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SCIENTIFIC OPINION

Commodity risk assessment of *Sorbus aucuparia* 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'. Taking into account the available scientific information, including the technical information provided by the applicant country, this Scientific Opinion covers the plant health risks posed by the following commodities: *Sorbus aucuparia* bare-root plants and rooted plants in pots up to 7 years old and specimen trees in pots up to 15 years old imported into the EU from the UK. A list of pests potentially associated with the commodities was compiled. The relevance of any pest was assessed based on evidence following defined criteria. Three EU quarantine pests (*Entoleuca mammata* and *Phytophthora ramorum* (non-EU isolates), *Erwinia amylovora*), were selected for further evaluation. For two of the selected pests (*E. mammata* and *P. ramorum*), the risk mitigation measures implemented in the UK and specified in the technical dossier 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. The degree of pest freedom varies between the pests evaluated, with *P. ramorum* being the pest most frequently expected on the imported *S. aucuparia* plants. The Expert Knowledge Elicitation indicated, with 95% certainty, that between 9812 and 10,000 bare-root *S. aucuparia* plants per 10,000 will be free from *P. ramorum*.

KEYWORDS

commodity risk assessment, European Union, mountain ash, plant health, plant pests, rowan

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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 ongoing, 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 organisations needs to be set.

In view of the above and in accordance with Article 29 of Regulation (EC) No 178/2002, the Commission asked EFSA to provide scientific opinion in the field of plant health for *Sorbus aucuparia* plants 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 (from this point onwards referred to as 'the Panel') was requested to conduct a commodity risk assessment of *Sorbus aucuparia* plants 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 Windsor Framework in conjunction with Annex 2 to that Framework, for the purposes of this Opinion, references to the United Kingdom do not include Northern Ireland.

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)

[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.

[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, pp. 1–279.

and Volga Federal District (Privolzhsky federalny okrug)), San Marino, Serbia, Switzerland, Türkiye, Ukraine and the UK (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 was 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 an 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 (from this point onwards referred to as 'the Dossier') provided by the applicant (UK, Department for Environment Food and Rural Affairs – from this point onwards 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,[6] from this point onwards 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 on the likelihood of pest freedom for each relevant pest given the risk mitigation measures proposed by DEFRA of the UK.

2 | DATA AND METHODOLOGIES

2.1 | Data provided by DEFRA of the UK

The Panel considered all the data and information in the Dossier provided by DEFRA of the UK in April 2023. 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 dossiers	*Sorbus aucuparia* commodity information final.pdf
2.0	Pest list	*Sorbus* pest list_checked_UK.xlsx
3.0	*Sorbus aucuparia* distribution map	*Sorbus_aucuparia*_distribution_map.pdf
4.0	List of plants produced in the *Sorbus* nurseries	*Sorbus_aucuparia*_producers_sample_product_list_UK.xlsx

[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.

[6]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, pp. 1–279.

2.2 | Literature searches performed by DEFRA

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
Aphids on the World's Plants	https://www.aphidsonworldsplants.info/
Butterflies and Moths of North America	https://www.butterfliesandmoths.org/
NEMAPLEX	https://nemaplex.ucdavis.edu/
UK Plant Health Portal	https://planthealthportal.defra.gov.uk/
Fauna Europaea	https://www.gbif.org/dataset/90d9e8a6-0ce1-472d-b682-3451095dbc5a
Global Taxonomic Database of Gracillariidae (Lepidoptera)	https://www.gbif.org/dataset/98fb9418-8215-4575-abfb-07a30b81acfc
Encyclopedia of Life	https://eol.org/
Fungi of Great Britain and Ireland	https://fungi.myspecies.info/
Forest research	https://www.forestresearch.gov.uk/
Nature Spot	https://www.naturespot.org.uk/
UK Beetles	https://www.ukbeetles.co.uk/
Spider Mites Web	https://www1.montpellier.inra.fr/CBGP/spmweb/
Thrips-iD	https://www.thrips-id.com/en/
Pyrenomycetes from southwestern France	https://pyrenomycetes.free.fr/
Beetles of Britain and Ireland	https://www.coleoptera.org.uk/
Biological Records Centre	https://www.brc.ac.uk/
British Bugs	https://www.britishbugs.org.uk/gallery.html
CABI Crop Protection Compendium	https://www.cabi.org/cpc/
CABI Plantwise Knowledge Bank	https://www.plantwise.org/knowledgebank/
CABI Publishing	https://www.cabi.org/what-we-do/publishing/
Checklist of Aphids of Britain	https://influentialpoints.com/aphid/Checklist_of_aphids_in_Britain.htm
EPPO Global Database	https://gd.eppo.int/
Global Biodiversity Information Facility	https://www.gbif.org/
NBN Atlas	https://species.nbnatlas.org/
Scalenet	https://scalenet.info/
UK Moths	https://ukmoths.org.uk/
UK Plant Health Information Portal	https://planthealthportal.defra.gov.uk/
USDA Forest Service	https://www.srs.fs.usda.gov/
USDA Fungal Database	https://nt.ars-grin.gov/fungaldatabases/

2.3 | Literature searches performed by EFSA

Literature searches in different databases were undertaken by EFSA to complete a list of pests potentially associated with the genus *Sorbus*. The following searches were combined: (i) a general search to identify pests reported on the genus *Sorbus* 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 on 12 July 2023. 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 the genus *Sorbus*. 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.

TABLE 3 Databases used by EFSA for the compilation of the pest list associated with *Sorbus* spp.

Database	Platform/link
Aphids on World Plants	https://www.aphidsonworldsplants.info/C_HOSTS_AAIntro.htm
CABI Crop Protection Compendium	https://www.cabi.org/cpc/
Database of Insects and their Food Plants	https://www.brc.ac.uk/dbif/hosts.aspx
Database of the World's Lepidopteran Hostplants	https://www.nhm.ac.uk/our-science/data/hostplants/search/index.dsml
EPPO Global Database	https://gd.eppo.int/
EUROPHYT	https://webgate.ec.europa.eu/europhyt/
Global Biodiversity Information Facility	https://www.gbif.org/
Google Scholar	https://scholar.google.com/
Leafminers	https://www.leafmines.co.uk/html/plants.htm
Nemaplex	https://nemaplex.ucdavis.edu/Nemabase2010/PlantNematodeHostStatusDDQuery.aspx
Plant Parasites of Europe	https://bladmineerders.nl/
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	https://scalenet.info/associates/
Spider Mites Web	https://www1.montpellier.inra.fr/CBGP/spmweb/advanced.php
USDA ARS Fungal Database	https://fungi.ars.usda.gov/
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
The American Phytopathological Society	https://www.apsnet.org/Pages/default.aspx

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 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.

2.4 | Methodology

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

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

In the second step, if applicable, the implemented risk mitigation measures for each relevant pest are evaluated.

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

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

1. Bare-root plants (single or up to 50 plants per bundle) out of 10,000 exported plant units.
2. Rooted plants in pots/cells (single or up to 5 plants per bundle) out of 10,000 exported plant units.
3. Specimen trees (single plants in pots) out of 10,000 exported plant units.

2.4.1 | Commodity data

Based on the information provided by DEFRA of the UK, the characteristics of the commodity are summarised in Section 3 of this Opinion.

2.4.2 | 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 all species of *Sorbus* based on information provided in the Dossier Sections 1.0 and 2.0 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 plants (i.e. *Sorbus*) were used when searching in the European and Mediterranean Plant Protection Organisation (EPPO) Global database (EPPO GD, online) and CABI Crop Protection Compendium (CABI, online). The same strategy was applied to the other databases (see Table 3) excluding EUROPHYT and Web of Science. The notifications of interceptions of EU member states were consulted for the years 2009–2023 (EUROPHYT, online, from 2009 to 2020 and TRACES-NT, online, from May 2020 to March 2023, Accessed: 5 April 2024). To check whether *Sorbus* spp. can act as a pathway, all notifications (all origins) for *Sorbus* spp. were evaluated. For each selected pest, it was checked if there were any notification records for UK (all commodities).

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 string is detailed in Appendix B and was run on 12 July 2023.

The titles and abstracts of the scientific papers retrieved were screened and the pests associated with *Sorbus* genus 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 and distribution) useful for the selection of the pests relevant for the purposes of this Opinion.

The compiled pest list (see Microsoft Excel® in Appendix C) includes all identified pests that use the genus *Sorbus* as a host.

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).

2.4.3 | Listing and evaluation of risk mitigation measures

All proposed risk mitigation measures were listed and evaluated. When evaluating the likelihood of pest freedom at origin, the following types of potential infestation/infection sources for *Sorbus aucuparia* in nurseries were considered (see also Figure 1):

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

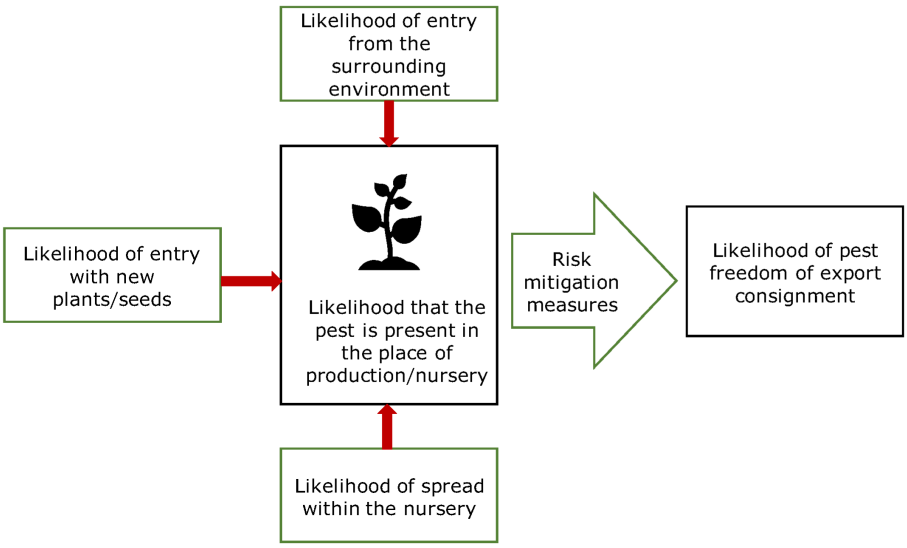


FIGURE 1 Conceptual framework to assess likelihood that plants are exported free from relevant pests. Source: EFSA PLH Panel (2019).

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

2.4.4 | Expert knowledge elicitation

To estimate the pest freedom of the commodities, an Expert Knowledge Elicitation (EKE) was performed following EFSA guidance (Annex B.8 of EFSA Scientific Committee, 2018).

The specific question for EKE was defined as follows: 'taking into account (i) the risk mitigation measures listed in the Dossier, and (ii) other relevant information (reported in the specific pest datasheets), how many of 10,000 plants, either single or in bundles, and specimen trees will be infested with the relevant pest/pathogen when arriving in the EU?'

The risk assessment considers bare-root plants (Figure 2) (bundles of 25 or 50 for seedlings or transplants; bundles of 5, 10 or 15 for whips; or single bare-root trees), rooted plants in pots/cells (Figure 3A, B, Figure 4), single or up to five plants per bundle (Figure 3B) and specimen trees in pots.

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 commodity consists of the following type of deciduous plant of *Sorbus aucuparia* (Table 4, Figures 2, 3, & 4):

TABLE 4 Type of *Sorbus aucuparia* plants to be exported to the EU (Dossier Section 1.0).

Type of plants	Age	Stem diameter (cm)	Height (cm)
Bare-root plants including whips, transplants and seedlings*	1–2 years old	0.4–1.0	20–150
Bare-root plants	1–7 years old	0.4–4.0	20–300
Rooted plants in pots including whips*	1–7 years old	0.4–1.0	20–300
Specimen trees in pots	Up to 15 years old	19	Up to 600

*Whips are slender, unbranched trees that can be bare-root or containerised.

FIGURE 2 Field grown *Sorbus aucuparia* for bare-root plant production (Source: Dossier Section 1.0).

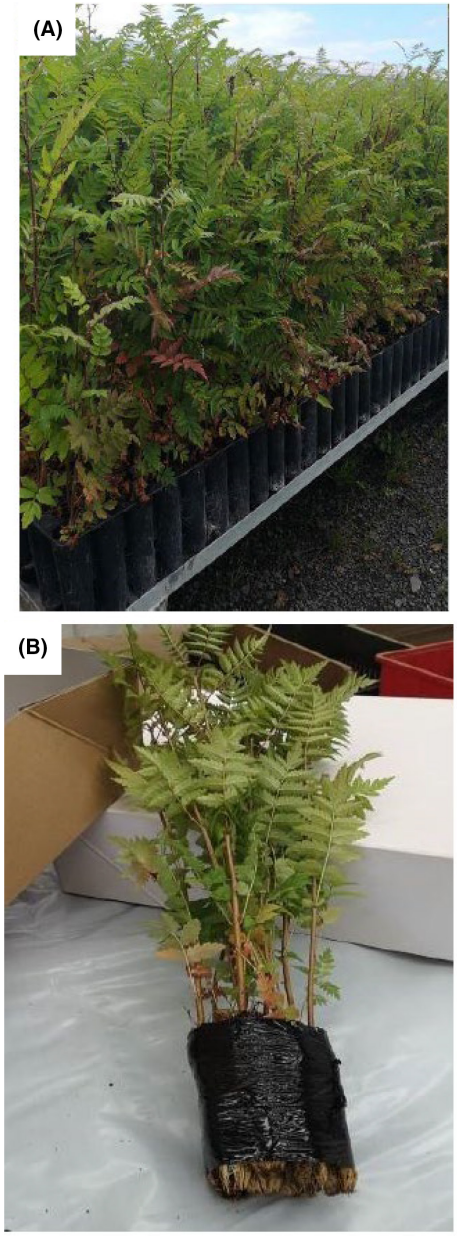


FIGURE 3 (A) Individual plants grown in cells; (B) Cell-grown plants bundled prior to dispatch of *Sorbus aucuparia* plants (Source: Dossier Section 1.0).

FIGURE 4 Rooted plants in pots grown in plastic trays on top of plastic protective membrane on gravel (Source: Dossier Section 1.0).

Rooted plants in pots may be exported with leaves, depending on the timing of the export and the life cycle of the species. Bare-root plants exported to the EU may also have some leaves at the time of export, in particular when exported in November. Specimen trees can be exported in any period of the year, but mainly from September to May (Dossier Section 1.0).

According to ISPM 36 (FAO, 2019), the commodity can be classified as 'bare-root plants' or 'rooted plants in pots'. According to the Dossier Section 1.0, the trade volume for *Sorbus aucuparia* is listed in Table 5.

TABLE 5 Expected trade volume per year and seasonal timing planned for export to the EU for *Sorbus aucuparia* plants.

Type of plant	Number of items	Seasonal timing
Bare-root plants	340,000	November–April
Rooted plants in pots	75,000	Mainly September–May
Specimen trees	125	Mainly September–May

Trade of all plant types will mainly be to Northern Ireland and Republic of Ireland.

- Bare-root plants will be lifted from late autumn until early spring (October–April) as this is the best time to move/export dormant plants (Dossier Section 1.0).
- Rooted plants in pots can be moved/exported at any time in the year to fulfil consumer demand, but more usually from September to May. These will probably be destined for amenity or garden centre trade rather than nurseries (Dossier Section 1.0).
- Specimen trees can be moved/exported at any time in the year to fulfil consumer demand, but more usually from September to May. These will probably be destined for amenity or garden centre trade rather than nurseries (Dossier section 1.0).

3.2 | Description of the production areas

The nurseries producing the commodity are distributed in the eastern part of Great Britain. All nurseries are registered as professional operators with the UK NPPO, either by the Animal and Plant Health Agency (APHA) in England and Wales, or by the Scottish Government, and are authorised to issue UK plant passports and phytosanitary certificates for export (Dossier Section 1.0).

Producers do not set aside separate areas for export production. All plants within UK nurseries are grown under the same phytosanitary measures, meeting the requirements of the UK Plant Passporting regime (Dossier Section 1.0). The production areas designated for export to the EU are indicated in the map below (Figure 5).

FIGURE 5 Location of the nurseries designated for export of *Sorbus aucuparia* to the European Union (Source: Dossier Section 1.0).

Nurseries:

The minimum and maximum sizes of nurseries growing *Sorbus aucuparia* for export are as follows.

- Container grown stock: minimum 8 ha/maximum 150 ha.
- Field-grown stock (for bare-root plants): maximum 325 ha.

The exporting nurseries grow a range of other plant species. The production area where *S. aucuparia* plants are grown is around 1%–5% of the total area of the nurseries. Most of the nurseries expected to export to the EU produce plants from seed and seedlings (UK plant passports); therefore, there are no mother plants of *S. aucuparia* present in the nurseries. There are however *S. aucuparia* cultivars that are chip budded in July/August and the seedling of the same species are used as rootstocks for all cultivars. Only one of the nurseries expected to export to the EU have mother plants of other tree species present in the nurseries. Approximately 20% of the nurseries likely to export to the EU also sell plants within the UK to final users as ornamental plants, e.g. to the Local Authorities/Landscape Architects (Dossier Section 1.0).

As the plants are intended for outdoor cultivation, only early growth stages are normally maintained under protection, such as young plants/seedlings where there is an increased vulnerability due to climatic conditions including frost. The commodity to be exported should therefore be regarded as outdoor grown. Growth under protection is primarily to protect against external climatic conditions rather than protection from pests. The early stages of 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 (Dossier Section 1.0).

Surrounding area

Exporting nurseries are predominately situated in rural areas. The surrounding land is mainly 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 1.0).

Arable crops

These are rotated in line with good farming practice but could include Oilseed rape (*Brassica napus*), Wheat (*Triticum*), barley (*Hordeum vulgare*), turnips (*Brassica rapa* subsp. *rapa*), potatoes (*Solanum tuberosum*) and maize (*Zea mays*) (Dossier Section 1.0).

Pasture

Predominantly ryegrass (*Lolium*) (Dossier Section 1.0).

Woodland

Woodlands tend to be a standard UK mixed woodland, with a range of UK native trees such as Oak (*Quercus robur*), pine (*Pinus*), Poplar (*Populus*), Ash (*Fraxinus*), sycamore (*Acer pseudoplatanus*), holly (*Ilex*), Norway maple (*Acer platanus*), field maple (*Acer campestre*) (Dossier Section 1.0).

Hedges

Hedges are made up of a range of species including hazel (*Corylus avellana*), yew (*Taxus baccata*), holly (*Ilex*), ivy (*Hedera*), alder (*Alnus glutinosa*), cherry laurel (*Prunus laurocerasus)*, hawthorn (*Crataegus*), blackthorn (*Prunus spinosa*) and leylandii (*Cupressus* × *leylandii*) (Dossier Section 1.0).

3.3 | Production and handling processes

3.3.1 | Source of planting material

The starting material is a mix of seeds and seedlings depending on the nursery. Some seedlings may be obtained from the EU (mostly the Netherlands). This is the only source of the plants obtained from abroad (Dossier Section 1.0).

S. aucuparia seeds purchased in the UK may be certified under the Forestry Commission's Voluntary Scheme for the Certification of Native Trees and Shrubs. This allows certification of seeds not covered by Schedule 1 of The Forest Reproductive Material (Great Britain) Regulations 2002 (legislation.gov.uk). *S. aucuparia* seedlings sourced in the UK are traded with UK Plant Passports; *S. aucuparia* seedlings from the EU countries are certified with phytosanitary certificates (Dossier section 1.0).

3.3.2 | Production cycle

The growing conditions are as follows (as defined in Annex 1 of ISPM 36 (FAO, 2019)):

- Grown outdoors/in the open air in containers (cells, and pots);
- Field grown.

Cell-grown trees may be grown in cells at one plant per cell. These may be grown under protection initially; however, most plants will be field grown, or field grown in containers.

Any plants in pots with organic growing medium being exported from UK to the EU need to meet the requirements for growing media in EU Regulation 2019/2072, Annex VII, and the UK already has exports to EU MS meeting this requirement.

In the production or procurement of plants, the use of growing media is assessed for the potential to harbour and transmit plant pests. Growers use virgin peat or peat-free compost, which is a mixture of coir, tree bark, wood fibre, etc. This compost is heat-treated by commercial suppliers during production to eliminate pests and diseases. It is supplied in sealed bulk bags or shrink-wrapped bales and stored off the ground on pallets, these are completely hygienic and free from contamination. Where delivered in bulk, compost is kept in a dedicated bunker, either indoors, or covered by tarpaulin outdoors, and with no risk of contamination with soil or other material (Dossier Section 1.0).

Plants for bare-root plant production are planted from late autumn until early spring (November–March); rooted plants in pots can be planted at any time of year[#], though winter is most common. Flowering occurs during late spring (April–June), depending upon the variety and weather conditions (Dossier Section 1.0).

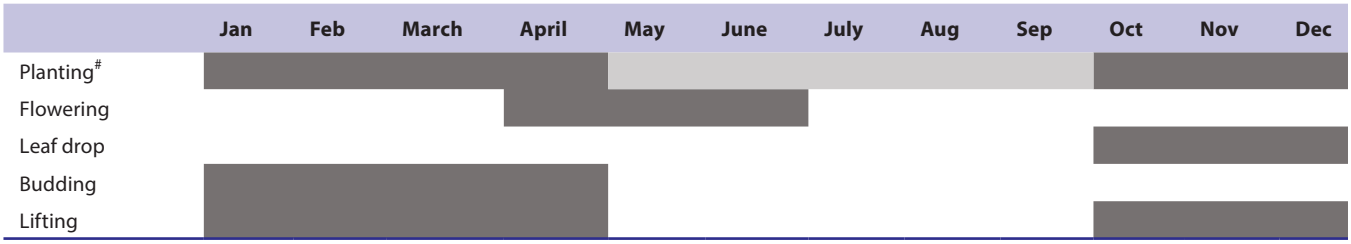
Large specimen trees in pots may be either grown in EU-compliant growing media in pots for their whole life, or initially grown in the field before being lifted, root-washed to remove any soil and then potted in EU-compliant growing media. Field-grown trees may be transplanted in the field approximately every 2 years to space trees out as they grow.

While some trees may be up to 15 years old, they are removed from the soil and root washed at no more than 6 years old and subsequently grown on from that point in EU-compliant growing media. To ensure a good root architecture, potted plants may subsequently be re-potted every 2–3 years into larger pots with fresh EU-compliant growing media. Soil testing could also be carried out to ensure pest freedom ahead of export.

Lifting:

- Bare-root plants will be harvested from autumn to early spring (October to April) to be able to easily lift plants from the field, and because this is the best time to move dormant plants. The plants are then root-washed on site and stored prior to export. Bare-root plants exported to the EU may also have some leaves at the time of export, in particular when exported in November (Dossier Section 1.0).
- Rooted plants in pots can be traded at any point in the year, but more usually from September to May. These will likely be destined for amenity or garden centre trade rather than nurseries. These plants may be exported with leaves, depending on the timing of the export and the life cycle of the species (Dossier Section 1.0).
- Specimen trees can be traded at any point in the year to fulfil consumer demand, but more usually from September to May. These will likely be destined for amenity or garden centre trade rather than nurseries (Dossier section 1.0) (Table 6).

TABLE 6 Period of the year when the commodity is produced and the phenology of the crop (including sowing/planting, flowering and harvesting periods).



The irrigation is done on a 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/water courses. 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. No quarantine pests have been found so far (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 at the nursery (Dossier Section 1.0). Growing areas 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 (Dossier Section 1.0).

General hygiene measures are undertaken as part of routine nursery production, including disinfection of tools and equipment between batches/lots. Tools are disinfected after operation on a stock and before being used on a different plant species. The tools are dipped and wiped with a clean cloth between trees to reduce the risk of virus and bacterial transfer between subjects. Virkon S (active substance: potassium peroxymonosulfate and sodium chloride) was reported as the most commonly used disinfectant. Growers keep records allowing traceability for all plant material handled (Dossier Section 1.0).

Plant material is regularly monitored for plant health issues. This monitoring is carried out by trained nursery staff via regular crop walking and records kept of this monitoring. Qualified agronomists also undertake regular crop walks to verify the producer's assessments. Curative or preventative actions are implemented together with an assessment of phytosanitary risk. Unless a pest can be immediately and definitively identified as non-quarantine growers are required to treat it as a suspect quarantine pest and notify the competent authority (Dossier Section 1.0).

Additional specific phytosanitary measures apply against *Phytophthora ramorum* (EU QP (Non-EU isolates)) and *Erwinia amylovora* (EU QP (EU Protected Zones)).

Plants infected with *P. ramorum* are removed and destroyed and potentially infected plants are 'held' (prohibited from moving). The UK has a containment policy in the wider environment with official action taken to remove infected trees. As part of an annual survey of 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 in a survey of 300 non-woodland wider environment sites annually (Dossier Section 1.0).

Pest and disease pressures vary from season to season. Chemical treatments are reported to be applied when required and depend on the situation at that time (disease pressure, growth stage, etc., and environmental factors) (Dossier Section 1.0).

There are no specific measures/treatments against soil pests. However, containerised plants are grown in trays on top of protective plastic membranes to prevent contact with soil (Figure 3). 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 1.0).

3.3.3 | Export procedure

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).

The following processes are typical of all exporting nurseries.

Bare-root plants are lifted and washed free from soil with a low-pressure washer in the outdoors nursery area away from packing/cold store area. In some cases, the plants may be kept in a cold storage for up to 5 months after harvesting prior to export (Dossier Section 1.0).

Prior to export bare-root plants may be placed in bundles, depending on the size of the plants (25 or 50 for seedlings or transplants; 5, 10 or 15 for whips; or single bare-root trees). They are then wrapped in polythene and packed and distributed on ISPM 15 certified wooden pallets, or metal pallets (Figure 6). 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 Section 1.0).

Rooted plants in pots are transported on Danish trolleys for smaller containers, or ISPM 15 certified pallets, or individually in pots for larger containers. Small volume orders may be packed in waxed cardboard cartons or polythene bags and dispatched via courier (Dossier Section 1.0).

The preparation of the commodities for export is carried out inside the nurseries in a closed environment, e.g. packing shed, except for the specimen trees, which are prepared outside in an open field due to their dimensions (Dossier Section 1.0).

Plants are transported by lorry (size dependent on load quantity). Sensitive plants will occasionally be transported by temperature-controlled lorry if weather conditions during transit are likely to be very cold (Dossier Section 1.0).

FIGURE 6 Preparation of the plants for export to the EU (Source: Dossier Section 1.0).

4 | IDENTIFICATION OF PESTS POTENTIALLY ASSOCIATED WITH THE COMMODITY

The search for potential pests associated with *Sorbus* spp. rendered 1206 species (see Microsoft Excel® file in Appendix C).

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.

The 19 EU-quarantine species that are reported to use *Sorbus* spp. as a host plant were evaluated (Table 7) 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 a host of the pest;
c. one or more life stages of the pest can be associated with the specified commodity.

Pests that fulfilled all criteria are selected for further evaluation.

Of the 19 EU-quarantine pest species evaluated, three pests were selected for further assessment.

TABLE 7 Overview of the evaluation of the 19 EU-quarantine pest species known to use *Sorbus* species as host plants for their relevance for this Opinion.

No.	Pest name according to EU legislation[a]	EPPO code	Group	Pest present in the UK	*Sorbus* confirmed as a host (reference)	Pest can be associated with the commodity (NA = not assessed)	Pest relevant for the opinion[b]
1	*Acleris nivisellana*	ACLRNV	Insect	No	EPPO (online)	NA	No
2	*Anoplophora chinensis*	ANOLCN	Insect	No	EPPO (online)	NA	No
3	*Anoplophora glabripennis*	ANOLGL	Insect	No	CABI (online)	NA	No
4	*Anthonomus quadrigibbus*	TACYQU	Insect	No	EPPO (online)	NA	No
5	*Carposina sasakii*	CARSSA	Insect	No	EPPO (online)	NA	No
6	*Choristoneura conflictana*	ARCHCO	Insect	No	EPPO (online)	NA	No
7	*Conotrachelus nenuphar*	CONHNE	Insect	No	EPPO (online)	NA	No
8	*Entoleuca mammata*	HYPOMA	Fungi	Yes	EPPO (online), GBIF (online), USDA (online)	Yes	Yes
9	*Erwinia amylovora*	ERWIAM	Bacteria	Yes	EPPO (online)	Yes	Yes*
10	*Margarodes vitis*	MARGVI	Insect	No	Scalenet (online)	NA	No
11	*Oemona hirta*	OEMOHI	Insect	No	EPPO (online)	NA	No
12	*Phytophthora ramorum*	PHYTRA	Chromista	Yes	EPPO (online), CABI (online), USDA (online)	NA	Yes
13	*Popillia japonica*	POPIJA	Insect	No	EPPO (online)	NA	No
14	*Rhagoletis pomonella*	RHAGPO	Insect	No	EPPO (online)	NA	No
15	*Saperda candida*	SAPECN	Insect	No	EPPO (online)	NA	No
16	*Septoria musiva*	MYCOPP	Fungi	No	EPPO (online), USDA (online)	NA	No
17	*Spodoptera eridania*	PRODER	Insect	No	EPPO (online)	NA	No
18	*Thaumetopoea processionea*	THAUPR	Insect	Yes	CABI (online)	NA	No*
19	Tomato ringspot virus	TORSV0	Virus	Yes	CABI (online)	NA	No*

[a]Commission Implementing Regulation (EU) 2019/2072.

[b]For the pests marked with an asterisk (*), further information is provided in Section 4.2. Commodity risk assessment of Crataegus monogyna from the UK.

4.2 | Additional information for selected pests

For *Erwinia amylovora* special import requirements are specified for *S. aucuparia*, in Annex X, Item 9 of Commission Implementing Regulation (EU) 2019/2072, therefore the evaluation for this pest consisted of checking whether or not the exporting country applies these measures. Since Brexit, the UK still applied exactly the same measures applied in the EU for protected zone quarantine pests (PZQP).

For two pest species, *Thaumetopoea processionea* and Tomato ringspot virus, the Panel concluded that there was no sufficient evidence to select them for further evaluation. The reasons for excluding these pests from further evaluation are reported below.

Thaumetopoea processionea: *Sorbus* is mentioned in the host list of *T. processionea* (EFSA PLH Panel, 2009); however, there is no evidence that adults oviposit on *S. aucuparia*. Larvae may be found on neighbouring defoliated oak trees and may disperse to *Sorbus* plants in the occasion of extend defoliation of oak trees, but there is no complete larval development reported. *T. processionea* is a quarantine species in the UK and larvae present on oak plants are expected to be detected by nursery staff or at plants for export inspection. Given the unlikely scenario that *T. processionea* larvae can be present on *Sorbus* plants with leaves and be exported to the EU, the panel concluded that *S. aucuparia* is not a feasible pathway for *T. processionea*.

Tomato ringspot virus: *Sorbus* (genus level) infections by ToRSV are reported by Chervyakova and Keldysh (2007). The virus is reported to be detected with serological techniques, electron microscopy, grafting and mechanical transmissions however, only general results are reported in which ToRSV was always detected in mixed infections with other nepoviruses. However, nepoviruses are known to cross-react in serological tests, have similar virion morphology when observed in the electron microscope and cause similar symptoms. At this time, host status of a plant species needs to be confirmed by two independent methods; therefore, the host status of *Sorbus* spp. (and furthermore *S. aucuparia*) is uncertain. In addition, even though the virus seems to be present in *Pelargonium* in UK (according to UK PRA), no nematode vector species, which is necessary for its spread, is present in the UK.

4.3 | Selection of other relevant pests (non-quarantine 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 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. *Sorbus* spp. is a host of the pest;
d. one or more life stages of the pest can be associated with the *Sorbus* spp.;
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 member states) and fulfilling the other criteria (i.e. c, d and e), and 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 member state;
- any other reason justified by the working group (e.g. recent evidence of presence).

Based on the information collected, 1206 potential pests (non-EU quarantine) known to be associated with *Sorbus* spp. were evaluated for their relevance to this Opinion.

Species were excluded from further evaluation when at least one of the conditions listed above (a–e) was not met. Details can be found in Appendix C (Microsoft Excel® file). None of the evaluated EU non-quarantine pests was selected for further evaluation.

4.4 | Summary of pests selected for further evaluation

Two pests that were identified to be present in UK and having potential for association with *Sorbus aucuparia* plants designated for export to the EU, selected for further evaluation, are listed in Table 8. The efficacy of the risk mitigation measures applied to the commodity were evaluated for these selected pests.

TABLE 8 List of relevant pests selected for further evaluation.

No.	Current scientific name	EPPO code	Taxonomic information	Group	Regulatory status
1	*Entoleuca mammata*	MELGFA	Xylariales, Xylariaceae	Fungi	EU Quarantine Pest
2	*Phytophthora ramorum*	PHYTRA	Peronosporales, Peronosporaceae	Chromista	EU Quarantine Pest

5 | RISK MITIGATION MEASURES

For the selected pests (Table 8), the Panel evaluated the likelihood that it could be present in the *S. aucuparia* 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, & 4.0), the Panel summarised the risk mitigation measures (see Table 9) that are implemented in the production nursery.

TABLE 9 Overview of implemented risk mitigation measures for *Sorbus aucuparia* plants designated for export to the EU from the UK.

No.	Risk mitigation measure	Evaluation and uncertainties
1	Registration of production sites	All nurseries are registered as professional operator with the UK NPPO, by the APHA for England and Wales, or with SASA for Scotland, and is authorised to issue UK plant passports (Dossier Section 1.0)
2	Certification of propagation material	Seeds of *S. aucuparia* purchased in the UK may be certified under the Forestry Commission's Voluntary Scheme for the Certification of Native Trees and Shrubs. Seedlings for *Sorbus* spp. production sourced in the UK are certified with UK Plant Passports; seedlings from the EU countries are certified with phytosanitary certificates (Dossier Section 1.0)
3	Origin and treatment of growing media	Rooted plants in pots: In the production or procurement of these plants, the use of growing media is assessed for the potential to harbour and transmit plant pests. Growers most commonly use virgin peat or peat-free compost, which is a mixture of coir, tree bark, wood fibre, etc. The compost is heat-treated by commercial suppliers during production to eliminate pests and diseases. It is supplied in sealed bulk bags or shrink-wrapped bales and stored off the ground on pallets, these are completely hygienic and free from contamination. Where delivered in bulk, compost is kept in a dedicated bunker, either indoors or covered by tarpaulin outdoors, and with no risk of contamination with soil or other material (Dossier Section 1.0)
4	Surveillance, monitoring and sampling	Inspection is carried out at least once a year as part of the Quarantine Surveillance programme (Great Britain uses the same framework for its surveillance programme as the EU). Surveillance is based on visual inspection with samples taken from symptomatic material, and where appropriate, samples are also taken from asymptomatic material (e.g. plants, tubers, soil, watercourses) (Dossier Section 1.0)
5	Hygiene measures	According to the Dossier Section 1.0, all the nurseries have plant hygiene and housekeeping rules and practices in place, which are communicated to all relevant employees. The measures include: • Growing media • Weed management • Water usage • Cleaning and sterilisation • Waste treatment and disposal • Visitors
6	Irrigation water quality and/or treatments	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. No quarantine pests have been found (Dossier Section 1.0)
7	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)

(Continues)

TABLE 9 (Continued)

No.	Risk mitigation measure	Evaluation and uncertainties
8	Washing of the roots (bare-root plants)	Bare-root plants are lifted from the field in winter and then root-washed on site and stored prior to export (Dossier Section 1.0)
9	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 Separate to any official inspection, plant material is checked by growers for plant health issues before dispatch Special provision for inspection of *P. ramorum* and *E. amylovora* are in place

5.2 | Evaluation of the current measures for the selected pests including uncertainties

The relevant risk mitigation measures acting on the selected pests were identified. Any limiting factors on the efficacy of the measures were documented. All the relevant information including the related uncertainties deriving from the limiting factors used in the evaluation are summarised in the pest datasheets provided in Appendix A.

Based on this information, an expert judgement has been given for the likelihood of pest freedom of the commodity taking into consideration the risk mitigation measures acting on the pest and their combination.

An overview of the evaluation of the selected pests is given in the sections below (Sections 5.2.1–5.2.2). The outcome of EKE on pest freedom after the evaluation of the proposed risk mitigation measures is summarised in Section 5.2.3.

5.2.1 | Overview of the evaluation of *Entoleuca mammata*

Overview of evaluation of *E. mammata* for bundles of bare-root plants					
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	9921 out of 10,000 plants	9961 out of 10,000 plants	9981 out of 10,000 plants	9993 out of 10,000 plants	9999 out of 10,000 plants
Proportion of infested plants	1 out of 10,000 plants	7 out of 10,000 plants	19 out of 10,000 plants	39 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** *E. mammata* is present in the UK, although not widely distributed. The pest was reported on *S. aucuparia* (Eriksson, 2014; Vasilyeva & Scheuer, 1996). Mechanical wounds including pruning wounds are expected to be present and may represent infection courts. The host plants can be present either inside or in the surroundings of the nurseries. Altogether, this suggests that the association of *E. mammata* with the commodity is possible **Measures taken against the pest and their efficacy** General measures taken by the nurseries are effective against the pathogen. These measures include (a) the use of certified plant material; (b) inspections, surveillance, monitoring, sampling and laboratory testing; (c) the removal of infected plant material and (d) application of pest control products **Interception records** In the EUROPHYT/TRACES-NT databases, there are no records of notification of Sorbus plants for planting or any other commodity from the UK due to the presence of *E. mammata* (EUROPHYT/TRACES-NT, online) **Shortcomings of current measures/procedures** No major shortcomings were identified in the evaluation **Main uncertainties** • The level of susceptibility of *Sorbus* spp. to the pathogen. • Whether symptoms on *Sorbus* spp. are recognisable and may be promptly detected. • The presence/abundance of the pathogen in the area where the nurseries is located. • Effect of fungicide treatments against the pathogen.				

Overview of evaluation of *E. mammata* for the rooted plants in pots					
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	9923 out of 10,000 plants	9961 out of 10,000 plants	9979 out of 10,000 plants	9990 out of 10,000 plants	9998 out of 10,000 plants
Proportion of infested plants	2 out of 10,000 plants	10 out of 10,000 plants	21 out of 10,000 plants	39 out of 10,000 plants	77 out of 10,000 plants

(Continued)

Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity** *E. mammata* is present in the UK, although not widely distributed. The pest was reported on *S. aucuparia* (Eriksson, 2014; Vasilyeva & Scheuer, 1996). Mechanical wounds including pruning wounds are expected to be present and may represent infection courts. The host plants can be present either inside or in the surroundings of the nurseries. Altogether, this suggests that the association of *E. mammata* with the commodity is possible **Measures taken against the pest and their efficacy** General measures taken by the nurseries are effective against the pathogen. These measures include (a) the use of certified plant material; (b) inspections, surveillance, monitoring, sampling and laboratory testing; (c) the removal of infected plant material and (d) application of pest control products **Interception records** In the EUROPHYT/TRACES-NT database, there are no records of notification of *Sorbus* plants for planting or any other commodity from the UK due to the presence of *E. mammata* (EUROPHYT/TRACES-NT, online) **Shortcomings of current measures/procedures** No major shortcomings were identified in the evaluation **Main uncertainties** • The level of susceptibility of *Sorbus* spp. to the pathogen. • Whether symptoms on *Sorbus* spp. are recognisable and may be promptly detected. • The presence/abundance of the pathogen in the area where the nurseries is located. • Effect of fungicide treatments against the pathogen.

Overview of evaluation of *E. mammata* for the specimen trees					
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	9886 out of 10,000 plants	9931 out of 10,000 plants	9959 out of 10,000 plants	9980 out of 10,000 plants	9996 out of 10,000 plants
Proportion of infested plants	4 out of 10,000 plants	20 out of 10,000 plants	41 out of 10,000 plants	69 out of 10,000 plants	114 out of 10,000 plants

Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity** *E. mammata* is present in the UK, although not widely distributed. The pest was reported on *S. aucuparia* (Eriksson, 2014; Vasilyeva & Scheuer, 1996). Mechanical wounds including pruning wounds are expected to be present and may represent infection courts. The host plants can be present either inside or in the surroundings of the nurseries. Altogether, this suggests that the association of *E. mammata* with the commodity is possible **Measures taken against the pest and their efficacy** General measures taken by the nurseries are effective against the pathogen. These measures include (a) the use of certified plant material; (b) inspections, surveillance, monitoring, sampling and laboratory testing; (c) the removal of infected plant material and (d) application of pest control products **Interception records** In the EUROPHYT/TRACES-NT database, there are no records of notification of *Sorbus* plants for planting or any other commodity from the UK due to the presence of *E. mammata* (EUROPHYT/TRACES-NT, online) **Shortcomings of current measures/procedures** No major shortcomings were identified in the evaluation **Main uncertainties** • The level of susceptibility of *Sorbus* spp. to the pathogen. • Whether symptoms on Sorbus spp. are recognisable and may be promptly detected. • The presence/abundance of the pathogen in the area where the nurseries is located. • Effect of fungicide treatments against the pathogen.

5.2.2 | Overview of the evaluation of *Phytophthora ramorum*

Overview of evaluation of *Phytophthora ramorum* for bundles of bare-root plants					
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	9812 out of 10,000 plants	9908 out of 10,000 plants	9969 out of 10,000 plants	9994 out of 10,000 plants	9999 out of 10,000 plants
Proportion of infected plants	1 out of 10,000 plants	6 out of 10,000 plants	31 out of 10,000 plants	92 out of 10,000 plants	188 out of 10,000 plants

(Continues)

(Continued)

Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity** *P. 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. *P. ramorum* has a wide host range. The possible entry of *P. ramorum* from the surrounding environment may occur through wind, water and infested soil propagules on feet of animals/humans entering the field (if any). The pathogen can also enter with new seedlings of *Sorbus aucuparia* and new plants of other species used for plant production in the nurseries **Measures taken against the pest and their efficacy** *P. ramorum* is a quarantine pest in UK and is under official control. General measures taken by the growers are effective against this pathogen. These measures include (a) registration of production sites; (b) the use of certified plant material; (c) surveillance, monitoring and sampling; (d) hygiene measures; (e) irrigation water testing; (f) washing of the roots of the bare-rooted plants; (g) application of pest control products; (h) inspection and management of plants before export **Shortcomings of current measures/procedures** No major shortcomings were identified in the evaluation **Main uncertainties** – It is not clear if the propagation material of alternative host is covered in the certification of plant material scheme. – The efficiency of the hygiene measures especially concerning the cleaning of the machinery and the possible movement of soil within the nursery. – In case of irrigation water, the frequency and the method used for the detection of the pathogen. – The health status of the other plant species cultivated/traded in the nurseries.

Overview of evaluation of *Phytophthora ramorum* for the rooted plants in pots					
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	9969 out of 10,000 plants	9984 out of 10,000 plants	9992 out of 10,000 plants	9996 out of 10,000 plants	9999 out of 10,000 plants
Proportion of infected plants	1 out of 10,000 plants	4 out of 10,000 plants	8 out of 10,000 plants	16 out of 10,000 plants	31 out of 10,000 plants
Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity** *P. 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. *P. ramorum* has a wide host range. The possible entry of *P. ramorum* from the surrounding environment to the nurseries may occur through wind, water and infested soil propagules on feet of animals/humans entering the nurseries. The pathogen can also enter the nurseries with new seedlings of *Sorbus aucuparia* and new plants of other species used for plant production in the nurseries **Measures taken against the pest and their efficacy** *P. ramorum* is a quarantine pest in UK and is under official control. General measures taken by the nurseries are effective against this pathogen. These measures include (a) registration of production sites; (b) the use of certified plant material; (c) the use of certified growing media; (d) surveillance, monitoring, and sampling; (e) hygiene measures; (f) irrigation water testing; (g) application of pest control products; (h) inspection and management of plants before export **Shortcomings of current measures/procedures** No major shortcomings were identified in the evaluation **Main uncertainties** – It is not clear if the propagation material of alternative host is covered in the certification of plant material scheme. – The efficiency of the hygiene measures especially concerning the cleaning of the machinery and the possible movement of soil within the nursery. – In case of irrigation water, the frequency and the method used for the detection of the pathogen.				

Overview of evaluation of *Phytophthora ramorum* for the specimen trees					
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	9901 out of 10,000 plants	9944 out of 10,000 plants	9978 out of 10,000 plants	9996 out of 10,000 plants	10,000 out of 10,000 plants
Proportion of infected plants	0.09 out of 10,000 plants	4 out of 10,000 plants	21 out of 10,000 plants	56 out of 10,000 plants	99 out of 10,000 plants

(Continued)

Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity** *P. 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. *P. ramorum* has a wide host range. The possible entry of *P. ramorum* from the surrounding environment to the nurseries may occur through wind, water and infested soil propagules on feet of animals/humans entering the nurseries. The pathogen can also enter the nurseries with new seedlings of *Sorbus aucuparia* and new plants of other species used for plant production in the nurseries **Measures taken against the pest and their efficacy** *P. ramorum* is a quarantine pest in UK and is under official control. General measures taken by the nurseries are effective against this pathogen. These measures include (a) registration of production sites; (b) the use of certified plant material; (c) the use of certified growing media; (d) surveillance, monitoring and sampling; (e) hygiene measures; (f) irrigation water testing; (g) application of pest control products; (h) inspection and management of plants before export **Shortcomings of current measures/procedures** No major shortcomings were identified in the evaluation **Main uncertainties** – It is not clear if the propagation material of alternative host is covered in the certification of plant material scheme. – The efficiency of the hygiene measures especially concerning the cleaning of the machinery and the possible movement of soil within the nursery. – In case of irrigation water, the frequency and the method used for the detection of the pathogen.

5.2.3 | Outcome of expert knowledge elicitation

Table 10 and Figure 7 show the outcome of the EKE regarding pest freedom after the evaluation of the currently proposed risk mitigation measures for the selected pests.

Figure 8 provides an explanation of the descending distribution function describing the likelihood of pest freedom after the evaluation of the currently proposed risk mitigation measures for *P. ramorum* on *S. aucuparia* bare-root plants designated for export to the EU.

TABLE 10 Assessment of the likelihood of pest freedom following evaluation of current risk mitigation measures against pests on *Sorbus aucuparia* 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		*Entoleuca mammata* (Bare rooted)					L	M		U
2		*Entoleuca mammata* (Potted plants)					L	M		U
3		*Entoleuca mammata* (Specimen trees)				L		M		U
4		*Phytophthora ramorum* (Bare rooted)				L		M		U
5		*Phytophthora ramorum* (Potted plants)						L	M	U
6		*Phytophthora ramorum* (Specimen trees)					L	M		U

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

Panel A

	Pest freedom category	Pest fee plants out of 10,000
	Sometimes pest free	≤ 5000
	More often than not pest free	5000 to ≤ 9000
	Frequently pest free	9000 to ≤ 9500
	Very frequently pest free	9500 to ≤ 9900
	Extremely frequently pest free	9900 to ≤ 9950
	Pest free with some exceptional cases	9950 to ≤ 9990
	Pest free with few exceptional cases	9990 to ≤ 9995
	Almost always pest free	9995 to ≤ 10,000

Panel B

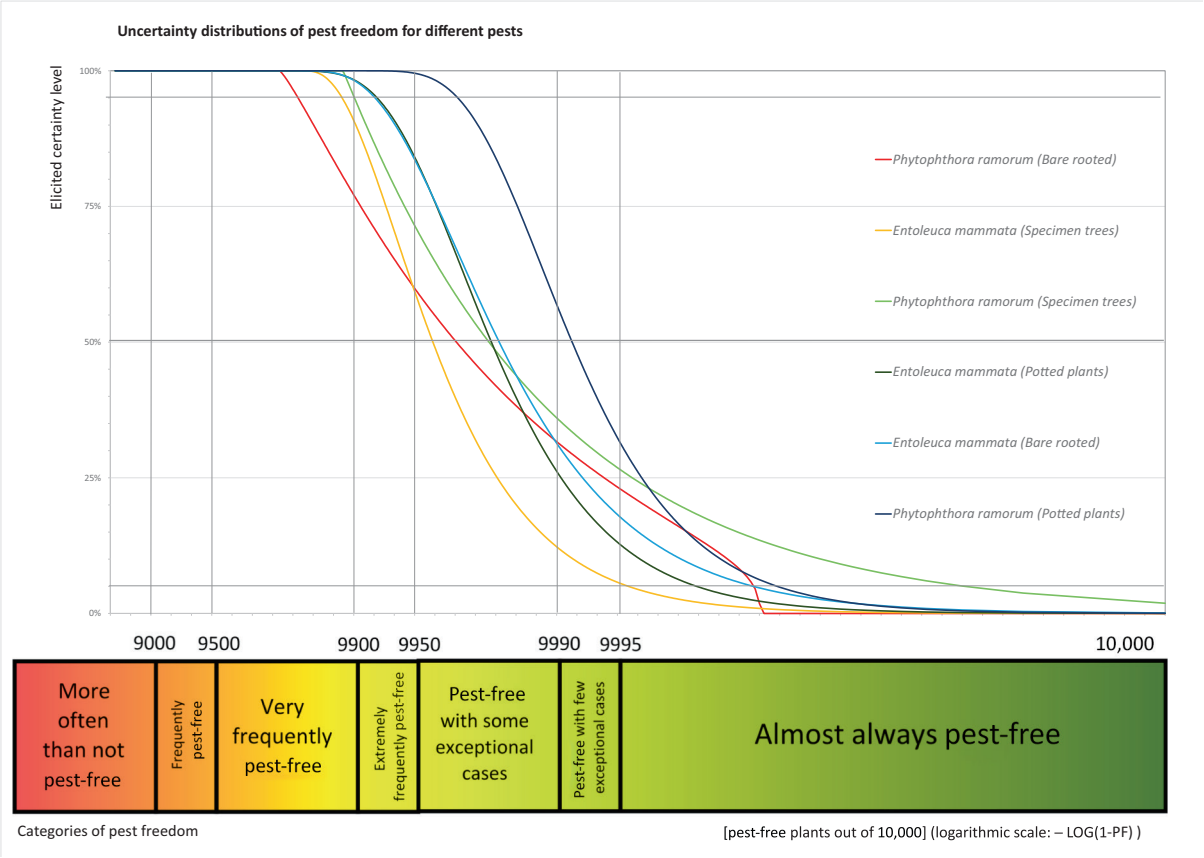


FIGURE 7 The elicited certainty (*y*-axis) of the number of pest-free *Sorbus aucuparia* plants (*x*-axis; log-scaled) out of 10,000 plants designated for export to the EU introduced from UK for all evaluated pests visualised as descending distribution function. Horizontal lines indicate the percentiles (starting from the bottom 5%, 25%, 50%, 75%, 95%).

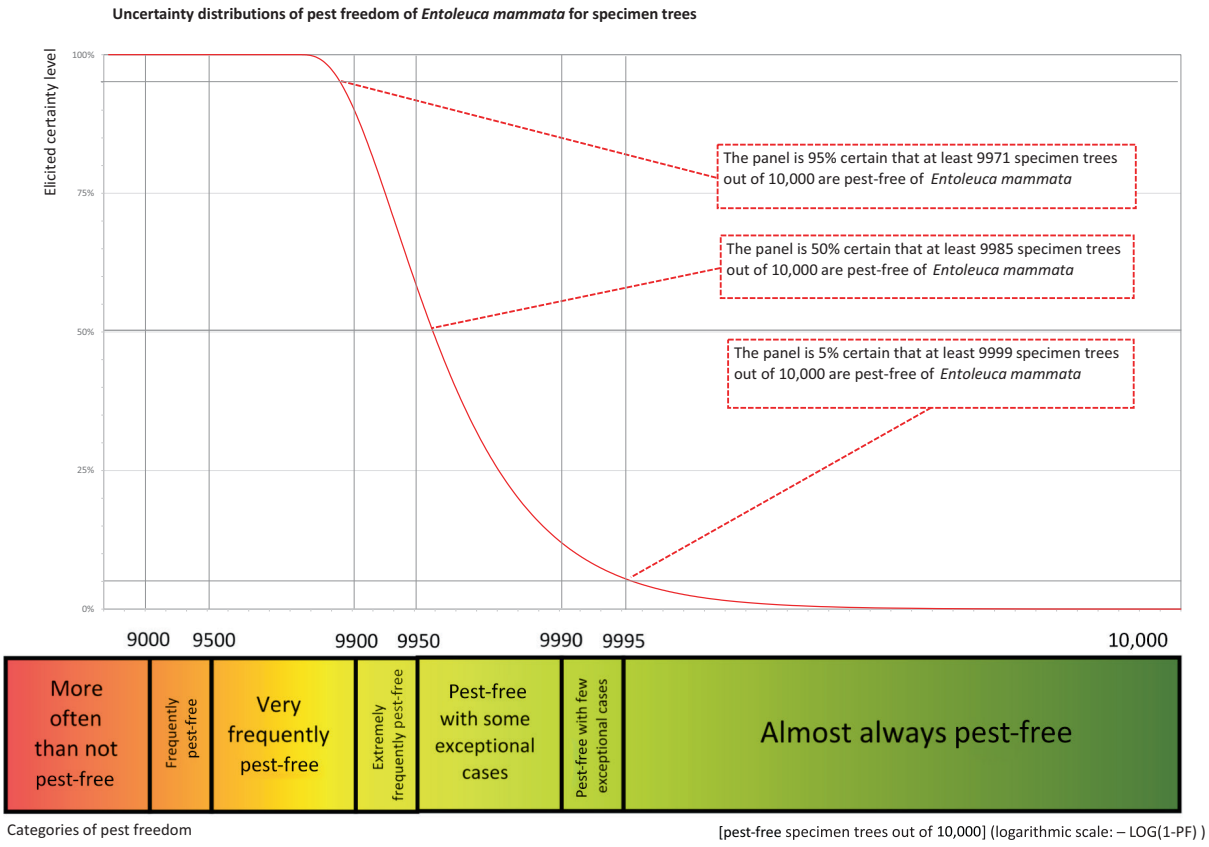


FIGURE 8 The explanation of the descending distribution function describing the likelihood of pest freedom after the evaluation of the currently proposed risk mitigation measures for *Sorbus aucuparia* specimen trees designated for export to the EU based on the example of *E. mammata*.

6 | CONCLUSIONS

There are two pests (*Entoleuca mammata* and *Phytophthora ramorum* (non-EU isolates)) identified to be present in UK and considered to be potentially associated with the *S. aucuparia* plants imported from the UK and relevant for the EU. The likelihood of the pest freedom after the evaluation of the implemented risk mitigation measures for bare-root, rooted plants in pots and specimen trees of *S. aucuparia* designated for export to the EU was estimated.

For *E. mammata*, the likelihood of pest freedom for bare-root *S. aucuparia* plants 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 9921 and 10,000 bare-root *S. aucuparia* plants per 10,000 will be free from *E. mammata*. The likelihood of pest freedom for rooted *S. aucuparia* plants in pots was estimated 'pest free with some 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 9923 and 10,000 rooted *S. aucuparia* plants in pots per 10,000 will be free from *E. mammata*. The likelihood of pest freedom for *S. aucuparia* specimen trees was estimated '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 9886 and 10,000 *S. aucuparia* specimen trees per 10,000 will be free from *E. mammata*.

For *P. ramorum*, the likelihood of pest freedom for bare-root *S. aucuparia* plants following evaluation of current risk mitigation measures was estimated as 'pest some 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 9812 and 10,000 bare-root *S. aucuparia* plants per 10,000 will be free from *P. ramorum*. The likelihood of pest freedom for rooted *S. aucuparia* plants in pots was estimated 'pest free with some exceptional cases' 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 9969 and 10,000 rooted *S. aucuparia* plants in pots per 10,000 will be free from *P. ramorum*. The likelihood of pest freedom for *S. aucuparia* specimen trees was estimated '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 9901 and 10,000 *S. aucuparia* specimen trees per 10,000 will be free from *P. ramorum*.

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 Organisation
PLH	Plant Health
PRA	Pest Risk Assessment
PZQPs	Protected Zone Quarantine Pests
RNQPs	Regulated Non-Quarantine Pests
UK	United Kingdom

GLOSSARY

Control (of a pest)	Suppression, containment or eradication of a pest population (IPPC Secretariat, 2024).
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 (IPPC Secretariat, 2024).
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (IPPC Secretariat, 2024).
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 (IPPC Secretariat, 2024).
Measures	Control (of a pest) is defined in ISPM 5 (IPPC Secretariat, 2024) as 'Suppression, containment or eradication of a pest population' (IPPC Secretariat, 2024). 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 (IPPC Secretariat, 2024).
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 (IPPC Secretariat, 2024).
Protected zone	A Protected zone is an area recognised at EU level to be free from a harmful organism, which is established in one or more other parts of the Union.

Quarantine pest	A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled (FAO, 2019).
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, 2019).
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, 2019).

CONFLICT OF INTEREST

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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APPENDIX A

Datasheets of pests selected for further evaluation

A.1 | *ENTOLEUCA MAMMATA*

A.1.1 | Organism information

Taxonomic information	Current valid scientific name: *Entoleuca mammata* Synonyms: Anthostoma blakei, Anthostoma morsei, Fuckelia morsei, Hypoxylon blakei, Hypoxylon holwayi, Hypoxylon mammatum, Hypoxylon morsei, Hypoxylon pauperatum, Hypoxylon pruinatum, Nemania mammata, Rosellinia pruinata, Sphaeria mammata, Sphaeria pruinata (according to Index Fungorum) Name used in the EU legislation: Entoleuca mammata (Wahlenb.) Rogers and Ju Order: Xylariales Family: Xylariaceae Common name: hypoxylon canker of poplar, canker of aspen
Group	Fungi
EPPO code	HYPOMA
Regulated status	*E. mammata* is listed in Annex III of Commission Implementing Regulation (EU) 2019/2072 as protected zone quarantine pest for Ireland The pathogen is quarantine pest in China and Israel. It is on the A1 list of Türkiye (EPPO, online)
Pest status in the UK	*E. mammata* is present in the UK, with few occurrences in England, Wales, Channel Islands and Scotland (CABI, online; EPPO, online)
Pest status in the EU	Not relevant, *E. mammata* is an EU regulated pest
Host status on *Sorbus*	*E. mammata* was reported on *Sorbus aucuparia* (Eriksson, 2014; Vasilyeva & Scheuer, 1996). There is no information on whether *E. mammata* can also infect other species of *Sorbus*
Risk Assessment information	• Scientific Opinion on the pest categorisation of *Entoleuca mammata* (EFSA PLH Panel, 2017). • UK Risk Register Details for *Entoleuca mammata* (DEFRA, online). • Express Pest Risk Analysis: *Entoleuca mammata* (Klejdysz et al., online). • Commodity risk assessment of *Acer campestris*, *A. platanoides*, *A. pseudoplatanus and A. campestre* plants from the UK (EFSA PLH Panel, 2023a, 2023b, 2023c, 2023d).
Other relevant information for the assessment	
Biology	*E. mammata* is an ascomycete fungus known as an important agent of canker disease in *Populus* species, mostly *Populus tremuloides* and *P. tremula*; other hardwood species like *Salix* spp. can also be infected (EFSA PLH Panel, 2017). The pathogen is native to North America and was introduced to Europe several centuries ago (Kasanen et al., 2004); it is now largely spread in the temperate zones of the northern hemisphere. *E. mammata* is present in Canada and in some northern states of the USA (Alaska, Iowa, Michigan, Minnesota, Montana, New Hampshire, New York, Wisconsin) The ascospores of *E. mammata* can infect the living wood of the hosts penetrating the periderm and invading tissues under healthy bark and through mechanical wounds, as well as through injuries caused by woodpeckers and insects, in particular the North American cerambycid beetles (mostly *Saperda inornata* and *Oberea* spp.) (Anderson et al., 1979a) and the cicada *Magicicada septemdecim* (Ostry and Anderson, 1983) not occurring in Europe; water stress can increase host susceptibility (EFSA PLH Panel, 2017). *E. mammata* is mostly found on trees 15–40 years old, but all ages can be infected (EFSA PLH Panel, 2017; EPPO, online). Infection usually starts from branches and twigs and then can spread to the main stem. The cankers expand very rapidly (7–8 cm per month) in summer and more slowly during winter; branches and stems can be girdled causing drying and breakage. The pathogen mostly develops in the range from 8 to 32°C, the optimum temperature is 28°C; toxins host-specific produced by the fungus are involved in pathogenesis (EFSA PLH Panel, 2017; EPPO, online_c; Stermer et al., 1984) *E. mammata* overwinters in host tissues as both mycelium and spores. Conidia are produced 5–14 months after infection, but their role in the disease transmission is considered not relevant (EFSA PLH Panel, 2017) The pathogen spreads over long distances via windborne ascospores, which are produced only 2–3 years after infection; cankers on felled trees on the ground can continue to produce ascospores for 23 months. Ascospores are dispersed at a temperature above −4°C and in wet weather; a minimum of 16°C is required for starting germination, which became rapid at 28–32°C (EFSA PLH Panel, 2017) Infected wood, mostly with bark, maybe a pathway for the passive spread of *E. mammata* in international trade; however, also young plants may carry ascospores or mycelium of the fungus, which can exist as a latent infection on living material inadvertently moved (EFSA PLH Panel, 2017; EPPO online)

(Continues)

(Continued)

Symptoms	**Main type of symptoms**	The symptoms are observed on *Populus* trees. Early symptoms of cankers on the bark appear as slightly sunken, yellowish-orange areas with an irregular border. Young cankers can be easily identified by removing the bark to expose the white mycelium in the cambial zone. The outer bark in older cankers is then lifted into blister-like patches and breaks away, exposing blackened areas prominently visible on green branches and trunks. Callus formation only occasionally develops because cankers spread very quickly (Anderson et al., 1979b; EPPO, online) Wilting of leaves may be observed when the trees are girdled, as well as sprouting of new shoots on stems and branches. Infected trees can be secondarily colonised by other fungi, accelerating the host decline (EPPO, online) There is no information on the symptoms caused to *Sorbus* plants
	Presence of asymptomatic plants	The disease caused by *E. mammata* has a latent period and symptoms can appear only 2 years after the ascospore infection; therefore, asymptomatic plants can be found (Ostry and Anderson, 2009)
	Confusion with other pests	Some *Hypoxylon* species present in Europe on deciduous trees (*H. confluens* and *H. udum*) show symptoms similar to those caused by *E. mammata* but can be easily distinguished in the laboratory by the ascospore characteristics (EFSA PLH Panel, 2017)
Host plant range	In North America, *Entoleuca mammata* mainly infects quacking aspen (*Populus tremuloides*); minor damage is recorded on *P. grandidentata*, *P. balsamifera* and various *Populus* hybrids Other reported hosts in North America are *Acer*, *Alnus*, *Betula*, *Carpinus*, *Fagus*, *Picea*, *Pyrus*, *Salix*, ***Sorbus*** and *Ulmus* (Manion and Griffin, 1986) In Europe, the main host is *Populus tremula;* other hosts are *Populus alba*, *P. nigra*, *P. trichocarpa* and the hybrid *P. tremula* × *P. tremuloides* (Ostry, 2013). The fungus is reported in *S. aucuparia* (USDA Fungal database, online)	
Reported evidence of impact	The fungus is an EU regulated pest	
Evidence that the commodity is a pathway	Plants for planting may carry ascospores and mycelium of *E. mammata* also as asymptomatic plants (EFSA PLH Panel; EPPO online_c). Mechanical wounds including pruning may facilitate infection courts. Bare-rooted plants and plants in pots with or without leaves can be a pathway	
Surveillance information	*E. mammata* is not a regulated pest for UK and it is not under official control and surveillance (Dossier, Section 1.0)	

A.1.2 | Possibility of pest presence in the nursery

A.1.2.1 | Possibility of entry from the surrounding environment

Entoleuca mammata is present in the UK in England, Channel Islands and Scotland (CABI, online; EPPO, online_b).

The pathogen can naturally spread with ascospores dispersed by air currents also over long distance.

The locations of the exporting nurseries are the same as for the nurseries evaluated for the *Acer* spp. Dossiers. Therefore, the panel assumes that the same host plant species are present in the surrounding environment.

Exporting 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. Woodlands tend to be a standard UK mixed woodland with a range of UK native trees that include host plants for the fungus such as *Quercus* sp., Poplar (*Populus*), Sycamore (*Acer pseudoplatanus*), Norway maple (*Acer platanus*) and field maple (*Acer campestre*). Hedges are made up of a range of species, including alder (*Alnus glutinosa*) as a host for *E. mammata* (Dossier Section 1.0).

Uncertainties:

– The presence of the pathogen on host plants in the surrounding area.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for *E. mammata* to enter the nurseries from the surrounding environment via ascospores transported by wind and air currents.

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

The starting material is a mix of seeds and seedlings depending on the nursery. *S. aucuparia* seeds purchased in the UK may be certified under the Forestry Commission's Voluntary Scheme for the Certification of Native Trees and Shrubs. Most

plants are grown from UK-produced seeds and seedlings; however, some plants may be obtained from the EU (mostly the Netherlands). This is the only source of plants obtained from abroad (Dossier Section 1.0).

Most of the nurseries expected to export to the EU produce plants from seed and seedlings (UK plant passports); therefore, there are no mother plants of *S. aucuparia* present in the nurseries. There are however *S. aucuparia* cultivars that are chip budded in July/August and the seedling of the same species are used as rootstocks for all cultivars (Dossier Section 1.0).

In addition to *S. aucuparia* plants, only one of the nurseries expected to export to the EU has mother plants of other tree species present in the nurseries (*S. intermedia*, *Corylus avellana* and various *Prunus* species) (Dossier Section 1.0). 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 travel with them.

The nurseries use 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 are heat-treated by commercial suppliers during production to eliminate pests and diseases (Dossier Section 1.0). There is no evidence that soil or growing media may be a pathway for *E. mammata*.

Uncertainties:

- No information is available on the provenance of new plants used for plant production in the area of the nurseries.
- It is not known if the fungus can be present on seeds or seedlings.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is possible for the pathogen to enter the nurseries via new seedlings of *Sorbus* and 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.1.2.3 | Possibility of spread within the nursery

Sorbus plants are grown in containers (cells, pots, tubes, etc.) outdoors, in the open air or 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 of *S. aucuparia* present in the nurseries (Dossier Section 1.0). Only one of the nurseries expected to export to the EU have mother plants of other tree species present in the nurseries (*S. intermedia*, *Corylus avellana* and various *Prunus* spp.) (Dossier Section 1.0), but none have been reported to be host of the fungus.

Once entered, ascospores of *E. mammata* could be produced on infected plants and naturally spread within the nurseries by air currents.

Uncertainties:

- No information on other host species (e.g. *Populus* spp.) that can be present in the export nursery.
- Whether ascospores are produced on infected nursery plants.

Taking into consideration the above evidence and uncertainties, the Panel considers that the spread of the pathogen within the nurseries is possible by air currents.

A.1.3 | Information from interceptions

In the EUROPHYT/TRACES-NT database, there are no records of notification of *Sorbus* plants for planting neither from the UK nor from other countries due to the presence of *Entoleuca mammata* (EUROPHYT/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 *E. mammata* is provided. The description of the risk mitigation measures currently applied in the UK is provided in Table A.1.

TABLE A.1 Evaluation of the risk mitigation measures.

N	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
1	Registration of production sites	Yes	All nurseries are registered as professional operator with the UK NPPO, by the APHA for England and Wales, or with SASA for Scotland, and is authorised to issue UK plant passports (Dossier Section 1.0) Evaluation: The risk mitigation measure is expected to be effective in reducing the likelihood of presence of the pathogen on the commodity Uncertainties: – Whether symptoms on *Sorbus* spp. are easily recognisable.
2	Certification of propagation material	Yes	Seeds of *S. aucuparia* purchased in the UK may be certified under the Forestry Commission's Voluntary Scheme for the Certification of Native Trees and Shrubs. Seedlings for *Sorbus* spp. production sourced in the UK are certified with UK Plant Passports; seedlings from the EU countries are certified with phytosanitary certificates (Dossier Section 1.0) Evaluation: The risk mitigation measure is expected to be effective in reducing the likelihood of the presence of the pathogen on the commodity Uncertainties: – None.
3	Origin and treatment of growing media	No	Rooted plants in pots: In the production or procurement of these plants, the use of growing media is assessed for the potential to harbour and transmit plant pests. Growers most commonly use virgin peat or peat-free compost, which is a mixture of coir, tree bark, wood fibre, etc. The compost is heat-treated by commercial suppliers during production to eliminate pests and diseases. It is supplied in sealed bulk bags or shrink-wrapped bales and stored off the ground on pallets, these are completely hygienic and free from contamination. Where delivered in bulk, compost is kept in a dedicated bunker, either indoors or covered by tarpaulin outdoors, and with no risk of contamination with soil or other material (Dossier Section 1.0) Evaluation: Not relevant
4	Surveillance, monitoring and sampling	Yes	Inspection is carried out at least once a year as part of the Quarantine Surveillance programme (Great Britain uses the same framework for its surveillance programme as the EU). Surveillance is based on visual inspection with samples taken from symptomatic material, and where appropriate, samples are also taken from asymptomatic material (e.g. plants, tubers, soil, watercourses) (Dossier Section 1.0) Evaluation: This measure could have some effect Uncertainties: – Whether symptoms caused by the pathogen on *Sorbus* are recognisable. – Whether *Sorbus* plants are subjected to annual surveys.
5	Hygiene measures	No	According to the Dossier Section 1.0, all the nurseries have plant hygiene and housekeeping rules and practices in place, which are communicated to all relevant employees. The measures include: • Growing media • Weed management • Water usage • Cleaning and sterilisation • Waste treatment and disposal • Visitors Evaluation: Not relevant Uncertainties: – Whether the pathogen could infect through pruning wounds thereby making effective the disinfection of pruning tools.
6	Irrigation water	No	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. No quarantine pests have been found (Dossier Section 1.0) Evaluation: Not applicable.
7	Application of pest control products	Yes	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) Evaluation: Although *E. mammata* is generally not a target of pesticide treatments in nurseries, some fungicides could reduce the likelihood of infection by the pathogen Uncertainties: – No specific information on the fungicides used. – The level of efficacy of fungicides in reducing infection of *E. mammata*.

TABLE A.1 (Continued)

N	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
8	Measures against soil pests	No	Bare-root plants are lifted from the field in winter and then root-washed on site and stored prior to export (Dossier Section 1.0) Evaluation: Not relevant
11	Inspections and management of plants before export	Yes	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 Separate to any official inspection, plant material is checked by growers for plant health issues before dispatch Special provisions for inspection of *P. ramorum* and *E. amylovora* are in place Evaluation: This measure could have some effect Uncertainties: – Whether symptoms caused by the pathogen on *Sorbus* are recognisable.

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

E. mammata was already assessed as relevant pest for commodity risk assessment of *Acer campestre* plants from UK (EFSA, 2023a), *Acer platanoides* plants from UK (EFSA, 2023b), *Acer pseudoplatanus* plants from UK (EFSA, 2023c) and *Acer palmatum* plants from UK (EFSA, 2023d). The similarities between the dossier of *Acer* spp. and *Sorbus aucuparia* are:

- The type of commodities exported (bare-root plants, potted plants and specimen trees);
- The age and size of the exported plants;
- The overall production system;
- The location of the nurseries and the other host plants present in the surrounding environment;
- There is no evidence of differences in the susceptibility of *Acer* spp. and *Sorbus aucuparia*;

The only difference between *Acer* spp. and *S. aucuparia* would be the possibility that chip budding is used for the production of some cultivars of *S. aucuparia*.

No other major differences were identified; therefore, the Panel reused the results and reasonings of the Expert Elicitation of pest freedom of the pest *E. mammata* of *Acer* plants (EFSA, 2023a, 2023b, 2023c, 2023d).

A.1.5.1 | Reasoning for a scenario which would lead to a reasonably low number of infected bare-root, potted plants and specimen trees

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 *S. aucuparia* to be unsuitable/minor hosts for the pathogen. The scenario also assumes that symptoms of the disease are visible and promptly detected during inspections.

A.1.5.2 | Reasoning for a scenario which would lead to a reasonably high number of infected bare-root, potted plants and specimen trees

The scenario assumes a high 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 *S. aucuparia* is a suitable host for the pathogen. The scenario also assumes that symptoms of the disease are difficult to be detected during inspections.

A.1.5.3 | Reasoning for a central scenario equally likely to over- or underestimate the number of infected bare-root, potted plants and specimen trees (Median)

The scenario assumes a limited presence of the pathogen in the nurseries and the surroundings and that the plants are exposed to the pathogen for a sufficient period of time to cause infection through mechanical wounds. *S. aucuparia* is considered a minor host.

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 pathogen in the UK including 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.1.6 | Elicitation outcomes of the assessment of the pest freedom for *Entoleuca mammata*

The elicited and fitted values for *E. mammata* agreed by the Panel are shown in Tables A.2–A.7 and in Figures A.1–A.3.

TABLE A.2 Elicited and fitted values of the uncertainty distribution of pest infection by *Entoleuca mammata* per 10,000 bare-root *Sorbus aucuparia* plants.

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0.0					8		18		40					110
EKE	0.166	0.479	1.07	2.43	4.51	7.45	10.8	19.2	30.8	38.8	49.5	62.5	78.5	93.1	110

Note: The EKE results are the *BetaGeneral (0.86753, 6.3245, 0, 222)* distribution fitted with @Risk version 7.6.

Based on the numbers of estimated infected bare-root ***Sorbus aucuparia*** plants, 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.3.

TABLE A.3 The uncertainty distribution of bundles free of *Entoleuca mammata* per 10,000 bare-root *Sorbus aucuparia* plants calculated by Table A.2.

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9890					9960		9982		9992					10,000
EKE results	9890	9907	9921	9938	9950	9961	9969	9981	9989	9993	9995	9998	9998.9	9999.5	9999.8

Note: The EKE results are the fitted values.

TABLE A.4 Elicited and fitted values of the uncertainty distribution of pest infection by *Entoleuca mammata* per 10,000 potted *Sorbus aucuparia* plants.

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0.0					10		20		40					110
EKE	0.483	1.09	2.04	3.87	6.33	9.51	12.9	21.0	31.7	39.0	48.9	61.0	76.7	91.5	110

Note: The EKE results are the *BetaGeneral (1.1366,15.87,0,415)* distribution fitted with @Risk version 7.6.

Based on the numbers of estimated infected ***S. aucuparia*** potted plants, 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.5.

TABLE A.5 The uncertainty distribution of bundles free of *Entoleuca mammata* per 10,000 potted *Sorbus aucuparia* plants calculated by Table A.4.

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9890					9960		9980		9990					10,000
EKE results	9890	9908	9923	9939	9951	9961	9968	9979	9987	9990	9994	9996	9998.0	9999.9	9999.5

Note: The EKE results are the fitted values.

TABLE A.6 Elicited and fitted values of the uncertainty distribution of pest infection by *Entoleuca mammata* per 10,000 specimen *Sorbus aucuparia* trees.

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0.0					20		40		70					140
EKE	1.077	2.39	4.43	8.27	13.3	19.6	26.2	40.7	58.4	69.3	82.9	97.7	114	127	140

Note: The EKE results are the *BetaGeneral (1.1493, 3.2004, 0, 180)* distribution fitted with @Risk version 7.6.

Based on the numbers of estimated infected ***S. aucuparia*** specimen trees, 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.7.

TABLE A.7 The uncertainty distribution of bundles free of *Entoleuca mammata* per 10,000 *Sorbus aucuparia* specimen trees calculated by Table A.6.

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9860					9930		9960		9980					10,000
EKE results	9860	9873	9886	9902	9917	9931	9942	9959	9974	9980	9987	9992	9996	9998	9999

Note: The EKE results are the fitted values.

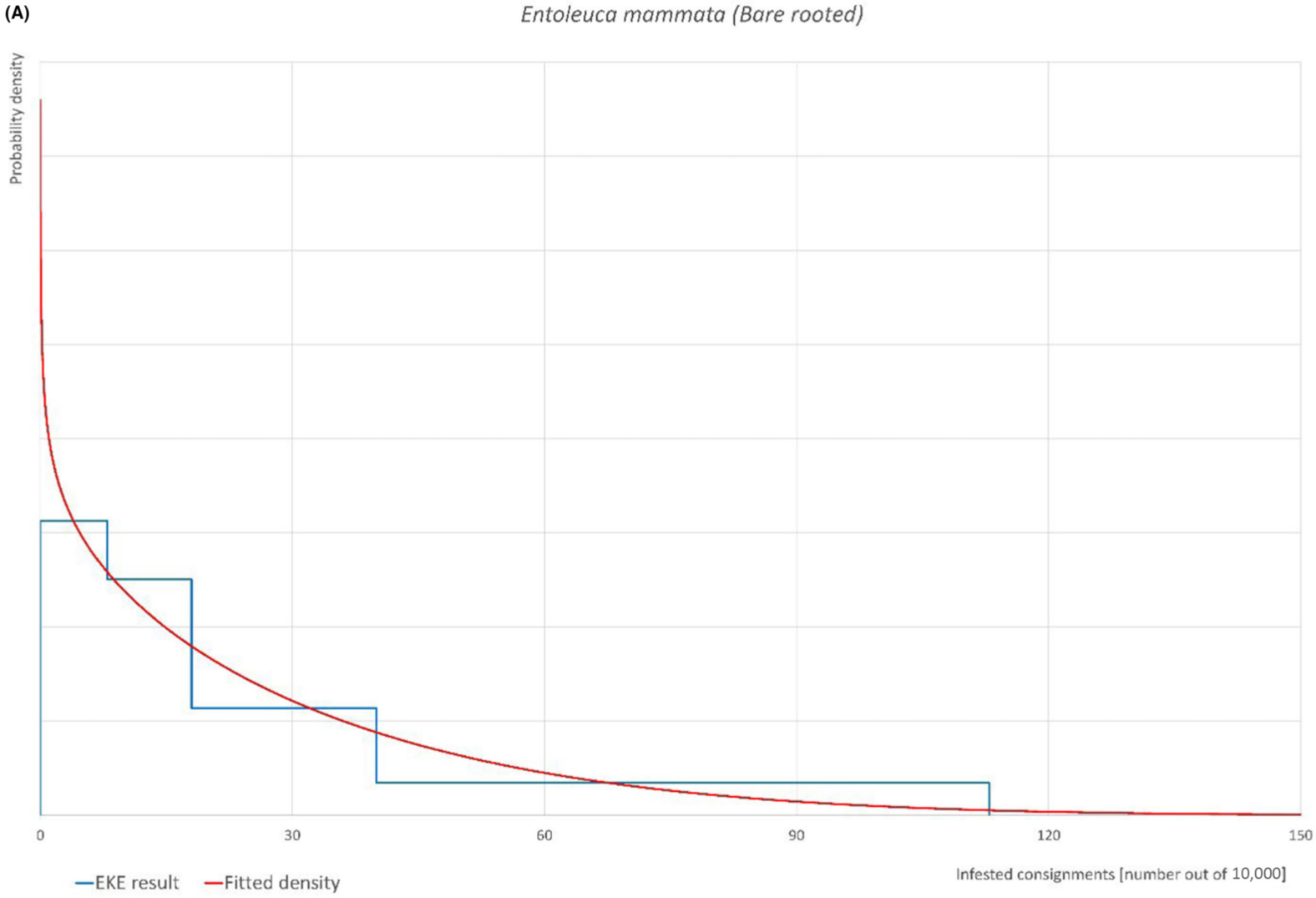


FIGURE A.1 (Continued)

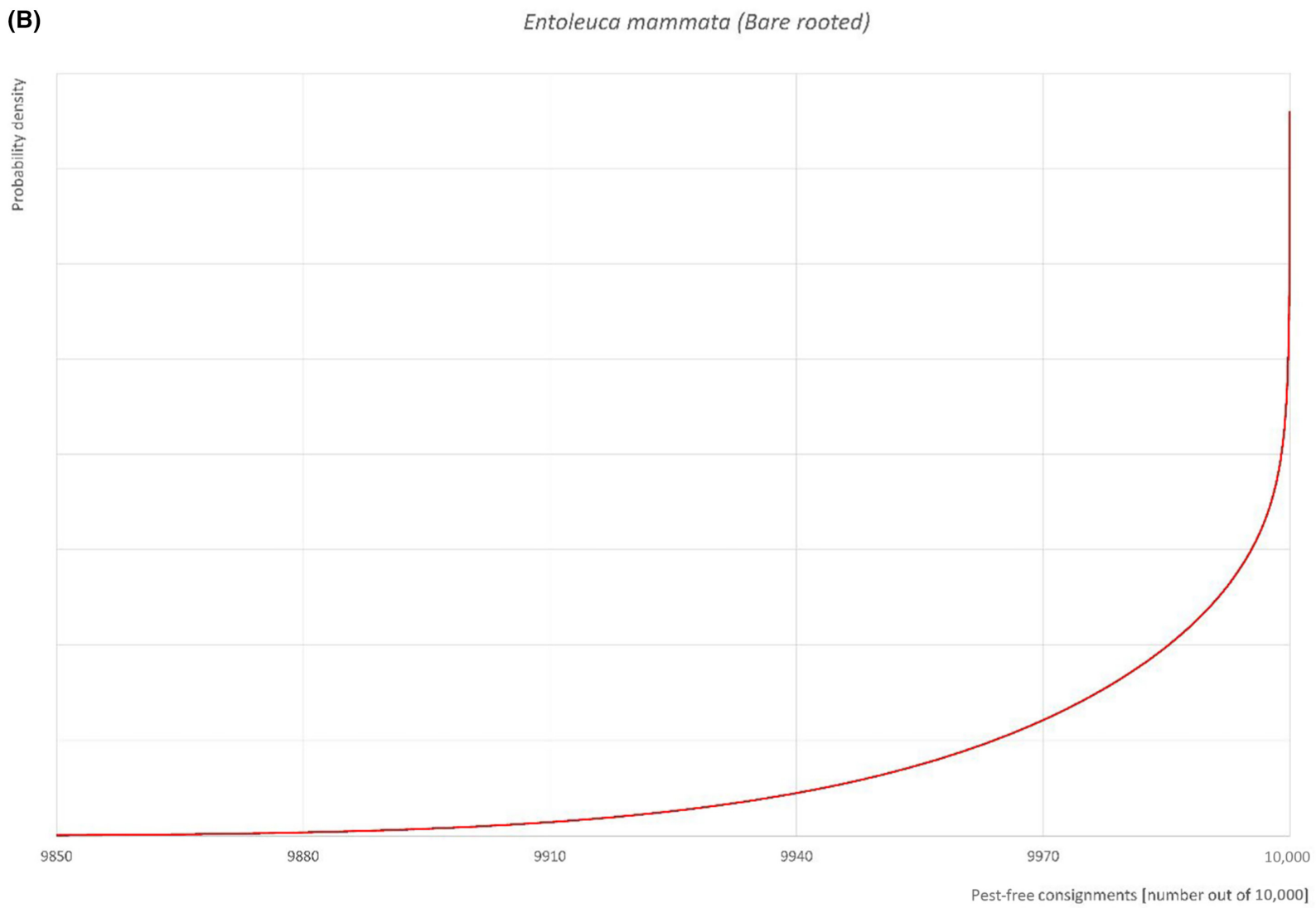


FIGURE A.1 (Continued)

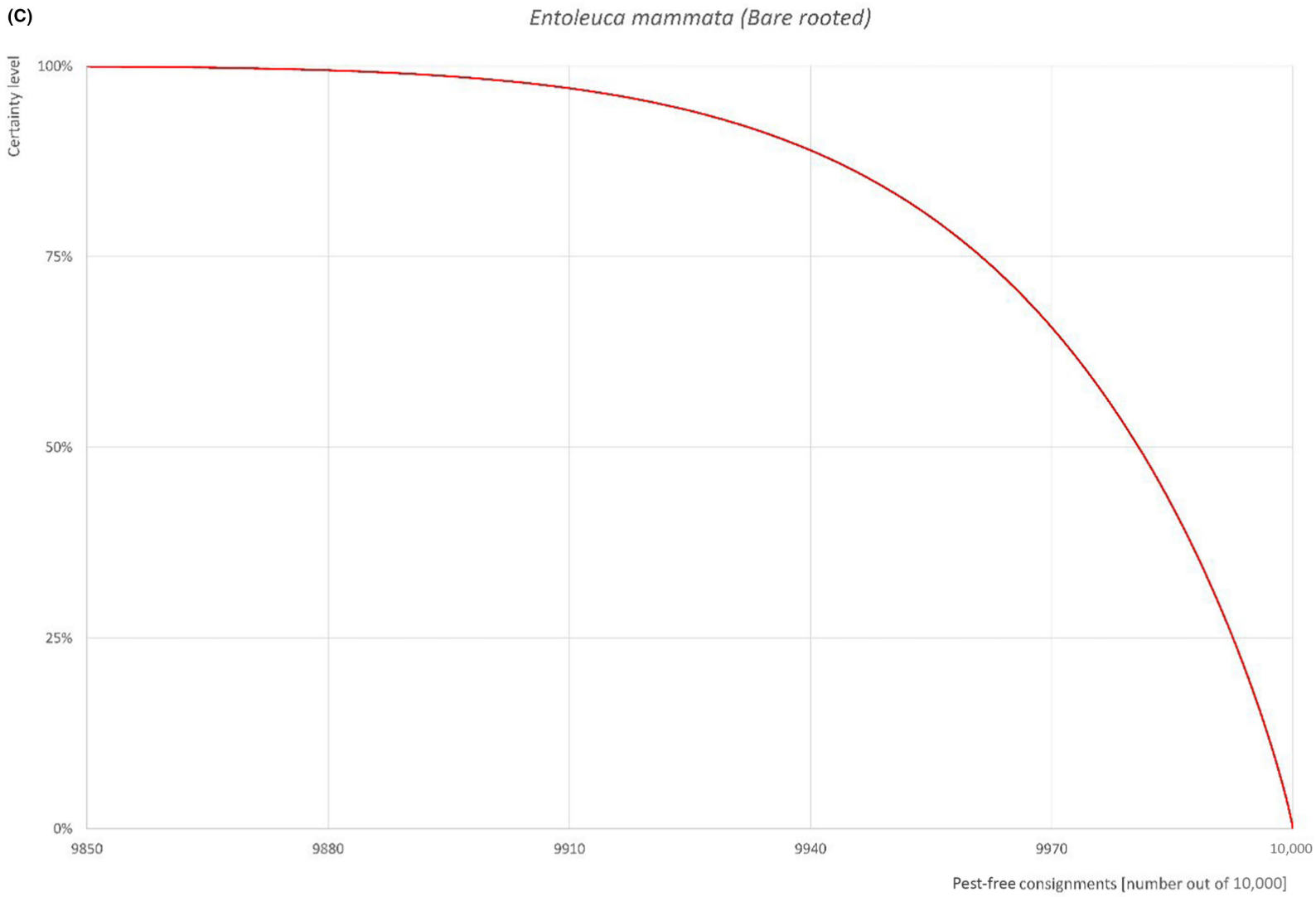


FIGURE A.1 (A) Elicited uncertainty of pest infestation per 10,000 bare-root *Sorbus aucuparia* plants (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (B) uncertainty of the proportion of pest-free 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.

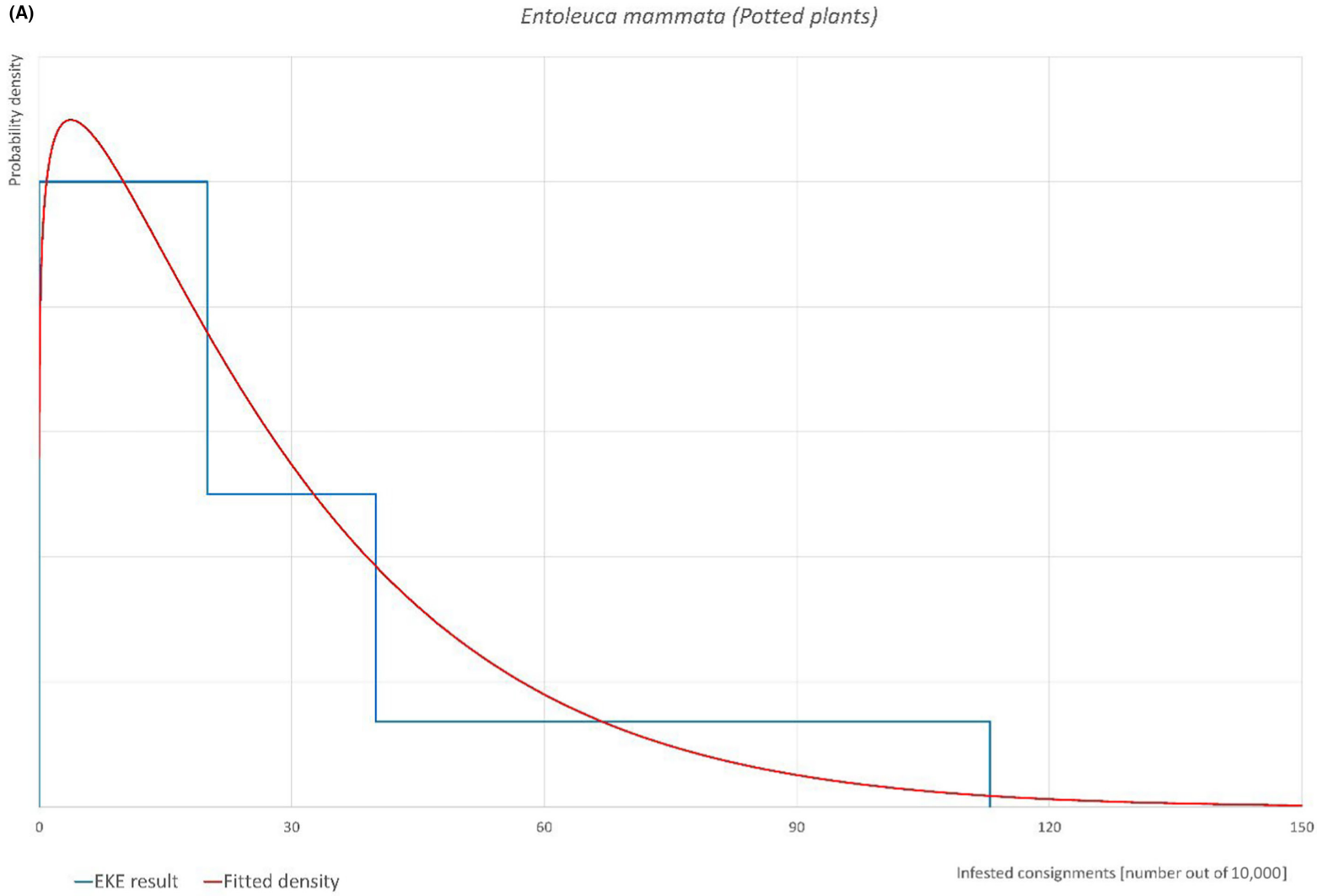


FIGURE A.2 (Continued)

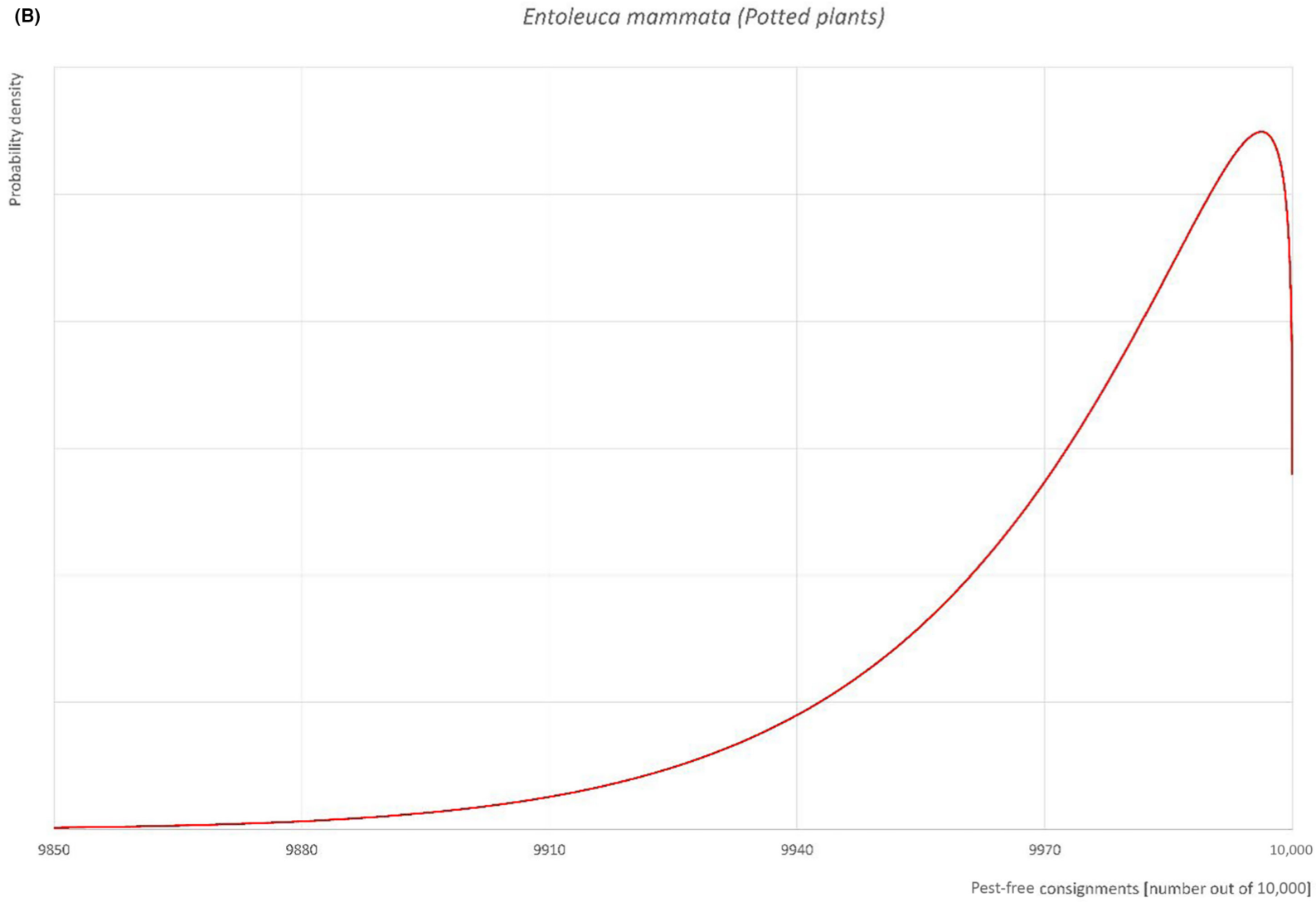


FIGURE A.2 (Continued)

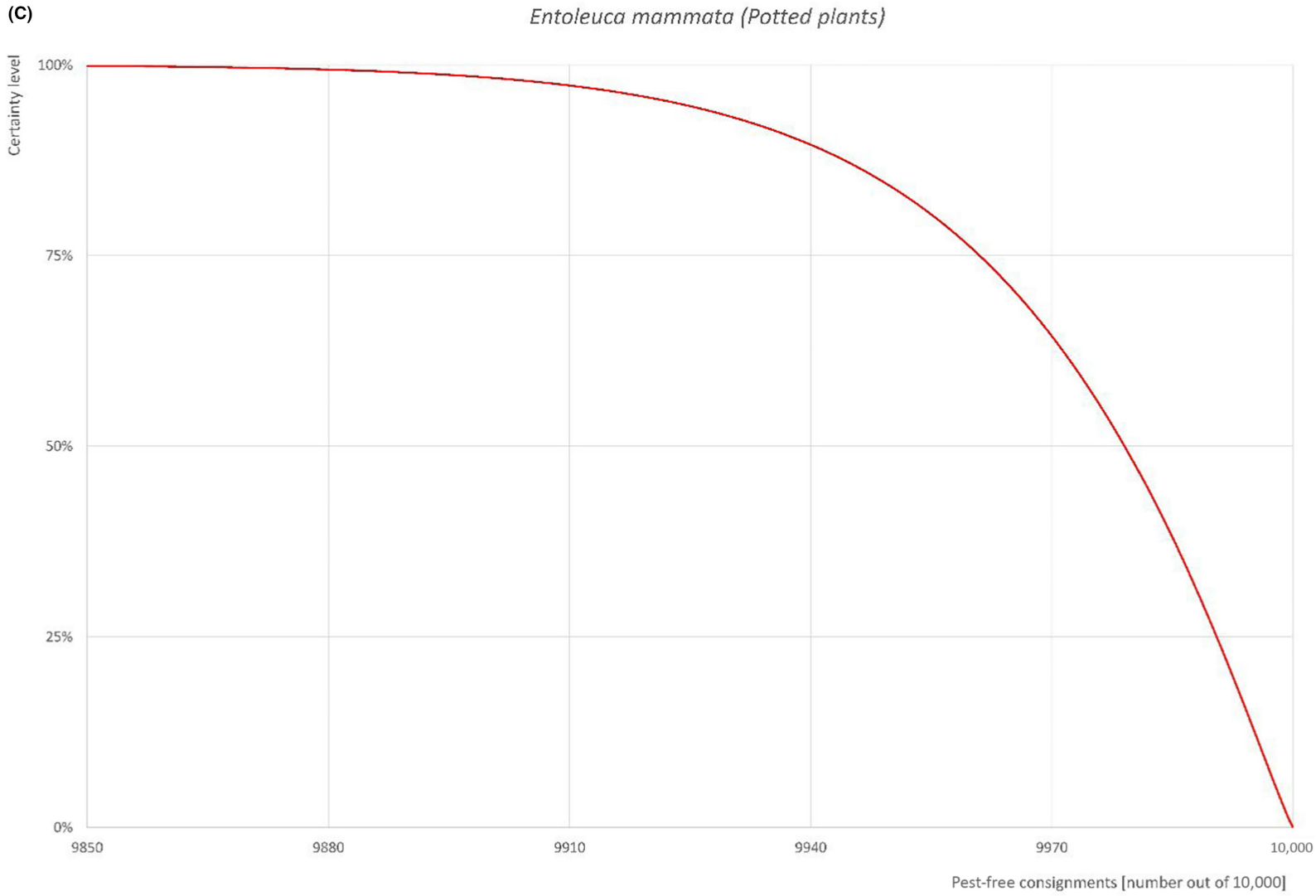


FIGURE A.2 (A) Elicited uncertainty of pest infestation per 10,000 rooted *Sorbus aucuparia* plants in pots (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (B) uncertainty of the proportion of pest-free 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.

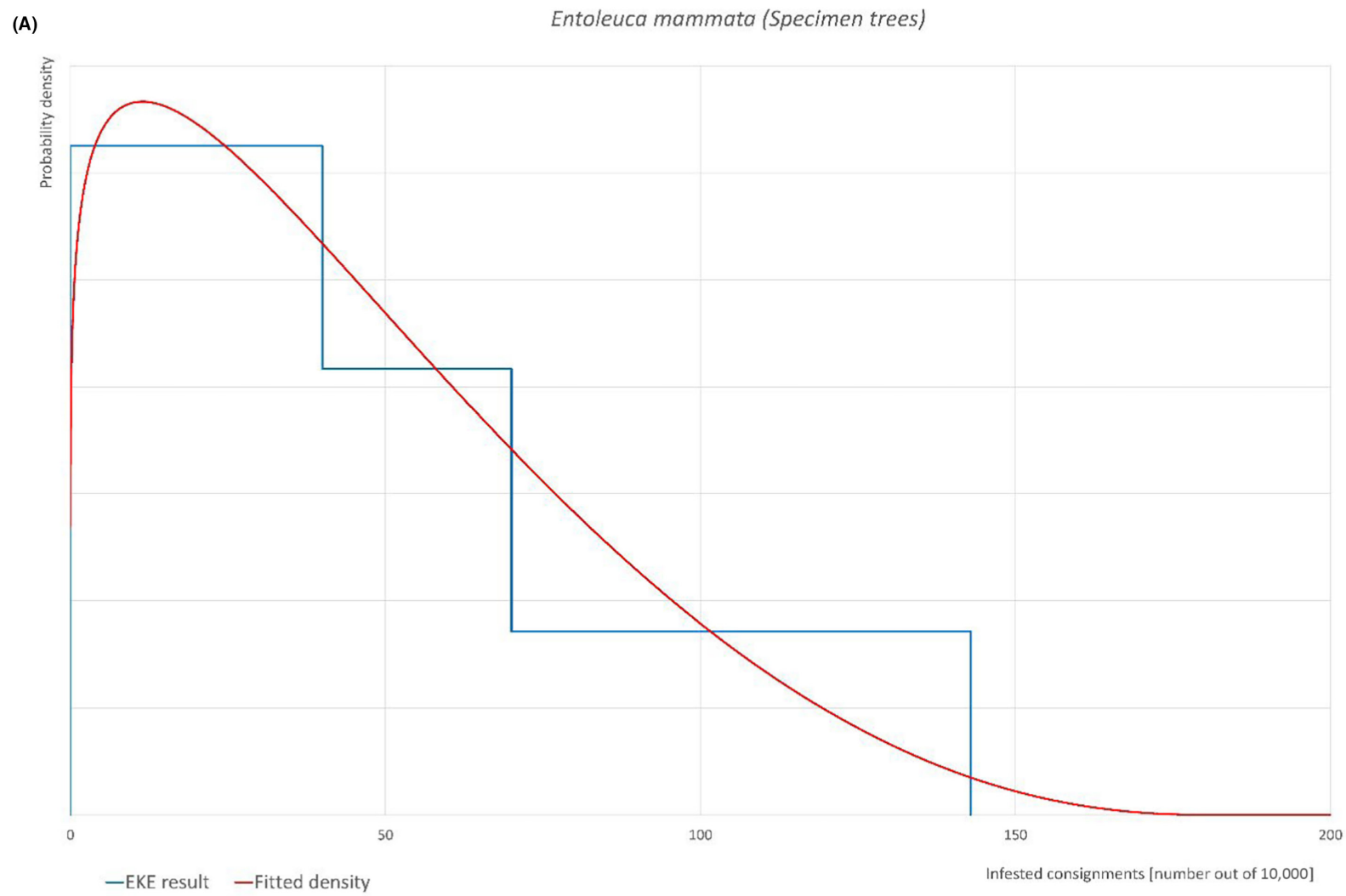
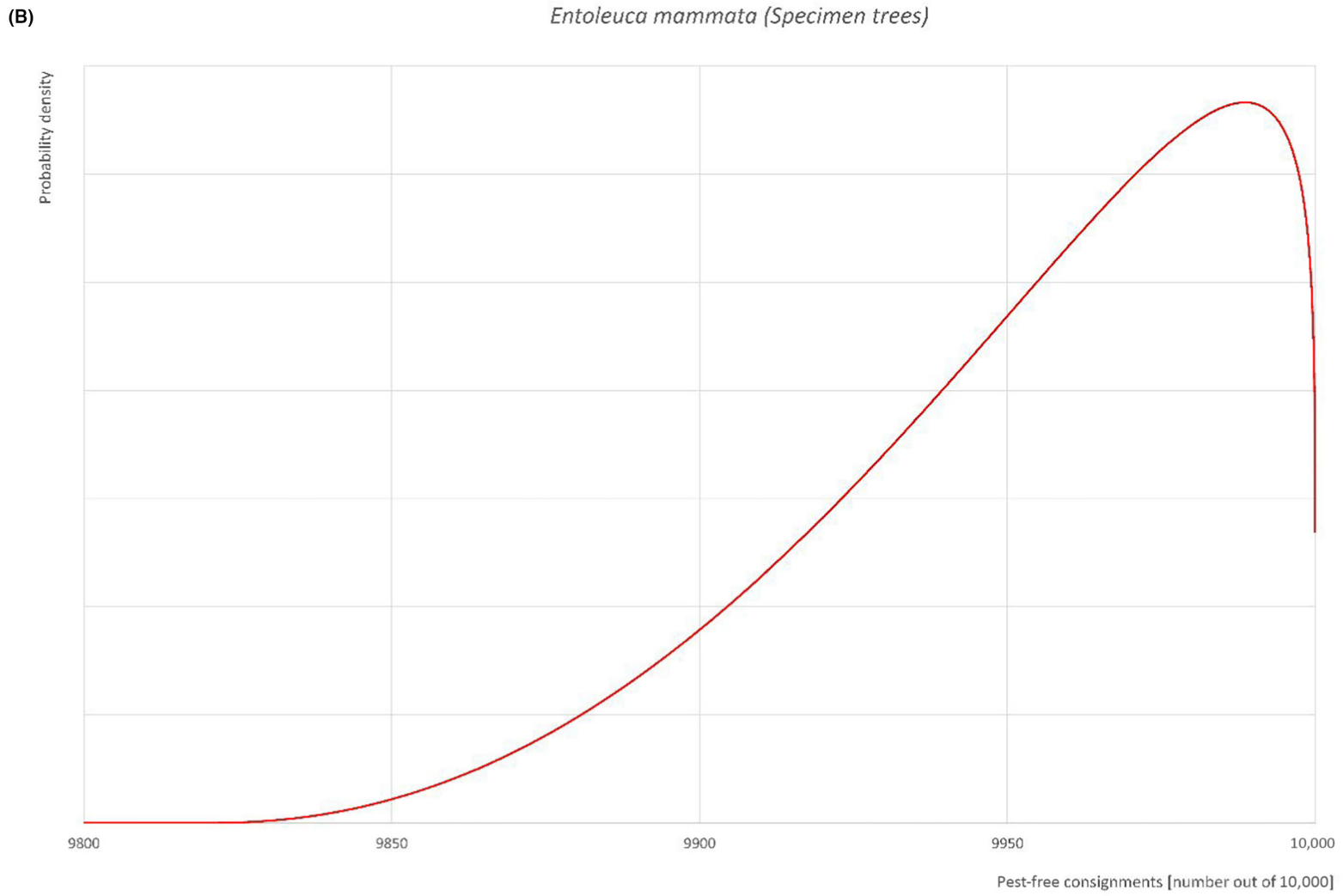


FIGURE A.3 (Continued)



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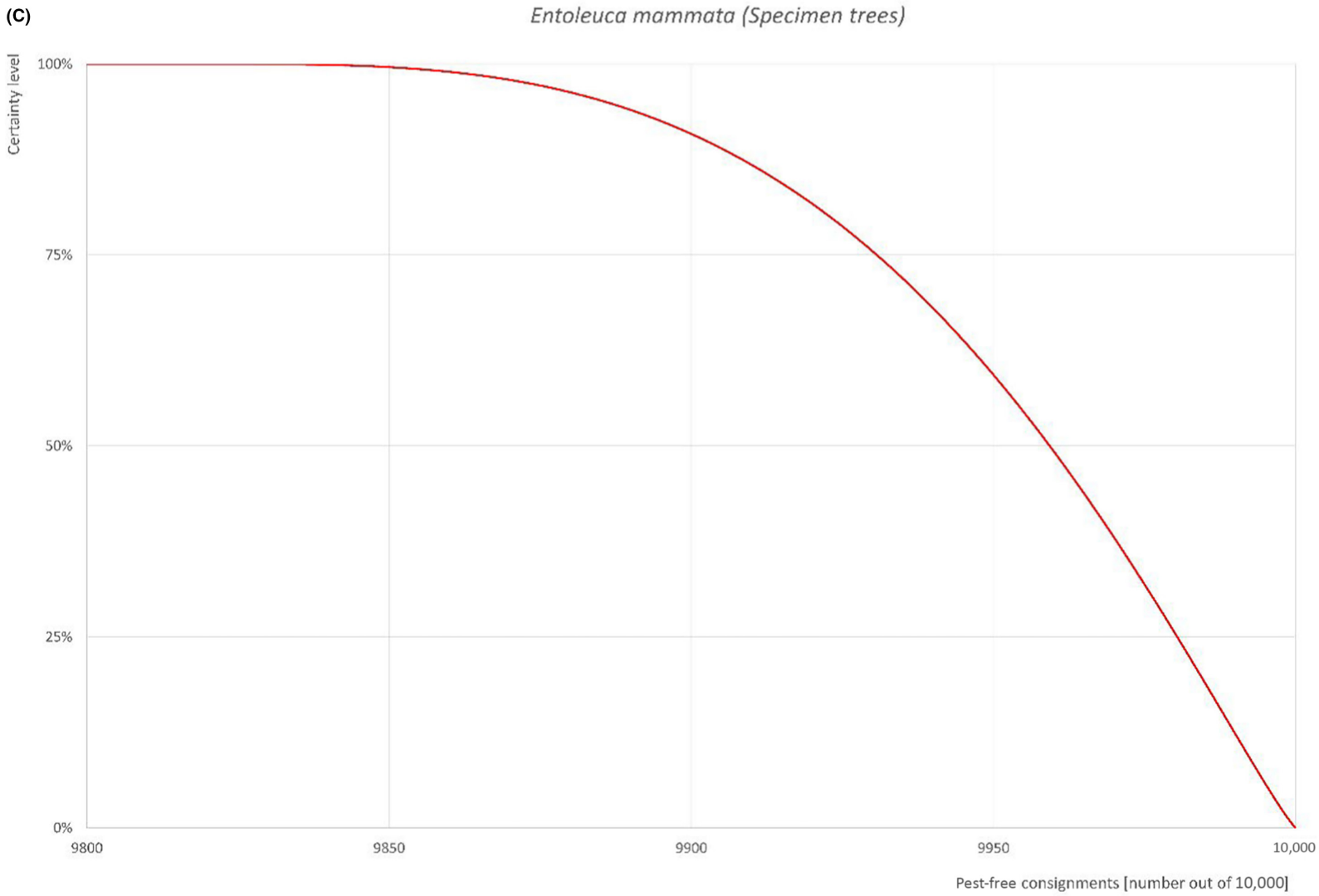

FIGURE A.3 (A) Elicited uncertainty of pest infestation per 10,000 specimen *Sorbus aucuparia* trees (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (B) uncertainty of the proportion of pest-free 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.

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A.2 | *PHYTOPHTHORA RAMORUM*

A.2.1 | 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

(Continues)

(Continued)

Regulated status	The pathogen is listed in Annex II of Commission Implementing Regulation (EU) 2019/2072 as *P. ramorum* (non-EU isolates) Werres, De Cock & Man in 't Veld [PHYTRA]. The EU isolates of *P. ramorum* are listed as regulated non-quarantine pest (RNQP). 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). Therefore, the lineages EU1 and EU2 are present in the UK, and these are considered as RNQP (EU1) and Union quarantine pest (EU2) for the EU The pathogen is included in the EPPO A2 list (EPPO, online) *P. ramorum* is listed as a quarantine pest in the UK (EPPO, online)
Pest status in the UK	*P. ramorum* is present in the UK (Brown and Brasier, 2007; Dossier Section 2.0; CABI, online; EPPO, online) Non-EU 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 a regulated pest in the EU
Host status on *Sorbus*	*Sorbus aucuparia* is reported to be a host of *P. ramorum* (DEFRA, 2015). *S. cashmiriana* is also reported as a host of *P. ramorum* in the UK (Jung et al., 2016)
Risk Assessment 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 Panel on Plant Health, 2011). – Pest risk management for *Phytophthora kernoviae* and *Phytophthora ramorum* (EPPO, 2013). – UK Risk Register Details for *Phytophthora ramorum* (DEFRA, online). – Commodity risk assessment of *Acer campestris*, *A. platanoides*, *A. pseudoplatanus and A. campestre* plants from the UK (EFSA PLH Panel, 2023a, 2023b, 2023c, 2023d).
Other relevant information for the assessment	
Biology	*P. ramorum* is most probably native to East Asia (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) *P. ramorum* is heterothallic oomycete species belonging to clade 8c (Blair et al., 2008) 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) *P. ramorum* produces sporangia on the surfaces of infected leaves and twigs of host plants. These sporangia can be splash-dispersed or carried by wind and rain to longer distances. The sporangia germinate in free water 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 (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) *P. 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 recolonize the phloem from the xylem. *P. ramorum* can remain viable within xylem for two or more years after the overlying phloem had been excised *P. ramorum* can disperse by aerial dissemination, water, movement of infected plant material and soil containing propagules on footwear, tires of trucks and mountain bikes, or the feet of animals (Brasier, 2008; Davidson et al., 2002) 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* (Brasier and Webber, 2010, Grünwald et al., 2008) 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 Health, 2011)
Symptoms	**Main type of symptoms** There is no information on the symptoms caused by *P. ramorum* to *Sorbus* spp. plants *P. 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.

(Continued)

Symptoms	**Presence of asymptomatic plants**	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)
	Confusion with other pests	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) *P. ramorum* can be easily distinguished from other *Phytophthora* species based on morphology (Grünwald et al., 2008) and molecular tests
Host plant range		*P. 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) 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*, *Arbutus unedo*, *Arctostaphylos columbiana*, *Agrostis 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*, *Cornus kousa*, *Cornus hybrids, 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*, ***Sorbus* spp.**, *Taxus baccata*, *Trientalis latifolia*, *Umbellularia californica*, *Vaccinium myrtillus*, *V. ovatum*, *V. parvifolium* and *Vinca minor* (APHIS USDA, 2022; Cave et al., 2008; EPPO, online; Jung et al., 2016)
Reported evidence of impact		Not relevant, *P. ramorum* is an EU regulated quarantine pest
Evidence that the commodity is a pathway		Life stages of *P. ramorum* can be present on leaves, stems, branches or roots of whips, bare-rooted plants and potted plants. *P. ramorum* can be present in soil; however, potted plants contain only new growing media. *P. ramorum* is regularly intercepted in the EU on different plant species intended for planting (EUROPHYT/TRACES-NT, online). Therefore, plants for planting of *Sorbus* spp. are possible pathway for *P. ramorum*
Surveillance information		The UK carries out surveys for *P. ramorum* (Dossier Section 1.0). At growing sites, *P. ramorum* -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 1.0) 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 Section 1.0)

A.2.2 | Possibility of pest presence in the nursery

A.2.2.1 | 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 1.0).

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

The locations of the exporting nurseries are the same as for the nurseries evaluated for the *Acer* spp. and *Cornus alba* and *C. sanguinea* Dossiers (EFSA PLH Panel 2023a, 2023b, 2023c, 2023d, 2024). Therefore, the Panel assumes that the same host plant species are present in the surrounding environment.

Exporting 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. Woodlands tend to be a standard UK mixed woodland with a range of UK native trees, that include host plants for the pathogen such as Oak (*Quercus robur*), Ash (*Fraxinus*), Sycamore (*Acer pseudoplatanus*), Holly (*Ilex*), Norway maple (*Acer platanus*), and field maple (*Acer campestre*). Hedges are made up of a range of species, including Yew (*Taxus baccata*), Holly (*Ilex*), Laurel (*Prunus laurocerasus*) and leylandii (Cupressus x leylandii) as a host for *P. ramorum* (Dossier Section 1.0 EPPO).

Uncertainties:

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

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

The starting material is a mix of seeds and seedlings depending on the nursery. *S. aucuparia* seeds purchased in the UK may be certified under the Forestry Commission's Voluntary Scheme for the Certification of Native Trees and Shrubs. Most plants are grown from UK-produced seeds and seedlings; however, some plants may be obtained from the EU (mostly the Netherlands). This is the only source of plants obtained from abroad (Dossier Section 1.0).

Most of the nurseries expected to export to the EU produce plants from seed and seedlings (UK plant passports); therefore, there are no mother plants of *S. aucuparia* present in the nurseries. There are however *S. aucuparia* cultivars that are chip budded in July/August and the seedling of the same species are used as rootstocks for all cultivars (Dossier Section 1.0).

In addition to *S. aucuparia* plants, only one of the nurseries expected to export to the EU has mother plants of other tree species present in the nurseries (*S. intermedia*, *Corylus avellana* and various *Prunus* species) (Dossier Section 1.0). 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 travel with them.

The nurseries use 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 are heat-treated by commercial suppliers during production to eliminate pests and diseases (Dossier Section 1.0). *P. ramorum* is able to survive in soil (Shishkoff, 2007) and therefore could potentially enter with infested soil/growing media.

Uncertainties:

- No information is available on the origin of plants other than *Sorbus* used for plant production in the nurseries.
- The effectiveness of removing all soil with a low-pressure washer for bare-rooted plants.

A.2.2.3 | Possibility of spread within the nursery

Sorbus plants are grown in containers (cells, pots, tubes, etc.) outdoors, in the open air, or 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).

The nurseries exporting *Sorbus* spp. plants produce several other host plants of *P. ramorum*. Therefore, is it possible that *P. ramorum* can spread within the nursery from infested host plants of other species to the plot with *Sorbus* spp. plants.

P. ramorum can spread within the nurseries by aerial dissemination/water splash: via soil, water, movement of infested plant material (e.g. infested leaves) and animals/humans (Davidson et al., 2002).

Uncertainties:

- The phytosanitary status of other species grown inside the nursery.

A.2.3 | Information from interceptions

P. ramorum is regularly intercepted in the EU on different plant species intended for planting (EUROPHYT/TRACES-NT, online). In the EUROPHYT/TRACES-NT database, there are no records of interceptions of *P. ramorum* on *Sorbus* spp. from third countries or on any other plant species from UK.

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. ramorum* is provided (Table A.8).

TABLE A.8 Evaluation of the risk mitigation measures.

Number	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
1	Registration of production sites	Yes	All nurseries are registered as professional operators with the UK NPPO, by the Animal and Plant Health Agency (APHA) and is authorised to issue UK plant passports (Dossier Section 1.0) Evaluation: Every nursery exporting to the EU is under supervision of the NPPO Uncertainties: – None
2	Certification of propagation material	Yes	The starting material of *S. aucuparia* production consists of seed and seedlings. Seeds are certified. Seedlings for *S. aucuparia* production sourced in the UK are certified with UK Plant Passports; seedlings from the EU countries are certified with phytosanitary certificates Evaluation: *P. ramorum* is a quarantine pest and it is highly unlikely that the pathogen is present on the certified starting material Uncertainties: – None
3	Origin and treatment of growing media	Yes	Rooted plants in pots: In the production or procurement of these plants, the use of growing media is assessed for the potential to harbour and transmit plant pests. Growers most commonly use virgin peat or peat-free compost, which is a mixture of coir, tree bark, wood fibre, etc. The compost is heat-treated by commercial suppliers during production to eliminate pests and diseases. It is supplied in sealed bulk bags or shrink-wrapped bales and stored off the ground on pallets, these are completely hygienic and free from contamination. Where delivered in bulk, compost is kept in a dedicated bunker, either indoors, or covered by tarpaulin outdoors, and with no risk of contamination with soil or other material (Dossier Section 1.0) Evaluation: The measure is efficient in preventing the entry of the pathogen via the substrate into the nursery Uncertainties: – None
4	Surveillance, monitoring and sampling	Yes	Inspection is carried out at least once a year as part of the Quarantine Surveillance programme (Great Britain uses the same framework for its surveillance programme as the EU). Surveillance is based on visual inspection with samples taken from symptomatic material, and where appropriate, samples are also taken from asymptomatic material (e.g. plants, tubers, soil, watercourses) (Dossier Section 1.0) Evaluation: The surveillance, monitoring and sampling can detect the pathogen. No results are reported Uncertainties: – The efficiency of the surveillance, monitoring and sampling
5	Hygiene measures	Yes	All nurseries have plant hygiene and housekeeping rules and practices in place, which are communicated to all relevant employees. The measures include: • Growing media • Weed management • Water usage • Cleaning and sterilisation • Waste treatment and disposal • Visitors Evaluation: These measures could be effective in reducing the risk of introduction and/or spread of the pathogen Uncertainties: – The efficiency of the hygiene measures
6	Irrigation water quality and/or treatments	Yes	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. No quarantine pests have been found (Dossier Section 1.0) Evaluation: There is no disinfestation treatment applied to the irrigation water. However, irrigation water is routinely sampled and tested for quarantine pests. This procedure can reduce the risk Uncertainties: – The frequency of sampling and the method used for the detection of the pathogen
7	Application of pest control products	Yes	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). Evaluation: The listed treatments are not sufficiently effective against *P. ramorum* if present Uncertainties: – The details about the products applied and the application scheme are unknown and the efficiency is unclear

(Continues)

TABLE A.8 (Continued)

Number	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
	Washing of the roots (bare-rooted plants)	Yes	Bare-rooted plants are lifted from the field in winter and then root-washed on site and stored prior to export (Dossier Section 1.0). Evaluation: The washing of the roots removes (parts of) the soil and thus also the pathogen Uncertainties: The effectiveness of the washing to remove all soil with the pathogen
8	Inspections and management of plants before export	Yes	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 before dispatch Special provision for inspection of *P. ramorum* is in place Evaluation: The inspections and management of plants before export can detect the pathogen Uncertainties: The efficiency of the inspections

A.2.5 | Overall likelihood of pest freedom

P. ramorum was already assessed as relevant pest for the commodity risk assessment of *Cornus alba* and *C. sanguinea* plants from UK (EFSA PLH Panel, 2024). There are large similarities in the production sites, procedures and exported commodity types for *Cornus* and *Sorbus*. Therefore, the Panel based the estimation of the overall likelihood of pest freedom on the Expert Knowledge Elicitation values of *Cornus*. The Panel identified as the only differences with *Cornus* plants production, the possibility of having some *Sorbus* plants grafted; therefore, the values were adjusted accordingly.

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

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 a short period of time and are exported without leaves. The scenario assumes *S. aucuparia* to be a minor host for the pathogen. The scenario also assumes that symptoms of the disease are visible and promptly detected during inspections.

Factors considered in this scenario were:

- The *P. ramorum* outbreaks are more frequent in the Western part of the country (the nurseries are in the Eastern part)
- The climate suitability for the pathogen in Eastern UK, where the nurseries are located, is low (dryer climate compared to the Western part)
- The pathogen is causing clear symptoms, easy to detect (leave blight)
- There is official surveillance of *S. aucuparia* nurseries
- Seed is not a pathway, seedlings of *S. aucuparia* are certified with UK plant passport
- Clean new soil material is used for potted plants
- Root washing effectively removes the soil aggregates from bare-root plants
- Irrigation water is regularly checked
- Some of the applied plant protection products may be effective in controlling the pathogen
- For specimen trees up to 15 years old, symptoms of *P. ramorum* are expected to be detected

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

The scenario assumes a high pressure of the pathogen in the nurseries and in the surroundings as suitable hosts are present. The scenario assumes that the pathogen infects leaves, which may still be present on the plants at the time of export. The scenario also assumes that symptoms of the disease are not easily recognisable during inspections.

Factors considered in this scenario were:

- *P. ramorum* is present in all regions of UK (including regions of nurseries)
- Plants can be symptomless with a latent period of some months
- Grafting can increase the incidence of the pathogen (via infected buds or by woundings)
- The measures adopted after the detection of the pathogen and their efficiency are unclear, nor results are reported
- Other host plants species are abundant in the surrounding environment
- Irrigation is applied (also overhead) and can spread the pathogen
- Favourable conditions for spread of the pathogen during production (in the nursery)
- Root washing does not effectively remove the soil aggregates

- The plant protection products used in the nurseries are not targeting *P. ramorum*
- Inspections cannot detect asymptomatic plants

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

The scenario assumes a limited presence of the pathogen in the nurseries and in the surroundings, and a limited susceptibility of *Sorbus* spp. The pathogen is a regulated 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 susceptibility of *Sorbus* spp. and 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 | Elicitation outcomes of the assessment of the pest freedom for *Phytophthora ramorum*

The elicited and fitted values for *P. ramorum* agreed by the Panel are shown in Tables A.9–A.14 and in Figures A.4–A.6.

TABLE A.9 Elicited and fitted values of the uncertainty distribution of pest infestation by *Phytophthora ramorum* per 10,000 bare-root plants.

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	1					10		20		100					220
EKE	0.996	1.01	1.07	1.43	2.67	5.83	11.3	31.2	66.9	92.4	125	158	188	207	220

Note: The EKE results are the *BetaGeneral (0.38211, 1.2078, 0.995, 232)* distribution fitted with @Risk version 7.6.

Based on the numbers of estimated infested bags of unrooted cuttings, the pest freedom was calculated (i.e. = 10,000 – number of infested bags 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 ramorum* per 10,000 bare-root 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	9780					9900		9980		9990					9999
EKE results	9780	9793	9812	9842	9875	9908	9933	9969	9989	9994	9997	9998.57	9998.93	9998.99	9999.00

Note: The EKE results are the fitted values.

TABLE A.11 Elicited and fitted values of the uncertainty distribution of pest infestation by *Phytophthora ramorum* per 10,000 potted/cell grown 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					44
EKE	0.194	0.438	0.818	1.55	2.53	3.81	5.17	8.38	12.7	15.6	19.6	24.4	30.7	36.7	44.1

Note: The EKE results are the *BetaGeneral (1.1382, 16.297, 0, 170)* distribution fitted with @Risk version 7.6.

Based on the numbers of estimated infested bags of unrooted cuttings, the pest freedom was calculated (i.e. = 10,000 – number of infested bags 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 ramorum* per 10,000 potted/cell grown 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	9956					9984		9992		9996					10,000
EKE results	9956	9963	9969	9976	9980	9984	9987	9992	9995	9996	9997	9998	9999.2	9999.6	9999.8

Note: The EKE results are the fitted values.

TABLE A.13 Elicited and fitted values of the uncertainty distribution of pest infection by *Phytophthora ramorum* per 10,000 specimen trees *Sorbus aucuparia* plants.

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0.0					7		15		60					110
EKE	0.0023	0.0193	0.0978	0.496	1.65	4.24	8.30	21.5	42.5	56.1	72.1	86.9	99.2	106	110

Note: The EKE results are the BetaGeneral (0.42718, 1.0313, 0.113) 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 specimen trees *Sorbus aucuparia* plants calculated by Table A.13.

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9890					9940		9985		9993					10,000
EKE results	9890	9894	9901	9913	9928	9944	9957	9978	9992	9996	9998	9999.5	9999.9	9999.98	10,000

Note: The EKE results are the fitted values.

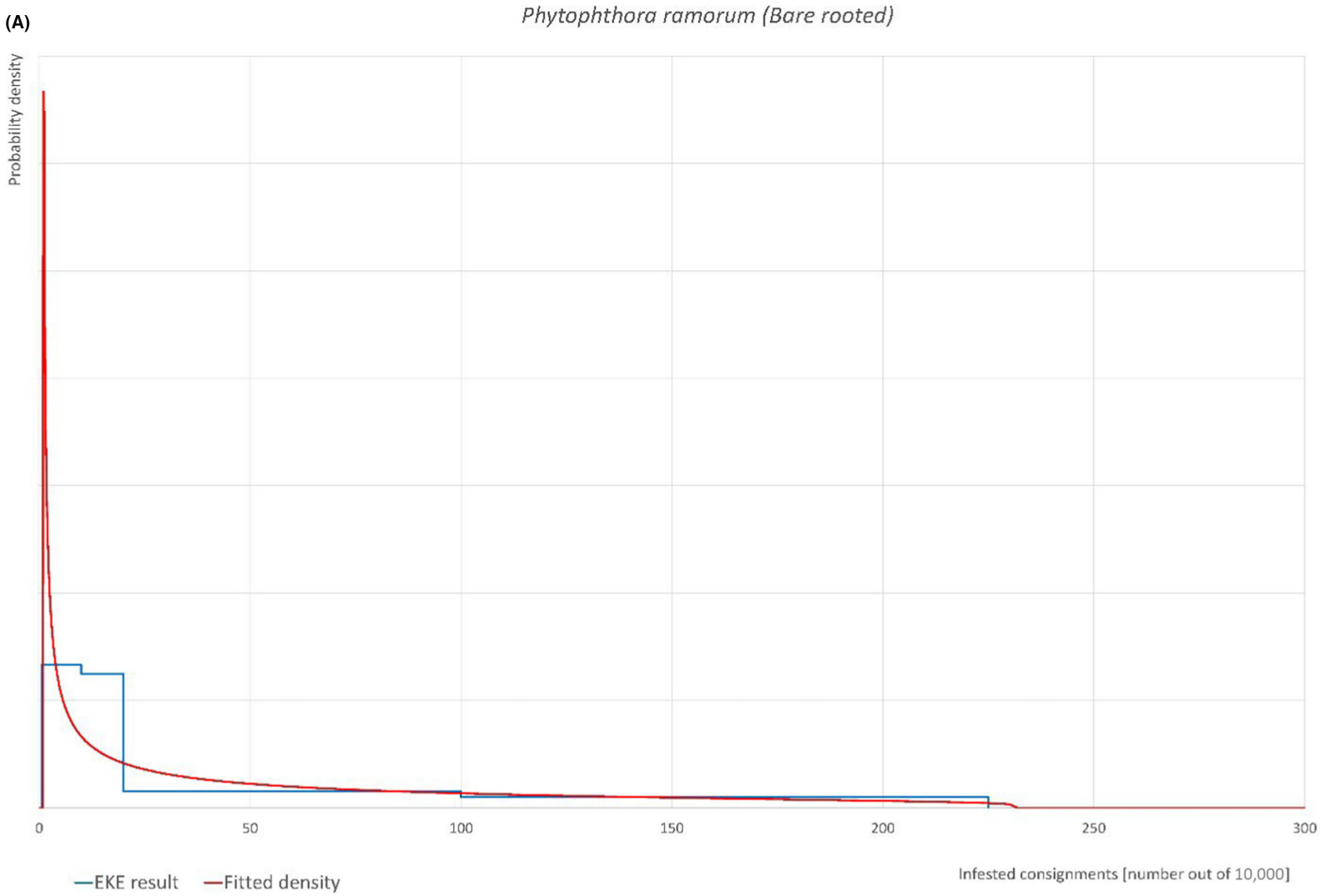

FIGURE A.4 (Continued)

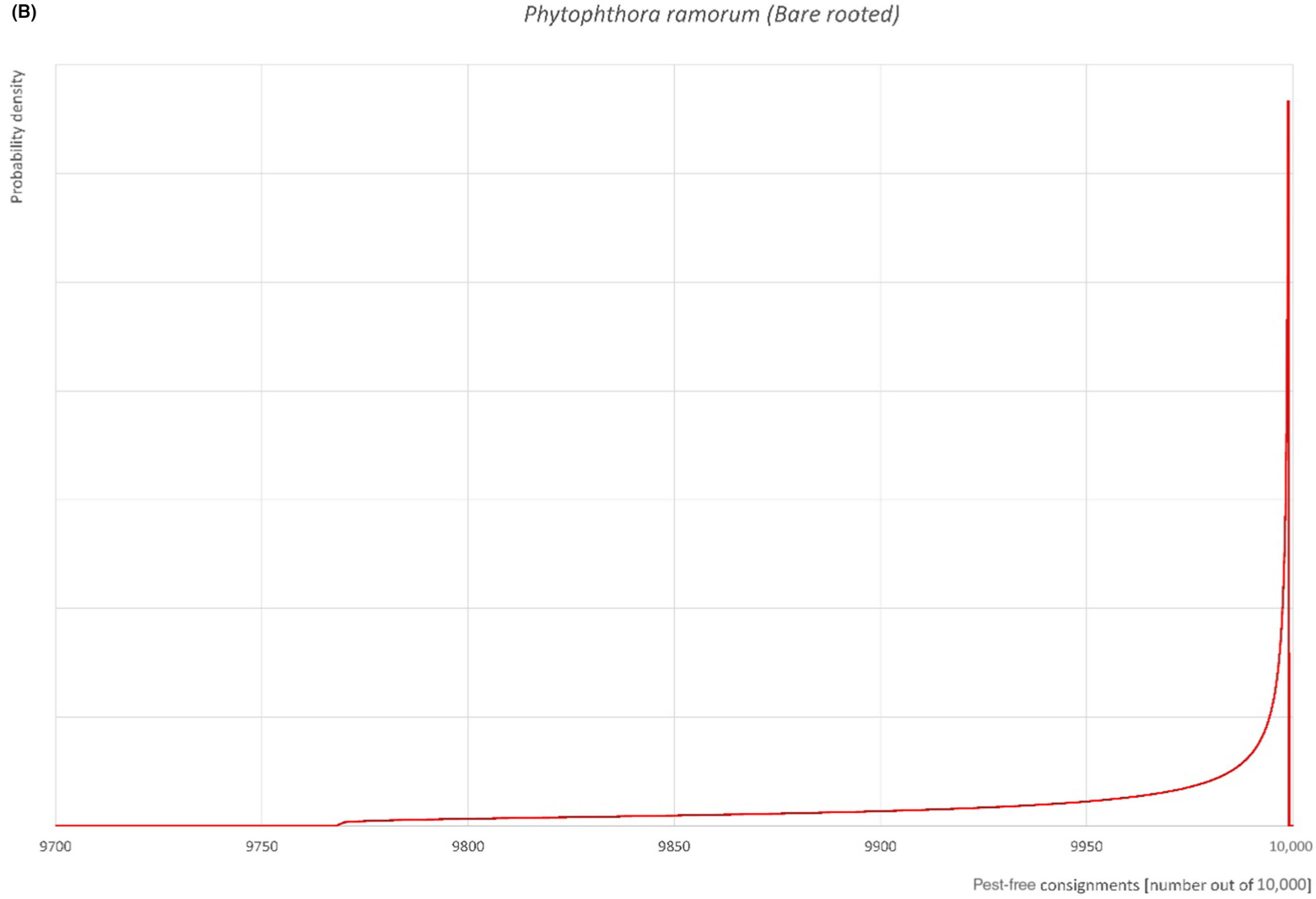

FIGURE A.4 (Continued)

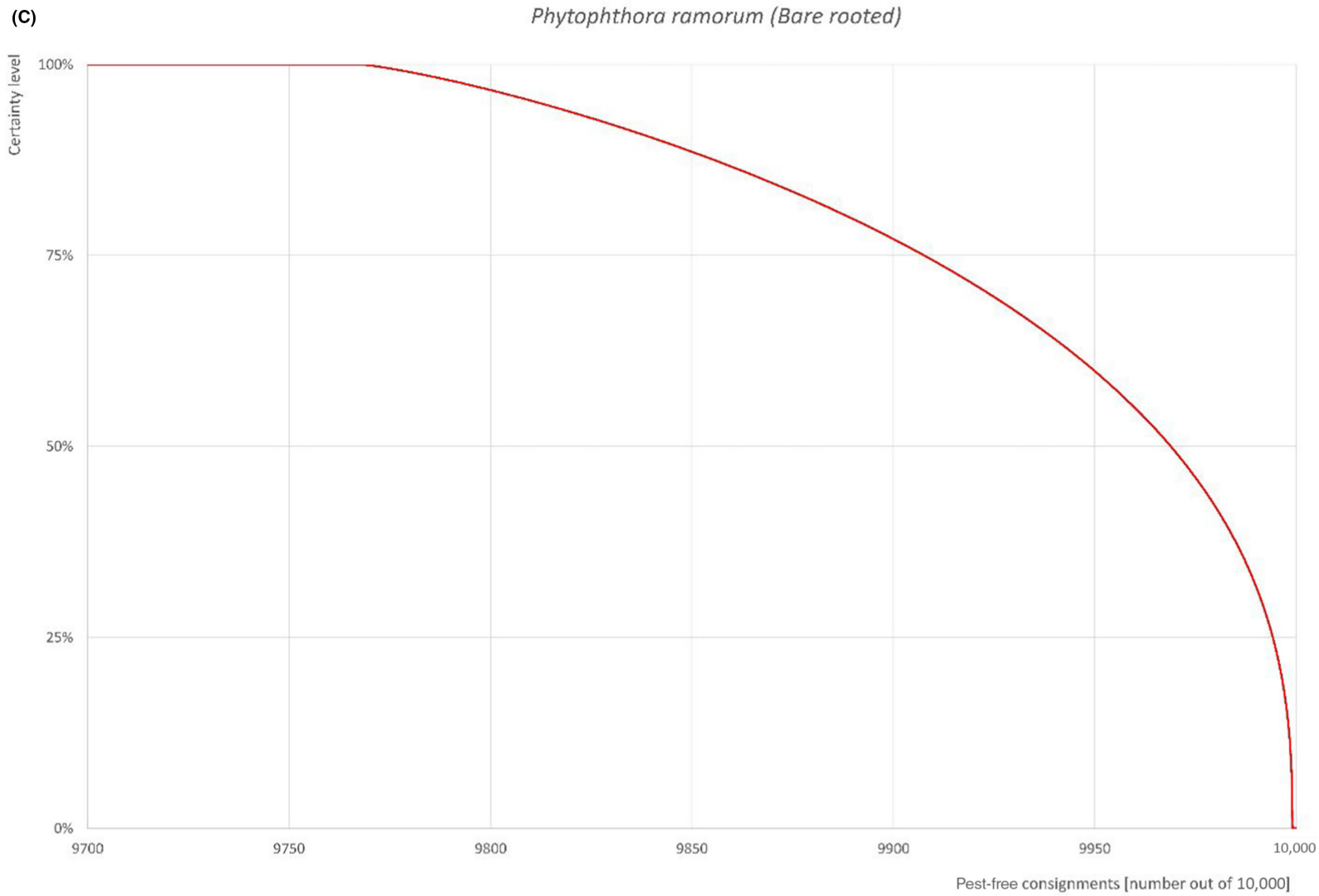

FIGURE A.4 (A) Elicited uncertainty of pest infestation per 10,000 bare-root *Sorbus aucuparia* plants (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (B) uncertainty of the proportion of pest-free 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.

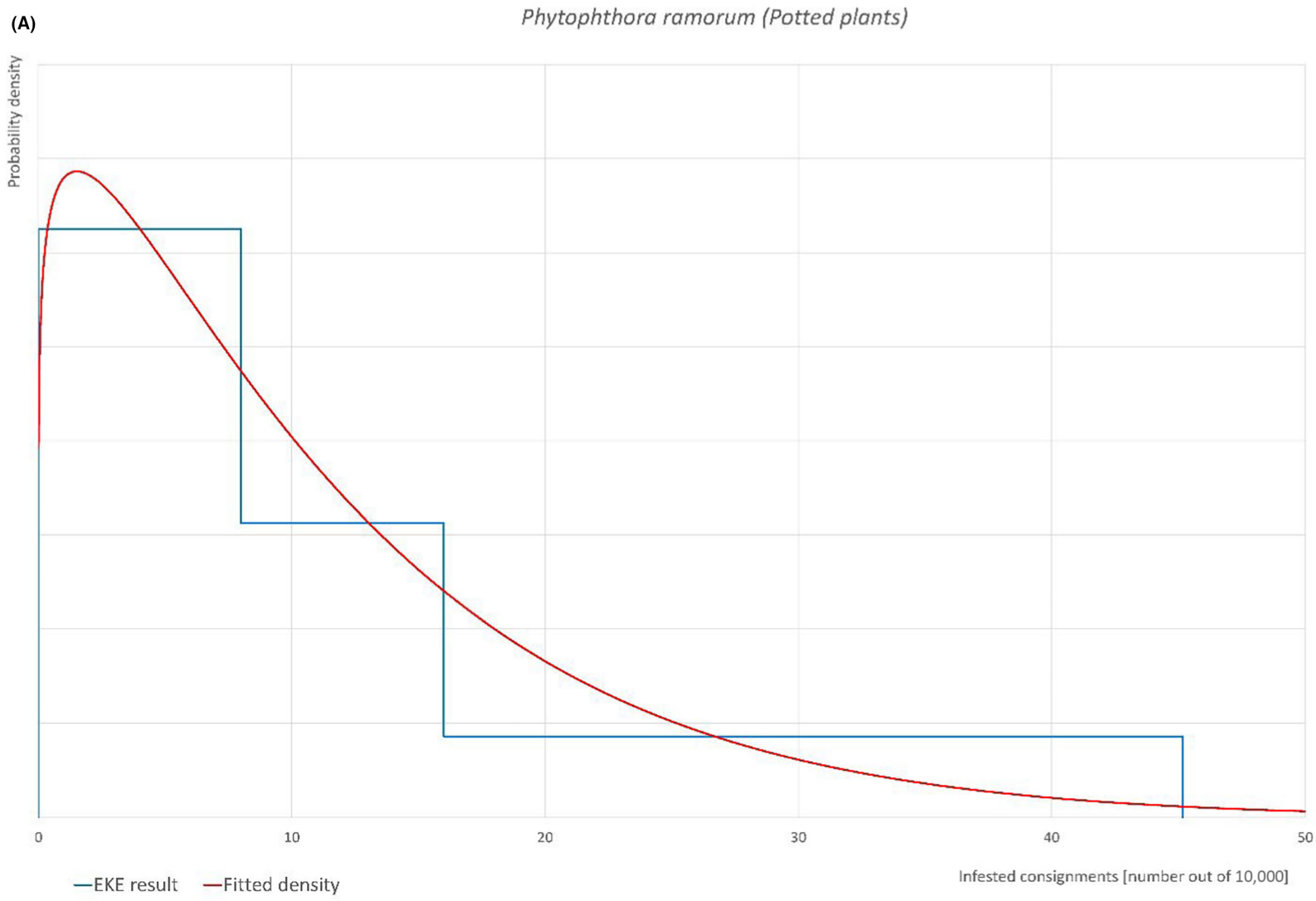

FIGURE A.5 (Continued)

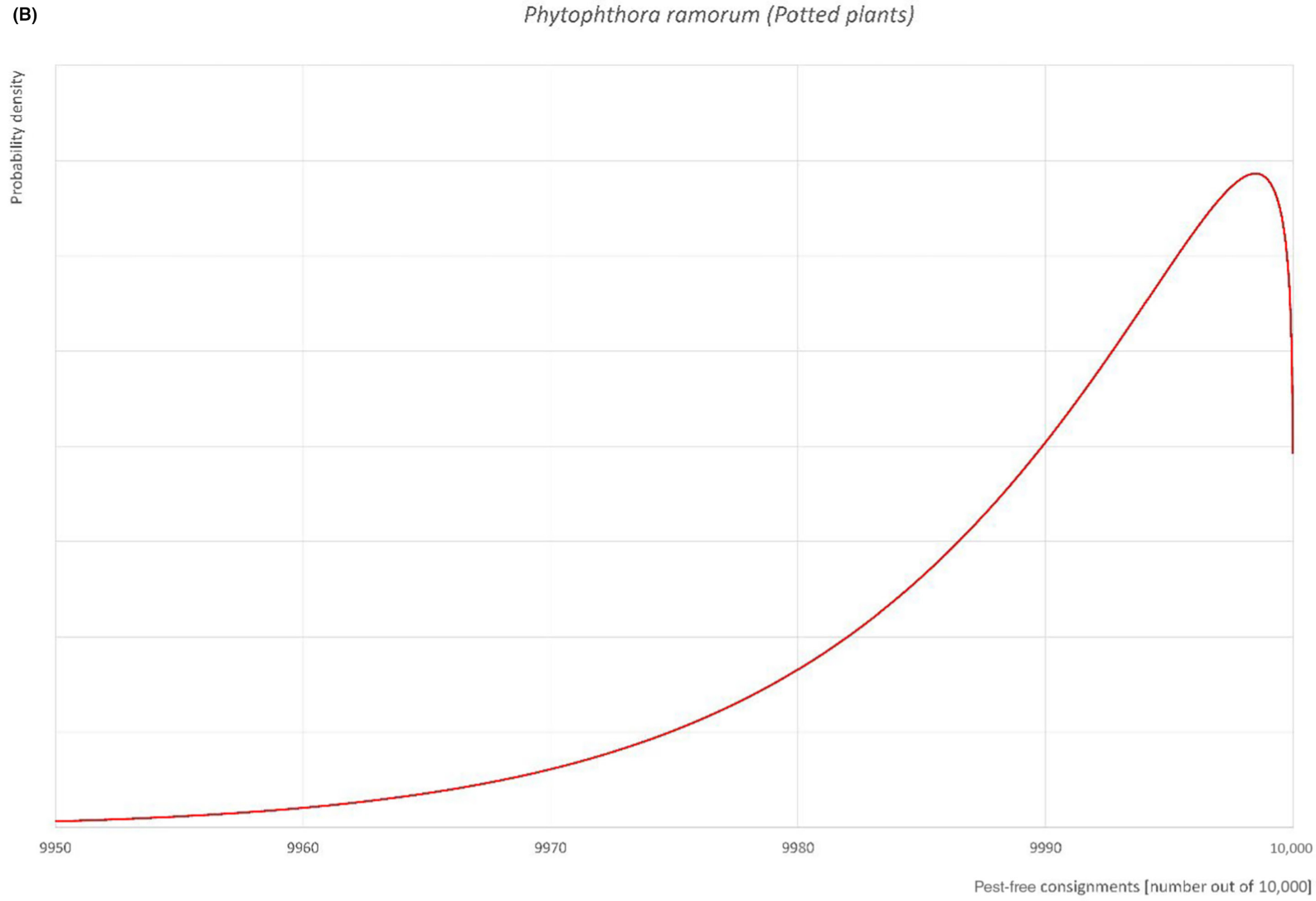

FIGURE A.5 (Continued)

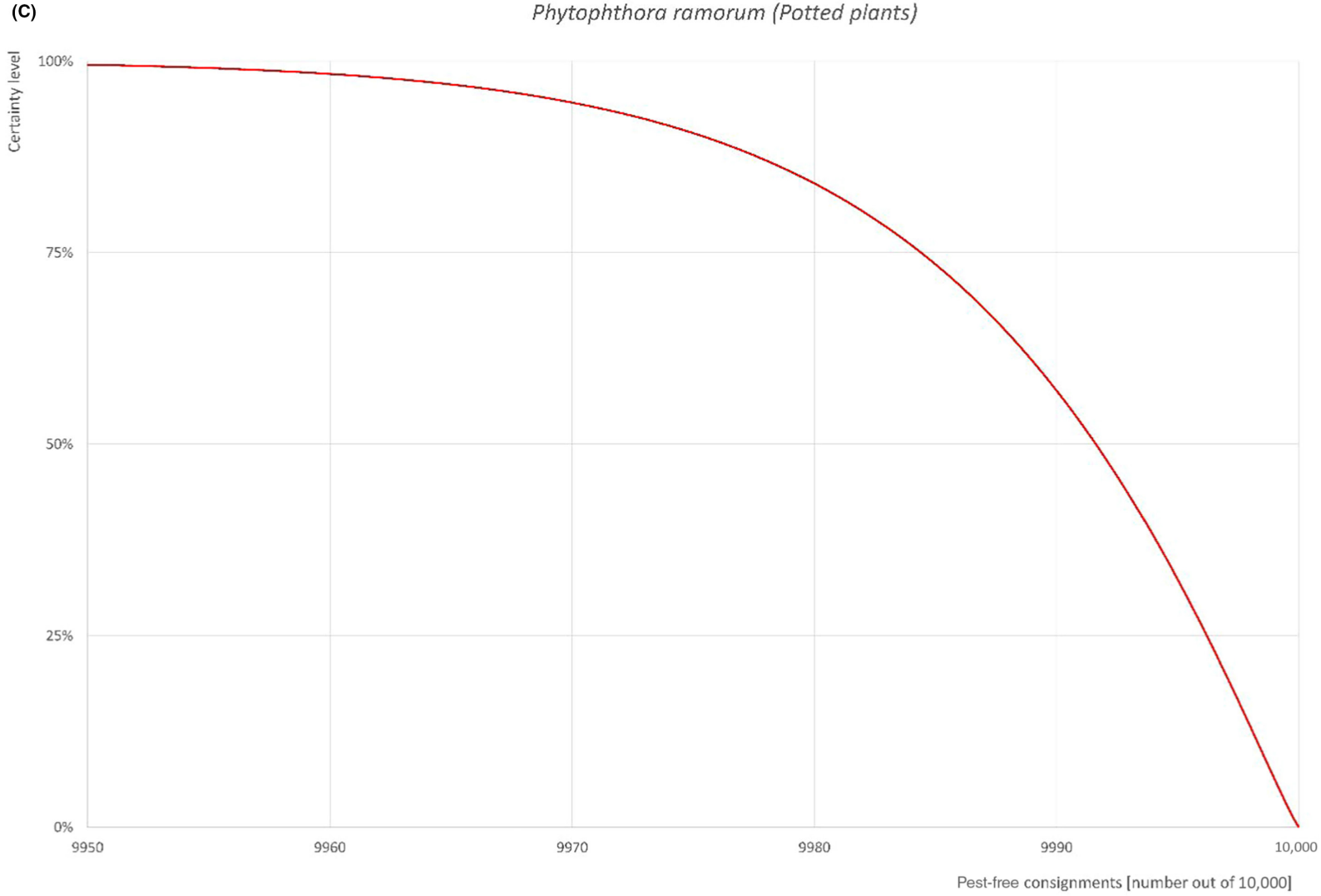

FIGURE A.5 (A) Elicited uncertainty of pest infestation per 10,000 rooted *Sorbus aucuparia* plants in pots (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (B) uncertainty of the proportion of pest-free 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.

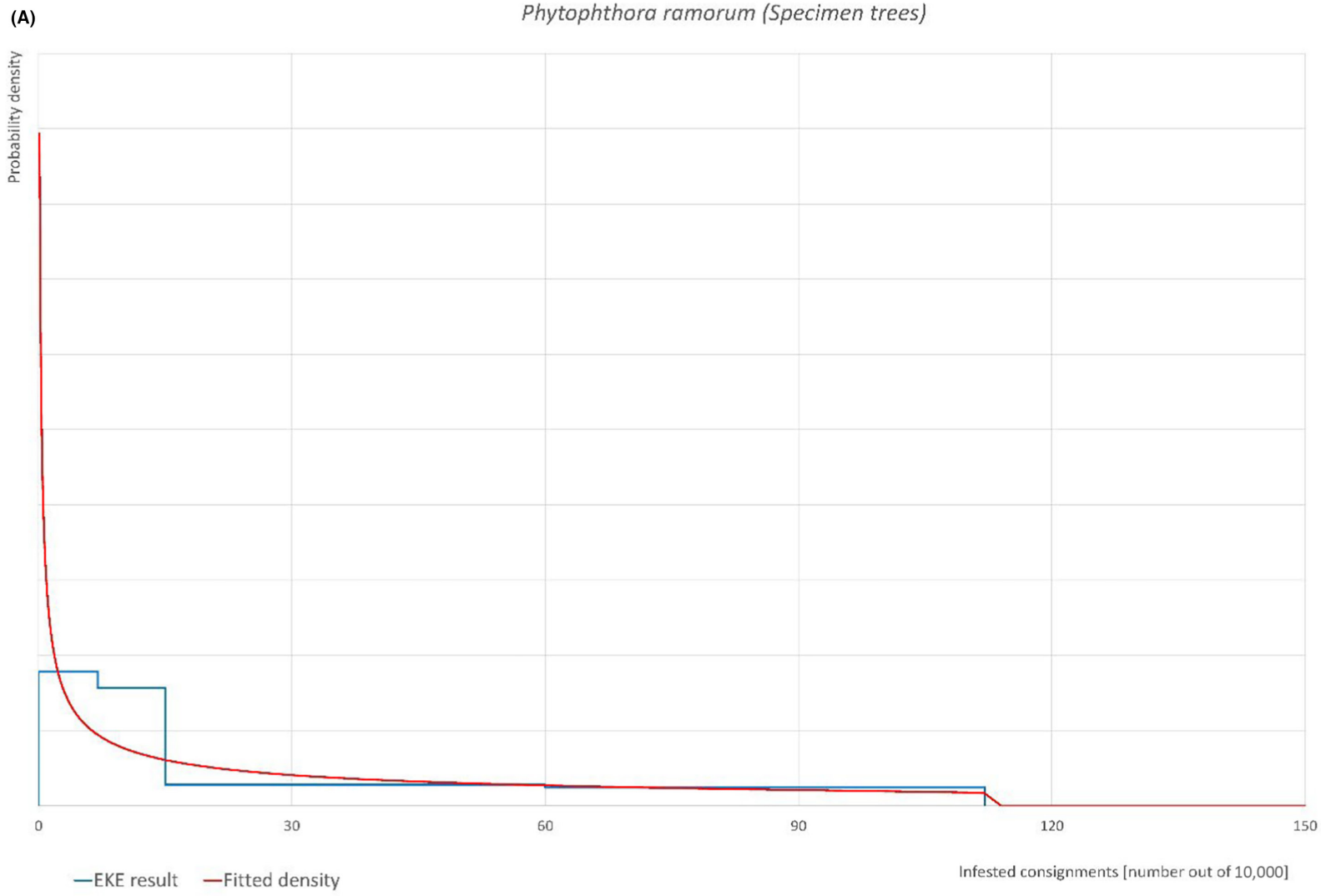

FIGURE A.6 (Continued)

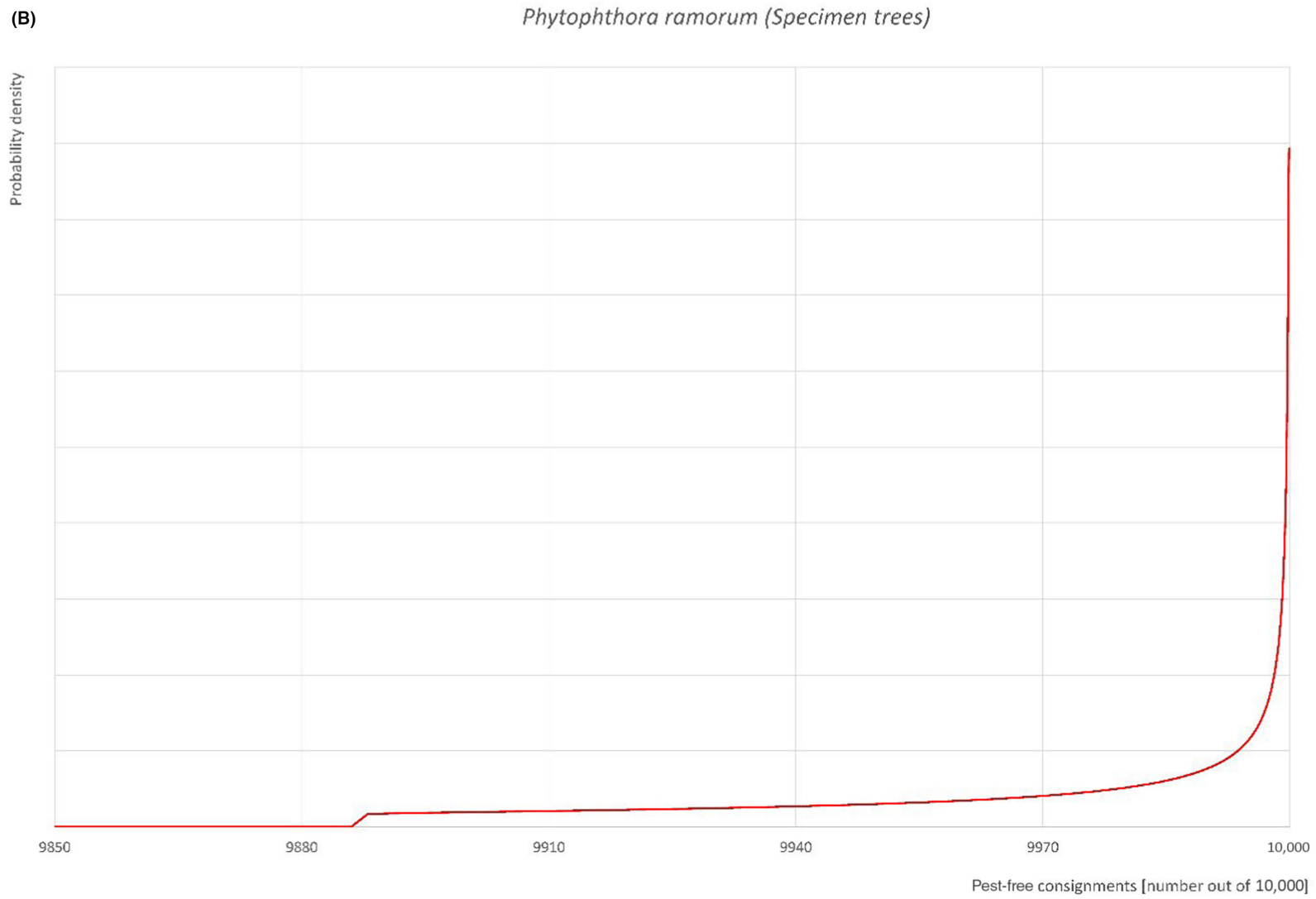

FIGURE A.6 (Continued)

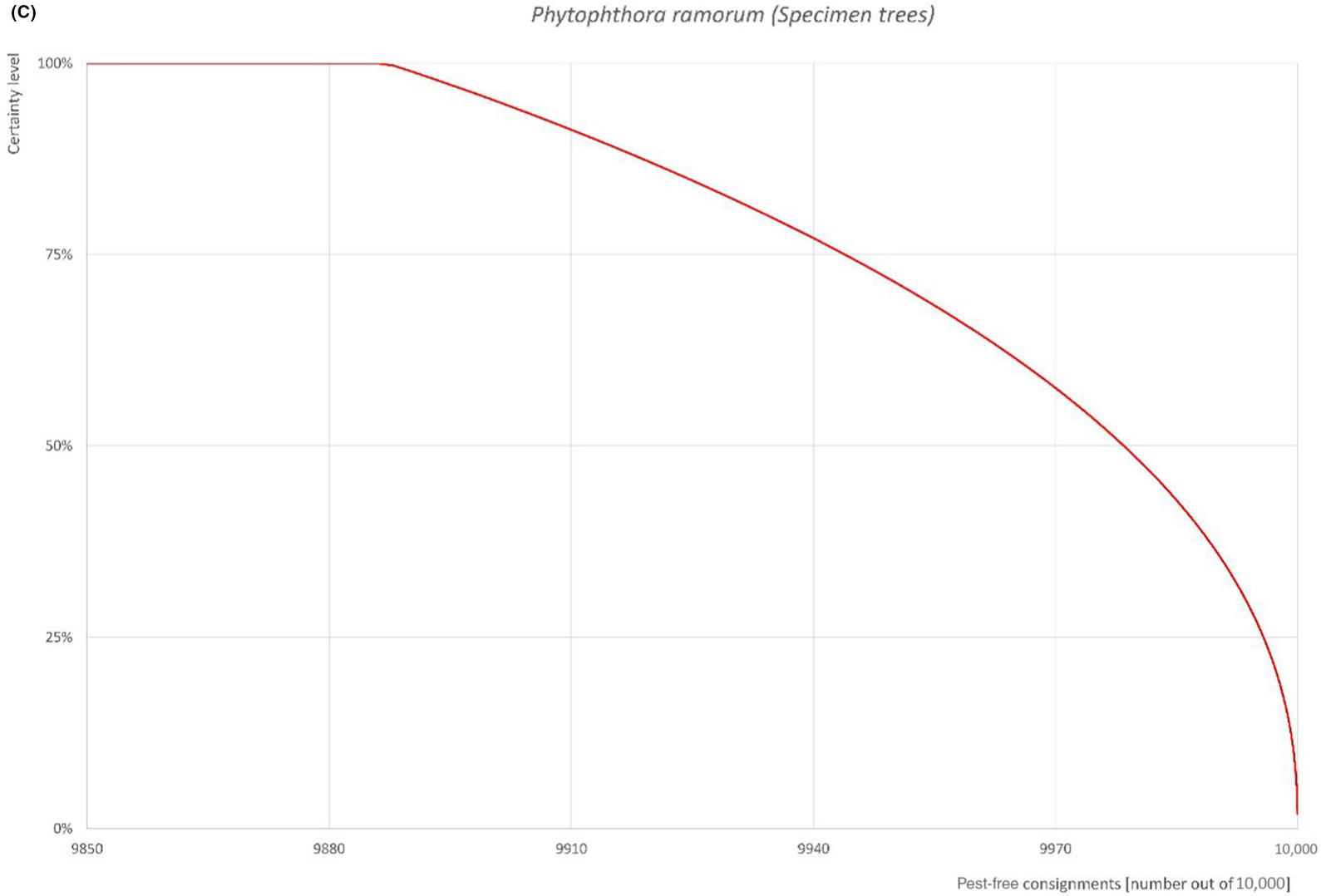

FIGURE A.6 (A) Elicited uncertainty of pest infestation per 10,000 specimen trees *Sorbus aucuparia* (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (B) uncertainty of the proportion of pest-free 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.

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APPENDIX B

Web of Science all databases search string

In the table below, the search string for ***Sorbus*** used on 12 July 2023 in Web of Science is reported. Totally, 458 papers were retrieved. Titles and abstracts were screened, and 28 pests were added to the list of pests (see Appendix C) (Table B.1).

TABLE B.1 String for *Sorbus*.

Web of Science All databasesa	TOPIC: "Sorbus" OR "Sorbus aucuparia" OR "mountain ash" AND TOPIC: "pathogen*" OR "pathogenic bacteria" OR "fung*" OR "oomycet*" OR "myce*" OR "bacteri*" OR "virus*" OR "viroid*" OR "insect$" OR "mite$" OR "phytoplasm*" OR "arthropod*" OR "nematod*" OR "disease$" OR "infecti*" OR "damag*" OR "symptom*" OR "pest$" OR "vector" OR "hostplant$" OR "host plant$" OR "host" OR "root lesion$" OR "decline$" OR "infestation$" OR "damage$" OR "symptom$" OR "dieback*" OR "die back*" OR "malaise" OR "aphid$" OR "curculio" OR "thrip$" OR "cicad$" OR "miner$" OR "borer$" OR "weevil$" OR "plant bug$" OR "spittlebug$" OR "moth$" OR "mealybug$" OR "cutworm$" OR "pillbug$" OR "root feeder$" OR "caterpillar$" OR "foliar feeder$" OR "virosis" OR "viruses" OR "blight$" OR "wilt$" OR "wilted" OR "canker" OR "scab$" OR "rot" OR "rots" OR "rotten" OR "damping off" OR "damping-off" OR "blister$" OR "smut" OR "mould" OR "mould" OR "damping syndrome$" OR "mildew" OR "scald$" OR "root knot" OR "root-knot" OR "rootkit" OR "cyst$" OR "dagger" OR "plant parasitic" OR "parasitic plant" OR "plant$parasitic" OR "root feeding" OR "root$feeding" OR "acari" OR "host$" OR "gall" OR "gall$" OR "whitefly" OR "whitefl*" OR "aleyrodidae" OR "thysanoptera" OR "moths" OR "scale" OR "scale$" OR "thripidae" OR "leafhoppers" OR "leafhopper$" OR "plant pathogens" OR "fungal" OR "aphididae" OR "Scolytinae" OR "bark beetle" NOT "heavy metal$" OR "pollut*" OR "weather" OR "propert*" OR "probes" OR "spectr*" OR "antioxidant$" OR "transformation" OR "Secondary plant metabolite$" OR "metabolite$" OR "Postharvest" OR "Pollin*" OR "Ethylene" OR "Thinning" OR "fertil*" OR "Mulching" OR "Nutrient$" 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 "cancer" OR "therapeutic" OR "psoriasis" OR "blood" OR "medicinal ethnobotany" OR "Nitrogen-fixing" OR "patients" OR "Probiotic drugs" OR "Antioxidant" OR "Anti-Inflammatory" OR "plasma levels" OR "ethnomedicinal" OR "traditional uses of medicinal plants" OR "Antitumor" OR "Neuroprotective" OR "Hypoglycemic" OR "ozone sensitivity" OR "cardiotonic" NOT TOPIC: "*Acanthosoma haemorrhoidale*" OR "*Acasis viretata*" OR "*Acleris cristana*" OR "*Acleris laterana*" OR "*Acleris nivisellana*" OR "*Acleris paradiseana*" OR "*Acleris rhombana*" OR "*Acleris sparsana*" OR "*Acleris tigricolor*" OR "*Acleris umbrana*" OR "*Acmaeoderella adspersula*" OR "*Acrobasis advenella*" OR "*Acrobasis tricolorella*" OR "*Acrogenospora carmichaeliana*" OR "*Acronicta alni*" OR "*Acronicta americana*" OR "*Acronicta auricoma*" OR "*Acronicta barnesii*" OR "*Acronicta clarescens*" OR "*Acronicta cuspis*" OR "*Acronicta euphorbiae*" OR "*Acronicta fragilis*" OR "*Acronicta grisea*" OR "*Acronicta interrupta*" OR "*Acronicta leporina*" OR "*Acronicta pruni*" OR "*Acronicta psi*" OR "*Acronicta radcliffei*" OR "*Acronicta rumicis*" OR "*Acronicta strigosa*" OR "*Acronicta superans*" OR "*Acronicta tridens*" OR "*Aculops arianus*" OR "*Aculus aucupariae*" OR "*Aculus schlechtendali*" OR "*Aecidiolum colliculosum*" OR "*Aecidium penicillatum*" OR "*Aglaope infausta*" OR "*Aglia tau*" OR "*Agrilus mendax*" OR "*Agrilus roscidus*" OR "*Agrilus sinuatus*" OR "*Agrilus solieri*" OR "*Agriopis aurantiaria*" OR "*Agriopis marginaria*" OR "*Agrochola helvola*" OR "*Alcis repandata*" OR "*Alebra sorbi*" OR "*Alebra wahlbergi*" OR "*Alfalfa mosaic virus*" OR "*Allographa ruiziana*" OR "*Allophyes oxyacanthae*" OR "*Alnetoidia alneti*" OR "*Alsophila pometaria*" OR "*Alternaria alternata*" OR "*Alternaria tenuissima*" OR "*Amorphogynia necessaria*" OR "*Amphipyra berbera*" OR "*Amphipyra pyramidea*" OR "*Amphipyra pyramidoides*" OR "*Amphisphaeria multipunctata*" OR "*Amphisphaeria sorbi*" OR "*Amphisphaeria umbrina*" OR "*Amphitetranychus viennensis*" OR "*Anisandrus dispar*" OR "*Annulohypoxylon multiforme var. Multiforme*" OR "*Anomoia purmunda*" OR "*Anoplophora chinensis*" OR "*Anoplophora glabripennis*" OR "*Anthaxia millefolii*" OR "*Anthaxia nitidula*" OR "*Anthaxia salicis*" OR "*Anthaxia semicuprea*" OR "*Anthaxia suzannae*" OR "*Antheraea polyphemus polyphemus*" OR "*Anthocoptes speciosus*" OR "*Anthocoris nemorum*" OR "*Anthonomus chevrolati*" OR "*Anthonomus conspersus*" OR "*Aphelenchus avenae*" OR "*Aphis fabae*" OR "*Aphis gossypii*" OR "*Aphis lantanae*" OR "*Aphis pomi*" OR "*Aphis spiraecola*" OR "*Apiognomonia errabunda*" OR "*Aplosporella demersa*" OR "*Aporia crataegi*" OR "*Aposphaeria subtilis*" OR "Apple chlorotic leaf spot virus" OR "Apple mosaic virus" OR "Apple scar skin viroid" OR "Apple stem grooving virus" OR "Apple stem pitting virus" OR "Arabis mosaic virus" OR "*Arboridia parvula*" OR "*Archiearis parthenias*" OR "*Archips asiaticus*" OR "*Archips crataegana*" OR "*Archips fuscocupreanus*" OR "*Archips podana*" OR "*Archips rosana*" OR "*Archips xylosteana*" OR "*Arctia caja*" OR "*Arge nigripes*" OR "*Arge sorbi*" OR "*Argyresthia conjugella*" OR "*Argyresthia semifusca*" OR "*Argyresthia sorbiella*" OR "*Argyresthia spiniella*" OR "*Argyresthia submontana*" OR "*Armillaria borealis*" OR "*Armillaria gallica*" OR "*Armillaria mellea*" OR "*Armillaria ostoyae*" OR "*Aromia moschata*" OR "*Arthopyrenia cinereopruinosa*" OR "*Arthopyrenia salicis*" OR "*Ascochyta potentillarum*" OR "*Ascochyta sorbina*" OR "*Ascocoryne albida*" OR "*Ascocoryne cylichnium*" OR "*Ascocoryne sarcoides*" OR "*Aspergillus clavatus*" OR "*Aspergillus fumigatus*" OR "*Aspergillus niger*" OR "*Aspergillus ochraceus*" OR "*Aspergillus terreus*" OR "*Aspidophorodon sorbi*" OR "*Asterodiaspis quercicola*" OR "*Asteromella hybridae*" OR "*Asteromella sorbicola*" OR "*Athelia binucleospora*" OR "*Athetis lepigone*" OR "*Atractotomus mali*" OR "*Aulacaspis mali*" OR "*Aulacaspis sorbi*" OR "*Auricularia mesenterica*" OR "*Autographa macrogamma*" OR "*Autographa pulchrina*" OR "*Bactericera trigonica*" OR "*Basilarchia arthemis*" OR "Bean yellow mosaic virus" OR "*Berkeleyomyces basicola*" OR "*Bertia moriformis*" OR "*Biscogniauxia discincola*" OR

(Continues)

TABLE B.1 (Continued)

"*Biscogniauxia marginata*" OR "*Biscogniauxia repanda*" OR "*Biston betularia*" OR "*Bjerkandera adusta*" OR "*Bjerkandera fumosa*" OR "*Bombardia bombarda*" OR "*Botryobasidium ellipsosporum*" OR "*Botryosphaeria stevensii*" OR "*Brachycaudus helichrysi*" OR "*Brachysporium britannicum*" OR "*Brachysporium masonii*" OR "*Brevicellicium olivascens*" OR "*Brunnipila calyculiformis*" OR "*Bucculatrix bechsteinella*" OR "*Bucculatrix thoracella*" OR "*Bucculatrix ulmella*" OR "*Buellia griseovirens*" OR "*Buellia sanguinolenta*" OR "*Byctiscus betulae*" OR "*Cabera pusaria*" OR "*Cacopsylla albipes*" OR "*Cacopsylla breviantennata*" OR "*Cacopsylla corcontum*" OR "*Cacopsylla crataegi*" OR "*Cacopsylla sorbi*" OR "*Calepitrimerus mathiasrexi*" OR "*Caligula boisduvali*" OR "*Caliroa annulipes*" OR "*Caliroa cerasi*" OR "*Callisto pfaffenzelleri*" OR "*Calliteara pudibunda*" OR "*Calycina citrina*" OR "*Campaea margaritaria*" OR "*Camposporium pellucidum*" OR "*Capronia pulcherrima*" OR "*Capronia semiimmersa*" OR "*Capua vulgana*" OR "*Carcina quercana*" OR "*Carposina sasakii*" OR "*Catenularia cupulifera*" OR "*Cenopalpus spinosus*" OR "*Ceranemota crumbi*" OR "*Ceratocystis piceae*" OR "*Cercospora kriegeriana*" OR "*Cerioporus leptocephalus*" OR "*Cerioporus squamosus*" OR "*Cerrena unicolor*" OR "*Ceuthospora pirina*" OR "*Chaetospermum camelliae*" OR "*Chaetosphaerella fusca*" OR "*Chaetosphaeria innumera*" OR "*Cherry leaf roll virus*" OR "*Chionaspis furfura*" OR "*Chionaspis salicis*" OR "*Chloroclysta miata*" OR "*Chloroclysta siterata*" OR "*Chloroclysta truncata*" OR "*Chondrostereum purpureum*" OR "*Choreutis pariana*" OR "*Choristoneura conflictana*" OR "*Choristoneura hebenstreitella*" OR "*Chrysobothris femorata*" OR "*Chrysobothris mali*" OR "*Chyliza leptogaster*" OR "*Cilioplea kansensis*" OR "*Cilix glaucata*" OR "*Cladius brullei*" OR "*Cladius compressicornis*" OR "*Cladosporium cladosporioides*" OR "*Cladosporium fumago*" OR "*Clathrospora diplospora*" OR "*Claussenomyces prasinulus*" OR "*Cleora cinctaria*" OR "*Closterotomus fulvomaculatus*" OR "*Cnidocampa flavescens*" OR "*Coccomyces coronatus*" OR "*Coccomyces tumidus*" OR "*Coleophora anatipenella*" OR "*Coleophora cerasivorella*" OR "*Coleophora coracipennella*" OR "*Coleophora currucipennella*" OR "*Coleophora hemerobiella*" OR "*Coleophora kroneella*" OR "*Coleophora prunifoliae*" OR "*Coleophora serratella*" OR "*Coleophora siccifolia*" OR "*Coleophora spinella*" OR "*Coleophora trigeminella*" ORP "*Coleophora violacea*" OR

"*Colletotrichum gloeosporioides*" OR "*Colocasia coryli*" OR "*Colotois pennaria*" OR "*Comstockaspis perniciosa*" OR "*Coniocarpon fallax*" OR "*Coniochaeta dakotensis*" OR "*Coniothyrium fuckelii*" OR "*Conistra vaccinii*" OR "*Conotrachelus nenuphar*" OR "*Contarinia floriperda*" OR "*Contarinia sorbi*" OR "*Coriolopsis gallica*" OR "*Coronophora angustata*" OR "*Coronophora annexa*" OR "*Coronophora gregaria*" OR "*Coronophora ovipara*" OR "*Corynespora cambrensis*" OR "*Coryneum foliicola*" OR "*Coryneum sorbi*" OR "*Corythucha arcuata*" OR "*Cosmia trapezina*" OR "*Cosmospora obscura*" OR "*Cossus cossus*" OR "*Crepidotus cesatii*" OR "*Crepidotus kubickae*" OR "*Crepidotus mollis*" OR "*Criconemella xenoplax*" OR "*Criconemoides macrodorum*" OR "*Cristulariella depraedans*" OR "*Crocallis elinguaria*" OR "*Crocigrapha normani*" OR "Croesus septentrionalis" OR "*Cryptocoryneum condensatum*" OR "Cryptodiaporthe aubertii" OR "*Cryptosphaeria moravica*" OR "*Cryptosporella femoralis*" OR "*Cryptosporiopsis diplodioides*" OR "*Cryptosporium aucupariae*" OR "*Cucurbitaria callista*" OR "*Cyathicula coronata*" OR "*Cyathicula cyathoidea*" OR "*Cyclophora linearia*" OR "*Cydia janthinana*" OR "*Cydia pomonella*" OR "*Cydia tenebrosana*" OR "*Cylindrobasidium evolvens*" OR "*Cytospora ampulliformis*" OR "*Cytospora centrivillosa*" OR "*Cytospora ceratosperma*" OR "*Cytospora chrysosperma*" OR "*Cytospora kunzei*" OR "*Cytospora leucostoma*" OR "*Cytospora massariana*" OR "*Cytospora nivea*" OR "Cytospora populina" OR "*Cytospora salicis*" OR "*Cytospora sorbi*" OR "*Cytospora sorbicola*" OR

"*Dactylaria candidula*" OR "*Daedaleopsis confragosa*" OR "*Daldinia concentrica*" OR "*Daldinia loculata*" OR "*Daldinia petriniae*" OR "*Dasineura aucupariae*" OR "*Dasyscyphella nivea*" OR "*Dasystoma salicella*" OR "*Datana ministra*" OR "*Dematophora necatrix*" OR "*Deraeocoris trifasciatus*" OR "*Dermea ariae*" OR "*Diaporthe decorticans*" OR "*Diaporthe eres*" OR "*Diaporthe hungariae*" OR "*Diaporthe impulsa*" OR "*Diaporthe sorbicola*" OR "*Diaporthe spiculosa*" OR "*Diarsia brunnea*" OR "*Diaspidiotus ancylus*" OR "*Diaspidiotus forbesi*" OR "*Diaspidiotus marani*" OR "*Diaspidiotus ostreaeformis*" OR "*Diaspidiotus pyri*" OR "*Diaspidiotus zonatus*" OR "*Diatrype decorticata*" OR "*Diatrype disciformis*" OR "*Diatrype rappazii*" OR "*Diatrype stigma*" OR "*Dicallomera fascelina*" OR "*Diderma radiatum*" OR "*Diloba caeruleocephala*" OR "*Dinemasporium pleurospora*" OR "*Dineura stilata*" OR "*Dineura testaceipes*" OR "*Diplocarpon mespili*" OR "*Diplococcium spicatum*" OR "*Discosia artocreas*" OR "*Discosphaerina sorbi*" OR "Discostroma corticola" OR "*Discostroma fuscellum*" OR "*Ditylenchus intermedius*" OR "*Dothiora sorbi*" OR "*Dothiorella pyrenophora*" OR "*Dothiorella scopulina*" OR "*Dryocoetes himalayensis*" OR "*Durandiella lenticellicola*" OR "*Dysaphis ariae*" OR "*Dysaphis aucupariae*" OR "*Dysaphis devecta*" OR "*Dysaphis indica*" OR "*Dysaphis pavlovskyana*" OR "*Dysaphis plantaginea*" OR "*Dysaphis plantaginis*" OR "*Dysaphis pyri*" OR "*Dysaphis sorbi*" OR "*Dysaphis reaumuri*" OR "Dysmicoccus wistariae" OR "*Dysstroma citrata*" OR "*Ectoedemia atricollis*" OR "*Ectropis crepuscularia*" OR "*Edwardsiana crataegi*" OR "*Edwardsiana frustrator*" OR "*Edwardsiana lanternae*" OR "*Edwardsiana rosae*" OR "*Elasmostethus interstinctus*" OR "*Elasmostethus minor*" OR "*Electrophaes corylata*" OR "*Elsinoe populi*" OR "*Emaravirus sorbi*" OR "*Ematurga atomaria*" OR "*Enarmonia formosana*" OR "*Endophragmiella ellisii*" OR "*Endothiella mespili*" OR "*Enerthenema papillatum*" OR "*Ennomos subsignaria*" OR "*Entoleuca mammata*" OR "*Entosordaria spiralis*" OR "*Eopyrenula leucoplaca*" OR "*Eotetranychus pruni*" OR "*Eotetranychus smithi*" OR "*Epidiaspis leperii*" OR "*Epinotia exquisitana*" OR "*Epirrita autumnata*" OR "*Epirrita christyi*" OR "Epitrimerus pyri" OR "Erannis defoliaria" OR "*Erannis golda*" OR "*Erannis tiliaria*" OR "*Ericaphis gentneri*" OR "*Eriogaster arbusculae*" OR "*Eriogaster catax*" OR "*Eriogaster lanestris*" OR "*Helicotylenchus digonicus*" OR "*Helicotylenchus pseudorobustus*" OR "*Helicotylenchus varicaudatus*" OR "*Heliococcus bohemicus*" OR "*Hemicycliophora subaolica*" OR "*Hemithea aestivaria*" OR "*Hendersonia sorbi*" OR "*Hendersonia torminalis*" OR "*Hericium coralloides*" OR "*Heterobasidion annosum*" OR "*Heterodera trifolii*" OR "*Heteroradulum deglubens*" OR "*Hohenbuehelia fluxilis*" OR "*Holwaya mucida*" OR "*Hoplocampa alpina*" OR "*Hoplocampa ariae*" OR "*Hoplocampa chamaemespili*" OR "*Hoplocampa plagiata*" OR "*Hyalophora cecropia*" OR "*Hyaloscypha intacta*" OR "*Hydnoporia tabacina*" OR "*Hydrelia flammeolaria*" OR "*Hymenochaetopsis intricata*" OR "Hymenoscyphus caudatus" OR "*Hymenoscyphus fructigenus*" OR "*Hymenoscyphus tetracladius*" OR "*Hyphantria cunea*" OR "*Hyphoderma setigerum*" OR "*Hyphodontia spathulata*" OR "*Hypochnicium bombycinum*" OR "*Hypoderma rubi*" OR "*Hypomecis punctinalis*" OR "*Hypomyces rostratus*" OR "*Hypoxylon apiculatum*" OR "*Hypoxylon fuscum*" OR "*Hypoxylon liviae*" OR "*Hyppa rectilinea*" OR "*Immotthia atrograna*" OR "*Incurvaria pectinea*" OR "*Inocutis dryophila*" OR "*Inonotus hispidus*" OR "*Inonotus obliquus*" OR "*Involvulus cupreus*" OR "*Iphiclides feisthamelii*" OR "*Iphiclides podalirius*" OR "*Iridopsis emasculata*" OR "*Iridopsis larvaria*" OR "*Irpex lacteus*" OR "*Issus coleoptratus*" OR "*Jackrogersella multiformis*" OR "*Janus compressus*" OR "*Jodis lactearia*" OR "*Karstenia sorbina*" OR "*Karstenula sorbicola*" OR "Kuehneromyces mutabilis" OR "*Kurtia argillacea*" OR "*Lacanobia contigua*" OR "*Lacanobia thalassina*" OR "*Lachnella fasciculata*" OR "*Lachnum corticale*" OR "*Lactarius subdulcis*" OR "*Laetiporus sulphureus*" OR "*Lasiocampa quercus*" OR "*Lasiosphaeria glabrata*" OR "*Lasiosphaeria ovina*" OR "*Lasiosphaeria racodium*" OR "*Lasiosphaeria sorbina*" OR "*Lasiosphaeris hirsuta*" OR "*Lasiosphaeris hispida*" OR "*Leiopus nebulosus*" OR "*Lentinus brumalis*" OR "*Lentinus substrictus*" OR "*Lentomitella cirrhosa*" OR "*Lepidosaphes pistaciae*" OR "*Lepidosaphes tubulorum*" OR "*Lepidosaphes ulmi*" OR "*Leptosphaeria sorbi*" OR "*Leptosphaeria suffulta*" OR

TABLE B.1 (Continued)

"*Leucodonta bicoloria*" OR "*Leucoptera malifoliella*" OR "*Leucostoma amphibola*" OR "*Leucostoma massarianum*" OR "*Lithomoia solidaginis*" OR "*Lithophane hepatica*" OR "*Lithophane innominata*" OR "*Lochmaea crataegi*" OR "*Lomographa bimaculata*" OR "*Lomographa semiclarata*" OR "*Lomographa simplicior*" OR "*Lomographa temerata*" OR "*Lomographa vestaliata*" OR "*Longidorus elongatus*" OR "*Lophiostoma compressum*" OR "*Lophiostoma nucula*" OR "*Lophocampa argentata*" OR "*Lophocampa maculata*" OR "*Lophodermium aucupariae*" OR "*Lophodermium foliicola*" OR "*Lophodermium punctiforme*" OR "*Loxostege sticticalis*" OR "*Luperus viridipennis*" OR "*Luquetia lobella*" OR "*Lycia hirtaria*" OR "*Lycia ursaria*" OR "*Lycorma delicatula*" OR "*Lygaeus creticus*" OR "*Lygocoris viridis*" OR "*Lymantor coryli*" OR "*Lymantria dispar*" OR "*Lyomyces crustosus*" OR "*Lyonetia clerkella*" OR "*Lyonetia prunifoliella*" OR "*Machimia tentoriferella*" OR "*Macroposthonia curvata*" OR "*Macrosiphum euphorbiae*" OR "Macrosiphum opportunisticum" OR "Macrosiphum pyrifoliae" OR "Macrosiphum sorbi" OR "Magdalis barbicornis" OR "Magdalis cerasi" OR "Magdalis ruficornis" OR "Malacocoris chlorizans" OR "Malacosoma americanum" OR "*Malacosoma californica pluvialis*" OR "*Malacosoma disstria*" OR "*Malacosoma parallela*" OR "*Marasmius favrei*" OR "*Margarodes vitis*" OR "*Marssonina sorbi*" OR "*Massaria ariae*" OR "*Massaria aucupariae*" OR "*Massaria sorbi*" OR "*Megastigmus brevicaudis*" OR "*Melanchra persicariae*" OR "*Melanchra pisi*" OR "*Melanconis marginalis*" OR "*Melanochaeta aotearoae*" OR "*Melanomma populicola*" OR "*Melanomma pulvis-pyrius*" OR "*Melanophora sorbi*" OR "*Melanopsamma pomiformis*" OR "*Melaspileella proximella*" OR "*Meligethes atratus*" OR "*Meloidogyne arenaria*" OR "*Meloidogyne hapla*" OR "*Meloidogyne incognita*" OR "*Meloidogyne javanica*" OR "*Meloidogyne mali*" OR "*Meloidogyne ulmi*" OR "*Menispora caesia*" OR "*Menispora glauca*" OR "*Merlinius tartuensis*" OR "*Mesites tardii*" OR "*Metopolophium dirhodum*" OR "*Micropera cotoneastri*" OR "*Micropera sorbi*" OR "*Microsphaeropsis olivacea*" OR "*Mimas tiliae*" OR "*Mollisia fuscidula*" OR "*Mollisia melaleuca*" OR "*Moma alpium*" OR "*Monilinia ariae*" OR "*Monilinia aucupariae*" OR "*Monilinia fructigena*" OR "*Monodictys paradoxa*" OR "*Montagnula obtusa*" OR "*Montagnula obtusa*" OR "*Mortierella candelabrum*" OR "*Musc"Aphis escherichi*" OR "*Musc"Aphis japonica*" OR "*Mutatoderma mutatum*" OR "*Mycomicrothelia confusa*" OR "*Mycosphaerella cinerascens*" OR "*Mycosphaerella maculiformis*" OR "*Mycosphaerella pyri*" OR "*Mycosphaerella topographica*" OR "*Myrmaecium rubricosum*" OR "*Myz"Aphis komatsubarae*" OR "*Myzus ornatus*" OR "*Myzus persicae*" OR "*Myzus ascalonicus*" OR "*Naetrocymbe nitescens*" OR "*Natantiella ligneola*" OR "*Nearct"Aphis californica*" OR "*Nearct"Aphis yohoensis*" OR "*Necator salmonicolor*" OR "*Nectria asiatica*" OR "*Nectria cinnabarina*" OR "*Nemania serpens*" OR "*Nemoria mimosaria*" OR "*Neocoenorrhinus minutus*" OR "*Neocucurbitaria subcaespitosa*" OR "*Neodasyscypha cerina*" OR "*Neofavolus suavissimus*" OR "*Neofusicoccum arbuti*" OR "*Neolygus contaminatus*" OR "*Neolygus viridis*" OR "*Neomyrmecridium sorbicola*" OR "*Neonectria ditissima*" OR "*Nerice bipartita*" OR "*Neta compacta*" OR "*Neurotoma iridescens*" OR "*Niesslia exilis*" OR "*Nigrograna fuscidula*" OR "*Nippolachnus bengalensis*" OR "*Nippolachnus micromeli*" OR" *Nitschkia collapsa*" OR "*Noctua fimbriata*" OR "*Nola cucullatella*" OR "*Numonia marmorea*" OR "*Numonia suavella*" OR "*Nymphalis antiopa*" OR "*Nymphalis polychloros*" OR "*Nymphalis vaualbum*" OR "*Ochropsora ariae*" OR "*Odontopera bidentata*" OR "*Oemona hirta*" OR "*Olethreutes mori*" OR "*Oligonychus newcomeri*" OR "*Oncopodiella robusta*" OR "*Operophtera brumata*" OR "*Operophtera fagata*" OR "*Ophthalmitis irrorataria*" OR "*Opisthograptis luteolata*" OR "*Orgyia antiqua*" OR "*Orgyia antiquoides*" OR "*Orgyia leucostigma*" OR "*Orius laticollis*" OR "*Orsodacne cerasi*" OR "*Orsodacne lineola*" OR "*Orthosia gothica*" OR "*Orthosia hibisci*" OR "*Orthosia miniosa*" OR "*Orthotaenia undulana*" OR "*Orthotylus bilineatus*" OR "*Ostropa barbara*" OR "*Otiorhynchus armadillo*" OR "*Otiorhynchus carinatopunctatus*" OR "*Otiorhynchus coecus*" OR "*Otiorhynchus fagi*" OR "*Otiorhynchus krattereri*" OR "*Otiorhynchus subdentarus*" OR "*Otiorhynchus tenebricosus*" OR "*Otthia spiraeae*" OR "*Ovatus insitus*" OR "*Oxyporus populinus*" OR "*Pammene rhediella*" OR "*Pammene spiniana*" OR "*Pamphilius aucupariae*" OR "*Pamphilius sylvaticus*" OR "*Pandemis cerasana*" OR "*Pandemis cinnamomeana*" OR "*Pandemis heparana*" OR "*Pandemis limitata*" OR "*Panonychus ulmi*" OR "*Papestra biren*" OR "*Papilio glaucus*" OR "*Papilionospora aspergilloides*" OR "*Pappia fissilis*" OR "*Paraclemensia acerifoliella*" OR "*Paradarisa consonaria*" OR "Paraphytoptus anisonychus" OR "*Paraswammerdamia lutarea*" OR "*Paraswammerdamia nebulella*" OR "*Paratrichodorus pachydermus*" OR "*Paratylenchus amblycephalus*" OR "*Paratylenchus projectus*" OR "*Parlatoria oleae*" OR "*Parornix anglicella*" OR "*Parornix anguliferella*" OR "*Parornix scoticella*" OR "*Parornix strobivorella*" OR "*Parthenolecanium corni corni*" OR "*Partylenchus neglectus*" OR "*Passalora ariae*" OR "Pear blister canker viroid" OR "*Penicillium carneum*" OR "*Penicillium expansum*" OR "*Penicillium griseofulvum*" OR "*Penicillium paneum*" OR "*Peniophora incarnata*" OR "*Peniophorella pallida*" OR "*Peniophorella praetermissa*" OR "*Peribatodes rhomboidaria*" OR "*Pertusaria pupillaris*" OR "*Pestalotiopsis sorbi*" OR "*Peyronellaea obtusa*" OR "*Peyronellaea obtusa*" OR "*Pezicula neocinnamomea*" OR "*Pezicula neoheterochroma*" OR "*Peziza micropus*" OR "*Pezizellaster serratus*" OR "*Phacellium sorbi*" OR "*Phaeoacremonium inflatipes*" OR "*Phaeoacremonium theobromatis*" OR "*Phaeoacremonium vibratile*" OR "*Phaeoacremonium vibratile*" OR "*Phaeoacremonium viticola*" OR "*Phalera bucephala*" OR "*Phanerochaete sordida*" OR "*Phellinopsis conchata*" OR "*Phellinus igniarius*" OR "*Phenacoccus aceris*" OR "*Phigalia pilosaria*" OR "*Phigalia titea*" OR "*Phlebia radiata*" OR "*Phlebia tremellosa*" OR "*Pholiota aurivella*" OR "*Pholiota squarrosa*" OR "*Phoma aucupariae*" OR "*Phoma leucospila*" OR "*Phomopsis sorbicola*" OR "*Phyllactinia guttata*" OR "*Phyllactinia mali*" OR "*Phyllactinia pyri-serotinae*" OR "*Phyllobius alpinus*" OR "*Phyllobius arborator*" OR "*Phyllobius argentatus*" OR "*Phyllobius calcaratus*" OR "*Phyllobius fessus*" OR "*Phyllobius glaucus*" OR "*Phyllobius pyri*" OR "*Phyllobius viridicollis*" OR "*Phyllocoptes sorbeus*" OR "*Phyllodesma tremulifolia*" OR "*Phyllonorycter blancardella*" OR "*Phyllonorycter cerisolella*" OR "*Phyllonorycter corylifoliella*" OR "*Phyllonorycter crataegella*" OR "*Phyllonorycter cydoniella*" OR "*Phyllonorycter deschkai*" OR "*Phyllonorycter hostis*" OR "*Phyllonorycter lantanella*" OR "*Phyllonorycter leucographella*" OR "*Phyllonorycter mespilella*" OR "*Phyllonorycter oxyacanthae*" OR "*Phyllonorycter sorbi*" OR "*Phyllonorycter sorbicola*" OR "*Phyllonorycter uchidai*" OR "*Phyllosticta aucupariae*" OR "*Phyllosticta capitalensis*" OR "*Phyllosticta globigera*" OR "*Phyllosticta leucospila*" OR "*Phyllosticta minima*" OR "*Phyllosticta phytoptorum*" OR "*Phyllosticta sorbi*" OR "*Phyllosticta sorbicola*" OR "*Phymatotrichopsis omnivora*" OR "*Physatocheila dumetorum*" OR "*Physatocheila smreczynskii*" OR "*Phytobia aucupariae*" OR "*Phytocoris dimidiatus*" OR "*Phytocoris reuteri*" OR "*Phytocoris tiliae*" OR "*Phytophthora cactorum*" OR "*Phytophthora cambivora*" OR "*Phytophthora cinnamomi*" OR "*Phytophthora citrophthora*" OR "*Phytophthora cryptogea*" OR "*Phytophthora inundata*" OR "*Phytophthora megasperma*" OR "*Phytophthora plurivora*" OR "*Phytophthora ramorum*" OR "*Phytoptus sorbi*" OR "*Picipes melanopus*" OR "*Picipes tubaeformis*" OR "*Plagiognathus arbustorum*" OR "*Plagodis dolabraria*" OR "*Plagodis pulveraria*" OR "*Planococcus citri*" OR "*Pleospora clavispora*" OR "*Pleurophomella sorbina*" OR "*Pleurophomopsis salicina*" OR "*Pleurotus cornucopiae*" OR "*Pleurotus djamor*" OR "*Pleurotus dryinus*" OR "*Pleurotus pulmonarius*" OR "*Pleurotus subareolatus*" OR "*Plicaturopsis crispa*" OR "Plum pox virus" OR "*Podosesia syringae*" OR "*Podosphaera clandestina*" OR "*Podosphaera curvispora*" OR "*Podosphaera macularis*" OR "*Podosphaera niesslii*" OR "*Poecilocampa populi*" OR "*Pogonocherus hispidus*" OR "*Polia bombycina*" OR "*Polydrusus amoenus*" OR "*Polydrusus cervinus*" OR "*Polydrusus marginatus*" OR "*Polydrusus picus*" OR "*Polydrusus pilosulus*" OR "*Polydrusus pilosus*" OR "*Popillia japonica*" OR "*Pratylenchus crenatus*" OR "*Pratylenchus penetrans*" OR "*Pratylenchus pseudopratensis*" OR "*Priophorus morio*" OR "*Priophorus pallipes*" OR "*Pristiphora condei*" OR "*Pristiphora denudata*" OR "*Pristiphora geniculata*" OR "*Prociphilus corrugatans*" OR "*Prociphilus oriens*" OR "*Proliferodiscus pulveraceus*" OR "*Proliferodiscus pulveraceus*" OR "*Propolis farinosa*" OR "*Prosoeuzophera impletella*" OR "*Protolampra sobrina*"

(Continues)

TABLE B.1 (Continued)

OR "*Protounguicularia barbata*" OR "*Protounguicularia barbata*" OR "Prune dwarf virus" OR "Prunus necrotic ringspot virus" OR "*Psallus ambiguus*" OR "*Psallus varians*" OR "*Pseudaulacaspis biformis*" OR "*Pseudaulacaspis pentagona*" OR "*Pseudochermes fraxini*" OR "*Pseudococcus longispinus*" OR "*Pseudopeziza pyri*" OR "*Pseudothyatira cymatophoroides*" OR "*Pseudovalsella thelebola*" OR "*Psyche casta*" OR "*Psyche crassiorella*" OR "*Psyche rotunda*" OR "*Ptilodon capucina*" OR "*Ptilodon jezoensis*" OR "*Ptycholoma lecheana*" OR "*Pulvinaria hydrangeae*" OR "*Pulvinaria kuwacola*" OR "*Pulvinaria vitis*" OR "*Punctelia subrudecta*" OR "*Pyrenopeziza cotoneastri*" OR "*Pythiogeton nigrescens*" OR "*Quaternaria dissepta*" OR "*Rabenhorstia clandestina*" OR "*Radulomyces confluens*" OR "*Radulomyces molaris*" OR "*Ramularia destruens*" OR "*Ramularia vizellae*" OR "Raspberry ringspot virus" OR "*Recurvaria leucatella*" OR "*Recurvaria nanella*" OR "*Resseliella quercivora*" OR "*Rhabdospora inaequalis*" OR "*Rhagium bifasciatum*" OR "*Rhagium mordax*" OR "*Rhagoletis pomonella*" OR "*Rhamphus oxyacanthae*" OR "*Rhamphus pulicarius*" OR "*Rhaphigaster nebulosa*" OR "*Rheumaptera undulata*" OR "*Rhinocladiella quercus*" OR "*Rhizobium radiobacter*" OR "*Rhizoctonia stridii*" OR "*Rhizopus stolonifer*" OR "*Rhodophaga advenella*" OR "*Rhogogaster chlorosoma*" OR "*Rhogogaster punctulata*" OR "*Rhopalosiphum insertum*" OR "*Rhopalosiphum nymphaeae*" OR "*Rhopalosiphum oxyacanthae*" OR "*Rhopalosiphum padi*" OR "*Rhopalosiphum rufiabdominale*" OR "*Rhopobota naevana*" OR "*Rhopobota unipunctana*" OR "*Rhyncaphytoptus sorbi*" OR "*Rhynchites aeneovirens*" OR "*Rhynchites aequatus*" OR "*Rhynchites caeruleus*" OR "*Rhynchites cupreus*" OR "*Rhynchites olivaceus*" OR "*Rhynchites pauxillus*" OR "*Rhyparia purpurata*" OR "*Ribautiana cruciata*" OR "*Ribautiana ulmi*" OR "*Ricania speculum*" OR "*Rigidoporus sanguinolentus*" OR "*Roestelia fimbriata*" OR "*Rosellinia abscondita*" OR "*Rosellinia aquila*" OR "*Rosellinia mammiformis*" OR "*Rotylenchus goodeyi*" OR "*Ruinenia clavata*" OR "*Saperda candida*" OR "*Saperda scalaris*" OR "*Sarcomyxa serotina*" OR "*Saturnia pavonia*" OR "*Satyrium liparops*" OR "*Schiz"Aphis piricola*" OR "*Schizothyrium jamaicense*" OR "*Schizura unicornis*" OR "*Scoliopteryx libatrix*" OR "*Scolytus intricatus*" OR "*Scolytus mali*" OR "*Scolytus multistriatus*" OR "*Scolytus rugulosus*" OR "*Scopula incanata*" OR "*Scopuloides rimosa*" OR "*Segestria leptalea*" OR "*Seimatosporium cassiopes*" OR "*Seiridium cupressi*" OR "*Selenia dentaria*" OR "*Semioscopis packardella*" OR "*Semioscopis steinkellneriana*" OR "*Septoria aucupariae*" OR "*Septoria hyalospora*" OR "*Septoria sitchensis*" OR "*Septoria torminalis*" OR "*Septosporium bulbotrichum*" OR "*Seticyphella tenuispora*" OR "*Sistotrema brinkmannii*" OR "*Sorb"Aphis chaetosiphon*" OR "Soybean mosaic virus" OR "*Spadicoides bina*" OR "*Sparganothis pettitana*" OR "*Sphaceloma sorbi*" OR "*Sphaerographium petiolicola*" OR "*Sphaerulina musiva*" OR "*Sphinx ligustri*" OR "*Spilocaea crataegi*" OR "*Spilonota ocellana*" OR "*Spilosoma luteum*" OR "*Sporidesmiella hyalosperma var. hyalosperma*" OR "*Sporidesmium eupatoriicola*" OR "*Sporidesmium folliculatum*" OR "*Sporobolomyces beijingensis*" OR "*Sporocadus dacicus*" OR "*Sporocadus microcyclus*" OR "*Sporocadus sorbi*" OR "*Staegeriella* sp." OR "*Stauropus fagi*" OR "*Steccherinum fimbriatum*" OR "*Steccherinum oreophilum*" OR "*Steingelia gorodetskia*" OR "*Stemphylium vesicarium*" OR "*Stenocybe septata*" OR "*Stephanitis pyri*" OR "*Stereum gausapatum*" OR "*Stereum rugosum*" OR "*Sterictiphora geminata*" OR "*steromella trautmanniana*" OR "*Sterrhopterix standfussi*" OR "*Stethoconus pyri*" OR "*Stictis brunnescens*" OR "*Stigmella aucupariae*" OR "*Stigmella hahniella*" OR "*Stigmella hybnerella*" OR "*Stigmella incognitella*" OR "*Stigmella magdalenae*" OR "*Stigmella mespilicola*" OR "*Stigmella nylandriella*" OR "*Stigmella oxyacanthella*" OR "*Stigmella sorbi*" OR "*Stigmella torminalis*" OR "*Stigmina carpophila*" OR "*Stomiopeltis betulae*" OR "Strawberry latent ringspot virus" OR "*Strophosomus capitatus*" OR "*Strossmayeria atriseda*" OR "*Strossmayeria bakeriana*" OR "*Stylodothis puccinioides*" OR "*Swammerdamia compunctella*" OR "*Swammerdamia lutarea*" OR "*Synanthedon myopaeformis*" OR "*Synanthedon pyri*" OR "*Synanthedon scitula*" OR "*Synanthedon stomoxiformis*" OR "*Syndemis musculana*" OR "*Synfenestella sorbi*" OR "*Tachycixius pilosus*" OR "*Taeniolella pulvillus*" OR "*Taeniolina scripta*" OR "*Taeniothrips inconsequens*" OR "*Tapesia cinerella*" OR "*Tapesia fusca*" OR "*Taphrina deformans*" OR "*Taphrina sorbi*" OR "*Tatianae"Rhynchites aequatus*" OR "*Teichospora bartholomewii*" OR "*Teleiodes italica*" OR "*Teleiodes vulgella*" OR "*Tenthredo balteata*" OR "*Tenthredo fagi*" OR "*Tenthredo ferruginea*" OR "*Tenthredo livida*" OR "*Tethea consimilis*" OR "*Tetranychus frater*" OR "*Tetranychus kanzawai*" OR "*Tetranychus schoenei*" OR "*Tetranychus urticae*" OR "*Thaumetopoea processionea*" OR "*Thelephora terrestris*" OR "*Thrips minutissimus*" OR "*Thyridaria sorbi*" OR "*Thyridaria triseptata*" OR "*Tingis angustata*" OR "Tobacco mosaic virus" OR "*Togninia tetraspora*" OR "*Tomasellia gelatinosa*" OR "Tomato black ring virus" OR "Tomato ringspot virus" OR "Tomato spotted wilt orthotospovirus" OR "*Tortrix sinapina*" OR "*Tortrix viridana*" OR "*Torymus druparum*" OR "*Torymus varians*" OR "*Trachycera marmorea*" OR "*Trachycera suavella*" OR "*Trachys minutus*" OR "*Trametes cinnabarina*" OR "*Trametes hirsuta*" OR "*Trametes ochracea*" OR "*Trametes pubescens*" OR "*Trametes versicolor*" OR "*Tremella mesenterica*" OR "*Trichiosoma sorbi*" OR "*Trichiosoma tibiale*" OR "*Trichiura crataegi*" OR "*Trichoderma harzianum*" OR "Trichoderma viride" OR "*Trichoferus campestris*" OR "*Trichosea ludifica*" OR "*Tricladium splendens*" OR "*Tritomegas bicolor*" OR "Trypodendron domesticum" OR "*Tuber puberulum*" OR "*Tubercularia ulmea*" OR "*Tubulicrinis propinquus*" OR "*Tylenchorhynchus claytoni*" OR "*Tylenchorhynchus dubius*" OR "*Tylenchus davainei*" OR "*Tylenchus thornei*" OR "*Tylenchus vulgaris*" OR "*Tympanis alnea*" OR "*Tympanis conspersa*" OR "*Tyromyces chioneus*" OR "*Valdensinia heterodoxa*" OR "*Valsa ceratophora*" OR "*Valsaria insitiva*" OR "*Varicosporium elodeae*" OR "*Vasates arianus*" OR "*Venturia aucupariae*" OR "*Venturia inaequalis*" OR "*Venturia orbiculata*" OR "*Venusia cambrica*" OR "*Venusia comptaria*" OR "*Viscum album*" OR "*Vuilleminia cystidiata*" OR "*Xenodidymella applanata*" OR "*Xestia collina*" OR "*Xiphinema americanum*" OR "*Xylaria filiformis*" OR "*Xylaria hypoxylon*" OR "*Xyleborinus attenuatus*" OR "*Xyleborus dispar*" OR "*Xyleborus dispar*" OR "*Xylodon radula*" OR "*Xylosandrus germanus*" OR "*Xyloterus domesticum*" OR "*Yponomeuta evonymella*" OR "*Yponomeuta padella*" OR "*Ypsolopha falciferella*" OR "*Ypsolopha parenthesella*" OR "*Ypsolopha scabrella*" OR "*Zeuzera pyrina*" OR "*Zygina flammigera*" OR "*Zygina schneideri*"

APPENDIX C

Excel file with the pest list of *Sorbus* species

Appendix C can be found in the online version of this output in the 'supporting information section'