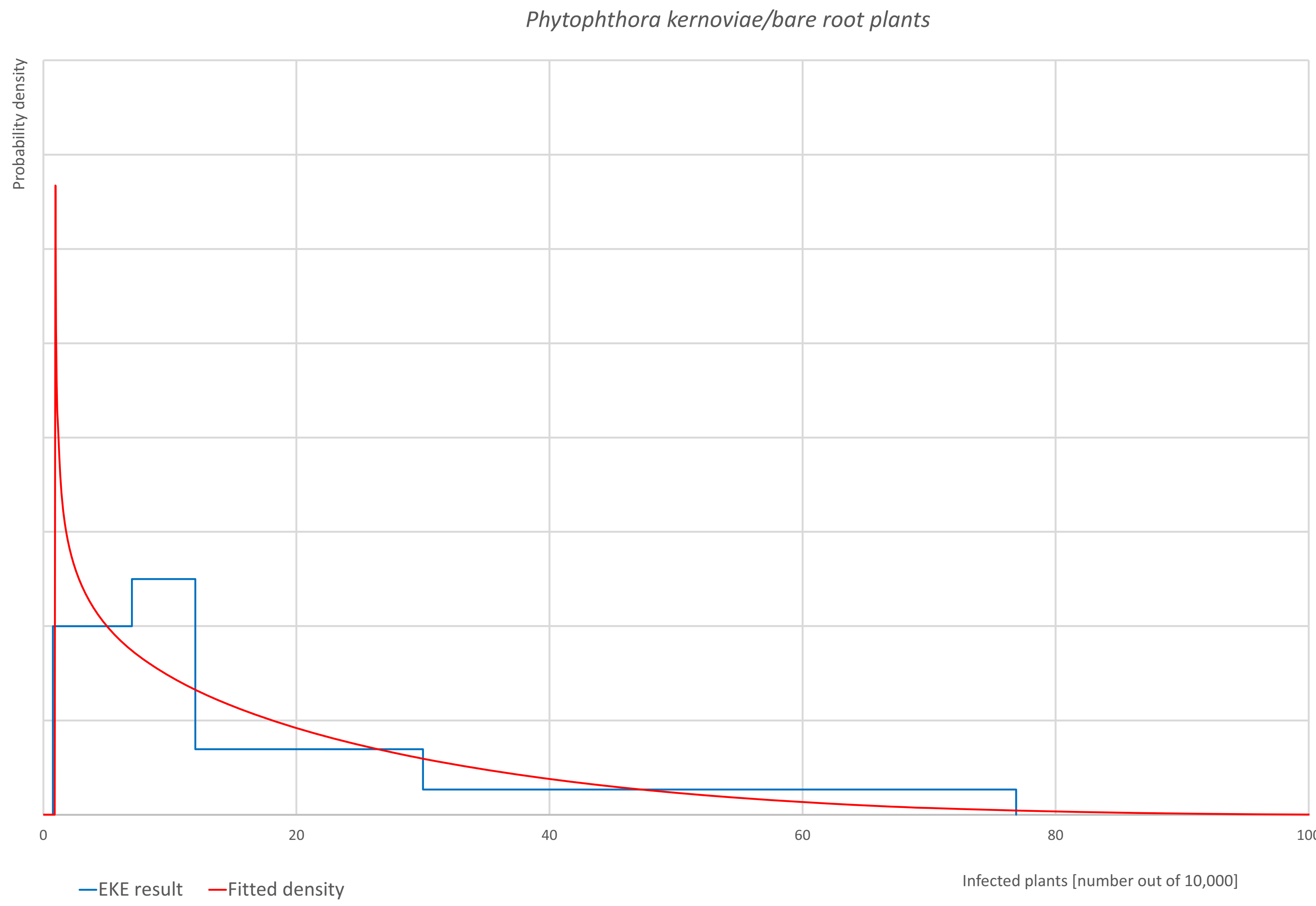
Based on the numbers of estimated infected plants the pest freedom was calculated (i.e. = 10,000 – number of infected plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.10.

Table A.10: The uncertainty distribution of plants free of *Phytophthora kernoviae* per 10,000 plants calculated by Table A.9

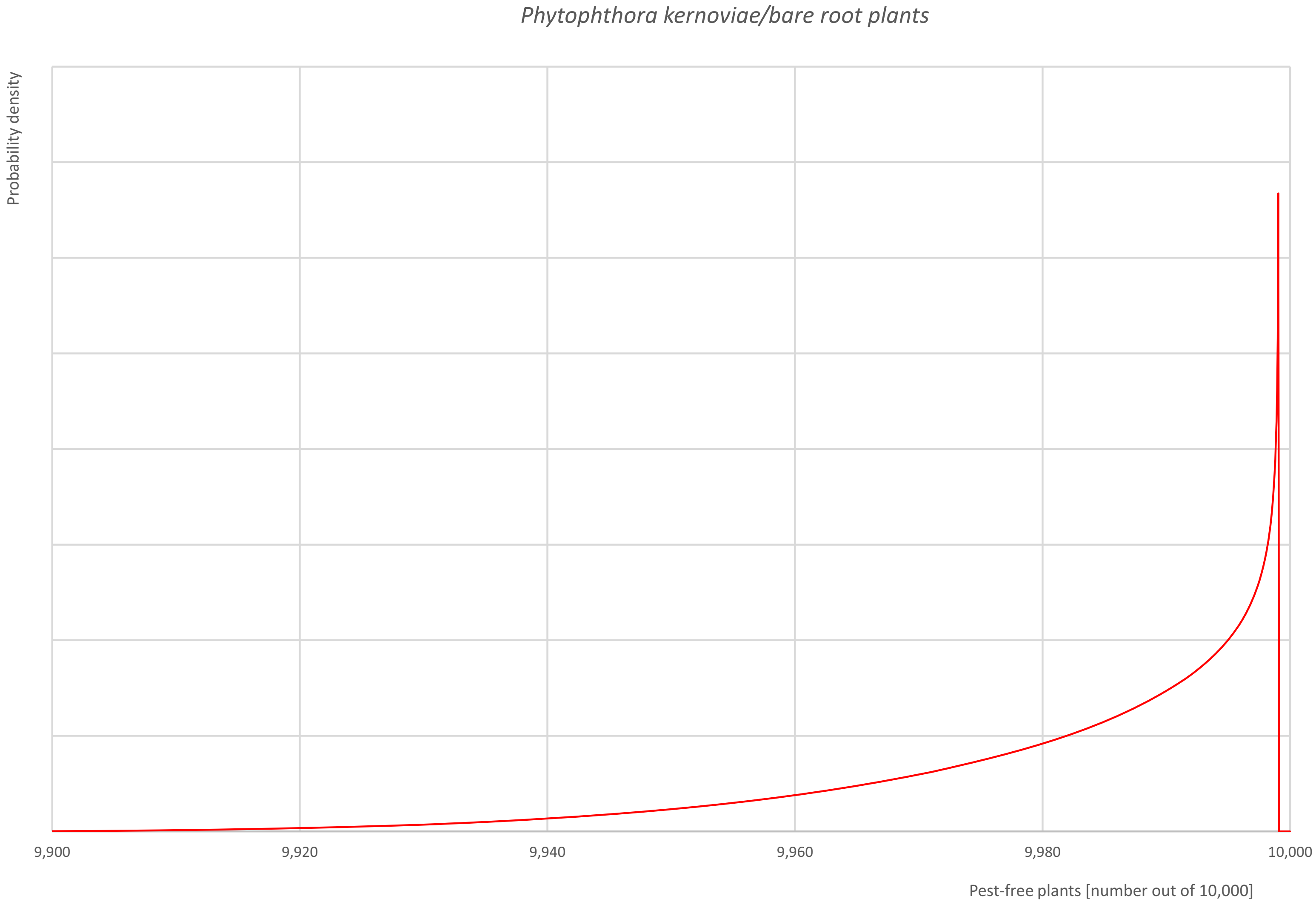
Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,925					9,970		9,988		9,993					9,999
EKE results	9,925	9,935	9,944	9,955	9,964	9,972	9,977	9,986	9,992	9,994	9,996	9,997.6	9,998.5	9,998.8	9,999.0

The EKE results are the fitted values.

(a)


Phytophthora kernoviae/bare root plants
Probability density
0
20
40
60
80
100
Infected plants [number out of 10,000]
EKE result
Fitted density

(b)


Phytophthora kernoviae/bare root plants
Probability density
9,900
9,920
9,940
9,960
9,980
10,000
Pest-free plants [number out of 10,000]

(c)

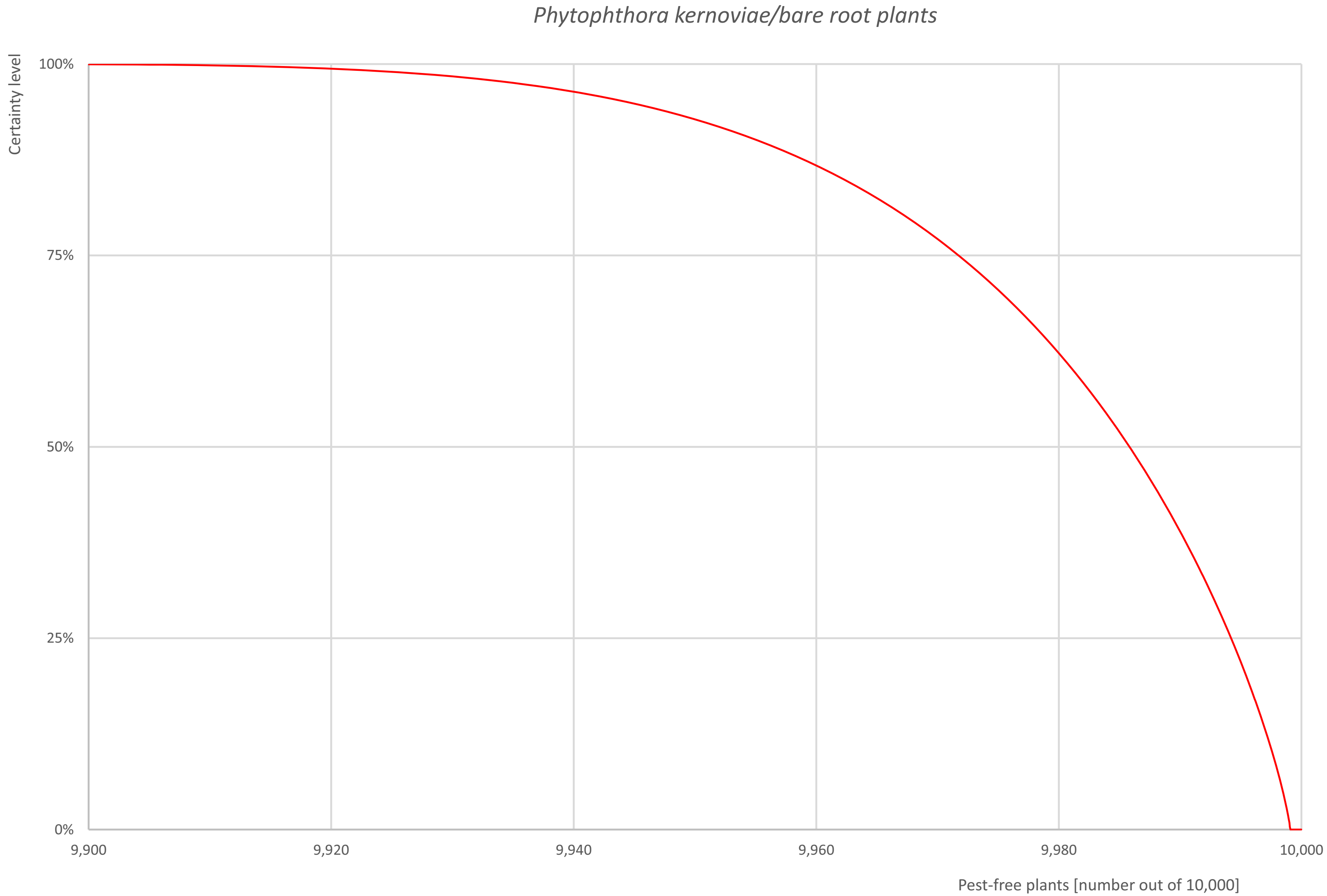


Figure A.5: (a) Elicited uncertainty of pest infection per 10,000 plants (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free plants per 10,000 (i.e.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

A.2.7. Overall likelihood of pest freedom for plants in pots up to 15 years old

A.2.7.1. Reasoning for a scenario which would lead to a reasonably low number of infected plants in pots up to 15 years old

The scenario assumes a low pressure of the pathogen in the nurseries and in the surroundings. Younger plants are exposed to the pathogen for only short period of time. The scenario also assumes that symptoms of the disease are visible and promptly detected during inspections.

A.2.7.2. Reasoning for a scenario which would lead to a reasonably high number of infected plants in pots up to 15 years old

The scenario assumes a high pressure of the pathogen because suitable hosts are present in the surroundings. Older trees are more likely to become infected due to longer exposure time and larger size. The scenario also assumes that symptoms of the disease are not easily recognisable during inspections.

A.2.7.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infected plants in pots up to 15 years old (Median)

The scenario assumes a limited presence of the pathogen in the nurseries and the surroundings. The pathogen is a provisional quarantine pest in the UK and under official control.

A.2.7.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

The limited information on the occurrence of the pathogen in the nurseries and the surroundings results in high level of uncertainties for infestation rates below the median. Otherwise, the pest pressure from the surroundings is expected to be low giving less uncertainties for rates above the median.

A.2.7.5. Elicitation outcomes of the assessment of the pest freedom for *Phytophthora kernoviae* on plants in pots up to 15 years old

The following Tables show the elicited and fitted values for pest infection (Table A.11) and pest freedom (Table A.12).

Table A.11: Elicited and fitted values of the uncertainty distribution of pest infection by *Phytophthora kernoviae* per 10,000 plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	1					10		18		40					115
EKE	1.00	1.41	2.10	3.58	5.70	8.60	11.8	19.7	30.7	38.3	48.7	61.6	78.4	94.4	115

The EKE results is the BetaGeneral (0.97337, 14.765, 0.75, 430) distribution fitted with @Risk version 7.6.

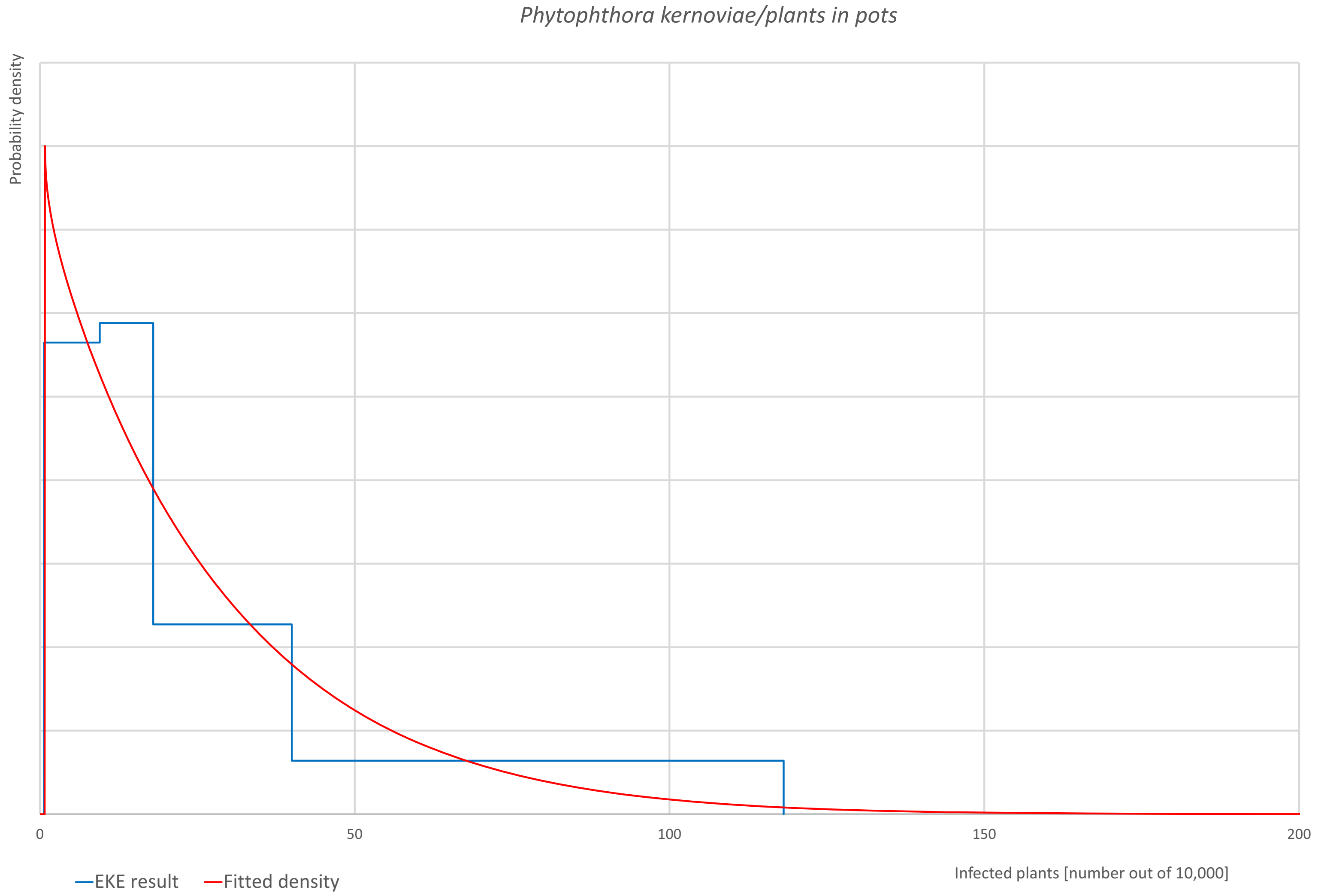
Based on the numbers of estimated infected plants the pest freedom was calculated (i.e. = 10,000 – number of infected plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.12.

Table A.12: The uncertainty distribution of plants free of *Phytophthora kernoviae* per 10,000 plants calculated by Table A.11

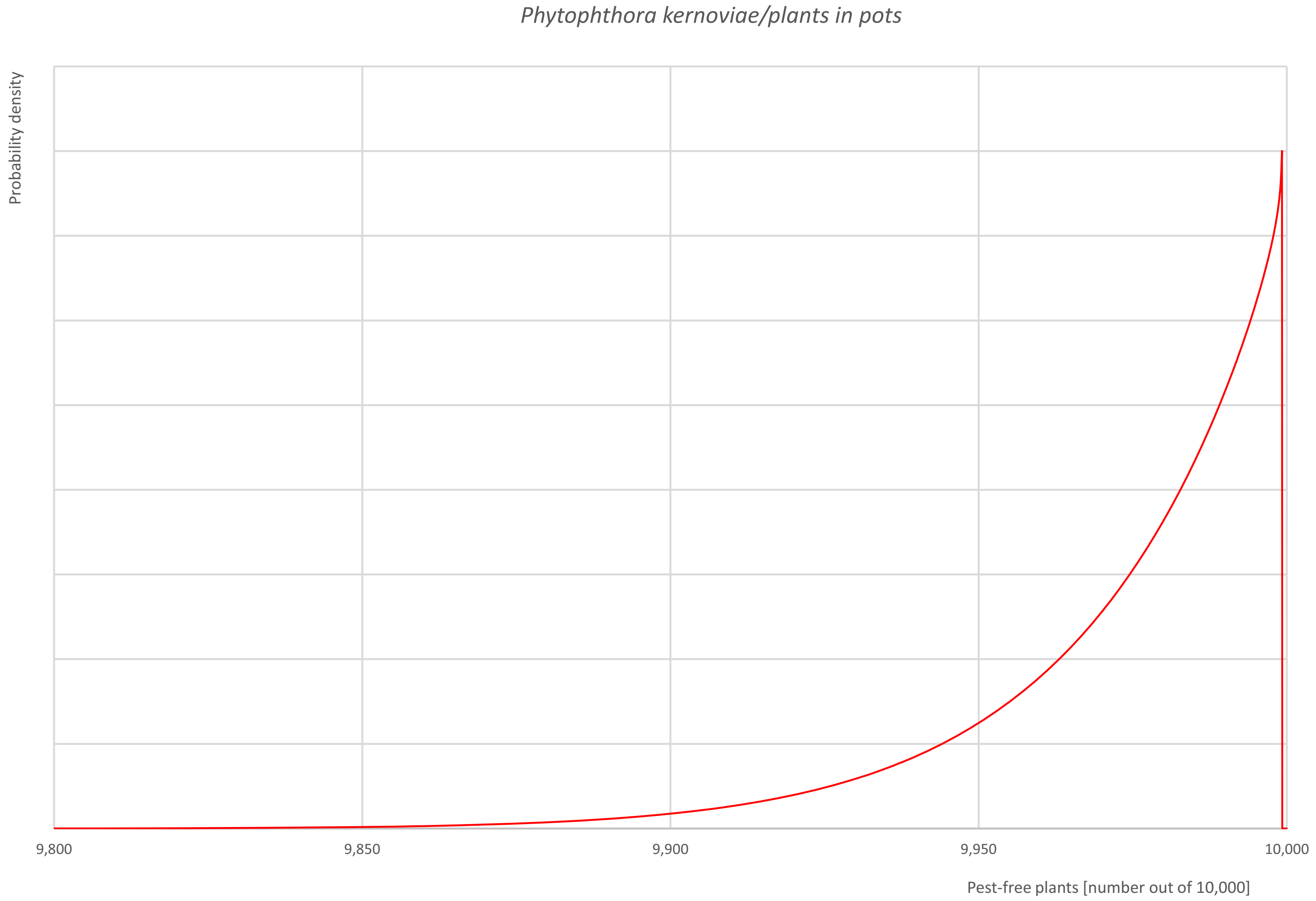
Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,885					9,960		9,982		9,991					9,999
EKE results	9,885	9,906	9,922	9,938	9,951	9,962	9,969	9,980	9,988	9,991	9,994	9,996	9,997.9	9,998.6	9,999.0

The EKE results are the fitted values.

(a)


Phytophthora kernoviae/plants in pots
Probability density
0
50
100
150
200
Infected plants [number out of 10,000]
EKE result
Fitted density

(b)


Phytophthora kernoviae/plants in pots
Probability density
9,800
9,850
9,900
9,950
10,000
Pest-free plants [number out of 10,000]

(c)

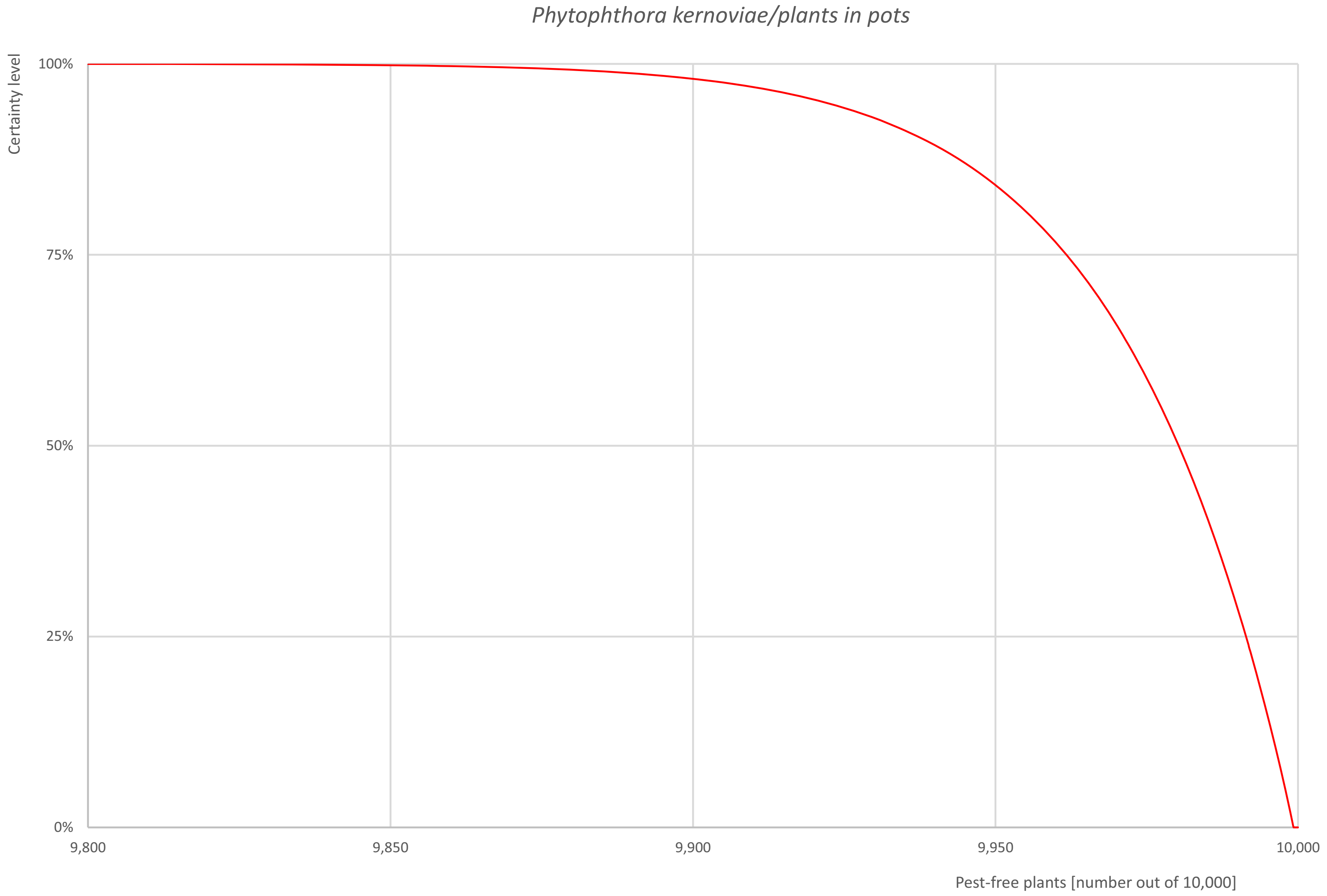


Figure A.6: (a) Elicited uncertainty of pest infection per 10,000 plants (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free plants per 10,000 (i.e.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

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A.3. *Phytophthora ramorum* (non-EU isolates)

A.3.1. Organism information

Taxonomic information	Current valid scientific name: *Phytophthora ramorum* Synonyms: – Name used in the EU legislation: *Phytophthora ramorum* (non-EU isolates) Werres, De Cock & Man in 't Veld [PHYTRA] Order: Peronosporales Family: Peronosporaceae Common name: Sudden Oak Death (SOD), ramorum bleeding canker, ramorum blight, ramorum leaf blight, twig and leaf blight Name used in the Dossier: *Phytophthora ramorum*
Group	Oomycetes
EPPO code	PHYTRA
Regulated status	The pathogen is listed in Annex II of Commission Implementing Regulation (EU) 2019/2072 as *Phytophthora ramorum* (non-EU isolates) Werres, De Cock & Man in 't Veld [PHYTRA]. The EU isolates of *P. ramorum* are listed as a protected zone quarantine pest. The pathogen is included in the EPPO A2 list (EPPO, online_a). *Phytophthora ramorum* is a quarantine pest in Canada, Israel, Mexico, Morocco and the United Kingdom. It is on A1 list of Brazil, Chile, Egypt, Kazakhstan, Türkiye and EAEU (=Eurasian Economic Union: Armenia, Belarus, Kazakhstan, Kyrgyzstan and Russia) (EPPO, online_b).
Pest status in the UK	*Phytophthora ramorum* is present in the UK (Brown and Brasier, 2007; Dossier Sections 2.0 and 5.0; CABI, online; EPPO, online_c). According to the Dossier Section 5.0, European isolates of *P. ramorum* are present in the UK: not widely distributed and under official control. It has been found in most regions of the UK, but it is more often reported in wetter, western regions.
Pest status in the EU	*Phytophthora ramorum* is present in the EU and it is currently reported in the following EU Member States: Belgium, Croatia, Denmark, Finland, France, Germany, Ireland, the Netherlands, Poland, Portugal and Slovenia (EPPO, online_c).
Host status on *Fagus sylvatica*	*Fagus sylvatica* is reported host of *P. ramorum* (Brown and Brasier, 2007; King et al., 2015; APHIS USDA, 2022; CABI, online; EPPO, online_d; Farr and Rossman, online). In inoculation experiments with *P. ramorum, F. sylvatica* was found to be moderately to highly susceptible as bark host but resistant as foliar host (Sansford et al., 2009).
PRA information	Pest Risk Assessments available: – Risk analysis for *Phytophthora ramorum* Werres, de Cock & Man in't Veld, causal agent of sudden oak death, ramorum leaf blight and ramorum dieback (Cave et al., 2008); – Risk analysis of *Phytophthora ramorum*, a newly recognised pathogen threat to Europe and the cause of sudden oak death in the USA (Sansford et al., 2009); – Scientific opinion on the pest risk analysis on *Phytophthora ramorum* prepared by the FP6 project RAPRA (EFSA PLH Panel, 2011); – Pest risk management for *Phytophthora kernoviae* and *P. ramorum* (EPPO, 2013); – Scientific Opinion on the commodity risk assessment of *Acer campestre* plants from the UK (EFSA PLH Panel, 2023a); – Scientific Opinion on the commodity risk assessment of *Acer palmatum* plants from the UK (EFSA PLH Panel, 2023b); – Scientific Opinion on the commodity risk assessment of *Acer platanoides* plants from the UK (EFSA PLH Panel, 2023c); – Scientific Opinion on the commodity risk assessment of *Acer pseudoplatanus* plants from the UK (EFSA PLH Panel, 2023d); – UK Risk Register Details for Phytophthora ramorum (DEFRA, online).

Other relevant information for the assessment	
Biology	*Phytophthora ramorum* is most probably native to East Asia (Poimala and Lilja, 2013; Jung et al., 2021). The pathogen is present in Asia (Japan, Vietnam), Europe (Belgium, Croatia, Denmark, Finland, France, Germany, Guernsey, Ireland, Luxembourg, the Netherlands, Norway, Poland, Portugal, Slovenia, the UK), North America (Canada, US) and South America (Argentina) (EPPO, online_c). So far there are 12 known lineages of *P. ramorum*: NA1 and NA2 from North American, EU1 from Europe (including the UK) and North America (Grünwald et al., 2009), EU2 from Northern Ireland and western Scotland (Van Poucke et al., 2012), IC1 to IC5 from Vietnam and NP1 to NP3 from Japan (Jung et al., 2021). *Phytophthora ramorum* is heterothallic oomycete species with two mating types: A1 and A2 (Boutet et al., 2010). *Phytophthora* species generally reproduce through (a) dormant (resting) spores which can be either sexual (oospores) or asexual (chlamydospores); and (b) fruiting structures (sporangia) which contain zoospores (Erwin and Ribeiro, 1996). *Phytophthora ramorum* produces sporangia on the surfaces of infected leaves and twigs of host plants. These sporangia can be splash-dispersed to other close or carried by wind and rain to longer distances. The sporangia germinate to produce zoospores that penetrate and initiate an infection on new hosts. In infected plant material the chlamydospores are produced and can serve as resting structures (Davidson et al., 2005; Grünwald et al., 2008). Trunk cankers (e.g. on *Quercus, Fagus*) are not known to support sporulation and therefore do not transmit the pathogen (DEFRA, 2008). The pathogen is also able to survive in soil (Shishkoff, 2007). In the west of Scotland, it persisted in soil for at least 2 years after its hosts were removed (Elliot et al., 2013). Oospores were only observed in pairing tests under controlled laboratory conditions (Brasier and Kirk, 2004). Optimal temperatures under laboratory conditions were 16–26°C for growth, 14–26°C for chlamydospore production and 16–22°C for sporangia production (Englander et al., 2006). *Phytophthora ramorum* is mainly a foliar pathogen; however, it was also reported to infect shoots, stems and occasionally roots of various host plants (Grünwald et al., 2008, Parke and Lewis, 2007). According to Brown and Brasier (2007), *P. ramorum* commonly occupies xylem beneath phloem lesions and may spread within xylem and possibly recolonise the phloem from the xylem. *Phytophthora ramorum* can remain viable within xylem for two or more years after the overlying phloem had been excised. *Phytophthora ramorum* can disperse by aerial dissemination, water, movement of infested plant material and soil containing propagules on footwear, tires of trucks and mountain bikes, or the feet of animals (Davidson et al., 2002; Brasier, 2008). Infected foliar hosts can be a major source of inoculum, which can lead to secondary infections on nearby host plants. Important foliar hosts in Europe are *Rhododendron* spp. and *Larix kaempferi* (Grünwald et al., 2008; Brasier and Webber, 2010). Infected *F. sylvatica* trees in the UK and the Netherlands have mostly been found in close proximity of infected rhododendron plants (Sansford et al., 2009). Possible pathways of entry for *P. ramorum* are plants for planting (excluding seed and fruit) of known susceptible hosts; plants for planting (excluding seed and fruit) of non-host plant species accompanied by contaminated attached growing media; soil/growing medium (with organic matter) as a commodity; soil as a contaminant; foliage or cut branches; susceptible (isolated) bark and susceptible wood (EFSA PLH Panel, 2011). *Phytophthora ramorum* caused rapid decline of *Lithocarpus densiflorus* and *Quercus agrifolia* in forests of California and Oregon (Rizzo et al., 2005) and *Larix kaempferi* in plantations of southwest England (Brasier and Webber, 2010).

<table>
<tr><td rowspan="3">Symptoms</td><td>Main type of symptoms</td><td>Phytophthora ramorum causes different types of symptoms depending on the host species and the plant tissue infected.

According to DEFRA (2008) P. ramorum causes three different types of disease:
a) 'Ramorum bleeding canker' – cankers on trunks of trees, which emit a dark ooze. As they increase in size they can lead to tree death.
b) 'Ramorum leaf blight' – infection of the foliage, leading to discoloured lesions on the leaves.
c) 'Ramorum dieback' – shoot and bud infections which result in wilting, discolouration and dying back of affected parts.

Symptoms on Quercus species are cankers of red, brown or black colour on trunk, browning of the crown, gradual leaf loss and death of trees (Davidson et al., 2003).

Leaf lesions and shoot dieback can be observed on foliar hosts such as Rhododendron, Viburnum, Pieris and Camellia. (Davidson et al., 2003, EPPO, online_e). On Larix kaempferi, P. ramorum causes foliage and bark infection that are visible as wilted shoot tips with blackened needles and stem lesions with resin bleeding (Braiser and Webber, 2010).

Symptoms on Lithocarpus densiflorus are lesions on leaves, cankers on trunk, branches and twigs; shoot tip dieback, leaf flagging and formation of a Shepard's crook. The trees can die within 1 year (Davidson et al., 2003).

Fagus sylvatica is known as a bark host without susceptible foliage (Denman et al., 2005, Sansford et al., 2009). According to Brown and Brasier (2007) Fagus sylvatica was exhibiting extensive aerial stem bleeding lesions caused by P. kernoviae and P. ramorum.</td></tr>
<tr><td>Presence of asymptomatic plants</td><td>If roots are infected by P. ramorum, the plants can be without aboveground symptoms for months until developmental or environmental factors trigger disease expression (Roubtsova and Bostock, 2009; Thompson et al., 2021).

Application of some fungicides may reduce symptoms and therefore mask infection, making it more difficult to determine whether the plant is pathogen-free (DEFRA, 2008).</td></tr>
<tr><td>Confusion with other pests</td><td>Various symptoms caused by P. ramorum can be confused with other pathogens, such as: canker and foliar symptoms caused by other Phytophthora species (P. cinnamomi, P. cambivora, P. citricola and P. cactorum); leaf lesions caused by rust in early stages; leafspots caused by sunburn; dieback of twigs and leaves caused by Botryosphaeria dothidea (Davidson et al., 2003).

Phytophthora ramorum can be easily distinguished from other Phytophthora species based on morphology (Grünwald et al., 2008) and molecular tests.</td></tr>
<tr><td>Host plant range</td><td colspan="2">Phytophthora ramorum has a very wide host range, which is expanding.

Main host plants include Camellia spp., Larix decidua, L. kaempferi, Pieris spp., Rhododendron spp., Syringa vulgaris, Viburnum spp. and the North American trees species, Lithocarpus densiflorus and Quercus agrifolia (EPPO online_d).</td></tr>
</table>

	Further proven hosts confirmed by Koch's postulates are *Abies grandis*, *A. magnifica*, *Acer circinatum*, *A. macrophyllum, A. pseudoplatanus*, *Adiantum aleuticum, A. jordanii, Aesculus californica*, *A. hippocastanum*, *Arbutus menziesii*, *A. unedo*, *Arctostaphylos columbiana*, *A. glauca*, *A. hooveri*, *A. manzanita, A. montereyensis*, *A. morroensis*, *A. pilosula*, *A. pumila*, *A. silvicola*, *A. viridissima*, *Calluna vulgaris*, *Castanea sativa*, *Ceanothus thyrsiflorus*, *Chamaecyparis lawsoniana*, *Chrysolepis chrysophylla*, *Cinnamomum camphora*, *Corylus cornuta*, *Fagus sylvatica*, *Frangula californica*, *Frangula purshiana*, *Fraxinus excelsior, Gaultheria procumbens*, *G. shallon*, *Griselinia littoralis*, *Hamamelis virginiana*, *Heteromeles arbutifolia*, *Kalmia* spp., *Larix* × *eurolepis*, *Laurus nobilis*,, *Lonicera hispidula*, *Lophostemon confertus*, *Loropetalum chinense*, *Magnolia* × *loebneri*, *M. oltsopa*, *M. stellata*, *Mahonia aquifolium*, *Maianthemum racemosum*, *Parrotia persica*, *Photinia fraseri*, *Phoradendron serotinum* subsp. *macrophyllum*, *Photinia* × fraseri, *Prunus laurocerasus*, *Pseudotsuga menziesii* var. *menziesii*,, *Quercuscerris*, *Q. chrysolepis*, *Q. falcata Q. ilex*, *Q. kelloggii*, *Q. parvula* var. *shrevei*,, *Rosa gymnocarpa*, *Salix caprea*, *Sequoia sempervirens*,, *Taxus baccata*, *Trientalis latifolia*, *Umbellularia californica*, *Vaccinium myrtillus*, *V. ovatum*, *V. parvifolium* and *Vinca minor* (Cave et al., 2008; APHIS USDA, 2022).
Reported evidence of impact	*Phytophthora ramorum* is an EU quarantine pest.
Evidence that the commodity is a pathway	*Phytophthora ramorum* is continuously intercepted in the EU on different plant species intended for planting (EUROPHYT, online; TRACES-NT, online) and according to EFSA PLH Panel (2011), *P. ramorum* can travel with plants for planting. Therefore, plants for planting are possible pathway of entry for *P. ramorum*.
Surveillance information	*Phytophthora ramorum* at growing sites: infested plants are destroyed, and potentially infested plants are 'held' (prohibited from moving). The UK has a containment policy in the wider environment with official action taken to remove infected trees (Dossier Section 3.0). As part of an annual survey at ornamental retail and production sites (frequency of visits determined by a decision matrix) *P. ramorum* is inspected on common host plants. An additional inspection, during the growing period, is carried out at plant passport production sites. Inspections are carried out at a survey to 300 non-woodland wider environment sites annually (Dossier Sections 3.0 and 5.0).

A.3.2. Possibility of pest presence in the nursery

A.3.2.1. Possibility of entry from the surrounding environment

Phytophthora ramorum is present in the UK, it has been found in most regions of the UK, but it is more often reported in wetter, western regions (Dossier Section 5.0).

The possible entry of *P. ramorum* from surrounding environment to the nurseries may occur through aerial dissemination, water and animals (Davidson et al., 2002).

Phytophthora ramorum has wide host range and can infect number of different plants. Suitable hosts of *P. ramorum* like *Abies* spp., *Acer* spp., *Aesculus* spp., *Camellia* spp., *Castanea* spp., *Larix* spp. (especially *L. kaempferi*), *Magnolia* spp., *Prunus* spp., *Quercus* spp., *Rhododendron* spp., *Rosa* spp., *Salix* spp., *Syringa* spp. and *Viburnum* spp. are present within 2 km from the nurseries (Dossier Section 3.0).

Uncertainties:

- The dispersal range of *P. ramorum* sporangia.
- No information available on the distance of the nurseries to sources of pathogen in the surrounding environment.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for the pathogen to enter the nurseries from surrounding environment. In the surrounding area, suitable hosts are present and the pathogen can spread by wind, rain and infested soil propagules on feet of animals entering the nurseries.

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

The starting materials are either seeds or seedlings. Seeds are certified and coming from the UK. Seedlings are either from the UK or the EU (the Netherlands and France) (Dossier Section 3.0). Seeds are not a pathway for the pathogen.

In addition to *Fagus* plants, the nurseries also produce other plants (Dossier Section 6.0). Out of them, there are many suitable hosts for the pathogen (such as *Abies* spp., *Acer* spp., *Aesculus* spp., *Arbutus* spp., *Calluna* spp., *Castanea* spp., *Larix* spp., *Viburnum* spp., etc.). However, there is no information on how and where the plants are produced. Therefore, if the plants are first produced in another nursery, the pathogen could possibly travel with them.

The nurseries are using virgin peat or peat-free compost (a mixture of coir, tree bark, wood fibre, etc.) as a growing media (Dossier Section 1.0). *Phytophthora ramorum* is able to survive in soil (Shishkoff, 2007) and therefore could potentially enter with infested soil/growing media. However, the growing media is certified and heat-treated by commercial suppliers during production to eliminate pests and diseases (Dossier Section 3.0).

Uncertainties:

- No information is available on the provenance of plants other than *F. sylvatica* used for plant production in the nurseries.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for the pathogen to enter the nurseries with new seedlings of *Fagus* and new plants of other species used for plant production in the area. The entry of the pathogen with seeds and the growing media the Panel considers as not possible.

A.3.2.3. Possibility of spread within the nursery

Fagus plants are either grown in containers (cells, pots, tubes, etc.) or in field. Cell grown trees may be grown in greenhouses, however most plants will be field grown, or field grown in containers (Dossier Section 1.0). There are no mother plants present in the nurseries (Dossier Section 3.0).

The pathogen can infect other suitable plants (such as *Abies* spp., *Aesculus* spp., *Castanea* spp., *Larix* spp., *Viburnum* spp., etc.) present within the nurseries and hedges surrounding the nurseries (*Prunus* spp.) (Dossier Sections 3.0 and 6.0).

Phytophthora ramorum can spread within the nurseries by aerial dissemination, soil, water, movement of infested plant material and animals (Davidson et al., 2002).

Uncertainties:

- None.

Taking into consideration the above evidence and uncertainties, the Panel considers that the spread of the pathogen within the nurseries is possible either by aerial dissemination, animals, movement of infested plant material, soil and water.

A.3.3. Information from interceptions

In the EUROPHYT/TRACES-NT database there are no records of notification of *Fagus sylvatica* plants for planting neither from the UK nor from other countries due to the presence of *Phytophthora ramorum* between the years 1995 and December 2022 (EUROPHYT, online; TRACES-NT, online).

A.3.4. Evaluation of the risk mitigation measures

In the table below, all risk mitigation measures currently applied in the UK are listed and an indication of their effectiveness on *Phytophthora ramorum* is provided. The description of the risk mitigation measures currently applied in the UK is provided in the Table 6.

N	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
1	Registration of production sites	Yes	*Phytophthora ramorum* is a quarantine organism in the UK and targeted by this measure. Uncertainties: – Whether disease symptoms on *F. sylvatica* and potential other host plants are recognisable, particularly at an early stage of infection.
2	Physical separation	No	Not relevant.
3	Certified plant material	Yes	*Phytophthora ramorum* is a quarantine organism in the UK and targeted by this measure. Uncertainties: – Whether disease symptoms on *F. sylvatica* and other potential host plants are recognisable, particularly at an early stage of infection.
4	Growing media	Yes	This measure should ensure pest-free growing media and is expected to prevent the introduction of the pathogen into the nurseries with growing media. Uncertainties: – None.
5	Surveillance, monitoring and sampling	Yes	This measure has an effect as the pathogen would be detected on nursery-grown plants, as well as on incoming plant material and growing media, and suspected plant material quarantined. Uncertainties: – Whether disease symptoms on *F. sylvatica* and other potential host plants are recognisable, particularly at an early stage of infection.
6	Hygiene measures	Yes	General hygiene measures will reduce the likelihood of the pathogen being spread by tools and equipment, although this is not a major pathway for the pest. Uncertainties: – None.
7	Removal of infested plant material	Yes	This measure could have some effect by removing potentially infested plant material, thus reducing the spread of the pathogen within the nursery. Uncertainties: – None.
8	Irrigation water	Yes	Testing of irrigation water would detect the pathogen, which can spread by water. Overhead irrigation could favour foliar infections and spread of the pathogen by water splash. Uncertainties: – Whether irrigation water is tested for *P. ramorum*.
9	Application of pest control products	Yes	Some fungicides could reduce the likelihood of foliar infection by the pathogen. Uncertainties: – No specific information on the fungicides used. – The level of efficacy of fungicides in reducing infection of *P. ramorum*. – The level to which the application of fungicides could suppress symptoms.

N	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
10	Measures against soil pests	Yes	This measure could have some effect by preventing root contact with soil where the pathogen may be present. Uncertainties: – None.
11	Inspections and management of plants before export	Yes	*Phytophthora ramorum* is a quarantine organism in the UK and the EU and this measure is expected to reduce the likelihood of infested plants being exported. Uncertainties: – Whether disease symptoms on *F. sylvatica* are recognisable, particularly at an early stage of infection.
12	Separation during transport to the destination	No	Not relevant.

A.3.5. Overall likelihood of pest freedom for bundles of whips and seedlings

A.3.5.1. Reasoning for a scenario which would lead to a reasonably low number of infected bundles of whips and seedlings

The scenario assumes a low pressure of the pathogen in the nurseries and in the surroundings. The plants are exposed to the pathogen for only short period of time. The scenario assumes *Fagus sylvatica* to be minor host for the pathogen. The scenario also assumes that symptoms of the disease are visible and promptly detected during inspections.

A.3.5.2. Reasoning for a scenario which would lead to a reasonably high number of infected bundles of whips and seedlings

The scenario assumes a high pressure of the pathogen in the nurseries and in the surroundings as suitable hosts are present. The scenario also assumes that symptoms of the disease are not easily recognisable during inspections.

A.3.5.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infected bundles of whips and seedlings (Median)

The scenario assumes a limited presence of the pathogen in the nurseries and the surroundings, and a limited susceptibility of *Fagus sylvatica*. The pathogen is a regulated quarantine pest in the UK and under official control.

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

The limited information on the susceptibility of *Fagus sylvatica* and the occurrence of the pathogen in the nurseries and the surroundings results in high level of uncertainties for infestation rates below the median. Otherwise, the pest pressure from the surroundings is expected to be low giving less uncertainties for rates above the median.

A.3.5.5. Elicitation outcomes of the assessment of the pest freedom for *Phytophthora ramorum* on bundles of whips and seedlings

The following Tables show the elicited and fitted values for pest infection (Table A.13) and pest freedom (Table A.14).

Table A.13: Elicited and fitted values of the uncertainty distribution of pest infection by *Phytophthora ramorum* per 10,000 bundles

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	2					16		30		60					120
EKE	1.98	2.63	3.77	6.25	9.84	14.7	20.0	32.4	48.1	58.0	70.3	83.7	98.2	109	121

The EKE results is the BetaGeneral (0.93089, 2.6837, 1.6, 148) distribution fitted with @Risk version 7.6.

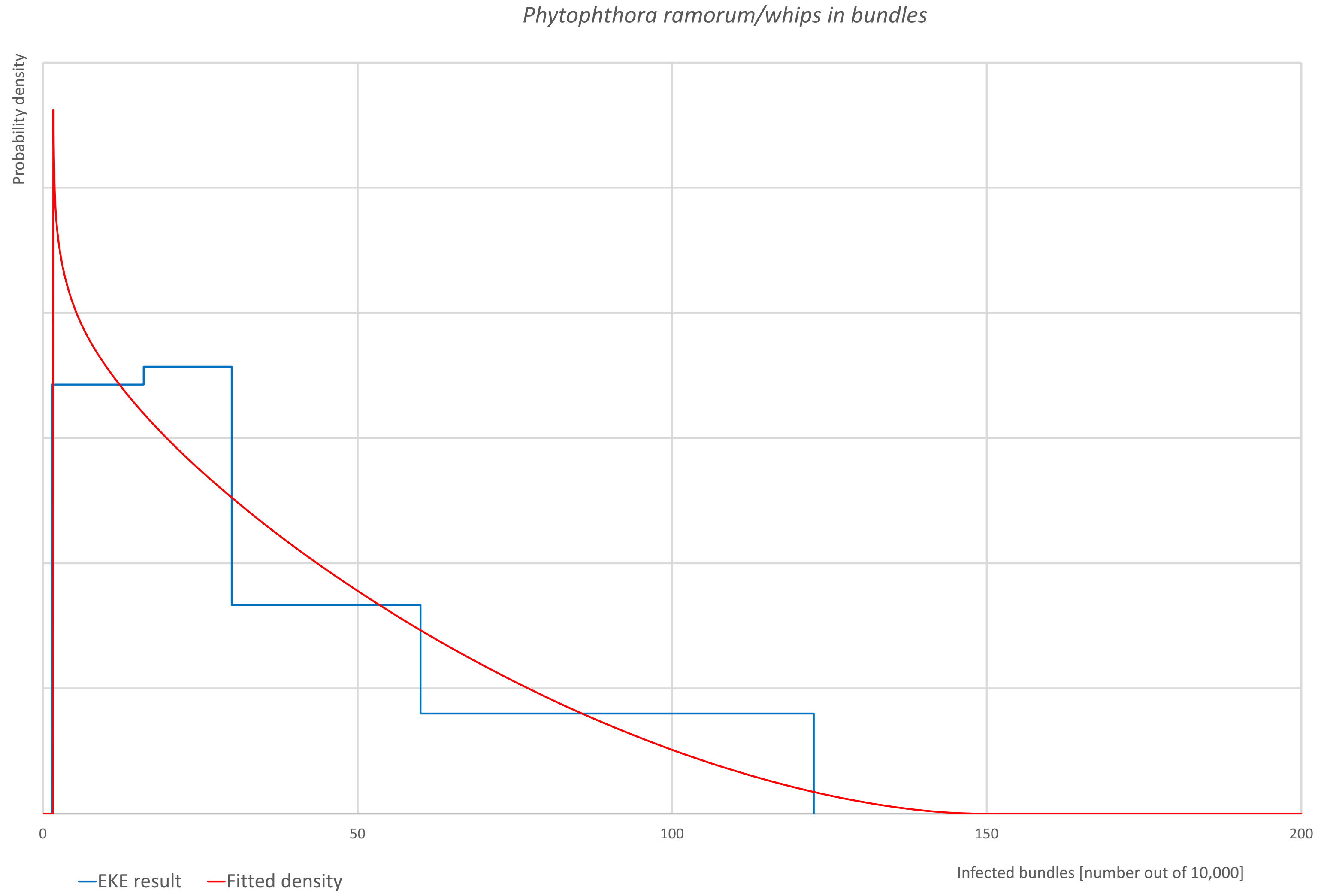
Based on the numbers of estimated infected bundles the pest freedom was calculated (i.e. = 10,000 – number of infected bundles per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.14.

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

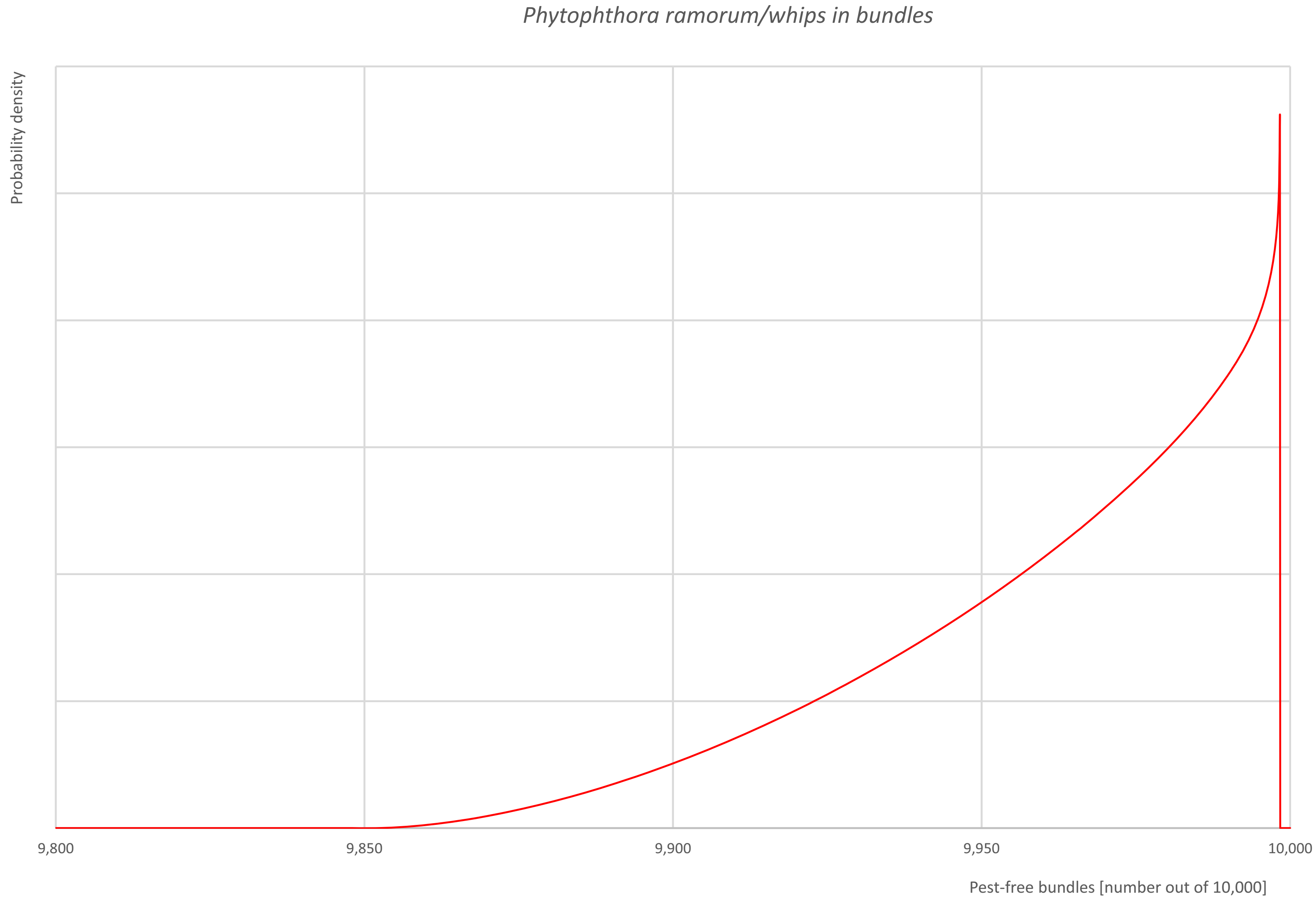
Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,880					9,940		9,970		9,984					9,998
EKE results	9,879	9,891	9,902	9,916	9,930	9,942	9,952	9,968	9,980	9,985	9,990	9,994	9,996	9,997	9,998

The EKE results are the fitted values.

(a)


Phytophthora ramorum/whips in bundles
Probability density
0
50
100
150
200
Infected bundles [number out of 10,000]
EKE result
Fitted density

(b)


Phytophthora ramorum/whips in bundles
Probability density
9,800
9,850
9,900
9,950
10,000
Pest-free bundles [number out of 10,000]

(c)

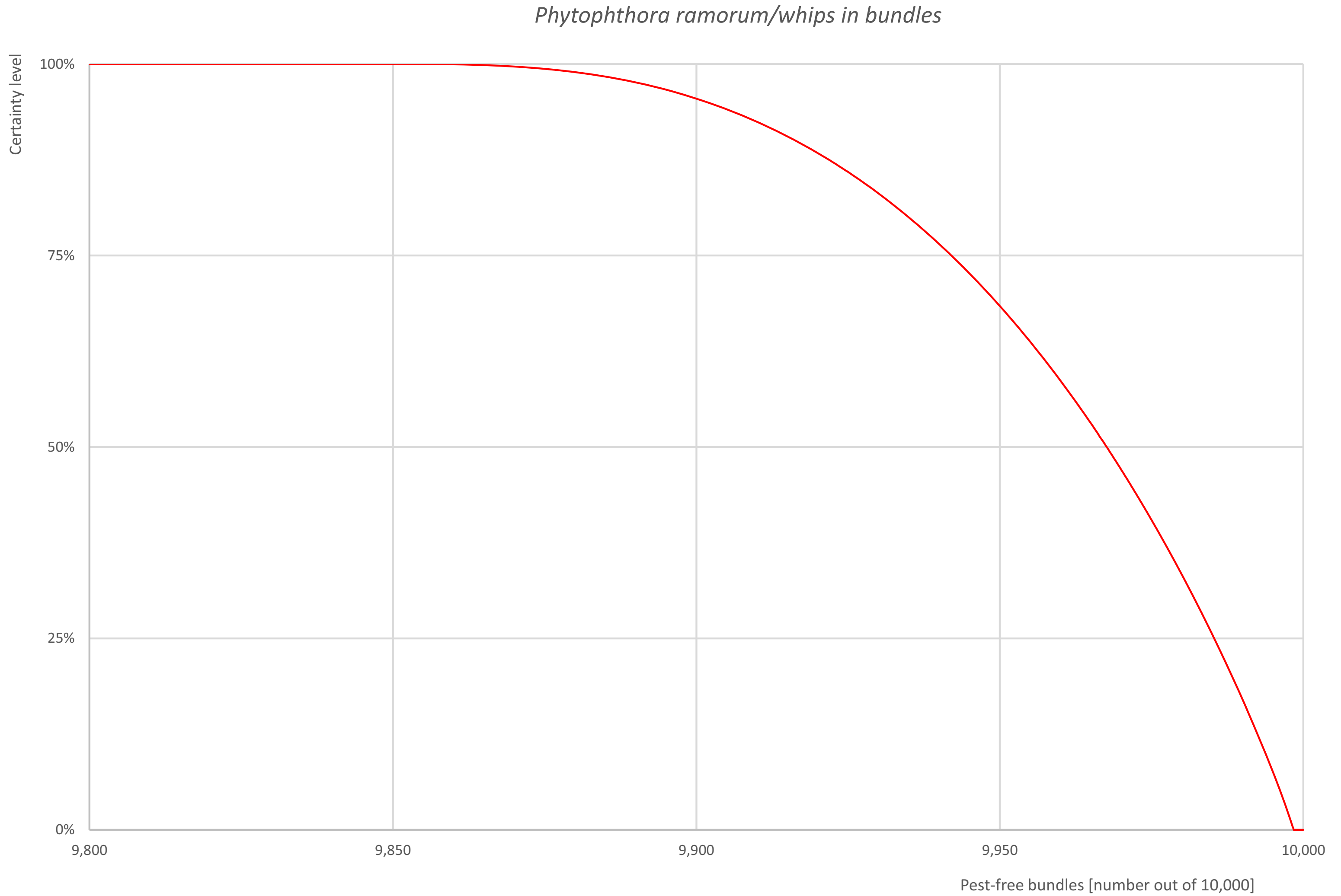


Figure A.7: (a) Elicited uncertainty of pest infection per 10,000 bundles (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free bundles per 10,000 (i.e.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

A.3.6. Overall likelihood of pest freedom for bare root plants/trees up to 7 years old

A.3.6.1. Reasoning for a scenario which would lead to a reasonably low number of infected bare root plants/trees up to 7 years old

The scenario assumes a low pressure of the pathogen in the nurseries and in the surroundings. Younger plants are exposed to the pathogen for only short period of time. The scenario assumes *Fagus sylvatica* to be minor hosts for the pathogen. The scenario also assumes that symptoms of the disease are visible and promptly detected during inspections.

A.3.6.2. Reasoning for a scenario which would lead to a reasonably high number of infected bare root plants/trees up to 7 years old

The scenario assumes a high pressure of the pathogen in the nurseries and in the surroundings as suitable hosts are present. Older trees are more likely to become infected due to longer exposure time and larger size. The scenario also assumes that symptoms of the disease are not easily recognisable during inspections.

A.3.6.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infected bare root plants/trees up to 7 years old (Median)

The scenario assumes a limited presence of the pathogen in the nurseries and the surroundings, and a limited susceptibility of *Fagus sylvatica*. The pathogen is a regulated quarantine pest in the UK and under official control.

A.3.6.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

The limited information on the susceptibility of *Fagus sylvatica* and the occurrence of the pathogen in the nurseries and the surroundings results in high level of uncertainties for infestation rates below the median. Otherwise, the pest pressure from the surroundings is expected to be low giving less uncertainties for rates above the median.

A.3.6.5. Elicitation outcomes of the assessment of the pest freedom for *Phytophthora ramorum* on bare root plants/trees up to 7 years old

The following Tables show the elicited and fitted values for pest infection (Table A.15) and pest freedom (Table A.16).

Table A.15: Elicited and fitted values of the uncertainty distribution of pest infection by *Phytophthora ramorum* per 10,000 plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	2					11		20		45					100
EKE	1.99	2.28	2.87	4.27	6.49	9.69	13.4	22.5	34.8	42.9	53.4	65.1	78.6	89.5	101

The EKE results is the BetaGeneral (0.81299, 3.1371, 1.85, 135) distribution fitted with @Risk version 7.6.

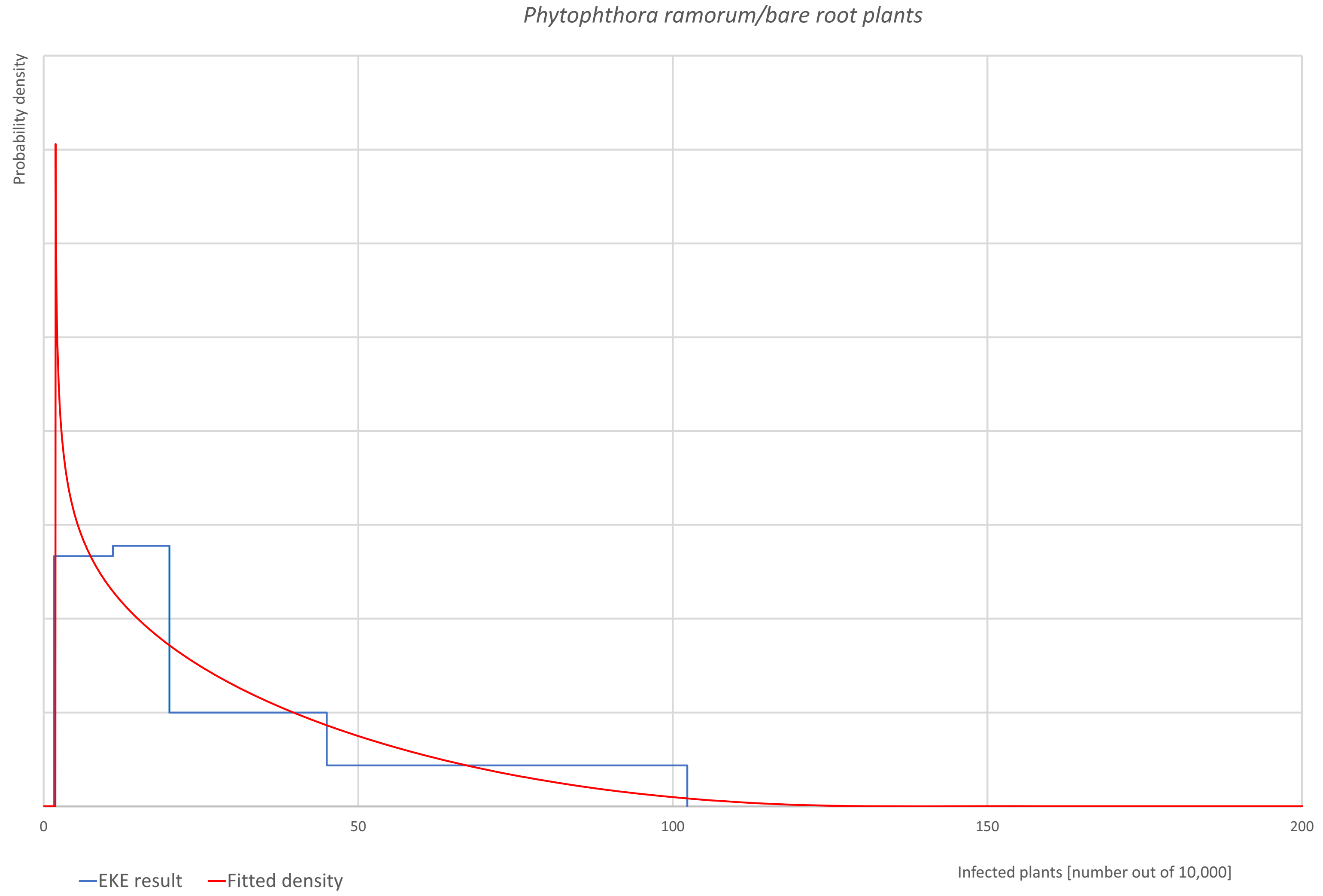
Based on the numbers of estimated infected plants the pest freedom was calculated (i.e. = 10,000 – number of infected plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.16.

Table A.16: The uncertainty distribution of plants free of *Phytophthora ramorum* per 10,000 plants calculated by Table A.15

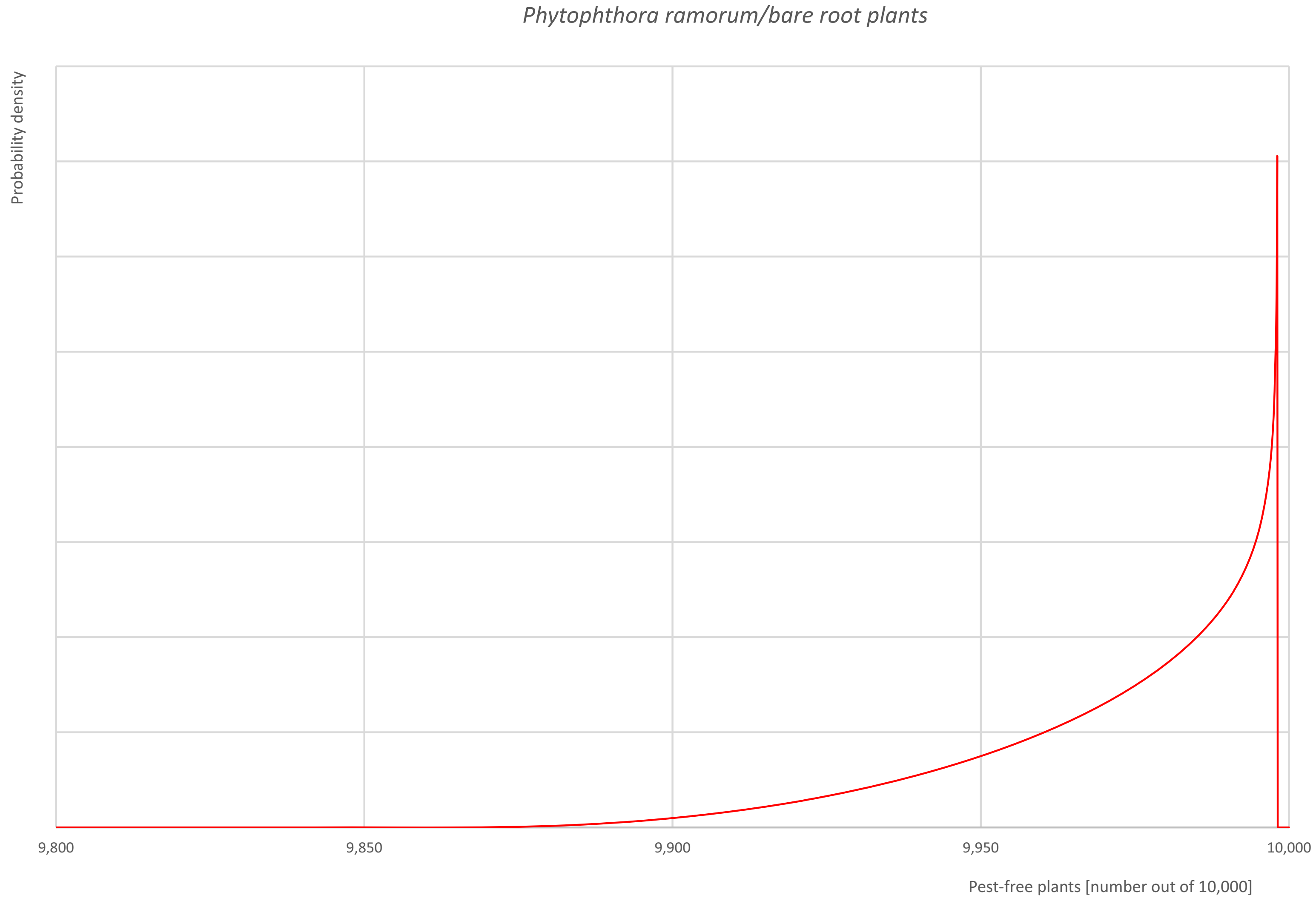
Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,900					9,955		9,980		9,989					9,998
EKE results	9,899	9,910	9,921	9,935	9,947	9,957	9,965	9,978	9,987	9,990	9,994	9,996	9,997.1	9,997.7	9,998.0

The EKE results are the fitted values.

(a)


Phytophthora ramorum/bare root plants
Probability density
0
50
100
150
200
EKE result
Fitted density
Infected plants [number out of 10,000]

(b)


Phytophthora ramorum/bare root plants
Probability density
9,800
9,850
9,900
9,950
10,000
Pest-free plants [number out of 10,000]

(c)

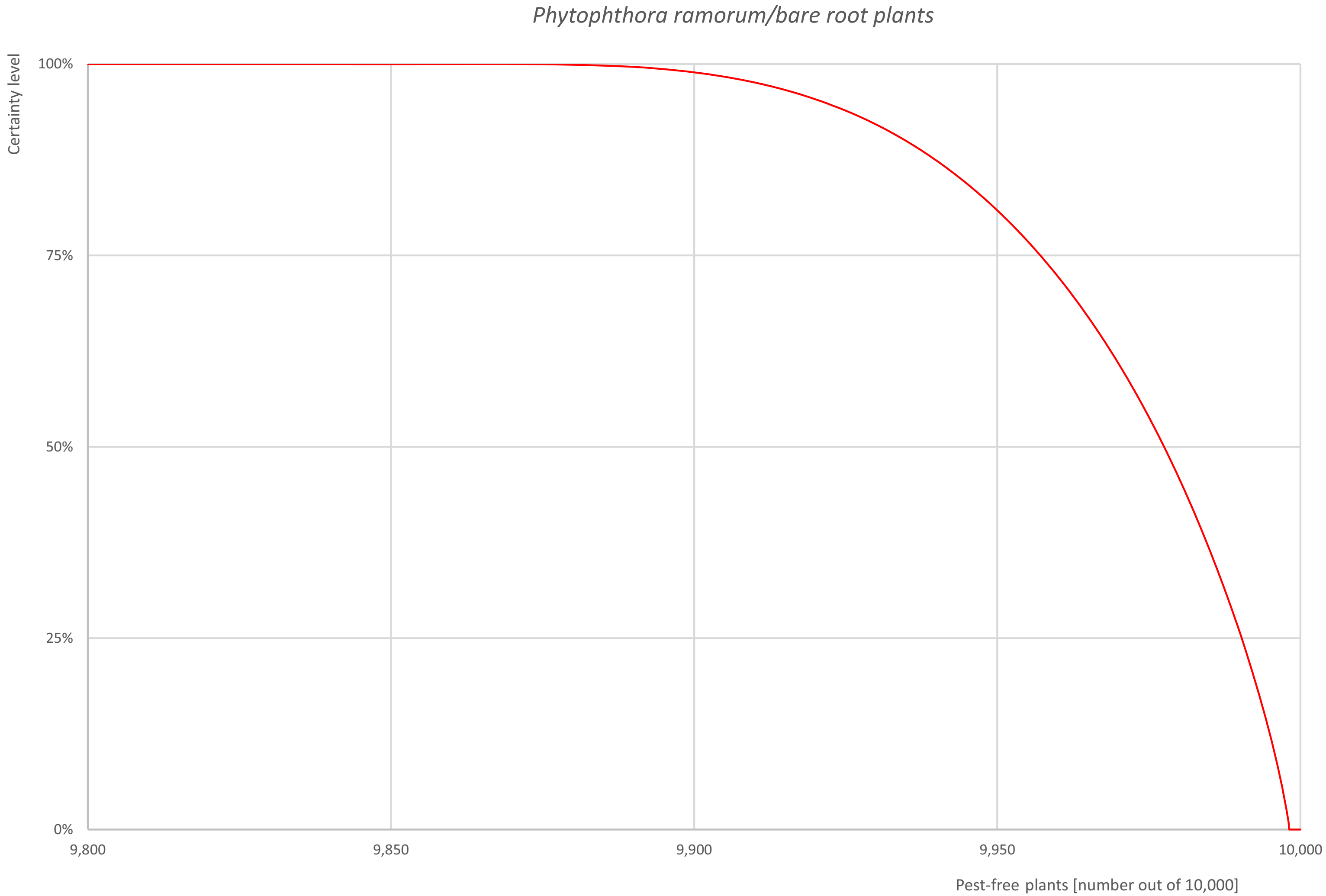


Figure A.8: (a) Elicited uncertainty of pest infection per 10,000 plants (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free plants per 10,000 (i.e.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

A.3.7. Overall likelihood of pest freedom for plants in pots up to 15 years old

A.3.7.1. Reasoning for a scenario which would lead to a reasonably low number of infected plants in pots up to 15 years old

The scenario assumes a low pressure of the pathogen in the nurseries and in the surroundings. Younger plants are exposed to the pathogen for only short period of time. The scenario assumes *Fagus sylvatica* to be minor hosts for the pathogen. The scenario also assumes that symptoms of the disease are visible and promptly detected during inspections.

A.3.7.2. Reasoning for a scenario which would lead to a reasonably high number of infected plants in pots up to 15 years old

The scenario assumes a high pressure of the pathogen in the nurseries and in the surroundings as suitable hosts are present. Older trees are more likely to become infected due to longer exposure time and larger size. The scenario also assumes that symptoms of the disease are not easily recognisable during inspections and that leaf debris of foliar hosts are incorporated into the growing media in pots.

A.3.7.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infected plants in pots up to 15 years old (Median)

The scenario assumes a limited presence of the pathogen in the nurseries and the surroundings, and a limited susceptibility of *Fagus sylvatica*. The pathogen is a regulated quarantine pest in the UK and under official control.

A.3.7.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

The limited information on the susceptibility of *Fagus sylvatica* and the occurrence of the pathogen in the nurseries and the surroundings results in high level of uncertainties for infestation rates below the median. Otherwise, the pest pressure from the surroundings is expected to be low giving less uncertainties for rates above the median.

A.3.7.5. Elicitation outcomes of the assessment of the pest freedom for *Phytophthora ramorum* on plants in pots up to 15 years old

The following Tables show the elicited and fitted values for pest infection (Table A.17) and pest freedom (Table A.18).

Table A.17: Elicited and fitted values of the uncertainty distribution of pest infection by *Phytophthora ramorum* per 10,000 plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	2					16		30		60					150
EKE	1.99	2.81	4.12	6.73	10.3	15.0	20.0	31.9	47.6	58.1	72.1	88.7	109	128	150

The EKE results is the BetaGeneral (1.0714, 7.536, 1.4, 320) distribution fitted with @Risk version 7.6.

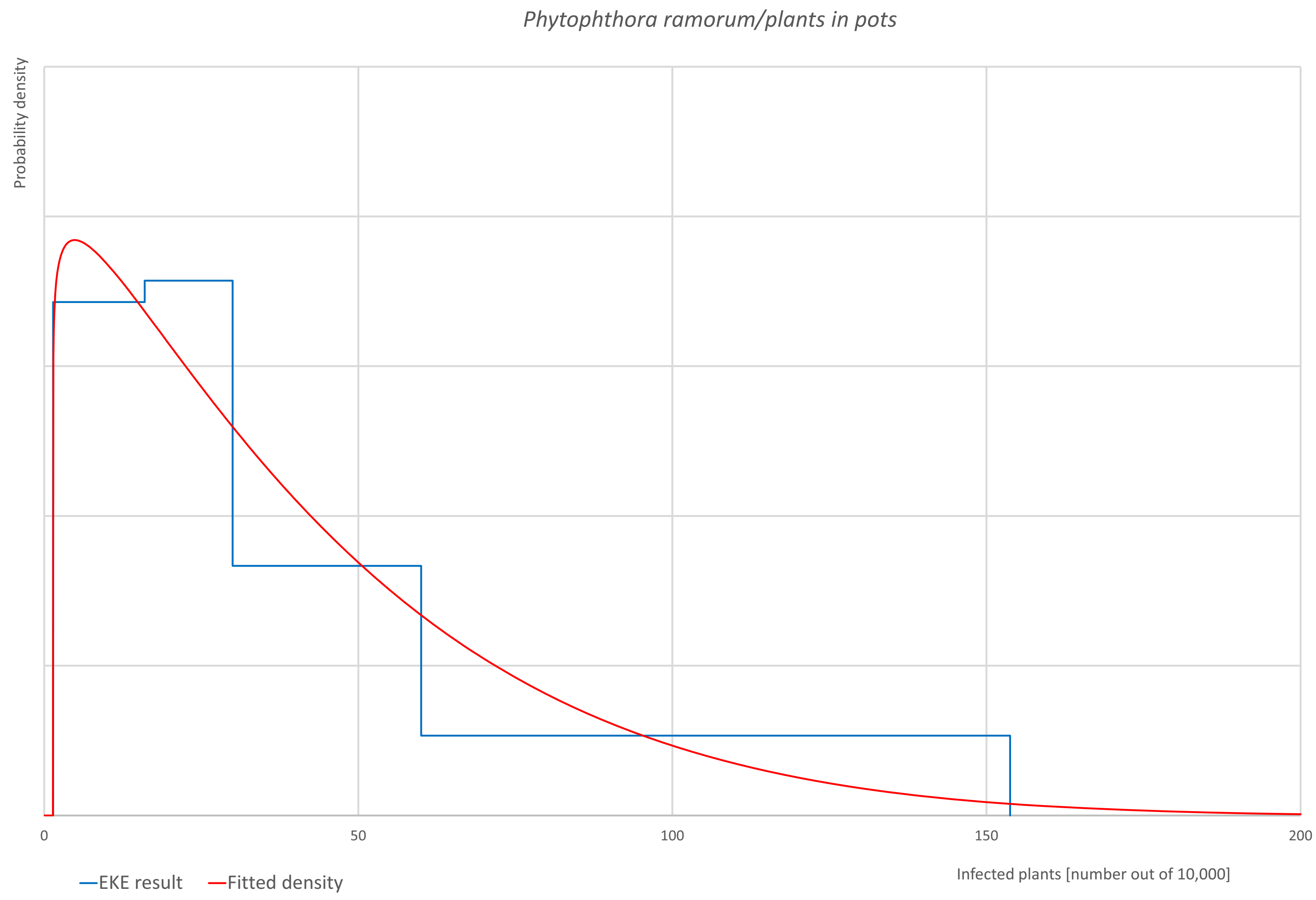
Based on the numbers of estimated infected plants the pest freedom was calculated (i.e. = 10,000 – number of infected plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.18.

Table A.18: The uncertainty distribution of plants free of *Phytophthora ramorum* per 10,000 plants calculated by Table A.17

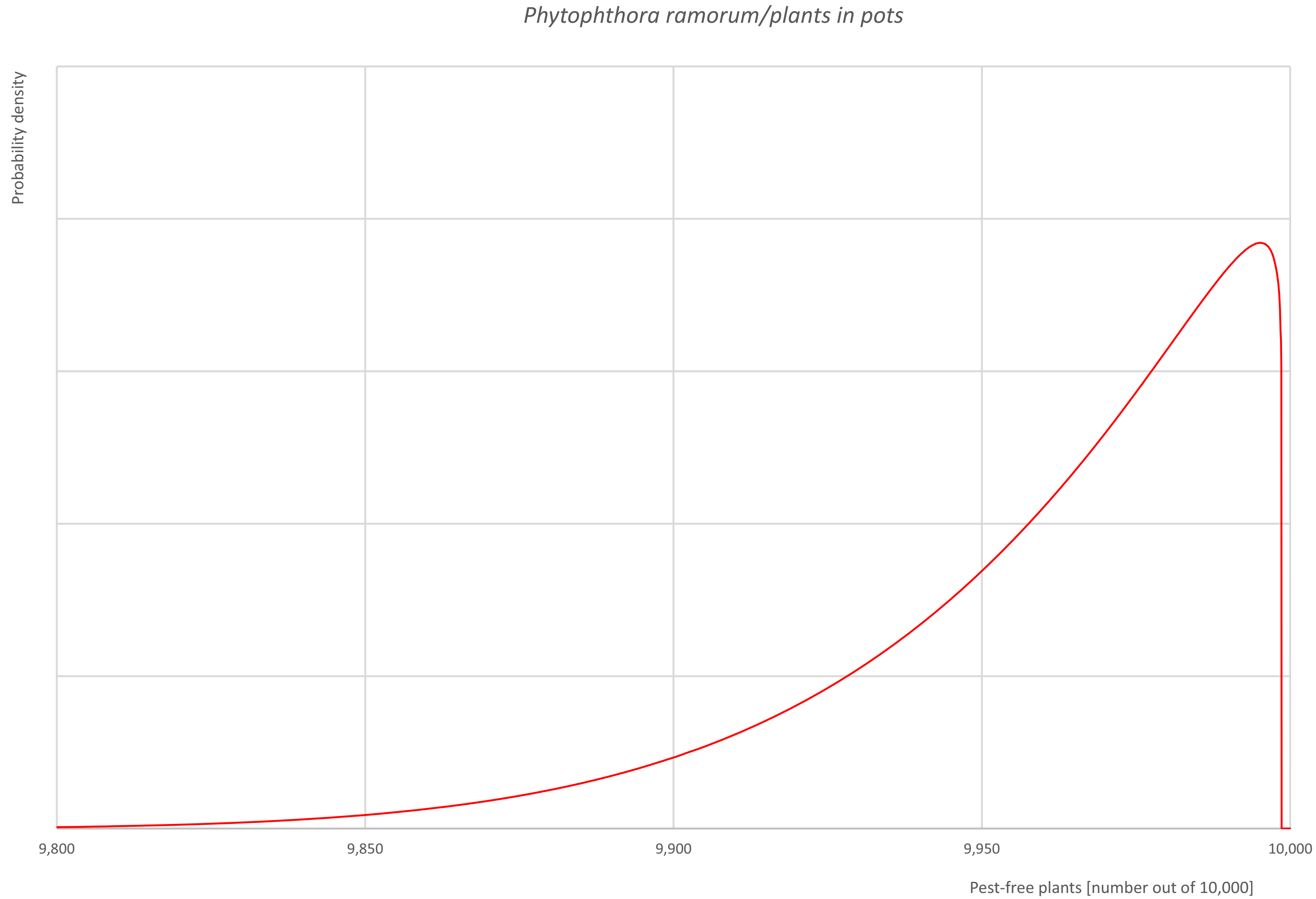
Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,850					9,940		9,970		9,984					9,998
EKE results	9,850	9,872	9,891	9,911	9,928	9,942	9,952	9,968	9,980	9,985	9,990	9,993	9,996	9,997	9,998

The EKE results are the fitted values.

(a)


Phytophthora ramorum/plants in pots
Probability density
0
50
100
150
200
Infected plants [number out of 10,000]
EKE result
Fitted density

(b)


Phytophthora ramorum/plants in pots
Probability density
9,800
9,850
9,900
9,950
10,000
Pest-free plants [number out of 10,000]

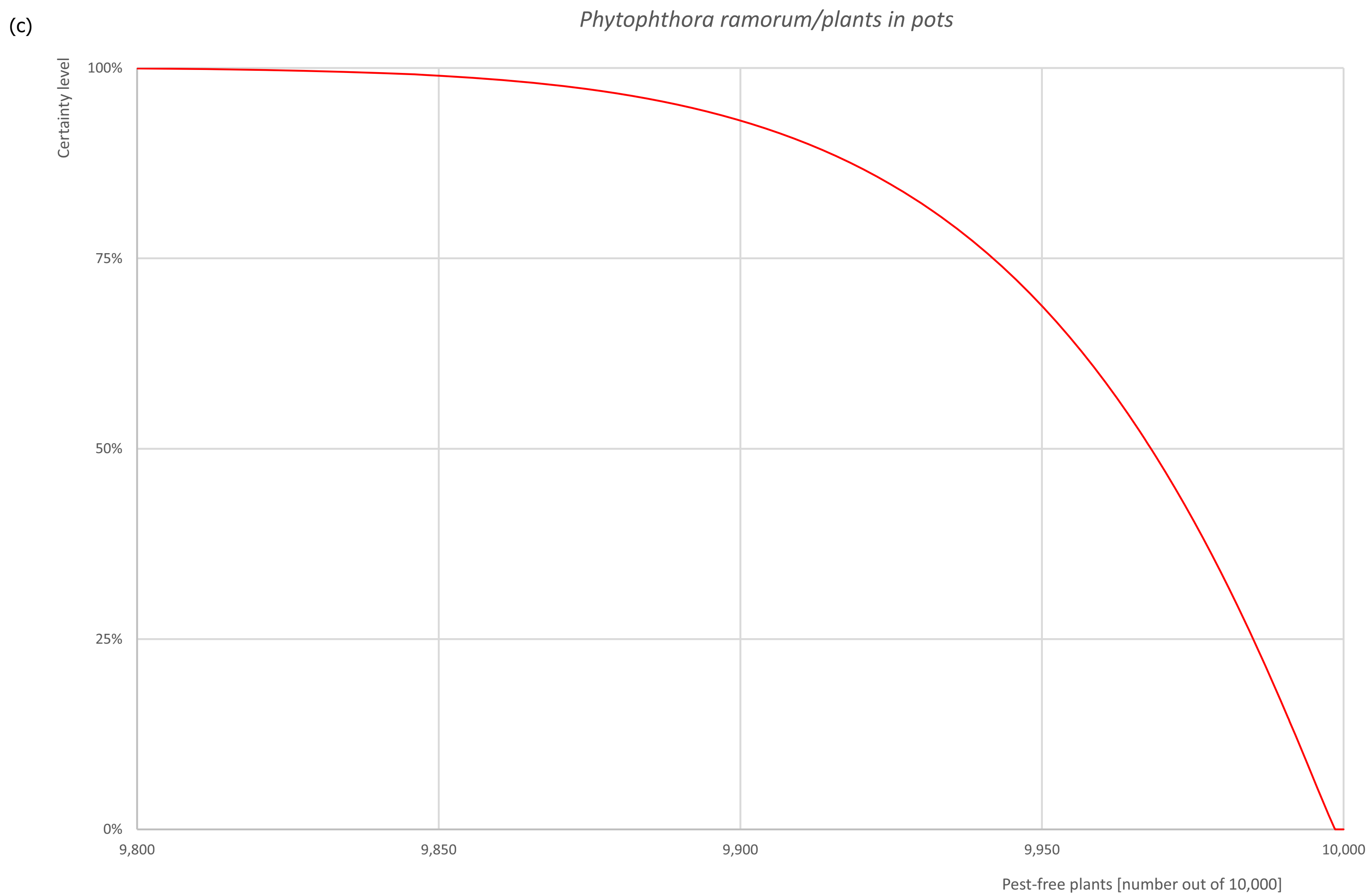


Figure A.9: (a) Elicited uncertainty of pest infection per 10,000 plants (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free plants per 10,000 (i.e.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

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A.4 *Thaumetopoea processionea*

A.4.1. Organism information

Taxonomic information	Current valid scientific name: *Thaumetopoea processionea* Synonyms: *Cnethocampa processionea, Traumatocampa processionea* Name used in the EU legislation: *Thaumetopoea processionea* L. Order: Lepidoptera Family: Notodontidae Common name: oak processionary moth (OPM), oak processionary caterpillar Name used in the Dossier: *Thaumetopoea processionea*
Group	Insects
EPPO code	THAUPR
Regulated status	*Thaumetopoea processionea* is listed in the Annex III of Commission Implementing Regulation (EU) 2019/2072 as a protected zone quarantine pest for Ireland. It is a protected zone quarantine pest in the UK and included in A1 lists for Argentina and Türkiye (EPPO, online_a). The Panel noted that the species is native to Türkiye (Groenen and Meurisse, 2012).
Pest status in the UK	*Thaumetopoea processionea* is present with breeding colonies in the UK since 2006. It is a species under official control, currently found in the London area and in the Southeast of England (EPPO, online_b). According to the Dossier Section 5.0 *T. processionea* is present in Great Britain, except in specified pest-free areas. In North Ireland the pest is absent: the entire country is pest free. In 2022, the *T. processionea* was found in Jersey (Channel Islands) where it is currently under eradication (EPPO, online_c) and also in the pest-free area in Hampshire (Dossier Section 5.0). According to Suprunenko et al. (2022) the eradication of *T. processionea* from the UK territory is 'no longer considered a feasible option'.
Pest status in the EU	*Thaumetopoea processionea* is a native European species reported to be present in 21 EU member states. It is absent only from Estonia, Finland, Ireland (introduced in 2020, eradicated in 2021), Latvia, Lithuania and Malta (EPPO, online_d; GBIF, online; de Jong et al., online). According to Groenen and Meurisse (2012) the discontinuous occurrence of *T. processionea* in central-northern Europe in the last two centuries, and its recent massive reappearance in north-western Europe, are due to long-term population fluctuations rather than range expansion.
Host status on *Fagus sylvatica*	According to Stigter (1997) 'In the Netherlands caterpillars were not only reported from oak but occasionally also from *Acacia*, *Betula*, *Crataegus*, *Fagus* and *Sorbus*. Reports from caterpillars feeding on those trees and developing into moths, however, are confined to beech.' The frequency of development on beech is not provided. The Panel considers that the development on *F. sylvatica* may happen because of spill over from oak trees completely defoliated, a situation that could occur in forest and not expected in tree nurseries. Eggs were never found on *Fagus*, so there is no evidence that *Fagus* is a reproductive host.
PRA information	Available Pest Risk Assessment: – Oak processionary moth Pest Risk Analysis (Evans, 2008); – Evaluation of a pest risk analysis on *Thaumetopoea processionea* L., the oak processionary moth, prepared by the UK and extension of its scope to the EU territory (Baker et al., 2009); – UK Risk Register Details for *Thaumetopoea processionea* (DEFRA, online).

<table>
<tr><th colspan="3">Other relevant information for the assessment</th></tr>
<tr><td>Biology</td><td colspan="2"> Thaumetopoea processionea is native to southern and central Europe, where it is more abundant and widespread in warm and sunny sites; in central and western Europe its presence is mainly dependent on population fluctuations which can be determined by aridity and climate change (Groenen and Meurisse, 2012; Csoka et al., 2018). The moth is also present in Türkiye and in the Middle East (Syria, Lebanon, Jordan, Israel) (Groenen and Meurisse, 2012; Battisti et al., 2015; Basso et al., 2017; CABI, online). Thaumetopoea processionea has four life stages: egg, larva (six instars), pupa and adult; it is a univoltine species, overwintering as 1st instar larva inside the egg (Zielonka, 2020; CABI, online; Forestry Commission, online). Adults, 25–35 mm wingspan, fly from July to September and can survive 4–10 days. Females lay 30–200 eggs, occasionally up to 300 (CABI, online), which are 2 mm long. The eggs are laid in batches on small branches of oaks (3.5–10 mm diameter). In autumn 1st instar larvae are found within the eggs; eggs and larvae are known to withstand up to −30°C, and a 90% rate of survival of overwintering eggs is observed after severe winters (Baker et al., 2009; Battisti et al., 2015). Egg hatching in April–May is usually well synchronised with oak bud flushing. The larval stage can last 60–70 days. Larvae feed on foliage gregariously from April to July and build a silky nest for each of the instars (CABI, online); however, a large bag-shaped nest weaved with silk is built only at 5th–6th larval stage in the medium-lower part of the trunk. The 35–40 mm mature caterpillars rest in the nest during the day and move in head-to-tail processions during the night in search of food. Larvae from 3rd instar onwards develop urticating hairs on the dorsal part of abdomen (Zielonka, 2020; CABI, online; EPPO, online_e). In the UK, the mature larvae pupate inside the nests from June to early September and adult flight can be normally observed from end July to late September (Forestry Commission, online). Natural dispersal of T. processionea is through adult flight. Larvae move in processions only to very short distances from one tree to another only when there is no food left (Stigter et al., 1997). Adults are good flyers (up to 50–100 km for males and up to 5–20 km for females); windborne spread of adults is also possible (Baker et al., 2009; EPPO, online_c). Males are known to be able to fly over the Channel from France to southern England; this is considered unlikely for females, which are heavier (Evans, 2007; Battisti et al., 2015; EPPO, online_e). In the UK, T. processionea has recently increased its expansion rate, passing from 1.66 km/year in 2006–2014 to 6.17 km/year in 2015–2019 (Suprunenko et al., 2022). The spread of T. processionea can also be human supported, mostly via trading of plants for planting carrying eggs, larvae and pupae. Cut branches and round wood with bark are considered pathways of lesser importance (Evans, 2008; Baker et al., 2009; EPPO, online_e). According to Stigter et al. (1997), larvae were found in oak nurseries in Northern Brabant. The presence of the pest in nurseries is confirmed by Baker et al. (2009) based on reports of the Dutch PPO. </td></tr>
<tr><td rowspan="2">Symptoms</td><td>Main type of symptoms</td><td> Main symptoms caused by larvae of T. processionea on oaks are skeletonisation of leaves and defoliation; presence of silken nests mainly on the lower branches and the lower part of the trunk; processions of caterpillars on the branches and trunks; egg batches in rows covered by scales, mostly on 1–2 years-old twigs. No information was found on symptoms observed on Fagus sylvatica so the symptoms are assumed to be similar to the ones on Quercus. Symptoms on humans and animals due to urticating hairs are skin rash, eye irritation, sore throat and breathing difficulty. </td></tr>
<tr><td>Presence of asymptomatic plants</td><td>No information on the presence of asymptomatic plants was found.</td></tr>
</table>

	Confusion with other pests	*Thaumetopoea processionea* is one of 15 species belonging to the genus *Thaumetopoea* worldwide, recently revised by Basso et al. (2017). The species is easily identified by both morphological features of adults, and features and host plants of larvae (it is the sole *Thaumetopoea* feeding on *Quercus* sp.) so that no confusion with other similar species is possible.
Host plant range	*Thaumetopoea processionea* is a specialist herbivore feeding on oaks in Europe (Damestoy, 2019). *Quercus* species known to be hosts of *T. processionea* are *Quercus boissieri, Q. calliprinos, Q. cerris, Q. frainetto, Q. infectoria, Q. ilex, Q. palustris, Q. petraea, Q. pubescens, Q. pyrenaica, Q. robur* and *Q. x turneri* (Baker et al., 2009; DEFRA, online; EPPO, online_f; EUROPHYT, online). Secondary, occasional hosts, only attacked during outbreaks are *Acacia, Betula, Carpinus, Castanea, Corylus, Crataegus, Juglans, Fagus, Pistacia, Pinus, Robinia* and *Sorbus*. However, beside *Quercus*, the development of larvae to adults is known only for *Fagus* (Stigter et al., 1997; EPPO online_e, f).	
Reported evidence of impact	*Thaumetopoea processionea* is both an important defoliating insect for oak species and a threat to human and domestic animal health. Marzano et al. (2020) provide a useful summary of how the multi-face OPM problem is currently felt by people and managers in the UK. The impact of *T. processionea* on forest health is variable: it is considered a minor pest for oak forests in Ukraine, Romania, Hungary, Slovenia; severe damage was instead reported from Germany, Italy, France, Belgium and Spain (Baker et al., 2009). In western Europe (Belgium, the Netherlands) and in the UK, the pest is mainly harmful to urban and road trees, as well as to amenity oak trees in parks, forest edges and countryside hedgerows (Battisti et al., 2015). Both in canopied stands and open forests, oaks weakened after severe defoliation by the *T. processionea* become more susceptible to secondary pests as buprestid beetles, bark and ambrosia beetles or root rot fungi. *T. processionea* may be hence considered a contributing factor in the oak decline, also resulting in loss of biodiversity (Baker et al., 2009; CABI Compendium, online). Impact on human health may be relevant mostly in urban areas, due to the severe pseudo-allergenic reactions caused by the contact of urticating hairs released by the larvae with skin, eyes and respiratory system. A good synthesis on health effects of *T. processionea* is provided by Rhalenbeck and Utikal (2015). Urticating hairs released by larvae spread by air currents also from nests, exuviae, pupal cases, and may remain active in the soil or in the litter for several years lengthening the social impact of the species (Baker et al., 2009). According to Stigter et al. (1997), after oak trees have been completely defoliated during outbreaks larvae of *T. processionea* can migrate to different hosts genera, as *Fagus*, but no specific information about the impact of *T. processionea* defoliation on *Fagus sylvatica* is available.	
Evidence that the commodity is a pathway	*Thaumetopoea processionea* was very frequently intercepted on *Quercus* plants for planting from the EU countries to the UK and Ireland, on plant of very similar size to those produced in the UK nurseries (EUROPHYT, online; TRACES-NT, online). In all probability, *T. processionea* has been introduced in the London area in 2005 via plants for planting of fastigiated oaks (Baker et al., 2009). Depending on the season, eggs, larvae and pupae may be present on host plants in nurseries everywhere the pest is present in exporting countries. *Fagus sylvatica* could be a pathway for mature larvae feeding on leaves. Egg masses and young larvae were never found on *Fagus* so there is an uncertainty on whether oviposition and early larvae development can occur on *Fagus*.	
Surveillance information	*Thaumetopoea processionea* is a quarantine pest under official control in the UK. As part of an annual survey at ornamental retail and production sites (frequency of visits determined by a decision matrix), *T. processionea* is inspected for on *Quercus*. An additional inspection, during the growing period, is carried out at plant passport production sites. Nursery staff is aware of *T. processionea* and check all *Quercus* products for signs, even where the pest is not present in the area. Movement restrictions for growing sites are enforced in the infested area and buffer zone.	

	There is an eradication policy for the buffer zone and pest-free area (Dossier Section 3.0). The Panel noted that the movement within the UK territory is only restricted to larger trees of *Quercus*. According to GOV.UK (online) 'Movement of oak trees in Great Britain: Restrictions on moving large oak trees (*Quercus* L.), with a girth (circumference) at 1.2 m above the root collar of 8 cm (2.55 cm diameter approx.) in GB vary dependent on what OPM management zone the trees are in.' Movement restrictions of *Fagus* is not mentioned in the Guidance.

A.4.2. Possibility of pest presence in the nursery

A.4.2.1. Possibility of entry from the surrounding environment

Thaumetopoea processionea is present in the UK territory with distribution restricted to a boundary including 86 local authorities in the London area and South East of England; recently (2022) the pest has also extended its presence to the previous pest free area of Hampshire (Dossier Section 5.0).

Adult moths have considerable spreading capacities (up to 50–100 km for males and up to 5–20 km for females); in the UK, the pest has strongly increased its expansion rate, passing from 1.66 km/year in 2006–2014 to 6.17 km/year in 2015–2019 (Suprunenko et al., 2022).

Thaumetopoea processionea breeds on *Quercus* species. On *Fagus* the mature larvae can complete the development according to Stigter et al. (1997) but oviposition and young larvae were never observed. Other secondary hosts are *Betula, Carpinus, Castanea, Corylus, Crataegus, Juglans, Pinus, Robinia* and *Sorbus*. All these species, mostly *Quercus* and *Fagus*, are widely present within 2 km from the nurseries (Dossier Section 3.0).

Uncertainties:

- The possibility of presence of the pest in the surrounding area of nurseries.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for *T. processionea* to enter the nurseries from surrounding environment. In the surrounding area, suitable hosts are present and flying adult moths can easily reach the nurseries.

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

The starting materials are only seeds and seedlings. Seeds are certified and coming from the UK. Seedlings are either from the UK, the EU (the Netherlands and France) (Dossier Section 3.0). Seeds are not a pathway for the pest.

In addition to *Fagus sylvatica* plants, the nurseries also produce other plants (Dossier Section 6.0). Out of them, only *Quercus* sp. are hosts on which the pest can complete the life cycle. However, there is no information on how and where the plants are produced. Therefore, if the plants are first produced in another nursery, the pest could possibly travel with them.

The nurseries are using virgin peat or peat-free compost (a mixture of coir, tree bark, wood fibre, etc.) as a growing media (Dossier Section 1.0). The growing media is certified and heat-treated by commercial suppliers during production to eliminate pests and diseases (Dossier Section 3.0). Soil and growing media are not pathways for *T. processionea*.

Uncertainties:

- None.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for the pest to enter the nurseries via new plants of *Quercus* and *F. sylvatica* used for plant production in the area. The entry of the pest with seeds and the growing media the Panel considers as not possible.

A.4.2.3. Possibility of spread within the nursery

Fagus sylvatica plants are either grown in containers (cells, pots, tubes, etc.) outdoors/in the open air or in field. Cell grown trees may be grown in greenhouses, however most plants will be field grown, or field grown in containers (Dossier Section 1.0). There are no mother plants present in the nurseries (Dossier Section 3.0).

The pest can infest other suitable plants mainly *Quercus* present within the nurseries (Dossier Sections 3.0 and 6.0).

Thaumetopoea processionea can spread within the nurseries by movement of larvae, adult flight and infested plant material.

Uncertainties:

– None.

Taking into consideration the above evidence and uncertainties, the Panel considers that the spread of the pest within the nurseries is possible both by movement of infested plant material and larvae, and flight of adult moths.

A.4.3. Information from interceptions

In the EUROPHYT/TRACES-NT database there are no records of notification of *Fagus sylvatica* plants for planting neither from the UK nor from other countries due to the presence of *T. processionea* between the years 1995 and December 2022 (EUROPHYT, online; TRACES-NT, online). However, there are many interceptions on *Quercus* plants from the EU to the UK in the same period.

A.4.4. Evaluation of the risk mitigation measures

In the table below, all risk mitigation measures currently applied in the UK are listed and an indication of their effectiveness on *T. processionea* is provided. The description of the risk mitigation measures currently applied in the UK is provided in the Table 6.

N	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
1	Registration of production sites	Yes	The registration and the release of the UK plant passport should be enough to warrant pest-free plant material for a quarantine pest in the UK. Uncertainties: – The detection of the egg masses on the twig can be difficult. – There were several interceptions of infested material in deliveries of certified plant material from the EU countries to the UK and Ireland.
2	Physical separation	No	As the production is not carried out in separate areas, the possibility that the pest can move from the outside to the nurseries and from one tree species to another within the nurseries is concrete. Uncertainties: – The proximity of *Quercus* to nurseries – The proximity of *Quercus* to *Fagus* plants in the nurseries
3	Certified plant material	Yes	The use of certified material should be enough to warrant pest-free status. Uncertainties: – The level of accuracy in testing for the presence of egg masses on traded plants.
4	Growing media	No	The pest is not affected by the growing medium as in the nurseries all the stages develop above ground. Uncertainties: – None.
5	Surveillance, monitoring and sampling	Yes	Regular surveys are carried out during the production by visual inspection of the plants. Any report of a quarantine pest is provided.

N	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
			Uncertainties: – The capacity of the inspectors to detect the egg masses on the twigs.
6	Hygiene measures	No	Weeding and disinfection are not relevant for this pest. Uncertainties: – None.
7	Removal of infested plant material	Yes	The removal of infested plants at the larval stage will have a positive effect although it would be difficult with the egg stage as egg masses are detectable only through a careful inspection of all the twigs. Uncertainties: – The level of accuracy in searching for egg masses.
8	Irrigation water	No	Water is not relevant for this pest. Uncertainties: – None.
9	Application of pest control products	Yes	The pest is easy to control at the larval stage and being a quarantine pest, its presence must be reported and measures taken. However, the egg masses are not susceptible to any crop protection method and there are no treatments available against the moths. Uncertainties: – None.
10	Measures against soil pests	No	Soil is not relevant for this pest. Uncertainties: – No.
11	Inspections and management of plants before export	Yes	Inspections carried out before export will be visual and would be enough to warrant that commodities are free of larvae. However, the detection of egg masses is difficult and it should require the individual checking of every twig in each plant. Uncertainties: – The capacity of the inspectors to detect the egg masses on the twigs of each plant.
12	Separation during transport to the destination	Yes	The separation of the plants during the transport would reduce the possibility that larvae are moving among plants if the transport happens when green leaves are occurring between April and August. Separation is not affecting the egg stage as they are not mobile. Uncertainties: – The period when the plants are moved. – The presence of green leaves at the time of transport.

A.4.5. Overall likelihood of pest freedom for bundles of whips and seedlings

A.4.5.1. Reasoning for a scenario which would lead to a reasonably low number of infested bundles of whips and seedlings

The nurseries are located in a pest-free area for the whole period of plant development and the plant material taken to the nurseries originate only from pest-free areas within the UK.

A.4.5.2. Reasoning for a scenario which would lead to a reasonably high number of infested bundles of whips and seedlings

The nurseries are not in a pest-free area and plant material taken to the nursery could originate from infested areas in the EU and in the UK. *Fagus* can receive some egg masses and the young larvae can feed on *Fagus* leaves. There is spill over of mature larvae from infested *Quercus* trees in the nurseries and the nearby *Fagus* trees.

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

The median is skewed to the left (lower values) because only one nursery seems to be included in the buffer zone (2022) and because *Fagus* was never observed as a host for the eggs and the young larvae.

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

The uncertainty is almost equally distributed around the median (the third quartile shows slightly less uncertainty) because 1. the species is very mobile and nurseries could get close to areas of establishment or to the buffer zone, 2. the potential oviposition and successful early larval development cannot be excluded as it has been not tested under experimental conditions.

A.4.5.5. Elicitation outcomes of the assessment of the pest freedom for *Thaumetopoea processionea* on bundles of whips and seedlings

The following Tables show the elicited and fitted values for pest infestation (Table A.19) and pest freedom (Table A.20).

Table A.19: Elicited and fitted values of the uncertainty distribution of pest infestation by *Thaumetopoea processionea* per 10,000 bundles

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0					2		3		5					10
EKE	0.0992	0.210	0.372	0.667	1.04	1.50	1.97	3.00	4.24	5.00	5.95	6.99	8.14	9.08	10.0

The EKE results is the BetaGeneral (1.2399, 3.486, 0, 13.2) distribution fitted with @Risk version 7.6.

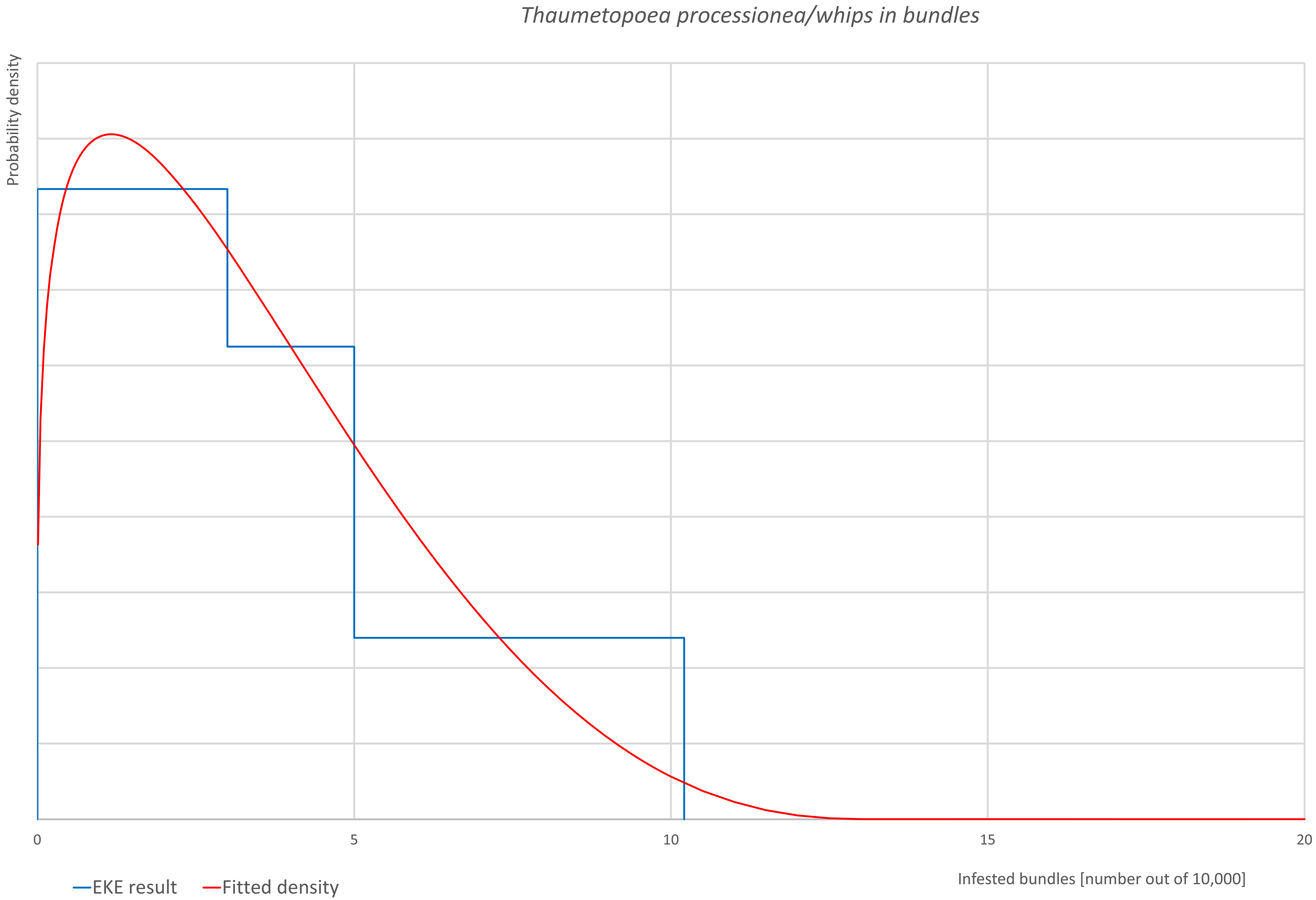
Based on the numbers of estimated infested bundles the pest freedom was calculated (i.e. = 10,000 – number of infested bundles per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.20.

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

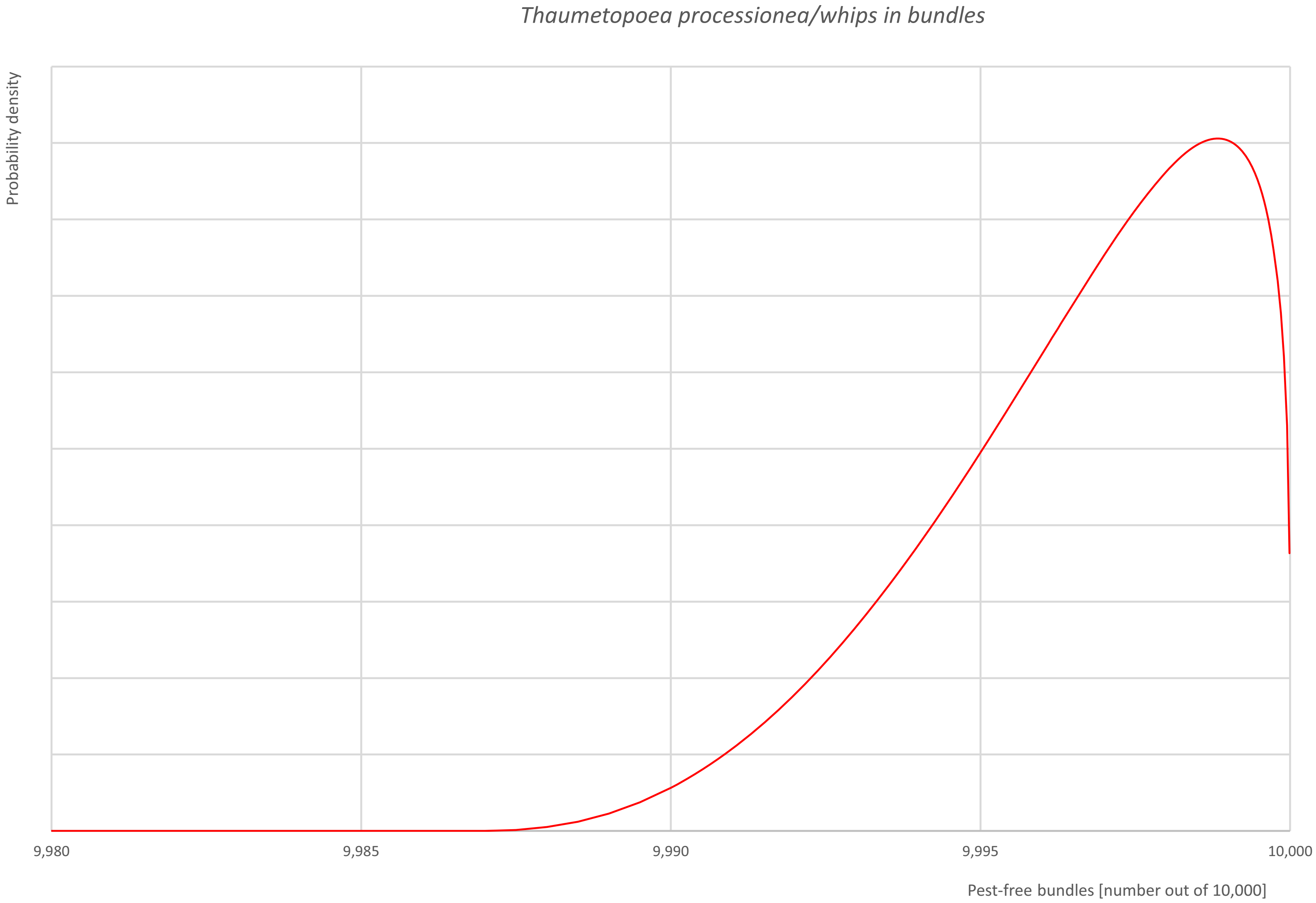
Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,990					9,995		9,997		9,999					10,000
EKE results	9,990	9,991	9,992	9,993	9,994	9,995	9,996	9,997	9,998.0	9,998.5	9,999.0	9,999.3	9,999.6	9,999.8	9,999.9

The EKE results are the fitted values.

(a)


Thaumetopoea processionea/whips in bundles
Probability density
0
5
10
15
20
Infested bundles [number out of 10,000]
EKE result
Fitted density

(b)


Thaumetopoea processionea/whips in bundles
Probability density
9,980
9,985
9,990
9,995
10,000
Pest-free bundles [number out of 10,000]

(c)

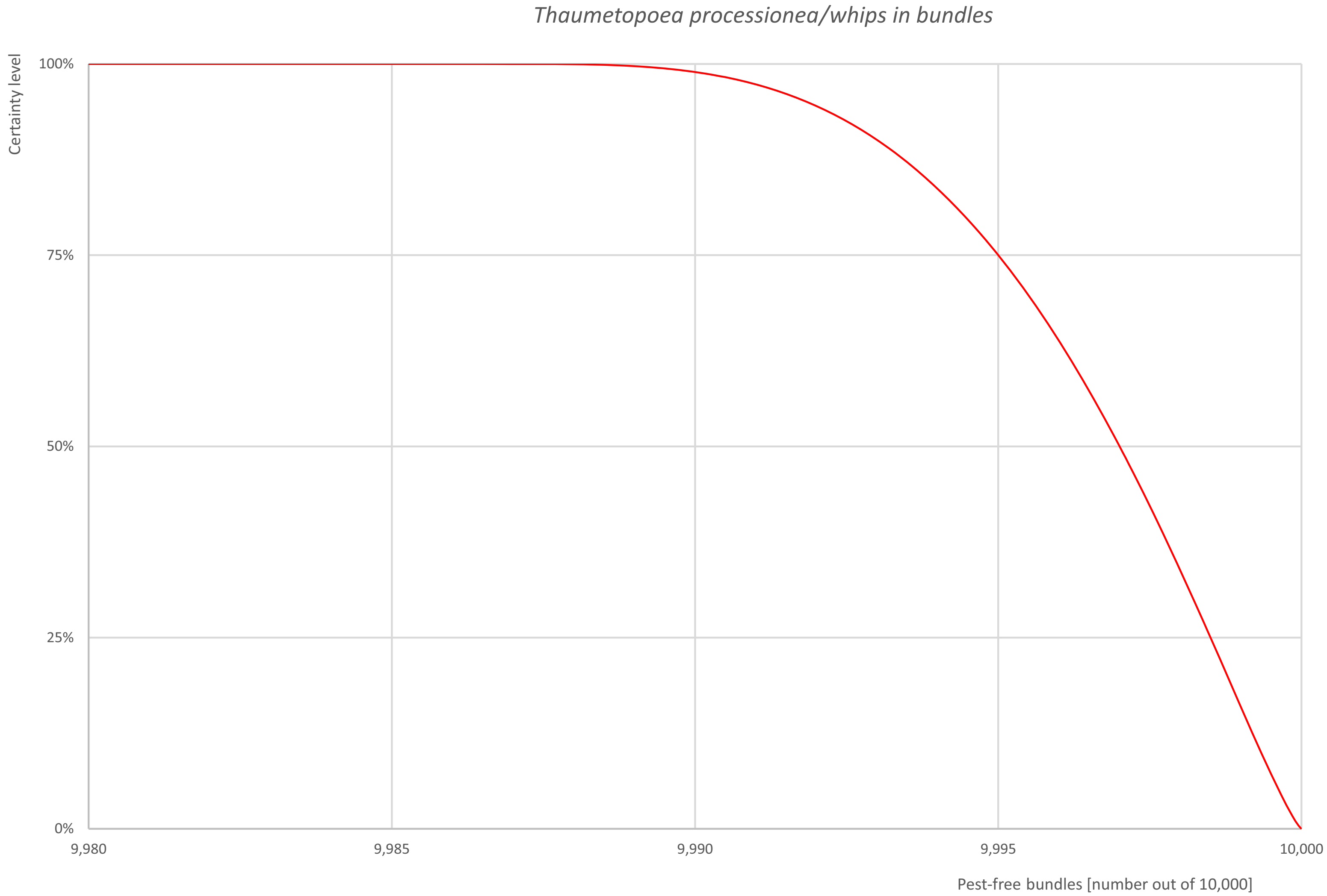


Figure A.10: (a) Elicited uncertainty of pest infestation per 10,000 bundles (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free bundles per 10,000 (i.e.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

A.4.6. Overall likelihood of pest freedom for bare root plants/trees up to 7 years old

A.4.6.1. Reasoning for a scenario which would lead to a reasonably low number of infested bare root plants/trees up to 7 years old

The nurseries are located in a pest-free area for the whole period of plant development and the plant material taken to the nurseries originate only from pest-free areas within the UK.

A.4.6.2. Reasoning for a scenario which would lead to a reasonably high number of infested bare root plants/trees up to 7 years old

The nurseries are not in a pest-free area and plant material taken to the nursery could originate from infested areas in the EU and in the UK. *Fagus* can receive some egg masses and the young larvae can feed on *Fagus* leaves. There is spill over of mature larvae from infested *Quercus* trees in the nurseries and the nearby *Fagus* trees.

A.4.6.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infested bare root plants/trees up to 7 years old (Median)

The median is skewed to the left (lower values) because only one nursery seems to be included in the buffer zone (2022) and because *Fagus* was never observed as a host for the eggs and the young larvae.

A.4.6.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

The uncertainty is almost equally distributed around the median (the third quartile shows slightly less uncertainty) because (1) the species is very mobile and nurseries could get close to areas of establishment or to the buffer zone, (2) the potential oviposition and successful early larval development cannot be excluded as it has been not tested under experimental conditions.

A.4.6.5. Elicitation outcomes of the assessment of the pest freedom for *Thaumetopoea processionea* on bare root plants/trees up to 7 years old

The following Tables show the elicited and fitted values for pest infestation (Table A.21) and pest freedom (Table A.22).

Table A.21: Elicited and fitted values of the uncertainty distribution of pest infestation by *Thaumetopoea processionea* per 10,000 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					10
EKE	0.099	0.210	0.372	0.667	1.04	1.50	1.97	3.00	4.24	5.00	5.95	6.99	8.14	9.08	10.0

The EKE results is the BetaGeneral (1.2399, 3.486, 0, 13.2) distribution fitted with @Risk version 7.6.

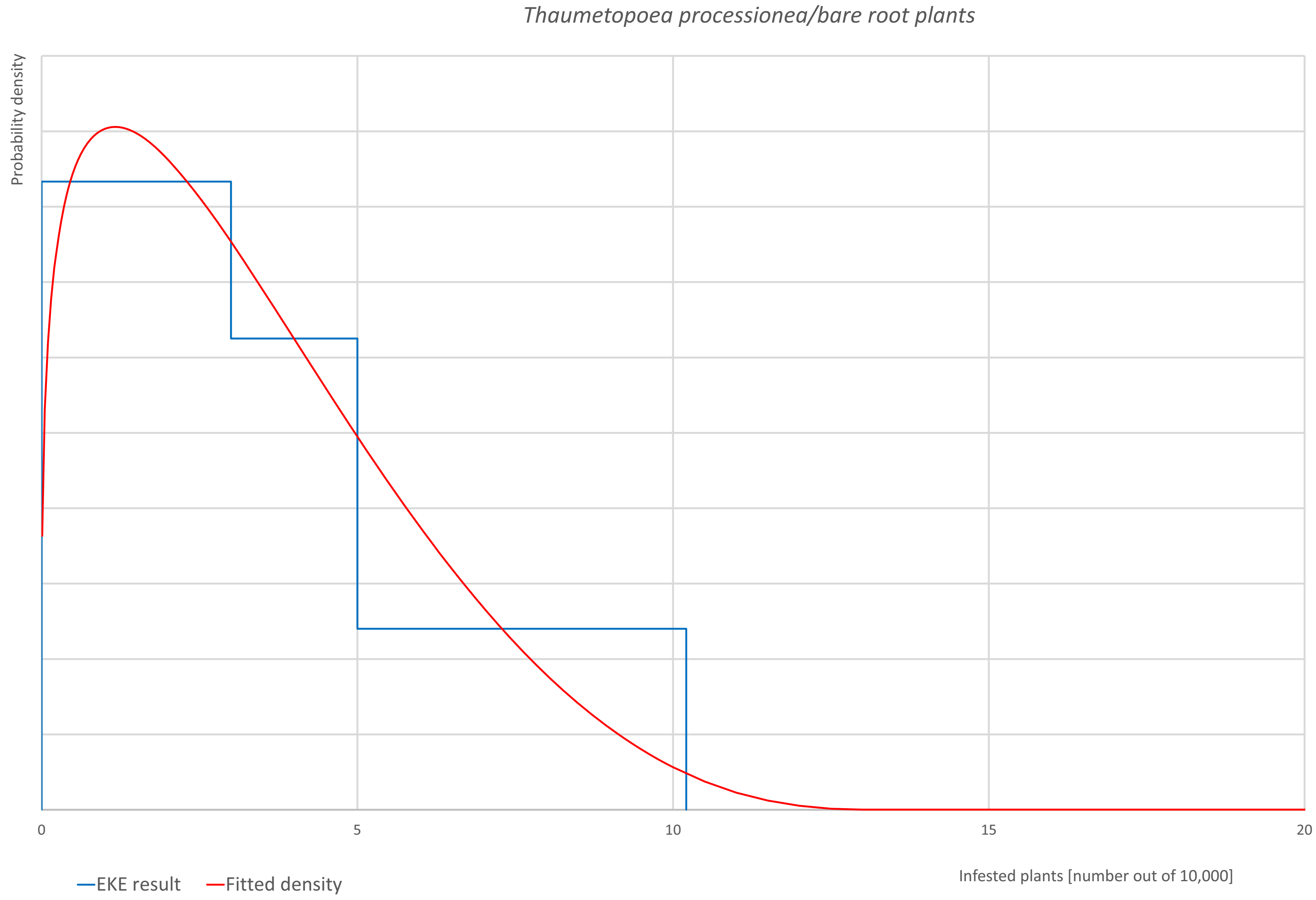
Based on the numbers of estimated infested plants the pest freedom was calculated (i.e. = 10,000 – number of infested plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.22.

Table A.22: The uncertainty distribution of plants free of *Thaumetopoea processionea* per 10,000 plants calculated by Table A.21

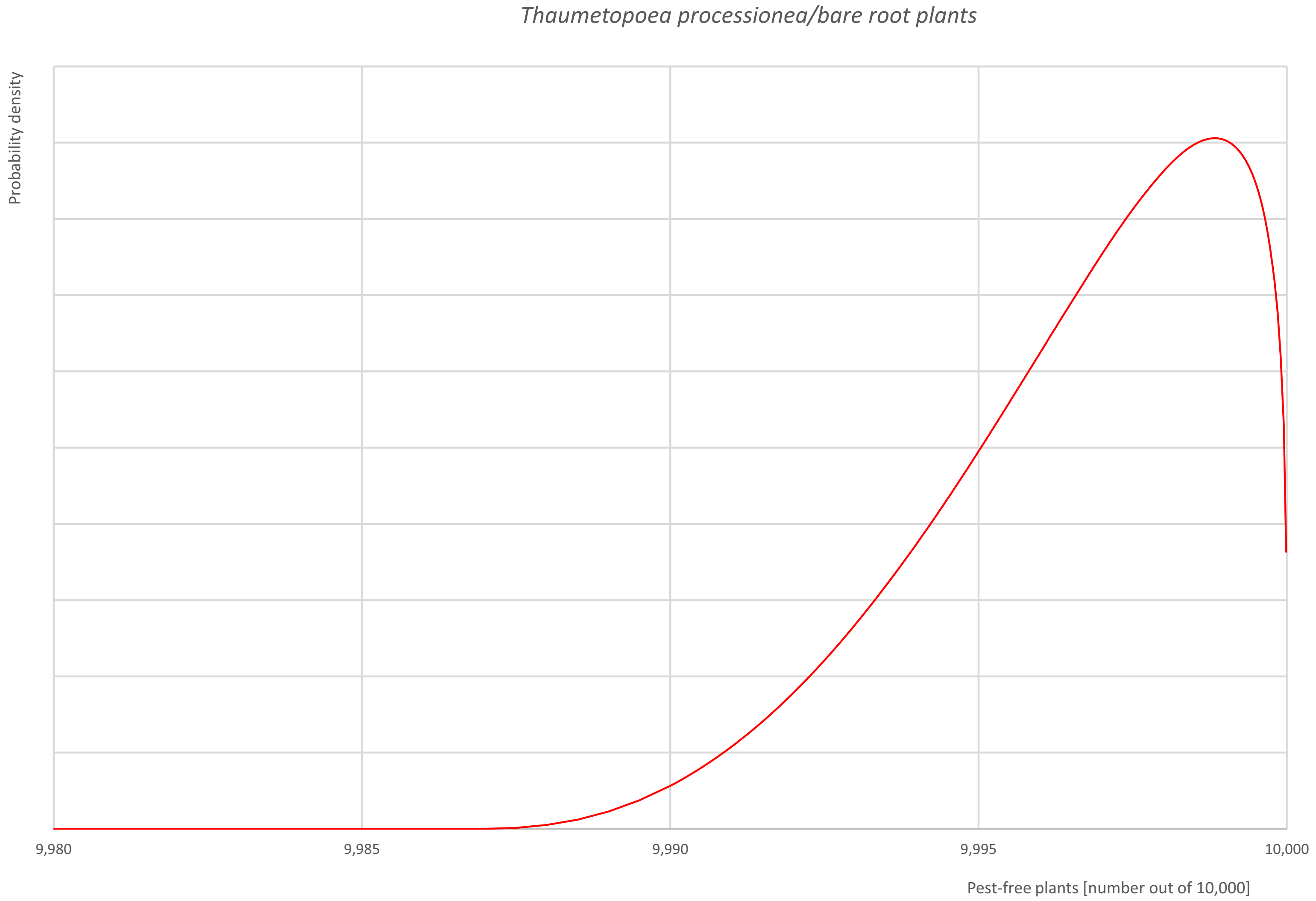
Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,990					9,995		9,997		9,999					10,000
EKE results	9,990	9,991	9,992	9,993	9,994	9,995	9,996	9,997	9,998.0	9,998.5	9,999.0	9,999.3	9,999.6	9,999.8	9,999.9

The EKE results are the fitted values.

(a)


Thaumetopoea processionea/bare root plants
Probability density
0
5
10
15
20
EKE result
Fitted density
Infested plants [number out of 10,000]

(b)


Thaumetopoea processionea/bare root plants
Probability density
9,980
9,985
9,990
9,995
10,000
Pest-free plants [number out of 10,000]

(c)

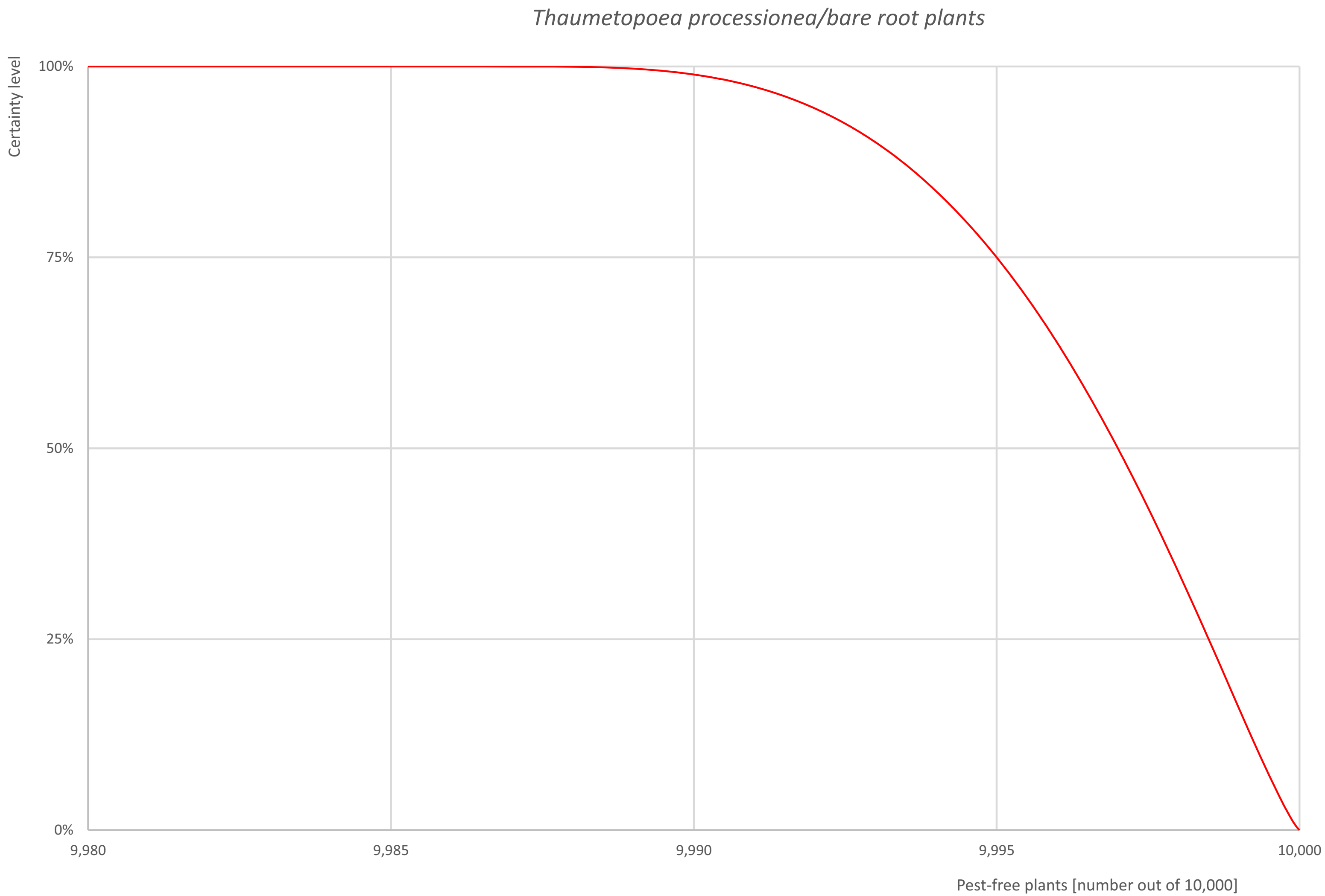


Figure A.11: (a) Elicited uncertainty of pest infestation per 10,000 plants (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free plants per 10,000 (i.e.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

A.4.7. Overall likelihood of pest freedom for plants in pots up to 15 years old

A.4.7.1. Reasoning for a scenario which would lead to a reasonably low number of infested plants in pots up to 15 years old

The nurseries are located in a pest-free area for the whole period of plant development and the plant material taken to the nurseries originate only from pest-free areas within the UK.

A.4.7.2. Reasoning for a scenario which would lead to a reasonably high number of infested plants in pots up to 15 years old

The nurseries are not in a pest-free area and plant material taken to the nursery could originate from infested areas in the EU and in the UK. *Fagus* can receive some egg masses and the young larvae can feed on *Fagus* leaves. There is spillover of mature larvae from infested *Quercus* trees in the nurseries and the nearby *Fagus* trees. Larger trees are more difficult to inspect effectively.

A.4.7.3. Reasoning for a central scenario equally likely to over- or underestimate the number of infested plants in pots up to 15 years old (Median)

The median is skewed to the left (lower values) because only one nursery seems to be included in the buffer zone (2022) and because *Fagus* was never observed as a host for the eggs and the young larvae.

A.4.7.4. Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/interquartile range)

The uncertainty is almost equally distributed around the median (the third quartile shows slightly less uncertainty) because (1) the species is very mobile and nurseries could get close to areas of establishment or to the buffer zone, (2) the potential oviposition and successful early larval development cannot be excluded as it has been not tested under experimental conditions.

A.4.7.5. Elicitation outcomes of the assessment of the pest freedom for *Thaumetopoea processionea* on plants in pots up to 15 years old

The following Tables show the elicited and fitted values for pest infestation (Table A.23) and pest freedom (Table A.24).

Table A.23: Elicited and fitted values of the uncertainty distribution of pest infestation by *Thaumetopoea processionea* per 10,000 plants

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0					4		8		16					40
EKE	0.167	0.395	0.762	1.49	2.48	3.77	5.17	8.43	12.7	15.6	19.4	23.8	29.3	34.2	40.0

The EKE results is the BetaGeneral (1.0764, 6.8505, 0, 80) distribution fitted with @Risk version 7.6.

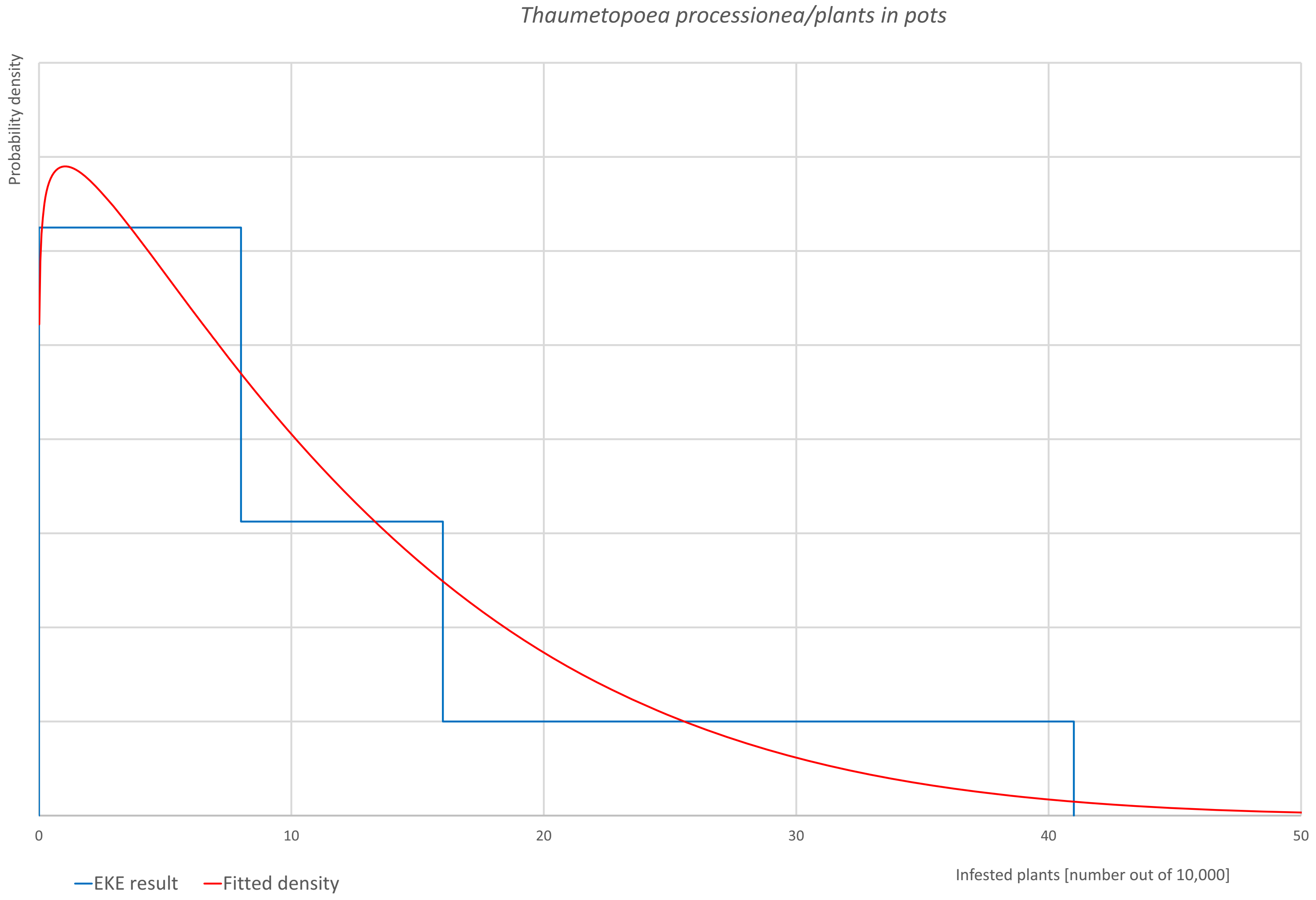
Based on the numbers of estimated infested plants the pest freedom was calculated (i.e. = 10,000 – number of infested plants per 10,000). The fitted values of the uncertainty distribution of the pest freedom are shown in Table A.24.

Table A.24: The uncertainty distribution of plants free of *Thaumetopoea processionea* per 10,000 plants calculated by Table A.23

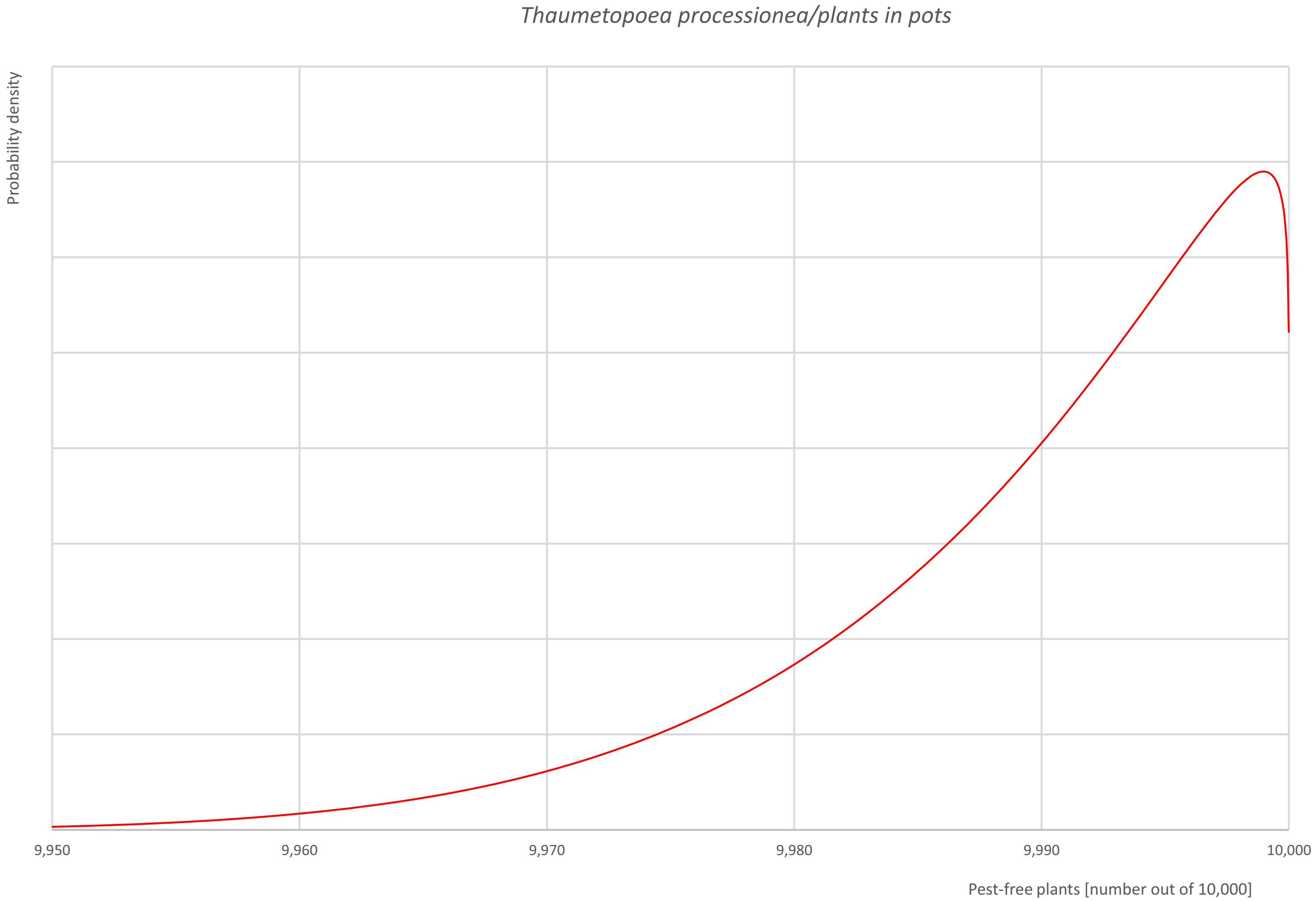
Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9,960					9,984		9,992		9,996					10,000
EKE results	9,960	9,966	9,971	9,976	9,981	9,984	9,987	9,992	9,995	9,996	9,997.5	9,998.5	9,999.2	9,999.6	9,999.8

The EKE results are the fitted values.

(a)


Thaumetopoea processionea/plants in pots
Probability density
0
10
20
30
40
50
Infested plants [number out of 10,000]
EKE result
Fitted density

(b)


Thaumetopoea processionea/plants in pots
Probability density
9,950
9,960
9,970
9,980
9,990
10,000
Pest-free plants [number out of 10,000]

(c)

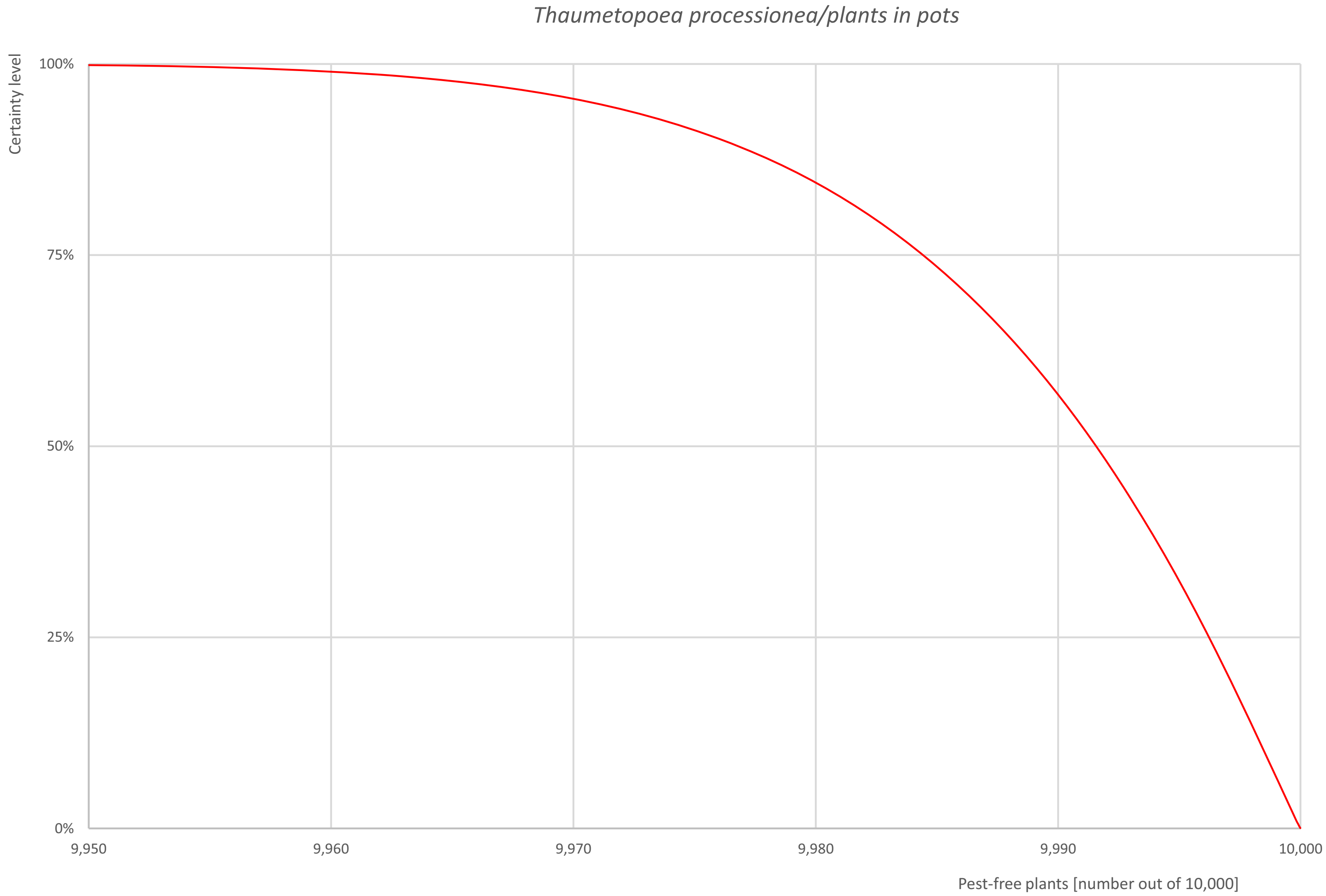


Figure A.12: (a) Elicited uncertainty of pest infestation per 10,000 plants (histogram in blue – vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (b) uncertainty of the proportion of pest-free plants per 10,000 (i.e.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

A.4.8. Reference list

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Appendix B – Web of Science All Databases Search String

In the Table B.1, the search string for *Fagus sylvatica* used in Web of Science is reported. Totally, 1,330 papers were retrieved. Titles and abstracts were screened, and 118 pests were added to the list of pests (see Appendix F).

Table B.1: String for *Fagus sylvatica*

Web of Science All databases	**TOPIC:** ("Fagus sylvatica" OR "beech" OR "European beech" OR "Castanea fagus" OR "Fagus aenea" OR "Fagus asplenifolia" OR "Fagus cochleata" OR "Fagus comptoniifolia" OR "Fagus crispa" OR "Fagus cristata" OR "Fagus cucullata" OR "Fagus cuprea" OR "Fagus echinata" OR "Fagus incisa" OR "Fagus laciniata" OR "Fagus pendula" OR "Fagus purpurea" OR "Fagus purpurea var. roseomarginata" OR "Fagus quercirdes" OR "Fagus salicifolia" OR "Fagus sylvestris" OR "Fagus tortuosa" OR "Fagus variegata")
	AND
	TOPIC: (pathogen* OR pathogenic bacteria OR fung* OR oomycet* OR myce* OR bacteri* OR virus* OR viroid* OR insect$ OR mite$ OR phytoplasm* OR arthropod* OR nematod* OR disease$ OR infecti* OR damag* OR symptom* OR pest$ OR vector OR hostplant$ OR "host plant$" OR host OR "root lesion$" OR decline$ OR infestation$ OR damage$ OR symptom$ OR dieback* OR "die back*" OR "malaise" OR aphid$ OR curculio OR thrip$ OR cicad$ OR miner$ OR borer$ OR weevil$ OR "plant bug$" OR spittlebug$ OR moth$ OR mealybug$ OR cutworm$ OR pillbug$ OR "root feeder$" OR caterpillar$ OR "foliar feeder$" OR virosis OR viroses OR blight$ OR wilt$ OR wilted OR canker OR scab$ OR rot OR rots OR rotten OR "damping off" OR "damping-off" OR blister$ OR "smut" OR mould OR mold OR "damping syndrome$" OR mildew OR scald$ OR "root knot" OR "root-knot" OR rootknot OR cyst$ OR "dagger" OR "plant parasitic" OR "parasitic plant" OR "plant$parasitic" OR "root feeding" OR "root$feeding")
	NOT
	TOPIC: ("winged seeds" OR metabolites OR *tannins OR climate OR "maple syrup" OR syrup OR mycorrhiz* OR "carbon loss" OR pollut* OR weather OR propert* OR probes OR spectr* OR antioxidant$ OR transformation OR RNA OR DNA OR "Secondary plant metabolite$" OR metabol* OR "Phenolic compounds" OR Quality OR Abiotic OR Storage OR Pollen* OR fertil* OR Mulching OR Nutrient* OR Pruning OR drought OR "human virus" OR "animal disease*" OR "plant extracts" OR immunological OR "purified fraction" OR "traditional medicine" OR medicine OR mammal* OR bird* OR "human disease*" OR biomarker$ OR "health education" OR bat$ OR "seedling$ survival" OR "anthropogenic disturbance" OR "cold resistance" OR "salt stress" OR salinity OR "aCER method" OR "adaptive cognitive emotion regulation" OR nitrogen OR hygien* OR "cognitive function$" OR fossil$ OR *toxicity OR Miocene OR postglacial OR "weed control" OR landscape)
	NOT
	TOPIC: ("Abraxas sylvata" OR "Absidia glauca" OR "Acalitus blastophthirus" OR "Acalitus plicans" OR "Acalitus plicans" OR "Acalitus plicator" OR "Acalitus stenaspis" OR "Acalitus stenaspis" OR "Acalles ptinoides" OR "Acalles turbatus" OR "Acanthococcus aceris" OR "Aceria fagineus" OR "Aceria hagleyensis" OR "Aceria nervisequa" OR "Aceria nervisequa" OR "Aceria nervisequus" OR "Aceria stenaspis" OR "Aceria stenaspis" OR "Aceria stenaspis var. plicans" OR "Acia stenodon" OR "Acladium conspersum" OR "Acleris cristana" OR "Acleris ferrugana" OR "Acleris literana" OR "Acleris sparsana" OR "Acleris sparsana" OR "Acleris sparsana" OR "Acleris tripunctana" OR "Acrodontium fagicola" OR "Acrogenospora megalospora" OR "Acronicta alni" OR "Acronicta americana" OR "Acrostalagmus luteoalbus" OR "Actinocladium rhodosporum" OR "Actinonema fagicola" OR "Adoxophyes orana" OR "Aglenchus agricola" OR "Aglia tau" OR "Agrilus angustulus" OR "Agrilus pannonicus" OR "Agrilus sulcicollis" OR "Agrilus viridis" OR "Agriopis aurantiaria" OR "Agriopis marginaria" OR "Agrochola macilenta" OR "Alborbis galericulata" OR "Alcis jubata" OR "Alnetoidia alneti" OR "Alternaria alternata" OR "Alternaria alternata" OR "Alternaria tenuis" OR "Altica quercetorum" OR "Amanita muscaria" OR "Amanita muscaria" OR "Amanita pantherina" OR "Amanita phalloides" OR "Amaurodon viridis" OR "Ambrosiella ferruginea" OR "Ampedus cinnabarinus" OR "Ampedus elongantulus" OR "Ampedus nigerrimus" OR "Ampedus nigrinus" OR

	"Ampedus pomonae" OR "Ampedus pomorum" OR "Ampedus praeustus" OR "Ampedus rufipennis" OR "Amphinema byssoides" OR "Amphipyra pyramidea" OR "Amphisphaeria fagi" OR "Amphisphaeria umbrina" OR "Anaglyptus mysticus" OR "Anavirga laxa" OR "Ancylis mitterbacheriana" OR "Ancylis mitterbacheriana" OR "Angerona prunaria" OR "Angustimassarina sylvatica" OR "Anisandrus dispar" OR "Annulohypoxylon cohaerens" OR "Anoplophora chinensis" OR "Anoplophora chinensis" OR "Anoplophora chinensis" OR "Anoplophora glabripennis" OR "Anoplophora glabripennis" OR "Anoplophora glabripennis" OR "Antheraea pernyi" OR "Anthostoma amoenum" OR "Anthostoma gastrinum" OR "Anthostoma hiascens" OR "Anthostoma rhenanum" OR "Anthostoma turgidum" OR "Anthostoma turgidum" OR "Anthostomella zonospora" OR "Antrodia heteromorpha" OR "Antrodia malicola" OR "Antrodia sinuosa" OR "Antrodia vaillantii" OR "Antrodiella hoehnelii" OR "Antrodiella semisupina" OR "Anungitea fragilis" OR "Anungitea rhabdospora" OR "Aphelia paleana" OR "Aphelia paleana" OR "Apiognomonia errabunda" OR "Apiognomonia errabunda" OR "Apiognomonia errabunda" OR "Apion vorax" OR "Apiosporium fumago" OR "Aplota palpella" OR "Apoda limacodes" OR "Apoderus coryli" OR "Aposphaeria freticola" OR "Aposphaeria pulviscula" OR "Apostemidium fiscellum" OR "Arachnopeziza aurata" OR "Arachnophora fagicola" OR "Aradus corticalis" OR "Arboridia ribauti" OR "Arctornis l-nigrum" OR "Arcyria denudata" OR "Arcyria nutans" OR "Argyresthia semitestacella" OR "Argyresthia semitestacella" OR "Argyresthia semitestacella" OR "Armillaria borealis" OR "Armillaria cepistipes" OR "Armillaria gallica" OR "Armillaria gallica" OR "Armillaria mellea" OR "Armillaria mellea" OR "Armillaria mellea" OR "Armillaria mellea" OR "Armillaria mucida" OR "Armillaria ostoyae" OR "Armillaria ostoyae" OR "Armillaria ostoyae" OR "Armillariella cepistipes" OR "Arrhenodes minutus" OR "Arthrinium arundinis" OR "Articulospora tetracladia" OR "Ascitendus austriacus" OR "Ascocoryne cylichnium" OR "Ascocoryne sarcoides" OR "Ascodichaena rugosa" OR "Ascolacicola austriaca" OR "Ascotremella faginea" OR "Asteromassaria macrospora" OR "Asteromella maculiformis" OR "Asterosporium asterospermum" OR "Asterosporium hoffmannii" OR "Asterosporium hoffmannii" OR "Athelia epiphylla" OR "Athelia salicum" OR "Athelopsis glaucina" OR "Atolmis rubricollis" OR "Attelabus nitens" OR "Auricularia mesenterica" OR "Automeris io" OR "Bactridium flavum" OR "Bactrodesmiella masonii" OR "Barbatosphaeria barbirostris" OR "Barya parasitica" OR "Basidiodendron caesiocinereum" OR "Basidioradulum radula" OR "Basiria tumida" OR "Bean yellow mosaic virus" OR "Bean yellow mosaic virus" OR "Belonidium cerineum" OR "Bertia moriformis" OR "Bertia moriformis" OR "Bertia moriformis var. latispora" OR "Bertia moriformis var. moriformis" OR "Beverwykella pulmonaria" OR "Biscogniauxia mediterranea" OR "Biscogniauxia mediterranea" OR "Biscogniauxia nummularia" OR "Biscogniauxia nummularia" OR "Bisifusarium penzigii" OR "Bispora antennata" OR "Bispora antennata" OR "Bispora monilioides" OR "Bispora pusilla" OR "Bisporella citrina" OR "Bisporella subpallida" OR "Biston betularia" OR "Bjerkandera adusta" OR "Bjerkandera adusta" OR "Bjerkandera adusta" OR "Bjerkandera fumosa" OR "Blastobasis decolorella" OR "Boleodorus thylactus" OR "Boletus edulis" OR "Bombardia bombarda" OR "Botryobasidium aureum" OR "Botryobasidium pruinatum" OR "Botryobasidium subcoronatum" OR "Botryosphaeria dothidea" OR "Botryosphaeria hoffmanni" OR "Botryosphaeria hoffmannii" OR "Botryosphaeria quercuum" OR "Botryosphaeria quercuum" OR "Botrytis cinerea" OR "Botrytis cinerea" OR "Botrytis cinerea" OR "Bourdotigloea concisa" OR "Brachionycha sphinx" OR "Brachysporiella laxa" OR "Brachysporium bloxami" OR "Brachysporium dingleyae" OR "Brachysporium nigrum" OR "Brome mosaic virus" OR "Bucculatrix packardella" OR "Bulgaria inquinans" OR "Bulgaria inquinans" OR "Bursaphelenchus xylophilus" OR "Byctiscus betulae" OR "Byssocorticium atrovirens" OR "Cacumisporium capitulatum" OR "Calepitrimerus fagi" OR "Calepitrimerus fagisylvaticus" OR "Caliroa annulipes" OR "Caliroa annulipes" OR "Caliroa cerasi" OR "Calliteara pudibunda" OR "Calliteara pudibunda" OR "Calocera cornea" OR "Calocera viscosa" OR "Caloptilia alchimiella" OR "Caloptilia robustella" OR "Calosphaeria fagi" OR "Calosphaeria minima" OR "Calosphaeria parasitica" OR "Calosphaeria princeps" OR "Calosphaeria tumidula" OR "Calycina citrina" OR "Calycina languida" OR "Camarops plana" OR "Camarops polysperma" OR "Camarops pugillus" OR "Camarops tubulina" OR "Camarosporium betulinum" OR "Campaea margaritata" OR "Camposporium antennatum" OR "Camposporium cambrense" OR "Camposporium hyalinum" OR "Candelabrum clathrosphaeroides" OR "Candelabrum desmidiaceum" OR "Candidatus Phytoplasma solani" OR "Cantharellus cinereus" OR "Capitotricha fagiseda" OR "Capnodium citri" OR "Capronia parasitica" OR "Capronia pilosella" OR "Capronia

	pulcherrima" OR "Carcina quercana" OR "Carcina quercana" OR "Carcina quercana" OR "Cardiophorus gramineus" OR "Catenulifera rhodogena" OR "Catinella olivacea" OR "Caudospora taleola" OR "Cecidomyia annulipes" OR "Cenococcum geophilum" OR "Cephalcia arvensis" OR "Cephalotheca purpurea" OR "Ceratosphaeria fragilis" OR "Ceratosphaeria lanuginosa" OR "Ceratostomella ampullasca" OR "Ceratostomella cuspidata" OR "Ceratostomella excelsior" OR "Ceratostomella hyalostoma" OR "Ceratostomella rostrata" OR "Cercophora caudata" OR "Ceriporia gilvescens" OR "Ceriporia reticulata" OR "Ceriporia viridans" OR "Ceriporiopsis gilvescens" OR "Ceriporiopsis pannocincta" OR "Ceriporiopsis pannocincta" OR "Cerrena unicolor" OR "Cerylon fagi" OR "Ceuthospora atra" OR "Ceuthospora lycopodii" OR "Chaenothecopsis pusilla" OR "Chaetomium discolor" OR "Chaetomium globosum" OR "Chaetoporus euporus" OR "Chaetopsis grisea" OR "Chaetosphaeria acutata" OR "Chaetosphaeria aterrima" OR "Chaetosphaeria chloroconia" OR "Chaetosphaeria decastyla" OR "Chaetosphaeria innumera" OR "Chaetosphaeria montana" OR "Chaetosphaeria myriocarpa" OR "Chaetosphaeria ovoidea" OR "Chaetosphaeria phaeostroma" OR "Chaetosphaeria pulviscula" OR "Chaetosphaeria pygmaea" OR "Chalara affinis" OR "Chalara cylindrosperma" OR "Chalara fungorum" OR "Chalara ovoidea "OR "Chalciporus piperatus" OR "Cheimonophyllum candidissimum" OR "Cheiracus ornatus" OR "Cheirospora botryospora" OR "Cherry leaf roll virus" OR "Cherry leaf roll virus" OR "Chloridium botryoideum" OR "Chloridium botryoideum var. botryoideum" OR "Chloridium clavaeforme" OR "Chloridium pachytrachelum" OR "Chloridium virescens" OR "Chloridium virescens var. chlamydosporum" OR "Chlorociboria aeruginascens" OR "Choiromyces venosus" OR "Chondrostereum purpureum" OR "Chondrostereum purpureum" OR "Chondrostereum purpureum" OR "Chrysobothris femorata" OR "Chrysobothris mali" OR "Chyliza leptogaster" OR "Cicadetta montana" OR "Cicones variegata" OR "Ciliciopodium brevipes" OR "Ciliochora calabrica" OR "Cirrenalia lignicola" OR "Cis alni" OR "Cistella dentata" OR "Cladosporium fumago" OR "Cladosporium herbarum" OR "Cladosporium herbarum" OR "Cladosporium nigrellum" OR "Claussenomyces prasinula" OR "Clavaria pistillaris" OR "Clavariadelphus fistulosus" OR "Clavicorona pyxidata" OR "Cleorodes lichenaria" OR "Clepsis rurinana" OR "Clepsis rurinana" OR "Clepsis rurinana" OR "Clitocybe cerussata" OR "Clitocybe infundibuliformis" OR "Clitocybe lignatilis" OR "Clitocybe nebularis" OR "Clitocybe nebularis" OR "Clonostachys compactiuscula" OR "Clytus arietis" OR "Coccomyces coronatus" OR "Coccomyces coronatus var. megathecius" OR "Coccomyces tumidus" OR "Codinaea britannica" OR "Codinaea fertilis" OR "Codinaea simplex" OR "Colletotrichum fioriniae" OR "Colletotrichum fioriniae" OR "Colletotrichum fioriniae" OR "Collybia confluens" OR "Collybia platyphylla" OR "Colocasia coryli" OR "Coltricia perennis" OR "Columnosphaeria fagi" OR "Comatricha nigra" OR "Comstockaspis perniciosa" OR "Comstockaspis perniciosa" OR "Coniochaeta ligniaria" OR "Coniochaeta subcorticalis" OR "Coniochaeta velutina" OR "Coniothyrium fuckelii" OR "Contarinia fagi" OR "Contarinia fagi" OR "Contarinia fagi" OR "Coprinus disseminatus" OR "Coprinus micaceus" OR "Cordana pauciseptata" OR "Coriolopsis gallica" OR "Coriolopsis trogii" OR "Coriolus hirsutus" OR "Coriolus hirsutus" OR "Coriolus pubescens" OR "Coriolus versicolor" OR "Coronophora annexa" OR "Corticium solani" OR "Coryne sarcoides" OR "Corynespora smithii" OR "Coryneum betulinum" OR "Coryneum fagineum" OR "Corythucha arcuata" OR "Coslenchus costatus" OR "Cosmia trapezina" OR "Cosmospora arxii" OR "Cosmospora coccinea" OR "Cossus cossus" OR "Craterellus cornucopioides" OR "Craterellus tubaeformis" OR "Craterium leucocephalum" OR "Crepidodera fulvicornis" OR "Crepidotus applanatus" OR "Crepidotus crocophyllus" OR "Crepidotus lundellii" OR "Crepidotus mollis" OR "Crepidotus sinuosus" OR "Crepidotus sphaerosporus" OR "Crepidotus sphaerosporus" OR "Crepidotus variabilis" OR "Criconema annuliferum" OR "Criconema princeps" OR "Crocallis elinguaria" OR "Crustomyces subabruptus" OR "Crustomyces subabruptus" OR "Cryptadelphia brevior" OR "Cryptadelphia groenendalensis" OR "Cryptadelphia obovata" OR "Cryptadelphia polyseptata" OR "Cryptocephalus pusillus" OR "Cryptococcus fagisuga" OR "Cryptococcus fagisuga" OR "Cryptococcus fagisuga" OR "Cryptococcus fagisuga" OR "Cryptococcus fagisuga" OR "Cryptodiaporthe galericulata" OR "Cryptodiaporthe salicina" OR "Cryptolestes spartii" OR "Cryptosporiopsis fasciculata" OR "Cryptostictis niesslii" OR "Cucurbitaria obducens" OR "Cyathus striatus" OR "Cyathus striatus" OR "Cyclophora linearia" OR "Cydia fagiglandana" OR "Cydia fagiglandana" OR "Cydia fagiglandana" OR "Cydia fagiglandana" OR "Cydia leguminana" OR "Cydia splendana" OR "Cylindrium aeruginosum" OR "Cylindrobasidium

	evolvens" OR "Cylindrocarpon album" OR "Cylindrocarpon candidum" OR "Cyphellopsis anomala" OR "Cytospora ambiens" OR "Cytospora ceratosperma" OR "Cytospora ceratosperma" OR "Cytospora decorticans" OR "Cytospora duriuscula" OR "Cytospora frangulae" OR "Cytospora intermedia" OR "Cytospora populina" OR "Cytospora prunicola" OR "Cytospora pustulata" OR "Cytospora pustulata" OR "Cytospora sacculus" OR "Cytosporella rubricosa" OR "Dacrymyces deliquescens" OR "Dacrymyces enatus" OR "Dacrymyces stillatus" OR "Dacrymyces stillatus" OR "Dactylaria chrysosperma" OR "Dactylaria fragilis" OR "Dactylaria obtriangularia" OR "Daedalea biennis" OR "Daedalea quercina" OR "Daedalea unicolor" OR "Daedaleopsis confragosa" OR "Daldinia childiae" OR "Daldinia concentrica" OR "Daldinia pyrenaica" OR "Daldinia vernicosa" OR "Dasyneura fagicola" OR "Dasyscypha bicolor" OR "Dasyscyphus bicolor" OR "Dasyscyphus brevipilus" OR "Dasyscyphus fagicola" OR "Dasyscyphus fuscescens" OR "Dasyscyphus fuscescens" OR "Dasyscyphus fuscescens var. fagicola" OR "Dasyscyphus virgineus" OR "Dasyscyphus virgineus" OR "Datana ministra" OR "Datronia mollis" OR "Degelia plumbea" OR "Deileptenia ribeata" OR "Dendrodochium affine" OR "Dendrostilbella prasinula" OR "Dentipellis fragilis" OR "Deporaus betulae" OR "Deporaus betulae" OR "Dialonectria ullevolea" OR "Diaporthe eres" OR "Diaporthe eres" OR "Diaporthe fagi" OR "Diaporthe fusicola" OR "Diaporthe medusaea var. viburni" OR "Diaporthe pustulata" OR "Diaporthe rudis" OR "Diaporthe rudis" OR "Diaspidiotus alni" OR "Diaspidiotus lenticularis" OR "Diaspidiotus osborni" OR "Diaspidiotus ostreaeformis" OR "Diaspidiotus ostreaeformis" OR "Diaspidiotus zonatus" OR "Diaspidiotus zonatus" OR "Diatrype decorticata" OR "Diatrype disciformis" OR "Diatrype disciformis" OR "Diatrype flavovirens" OR "Diatrype stigma" OR "Diatrype stigma" OR "Diatrypella angulata" OR "Diatrypella aspera" OR "Diatrypella favacea" OR "Diatrypella melaleuca" OR "Diatrypella melaleuca" OR "Diatrypella verrucaeformis" OR "Dichaena faginea" OR "Dichomeris ustalella" OR "Dichomeris ustalella" OR "Dichomitus campestris" OR "Dictyochaeta fertilis" OR "Dictyosporium toruloides" OR "Didymium nigripes" OR "Didymium squamulosum" OR "Digitodesmium elegans" OR "Diplococcium spicatum" OR "Diplodia faginea" OR "Diplodia sapinea" OR "Dirphia avia" OR "Dirphia baroma" OR "Discosia artocreas" OR "Discosia artocreas f. fagi-sylvaticae" OR "Discosia fagi" OR "Discosia faginea" OR "Discosia italica" OR "Discosia minuta" OR "Discosia neofraxinea" OR "Discula fagi" OR "Discula quercina" OR "Discula umbrinella" OR "Diurnea fagella" OR "Diurnea fagella" OR "Diurnea fagella" OR "Diurnea lipsiella" OR "Dogwood Ringspot Strain of Cherry Leafroll Virus" OR "Drepana cultraria" OR "Drymonia dodonaea" OR "Dryocoetes alni" OR "Dryocoetinus alni" OR "Eacles imperialis" OR "Eacles penelope" OR "Echinosphaeria canescens" OR "Ectoedemia liebwerdella" OR "Ectropis consonaria" OR "Ectropis crepuscularia" OR "Ectropis crepuscularia" OR "Edwardsiana flavescens" OR "Edwardsiana frustrator" OR "Eichleriella deglubens" OR "Eilema deplana" OR "Eilema sororcula" OR "Elasmucha grisea" OR "Endophragmia catenulata" OR "Endophragmiella fagicola" OR "Endophragmiella lignicola" OR "Endophragmiella ovoidea" OR "Endothia gyrosa" OR "Endothia parasitica" OR "Ennomos erosaria" OR "Ennomos quercinaria" OR "Eotetranychus carpini" OR "Eotetranychus carpini" OR "Eotetranychus fagi" OR "Epicoccum nigrum" OR "Epirrita christyi" OR "Epirrita christyi" OR "Epitrimerus fagi" OR "Erannis defoliaria" OR "Eriophyes nervisequus" OR "Ernoporus fagi" OR "Erysiphe alphitoides" OR "Erysiphe alphitoides" OR "Erysiphe communis" OR "Eucnemis capucina" OR "Eulecanium ciliatum" OR "Eulecanium tiliae" OR "Eulecanium tiliae" OR "Eulia ministrana" OR "Eupithecia irriguata" OR "Euproctis chrysorrhoea" OR "Euproctis similis" OR "Eupsilia transversa" OR "Eurhadina concinna" OR "Eutypa flavovirens" OR "Eutypa flavovirens" OR "Eutypa flavovirescens" OR "Eutypa lata" OR "Eutypa lata" OR "Eutypa lata" OR "Eutypa spinosa" OR "Eutypa spinosa" OR "Eutypella cerviculata" OR "Eutypella leprosa" OR "Eutypella quaternata" OR "Eutypella stellulata" OR "Eutypella tetraploa" OR "Euura fagi" OR "Euwallacea fornicatus sensu lato" OR "Euwallacea fornicatus sensu stricto" OR "Exidia glandulosa" OR "Exidia thuretiana" OR "Exidiopsis effusa" OR "Exochalara imbricata" OR "Exochalara longissima" OR "Fagocyba cruenta" OR "Fagocyba cruenta" OR "Farlowiella carmichaeliana" OR "Farlowiella carmichaeliana" OR "Favolus alveolaris" OR "Fenestella fenestrata" OR "Fennellia flavipes" OR "Filenchus filiformis" OR "Fistulina hepatica" OR "Flabellascus tenuirostris" OR "Flagelloscypha kavinae" OR "Flammulaster carpophilus" OR "Flammulaster erinaceella" OR "Flammulaster limulatus" OR "Flammulina velutipes" OR "Fomes annosus" OR "Fomes conchatus" OR "Fomes connatus" OR "Fomes ferruginosus" OR "Fomes fomentarius" OR "Fomes fomentarius" OR "Fomes fomentarius" OR "Fomes fraxinophilus" OR

	"Fomes igniarius" OR "Fomes ohiensis" OR "Fomes pinicola" OR "Fomes roseus" OR "Fomes ungulatus" OR "Fomitiporella cavicola" OR "Fomitiporia mediterranea" OR "Fomitopsis pinicola" OR "Fomitopsis pinicola" OR "Fuligo rufa" OR "Fusarium aquaeductuum" OR "Fusarium arthrosporioides" OR "Fusarium avenaceum" OR "Fusarium avenaceum" OR "Fusarium ciliatum" OR "Fusarium culmorum" OR "Fusarium melanochlorum" OR "Fusarium oxysporum" OR "Fusarium oxysporum" OR "Fusarium penzigii" OR "Fusarium solani" OR "Fuscoporia ferruginosa" OR "Fuscoporia ferruginosa" OR "Fusicladium fagi" OR "Fusicoccum advenum" OR "Fusicoccum galericulatum" OR "Fusicoccum macrosporum" OR "Galerina marginata" OR "Ganoderma applanatum" OR "Ganoderma applanatum" OR "Ganoderma applanatum" OR "Ganoderma lipsiense" OR "Ganoderma lucidum" OR "Ganoderma pfeifferi" OR "Geometra papilionaria" OR "Gibberella avenacea" OR "Gibberella intricans" OR "Globisporangium ultimum" OR "Gloeocystidiellum porosum" OR "Gloeoporus adustus" OR "Gloeoporus dichrous" OR "Gloeosporium fagi" OR "Gloeosporium fagicola" OR "Gloeosporium fuckelii" OR "Gloiothele lactescens" OR "Gloniopsis curvata" OR "Gloniopsis praelonga" OR "Glonium lineare" OR "Gnomonia cerastis" OR "Gnomonia errabunda" OR "Gnomonia errabunda" OR "Gnomonia setacea" OR "Gonytrichum caesium" OR "Gonytrichum chlamydosporium" OR "Grandinia farinacea" OR "Graphilbum fragrans" OR "Grifola frondosa" OR "Grifola frondosa" OR "Grifola umbellata" OR "Grosmannia cainii" OR "Grynobius planus" OR "Guignardia maculiformis" OR "Gymnopilus hybridus" OR "Gyrothrix grisea" OR "Haplotrichum aureum" OR "Haplotrichum conspersum" OR "Harpyia milhauseri" OR "Hartigiola annulipes" OR "Hartigiola annulipes" OR "Hartigiola annulipes" OR "Hebeloma crustuliniforme" OR "Hebeloma sacchariolens" OR "Helicobasidium brebissonii" OR "Helicobasidium purpureum" OR "Helicogloea aquilonia" OR "Helicogloea sebacea" OR "Helicomyces candidus" OR "Helicomyces tenuis" OR "Helicosporium griseum" OR "Helicosporium vegetum" OR "Helicotylenchus digonicus" OR "Helicotylenchus pseudorobustus" OR "Heliococcus bohemicus" OR "Helminthosphaeria carpathica" OR "Helminthosphaeria pilifera" OR "Helminthosporium austriacum" OR "Helminthosporium quercinum" OR "Helminthosporium velutinum" OR "Helops caeruleus" OR "Helotium humile" OR "Helvella leucomelaena" OR "Hemitrichia clavata" OR "Henningsomyces candidus" OR "Hepialus humuli" OR "Hericium clathroides" OR "Hericium coralloides" OR "Hericium erinaceus" OR "Heterobasidion abietinum" OR "Heterobasidion annosum" OR "Heterobasidion annosum" OR "Heterobasidion annosum sensu lato" OR "Heterobasidion parviporum" OR "Heterogenea asella" OR "Hohenbuehelia mastrucata" OR "Hohenbuehelia petaloides" OR "Hyalopeziza millepunctata" OR "Hyaloscypha dematiicola" OR "Hyaloscypha hyalina" OR "Hydnum cirrhatum" OR "Hydropus subalpinus" OR "Hylecoetus dermestoides" OR "Hylesinus oleiperda" OR "Hylesinus varius" OR "Hylis olexai" OR "Hylobius abietis" OR "Hymenochaete cinnamomea" OR "Hymenochaete corrugata" OR "Hymenochaete rubiginosa" OR "Hymenoscyphus caudatus" OR "Hymenoscyphus fagineus" OR "Hymenoscyphus phyllogenus" OR "Hymenoscyphus repandus" OR "Hymenoscyphus rokebyensis" OR "Hymenoscyphus serotinus" OR "Hymenoscyphus syringicolor" OR "Hymenoscyphus virgultorum" OR "Hyphoderma argillaceum" OR "Hyphoderma praetermissum" OR "Hyphoderma radula" OR "Hyphoderma setigerum" OR "Hyphodermella corrugata" OR "Hyphodontia alutaria" OR "Hyphodontia arguta" OR "Hyphodontia breviseta" OR "Hyphodontia sambuci" OR "Hypholoma capnoides" OR "Hypholoma fasciculare" OR "Hypholoma sublateritium" OR "Hypochnicium polonense" OR "Hypocrea aureoviridis" OR "Hypocrea brunneoviridis" OR "Hypocrea crystalligena" OR "Hypocrea epimyces" OR "Hypocrea fomiticola" OR "Hypocrea gelatinosa" OR "Hypocrea lixii" OR "Hypocrea parepimyces" OR "Hypocrea rufa" OR "Hypocrea schweinitzii" OR "Hypocrea silvae-virgineae" OR "Hypocrea sinuosa" OR "Hypocrea strictipilosa" OR "Hypomyces corticiicola" OR "Hypoxylon atropunctatum" OR "Hypoxylon bipapillatum" OR "Hypoxylon coccineum" OR "Hypoxylon cohaerens" OR "Hypoxylon cohaerens" OR "Hypoxylon crustaceum" OR "Hypoxylon deustum" OR "Hypoxylon fragiforme" OR "Hypoxylon fragiforme" OR "Hypoxylon fuscum" OR "Hypoxylon fuscum" OR "Hypoxylon howeanum" OR "Hypoxylon howeianum" OR "Hypoxylon macrocarpum" OR "Hypoxylon mediterraneum" OR "Hypoxylon porphyreum" OR "Hypoxylon rubiginosum" OR "Hypoxylon rubiginosum" OR "Hypoxylon rubiginosum var. Rubiginosum" OR "Hypoxylon rutilum" OR "Hypoxylon rutilum" OR "Hypoxylon serpens" OR "Hysterium angustatum" OR "Hysterographium flexuosum" OR "Hysterographium fraxini" OR "Imimyces densus" OR "Incrupilella flexipila" OR "Incrustoporia semipileata" OR

	"Incurvaria masculella" OR "Inocybe brunnea" OR "Inocybe geophila" OR "Inocybe grammata" OR "Inocybe jurana" OR "Inocybe maculata" OR "Inocybe pyriodora" OR "Inonotus cuticularis" OR "Inonotus cuticularis" OR "Inonotus dryadeus" OR "Inonotus hastifer" OR "Inonotus hispidus" OR "Inonotus nidus-pici" OR "Inonotus nodulosus" OR "Inonotus obliquus" OR "Inonotus polymorphus" OR "Inonotus radiatus" OR "Irpex lacteus" OR "Ischnoderma resinosum" OR "Ischnodes sanguinicollis" OR "Isotoma notabilis" OR "Isotomiella minor" OR "Itersonilia perplexans" OR "Jattaea faginea" OR "Jattaea herbicola" OR "Jattaea tumidula" OR "Junghuhnia nitida" OR "Junghuhnia nitida" OR "Kastanostachys aterrima" OR "Kionocephala catenulata" OR "Kretzschmaria deusta" OR "Kretzschmaria deusta" OR "Kretzschmaria deusta" OR "Laccaria laccata" OR "Laccaria laccata var. pallidifolia" OR "Laccaria tetraspora f. major" OR "Laccaria tetraspora f. major" OR "Lachnum hyalinellum var. fructincola" OR "Lachnum impudicum" OR "Lachnum niveum" OR "Lachnum virgineum" OR "Lachnum virgineum" OR "Lachnus exsiccator" OR "Lachnus pallipes" OR "Lachnus pallipes" OR "Lachnus roboris" OR "Lactarius blennius" OR "Lactarius controversus" OR "Lactarius pyrogalus" OR "Laestadia faginea" OR "Laetiporus sulphureus" OR "Laetiporus sulphureus" OR "Lamproderma sauteri" OR "Lamprotettix nitidulus" OR "Lasiosphaeria canescens" OR "Lasiosphaeria caudata" OR "Lasiosphaeria glabrata" OR "Lasiosphaeria hirsuta" OR "Lasiosphaeria hispida" OR "Lasiosphaeria ovina" OR "Lasiosphaeria rhacodium" OR "Lasiosphaeria spermoides" OR "Lasiosphaeria strigosa" OR "Laxitextum bicolor" OR "Lecythothecium duriligni" OR "Leiopus nebulosus" OR "Lelenchus leptosoma" OR "Lentaria mucida" OR "Lentinellus flabelliformis" OR "Lentinellus ursinus" OR "Lentinus lepideus" OR "Lentomitella cirrhosa" OR "Lenzites betulina" OR "Lenzites betulinus" OR "Leocarpus fragilis" OR "Lepidosaphes conchiformis" OR "Lepidosaphes ulmi" OR "Lepidosaphes ulmi" OR "Lepiota cristata" OR "Lepiota procera" OR "Leptographium tardum" OR "Leptographium trypodendri" OR "Leptographium vulnerum" OR "Leptoporus caesius" OR "Leptoporus lacteus" OR "Leptosphaeria valdobbiae" OR "Leptothyrium botryoides" OR "Leptura scutellata" OR "Leucostoma auerswaldii" OR "Libertella disciformis" OR "Libertella faginea" OR "Libertella faginea" OR "Libertella faginea f. minor" OR "Libertella faginea f. minor" OR "Limacella guttata" OR "Limoniscus violaceus" OR "Lindbergina aurovittata" OR "Litylenchus crenatae" OR "Litylenchus crenatae mccanni" OR "Litylenchus crenatae mccannii" OR "Lobatopedis foliicola" OR "Lonchaea contigua" OR "Longidorus carpathicus" OR "Longidorus carpathicus" OR "Longidorus elongatus" OR "Longidorus fagi" OR "Longidorus holovachovi" OR "Longidorus macrosoma" OR "Lopadostoma gastrinum" OR "Lopadostoma turgidum" OR "Lopadostoma turgidum" OR "Lophiostoma angustilabrum var. crenatum" OR "Lophiostoma glabrotunicatum" OR "Lophiotrema boreale" OR "Luzulaspis nemorosa" OR "Lycogala epidendrum" OR "Lycoperdon perlatum var. nigrescens" OR "Lymantria dispar" OR "Lymantria mathura" OR "Lymantria monacha" OR "Lymantria monacha" OR "Lymantria monacha" OR "Malacosoma neustria" OR "Malenchus bryophilus" OR "Marasmiellus candidus" OR "Marasmius alliaceus" OR "Marasmius bresadolae" OR "Marasmius rotula" OR "Marasmius scorodonius" OR "Marasmius setosus" OR "Massaria loricata" OR "Massarina eburnea" OR "Massarina eburnea" OR "Massarina macrospora" OR "Megapenthes lugens" OR "Melanamphora spinifera" OR "Melanconiella chrysodiscosporina" OR "Melanconium atrum" OR "Melanconium ovatum" OR "Melanconium stromaticum" OR "Melandrya caraboides" OR "Melanomma aspegrenii" OR "Melanomma fuscidulum" OR "Melanomma pulvis-pyrius" OR "Melanomma pulvis-pyrius" OR "Melanophila acuminata" OR "Melanops fagicola" OR "Melanopsamma pomiformis" OR "Melanopsammella vermicularioides" OR "Melanotus erythropus" OR "Melasis buprestoides" OR "Melogramma bulliardii" OR "Melogramma ferrugineum" OR "Melogramma spiniferum" OR "Melogramma spiniferum" OR "Meloidogyne mali" OR "Meloidogyne mali" OR "Melolontha melolontha" OR "Melolontha melolontha" OR "Menispora caesia" OR "Menispora ciliata" OR "Menispora glauca" OR "Mensularia hastifera" OR "Mensularia nodulosa" OR "Meripilus giganteus" OR "Meruliopsis corium" OR "Meruliopsis purpurea" OR "Merulius corium" OR "Merulius tremellosus" OR "Merulius tremellosus" OR "Metatrichia vesparium" OR "Microbotryum dianthorum" OR "Microbotryum violaceum" OR "Microdiplodia subtecta" OR "Microsphaera alni var. extensa" OR "Microsphaera alphitoides" OR "Microsphaera alphitoides var. alphitoides" OR "Microthyrium fagi" OR "Microthyrium inconspicuum" OR "Microthyrium microscopicum" OR "Mikiola cristata" OR "Mikiola fagi" OR "Mikiola fagi" OR "Mikiola fagi" OR "Mollisia cinerea" OR "Mollisia cinerea" OR "Mollisia cinerella" OR "Mollisia fusca" OR "Mollisia melaleuca" OR "Moniliopsis fagi" OR "Monochetus

	sulcatus" OR "Monochetus sulcatus" OR "Mortierella bainieri" OR "Mortierella pusilla" OR "Mortierella strangulata" OR "Mucor circinelloides" OR "Mucor circinelloides" OR "Mucor plasmaticus" OR "Mycena abramsii" OR "Mycena arcangeliana" OR "Mycena capillaris" OR "Mycena cortiana" OR "Mycena crocata" OR "Mycena galericulata" OR "Mycena haematopoda" OR "Mycena hiemalis" OR "Mycena inclinata" OR "Mycena niveipes" OR "Mycena olida" OR "Mycena polygramma" OR "Mycena pura" OR "Mycena renati" OR "Mycena speirea" OR "Mycena viscosa" OR "Mycoacia nothofagi" OR "Mycoacia uda" OR "Mycoacia uda" OR "Mycoleptodon fimbriatus" OR "Mycosphaerella fagi" OR "Mycosphaerella fagi" OR "Mycosphaerella faginea" OR "Mycosphaerella flageoletiana" OR "Mycosphaerella punctiformis" OR "Mycosphaerella punctiformis" OR "Myrmaecium fulvopruinatum" OR "Myxofusicoccum galericulatum" OR "Myxosporium roumeguerei" OR "Natantiella ligneola" OR "Nectria cinnabarina" OR "Nectria cinnabarina" OR "Nectria cinnabarina" OR "Nectria coccinea" OR "Nectria coccinea" OR "Nectria ditissima" OR "Nectria ditissima" OR "Nectria ellisii" OR "Nectria galligena" OR "Nectria nigrescens" OR "Nectria peziza" OR "Nectria veuillotiana" OR "Nectriella chrysites" OR "Nemania atropurpurea" OR "Nemania chestersii" OR "Nemania effusa" OR "Nemania serpens" OR "Nemania serpens var. colliculosa" OR "Nemania serpens var. serpens" OR "Nematopogon swammerdamella" OR "Nematopogon swannerdamella" OR "Nematus fagi" OR "Neobulgaria pura" OR "Neohendersonia kickxii" OR "Neonectria coccinea" OR "Neonectria coccinea" OR "Neonectria coccinea" OR "Neonectria coccinea" OR "Neonectria ditissima" OR "Neonectria ditissima" OR "Neonectria ditissima" OR "Neonectria ditissima" OR "Neonectria faginata" OR "Neonectria punicea" OR "Neonectria punicea" OR "Neta patuxentica" OR "Newsteadia floccosa" OR "Nitschkia cupularis" OR "Noctua fimbriata" OR "Nola confusalis" OR "Nummularia bulliardii" OR "Nummularia regia" OR "Odontia papillosa" OR "Oedemium minus" OR "Oemona hirta" OR "Ohleria modesta" OR "Oidium aureum" OR "Oidium quercinum" OR "Olethreutes fagigemmeana" OR "Oligoporus caesius" OR "Oligoporus caesius" OR "Oligoporus floriformis" OR "Oligoporus fragilis" OR "Oligotrophus fagicola" OR "Oligotrophus fagineus" OR "Operophtera brumata" OR "Operophtera brumata" OR "Operophtera brumata" OR "Operophtera brumata" OR "Operophtera fagata" OR "Operophtera fagata" OR "Ophiostoma arduennense" OR "Ophiostoma bacillisporum" OR "Ophiostoma borealis" OR "Ophiostoma distortum" OR "Ophiostoma minus" OR "Ophiostoma pseudokarelicum" OR "Ophiostoma quercus" OR "Ophiostoma sparsiannulatum" OR "Ophiostoma taphrorychi" OR "Ophiostoma torulosum" OR "Orbilia coccinella" OR "Orbilia sarraziniana" OR "Orbilia xanthostigma" OR "Orchestes fagi" OR "Orgyia antiqua" OR "Orgyia leucostigma" OR "Orgyia recens" OR "Orthosia cerasi" OR "Orthosia cerasi" OR "Ossiannilssonola callosa" OR "Ossicaulis lignatilis" OR "Otiorhynchus armadillo" OR "Otiorhynchus singularis" OR "Oudemansiella mucida" OR "Oudemansiella radicata" OR "Pammene fasciana" OR "Pammene fasciana" OR "Pammene herrichiana" OR "Pammene herrichiana" OR "Panellus serotinus" OR "Panellus stipticus" OR "Panonychus ulmi" OR "Panonychus ulmi" OR "Paracamarosporium fagi" OR "Paradarisa consonaria" OR "Paradendryphiopsis laxa" OR "Paratrichodorus pachydermus" OR "Paratylenchus projectus" OR "Paratylenchus straeleni" OR "Parornix fagivora" OR "Parornix fagivora" OR "Parornix fagivora" OR "Parornix fagivora" OR "Parthenolecanium corni" OR "Pealius quercus" OR "Pellicularia subcoronata" OR "Pellidiscus pallidus" OR "Peniophora byssoides" OR "Peniophora cinerea" OR "Peniophora incarnata" OR "Peniophora lycii" OR "Peniophora subincarnata" OR "Peroneutypa heteracantha" OR "Perrotia flammea" OR "Pestalotia breviseta" OR "Pestalotia funerea var. punctiformis" OR "Pestalotia hartigii" OR "Petrakia fagi" OR "Petrakia liobae" OR "Petrakia liobae" OR "Pezicula cinnamomea" OR "Pezicula fagacearum" OR "Pezicula neocinnamomea" OR "Peziza repanda" OR "Phaeoacremonium leptorrhynchum" OR "Phaeoacremonium vibratile" OR "Phaeostalagmus cyclosporus" OR "Phalera bucephala" OR "Phalera bucephala" OR "Phalera bucephala" OR "Phalera bucephala" OR "Phanerochaete affinis" OR "Phanerochaete sanguinea" OR "Phanerochaete sordida" OR "Phanerochaete velutina" OR "Phegomyia fagicola" OR "Phegomyia fagicola" OR "Phegomyia fagicola" OR "Phellinus alni" OR "Phellinus cavicola" OR "Phellinus conchatus" OR "Phellinus ferruginosus" OR "Phellinus ferruginosus" OR "Phellinus hartigii" OR "Phellinus igniarius" OR "Phellinus robustus" OR "Phenacoccus aceris" OR "Phenacoccus aceris" OR "Phenacoccus aceris" OR "Phialocephala fortinii" OR "Phialophora alba" OR "Phialophora brachyconia" OR "Phialophora fastigiata" OR "Phialophora verrucosa" OR "Phlebia livida" OR "Phlebia radiata" OR "Phlebia uda" OR "Phleogena faginea" OR

	"Pholiota adiposa" OR "Pholiota aurivella" OR "Pholiota curvipes" OR "Pholiota gummosa" OR "Pholiota squarrosa" OR "Pholiota squarrosoides" OR "Pholiota tuberculosa" OR "Phomopsis carnea" OR "Phomopsis diaporthes-macrostomae" OR "Phragmospathula papillifera" OR "Phyllactinia corylea" OR "Phyllactinia corylea" OR "Phyllactinia guttata" OR "Phyllactinia guttata" OR "Phyllactinia guttata" OR "Phyllactinia guttata" OR "Phyllactinia orbicularis" OR "Phyllactinia suffulta" OR "Phyllaphis fagi" OR "Phyllaphis fagi" OR "Phyllaphis fagi" OR "Phyllaphis fagi" OR "Phyllobius argentatus" OR "Phyllobius argentatus" OR "Phyllonorycter maestingella" OR "Phyllonorycter maestingella" OR "Phyllonorycter maestingella" OR "Phyllonorycter maestingella" OR "Phyllonorycter maestingella" OR "Phyllonorycter messaniella" OR "Phyllonorycter messaniella" OR "Phyllonorycter messaniella" OR "Phyllonorycter restrictella" OR "Phyllosticta fagi" OR "Phyllosticta faginea" OR "Phyllosticta stettiniana" OR "Phyllotopsis nidulans" OR "Physarum nutans" OR "Physisporinus sanguinolentus" OR "Physisporinus sanguinolentus" OR "Phytomyza ranunculi" OR "Phytophthora cactorum" OR "Phytophthora cactorum" OR "Phytophthora cactorum" OR "Phytophthora cambivora" OR "Phytophthora cambivora" OR "Phytophthora cambivora" OR "Phytophthora cinnamomi" OR "Phytophthora cinnamomi" OR "Phytophthora cinnamomi" OR "Phytophthora citricola" OR "Phytophthora citricola" OR "Phytophthora citricola" OR "Phytophthora citricola" OR "Phytophthora europaea" OR "Phytophthora gonapodyides" OR "Phytophthora gonapodyides" OR "Phytophthora gonapodyides" OR "Phytophthora hedraiandra" OR "Phytophthora hedraiandra" OR "Phytophthora hedraiandra" OR "Phytophthora hedraiandra" OR "Phytophthora inflata" OR "Phytophthora kernoviae" OR "Phytophthora kernoviae" OR "Phytophthora kernoviae" OR "Phytophthora kernoviae" OR "Phytophthora pini" OR "Phytophthora plurivora" OR "Phytophthora plurivora" OR "Phytophthora plurivora" OR "Phytophthora pseudosyringae" OR "Phytophthora pseudosyringae" OR "Phytophthora pseudosyringae" OR "Phytophthora psychrophila" OR "Phytophthora quercina" OR "Phytophthora ramorum" OR "Phytophthora ramorum" OR "Phytophthora ramorum" OR "Phytophthora ramorum" OR "Phytophthora syringae" OR "Phytophthora syringae" OR "Phytophthora tubulina" OR "Phytophthora uliginosa" OR "Phytophthora vulcanica" OR "Plagodis dolabraria" OR "Platycis cosnardi" OR "Platycis minutus" OR "Platypus cylindrus" OR "Platypus cylindrus" OR "Pleurophomella faginea" OR "Pleurophomopsis salicina" OR "Pleurostoma minimum" OR "Pleurothecium recurvatum" OR "Pleurotus dryinus" OR "Pleurotus ostreatus" OR "Pleurotus ostreatus" OR "Pleurotus pulmonarius" OR "Pleurotus salignus" OR "Pleurotus ulmarius" OR "Plicaturopsis crispa" OR "Plicaturopsis crispa" OR "Pluteus cervinus" OR "Pluteus chrysophaeus" OR "Pluteus cinereofuscus" OR "Pluteus godeyi" OR "Pluteus griseopus" OR "Pluteus hispidulus" OR "Pluteus leoninus" OR "Pluteus nanus" OR "Pluteus phlebophorus" OR "Pluteus podospileus" OR "Pluteus punctipes" OR "Pluteus roberti" OR "Pluteus romellii" OR "Pluteus salicinus" OR "Pluteus semibulbosus" OR "Pluteus thomsonii" OR "Pluteus umbrosus" OR "Polydrusus cervinus" OR "Polydrusus cervinus" OR "Polydrusus marginatus" OR "Polydrusus mollis" OR "Polydrusus mollis" OR "Polydrusus prasinus" OR "Polydrusus pterygomalis" OR "Polydrusus tereticollis" OR "Polydrusus undatus" OR "Polymorphum fagineum" OR "Polyporus adustus" OR "Polyporus albellus" OR "Polyporus applanatus" OR "Polyporus arcularius" OR "Polyporus badius" OR "Polyporus benzoinus" OR "Polyporus biformis" OR "Polyporus brumalis" OR "Polyporus brumalis" OR "Polyporus ciliatus" OR "Polyporus cinnabarinus" OR "Polyporus cuticularis" OR "Polyporus delectans" OR "Polyporus frondosus" OR "Polyporus giganteus" OR "Polyporus giganteus" OR "Polyporus gilvus" OR "Polyporus glomeratus" OR "Polyporus graveolens" OR "Polyporus hirsutus" OR "Polyporus hispidus" OR "Polyporus melanopus" OR "Polyporus pargamenus" OR "Polyporus perennis" OR "Polyporus perennis" OR "Polyporus pubescens" OR "Polyporus radiatus" OR "Polyporus radiatus" OR "Polyporus resinosus" OR "Polyporus rheades" OR "Polyporus semipileatus" OR "Polyporus spraguei" OR "Polyporus spumeus" OR "Polyporus squamosus" OR "Polyporus squamosus" OR "Polyporus squamosus" OR "Polyporus sulphureus" OR "Polyporus tuberaster" OR "Polyporus tulipiferae" OR "Polyporus varius" OR "Polyporus zonatus" OR "Polyscytalum fagicola" OR "Polyscytalum fecundissimum" OR "Polystictus versicolor" OR "Popillia japonica" OR "Poria aestivalis" OR "Poria ambigua" OR "Poria canescens" OR "Poria ferruginosa" OR "Poria gilvescens" OR "Poria nigrescens" OR "Poria nordmanni" OR "Poria obliqua" OR "Poria punctata" OR "Poria rhodella" OR "Poria romellii" OR "Poria semitincta" OR "Poria tenuis" OR "Poria unita" OR "Poria versipora" OR "Poria viridans" OR "Poria vitrea" OR "Porostereum spadiceum" OR

	"Potato virus X" OR "Pratylenchus penetrans" OR "Pratylenchus penetrans" OR "Pratylenchus penetrans" OR "Prionus coriarius" OR "Propolomyces versicolor" OR "Protodontia ellipsospora" OR "Protodontia subgelatinosa" OR "Protounguicularia brevicapitata" OR "Psallus perrisi" OR "Psathyrella maculata" OR "Psathyrella microrhiza" OR "Pseudocistela ceramboides" OR "Pseudodidymella fagi" OR "Pseudodirphia eumedide" OR "Pseudohydnum gelatinosum" OR "Pseudoips fagana" OR "Pseudoips fagana ssp. Brittanica" OR "Pseudoips prasinana ssp. Brittanica" OR "Pseudospiropes hughesii" OR "Pseudospiropes nodosus" OR "Pseudospiropes simplex" OR "Pseudospiropes subuliferus" OR "Pseudotelphusa paripunctella" OR "Pseudotomentella tristis" OR "Pseudotrichia mutabilis" OR "Pseudovalsa longipes" OR "Psilenchus hilarulus" OR "Psilocorsis cryptolechiella" OR "Psilospora faginea" OR "Ptilinus pectinicornis" OR "Ptilinus pectinicornis" OR "Ptilodon capucina" OR "Pulcherricium caeruleum" OR "Pulvinaria kuwacola" OR "Pulvinaria regalis" OR "Pulvinaria vitis" OR "Pycnoporus cinnabarinus" OR "Pyrochroa coccinea" OR "Pythium ultimum" OR "Pythium ultimum" OR "Quadraspidiotus ostreaeformis" OR "Quadraspidiotus zonatus" OR "Quaternaria persoonii" OR "Quaternaria persoonii" OR "Quaternaria quaternata" OR "Quaternaria quaternata" OR "Rabocerus foveolatus" OR "Rabocerus gabrieli" OR "Ramichloridium anceps" OR "Ramularia unterseheri" OR "Ramularia vizellae" OR "Resinicium bicolor" OR "Resupinatus applicatus" OR "Rhagium mordax" OR "Rhamphoria delicatula" OR "Rhamphoria pyriformis" OR "Rhinocladiella anceps" OR "Rhinocladiella atrovirens" OR "Rhinocladium pulchrum" OR "Rhizoctonia solani" OR "Rhizoctonia solani" OR "Rhizodiscina lignyota" OR "Rhodocybe mundula" OR "Rhyncaphytoptus fagacis" OR "Rhyncaphytoptus gracilipes" OR "Rhyncaphytoptus gracilipes" OR "Rhynchaenus fagi" OR "Rhynchaenus fagi" OR "Rhyncolus gracilis" OR "Rhyncolus lignarius" OR "Rhyncolus truncorum" OR "Ribautiana debilis" OR "Rickenella fibula" OR "Rigidoporus sanguinolentus" OR "Rigidoporus undatus" OR "Rosellinia aquila" OR "Rosellinia helvetica" OR "Rosellinia necatrix" OR "Rosellinia pulveracea" OR "Rosellinia quercina" OR "Rosellinia subsimilis" OR "Rosellinia thelena" OR "Rotylenchus buxophilus" OR "Rotylenchus robustus" OR "Russula acrolamellata" OR "Russula sororia" OR "Rutstroemia petiolorum" OR "Saprosites mendax" OR "Schiffermuelleria grandis" OR "Schizophyllum commune" OR "Schizophyllum commune" OR "Schizophyllum commune" OR "Schizopora paradoxa" OR "Schizopora paradoxa" OR "Sclerophoma pythiophila" OR "Scolicosporium fagi" OR "Scolicosporium macrosporium" OR "Scolytus intricatus" OR "Scolytus intricatus" OR "Scolytus rugulosus" OR "Scolytus rugulosus" OR "Scopuloides rimosa" OR "Scutellinia scutellata" OR "Scytinostroma hemidichophyticum" OR "Seimatosporium glandigenum" OR "Selenia tetralunaria" OR "Selenosporella curvispora" OR "Septoria cucubali" OR "Septoria fagi" OR "Simocybe centunculus" OR "Simocybe sumptuosa" OR "Sinodendron cylindricum" OR "Sistotrema brinkmannii" OR "Skeletocutis amorpha" OR "Skeletocutis nivea" OR "Skeletocutis nivea" OR "Solenia araneosa" OR "Sordaria macrospora" OR "Spadicoides bina" OR "Spadicoides grovei" OR "Sphaeria hiascens" OR "Sphaerobolus stellatus" OR "Sphaeropsis sapinea" OR "Sphaerulina myriadea" OR "Sphrageidus similis" OR "Splanchnonema loricatum" OR "Spondylocladiopsis cupulicola" OR "Spondylocladiopsis cupulicola" OR "Spongipellis delectans" OR "Spongipellis pachyodon" OR "Spongipellis spumeus" OR "Sporidesmium folliculatum" OR "Sporocadus lichenicola" OR "Sporormiella minima" OR "Sporoschisma juvenile" OR "Sporoschisma mirabile" OR "Sporothrix cracoviensis" OR "Sporothrix inflata" OR "Sporothrix undulata" OR "Stauropus fagi" OR "Steccherinum laeticolor" OR "Steccherinum ochraceum" OR "Steccherinum septentrionale" OR "Stegana nigrithorax" OR "Stegonsporium exhibens" OR "Stegonsporium pyriforme" OR "Stemonitis fusca" OR "Stenagostus villosus" OR "Stereum gausapatum" OR "Stereum hirsutum" OR "Stereum hirsutum" OR "Stereum ostrea" OR "Stereum purpureum" OR "Stereum rugosum" OR "Stereum subtomentosum" OR "Stictis radiata" OR "Stigmella hemargyrella" OR "Stigmella hemargyrella" OR "Stigmella hemargyrella" OR "Stigmella tityrella" OR "Stigmella tityrella" OR "Stigmella tityrella" OR "Stilbospora macrosperma" OR "Stilbospora pyriformis" OR "Stromatoscypha fimbriata" OR "Stropharia aeruginosa" OR "Strophedra weirana" OR "Strophedra weirana" OR "Strophedra weirana" OR "Strophosomus capitatus" OR "Strophosomus melanogrammus" OR "Sympodiella goidanichii" OR "Synanthedon spuleri" OR "Synanthedon vespiformis" OR "Synanthedon vespiformis" OR "Synanthedon vespiformis" OR "Taeniolella faginea" OR "Taenothrips inconsequens" OR "Tapesia cinerella" OR "Tapesia fusca" OR "Tapesia melaleucoides" OR "Tapesia rivularis" OR "Taphrorychus bicolor" OR "Targionia vitis" OR "Teleiodes paripunctella"

	OR "Tetranychus urticae" OR "Thaumetopoea processionea" OR "Thelonectria veuillotiana" OR "Thyridopteryx ephemeraeformis" OR "Thyridopteryx ephemeraeformis" OR "Tillus elongatus" OR "Tobacco necrosis virus" OR "Togninia vibratilis" OR "Togniniella acerosa" OR "Tomato black ring virus" OR "Tomentella atramentaria" OR "Tomentella atroarenicolor" OR "Tomentella bicolor" OR "Tomentella botryoides" OR "Tomentella brevispina" OR "Tomentella bryophila" OR "Tomentella cinerascens" OR "Tomentella cinereoumbrina" OR "Tomentella crinalis" OR "Tomentella ellisii" OR "Tomentella ferruginea" OR "Tomentella fibrosa" OR "Tomentella lateritia" OR "Tomentella neobourdotii" OR "Tomentella pilosa" OR "Tomentella puberula" OR "Tomentella punicea" OR "Tomentella ramosissima" OR "Tomentella rubiginosa" OR "Tomentella subclavigera" OR "Tomentella sublilacina" OR "Tomentella terrestris" OR "Tomentella umbrinospora" OR "Tomentella violaceofusca" OR "Tomentella viridula" OR "Tomentellina fibrosa" OR "Tomentellopsis echinospora" OR "Tomoxia bucephala" OR "Tortrix viridana" OR "Tortrix viridana" OR "Tortrix viridana" OR "Trachodes hispidus" OR "Trametes cervina" OR "Trametes gallica" OR "Trametes gibbosa" OR "Trametes gibbosa" OR "Trametes hirsuta" OR "Trametes hispida" OR "Trametes mollis" OR "Trametes pubescens" OR "Trametes rubescens" OR "Trametes versicolor" OR "Trametes versicolor" OR "Trametes versicolor" OR "Trechispora farinacea" OR "Trechispora mollusca" OR "Trechispora vaga" OR "Trematosphaeria morthieri" OR "Trematosphaeria pertusa" OR "Tremella foliacea" OR "Tremella mesenterica" OR "Tremex fuscicornis" OR "Triaxomasia caprimulgella" OR "Trichaptum biforme" OR "Trichia contorta" OR "Trichia favoginea" OR "Trichia varia" OR "Trichoderma lignorum" OR "Trichodorus sparsus" OR "Trichoferus campestris" OR "Tricholoma flavovirens" OR "Tricholoma psammopus" OR "Trichosphaeria pilosa" OR "Trichothecium roseum" OR "Trichothyrina cupularum" OR "Tricladium splendens" OR "Trionymus newsteadi" OR "Triposporium elegans" OR "Trisateles emortualis" OR "Tropideres sepicola" OR "Trypodendron domesticum" OR "Trypodendron domesticum" OR "Tubakia dryina" OR "Tubaria hiemalis" OR "Tubercularia vulgaris" OR "Tubeufia rugosa" OR "Tubulicrinis accedens" OR "Tulasnella violea" OR "Tylenchus elegans" OR "Typhlocyba quercus" OR "Tyromyces caesius" OR "Tyromyces caesius" OR "Tyromyces chioneus" OR "Tyromyces chioneus" OR "Tyromyces fissilis" OR "Tyromyces guttulatus" OR "Tyromyces lacteus" OR "Tyromyces tephroleucus" OR "Tyromyces tephroleucus" OR "Uleiota planata" OR "Umbrinosphaeria caesariata" OR "Unguicularia scrupulosa" OR "Uraba lugens" OR "Ustulina deusta" OR "Ustulina microsperma" OR "Valdensia heterodoxa" OR "Valsa ambiens" OR "Valsa ambiens" OR "Valsa ceratosperma" OR "Valsa decorticans" OR "Valsa pustulata" OR "Valsa pustulata" OR "Verticicladium trifidum" OR "Verticillium albo-atrum" OR "Verticillium dahliae" OR "Verticillium olivaceum" OR "Verticillium tenuissimum" OR "Volvaria bombycina" OR "Vuilleminia comedens" OR "Watsonalla cultraria" OR "Winterina clavata" OR "Xanthia aurago" OR "Xenasmatella tulasnelloidea" OR "Xerocomellus cisalpinus" OR "Xerocomus chrysenteron" OR "Xerula radicata" OR "Xiphinema diversicaudatum" OR "Xiphinema diversicaudatum" OR "Xiphinema diversicaudatum" OR "Xiphinema index" OR "Xiphinema rivesi" OR "Xylaria carpophila" OR "Xylaria corniformis" OR "Xylaria hypoxylon" OR "Xylaria longipes" OR "Xylaria polymorpha" OR "Xylaria polymorpha" OR "Xyleborinus attenuatus" OR "Xyleborinus saxeseni" OR "Xyleborinus saxesenii" OR "Xyleborus dispar" OR "Xyleborus dispar" OR "Xyleborus dryographus" OR "Xyleborus monographus" OR "Xyleborus saxeseni" OR "Xylomelasma sordidum" OR "Xylosandrus crassiusculus" OR "Xylosandrus germanus" OR "Xylosandrus germanus" OR "Xylosandrus germanus" OR "Xyloterus domesticum" OR "Ypsolopha vittella" OR "Zanclognatha tarsipennalis" OR "Zeuzera pyrina" OR "Zeuzera pyrina" OR "Zignoella fallax" OR "Zignoella ossaea" OR "Zignoella ovoidea")

Appendix C – Plant taxa reported to be present in the nurseries of *Fagus sylvatica*

Table C.1: Plant taxa reported in the Dossier Section 6.0 to be present in the nurseries of *Fagus sylvatica*

Number	Plant taxa	Number	Plant taxa
1	*Abelia*	292	*Lavatera*
2	*Abies alba*	293	*Leucanthemum*
3	*Abies concolor*	294	*Leucothoe*
4	*Abies fraserii*	295	*Leycesteria*
5	*Abies grandis*	296	*Leymus*
6	*Abies koreana*	297	*Liatris*
7	*Abies nobilis*	298	*Ligularia*
8	*Abies nordmanniana*	299	*Ligustrum*
9	*Abies procera*	300	*Ligustrum ovalifolium*
10	*Acacia*	301	*Ligustrum ovalifolium* 'Aureum'
11	*Acanthus*	302	*Ligustrum vulgare*
12	*Acer*	303	*Liquidambar*
13	*Acer campestre*	304	*Liquidambar styr.* 'Slender Silhouette'
14	*Acer campestre* 'Elsrijk'	305	*Liquidambar styraciflua*
15	*Acer campestre fastigiata*	306	*Liquidambar styraciflua* 'Lane Roberts'
16	*Acer campestre* 'Streetwise'	307	*Liquidambar styraciflua* 'Worplesdon'
17	*Acer capillipes*	308	*Liriodendron tulipifera*
18	*Acer cappodocicum* 'Rubrum'	309	*Liriope*
19	*Acer davidii*	310	*Lithodora*
20	*Acer davidii* 'George Forrest'	311	*Lobelia*
21	*Acer griseum*	312	*Lonicera*
22	*Acer lobelii*	313	*Lonicera nitida*
23	*Acer macrocarpa*	314	*Lonicera periclymenum*
24	*Acer palmatum*	315	*Lupinus*
25	*Acer palmatum* 'Atropurpureum'	316	*Luzula*
26	*Acer palmatum* 'Red Wings'	317	*Lysimachia*
27	*Acer pensylvanicum*	318	*Magnolia*
28	*Acer platanoides*	319	*Magnolia* 'Galaxy'
29	*Acer platanoides* 'Columnare'	320	*Magnolia grandiflora* 'Ferruginea'
30	*Acer platanoides* 'Crimson King'	321	*Magnolia kobus*
31	*Acer platanoides* 'Crimson Sentry'	322	*Mahonia*
32	*Acer platanoides* 'Deborah'	323	*Malus*
33	*Acer platanoides* 'Emerald Queen'	324	*Malus* 'Adirondack'
34	*Acer platanoides* 'Globosum'	325	*Malus* 'Comtesse de Paris'
35	*Acer platanoides* 'Perfect Upright'	326	*Malus* 'Evereste'
36	*Acer platanoides* 'Princeton Gold'	327	*Malus* 'Freja'
37	*Acer pseudoplatanus*	328	*Malus hupehensis*
38	*Acer pseudoplatanus* 'Erectum'	329	*Malus* 'Mokum'
39	*Acer pseudoplatanus purpurea*	330	*Malus sylvestris*
40	*Acer rubrum*	331	*Malus trilobata*
41	*Acer rubrum* 'Karpick'	332	*Malus tschonoskii*
42	*Acer rubrum* 'October Glory'	333	*Matteuccia*
43	*Acer tataricum* subsp. *Ginnala*	334	*Maytenus boaria*
44	*Acer* × *freemanii* 'Armstrong'	335	*Meconopsis*
45	*Acer* × *freemanii* 'Autumn Blaze'	336	*Metasequoia glyptostroboides*

Number	Plant taxa	Number	Plant taxa
46	*Achillea*	337	*Miscanthus*
47	*Acorus*	338	*Molinia*
48	*Actaea*	339	*Monarda*
49	*Aesculus hippocastanum* 'Baumannii'	340	*Myrtus*
50	*Aesculus indica*	341	*Nandina*
51	*Aesculus* × *carnea* 'Briotii'	342	*Nemesia*
52	*Agapanthus*	343	*Nepeta*
53	*Agastache*	344	*Nothofagus antarctica*
54	*Ajuga*	345	*Nothofagus*
55	*Akebia*	346	*Nyssa sylvatica*
56	*Alchemilla*	347	*Olea europea*
57	*Allium*	348	*Olearia*
58	*Alnus*	349	*Ophiopogon*
59	*Alnus cordata*	350	*Osmanthus*
60	*Alnus glutinosa*	351	*Osmunda*
61	*Alnus glutinosa* 'Laciniata'	352	*Ostrya carpinifolia*
62	*Alnus incana*	353	*Pachysandra*
63	*Alnus incana* 'Aurea'	354	*Pachystegia*
64	*Alnus rubra*	355	*Paeonia*
65	*Alnus spaethii*	356	*Panicum*
66	*Alstroemeria*	357	*Parrotia persica* 'Vanessa'
67	*Amelanchier*	358	*Paulownia tomentosa*
68	*Amelanchier canadensis*	359	*Pennisetum*
69	*Amelanchier grandiflora* 'Ballerina'	360	*Penstemon*
70	*Amelanchier lamarckii*	361	*Perovskia*
71	*Amelanchier lamarckii* 'Robin Hill'	362	*Persicaria*
72	*Ammonophylla*	363	*Philadelphus*
73	*Anemanthele*	364	*Phlomis*
74	*Anemone*	365	*Phlox*
75	*Aquilegia*	366	*Phormium*
76	*Araucaria araucana*	367	*Photinia*
77	*Arbutus*	368	*Photinia* × *fraseri* 'Red Robin'
78	*Arbutus unedo*	369	*Phygelius*
79	*Armeria*	370	*Physocarpus*
80	*Artemisia*	371	*Physostegia*
81	*Arum*	372	*Picea abies*
82	*Aruncus*	373	*Picea omorika*
83	*Asplenium*	374	*Picea orientalis*
84	*Astelia*	375	*Picea pungens glauca*
85	*Aster*	376	*Picea sitchensis*
86	*Astilbe*	377	*Pinus*
87	*Astrantia*	378	*Pinus nigra*
88	*Athyrium*	379	*Pinus nigra* var. *austriaca*
89	*Aucuba*	380	*Pinus peuce*
90	*Baptisia*	381	*Pinus pinaster*
91	*Berberis*	382	*Pinus pungens glauca*
92	*Berberis darwinii*	383	*Pinus radiata*
93	*Berberis thunbergii*	384	*Pinus sylvestris*
94	*Berberis thunbergii* f. *atropurpurea*	385	*Pittosporum*
95	*Bergenia*	386	*Platanus orientalis digitalis*

Number	Plant taxa	Number	Plant taxa
96	*Betula*	387	*Platanus* × *hispanica louisalead*
97	*Betula albosinensis* 'Fascination'	388	*Platanus*
98	*Betula albosinensis* 'Hillier'	389	*Polemonium*
99	*Betula albosinensis* 'Red Panda'	390	*Polygonatum*
100	*Betula* 'Edinburgh'	391	*Polypodium*
101	*Betula ermanii*	392	*Polystichum*
102	*Betula lenta*	393	*Populus*
103	*Betula nigra*	394	*Populus nigra* 'Italica'
104	*Betula papyrifera* var. *kenaica*	395	*Populus nigra*
105	*Betula pendula*	396	*Populus tremula*
106	*Betula pendula* 'Dalecarlica'	397	*Potentilla*
107	*Betula pendula fastigiata* 'Obelisk'	398	*Primula*
108	*Betula pendula* 'Zwitsers Glory'	399	*Prunus*
109	*Betula pubescens*	400	*Prunus* 'Accolade'
110	*Betula utilis* 'Jermyns'	401	*Prunus* 'Amanogawa'
111	*Betula utilis* var. *jacquemontii*	402	*Prunus avium*
112	*Blechnum*	403	*Prunus avium* 'Landscape Bloom'
113	*Brachyglottis*	404	*Prunus avium* 'Plena'
114	*Brunnera*	405	*Prunus campanulata*
115	*Buddleja*	406	*Prunus cera*
116	*Buxus*	407	*Prunus cerasifera*
117	*Buxus sempervirens*	408	*Prunus cerasifera* 'Nigra'
118	*Calamagrostis*	409	*Prunus cerasifera* 'Pissardii'
119	*Calluna*	410	*Prunus* 'Ichiyo'
120	*Campanula*	411	*Prunus* 'Kanzan'
121	*Carex*	412	*Prunus* 'Kursar'
122	*Carpinus*	413	*Prunus lau.*'Rotund'
123	*Carpinus betulus*	414	*Prunus laurocerasus*
124	*Carpinus betulus* 'Cube Head'	415	*Prunus laurocerasus* 'Magnoliifolia'
125	*Carpinus betulus* 'Pleached'	416	*Prunus* 'Litigiosa'
126	*Carpinus betulus* 'Fastigiata'	417	*Prunus lusitanica*
127	*Carpinus betulus* 'Lucas'	418	*Prunus maackii* 'Amber Beauty'
128	*Carpinus betulus* 'Streetwise'	419	*Prunus* 'Mount Fuji'
129	*Caryopteris*	420	*Prunus padus*
130	*Castanea*	421	*Prunus padus* 'Select'
131	*Castanea sativa*	422	*Prunus* 'Pandora'
132	*Castanea sativa* 'Anny's Summer Red'	423	*Prunus sargentii*
133	*Catalpa bignoniodes*	424	*Prunus sargentii* 'Rancho'
134	*Ceanothus*	425	*Prunus serrula*
135	*Cedrus atlantica* 'Glauca'	426	*Prunus* 'Shirofugen'
136	*Cedrus atlantica*	427	*Prunus* 'Snow Goose'
137	*Cedrus deodara*	428	*Prunus spinosa*
138	*Cedrus libani*	429	*Prunus* 'Spire'
139	*Celtis australis*	430	*Prunus* 'Sunset Boulevard'
140	*Centaurea*	431	*Prunus* 'Tai-haku'
141	*Centranthus*	432	*Prunus* × *schmittii*
142	*Ceratostigma*	433	*Prunus* × *sub.* 'Autumnalis Rosea'
143	*Cercidiphyllum japonicum*	434	*Prunus* × *subhirtella* 'Autumnalis'
144	*Cercis canadensis*	435	*Prunus yedoensis*
145	*Cercis silaquastrum*	436	*Pseudotsuga menziesii*

Number	Plant taxa	Number	Plant taxa
146	*Chaenomeles*	437	*Pterocarya stenoptera* 'Fern Leaf'
147	*Chamaecyparis*	438	*Pulmonaria*
148	*Chamaecyparis lawsoniana*	439	*Pyracantha*
149	*Choisya*	440	*Pyrus*
150	*Cistus*	441	*Pyrus calleryana* 'Chanticleer'
151	*Clematis*	442	*Pyrus calleryana* 'Red Spire'
152	*Convolvulus*	443	*Pyrus communis*
153	*Coprosma*	444	*Quercus*
154	*Coreopsis*	445	*Quercus castaneifolia* 'Green Spire'
155	*Cornus*	446	*Quercus cerris*
156	*Cornus kousa* var. *chinensis*	447	*Quercus frainetto* 'Hungarian Crown'
157	*Cornus sanguinea*	448	*Quercus ilex*
158	*Cortaderia*	449	*Quercus palustris*
159	*Corydalis*	450	*Quercus palustris* 'Green Pillar'
160	*Corylus*	451	*Quercus petraea*
161	*Corylus avellana*	452	*Quercus robur*
162	*Corylus colurna*	453	*Quercus robur* 'Fastigiata Koster'
163	*Cosmos*	454	*Quercus rubra*
164	*Cotinus*	455	*Quercus* × *bimundorum* 'Crimson Spire'
165	*Cotoneaster*	456	*Rhamnus*
166	*Cotoneaster bullatus*	457	*Rhamnus cathartica*
167	*Cotoneaster franchettii*	458	*Rhamnus frangula*
168	*Cotoneaster horizontalis*	459	*Rhus*
169	*Cotoneaster lacteus*	460	*Ribes*
170	*Cotoneaster simonsii*	461	*Robinia* Casque Rouge/Bessoniana
171	*Crataegus*	462	*Robinia pseudoacacia*
172	*Crataegus laevigata* 'Pauls Scarlet'	463	*Robinia*
173	*Crataegus lavallei* 'Carreri'	464	*Rosa*
174	*Crataegus monogyna*	465	*Rosa arvensis*
175	*Crataegus persimilis* 'Prunifolia'	466	*Rosa canina*
176	*Crocosmia*	467	*Rosa rubiginosa*
177	*Cryptomeria japonica*	468	*Rosa rugosa*
178	*Cupressocyparis*	469	*Rosa rugosa* 'Alba'
179	*Cupressocyparis leylandii*	470	*Rosa rugosa rubra*
180	*Cupressus*	471	*Rosa spinosissima*
181	*Cupressus macrocarpa*	472	*Rosmarinus*
182	*Cynoglossum*	473	*Rudbeckia*
183	*Cytisus*	474	*Salix*
184	*Dahlia*	475	*Salix alba*
185	*Daphne*	476	*Salix alba* 'Britzensis'
186	*Davidia involucrata*	477	*Salix aurita*
187	*Delosperma*	478	*Salix babylonica pendula*
188	*Delphinium*	479	*Salix caprea*
189	*Deschampsia*	480	*Salix cinerea*
190	*Deutzia*	481	*Salix pentandra*
191	*Dicentra*	482	*Salix viminalis*
192	*Diervilla*	483	*Salvia*
193	*Digitalis*	484	*Sambucus*
194	*Doronicum*	485	*Sambucus nigra*
195	*Dryopteris*	486	*Sanguisorba*

Number	Plant taxa	Number	Plant taxa
196	*Echinacea*	487	*Santolina*
197	*Echinops*	488	*Sarcococca confusa*
198	*Elaeagnus*	489	*Scabiosa*
199	*Epimedium*	490	*Schizostylis*
200	*Eremurus*	491	*Sedum*
201	*Erigeron*	492	*Senecio*
202	*Eriophorum*	493	*Sequoia sempervirens*
203	*Eriostemon*	494	*Sequoiadendron giganteum*
204	*Eryngium*	495	*Sesleria*
205	*Erysimum*	496	*Sorbaria*
206	*Escallonia*	497	*Sorbus*
207	*Eucalyptus*	498	*Sorbus aria*
208	*Eucalyptus glaucescens*	499	*Sorbus aria* 'Majestica'
209	*Eucalyptus gunnii*	500	*Sorbus arnoldiana* 'Golden Wonder'
210	*Euonymus*	501	*Sorbus aucuparia*
211	*Euonymus europaeus*	502	*Sorbus aucuparia* 'Aspleniifolia'
212	*Euonymus europaeus* 'Red Cascade'	503	*Sorbus aucuparia* 'Cardinal Royal'
213	*Euonymus japonicus* 'Bravo'	504	*Sorbus aucuparia* 'Sheerwater Seedling'
214	*Euphorbia*	505	*Sorbus aucuparia* 'Streetwise'
215	*Exochorda*	506	*Sorbus* 'Autumn Spire'
216	*Fagus*	507	*Sorbus commixta* 'Embley'
217	*Fagus aspelenifolia*	508	*Sorbus commixta* 'Olympic Flame'
218	*Fagus sylvatica*	509	*Sorbus* 'Glowing Pink'
219	*Fagus sylvatica* 'Atropurpurea'	510	*Sorbus* 'Hemsleyi John Bond'
220	*Fagus sylvatica* 'Dawyck'	511	*Sorbus intermedia*
221	*Fagus sylvatica* 'Dawyck Gold'	512	*Sorbus intermedia* 'Browers'
222	*Fagus sylvatica* 'Dawyck Purple'	513	*Sorbus* 'John Mitchell'
223	*Fagus sylvatica* 'Purpurea'	514	*Sorbus* 'Sunshine'
224	*Fargesia*	515	*Sorbus torminalis*
225	*Fatsia*	516	*Sorbus* × *thuringiaca* 'Fastigiata'
226	*Festuca*	517	*Spiraea*
227	*Filipendula*	518	*Stachys*
228	*Foeniculum*	519	*Stachyurus*
229	*Forsythia*	520	*Stewartia pseudocamellia*
230	*Fraxinus americana*	521	*Stipa*
231	*Fraxinus angustifolia*	522	*Symphiocarpus*
232	Fruit Trees	523	*Symphoricarpos*
233	*Fuchsia*	524	*Symphytum*
234	*Galium*	525	*Syringa*
235	*Garrya*	526	*Taxodium dist*. 'Nutans'
236	*Gaultheria procumbens*	527	*Taxodium distichum*
237	*Gaultheria shallon*	528	*Taxus*
238	*Gaura*	529	*Taxus baccata*
239	*Genista*	530	*Tellima*
240	*Geranium*	531	*Thalictrum*
241	*Geum*	532	*Thuja*
242	*Ginkgo biloba*	533	*Thuja plicata*
243	*Ginkgo biloba* 'Globosum'	534	*Thuja plicata* 'Fastigiata'
244	*Ginkgo biloba* 'Saratoga'	535	*Thymus*
245	*Gleditsia triacanthos* 'Skyline'	536	*Tiarella*

Number	Plant taxa	Number	Plant taxa
246	*Griselinia*	537	*Tilia*
247	*Hakonechloa*	538	*Tilia cordata*
248	*Halesia carolina*	539	*Tilia cordata* 'Corzam'
249	*Halimium*	540	*Tilia cordata* 'Greenspire'
250	*Hebe*	541	*Tilia cordata* 'Streetwise'
251	*Hedera*	542	*Tilia cordata* 'Winter Orange'
252	*Helenium*	543	*Tilia* 'Harold Hillier'
253	*Helichrysum*	544	*Tilia henryana*
254	*Helleborus*	545	*Tilia oliveri*
255	*Hemerocallis*	546	*Tilia petolaris* 'Chelsea Sentinel'
256	*Heuchera*	547	*Tilia platanoides*
257	*Heucherella*	548	*Tilia platyphyllos*
258	*Hippophae*	549	*Tilia platyphyllos* 'Aurea'
259	*Hippophae rhamnoides*	550	*Tilia platyphyllos* 'Princes Street'
260	*Hippophae salicifolia* 'Streetwise'	551	*Tilia platyphyllos* 'Streetwise'
261	*Hosta*	552	*Tilia tomentosa* 'Brabant'
262	*Houttuynia*	553	*Tilia* × *euchlora*
263	*Hydrangea*	554	*Tilia* × *europaea* 'Pallida'
264	*Hypericum*	555	*Trachelospermum*
265	*Iberis*	556	*Trachycarpus fortunei*
266	*Ilex*	557	*Tradescantia*
267	*Ilex aquifolium*	558	*Tricyrtis*
268	*Ilex aquifolium* 'Marijo'	559	*Trollius*
269	*ilex crenata*	560	*Tsuga heterophylla*
270	*Ilex* × *altaclarensis* 'James G. Esson'	561	*Ulex*
271	*Ilex* × *altaclerensis* 'Golden King'	562	*Ulex europaeus*
272	*Ilex* × *Koehneana* 'Chestnut Leaf'	563	*Ulmus*
273	*Imperata*	564	*Ulmus* 'Columnella'
274	*Iris*	565	*Ulmus* 'Fiorente'
275	*Jasminum*	566	*Ulmus glabra*
276	*Juglans nigra*	567	*Ulmus* 'New Horizon'
277	*Juglans regia*	568	*Ulmus* 'Rebona'
278	*Juniperus*	569	*Ulmus* 'San Zenobi'
279	*Juniperus communis*	570	*Uncinia*
280	*Knautia*	571	*Verbena*
281	*Kniphofia*	572	*Veronica*
282	*Koelreuteria paniculata*	573	*Viburnum*
283	*Laburnum*	574	*Viburnum lantana*
284	*Laburnum anagyroides*	575	*Viburnum opulus*
285	*Lamium*	576	*Vinca*
286	*Larix*	577	*Weigela*
287	*Larix decidua*	578	*Wisteria sinensis*
288	*Larix kaempferi*	579	× *Cupressocyparis leylandii*
289	*Larix* × *decidua*	580	*Yucca*
290	*Larix* × *eurolepsis*	581	*Yucca filamentosa*
291	*Lavandula*	582	*Zelkova serrata* 'Green Vase'

Appendix D – Water used for irrigation

All mains water used meets the UK standard Water Supply (Water quality) regulation 2016 and the WHO/EU potable water standards, (Drinking water Directive (98/83/EC and the revised Drinking Water Directive 2020/2184)) which includes a total freedom from both human and plant pathogens (Article 2–(7)). All mains water conducting pipework fully complies with the UK Water Supply (Water Fittings) regulations of 1999 and the amendments of 2019. Irrigation water used is not stored in any open tanks where air borne contamination could take place and is entirely isolated from any outside exposure (Dossier Section 3.0).

Bore hole water supply: in some cases, where the underlying geology permits, nurseries can draw water directly from bore holes drilled into underground aquafers. The water that fills these aquafers is naturally filtered through the layers of rock (e.g. limestone) over long periods of time, many millennia in some cases. The water from such supplies is generally of such high quality that it is fit for human consumption with little to no further processing and is often bottled and sold as mineral water (Dossier Section 3.0).

Rainwater or freshwater watercourse supply: some nurseries contributing to this application for both environmental and efficiency reasons use a combination of rain capture systems or abstract directly from available watercourses. All water is passed through a sand filtration system to remove contaminants and is contained in storage tanks prior to use. One nursery that operates this approach is currently in the process of installing additional nanobubble technology to treat the water (Dossier Section 3.0).

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

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

N	Pest name	EPPO code	Group	Pest present in the UK	Present in the EU	*Fagus sylvatica* confirmed as a host (reference)	Pest can be associated with the commodity	Impact	Justification for inclusion in this list
1	*Blastobasis decolorella*	BLAADE	Insects	Yes	Limited	*F. sylvatica* (Database of Insects and their Food Plants, online)	Uncertain	No Data	Uncertainty about association to the commodity and about impact.
2	*Coryneum betulinum*	–	Fungi	Yes	Limited	*F. sylvatica* (Farr and Rossman, online)	Yes	No Data	Uncertainty about impact.
3	*Nectria ellisii*	–	Fungi	Yes	Limited	*F. sylvatica* (Farr and Rossman, online)	Yes	No Data	Uncertainty about impact.

Appendix F – Excel file with the pest list of *Fagus sylvatica*

Appendix F can be found in the online version of this output (in the 'Supporting information section'): https://efsa.onlinelibrary.wiley.com/doi/10.2903/j.efsa.2023.8118#support-informationsection