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SCIENTIFIC OPINION

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Commodity risk assessment of *Berberis thunbergii* plants from the UK

EFSA Panel on Plant Health (PLH) | Antonio Vicent Civera | Paula Baptista | Anna Berlin | Elisavet Chatzivassiliou | Jaime Cubero | Nik Cunniffe | Eduardo de la Peña | Nicolas Desneux | Francesco Di Serio | Anna Filipiak | Paolo Gonthier | Beata Hasiów-Jaroszewska | Hervé Jactel | Blanca B. Landa | Lara Maistrello | David Makowski | Panagiotis Milonas | Nikos T. Papadopoulos | Hanna Susi | Dirk Jan van der Gaag | Jane Debode | Christophe Lacomme | Charles Manceau | Christer Sven Magnusson | Juan A. Navas-Cortes | Christos Kritikos | Maria Kormpi | Dimitrios Papachristos | Chrysavgi Reppa | Antigoni Akrivou | Spyridon Antonatos | Despoina Beris | Olaf Mosbach Schulz | Monia Federica Lombardo | Ciro Gardi | Roel Potting

Correspondence: plants@efsa.europa.eu

The declarations of interest of all scientific experts active in EFSA's work are available at https://open.efsa.europa.eu/experts

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: *Berberis thunbergii*, bare root plants (up to 3 years old), whips (up to 2 years old) and rooted plants in pots (up to 4 years old) imported into the EU from the UK. A list of pests potentially associated with the commodities was compiled. The relevance of each pest was assessed based on evidence following defined criteria. One EU quarantine pest (*Phytophthora ramorum* (non-EU isolates)), one protected zone quarantine pest (*Bemisia tabaci* (European populations)) and one non-quarantine pest (*Phytophthora kernoviae*) were selected for further evaluation. For the selected pests, the risk mitigation measures implemented in the UK and specified in the technical dossier were evaluated taking into account the factors reducing their efficacy. 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 evaluated imported commodities. Expert Knowledge Elicitation indicated, with 95% certainty, that between 9975 and 10,000 per 10,000 *B. thunbergii* rooted plants in pots would be free from *P. ramorum*.

KEYWORDS

barberry, *Berberis thunbergii*, commodity risk assessment, European Union, plant health, plant pests

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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 *Berberis thunbergii* DC. 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 *B. thunbergii* plants from the UK following the Guidance on commodity risk assessment for the evaluation of high-risk plant dossiers (EFSA PLH Panel, 2019) and the protocol for commodity risk assessment as presented in the EFSA standard protocols for scientific assessment (EFSA PLH Panel, 2024; Gardi et al., 2024), 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

[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.

parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (SeveroZapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo-Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug)), San Marino, Serbia, Switzerland, Turkey, Ukraine and the UK (except Northern Ireland[5]). Those countries are historically linked to the reference to 'non-European countries' existing in the previous legal framework, Directive 2000/29/EC.

Consequently, for those countries,

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

Pests listed as 'Regulated Non-Quarantine Pest' (RNQP) in Annex IV of the Commission Implementing Regulation (EU) 2019/2072, and deregulated pests [i.e. pest which were listed as quarantine pests in the Council Directive 2000/29/EC and were deregulated by Commission Implementing Regulation (EU) 2019/2072] were not considered for further evaluation. In case a pest is at the same time regulated as 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;
- 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;
- 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.

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 October 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	Technical dossier	Berberis thunbergii commodity information final.pdf
2	Pest list	Berberis pest list_UK.xlsx
3	Distribution of *Berberis thunbergii* plants	Berberis_thunbergii_distribution.pdf
4	List of plants produced in the nurseries	Berberis_thunbergii_producers_sample_product_list.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 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.

[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.

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 and 2).

TABLE 2 Databases used in the literature searches by DEFRA of the UK.

Database	Platform/link
Aphids on World Plants	https://www.aphidsonworldsplants.info/
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
Butterflies and Moths of North America	https://www.butterfliesandmoths.org/
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
Encyclopedia of Life	https://eol.org/
EPPO Global Database	https://gd.eppo.int/
Fauna Europaea	https://www.gbif.org/dataset/90d9e8a6-0ce1-472d-b682-3451095dbc5a
Forest research	https://www.forestresearch.gov.uk/
Fungi of Great Britain and Ireland	https://fungi.myspecies.info/
Global Biodiversity Information Facility	https://www.gbif.org/
Global Taxonomic Database of Gracillariidae (Lepidoptera)	https://www.gbif.org/dataset/98fb9418-8215-4575-abfb-07a30b81acfc
National Collection of Plant Pathogenic Bacteria (NCPPB)	https://ncppb.fera.co.uk/ncppbresult.cfm
Nature Spot	https://www.naturespot.org.uk/
Natural History Museum (NHM)	https://data.nhm.ac.uk/dataset/hosts
NBN Atlas	https://species.nbnatlas.org/
NEMAPLEX	https://nemaplex.ucdavis.edu/
Plant Parasites of Europe – leafminers, galls and fungi	https://bladmineerders.nl/
Pyrenomycetes from southwestern France	https://pyrenomycetes.free.fr/
Scalenet	https://scalenet.info/
Spider Mites Web	https://www1.montpellier.inra.fr/CBGP/spmweb/
The Sawflies (Symphyta) of Britain and Ireland	https://www.sawflies.org.uk/
Thrips-iD	https://www.thrips-id.com/en/
UK Beetles	https://www.ukbeetles.co.uk/
UK Moths	https://ukmoths.org.uk/
UK Plant Health Information Portal	https://planthealthportal.defra.gov.uk/

2.2 | Literature searches performed by EFSA

Literature searches in different databases were undertaken by EFSA to complete a list of pests potentially associated with the genus *Berberis*. The following searches were performed successively: (i) a general search to identify pests reported on the genus *Berberis*, and subsequently (ii) a tailored search to identify whether the above pests are present or not in the UK. The searches were concluded on 6 December 2024. 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 *Berberis*. As for Web of Science, the literature search was performed using a specific, ad hoc established search string (Appendix B). The string was run in 'All Databases' with no range limits for time or language filters. The methodology is further explained in Section 2.3.2.

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

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	http://www.leafmines.co.uk/html/plants.htm
Nemaplex	http://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

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.

2.3 | Methodology

When developing the Opinion, the Panel followed the EFSA Guidance on commodity risk assessment for the evaluation of high-risk plant dossiers (EFSA PLH Panel, 2019). In the first step, pests potentially associated with the commodity in the country of origin (EU-regulated pests and other pests) that may require risk mitigation measures 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 units out of 10,000 exported units (for the description of units, see Section 2.3.4).

2.3.1 | 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.

2.3.2 | Identification of pests potentially associated with the commodity

To evaluate the pest risk associated with the importation of the commodity from the UK, a pest list was compiled. The pest list is a compilation of all identified plant pests reported as associated with all species of *Berberis* genus 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. *Berberis*) 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 (Table 3) excluding EUROPHYT and Web of Science. The notifications of interceptions associated with *Berberis* species from the whole world to the EU were investigated on EUROPHYT from 1995 to May 2020 and TRACES-NT from May 2020 to January 2025, respectively. To check whether *Berberis* species can act as a pathway, all notifications (all origins) for *Berberis* spp. were evaluated. For each selected pest, it was checked if there were any notification records for UK (all commodities).

The search query 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 during searches in other databases. The established search string is detailed in Appendix B and was run on 6 December 2024.

The titles and abstracts of the scientific papers retrieved were screened and the pests associated with *Berberis* genus were included in the pest list. The pest list was eventually further updated 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 includes all identified pests that use the genus *Berberis* as a host (Appendix C).

The relevance of EU-quarantine pests was first assessed (Section 4.1), followed by an assessment of the relevance of any other plant pests (Section 4.2).

2.3.3 | Listing and evaluation of risk mitigation measures

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

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

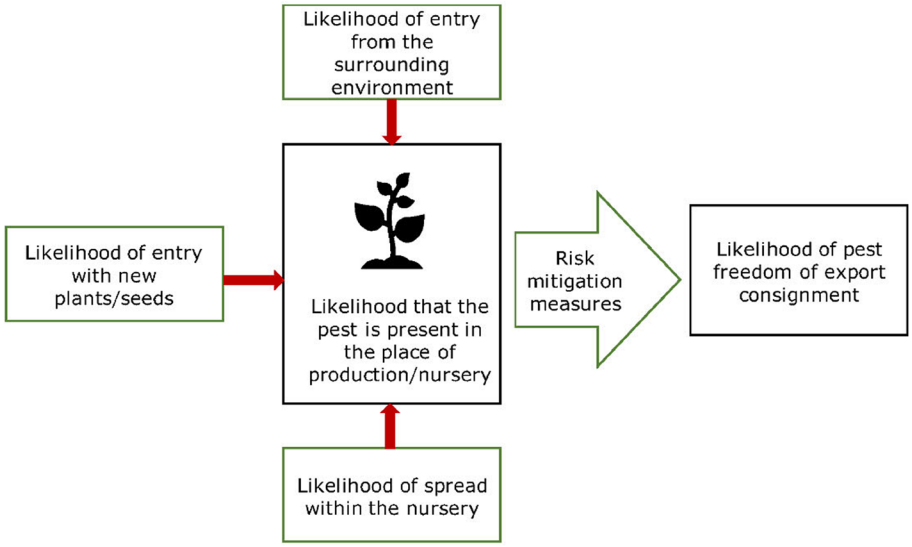


FIGURE 1 Conceptual framework to assess likelihood that plants are exported free from relevant pests. Source: EFSA PLH Panel (2019).

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 (Appendix A).

2.3.4 | Expert knowledge elicitation

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

The specific question for EKE was defined as follows: 'taking into account (i) the risk mitigation measures listed in the Dossier, and (ii) other relevant information (reported in the specific pest datasheets), how many out of 10,000 plant units,

will be infested with the relevant pest/pathogen when arriving in the EU?'. The plant units are defined as either (i) single bare-rooted plants or (ii) bundles of whips (5, 10, 15) or (iii) bundles of seedlings and transplants (25, 50), (iv) single-rooted plants in pots, (v) bundles of up to five rooted plants in pots.

The risk assessment considers two group of commodities which were (i) bare root plants and whips and (ii) rooted plants 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 to be imported from the UK to EU is *Berberis thunbergii* DC. (common name: Japanese barberry, Thunberg's barberry, red barberry; family: Berberidaceae), in the form of bare root plants and whips, and rooted plants in pots (Figure 2; Table 4).

TABLE 4 Type of *Berberis thunbergii* plants commodities to be exported to the EU (Dossier Section 1).

Type of plant	Age	Diameter (max)	Height/length (max)
Whips	1–2 years	10 mm	100 cm
Bare root plants (seedlings or transplants)	1–3 years	40 mm	60 cm
Rooted plants in pots	1–4 years	40 mm	60 cm

The Panel considered the definition of the different types of commodities as follows:

- whip: a young, bare root, slender plant (often a tree or shrub), unbranched or with a single stem;
- seedling: a young plant that has just sprouted from a seed;
- transplant: a plant that has been transplanted during its growth.

FIGURE 2 *Berberis thunbergii* plants grown in pots on a membrane on top of a gravel bed (Source: Dossier Section 1).

The commodity is intended for export to the EU, specifically for the amenity or garden centre trade rather than for nurseries. Specifically, exported plants are only supplied directly to professional operators and traders.

According to ISPM 36 (FAO, 2019), the commodity can be classified as 'bare root plants' and 'rooted plants in pots'. According to the Dossier Section 1, the expected trade volume for *B. thunbergii* is listed in Table 5.

TABLE 5 Expected trade volume per year and seasonal timing planned for export to the EU for *Berberis thunbergii commodities*.

Type of plant	Number of items	Seasonal timing
Bare root plants	7000	November to April
Rooted plants in pots	5000	All year

Trade of all plant types will mainly be to Northern Ireland and the Republic of Ireland. As for seasonal timing, bare root plants will be harvested in winter (November to April) as this is the best time to move/export dormant plants, while 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. Bare root plants may have some leaves at the time of export, particularly when exported in early winter. Rooted plants in pots may be exported with or without their leaves, depending on the timing of the export and the life cycle of the species, in any period of the year (Dossier Section 1).

3.2 | Description of the production areas

The map provided by the applicant includes the nurseries producing the commodity for export to the EU (Dossier Section 1). According to the dossier, the provided locations of the nurseries correspond to those that contributed to the dossier, and do not exclude the possibility that other nurseries may wish to export *B. thunbergii* products to the EU in the future. Such nurseries would need to meet the import requirements set out in any subsequent EU legislation, as would the nurseries that have contributed technical information to the dossiers.

All nurseries and producers are registered as professional operators with the UK NPPO, either by the Animal and Plant Health Agency (APHA) in England and Wales, or with SASA by the Scottish Government, and are authorised to issue UK plant passports and phytosanitary certificates for export, verifying they meet the required national sanitary standards (Dossier Section 1).

According to the dossier, most of the nurseries also produce plants for the local market, and there is no distancing between production areas for the export and the local market. All plants within UK nurseries are grown under the same phytosanitary measures, meeting the requirements of the UK Plant Passporting regime (Dossier Section 1).

Based on the global Köppen–Geiger climate zone classification (Kottek et al., 2006), the climate of the production areas of *B. thunbergii* in UK is classified as Cfb.

The minimum and maximum sizes of nurseries growing *B. thunbergii* for export are as follows: for container grown stock, a minimum of 8 ha and a maximum of 150 ha; for field-grown stock intended for bare root plants, the maximum size is 325 ha.

The exporting nurseries cultivate a variety of other plant species. The minimum and maximum proportions of *B. thunbergii* grown compared to other plants species are approximately 0.2%–0.5% (Dossier Section 1). The commodities grown at the nurseries will vary depending on the year and season.

The 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. Arable crops are rotated in line with good farming practice and could include oilseed rape (*Brassica napus*), wheat (*Triticum* spp.), barley (*Hordeum vulgare*), turnips (*Brassica rapa* subsp. *rapa*), potatoes (*Solanum tuberosum*) and maize (*Zea mays*) (Dossier Section 1).

The pasture is predominantly composed of ryegrass (*Lolium* spp.) (Dossier Section 1).

Woodlands tend to be a standard UK mixed woodland, with a range of UK native trees such as ash (*Fraxinus* spp.), field maple (*Acer campestre*), holly (*Ilex* spp.), Norway maple (*Acer platanoides*), oak (*Quercus robur*), pine (*Pinus* spp.), poplar (*Populus* spp.), sycamore (*Acer pseudoplatanus*) (Dossier Section 1). The nearest woodland to the nursery borders the boundary fence.

Hedges are often used to define field boundaries and grown along roadsides (Dossier Section 1) and are made up of a range of species including alder (*Alnus glutinosa*), blackthorn (*Prunus spinosa*), hazel (*Corylus avellana*), holly (*Ilex* spp.), hawthorn (*Crataegus* spp.), ivy (*Hedera* spp.), laurel (*Prunus laurocerasus*), leylandii (*Cupressus* × *leylandii*) and yew (*Taxus baccata*) (Dossier Section 1). The minimum distance in a straight line, between the growing area in the nurseries and the closest *B. thunbergii* plants in the local surroundings is 10 m. It is not possible to identify what plant species are growing within the gardens of private dwellings.

3.3 | Production and handling processes

3.3.1 | Growing conditions

As the plants are intended for outdoor cultivation, only early growth stages are normally maintained under protection, such as young plants/seedlings that are vulnerable 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).

The growing media used are either virgin peat or peat-free compost (a mixture of coir, tree bark, wood fibre, etc.) complying with the requirements for growing media as specified in the Annex VII of the Commission Implementing Regulation 2019/2072. This growing media are certified and heat-treated by commercial suppliers during production to eliminate pests and diseases. 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, by adopting the systems approach, using soil

testing for European Union Quarantine Pests present in UK, watering with water free from brown rot and removing as much soil as possible.

3.3.2 | Source of planting material

The starting material is a mix of seeds and seedlings. Plants are not grown from certified seed; seedlings sourced in the UK are certified with UK Plant Passports; seedlings from the EU countries are certified with phytosanitary certificates. Some plants may be obtained from EU (mainly Netherlands, Belgium and France). The EU is the only source of the plants obtained from abroad.

The nursery expected to export to the EU does not produce plants from grafting, they use only seed and seedlings; therefore, there are no mother plants of *B. thunbergii* present in the nursery. The nursery expected to export to the EU also does not have mother plants of other species present in the nursery.

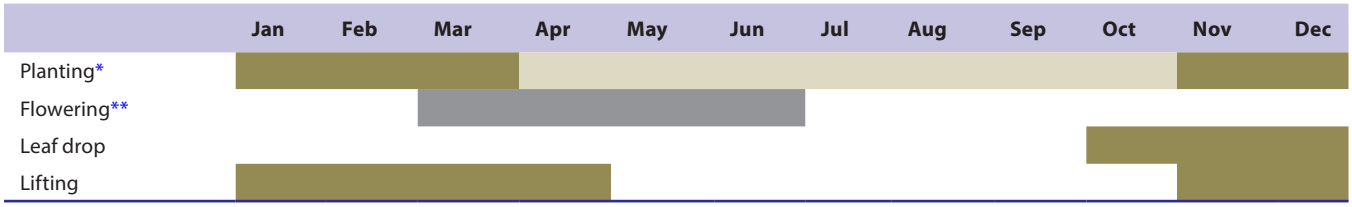
3.3.3 | Production cycle

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

- field grown in containers (cells, pots, tubes, etc.) outdoors/ in the open air;
- field grown (in soil).

The commodity production stages and the phenology of the crop associated are reported in Table 6.

TABLE 6 Commodity production stages (planting) and the phenology of the crop (including flowering, leaf drop) and harvesting periods (lifting).



*Rooted plants in pots can be planted at any time of year (light grey), though winter is most common (dark grey). **Flowering occurs during the spring season, depending upon the variety and weather conditions.

Planting. Bare root plants are planted from November to March; rooted plants in pots can be planted at any time of year, though winter is most common.

Growing. Rooted plants 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 as young plants, root-washed to remove any soil and then potted in EU-compliant growing media. In any case, plants will be lifted from the field a minimum of one growing season prior to export.

Pruning. Bare root plants and rooted plants in pots are pruned as required, while whips are not pruned.

Irrigation. 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/watercourses.

Hygiene measures. All nurseries have plant hygiene, housekeeping rules and practices in place, which are communicated to all relevant employees. The rules will be dependent on the plants handled and the type of business but will refer to growing media, weed management, water usage, tools and visitors.

The growing media are 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 to reduce risk of contamination with soil or other material (Dossier Section 1).

Growers must have an appropriate programme of weed management in place on the nursery. 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. The predominant species is rye grass (*Lolium* spp.). Other identified species may include dandelions (*Taraxacum officinale*), hairy bittercress (*Cardamine hirsute*), common daisy (*Bellis perennis*), creeping cinquefoil (*Potentilla reptans*) and bluebells (*Hyacinthoides non-scripta*).

Growers are required to assess water sources, irrigation and drainage systems used in 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. All mains water supply meets the UK standard Water Supply (Water quality) regulation 2016 and the WHO/EU potable water standards Drinking water Directive (98/83/EC and the revised Drinking Water Directive 2020/2184) which includes a total freedom from both human and plant pathogens (Article 2-(7)). All mains water conducting pipework fully complies with the UK Water Supply (Water Fittings) regulations of 1999 and the amendments of 2019. Irrigation water used

is not stored in any open tanks where air borne contamination could take place and is entirely isolated from any outside exposure. All water is passed through a sand filtration system to remove contaminants and is contained in storage tanks prior to use. One nursery that operates this approach is currently in the process of installing additional nanobubble technology to treat the water. In some cases, where the underlying geology permits, nurseries can draw water directly from bore holes drilled into underground aquifers. The water that fills these aquifers is naturally filtered through the layers of rock (e.g. limestone) over long periods of time, many millennia in some cases. The water from such supplies is generally of such high quality that it is fit for human consumption with little to no further processing and is often bottled and sold as mineral water. Some nurseries contributing to rainwater or freshwater watercourse application for both environmental and efficiency reasons use a combination of rain capture systems or abstract directly from available watercourses. Regardless of the source of the water used to irrigate, none of the nurseries contributing information to this dossier have experienced the introduction of a pest/disease from water supply (Dossier Section 1).

Disinfection of tools and equipment between batches/lots are general hygiene measures undertaken as part of nursey production. 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 pest transfer (e.g. virus, bacteria, fungi, phytoplasmas, etc.).

All residues or waste materials shall be assessed for the potential to host, harbour and transmit pests. Post-harvest and through the autumn and winter, nursery management is centred on pest and disease prevention and maintaining good levels of nursery hygiene. Leaves, prunings and weeds are all removed from the nursery to reduce the number of over wintering sites for pests and diseases.

Hygiene practices and rules are communicated to and complied with by visitors, and any areas that are restricted for plant health reasons are clearly delineated and signposted.

3.3.4 | Post-harvest processes and export procedure

For export procedures, 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).

The following processes are typical of 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. 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. 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).
- Rooted plants are lifted, root-washed and placed in pots with new growing media and stored prior to export, transported on Danish trolleys for smaller containers, or ISPM 15 certified pallets, or individually in pots for larger containers (Dossier Section 1).

The preparation of the commodities for export is carried out inside the nurseries in a closed environment, e.g. packing shed (Dossier Section 1). 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).

4 | IDENTIFICATION OF PESTS POTENTIALLY ASSOCIATED WITH THE COMMODITY

The search for potential pests associated with *Berberis* genus rendered 759 species (for search string, Appendix B; for pest list, 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 22 EU-quarantine species or groups of species that are reported to use *Berberis* genus 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 22 EU-quarantine species (or groups of species) evaluated, two species, *Bemisia tabaci* (European populations) and *Phytophthora ramorum* (non-EU isolates) are present in UK and were selected for further evaluation.

TABLE 7 Overview of the evaluation of the 22 EU-quarantine pest species known to use *Berberis* genus 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	*Berberis* confirmed as a host	Pest can be associated with the commodity (NA = not assessed)	Pest relevant for the opinion
1	*Aphis citricidus*	TOXOCI	Insects	No	*Berberis* spp. (Singh & Singh, 2017)	NA	No
2	*Bemisia tabaci* (European populations)[b]	BEMITA	Insects	Yes	*B. thunbergii* (Li et al., 2011)	Yes	Yes
3	*Bemisia tabaci* (non-European populations)	BEMITA	Insects	No	*B. thunbergii* (Li et al., 2011)	NA	No
4	*Candidatus Phytoplasma hispanicum* - 16SrXIII-F subgroup	PHYP07	Phytoplasmas	No	*B. microphylla* (Madariaga & Ramírez, 2019)	NA	No
5	*Phoma andina*	PHOMAN	Fungi	No	*B. darwinii* (Mujica & Vergara, 1945)	NA	No
6	*Phymatotrichopsis omnivora*	PHMPOM	Fungi	No	*B. thunbergii, B. vulgaris, B. canadensis* (Anonymous, 1960)	NA	No
7	*Phytophthora ramorum* (non-EU isolates)	PHYTRA	Oomycetes	Yes	*B. aquifolium* (Cave et al., 2008; Elliott et al., 2021; USDA, 2010)	Yes	Yes
8	*Popillia japonica*	POPIJA	Insects	No	*B. thunbergii* and *B. vulgaris* (Held, 2004; Rowe et al., 2002; Tayeh et al., 2023)	NA	No
9	*Scirtothrips dorsalis*	SCTDO	Insects	No	*B. bealei* (Kumar et al., 2013)	NA	No
10	*Xylella fastidiosa*	XYLEFA	Bacteria	No	*B. thunbergii* (EFSA, 2024)	NA	No
11	*Xylella fastidiosa* subsp. *multiplex*	XYLEFM	Bacteria	No	*B. thunbergii* (EFSA, 2024)	NA	No
Scolytinae spp. (non-European)							
12	*Anisandrus mussooriensis* (non-European)	–	Insects	No	*Berberis* spp. (Scolytinae hosts and distribution database, online)	NA	No
13	*Corthylus punctatissimus* (non-European)	CORHPU	Insects	No	*Berberis* spp. (Scolytinae hosts and distribution database, online)	NA	No
14	*Hypothenemus rotundicollis* (non-European)	–	Insects	No	*Berberis* spp. (Scolytinae hosts and distribution database, online)	NA	No
15	*Thysanoes berbericolens* (non-European)	–	Insects	No	*Berberis* spp. (Scolytinae hosts and distribution database, online)	NA	No
16	*Xylosandrus brevis* (non-European)	–	Insects	No	*Berberis* spp. (Scolytinae hosts and distribution database, online)	NA	No
Tephritidae spp. (non-European)							
17	*Rhagoletis berberis* (non-European)	–	Insects	No	*Berberis* spp. (EFSA PLH Panel, 2020)	NA	No
18	*Rhagoletis caucasica* (non-European)	–	Insects	No	*Berberis* spp. (EFSA PLH Panel, 2020)	NA	No

(Continues)

TABLE 7 (Continued)

No.	Pest name according to EU legislation[a]	EPPO code	Group	Pest present in the UK	*Berberis* confirmed as a host	Pest can be associated with the commodity (NA = not assessed)	Pest relevant for the opinion
19	*Rhagoletis chumsanica* (non-European)	–	Insects	No	*Berberis* spp. (EFSA, 2020)	NA	No
20	*Rhagoletis kurentsovi* (non-European)	–	Insects	No	*Berberis* spp. (EFSA, 2020)	NA	No
21	*Rhagoletis magniterebra* (non-European)	–	Insects	No	*Berberis* spp. (EFSA, 2020)	NA	No
22	*Rhagoletis samojlovitshae* (non-European)	–	Insects	No	*Berberis* spp. (EFSA, 2020)	NA	No

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

[b]*Bemisia tabaci* (European populations) is regulated as a protected zone quarantine pest.

4.2 | 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 exporting country. 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. *Berberis thunbergii* is a host of the pest;
d. one or more life stages of the pest can be associated with the traded commodity of *B. thunbergii*;
e. the pest may have an impact in the EU.

For non-regulated species with a limited distribution in the EU (i.e. present in one or a few EU member states), they should also satisfy at least one of the following conditions for the pest to be selected for further evaluation:

- 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, 749 potential pests (non-EU quarantine) known to be associated with *Berberis* were evaluated for their relevance to this Opinion. Species were excluded from further evaluation when at least one of the conditions listed above (a–e) was not met. Details can be found in the pest list (Appendix C). Of the evaluated pests not regulated in the EU, one pest (*Phytophthora kernoviae*) was selected for further evaluation because it met all the selection criteria. More information on this species can be found in the pest datasheets (Appendix A).

Several *Puccinia* species, including *P. graminis* and *P. striiformis*, have *Berberis* as an alternate host (i.e. a host required for the pathogen to complete its life cycle) and are present in the EU. Therefore, they do not fulfil the selection criteria. However, because of the importance of these cereal rust pathogens for the EU, the Panel wants to report the following notes:

– It is important to avoid planting of *Berberis* species near agricultural areas of cereal production. Based on the collected evidence, there are no reports that *P. graminis* has been found on *B. thunbergii*.
– There are 32 resistant varieties of *B. thunbergii* to *P. graminis* (USDA, Federal Register, online).
– New stem rust races could be introduced with the trade of *Berberis* spp. plants.
– Genetic diversity and new virulence combinations can develop on introduced *Berberis* spp. plants.
– Arrival of new stem rust races by wind to Europe can also happen and cannot be prevented. *Puccinia graminis* and *P. striiformis* are present in the EU and have no quarantine status in the EU.

4.3 | Summary of pests selected for further evaluation

The three pests satisfying all the relevant criteria listed in Sections 4.1 and 4.2 are selected for further evaluation (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	*Bemisia tabaci* (European populations)	BEMITA	Hemiptera; Aleyrodidae	Insects	Protected Zone Quarantine Pest
2	*Phytophthora ramorum* (non-EU isolates)	PHYTRA	Peronosporales, Peronosporaceae	Oomycetes	EU Quarantine Pest
3	*Phytophthora kernoviae*	PHYTKE	Peronosporales, Peronosporaceae	Oomycetes	Non-EU Quarantine Pest

5 | RISK MITIGATION MEASURES

For each of the selected pests (Table 8), the Panel evaluated the likelihood that it could be present in the *B. thunbergii* 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 (Appendix A).

5.1 | Risk mitigation measures applied in the UK

- With the information provided by the UK (Dossier Sections 1, 2, 3, & 4), the Panel summarised the risk mitigation measures (Table 9) that are implemented in the production nursery.

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

No.	Risk mitigation measure	Implementation in the UK
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).
2	Certification of propagation material	Plants are not grown from certified seed; seedlings sourced in the UK are certified with UK Plant Passports; seedlings from the EU countries are certified with phytosanitary certificates.
3	Origin and treatment of growing media	In the production or procurement of *B. thunbergii* 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. 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).
4	Surveillance, monitoring and sampling	During production, 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, soil, watercourses) (Dossier Section 1).
5	Hygiene measures	According to the Dossier Section 1, all the nurseries have plant hygiene and housekeeping rules and practices in place, which are communicated to all relevant employees. These practices cover growing media, weed management, water usage, cleaning and sterilisation, waste treatment and disposal and the management of 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. Rainwater that is collected is sand filtrated. Water is routinely sampled and sent for analysis. No quarantine pests have been found (Dossier Section 1).
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).
8	Washing of the roots	Bare root plants are lifted and washed free from soil (Dossier Section 1). When initially grown in the field, rooted plants in pots are lifted and root washed to remove any soil (Dossier Section 1)
9	Inspections and management of plants before export	Pre-export inspections are undertaken as part of the process of issuing a phytosanitary certificate. These inspections are generally undertaken as near to the time of export as possible, usually within 1–2- days, and not more than 2 weeks before export. Separate from any official inspection, plant material is checked by growers for plant health issues before dispatch.

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. Factors reducing 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 (*B. tabaci*, *P. kernoviae* and *P. ramorum*) is given in the sections below (Sections 5.2.1–5.2.3). The outcome of EKE on pest freedom after the evaluation of the proposed risk mitigation measures is summarised in Section 5.2.3.

For *P. kernoviae*, the EKE outcomes for the two commodities (bare root plants and whips, and rooted plants in pots) were identical. The probability that *B. tabaci* is associated with *B. thunbergii* plants is considered as very low, irrespective to the commodity types. Therefore, these commodities were presented as a single commodity (*all plants*), resulting in a combined Overview (Section 5.2.1) and figure explanation (Figure 4).

5.2.1 | Overview of the evaluation of *Bemisia tabaci* (European populations)

Overview of the evaluation of *Bemisia tabaci* for bare root all commodity plants (bare root plants, whips and rooted plants in pots)					
Rating of the likelihood of pest freedom	Almost always pest free (based on the median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free bundles/plants	**9993** out of 10,000 bundles/plants	**9995** out of 10,000 bundles/plants	**9997** out of 10,000 bundles/plants	**9999** out of 10,000 bundles/plants	**10,000** out of 10,000 bundles/plants
Proportion of infected plants	**0** out of 10,000 plants	**1** out of 10,000 plants	**3** out of 10,000 plants	**5** out of 10,000 plants	**7** out of 10,000 plants
Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity**				
	Bemisia tabaci has a broad host range and *Berberis* genus is considered a minor host (for references, see Appendix A.2). *Bemisia tabaci* is present in the UK, with few occurrences. UK outbreaks of *B. tabaci* have been restricted to greenhouses and subjected to eradication procedures. There are no reports of summertime transient populations of *B. tabaci* occurring outside greenhouses anywhere in Northern Europe, therefore is unlikely that *B. tabaci* is present on *Berberis* plants grown outdoors in the UK. **Pest control measures applied during production** Pest control measures implemented during the production of *B. thunbergii* plants that may have an effect on the presence of *B. tabaci* include: (a) registration of production sites; (b) use of certified plant material; (c) surveillance, monitoring and sampling; (d) hygiene measures; (e) application of plant protection products; (f) inspection and management of plants before export. **Evaluation of control measures** Overall, the measures taken by the growers are effective against the pest. The following critical points have been identified: – Leaves may remain on the commodity at the time of export facilitating pest presence. – Early infestations are difficult to detect. **Interception records** In the EUROPHYT/TRACES-NT database, there are no records of notification for *Berberis* plants for planting, either from the UK or from other countries, due to the presence of *B. tabaci* between 1995 and February 2025 (EUROPHYT; TRACES-NT, online). **Main uncertainties** – The level of host suitability of *B. thunbergii* to the pest. – Possibility of the presence of the pest outside greenhouses in summertime. – Pest abundance in the nursery and the surroundings. – The efficacy of surveillance and the application of measures targeting the pest.				

5.2.2 | Overview of the evaluation of *Phytophthora kernoviae*

Overview of the evaluation of *Phytophthora kernoviae* for all commodity plants (bare root plants, whips and rooted plants in pots)					
Rating of the likelihood of pest freedom	Pest free with some exceptional cases (based on the median).				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free bundles/plants	**9983** out of 10,000 bundles/plants	**9990** out of 10,000 bundles/plants	**9995** out of 10,000 bundles/plants	**9998** out of 10,000 bundles/plants	**10,000** out of 10,000 bundles/plants
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of infected plants/bundles	**0** out of 10,000 bundles/plants	**2** out of 10,000 bundles/plants	**5** out of 10,000 bundles/plants	**10** out of 10,000 bundles/plants	**17** out of 10,000 bundles/plants

(Continues)

(Continued)

Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity** *Phytophthora kernoviae* is present in the UK with a restricted distribution. The pathogen has a wide host range including the genus *Berberis*. The main hosts (e.g. *Rhododendron* spp.) can be present in the surroundings of the nurseries. Aerial inoculum could be produced on these host plants and potentially leading to bark, leaf and root infections in the commodity. **Pest control measures applied during production** *Phytophthora kernoviae* is a provisional quarantine pest in the UK and is under official control. Pest control measures implemented during the production of *B. thunbergii* plants include: (a) registration of production sites; (b) use of certified plant material; (c) origin and treatment of growing media; (d) surveillance, monitoring, and sampling; (e) hygiene measures; (f) irrigation water testing; (g) washing of the roots of the field grown plants (up to 3 years old); (h) application of pest control products; (i) inspection and management of plants before export. **Evaluation of control measures** Overall, the measures taken by growers are effective against this pathogen. However, the following critical points were identified: – The washing of the roots removes (parts of) the soil, along with the pathogen present in the soil. – Leaves may remain on the commodity at the time of export increasing the likelihood of pathogen presence. – Early infections are difficult to detect through visual inspections. **Interception records** In the EUROPHYT/TRACES-NT database there are no records of notification for *Berberis* plants for planting, either from the UK or from other countries, due to the presence of *P. kernoviae* between 1995 and February 2025 (EUROPHYT; TRACES-NT, online). **Main uncertainties** – The level of susceptibility of *B. thunbergii* to the pathogen. – Whether symptoms may be promptly detected. – The presence/abundance of the pathogen in the area where the nurseries are located. – The level of efficacy of phytosanitary treatments against the pathogen.

5.2.3 | Overview of the evaluation of *Phytophthora ramorum*

Overview of the evaluation of *Phytophthora ramorum* for bare root plants and whips					
Rating of the likelihood of pest freedom	**Pest free with some exceptional cases** (based on the median)				
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free bundles/plants	**9975** out of 10,000 bundles/plants	**9985** out of 10,000 bundles/plants	**9992** out of 10,000 bundles/plants	**9996** out of 10,000 bundles/plants	**10,000** out of 10,000 bundles/plants
Proportion of infected plants	**0** out of 10,000 plants	**4** out of 10,000 plants	**8** out of 10,000 plants	**15** out of 10,000 plants	**25** out of 10,000 plants
Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity** *Phytophthora ramorum* is present in most regions of the UK, but it is more often reported in wetter, western regions. *Phytophthora ramorum* has a broad host range, including *Berberis* as natural host (for references, see Appendix A.2). The potential entry of propagules of *P. ramorum* from the surrounding environment may occur via wind, water and soil carried on shoes or feet of animals entering the nursery (if any). Additionally, the pathogen can enter with new seedlings of *Berberis* or other plant species used for plant production in the nurseries. **Pest control measures applied during production** Pest control measures implemented during the production of *B. thunbergii* plants include: (a) registration of production sites; (b) use of certified plant material; (c) surveillance, monitoring and sampling; (d) hygiene measures; (e) irrigation water testing; (f) washing of the roots of the field grown plants (up to 3 years old); (g) application of pest control products; (h) inspection and management of plants before export. **Evaluation of control measures** Overall, the measures taken by the growers are effective against this pathogen. The following critical points have been identified: – The washing of the roots removes (parts of) the soil, along with the pathogen present in the soil, but it does not remove the pathogen that may occasionally be present in the roots. – Leaves may remain on the commodity at the time of export increasing the likelihood of pathogen presence. – Early infections are difficult to be detected through visual inspections. **Interception records** In the EUROPHYT/TRACES-NT database, there are no records of notification for *Berberis* plants for planting, either from the UK or from other countries, due to the presence of *P. ramorum* between 1995 and February 2025 (EUROPHYT; TRACES-NT, online). **Main uncertainties** – The effectiveness of hygiene measures, particularly regarding the cleaning of the machinery and the potential movement of soil within the nursery. – Whether symptoms on *Berberis* are recognisable and may be promptly detected. – The level of susceptibility of *B. thunbergii* to the pathogen.				

Overview of the evaluation of *Phytophthora ramorum* for 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	**9975** out of 10,000 plants	**9985** out of 10,000 plants	**9992** out of 10,000 plants	**9996** out of 10,000 plants	**10,000** out of 10,000 plants
Proportion of infected plants	**0** out of 10,000 plants	**4** out of 10,000 plants	**8** out of 10,000 plants	**15** out of 10,000 plants	**25** out of 10,000 plants
Summary of the information used for the evaluation	**Possibility that the pest could become associated with the commodity** *Phytophtora ramorum* is present in most regions of the UK, but it is more often reported in wetter, western regions. *P. ramorum* has a broad host range, including *Berberis* as natural host (for references see Appendix A.2). The potential entry of propagules of *P. ramorum* from the surrounding environment may occur via wind, water, and soil carried on shoes or feet of animals entering the nursery (if any). Additionally, the pathogen can enter with new seedlings of *Berberis* or other plant species used for plant production in the nurseries. **Pest control measures applied during production** Pest control measures implemented during the production of *B. thunbergii* plants include: (a) registration of production sites; (b) use of certified plant material; (c) origin and treatment of growing media; (d) surveillance, monitoring, and sampling; (e) hygiene measures; (f) irrigation water testing; (g) washing of the roots of the field grown plants (up to 3 years old); (h) application of pest control products; (i) inspection and management of plants before export. **Evaluation of control measures** Overall, the measures taken by the growers are effective against this pathogen. The following critical points have been identified: – The washing of the roots removes (parts of) the soil, along with the pathogen present in the soil, but it does not remove the pathogen that may occasionally be present in the roots. – Leaves may remain on the commodity at the time of export increasing the likelihood of pathogen presence. – Early infections are difficult to be detected through visual inspections. **Interception records** In the EUROPHYT/TRACES-NT database, there are no records of notification for *Berberis* plants for planting, either from the UK or from other countries, due to the presence of *P. ramorum* between 1995 and February 2025 (EUROPHYT; TRACES-NT, online). **Main uncertainties** – The effectiveness of hygiene measures, particularly regarding the cleaning of the machinery and the potential movement of soil within the nursery. – Whether symptoms on *Berberis* are recognisable and may be promptly detected. – The level of susceptibility of *B. thunbergii* to the pathogen.				

5.3 | Outcome of expert knowledge elicitation

Table 10 and Figure 3 show the outcome of the EKE regarding pest freedom after the evaluation of the currently proposed risk mitigation measures for the selected pests. Figure 4 provides an explanation of the descending distribution function describing the likelihood of pest freedom after the evaluation of the currently proposed risk mitigation measures for *B. thunbergii* (i) bare root plants and whips, (ii) rooted plants in pots (single plants in pots) designated for export to EU for *P. ramorum;* and (iii) both commodities (all plants) for *B. tabac*i and *P. kernoviae*.

TABLE 10 Assessment of the likelihood of pest freedom following evaluation of current risk mitigation measures against pests on *Berberis thunbergii* 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	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	*Bemisia tabaci*, all plants							L	MU
2	*Phytophthora kernoviae*, all plants						L	M	U
3	*Phytophthora ramorum*, bare root plants						L	M	U
4	*Phytophthora ramorum*, potted plants						L	M	U

PANEL A

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

PANEL B

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

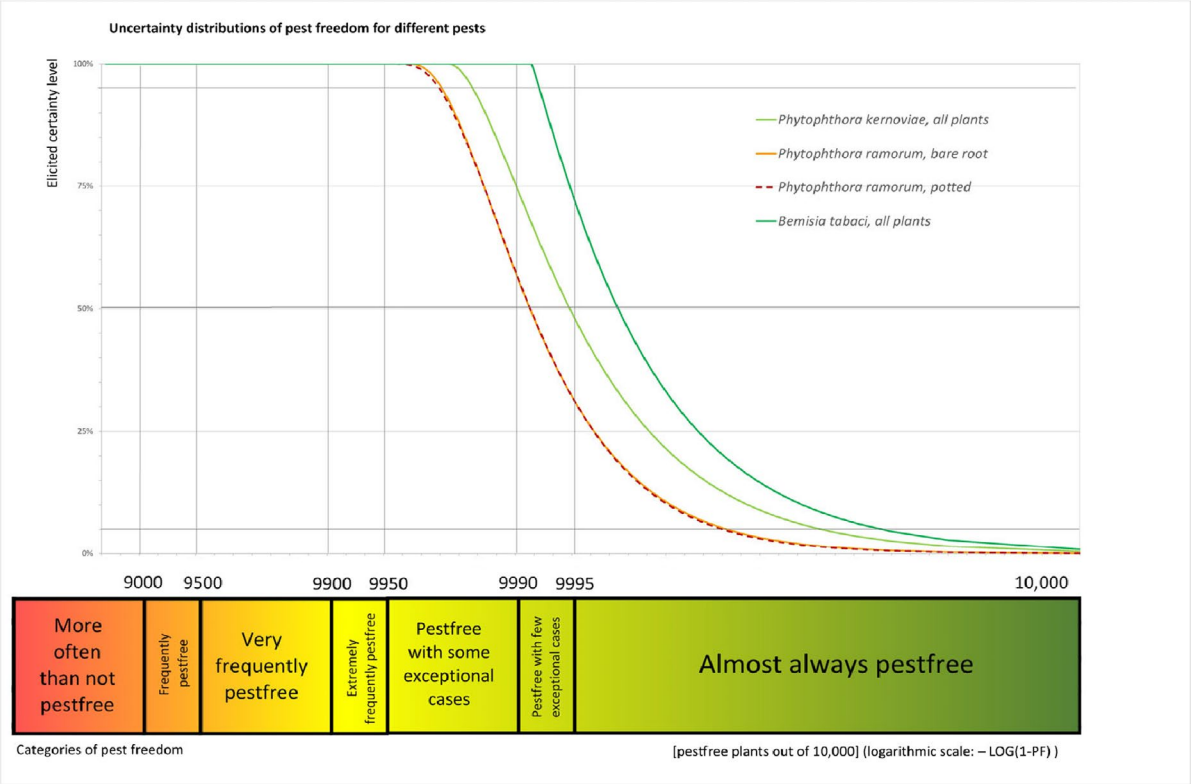


FIGURE 3 The Elicited certainty (*y*-axis) of the number of pest-free *Berberis thunbergii* plants (*x*-axis; log-scaled) out of 10,000 plants designated for export to the EU introduced from UK for all evaluated pests visualised as descending distribution function. Horizontal lines indicate the percentiles (starting from the bottom 5%, 25%, 50%, 75%, 95%).

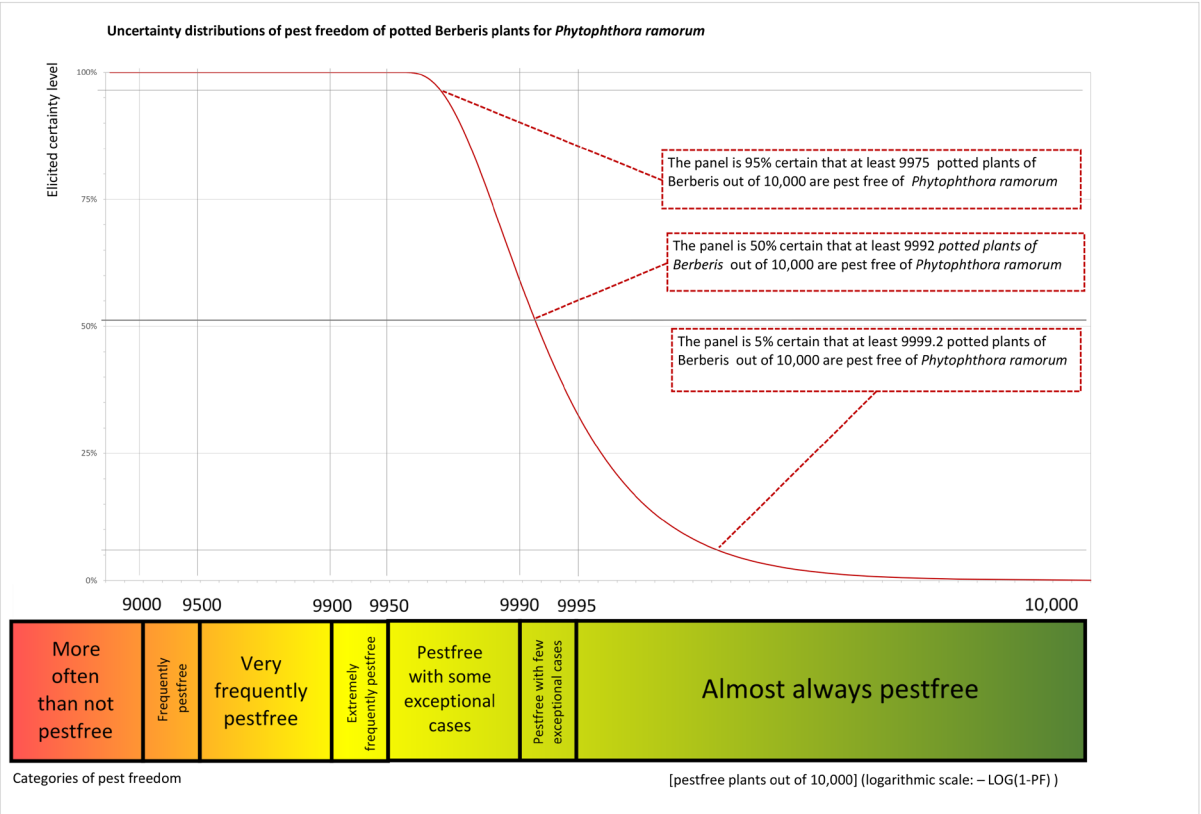


FIGURE 4 The Explanation of the descending distribution function describing the likelihood of pest freedom for *Berberis thunbergii* plants designated for export to the EU based on the example of *Phytophthora ramorum*.

6 | CONCLUSIONS

There are three pests (*Bemisia tabaci*, *Phytophthora kernoviae* and *P. ramorum* (non-EU isolates)) identified to be present in UK and considered to be potentially associated with the *B. thunbergii* 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 plants, whips and rooted plants in pots of *B. thunbergii* designated for export to the EU was estimated.

For *B. tabaci*, the likelihood of pest freedom for the commodity bare root plants, whips, and rooted plants in pots (all plants), following evaluation of current risk mitigation measures, was estimated as 'almost always pest free' with the 90% uncertainty range reaching from 'extremely frequently pest free' to 'almost always pest free'. The EKE indicated, with 95% certainty, that between 9993 and 10,000 plants per 10,000 will be free from *B. tabaci*.

For *P. kernoviae*, the likelihood of pest freedom for the commodity bare root plants, whips, and rooted plants in pots (all plants), following evaluation of current risk mitigation measures, was identical and estimated as 'pest free with few 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 9983 and 10,000 plants per 10,000 will be free from *P. kernoviae*.

For *P. ramorum*, the likelihood of pest freedom for bare root plants and whips following evaluation of current risk mitigation measures was estimated as 'pest free with few 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 9975 and 10,000 bundles of bare root plants and whips per 10,000 will be free from *P. ramorum*. The likelihood of pest freedom for rooted plants in pots 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 9975 and 10,000 rooted plants in pots per 10,000 will be free from *P. ramorum*.

GLOSSARY

Control (of a pest)	Suppression, containment or eradication of a pest population (FAO, 2024a, 2024b).
Entry (of a pest)	Movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled (FAO, 2024b).
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO, 2024b).
Impact (of a pest)	The impact of the pest on the crop output and quality and on the environment in the occupied spatial units.
Introduction (of a pest)	The entry of a pest resulting in its establishment (FAO, 2024b).
Measures	Control (of a pest) is defined in ISPM 5 (FAO, 2024b) as 'Suppression, containment or eradication of a pest population' (FAO, 2024a). Control measures are measures that have a direct effect on pest abundance. Supporting measures are organisational measures or procedures supporting the choice of appropriate risk mitigation measures that do not directly affect pest abundance.
Pathway	Any means that allows the entry or spread of a pest (FAO, 2024b).
Phytosanitary measures	Any legislation, regulation or official procedure having the purpose to prevent the introduction or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests (FAO, 2024b).
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, 2024b).
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, 2024b).
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, 2024b).

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 Organisation
FAO	Food and Agriculture Organisation
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

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PANEL MEMBERS

Antonio Vicent Civera, Paula Baptista, Anna Berlin, Elisavet Chatzivassiliou, Jaime Cubero, Nik Cunniffe, Eduardo de la Peña, Nicolas Desneux, Francesco Di Serio, Anna Filipiak, Paolo Gonthier, Beata Hasiów-Jaroszewska, Hervé Jactel, Blanca B. Landa, Lara Maistrello, David Makowski, Panagiotis Milonas, Nikos T. Papadopoulos, Roel Potting, Hanna Susi, and Dirk Jan van der Gaag.

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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 | *BEMISIA TABACI* (EUROPEAN POPULATIONS)

A.1.1 | Organism information

Taxonomic information	Current valid scientific name: *Bemisia tabaci* (Gennadius, 1889) Synonyms: *Aleurodes inconspicua*, *Aleurodes tabaci*, *Bemisia achyranthes*, *Bemisia bahiana*, *Bemisia costa-limai*, *Bemisia emiliae*, *Bemisia goldingi*, *Bemisia gossypiperda*, *Bemisia gossypiperda mosaicivectura*, *Bemisia hibisci*, *Bemisia inconspicua*, *Bemisia longispina*, *Bemisia lonicerae*, *Bemisia manihotis, Bemisia minima*, *Bemisia minuscula*, *Bemisia nigeriensis*, *Bemisia rhodesiaensis*, *Bemisia signata*, *Bemisia vayssieri* Name used in the EU legislation: *Bemisia tabaci* Genn. (non-European populations) known to be vector of viruses [BEMITA] Order: Hemiptera Family: Aleyrodidae Common name: Tobacco whitefly, cassava whitefly, cotton whitefly, silver-leaf whitefly, sweet-potato whitefly, Name used in the dossier: *Bemisia tabaci*
Group	Insects
EPPO code	BEMITA
Regulated status	The pest is listed in Annex II/A of Commission implementing Regulation (EU) 2019/2072 as *Bemisia tabaci* Genn. (non-European populations) known to be vector of viruses [BEMITA], and in Annex III as Protected Zone Quarantine Pest (European populations).
Pest status in UK	*Bemisia tabaci* (European populations) is present in UK (CABI, online; EPPO, online).
Pest status in the EU	*Bemisia tabaci* (European populations) is regulated in the EU as a Protected Zone Quarantine Pest for Ireland, Northern Ireland and Sweden.
Host status on *Berberis thunbergii*	*Berberis* species are reported as host plants for *B. tabaci* (EFSA, 2013; Li et al., 2011).
PRA information	– Scientific Opinion on the risks to plant health posed by *Bemisia tabaci* species complex and viruses it transmits for the EU territory (EFSA PLH Panel, 2013) – Scientific Opinion on the commodity risk assessment of *Persea americana* from Israel (EFSA PLH Panel, 2021) – Scientific report on the commodity risk assessment of specified species of *Lonicera* potted plants from Turkey (EFSA PLH Panel, 2022a) – Scientific Opinion on the commodity risk assessment of *Jasminum polyanthum* unrooted cuttings from Uganda (EFSA PLH Panel, 2022b) – UK Risk Register Details for *Bemisia tabaci* non-European populations (DEFRA, online) – Scientific Opinion on the commodity risk assessment of *Berberis thunbergii* potted plants from Turkey (EFSA PLH Panel, 2022c)
Other relevant information for the assessment	
Biology	*Bemisia tabaci* is a complex of at least 40 cryptic species that are morphologically identical but distinguishable at molecular level (Khatun et al., 2018). The species differ from each other in host association, spread capacity, transmission of viruses and resistance to insecticides (De Barro et al., 2011). It is an important agricultural pest that can transmit more than 121 viruses (belonging to genera Begomovirus, Crinivirus, Ipomovirus, Carlavirus and Torradovirus) and cause significant damage to major food crops such as *Solanaceous* and cucurbits crops and ornamental plants (EFSA PLH Panel, 2013). *Bemisia tabaci* adult is about 1 mm long. It develops through three life stages: egg, nymph (four instars) and adult (Walker et al., 2009). Nymphs of *B. tabaci* mainly feed on phloem in minor veins of the underside leaf surface (Cohen et al., 1996). Adults feed on both phloem and xylem of leaves (Walker et al., 2009). *Bemisia tabaci* is multivoltine with up to 15 generations per year (Ren et al., 2001). The life cycle from egg to adult requires from 2.5 weeks up to 2 months depending on the temperature (Norman et al., 1995) and the host plant (Coudriet et al., 1985). *Bemisia tabaci* has a high reproductive potential and each female can lay more than 300 eggs during their lifetime (Gerling et al., 1986), which can be found mainly on the underside of the leaves (CABI, online). During oviposition, females insert eggs with the pedicel directly into leaf tissue (Paulson and Beardsley, 1985). Out of all life stages, only the first instar nymph (crawler) and adults are mobile. Movement of crawlers by walking is very limited, usually within the leaf where they hatched (Price and Taborsky, 1992) or to more suitable neighbouring leaves. The average distance was estimated to be within 10–70 mm (Summers et al., 1996). For these reasons, they are not considered to be good colonisers. On the contrary, adults can fly reaching quite long distances in a search of a host plant. According to Cohen et al. (1988), marked individuals were trapped 7 km away from the initial place after 6 days. Long-distance passive dispersal by wind is also possible (Byrne, 1999).

(Continued)

Symptoms	**Main type of symptoms**	Wide range of symptoms can occur on plants due to direct feeding of the pest, contamination of honeydew and sooty moulds, transmitted viruses and phytotoxic responses. Plants exhibit one or more of these symptoms: chlorotic spotting, vein yellowing, intervein yellowing, leaf yellowing, yellow blotching of leaves, yellow mosaic of leaves, leaf curling, leaf crumpling, leaf vein thickening, leaf enations, leaf cupping, stem twisting, plant stunting, wilting, leaf loss and silvering of leaves (CABI, online; EPPO, 2004).
	Presence of asymptomatic plants	No asymptomatic period is known to occur in the infested plants. However, eggs and first instar larvae are difficult to detect. Symptoms of the infestation by the insect are visible. *Bemisia tabaci* is a vector of several viruses and their infection could be asymptomatic.
	Confusion with other pathogens/pests	*Bemisia tabaci* can be easily confused with other whitefly species such as B. *afer, Trialeurodes lauri, T. packardi, T. ricini, T. vaporariorum* and *T. variabilis*. A microscopic slide is needed for morphological identification (EPPO, 2004). Different species of *B. tabaci* complex can be distinguished using molecular methods (De Barro et al., 2011).
Host plant range	*Bemisia tabaci* is a polyphagous pest with a wide host range, comprising more than 1000 different plant species (Abd-Rabou and Simmons, 2010, CABI, online), including *B. thunbergii* (Li et al., 2011).	
What life stages could be expected on the commodity	All life stages of *B. tabaci* (eggs, larvae and adults) are present on the leaves of the plants and could be present on *Berberis* plants.	
Surveillance information	*Bemisia tabaci* has a quarantine status in UK, therefore regular surveillance is performed and outbreaks in greenhouses are subject to eradications.	

A.1.2 | Possibility of pest presence in the nursery

A.1.2.1 | Possibility of entry from the surrounding environment

Bemisia tabaci has a quarantine status in the UK and outbreaks occurs in greenhouses. There are no records of *B. tabaci* establishing outdoors during summer (Bradshaw et al., 2019; Cuthbertson and Vänninen, 2015). Bradshaw et al. (2019) indicate that theoretically *B. tabaci* could complete in summertime one generation across most of Scotland, and one to three generations over England and Wales. However, the temperatures experienced during cold days and nights in summer may be low enough to cause chilling injury to *B. tabaci*, thereby inhibiting development and preventing establishment in the UK. It is unlikely, therefore, that this pest will establish outdoors in the UK under current climate conditions.

Bemisia tabaci could be present on host plants grown in greenhouses located in the neighbourhood of the nursery. *B. tabaci* may disperse from greenhouses in the surrounding environment of field grown *Berberis* plants. The only possibility for *B. tabaci* to be associated with the exported plants is the scenario where the pest that is present in the greenhouse successfully can disperse to outdoor plants ready for export. Therefore, it is highly unlikely that the exported plants are infested with *B. tabaci*.

Uncertainties

- Exact locations where the whitefly is present.
- Possibility of spread beyond the infested greenhouses.
- The host plant species present in the greenhouse.

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

The UK has regulations in place for plant propagating material that are in line with those of European Union, and this equivalence has been recognised in Commission Implementing Decision (EU) 2020/2219. The starting material for most nurseries is certified seeds and seedlings. The seeds are not a pathway for the whitefly. Seedlings sourced in the UK are certified with UK Plant Passports; seedlings from the EU countries are certified with phytosanitary certificates. Therefore, it is highly unlikely that *B. tabaci* is associated with the starting material.

A.1.2.3 | Possibility of spread within the nursery

It is highly unlikely that *Bemisia* populations are present on host plants grown outdoors. Host plants of *Bemisia* could be present in greenhouses of the nursery and adults could escape and spread to outdoor grown plants.

A.1.3 | Information from interceptions

In the EUROPHYT; TRACES-NT database, there are no records of notification of *Berberis* plants for planting neither from the UK nor from other countries due to the presence of *B. tabaci* between the years 1995 and April 2025 (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 *B. tabaci* is provided. The description of the risk mitigation measures currently applied in the UK is provided in Table 9.

No.	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 Animal Plant Health Agency (APHA) for England and Wales, or with SASA for Scotland, and is authorised to issue UK plant passports (Dossier Section 1). Evaluation: – The risk mitigation measure is expected to be effective in reducing the likelihood of presence of the pest on the commodity. Uncertainties: – None.
2	Certification of plant material	Yes	Plants are not grown from certified seed; seedlings sourced in the UK are certified with UK Plant Passports; seedlings from the EU countries are certified with phytosanitary certificates. Evaluation: – *Bemisia tabaci* is a quarantine pest in the UK and it is highly unlikely that the pest is present on the certified starting material. Uncertainties: – None.
3	Origin and treatment of growing media	No	In the production or procurement of *B. thunbergii* 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. 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).
4	Surveillance, monitoring and sampling	Yes	During production, inspection is carried out at least once a year as part of the Quarantine Surveillance programme (UK 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). Evaluation: – The surveillance, monitoring and sampling can detect the pest. No results are reported. Uncertainties: – The efficiency of the surveillance, monitoring and sampling.
5	Hygiene measures	No	According to the Dossier Section 1, all the nurseries have plant hygiene and housekeeping rules and practices in place, which are communicated to all relevant employees. These practices cover growing media, weed management, water usage, cleaning and sterilisation, waste treatment and disposal, and the management of visitors.
6	Irrigation water quality and/or treatments	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. Rainwater that is collected is sand filtrated. Water is routinely sampled and sent for analysis. No quarantine pests have been found (Dossier Section 1).
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). Evaluation: – Some plant protection products are applied and could reduce the likelihood of the infestation of the pest, but detailed information is lacking in the Dossier. Uncertainties: – No specific information on the efficacy of the plant protection products used.
8	Washing of the roots (bare root plants)	No	Bare root plants are lifted and washed free from soil (Dossier Section 1). When initially grown in the field, rooted plants in pots are lifted and root washed to remove any soil (Dossier Section 1).

(Continues)

(Continued)

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
9	Inspections and management of plants before export	Yes	Pre-export inspections are undertaken as part of the process of issuing a phytosanitary certificate. The inspections are generally undertaken as near to the time of export as possible, usually within 1–2 days, and not more than 2 weeks before export. Separate to any official inspection, plant material is checked by growers for plant health issues before dispatch. Evaluation: – The inspections and management of plants before export can detect the pest. Uncertainties: – Whether early infestations of the pest on *B. thunbergii* species are identified by visual inspections.

A.1.5 | Overall likelihood of pest freedom for the exported commodities

Bemisia tabaci was already assessed as actionable pest for the following plant commodities originating in the UK: *Ligustrum delavayanum* grafted on *Ligustrum japonicum* (EFSA PLH Panel, 2022d), *Acer campestre* (EFSA PLH Panel, 2023a), *Acer palmatum* (EFSA PLH Panel,2023b), *Acer platanoides* (EFSA PLH Panel, 2023c), *Acer pseudoplatanus* (EFSA PLH Panel, 2023d), *Ligustrum ovalifolium* and *Ligustrum vulgare* (EFSA PLH Panel, 2024a), *Prunus avium* (EFSA PLH Panel, 2024b), *Prunus spinosa* (EFSA PLH Panel, 2024c), *Populus alba Populus nigra* and *Populus tremula* (EFSA PLH Panel, 2025). The same values for *Prunus* spp. were considered applicable to the commodities of *Berberis thunbergii* for the following reasons: *Prunus* spp. and *B. thunbergii* are not reported as major hosts for *B. tabaci* (EPPO GD, online). In addition, the commodity types (whips, bare root plants, potted plants), production conditions, risk mitigation measures, inspection and surveillance and the possible presence of leaves on the exported plants are similar.

The probability that *B. tabaci* is associated with *B. thunbergii* plants is considered as very low, irrespective to the commodity types. Therefore, the Panel decided to consider the lowest estimated values of pest freedom of *B. tabaci* for *Prunus* spp. (bare root plants) for all commodity types of *B. thunbergii*. For reasoning of the estimated values (Overall likelihood of pest freedom) see section A.1.5 of the *Prunus* spp. opinions (EFSA PLH Panel, 2024b, 2024c).

A.1.6 | Elicitation outcomes of the assessment of the pest freedom for *Bemisia tabaci* on all commodity plants (bare root plants, whips and rooted plants in pots)

The EKE outcomes for the two commodities (bare root plants and whips, and rooted plants in pots) of *B. tabaci* were identical. Therefore, these were presented as a single commodity (all plants), resulting in unified tables and figures. For reasoning of the estimated values, see section A.1.5 of the *Prunus* spp. opinions (EFSA PLH Panel, 2024b, 2024c).

The elicited and fitted values for *B. tabaci* for pest infestation and pest freedom agreed by the Panel are shown in Tables A.1, A.2 and in Figures A.1.

TABLE A.1 Elicited and fitted values of the uncertainty distribution of pest infestation by *Bemisia tabaci* (European populations) per 10,000 plants.

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0					1		3		5					8
EKE	0.0121	0.0431	0.113	0.296	0.606	1.07	1.59	2.84	4.31	5.13	6.02	6.80	7.44	7.79	8.02

Note: The EKE results are the BetaGeneral (0.72005, 1.1194, 0, 8.2) distribution fitted with @Risk version 7.6.

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

TABLE A.2 The uncertainty distribution of plants free of *Bemisia tabaci* (European populations) per 10,000 plants calculated by Table A.1.

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9992					9995		9997		9999					10,000
EKE results	9992.0	9992.2	9992.6	9993.2	9994	9995	9996	9997	9998.4	9998.9	9999.4	9999.7	9999.89	9999.96	9999.99

Note: The EKE results are the fitted values.

(A)

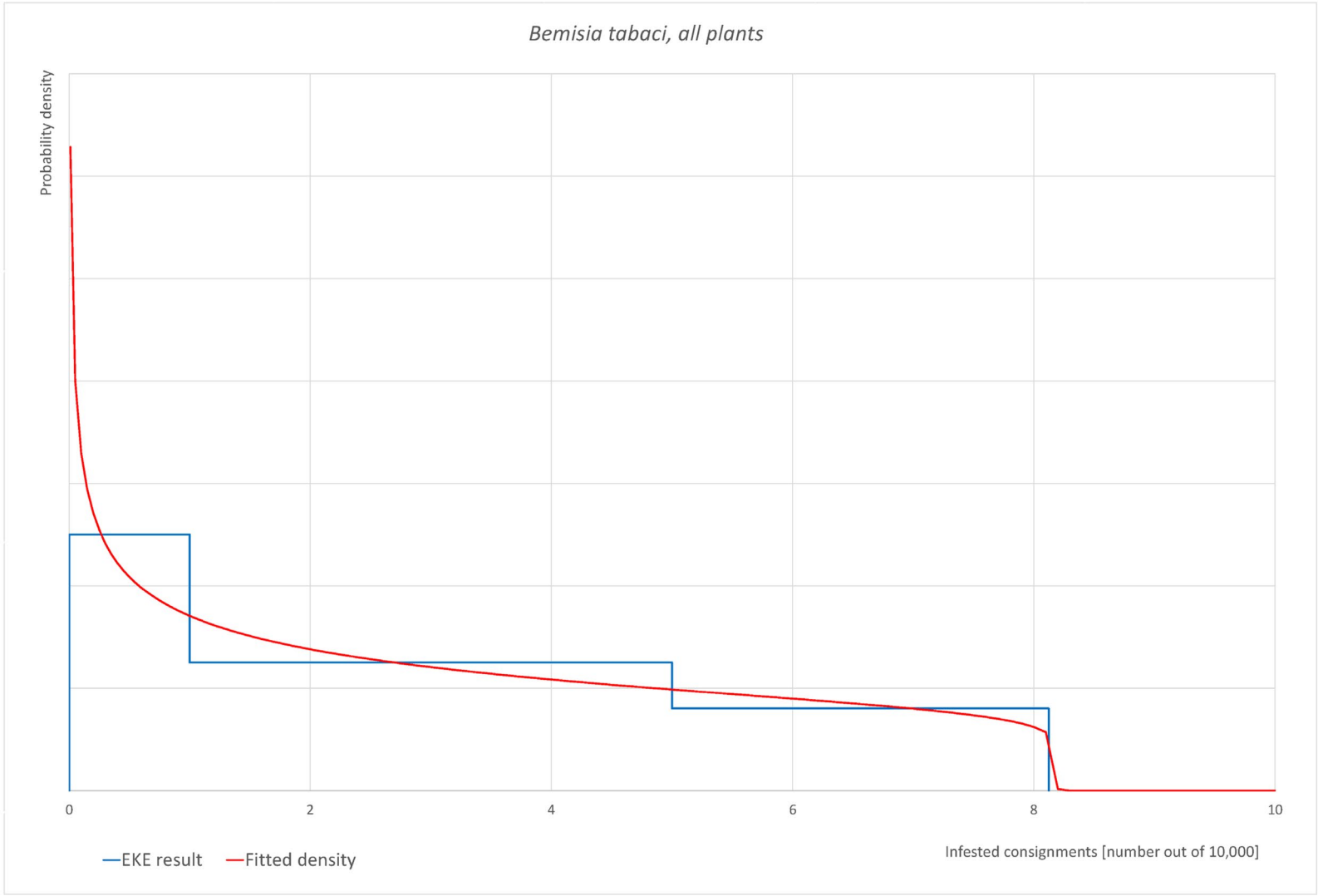

FIGURE A.1 (Continued)

(B)

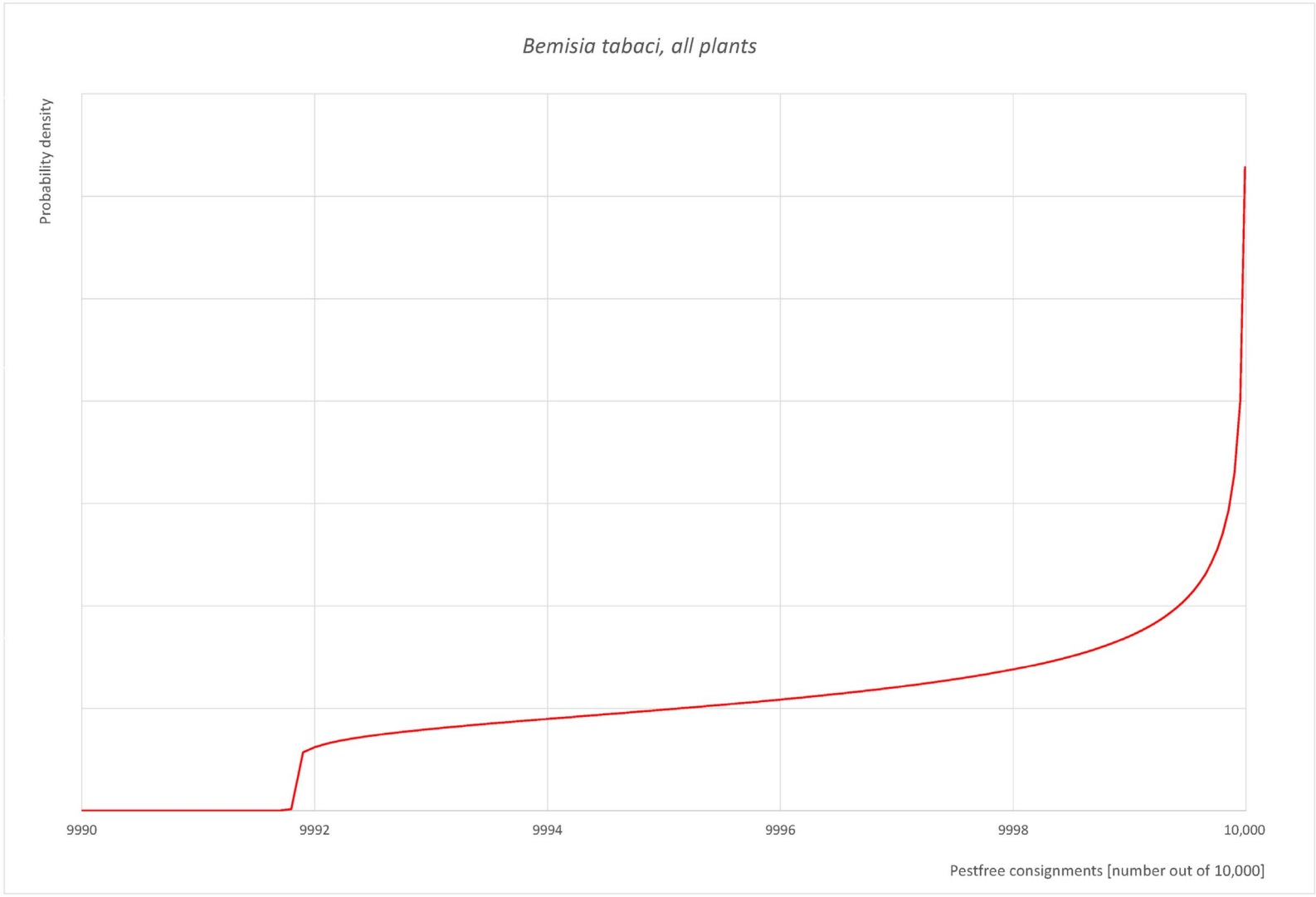

FIGURE A.1 (Continued)

(C)

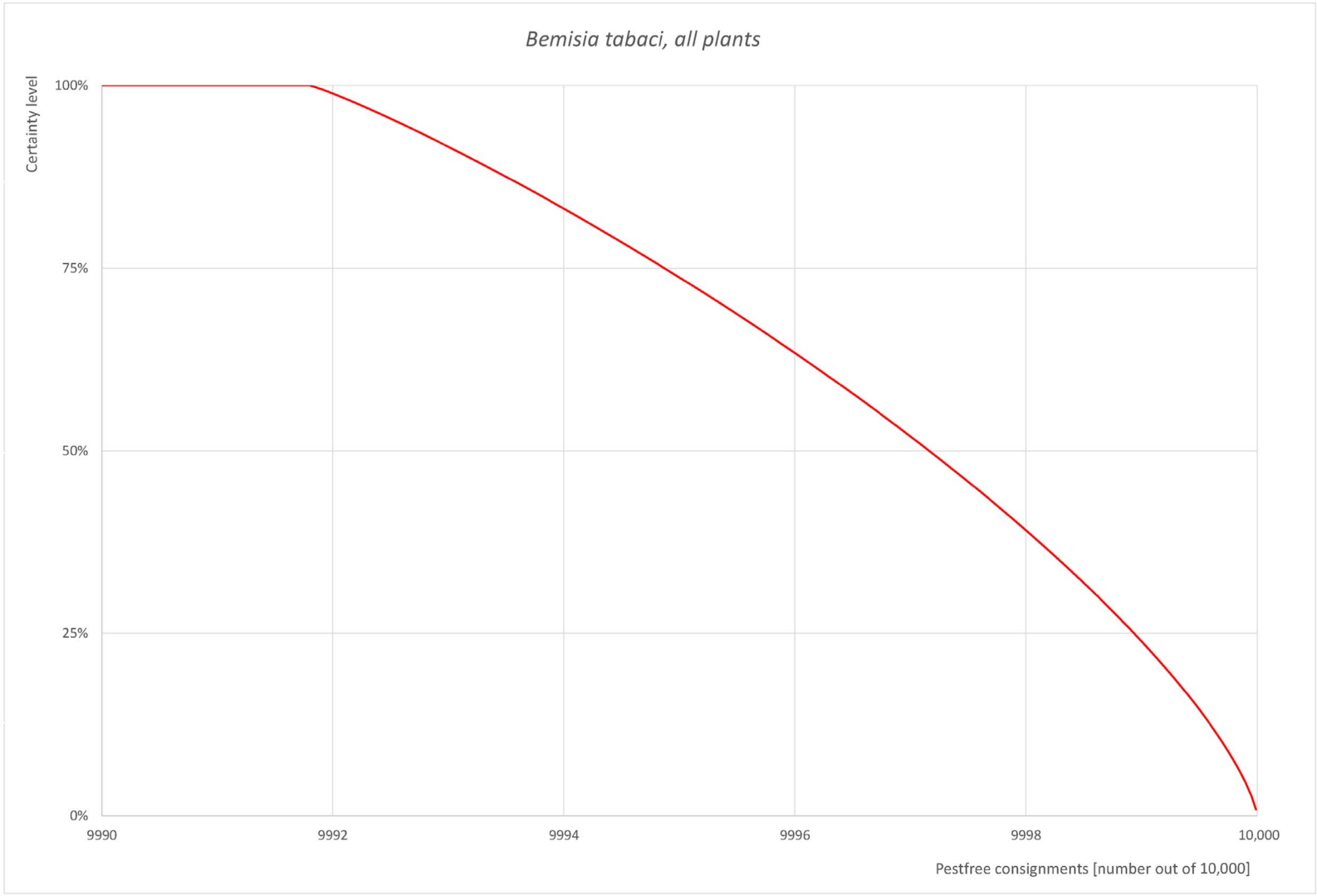

FIGURE A.1 (A) Elicited uncertainty of pest infestation per 10,000 plants (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (B) uncertainty of the proportion of pest-free plants per 10,000 (i.e. =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

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A.2 | *PHYTOPHTHORA KERNOVIAE*

A.2.1 | Organism information

Taxonomic information	Current valid scientific name: *Phytophthora kernoviae* Brasier, Beales & S.A. Kirk Synonyms: – Name used in the EU legislation: – Order: Peronosporales Family: Peronosporaceae Common name: – Name used in the Dossier: *Phytophthora kernoviae*
Group	Oomycetes
EPPO code	PHYTKE
Regulated status	*Phytophthora kernoviae* is not regulated in the EU. The pathogen is included in the EPPO A2 list (EPPO, online_a). *Phytophthora kernoviae* is quarantine in Morocco. It is on A1 list of Chile, Egypt, Kazakhstan, and EAEU (=Eurasian Economic Union: Armenia, Belarus, Kazakhstan, Kyrgyzstan and Russia) and on A2 list of the United Kingdom (EPPO, online_b). There are import requirements in place for *P. kernoviae* on *Quercus* spp. from the UK (Commission Implementing Regulation (EU) 2023/2743[7]).
Pest status in the UK	*Phytophthora kernoviae* is present in the UK in England, Scotland and Wales (Brasier et al., 2005; Elliot et al., 2013; EPPO, online_c; Farr and Rossman, online; Webber, 2008). From 2003 till January 2008 the pathogen was found mainly in natural environments and has been reported in three nurseries. In May 2008, it was found on imported plant material in a nursery in Kent (DEFRA, 2008). According to the Dossier Section 1, in the UK *P. kernoviae* is present but not widely distributed. In the UK is listed as a provisional quarantine pest, and it is under official control in Great Britain. Not recorded in North Ireland.
Pest status in the EU	*Phytophthora kernoviae* is present in Ireland (EPPO, online_c; O'Hanlon et al., 2016). It was first found in *Rhododendron ponticum* in woodlands in Cork County (South coast of Ireland) in 2008 (EPPO, online_d).
Host status on *Berberis*	*Phytophthora kernoviae* has been reported in *Berberis* genus referred as *Mahonia* leaf necrosis (Fera, 2015).
PRA information	Pest Risk Assessments available: – Pest risk management for *Phytophthora kernoviae* and *Phytophthora ramorum* (EPPO, 2013); – UK Risk Register Details for *Phytophthora kernoviae* (DEFRA, online); – Commodity risk assessment of *Fagus sylvatica* plant from the UK (EFSA PLH Panel, 2023a); – Commodity risk assessment of *Quercus petraea* plant from the UK (EFSA PLH Panel, 2023b); – Commodity risk assessment of *Quercus robur* (EFSA PLH Panel, 2023c).

[7] Commission Implementing Regulation (EU) 2023/2743 of 8 December 2023 amending Implementing Regulation (EU) 2018/2019 as regards certain plants for planting of Quercus petraea and Quercus robur originating in the United Kingdom and Implementing Regulation (EU) 2020/1213 as regards the phytosanitary measures for the introduction of those plants for planting into the Union territory.

(Continued)

Other relevant information for the assessment		
Biology		*Phytophthora kernoviae* is present in Europe (Ireland, the United Kingdom), Oceania (New Zealand) and South America (Argentina, Chile) (EPPO, online_c; Farr and Rossman, online). The pathogen was first found on *Fagus sylvatica* and *Rhododendron ponticum* in Cornwall, south-west England in 2003 during official surveillance activities for *P. ramorum*. Its origin is unclear (Brasier et al., 2005), but it is suggested to be native to New Zealand (Studholme et al., 2019). *Phytophthora* species generally reproduce through: a) dormant (resting) spores which can be either sexual (oospores) or asexual (chlamydospores); and b) fruiting structures (sporangia) which contain zoospores (Erwin and Ribeiro, 1996). *Phytophthora kernoviae* belongs to clade 10c (Blair et al., 2008; Jung et al., 2022). The pathogen is self-fertile (homothallic) and produces oogonia, oospores and highly caducous sporangia. Chlamydospores were not observed. The sporangia are either splash or wind dispersed over short distances (Brasier et al., 2005; DEFRA, 2008). Sporangia are only formed on hosts with susceptible foliage. *Rhododendron* is the most abundant sporulating host in Great Britain woodlands. Trunk cankers (e.g. on *F. sylvatica*) are not known to support sporulation and therefore do not transmit the pathogen. This appears to be a dead end for the pathogen (DEFRA, 2008). Optimum conditions for growth require temperatures between 18°C and 26°C (Brasier et al., 2005) and moisture (DEFRA, 2008). Optimum temperature for infection on *R. ponticum* was reported to be between 15°C and 20°C (Shelley et al., 2018). Oospore germination was optimal at 18°C and 20°C. Germination was higher when oospores were exposed to continuous light compared to those in the dark, although not significantly for all isolates (Widmer, 2010). *Phytophthora kernoviae* infects leaves, shoots, stems, buds (DEFRA, 2008) and also roots (Fichtner et al., 2011). According to Brown and Brasier (2007), *P. kernoviae* commonly occupies xylem beneath phloem lesions and may spread within xylem and possibly recolonize the phloem from the xylem. *P. kernoviae* can remain viable within xylem for 2 or more years after the overlying phloem had been excised. *Phytophthora kernoviae* can be found in soil, leaf litter and water streams (DEFRA, 2008). According to Widmer (2011) oospores of *P. kernoviae* buried in sand can survive for long periods at temperatures of 30°C and below. In the west of Scotland inoculum of *P. kernoviae* persisted in soil for at least 2 years after its hosts were removed (Elliot et al., 2013). In Chile, *P. kernoviae* was common to small forest streams (Jung et al., 2018). *P. kernoviae* can disperse by soil containing propagules on shoes, feet of animals and machinery (Brasier, 2008; DEFRA, 2008). Possible pathways of entry for *P. kernoviae* are plants for planting (excluding seed and fruit) of known susceptible hosts; plants for planting (excluding seed and fruit) of non-host plant species accompanied by contaminated attached growing media; soil/growing medium (with organic matter) as a commodity; soil as a contaminant; foliage or cut branches; susceptible (isolated) bark and susceptible wood (EPPO, 2013).
Symptoms	**Main type of symptoms**	According to DEFRA (2008), *P. kernoviae* causes three different types of disease: a. 'Kernoviae bleeding canker' – cankers on trunks of trees, which emit a dark ooze. As they increase in size, they can lead to tree death. b. 'Kernoviae leaf blight' – infection of the foliage, leading to discoloured lesions on leaves. c. 'Kernoviae dieback' – shoot and bud infections which result in wilting, discolouration and dying back of affected parts. *Phytophthora kernoviae* causes bark necrosis and bleeding stem lesions above ground level on *Fagus sylvatica* (Brasier et al., 2005). There is an uncertainty whether such symptoms develop on young plants and plants for planting. The pathogen was also observed to infect roots of *F. sylvatica* (Fichtner et al., 2012, citing others). On *R. ponticum* the pathogen causes shoot dieback, foliar necrosis, wilting, cankers, defoliation, and death (Brasier et al., 2005; Beales et al., 2006). Symptoms on *Drimys winteri* in a native forest of southern Chile showed necrosis around the midrib of leaves (Sanfuentes et al., 2016) and bleeding canker in the UK (EPPO, online_f). It was found to be infecting stems of *Q. robur* and causing bleeding cankers in the UK (Brasier et al., 2005; DEFRA, 2008). Limited information is available on symptoms on *Berberis* sp., except for foliar necrosis (Fera, 2015).
	Presence of asymptomatic plants	*Phytophthora kernoviae* has been observed causing asymptomatic infections of leaves on *Rhododendron* 'Cunninghams White' and *Quercus ilex* (Denman et al., 2009) and symptomless infections of roots in *R. ponticum* (Fichtner et al., 2011). Application of some plant protection products may reduce symptoms and therefore mask infection, making it more difficult to determine whether the plant is pathogen-free (DEFRA, 2008).
	Confusion with other pests	*Phytophthora kernoviae* can be easily distinguished from other *Phytophthora* species based on morphology (Brasier et al., 2005) and molecular tests (Beales et al., 2006; EPPO, 2013; Hughes et al., 2011).
Host plant range		*Phytophthora kernoviae* has a broad host range. Main host plants include *F. sylvatica* and *R. ponticum* (EPPO, online_e). Other hosts are *Aesculus hippocastanum*, *Agathis australis*, *Annona cherimola*, **Berberis spp.**, *Castanea sativa*, *Drimys winteri*, *Fagus grandiflora*, *Gevuina avellana*, *Hedera helix*, *Ilex aquifolium*, *Leucothoe fontanesiana*, *Liriodendron tulipifera*, *Lomatia myricoides*, *Magnolia amoena*, *M. cylindrica*, *M. delavayi*, *M. doltsopa*, *M. kobus*, *M. liliiflora*, *M. salicifolia*, *M. sargentiana*, *M. sprengeri*, *M. stellata*, *M. wilsonii*, *M.* x *brooklynensis*, *M.* x *soulangeana*, *Michelia doltsopa*, *Photinia* sp., *Pieris formosa*, *P. japonica*, *Pinus radiata*, *Podocarpus salignus*, *Prumnopitys ferruginea*, *Prunus laurocerasus*, *Quercus ilex*, *Q. robur*, *Sequoiadendron giganteum* and *Vaccinium myrtillus* (Brasier et al., 2005; Dick et al., 2014; O'Hanlon et al., 2016; EPPO, online_e; Farr and Rosmann, online). Experimental hosts are *R. macrophyllum*, *R. occidentale* and *Umbellularia californica* (Fichtner et al., 2012; EPPO, online_e). Some of the hosts can be infected and can produce infective sporangia on leaves including *Drimys* spp., *Gevuina avellana*, *Ilex*, *Liriodendron tulipifera*, *Magnolia*, *Michelia*, *Prunus laurocerasus, Q. ilex* and *R. ponticum* (DEFRA, 2008).

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Reported evidence of impact	In the UK, *P. kernoviae* appears to be a serious foliar pathogen on *Rhododendron* species (Webber, 2008). According to Beales et al. (2009) *P. kernoviae* has caused significant impact on ornamental plants and tree species since 2003 mainly in south-west England. In New Zealand, the pathogen together with *P. pluvialis* is connected to red needle cast disease (Dick et al., 2014) or needle blight of *Pinus radiata* (McDougal and Ganley, 2021). However, it has rarely been associated with plant disease (Scott and Williams, 2014).
Evidence that the commodity is a pathway	Life stages of *P. kernoviae* can be present on leaves, stems, branches or roots of whips, bare root plants and potted plants. *P. kernoviae* can be present in soil, however potted plants contain only new growing media.
Surveillance information	This pathogen is regulated as a provisional quarantine pest in the UK. It has been found in all three countries of Great Britain (England, Scotland and Wales), with the highest number of confirmed cases in the counties of Devon and Cornwall in South-West England (EPPO RS, 2009). It has not been recorded in Northern Ireland (EPPO, online). As part of an annual survey at ornamental retail and production sites (frequency of visits determined by a decision matrix) *P. kernoviae* is inspected for on common hosts plants (Dossier Section 1).

A.2.2 | Possibility of pest presence in the nursery

A.2.2.1 | Possibility of entry from the surrounding environment

Phytophthora kernoviae is present in the UK, it has been found in England, Scotland and Wales (Brasier et al., 2005; Elliot et al., 2013; EPPO, online_c; Farr and Rossman, online; Webber, 2008). The possible entry of *P. kernoviae* from surrounding environment to the nurseries may occur through wind and rain (Brasier et al., 2005), water (Jung et al., 2018), people, animals and machinery entering the nursery with infested soil (Brasier, 2008).

Exporting nurseries are predominately situated in the rural areas. *Phytophthora kernoviae* has wide host range and can infect a number of different plants. Suitable hosts of *Hedera* spp., Ilex spp., *Pinus* spp., *Prunus laurocerasus* and *Q. rubur* are present in the woodlands near the nursery or in the hedges to define field boundaries (Dossier Section 1; EPPO, online_e).

Uncertainties

- The host status of *B. thunbergii*.
- The dispersal range of *P. kernoviae* sporangia.
- The distance of the nurseries to sources of pathogen in the surrounding environment.

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

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

The starting materials are either seeds or seedlings. Plants are not grown from certified seed (Dossier Section 1). Seedlings are sourced from the UK or the EU (mainly Netherlands, Belgium and France) and are certified with phytosanitary certificates (Dossier Section 1). The pathogen is not known to be seedborne or seed transmitted, therefore not expected to enter the nursery via the seed pathway. The nurseries are using virgin peat or peat-free compost (a mixture of coir, tree bark, wood fibre, etc.) as a growing media (Dossier Section 1). *Phytophthora kernoviae* is able to survive in soil (Elliot et al., 2013) and therefore could potentially enter with infested soil/growing media. However, the growing media is certified and heat-treated by commercial suppliers during production to eliminate pests and diseases (Dossier Section 1). Therefore, if the plants are first produced in another nursery, the pathogen could possibly travel with them.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is unlikely for the pathogen to enter the nurseries via seeds or seedlings of *B. thunbergii*.

A.2.2.3 | Possibility of spread within the nursery

Berberis plants are either grown in containers (cells, pots, tubes, etc.) outdoors/in the open air or in field. There are no mother plants of any species present in the nurseries (Dossier Section 1).

The pathogen can infect other suitable plants present within the nurseries, such as *Castanea* spp., *Fagus* spp. [(*F. sylvatica* is a 'Major host', according to EPPO (online)], *Hedera* spp., *Ilex* spp., *Leucothoe* spp., *Magnolia* spp., *Prunus* spp., *Quercus* spp. or plants present in hedges surrounding the nurseries, *Hedera* spp., Ilex spp., *Pinus* spp., *Prunus laurocerasus* and *Q. rubur* (Dossier Sections 1; EPPO, online_e).

Phytophthora kernoviae 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

– Other host species present in the nurseries and their phytosanitary status.

A.2.3 | Information from interceptions

In the EUROPHYT; TRACES-NT database, there are no records of notification of *Berberis* plants for planting neither from the UK nor from other countries due to the presence of *P. kernoviae* between the years 1995 and January 2025 (EUROPHYT; TRACES-NT, online).

A.2.4 | Evaluation of the risk mitigation measures

In the table below, all risk mitigation measures currently applied in the UK are listed and an indication of their effectiveness on *P. kernoviae* is provided. The description of the risk mitigation measures currently applied in the UK is provided in Table 9.

No.	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 Animal Plant Health Agency (APHA) for England and Wales, or with SASA for Scotland, and is authorised to issue UK plant passports (Dossier Section 1). Evaluation: – The risk mitigation measure is expected to be effective in reducing the likelihood of presence of the pathogen on the commodity. Uncertainties: – Whether early symptoms on *B. thunbergii* are easily recognisable.
2	Certification of plant material	Yes	Plants are not grown from certified seed; seedlings sourced in the UK are certified with UK Plant Passports; seedlings from the EU countries are certified with phytosanitary certificates. Evaluation: – *Phytophthora kernoviae* is a quarantine pest in the UK and it is highly unlikely that the pathogen is present on the certified starting material. The pest is also not known to be seed-transmitted or seed-borne. Uncertainties: – None.
3	Origin and treatment of growing media	Yes	In the production or procurement of *B. thunbergii* 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. 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). Evaluation: – The measure is efficient in preventing the entry of the pathogen via the growing media into the nursery. Uncertainties: – None.
4	Surveillance, monitoring and sampling	Yes	During production, 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). 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	According to the Dossier Section 1, all the nurseries have plant hygiene and housekeeping rules and practices in place, which are communicated to all relevant employees. These practices cover growing media, weed management, water usage, cleaning and sterilisation, waste treatment and disposal and the management of visitors. Evaluation: – It is unlikely that the pathogen spreads by the pruning tools. – The correct disposal of infected plant material prevents the spread of the fungus. Uncertainties: – The efficiency of hygiene measures performed in the nurseries.

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No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
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. Rainwater that is collected is sand filtrated. Water is routinely sampled and sent for analysis. No quarantine pests have been found (Dossier Section 1). 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). Evaluation: – Some plant protection products are applied and could reduce the likelihood of the infection by the pathogen, but detailed information is lacking in the Dossier. Uncertainties: – No specific information on the efficacy of the plant protection products used.
8	Washing of the roots (bare root plants)	Yes	Bare root plants are lifted and washed free from soil (Dossier Section 1). When initially grown in the field, rooted plants in pots are lifted and root washed to remove any soil (Dossier Section 1). Evaluation: – The washing of the roots removes (parts of) the soil and the pathogen present in the soil. Uncertainties: – vThe effectiveness of the washing to remove all soil with the pathogen.
9	Inspections and management of plants before export	Yes	Pre-export inspections are undertaken as part of the process of issuing a phytosanitary certificate. The inspections are generally undertaken as near to the time of export as possible, usually within 1–2 days, and not more than 2 weeks before export. Separate to any official inspection, plant material is checked by growers for plant health issues before dispatch. Evaluation: – The inspections and management of plants before export can detect the pathogen. Uncertainties: – Whether early symptoms caused by the pathogen on *B. thunbergii* species are identified by visual inspections.

A.2.5 | Overall likelihood of pest freedom for the exported commodity (comparative)

A.2.5.1 | Comparison with other relevant commodity Risk Assessments involving ***Phytophthora kernoviae***

The values were based on the EKE of *P. ramorum* (Appendix A, Section A.2), because the two pathogens share the same biology and Quarantine status in the UK, the only difference between the two species is the more restricted distribution of *P. kernoviae* in the UK.

A.2.6 | Overall likelihood of pest freedom for bundles of bare root plants (up to 3 years old) and whips (up to 2 years old)

A.2.6.1 | Reasoning for a scenario which would lead to a reasonably low number of infected bundles of bare root plants and whips

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 and are exported as dormant plants without leaves. The scenario assumes *B. thunbergii* to be minor hosts for the pathogen. The scenario also assumes that symptoms of the disease are visible and promptly detected during inspections. The washing of the roots removes (parts of) the soil, and the pathogen present in the soil.

A.2.6.2 | Reasoning for a scenario which would lead to a reasonably high number of infected bundles of bare root plants and whips

The scenario assumes a high pressure of the pathogen in the surrounding environment of the nurseries because suitable hosts are present. The scenario assumes that the pathogen can infect leaves, which may still be present on the plants at the

time of export. The scenario also assumes that the pathogen is not detected during the inspections because of presence of asymptomatic plants or difficulties in recognising early symptoms. The washing of the roots may not remove all the attached soil from the plants.

A.2.6.3 | Reasoning for a central scenario equally likely to over- or underestimate the number of infected bundles of bare root plants and whips (Median)

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

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

The limited information on the occurrence of the pathogen in the nurseries and the surroundings and the susceptibility of *B. thunbergii* results in high level of uncertainties

A.2.7 | Overall likelihood of pest freedom for rooted plants in pots (up to 4 years old)

A.2.7.1 | Reasoning for a scenario which would lead to a reasonably low number of infected rooted plants in pots

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 and are exported as dormant plants without leaves. The scenario assumes *B. thunbergii* to be minor hosts for the pathogen. The scenario also assumes that symptoms of the disease are visible and promptly detected during inspections.

A.2.7.2 | Reasoning for a scenario which would lead to a reasonably high number of infected rooted plants in pots

The scenario assumes a high pressure of the pathogen in the surrounding environment of the nurseries because suitable hosts are present. The scenario assumes that the pathogen can infect leaves, which may still be present on the plants at the time of export. The scenario also assumes that the pathogen is not detected during the inspections because of presence of asymptomatic plants or difficulties in recognising early symptoms.

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

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

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

The limited information on the occurrence of the pathogen in the nurseries and the surroundings and the susceptibility of *B. thunbergii* results in high level of uncertainties.

A.2.8 | Elicitation outcomes of the assessment of the pest freedom for *Phytophthora kernoviae* on all commodity plants (bare root plants, whips and rooted plants in pots)

The EKE outcomes for the two commodities (bare root plants and whips, and rooted plants in pots) of *P. kernoviae* were identical. Therefore, these were presented as a single commodity (all plants), resulting in unified tables and figures.

The elicited and fitted values for ***P. kernoviae*** for pest infestation and pest freedom agreed by the Panel are shown in Tables A.3, A.4 and in Figures A.2.

TABLE A.3 Elicited and fitted values of the uncertainty distribution of pest infestation by *Phytophthora kernoviae* per 10,000 plants.

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0					11		5		10					20
EKE	0.0297	0.0964	0.235	0.578	1.13	1.94	2.87	5.13	8.06	9.88	12.1	14.4	16.8	18.5	20.0

Note: The EKE results are the *BetaGeneral (0.77867, 1.968, 0, 22.6)* distribution fitted with @Risk version 7.6.

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

TABLE A.4 The uncertainty distribution of plants free of *Phytophthora kernoviae* per 10,000 plants calculated by Table A.3.

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9980					9990		9995			9998				10,000
EKE results	9980	9982	9983	9986	9988	9990	9992	9995	9997	9998.1	9998.9	9999.4	9999.8	9999.9	10000.0

Note: The EKE results are the fitted values.

(A)

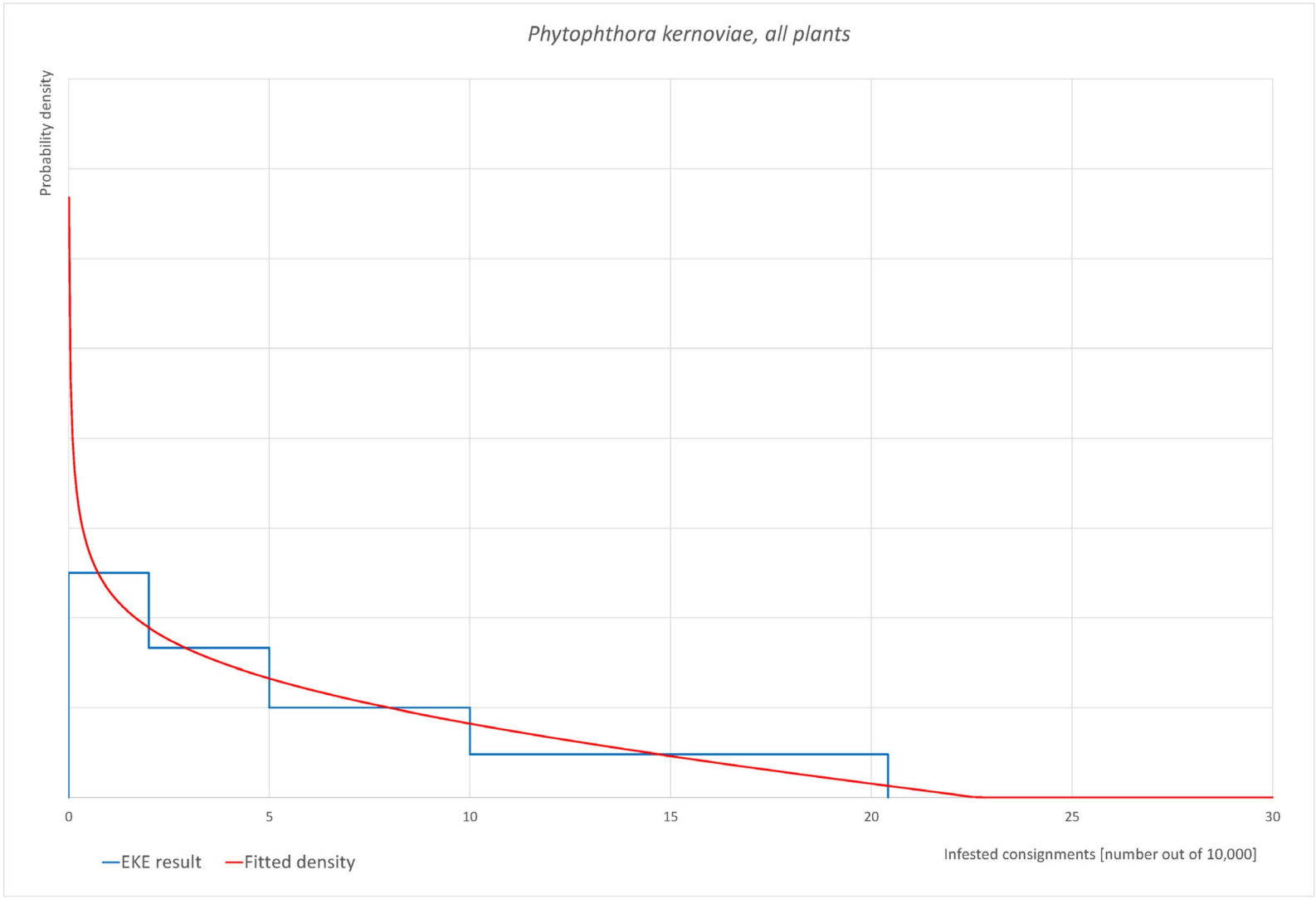

FIGURE A.2 (Continued)

(B)

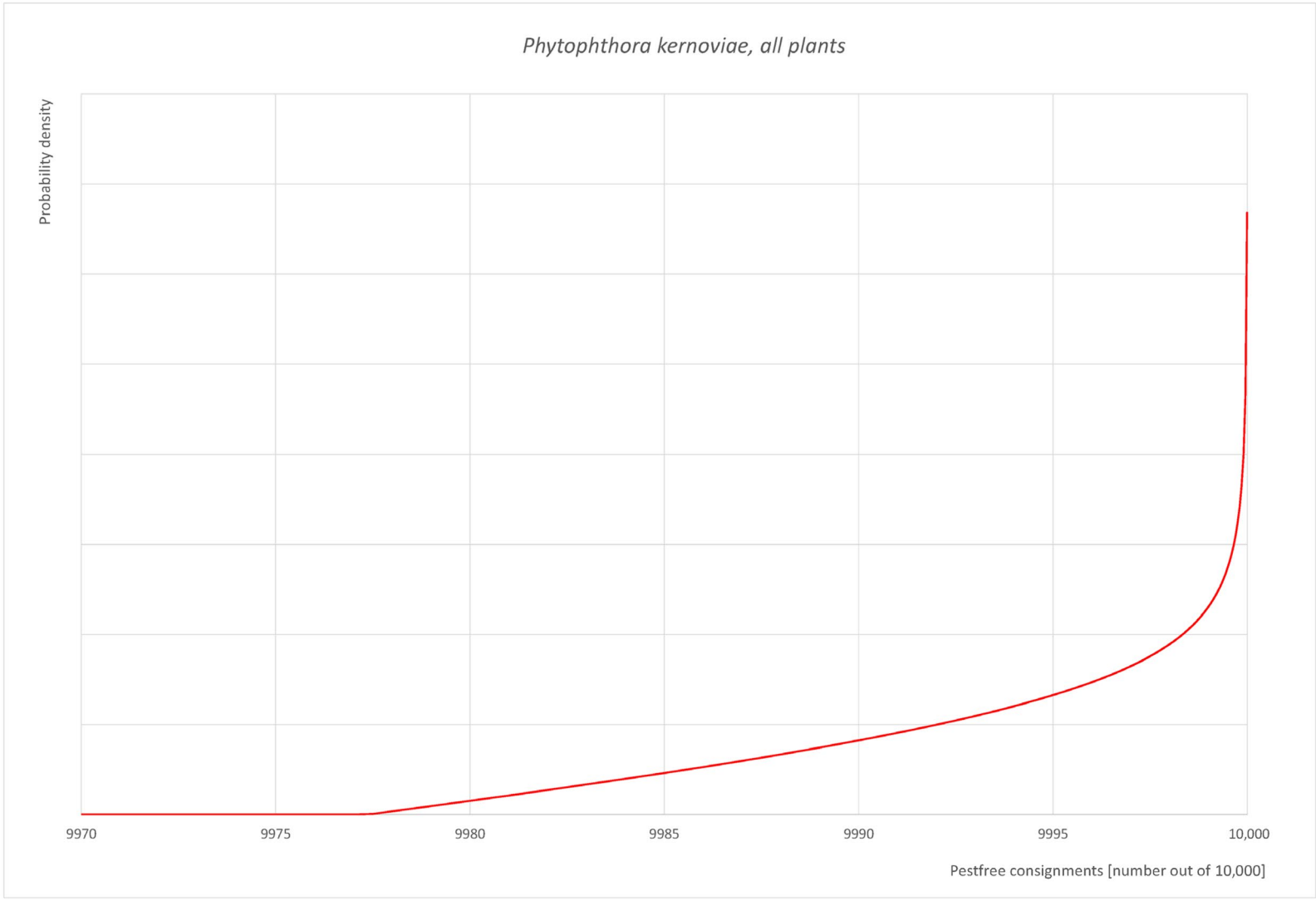

FIGURE A .2 (Continued)

(C)

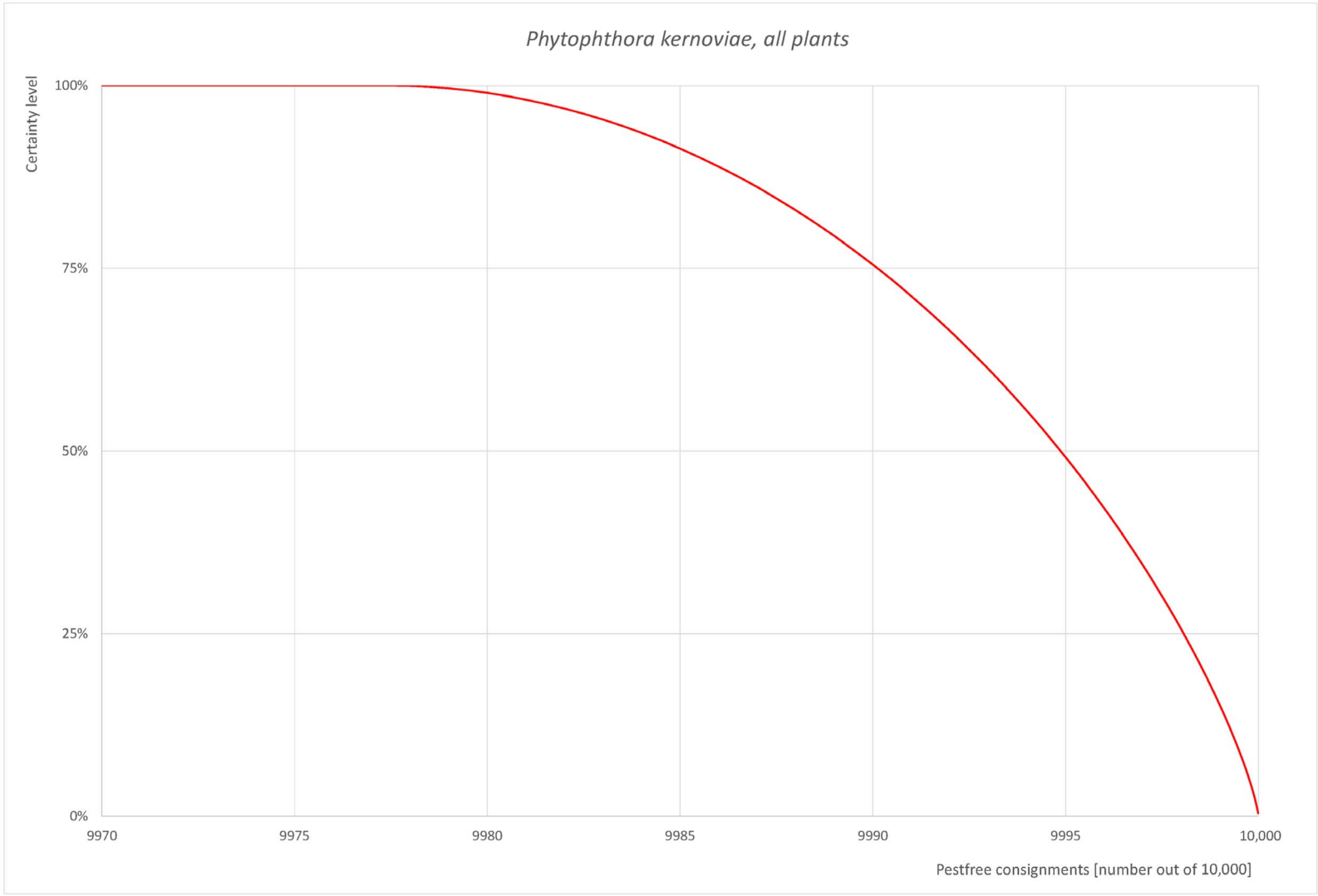

FIGURE A.2 (A) Elicited uncertainty of pest infection per 10,000 plants (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (B) uncertainty of the proportion of pest-free plants per 10,000 (i.e. = 1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

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A.3 | *PHYTOPHTHORA RAMORUM*

A.3.1 | Organism information

Taxonomic information	Current valid scientific name: *Phytophthora ramorum* Werres, De Cock & man in 't veld Synonyms: – Name used in the EU legislation: *Phytophthora ramorum* (non-EU isolates) Werres, De Cock & man in 't veld [PHYTRA] Order: Peronosporales Family: Peronosporaceae Common name: Sudden oak death (SOD), ramorum bleeding canker, ramorum blight, ramorum leaf blight, twig and leaf blight Name used in the dossier: *Phytophthora ramorum*
Group	Oomycetes
EPPO code	PHYTRA
Regulated status	The pathogen is listed in Annex II of Commission Implementing Regulation (EU) 2019/2072 as *Phytophthora ramorum* (non-EU isolates) Werres, De Cock & Man in 't Veld [PHYTRA]. The EU isolates of *P. ramorum* are listed as regulated non quarantine pest (RNQP). The pathogen is included in the EPPO A2 list (EPPO, online_a). *Phytophthora ramorum* is listed as a quarantine pest in the UK (EPPO, online_b).
Pest status in the UK	*Phytophthora ramorum* is present in the UK (Brown and Brasier, 2007; Dossier Section 1; CABI, online; EPPO, online_c). According to the Dossier Section 1, 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 Berberis spp.	*Berberis aquifolium* is reported as a host (Cave et al., 2008; Elliott et al., 2021; USDA, 2010). Because of the wide host range of *P. ramorum*, the Panel assumes that *B. thunbergii* can be a host.
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 PLH Panel, 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 campestre* (EFSA PLH Panel, 2023a); – Commodity risk assessment *Acer palmatum* EFSA PLH Panel, 2023b); – Commodity risk assessment of *Acer platanoides* (EFSA PLH Panel, 2023c); – Commodity risk assessment of *Acer pseudoplatanus* (EFSA PLH Panel, 2023d); – Commodity risk assessment of *Alnus cordata*, *A. glutinosa* and *A. incana* (EFSA PLH Panel, 2025); – Commodity risk assessment of *Betula pendula* and *B. pubescens* (EFSA PLH Panel, 2024a); – Commodity risk assessment of *Cornus alba* and *C. sanguinea* (EFSA PLH Panel, 2024b); – Commodity risk assessment of *Corylus avellana* (EFSA PLH Panel, 2024c); – Commodity risk assessment of *Fagus sylvatica* (EFSA PLH Panel, 2023e); – Commodity risk assessment of *Quercus petraea* (EFSA PLH Panel, 2023f); – Commodity risk assessment of *Quercus robur* (EFSA PLH Panel, 2023g); – Commodity risk assessment of *Sorbus aucuparia* (EFSA PLH Panel, 2024d).

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Other relevant information for the assessment		
Biology		*Phytophthora ramorum* is most probably native to East Asia (Jung et al., 2021; Poimala and Lilja, 2013). The pathogen is present in Asia (Japan, Vietnam), Europe (Belgium, Croatia, Denmark, Finland, France, Germany, Guernsey, Ireland, Luxembourg, the Netherlands, Norway, Poland, Portugal, Slovenia, the UK), North America (Canada, US) and South America (Argentina) (EPPO, online_c). *Phytophthora 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). *Phytophthora 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). *Phytophthora ramorum* is mainly a foliar pathogen, however it was also reported to infect shoots, stems and occasionally roots of various host plants (Grünwald et al., 2008; Parke and Lewis, 2007). According to Brown and Brasier (2007), *P. ramorum* commonly occupies xylem beneath phloem lesions and may spread within xylem and possibly recolonise the phloem from the xylem. *P. ramorum* can remain viable within xylem for 2 or more years after the overlying phloem has been excised. *Phytophthora 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 media (with organic matter) as a commodity; soil as a contaminant; foliage or cut branches; susceptible (isolated) bark and susceptible wood (EFSA PLH Panel, 2011).
Symptoms	**Main type of symptoms**	Symptoms on *Berberis aquifolium* are similar to *Phytophthora* foliar infections on other woody broadleaved plants (Elliot et al., 2021). *Phytophthora ramorum* causes different types of symptoms depending on the host species and the plant tissue infected. According to DEFRA (2008) *P. ramorum* causes three different types of disease: a. 'Ramorum bleeding canker' – cankers on trunks of trees, which emit a dark ooze. As they increase in size they can lead to tree death. b. 'Ramorum leaf blight' – infection of the foliage, leading to discoloured lesions on the leaves. c. 'Ramorum dieback' – shoot and bud infections which result in wilting, discoloration and dying back of affected parts.
	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 and molecular tests (EPPO, 2006).
Host plant range		*Phytophthora ramorum* has a very wide host range, which is expanding. Main host plants include *Camellia* spp., *Larix decidua*, *L. kaempferi*, *Pieris* spp., *Rhododendron* spp., *Syringa vulgaris, Viburnum* spp. and the North American trees species, *Lithocarpus densiflorus* and *Quercus agrifolia* (EPPO online_d). 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*, *B. aquifolium, 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*, *Taxus baccata*, *Trientalis latifolia*, *Umbellularia californica*, *Vaccinium myrtillus*, *V. ovatum*, *V. parvifolium*, and *Vinca minor* (APHIS USDA, 2022; Cave et al., 2008; EPPO, online d; Jung et al., 2016).

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Reported evidence of impact	*Phytophthora 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 (with or without leaves), branches or roots of whips, bare root 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).
Surveillance information	The UK carries out surveys for *P. ramorum* (Dossier Section 1). 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). As part of an annual survey at ornamental retail and production sites (frequency of visits determined by a decision matrix), *P. ramorum* is inspected on common host plants. An additional inspection, during the growing period, is carried out at plant passport production sites. Inspections are carried out at a survey to 300 non-woodland wider environment sites annually (Dossier Sections 1).

A.3.2 | Possibility of pest presence in the nursery

A.3.2.1 | Possibility of entry from the surrounding environment

Phytophthora ramorum is present in the UK, it has been found in most regions of the UK, but it is more often reported in wetter, western regions (Dossier Section 1). The possible entry of *P. ramorum* from surrounding environment to the nurseries may occur through aerial dissemination, water and animals (Davidson et al., 2002).

Exporting nurseries are predominately situated in the rural areas. *Phytophthora ramorum* has wide host range and can infect number of different plants. Suitable hosts of *Acer pseudoplatanus*, *Fraxinus* spp., *Ilex* spp., *Prunus laurocerasus* and *Quercus robur, Taxus baccata* are present in the woodlands near the nursery or in the hedges to define field boundaries (Dossier Section 1; EPPO, online_e).

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.
- The host status of *B. thunbergii*.

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

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

The starting materials are either seeds or seedlings. Plants are not grown from certified seed (Dossier Section 1). Seedlings are sourced from the UK or the EU (mainly Netherlands, Belgium and France) and are certified with phytosanitary certificates (Dossier Section 1). The pathogen is not known to be seedborne or seed transmitted, therefore not expected to enter the nursery via the seed pathway.

The seedling pathway is unlikely because the conditions of their production (seedbed in the greenhouse, pest free growing media) are expected to prevent the infection of seedlings.

The pathogen is soilborne and soil or growing media may be a pathway for *P. ramorum*. The nurseries use virgin peat or peat-free compost (a mixture of coir, tree bark, wood fibre, etc.) as growing media (Dossier Section 1). The growing media are heat treated by commercial suppliers during production to eliminate pests and diseases (Dossier Section 1). In addition to *Berberis* plants, the nurseries also produce other plants (Dossier Section 4). Out of them, there are suitable hosts for the pathogen, such as *Acer* spp., *Alnus* spp., *Arbutus* spp., *Betula* spp., *Choisya* spp., *Cornus* spp., *Corylus* spp., *Cotoneaster* spp., *Dryopteris* spp., *Eucalyptus* spp., *Euonymus* spp., *Fagus* spp., *Garrya* spp., *Griselinia* spp., *Ilex* spp., *Larix* spp., *Leucothoe* spp., *Lonicera* spp., *Magnolia* spp., *Osmanthus* spp., *Photinia* spp., *Physocarpus* spp., *Pittosporum* spp., *Prunus* spp., *Pyracantha* spp., *Quercus* spp., Ribes spp., Rosa spp., *Salix* spp., *Syringa* spp., *Taxus* spp., *Viburnum* spp., and *Vinca* spp. However, there is no information on how and where the plants are produced (Dossier Section 4, EPPO, online_e). Therefore, if the plants are first produced in another nursery, the pathogen could possibly travel with them.

Taking into consideration the above evidence and uncertainties, the Panel considers that it is unlikely for the pathogen to enter the nurseries via seeds or seedlings of *B. thunbergii*.

A.3.2.3 | Possibility of spread within the nursery

Berberis thunbergii plants are grown in containers (cells, pots, tubes, etc.) outdoors, in the open air, or field. (Dossier Section 1). There are no mother plants present in the nurseries (Dossier Section 1).

The pathogen can infect other suitable plants present within the nurseries, such as *Castanea* spp., *Fagus* spp., *Hedera* spp., *Ilex* spp., *Leucothoe* spp., *Magnolia* spp., *Prunus* spp., *Quercus* spp. or plants present in hedges surrounding the nurseries, *Hedera* spp., Ilex spp., *Pinus* spp., *Prunus laurocerasus* and *Q. robur* (Dossier Section 1; EPPO, online_e) or plants present in hedges surrounding the nurseries, such as *Acer* spp., *Alnus* spp., *Arbutus* spp., *Betula* spp., *Choisya* spp., *Cornus* spp., *Corylus* spp., *Cotoneaster* spp., *Dryopteris* spp., *Eucalyptus* spp., *Euonymus* spp., *Fagus* spp., *Garrya* spp., *Griselinia* spp., *Ilex* spp., *Larix* spp., *Leucothoe* spp., *Lonicera* spp., *Magnolia* spp., *Osmanthus* spp., *Photinia* spp., *Physocarpus* spp., *Pittosporum* spp., *Prunus* spp., *Pyracantha* spp., *Quercus* spp., Ribes spp., Rosa spp., *Salix* spp., *Syringa* spp., *Taxus* spp., *Viburnum* spp., and *Vinca* spp. (Dossier Section 4; EPPO, online_e).

Phytophthora 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 host species present in the nurseries and phytosanitary status.
- The host status of *B. thunbergii*.

A.3.3 | Information from interceptions

Phytophthora 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 notification of *Berberis* plants for planting neither from the UK nor from other countries due to the presence of *P. ramorum* between the years 1995 and January 2025 (EUROPHYT; TRACES-NT, online).

A.3.4. | Evaluation of the risk mitigation measures

In the table below, all risk mitigation measures currently applied in the UK are listed and an indication of their effectiveness on *P. ramorum* is provided. The description of the implemented risk mitigation measures is provided in Table 9.

No.	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 Animal Plant Health Agency (APHA) for England and Wales, or with SASA for Scotland, and is authorised to issue UK plant passports (Dossier Section 1). Evaluation: – The risk mitigation measure is expected to be effective in reducing the likelihood of presence of the pathogen on the commodity. Uncertainties: – Whether early symptoms on *B. thunbergii* are easily recognisable.
2	Certification of plant material	Yes	Plants are not grown from certified seed; seedlings sourced in the UK are certified with UK Plant Passports; seedlings from the EU countries are certified with phytosanitary certificates. Evaluation: – *Phytophthora ramorum* is a quarantine pest in the UK 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	In the production or procurement of *B. thunbergii* 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. 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). Evaluation: – The measure is efficient in preventing the entry of the pathogen via the growing media into the nursery. Uncertainties: – None.

(Continued)

No.	Risk mitigation measure	Effect on the pest	Evaluation and uncertainties
4	Surveillance, monitoring and sampling	Yes	During production, 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). 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	According to the Dossier Section 1, all the nurseries have plant hygiene and housekeeping rules and practices in place, which are communicated to all relevant employees. These practices cover growing media, weed management, water usage, cleaning and sterilisation, waste treatment and disposal, and the management of visitors. Evaluation: – It is unlikely that the pathogen spreads by the pruning tools. – The correct disposal of infected plant material prevents the spread of the fungus. Uncertainties: – The efficiency of hygiene measures performed in the nurseries.
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. Rainwater that is collected is sand filtrated. Water is routinely sampled and sent for analysis. No quarantine pests have been found (Dossier Section 1). 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). Evaluation: – Some plant protection products are applied and could reduce the likelihood of the infection by the pathogen, but detailed information is lacking in the Dossier. Uncertainties: – No specific information on the efficacy of the plant protection products used.
8	Washing of the roots (bare root plants)	Yes	Bare root plants are lifted and washed free from soil (Dossier Section 1). When initially grown in the field, rooted plants in pots are lifted and root washed to remove any soil (Dossier Section 1). Evaluation: – The washing of the roots removes (parts of) the soil and the pathogen present in the soil. Uncertainties: – The effectiveness of the washing to remove all soil with the pathogen.
9	Inspections and management of plants before export	Yes	Pre-export inspections are undertaken as part of the process of issuing a phytosanitary certificate. There inspections are generally undertaken as near to the time of export as possible, usually within 1–2 days, and not more than 2 weeks before export. Separate to any official inspection, plant material is checked by growers for plant health issues before dispatch. Evaluation: – The inspections and management of plants before export can detect the pathogen. Uncertainties: – Whether early symptoms caused by the pathogen on *B. thunbergii* species are identified by visual inspections.

A.3.5 | Overall likelihood of pest freedom for the exported commodity (comparative)

A.3.5.1 | Comparison with other relevant commodity Risk Assessments involving ***Phytophthora ramorum***

Phytophthora ramorum was already assessed as actionable pest for several commodity risk assessments of *Acer* campestre, *A. palmatum*, *A. platanoides*, *A. pseudoplatanus*, *Alnus cordata, A. glutinosa, A. incana*, *Betula pendula*, *B. pubescens*., *Cornus*

alba, C. sanguinea, Corylus avellana, Fagus sylvatica, Quercus petraea, Q. robur and *Sorbus* spp. plants from the UK (EFSA PLH Panel, 2023a, 2023b, 2023c, 2023d, 2023e, 2023f, 2023g; 2024a, 2024b, 2024c, 2024d; 2025).

There are large similarities in the production sites, procedures and exported commodity types for *B. thunbergii* and the abovementioned plant species from the UK. Therefore, the Panel based the EKE values on the results of the previous assessments taking into account the age and the host status of the evaluated plants.

A.3.6 | Overall likelihood of pest freedom for bundles of bare root plants (up to 3 years old) and whips (up to 2 years old)

A.3.6.1 | Reasoning for a scenario which would lead to a reasonably low number of infected bundles of bare root plants and whips

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 and are exported as dormant plants without leaves. The scenario assumes *B. thunbergii* to be minor hosts for the pathogen. The scenario also assumes that symptoms of the disease are visible and promptly detected during inspections. The washing of the roots removes (parts of) the soil and the pathogen present in the soil.

A.3.6.2 | Reasoning for a scenario which would lead to a reasonably high number of infected bundles of bare root plants and whips

The scenario assumes a high pressure of the pathogen in the surrounding environment of the nurseries because suitable hosts are present. The scenario assumes that the pathogen can infect leaves, which may still be present on the plants at the time of export. The scenario also assumes that the pathogen is not detected during the inspections because of the presence of asymptomatic plants or difficulties in recognising early symptoms. Grafting can increase the incidence of the pathogen (via infected buds or by woundings). The washing of the roots may not remove all the attached soil from the plants.

A.3.6.3 | Reasoning for a central scenario equally likely to over- or underestimate the number of infected bundles of bare root plants and whips (Median)

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

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

The limited information on the occurrence of the pathogen in the nurseries and the surroundings and the susceptibility of *B. thunbergii* results in high level of uncertainty.

A.3.7 | Elicitation outcomes of the assessment of the pest freedom for *Phytophthora ramorum* on bare root plants and whips

The elicited and fitted values for *P. ramorum* for pest infestation and pest freedom agreed by the Panel are shown in Tables A.5, A.6 and in Figures A.3.

TABLE A.5 Elicited and fitted values of the uncertainty distribution of pest infestation by *Phytophthora ramorum* per 10,000 bundles of bare root plants and whips.

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0					4		8		15					30
EKE	0.156	0.380	0.747	1.48	2.50	3.81	5.20	8.36	12.3	14.7	17.7	21.0	24.5	27.3	30.1

Note: The EKE results are the *BetaGeneral (1.0376, 2.8764, 0, 37.5)* distribution fitted with @Risk version 7.6).

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

TABLE A.6 The uncertainty distribution of plants free of *Phytophthora ramorum* per 10,000 plants of small trees calculated by Table A.5.

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9970					9985		9992		9996					10,000
EKE results	9970	9973	9975	9979	9982	9985	9988	9992	9995	9996	9997.5	9998.5	9999.3	9999.6	9999.8

Note: The EKE results are the fitted values.

(A)

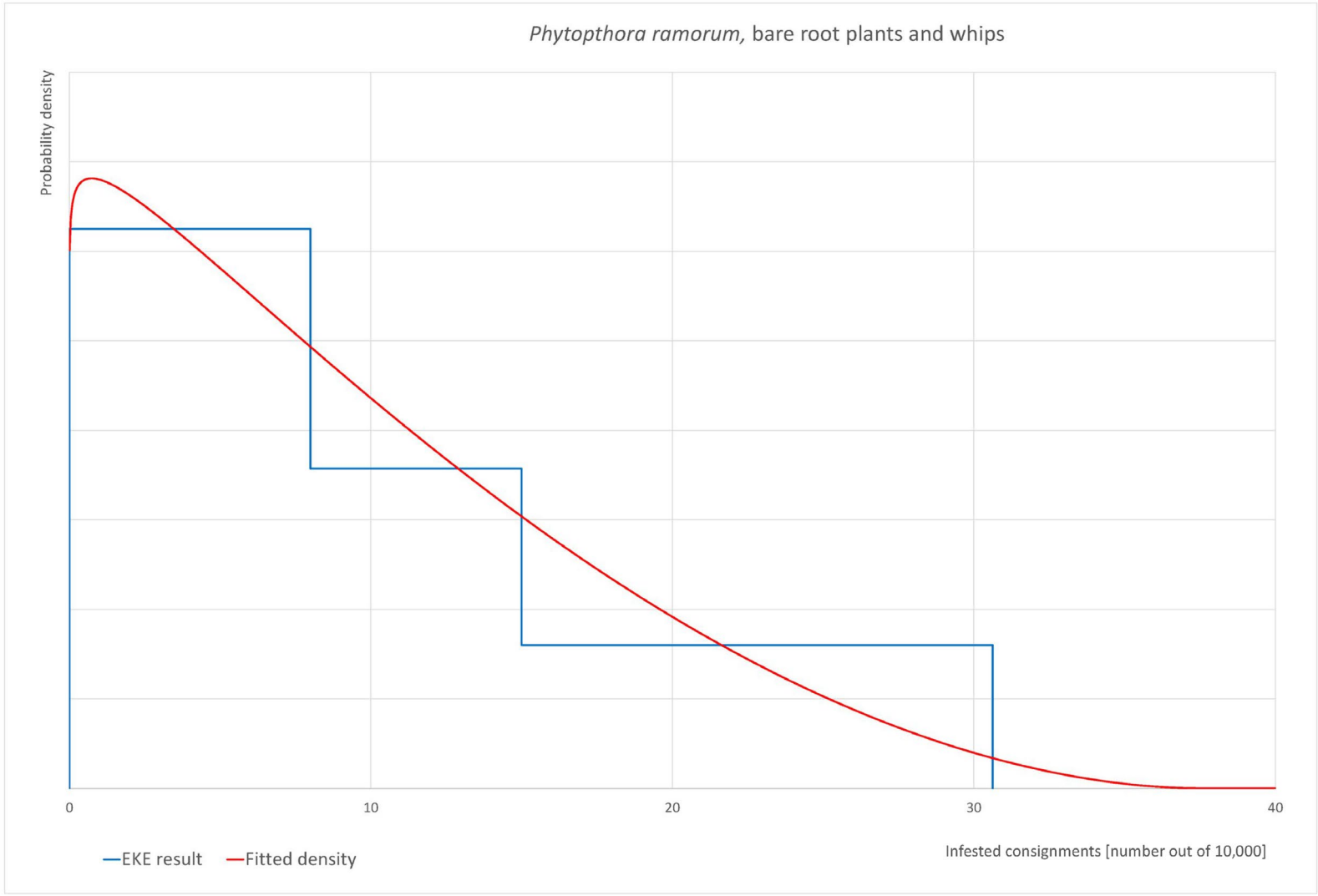

FIGURE A.3 (Continued)

(B)

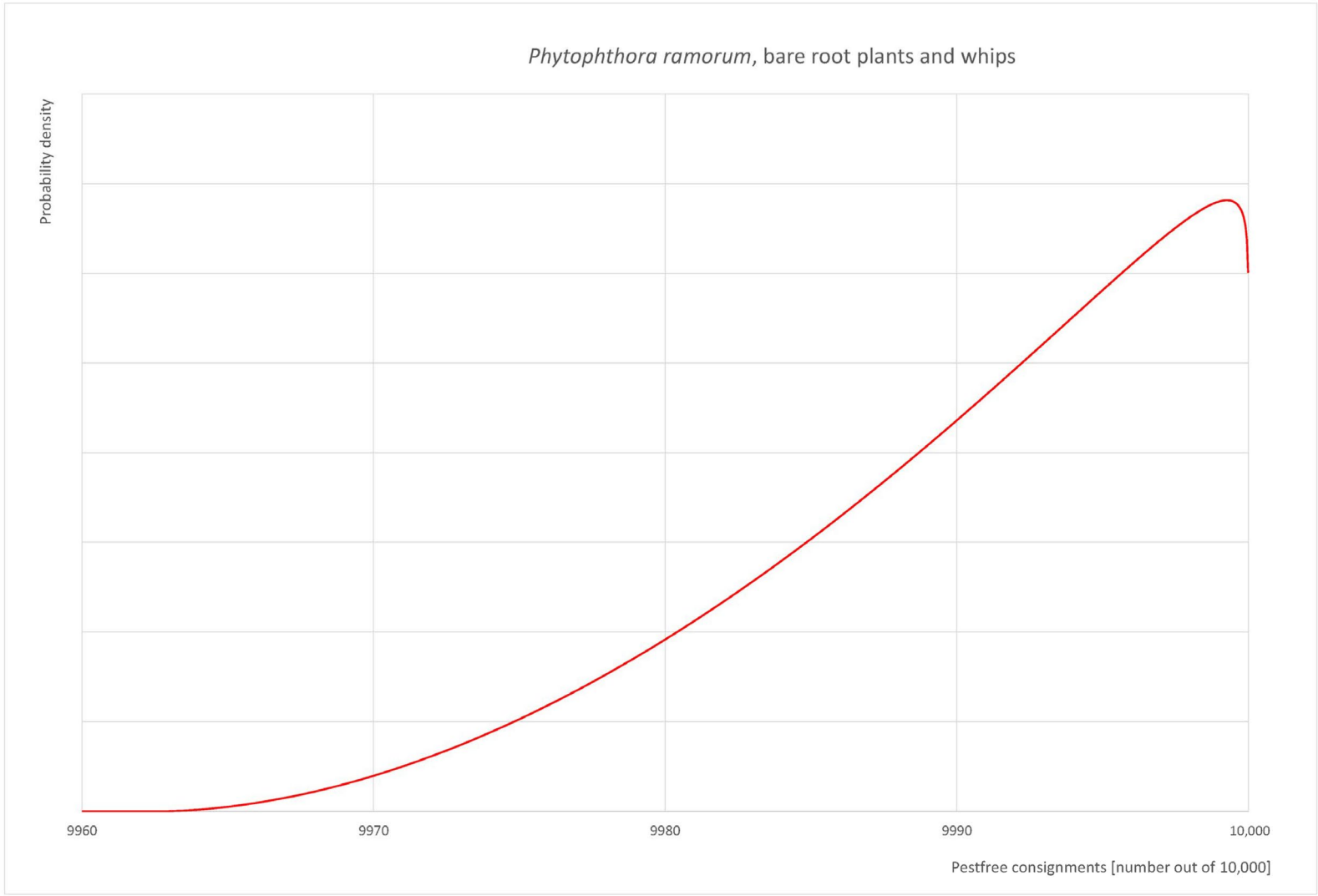

FIGURE A.3 (Continued)

(C)

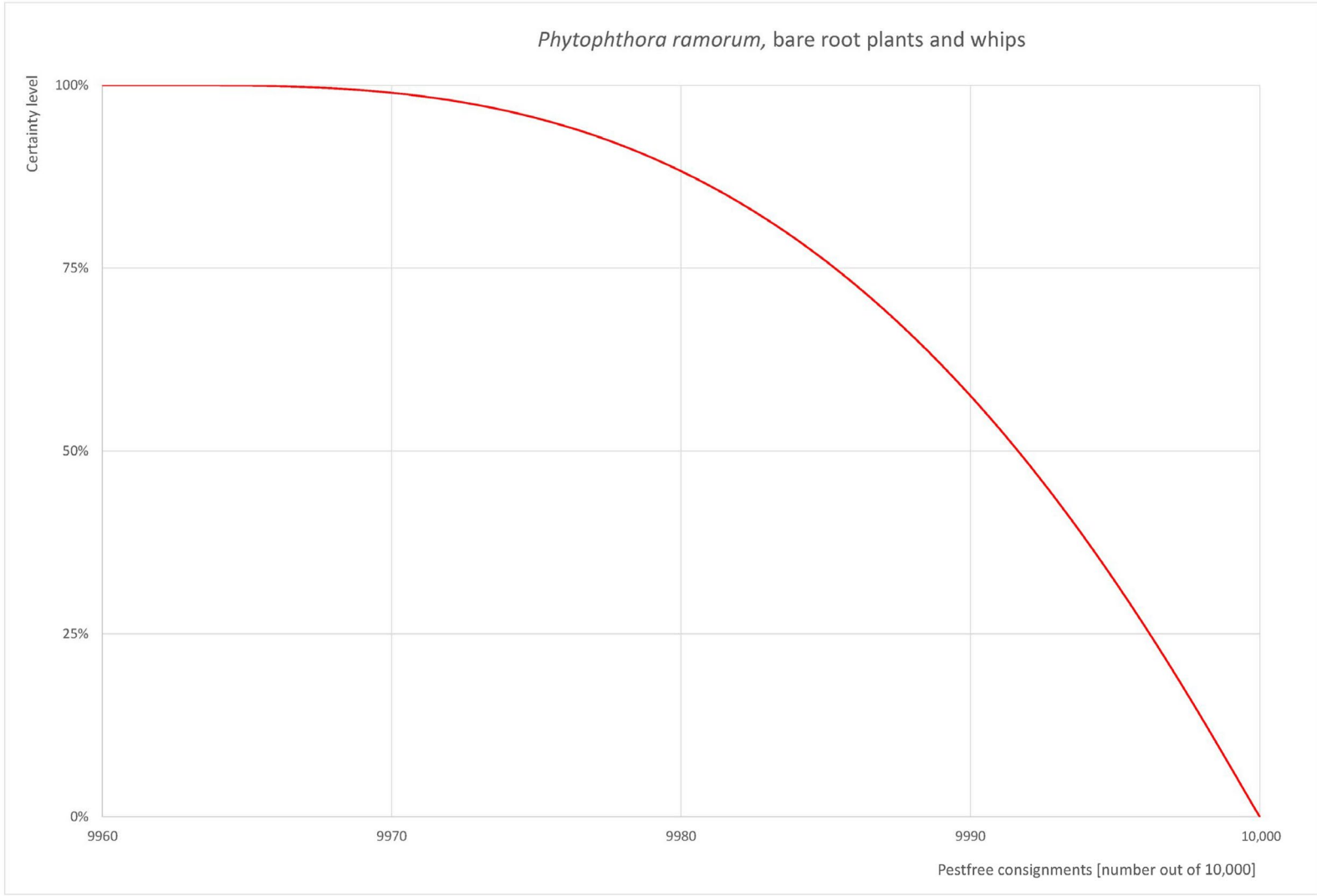

FIGURE A.3 (A) Elicited uncertainty of pest infection per 10,000 bare root plants and whips (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (B) uncertainty of the proportion of pest-free bundles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

A.3.8 | Overall likelihood of pest freedom for rooted plants in pots (up to 4 years old)

A.3.8.1. | Reasoning for a scenario which would lead to a reasonably low number of infected rooted plants in pots

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 and are exported as dormant plants without leaves. The scenario assumes *B. thunbergii* to be minor hosts for the pathogen. The scenario also assumes that symptoms of the disease are visible and promptly detected during inspections.

A.3.8.2 | Reasoning for a scenario which would lead to a reasonably high number of infected rooted plants in pots

The scenario assumes a high pressure of the pathogen in the surrounding environment of the nurseries because suitable hosts are present. The scenario assumes that the pathogen can infect leaves, which may still be present on the plants at the time of export. The scenario also assumes that the pathogen is not detected during the inspections because of presence of asymptomatic plants or difficulties in recognising early symptoms.

A.3.8.3 | Reasoning for a central scenario equally likely to over- or underestimate the number of infected rooted plants in pots (Median)

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

A.3.8.4 | Reasoning for the precision of the judgement describing the remaining uncertainties (1st and 3rd quartile/ interquartile range)

The limited information on the occurrence of the pathogen in the nurseries and the surroundings and the susceptibility of *B. thunbergii* results in high level of uncertainty.

A.3.9 | Elicitation outcomes of the assessment of the pest freedom for *Phytophthora ramorum* on rooted plants in pots

The elicited and fitted values for *P. ramorum* for pest infestation and pest freedom agreed by the Panel are shown in Tables A.7, A.8 and in Figures A.4.

TABLE A.7 Elicited and fitted values of the uncertainty distribution of pest infestation by *Phytophthora ramorum* per 10,000 rooted plants in pots.

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	0					4		8		15					32
EKE	0.175	0.411	0.789	1.53	2.54	3.83	5.20	8.32	12.2	14.7	17.9	21.3	25.3	28.6	32.0

Note: The EKE results are the *BetaGeneral (1.0796, 3.6387, 0, 44)* distribution fitted with @Risk version 7.6.

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

TABLE A.8 The uncertainty distribution of plants free of *Phytophthora ramorum* per 10,000 rooted plants in pots calculated by Table A.7.

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9968					9985		9992		9996					10,000
EKE results	9968	9971	9975	9979	9982	9985	9988	9992	9995	9996	9997	9998	9999.2	9999.6	9999.8

Note: The EKE results are the fitted values.

(A)

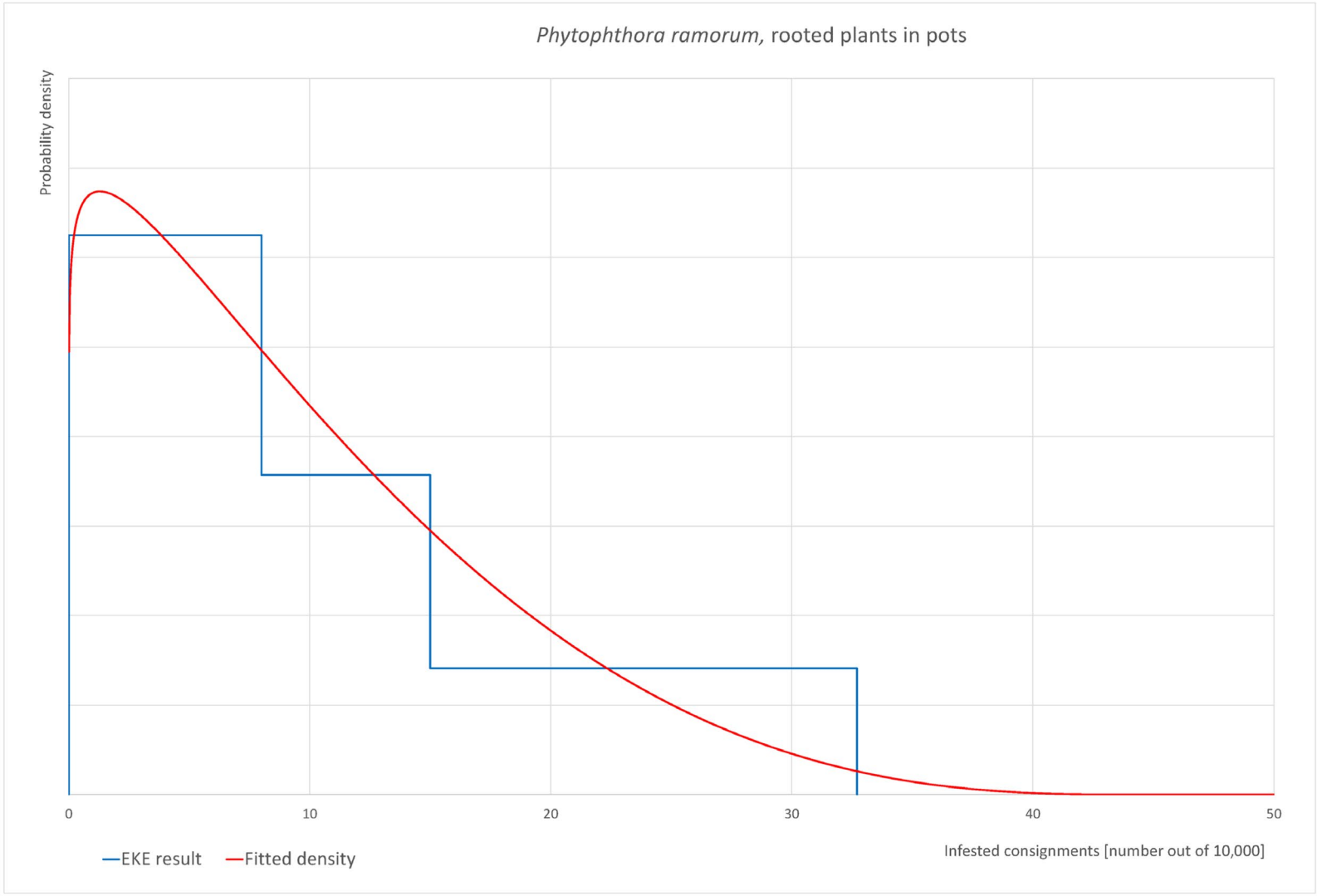

FIGURE A .4 (Continued)

(B)

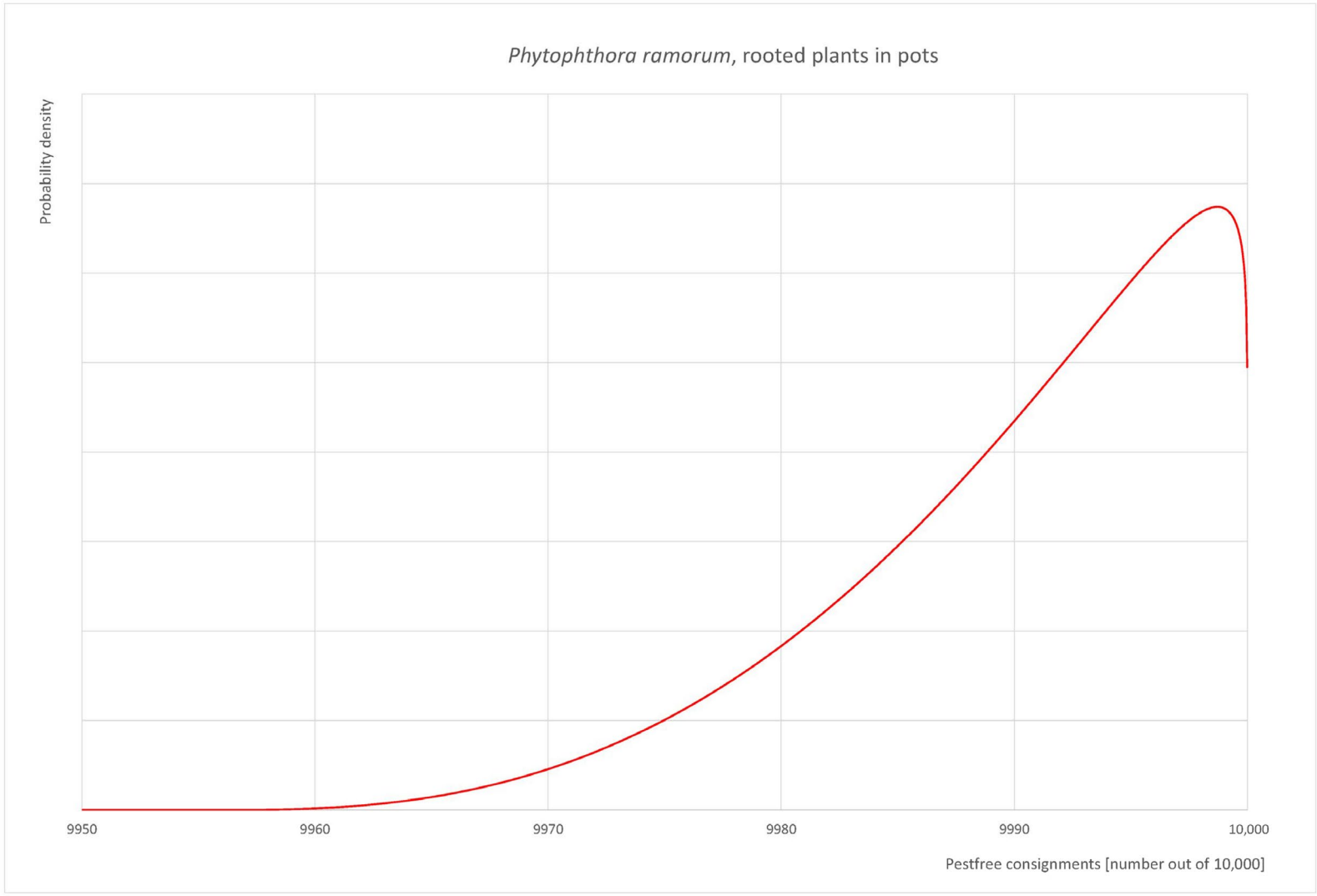

FIGURE A.4 (Continued)

(C)

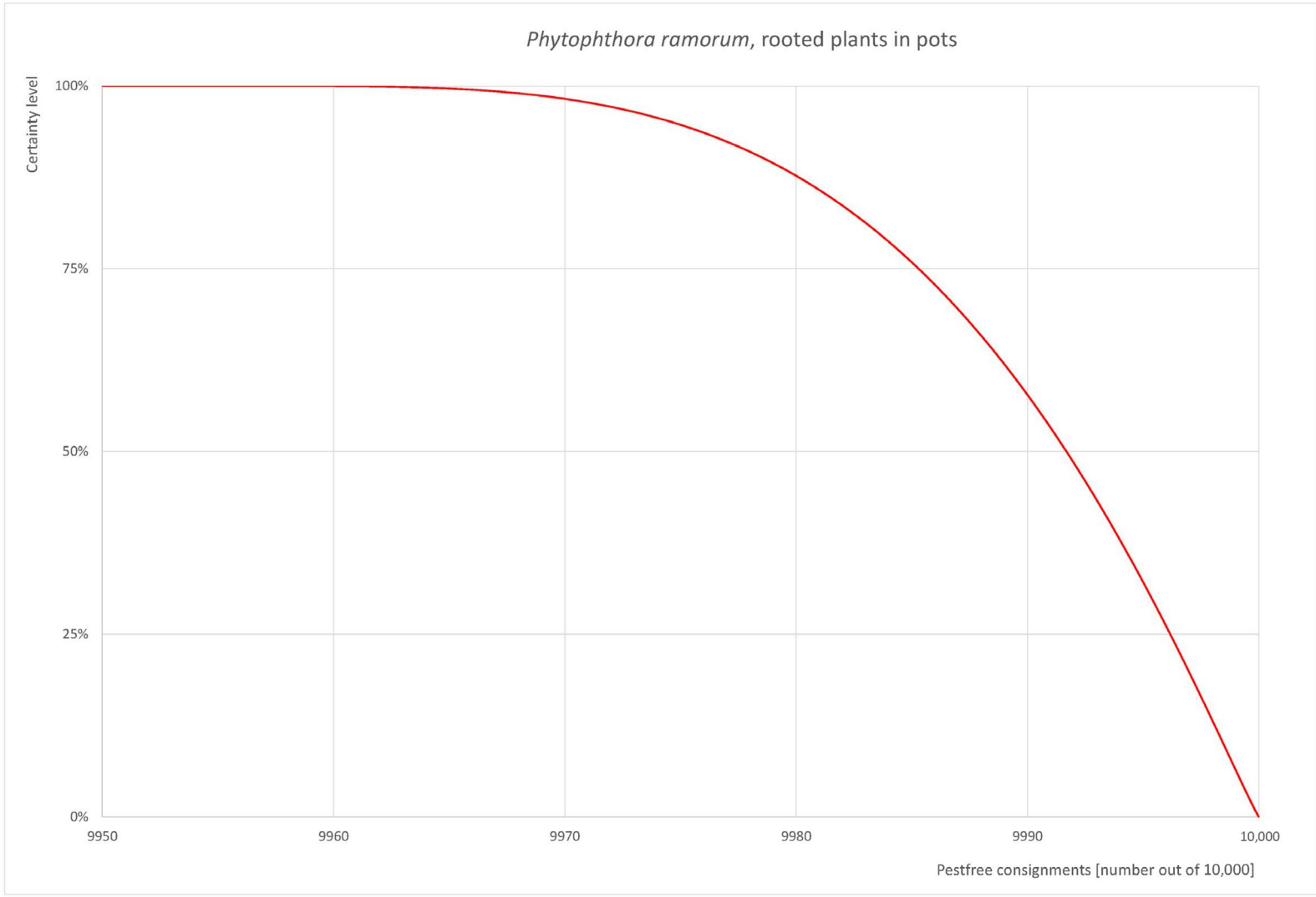

FIGURE A.4 (A) Elicited uncertainty of pest infection per 10,000 rooted plants in pots (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (B) uncertainty of the proportion of pest-free bundles per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

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APPENDIX B

Web of Science All Databases Search String 6/12/2024

In the table below, the search string used in Web of Science for *Berberis thunbergii* is reported. In total, 303 papers were retrieved. Titles and abstracts were screened, and 18 pests were added to the list of pests (see Appendix C).

Web of Science All databases	TOPIC: "Berberis" OR "barberry" OR "Mahonia" 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: "16SrII-C subgroup phytoplasma" OR "16SrV-B subgroup phytoplasma" OR "Acarosporina berberidis" OR "Acaudaleyrodes rachipora" OR "Aceria caliberberis" OR "Acleris variegana" OR "Aecidium aridum" OR "Aecidium berberidis-morrisonensis" OR "Aecidium berberidis-ruscifoliae" OR "Aecidium haussknechtianum" OR "Aecidium jacobsthalii-henrici" OR "Aecidium leveilleanum" OR "Aecidium montanum" OR "Aecidium navarinum" OR "Aecidium niitakense" OR "Aecidium teodorescoi" OR "Aecidium tubiforme" OR "Aegyptobia beglarovi" OR "Aegyptobia gotohi" OR "Aegyptobia kermaniensis" OR "Aeolothrips collaris" OR "Aeolothrips intermedius" OR "Aeolothrips melaleucus" OR "Agonoscena pegani" OR "Agroathelia rolfsii" OR "Agrochola helvola" OR "Agylla albifinis" OR "Agylla metaxantha" OR "Agylla ramelana" OR "Agyrium subantarcticum" OR "Alcis repandata" OR "Aleuroplatus berbericolus" OR "Aleuroplatus ovatus" OR "Aleurotrachelus rhamnicola" OR "Alloexidiopsis calcea" OR "Alternaria alternata" OR "Alternaria brassicae" OR "Alternaria longissima" OR "Alternaria solani" OR "Alternaria tenuissima" OR "Alypia octomaculata" OR "Amegosiphon platicaudum" OR "Amniculicola longissima" OR "Amphisphaeria berberidicola" OR "Amphisphaeria dusenii" OR "Anguillospora crassa" OR "Anoecia corni" OR "Anomoia purmunda" OR "Aonidiella aurantii" OR "Aonidiella citrina" OR "Aphis aurantii" OR "Aphis berberidorum" OR "Aphis citricidus" OR "Aphis fabae" OR "Aphis nasturtii" OR "Aphis odinae" OR "Aphis patagonica" OR "Aphis pomi" OR "Aphis spiraecola" OR "Aphthona varipes" OR "Aplonobia berberis" OR "Aporia agathon" OR "Aporia hippia" OR "Aporia leucodice" OR "Apple mosaic virus" OR "Arctorthezia pseudoccidentalis" OR "Arge berberidis" OR "Arge longicornis" OR "Arge ochropus" OR "Argyresthia bonnetella" OR "Ascochyta australis" OR "Aspergillus flavus" OR "Aspidaspis densiflorae" OR "Aspidiotus nerii" OR "Asteromassaria berberidicola" OR "Asteromassaria berberidicola" OR "Asteromella garbowskii" OR "Athetis lepigone" OR "Athyma opalina" OR "Attacus atlas" OR "Attacus taprobanis" OR "Auchmis detersa" OR "Auchmis inextricata" OR "Aulacorthum solani" OR "Aureobasidium pullulans" OR "Bactericera berberae" OR "Bemisia berbericola" OR "Bemisia tabaci" OR "Berberidaphis lydiae" OR "Berberisomyia sobolevi" OR "Biscogniauxia rosacearum" OR "Biston regalis" OR "Blennoria patagonica" OR "Blogiascospora marginata" OR "Boleodorus impar" OR "Boleodorus thylactus" OR "Boleodorus typicus" OR "Boleodorus volutus" OR "Borovecia gadorensis" OR "Botryosphaeria dothidea" OR "Botrytis cinerea" OR "Bryobia rubrioculus" OR "Cacia cretifera" OR "Cacoecimorpha pronubana" OR "Cacopsylla curtiantenna" OR "Cadra cautella" OR "Caliroa annulipes" OR "Calliteara grotei" OR "Calliteara pudibunda" OR "Callosamia promethea" OR "Calospora etilis" OR "Calyptospora columnaris" OR "Camarosporium antarcticum" OR "Camarosporium berberidicola" OR "Camarosporium berberidis" OR "Campylospora parvula" OR "Candidatus Phytoplasma hispanicum" OR "Capnodium berberidis" OR "Capnodium citri" OR "Carposina berberidella" OR "Cavariella aegopodii" OR "Cephalothrips coxalis" OR "Ceratitis capitata" OR "Cercospora boutelouae" OR "Cerococcus koebelei" OR "Cerococcus parrotti" OR "Ceroplastes ceriferus" OR "Ceroplastes japonicus" OR "Ceroplastes pseudoceriferus" OR "Ceroplastes sinensis" OR "Ceuthospora magellanica" OR "Chaetomium setosum" OR "Cheimophila salicella" OR "Chionaema bellissima" OR "Chrysomphalus aonidum" OR "Chrysomphalus dictyospermi" OR "Ciboria ranikhetiensis" OR "Cilioplea coronata" OR "Cladosporium aecidiicola" OR "Cladosporium fumago" OR

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"Cladosporium herbarum" OR "Cladosporium ushuwaiense" OR "Clonostachys rosea" OR "Closterotomus biclavatus" OR "Coccomyces coronatus" OR "Coccomyces dentatus" OR "Coccura suwakoensis" OR "Coccura suwakoensis" OR "Coccus hesperidum" OR "Coccus pseudomagnoliarum" OR "Colletotrichum acutatum" OR "Colletotrichum aotearoa" OR "Colletotrichum coccodes" OR "Colletotrichum coffeanum" OR "Colletotrichum gloeosporioides" OR "Colletotrichum kahawae" OR "Comoclathris pentamera" OR "Comstockaspis perniciosa" OR "Coniochaeta dakotensis" OR "Coniochaeta ligniaria" OR "Coniochaeta niesslii" OR "Coniothyrium berberidiphilum" OR "Coniothyrium berberidis-vulgaris" OR "Coniothyrium bergii" OR "Coniothyrium insitivum" OR "Conistra ligula" OR "Contarinia nasturtii" OR "Coreus marginatus" OR "Coronophora paucispora" OR "Corthylus punctatissimus" OR "Coryneum foliicola" OR "Coryphista meadii" OR "Criconemoides morgens" OR "Crocallis elinguaria" OR "Crocallis tusciaria" OR "Cryptomarasmius sphaerodermus" OR "Cucumber mosaic virus" OR "Cucurbitaria berberidis" OR "Cucurbitaria moriformis" OR "Cucurbitaria oromediterranea" OR "Cumminsiella antarctica" OR "Cumminsiella antarctica" OR "Cumminsiella sanguinea" OR "Cumminsiella santa" OR "Cumminsiella standleyana" OR "Cumminsiella stolpiana" OR "Cumminsiella stolpiana" OR "Cumminsiella texana" OR "Cumminsiella wootoniana" OR "Cyamophila fabra" OR "Cyamophila otidaexocha" OR "Cylindrocarpon aquaticum" OR "Cyrtidula hippocastani" OR "Cyrtidula hippocastani" OR "Cytospora berberidis" OR "Dasineura berberidis" OR "Dematophora necatrix" OR "Dendrothrips saltatrix" OR "Diacrisia unifascia" OR "Dialonectria episphaeria" OR "Diaporthe detrusa" OR "Diaporthe koelreuteriae" OR "Diaporthe tersa" OR "Diaspidiotus africanus" OR "Diaspidiotus uvae" OR "Diatrype berberidis" OR "Dichomera macrospora" OR "Dictyodothis berberidis" OR "Dictyotrichiella delicatula" OR "Didymella aliena" OR "Didymella cadubriae" OR "Didymella glomerata" OR "Didymella macrostoma" OR "Didymella nigricans" OR "Didymosphaeria berberidicola" OR "Didymosphaeria epidermidis" OR "Didymosphaeria oblitescens" OR "Dionconotus parnisanus" OR "Diplodia berberidis" OR "Diplodia mahoniae" OR "Diplodia mutila" OR "Diplodia seriata" OR "Diplodina berberidina" OR "Diplodina berberidina" OR "Diptacus berberinus" OR "Discosphaerina cytisi" OR "Discostroma fuscellum" OR "Ditula angustiorana" OR "Diurnea lipsiella" OR "Doloploca punctulana" OR "Dothidea berberidis" OR "Dothidea berberidis" OR "Dothidea hippophaes" OR "Dothiorella viticola" OR "Drosophila suzukii" OR "Dynaspidiotus britannicus" OR "Ectropis crepuscularia" OR "Edythea berberidis" OR "Edythea quitensis" OR "Edythea soratensis" OR "Edythea tenella" OR "Elasmostethus brevis" OR "Eotetranychus carpini" OR "Epicoccum nigrum" OR "Epidiaspis leperii" OR "Erimococcus kimmericus" OR "Eriosphaeria australis" OR "Erysiphe begoniicola" OR "Erysiphe berberidicola" OR "Erysiphe berberidis" OR "Erysiphe cruciferarum" OR "Erysiphe divaricata" OR "Erysiphe golovinii" OR "Erysiphe multappendicis" OR "Erysiphe polygoni" OR "Erysiphe sichuanica" OR "Erysiphe thaxteri" OR "Euphyllura berberae" OR "Eupithecia exiguata" OR "Eupithecia subfuscata" OR "Euscotia inextricata" OR "Eutypa lata" OR "Eutypa peraffinis" OR "Eutypella aequilinearis" OR "Eutypella russodes" OR "Exapate congelatella" OR "Excipularia fusispora" OR "Exidiopsis leucophaea" OR "Exophiala pisciphila" OR "Favolaschia antarctica" OR "Favolaschia aulaxina" OR "Fibroporia vaillantii" OR "Fomitiporia punctata" OR "Frankliniella occidentalis" OR "Fumago vagans" OR "Fusarium falciforme" OR "Fusarium lateritium" OR "Fusarium oxysporum" OR "Fusarium solani" OR "Fusicoccum luteum" OR "Gambleola cornuta" OR "Gambleola cornuta" OR "Gastropacha quercifolia" OR "Geocenamus dobroticus" OR "Gerwasia quitensis" OR "Gibbera patagonica" OR "Globisporangium debaryanum" OR "Gnomoniopsis comari" OR "Gonocerus acuteangulatus" OR "Grammoptera ruficornis" OR "Greenidea kumaoni" OR "Gymnoscelis rufifasciata" OR "Halyomorpha halys" OR "Haplothrips andresi" OR "Haplothrips angusticornis" OR "Haplothrips reuteri" OR "Heliococcus sulcii" OR "Helminthosphaeria sanguinolenta" OR "Helminthosphaeria sanguinolenta" OR "Helminthosporium velutinum" OR "Hemaspidoproctus senex" OR "Hemiberlesia lataniae" OR "Hemithea aestivaria" OR "Hendersonia dickasonii" OR "Hendersonia sarmentorum" OR "Heterobasidion annosum" OR "Heterodera avenae" OR "Hirneola antarctica" OR "Hoehneliella perplexa" OR "Hyalophora cecropia" OR "Hydaphias hofmanni" OR "Hydria montivaga" OR "Hymenochaete colliculosa" OR "Hymenoscyphus buccinula" OR "Hymenoscyphus buccinula" OR "Hymenoscyphus caudatus" OR "Hymenoscyphus leucopus" OR "Hymenoscyphus titubans" OR "Hyperchiria incisa" OR "Hyphantria cunea" OR "Hyphodontia arguta" OR "Hypoderma berberidis" OR "Hypoderma minteri" OR "Hypomecis punctinalis" OR "Icerya purchasi" OR "Irantylenchus vicinus" OR "Jaapiella kovalevi" OR "Kabatiella berberidis" OR "Karschia fuegiana" OR "Keissleriella cladophila" OR "Kleidocerys resedae" OR "Lacanobia thalassina" OR "Lachnum albidulum" OR "Lachnum australe" OR "Lachnum rhytismatis" OR "Laestadia angulata" OR "Lambertella berberidis" OR "Lambertella kumaonica" OR "Lanzia parasitica" OR "Larerannis orthogrammaria" OR "Lasiocampa quercus" OR "Lasiodiplodia theobromae" OR "Lasioptera berberina" OR "Lasiosphaeris hirsuta" OR "Lecanodiaspis prosopidis" OR "Lecanodiaspis thamnosmae" OR "Lepidosaphes malicola" OR "Lepidosaphes ulmi" OR "Leptosphaeria artemisiae" OR "Leptosphaeria berberidicola" OR "Leptosphaeria castagnei" OR "Leptosphaeria inconspicua" OR "Leptosphaeria punjabensis" OR "Leptosphaeria robusta" OR "Leptostroma berberidis" OR "Leptothyrium berberidis" OR "Leptoxyphium fumago" OR "Ligdia adustata" OR "Liosomaphis berberidis" OR "Liosomaphis atra" OR "Liosomaphis berberidis" OR "Liosomaphis himalayensis" OR "Liosomaphis ornata" OR "Lobesia botrana" OR "Lophiostoma compressum" OR "Lophiostoma quadrinucleatum" OR "Lophodermium berberidis" OR "Lophodermium foliicola" OR "Lophodermium johnstonii" OR "Luteonectria nematophila" OR "Lycia graecarius" OR "Lycia hirtaria" OR "Lymantria dispar" OR "Macropsis berberidicola" OR "Macropsis berberidis" OR "Macrosiphum euphorbiae" OR "Macrosiphum pachysiphum" OR "Magnococcus berberis" OR "Malacosoma americanum" OR "Malacosoma neustria" OR "Malacosoma parallela" OR "Massarina polymorpha" OR "Melanchra persicariae" OR "Melanomma pulvis-pyrius" OR "Meloderma desmazieri" OR "Meloidogyne arenaria" OR "Meloidogyne hapla" OR "Meloidogyne incognita" OR "Meloidogyne javanica" OR "Menispora caesia" OR "Merlinius acuminatus" OR "Merlinius brevidens" OR "Metasphaeria desolationis" OR "Metcalfa pruinosa" OR "Metopolophium berberinutritum" OR "Microdiplodia microsporella" OR "Microsphaera grossulariae" OR "Microsphaeropsis conielloides" OR "Microsphaeropsis olivacea" OR "Microthyrium fagi" OR "Moellerodiscus berberidis" OR "Mollisiopsis subantarctica" OR "Monilinia fructigena" OR "Montagnella berberidis" OR "Mycetinis copelandii" OR "Mycetinis salalis" OR "Mycosphaerella ambiens" OR "Mycosphaerella berberidis" OR "Mycosphaerella berberidis" OR "Mycterothrips albidicornis" OR "Myrothecium inundatum" OR "Myzocallis aptera" OR "Myzus persicae" OR "Nectria antarctica" OR "Nectria berberidicola" OR "Nectria cinnabarina" OR "Neofusicoccum ribis" OR "Neonectria lugdunensis" OR "Neopsilenchus magnidens" OR "Neoscytalidium dimidiatum" OR "Neoselenaspidus silvaticus" OR "Neostauropus sikkimensis" OR "Noctua comes" OR "Noctua fimbriata" OR "Noctua pronuba" OR "Odontopera bidentata" OR "Omphalocera cariosa" OR "Oncopodium antoniae" OR "Orgyia leucostigma" OR "Orhespera glabricollis" OR "Orhespera impressicollis" OR "Orientus ishidae" OR "Orthosia opima" OR "Otiorhynchus crataegi" OR "Otiorhynchus veterator" OR "Otthia amelanchieris" OR "Otthia lisae" OR "Ourapteryx sambucaria" OR "Pandemis cerasana" OR "Paracoccus burnerae" OR "Paraconiothyrium fuckelii" OR "Paratylenchus vandenbrandei" OR "Pareulype berberata" OR "Parlatoreopsis

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longispina" OR "Parlatoria camelliae" OR "Parlatoria oleae" OR "Parlatoria pergandii" OR "Parmena slamai" OR "Parodiella negeriana" OR "Parthenolecanium corni" OR "Parthenolecanium persicae" OR "Peliococcus morrisoni" OR "Peniophora incarnata" OR "Peniophorella praetermissa" OR "Peribatodes rhomboidaria" OR "Pestalotia berberidis" OR "Pestalotia jodhpurensis" OR "Pestalotiopsis japonica" OR "Pestalotiopsis osyridis" OR "Pestalozzina berberidina" OR "Pestalozzina berberidis" OR "Pezicula microspora" OR "Phacidium foliicola" OR "Phaeoacremonium iranianum" OR "Phaeoacremonium minimum" OR "Phaeodothis winteri" OR "Phenacoccus aceris" OR "Phenacoccus aceris" OR "Phenacoccus berberis" OR "Phenacoccus tataricus" OR "Phlogophora meticulosa" OR "Pholiota subflammans" OR "Phoma berberidella" OR "Phoma berberidicola" OR "Phoma berberidis" OR "Phoma empetrifolia" OR "Phoma herbarum" OR "Phomopsis berberidis" OR "Phomopsis berberina" OR "Phtheochroa decipiens" OR "Phyllactinia alnicola" OR "Phyllactinia guttata" OR "Phyllocoptes congranulatus" OR "Phyllocoptes granulatus" OR "Phyllocoptes graminis" OR "Phyllosticta berberidicola" OR "Phyllosticta capitalensis" OR "Phyllosticta japonica" OR "Phyllosticta mahoniae" OR "Phyllosticta mahoniicola" OR "Phyllosticta westendorpii" OR "Phymatotrichopsis omnivora" OR "Phytophthora cinnamomi" OR "Phytophthora kernoviae" OR "Phytophthora nicotianae" OR "Phytophthora plurivora" OR "Phytophthora ramorum" OR "Planococcus citri" OR "Platysporoides togwotiensis" OR "Platysporoides togwotiensis" OR "Pleosphaeria fuegiana" OR "Pleospora aggregata" OR "Pleospora amelanchieris" OR "Pleospora berberidicola" OR "Pleospora berberidis" OR "Pleospora orbicularis" OR "Pleospora rudis" OR "Pleurotus berberidicola" OR "Plodia interpunctella" OR "Pochazia shantungensis" OR "Polia bombycina" OR "Polychaeton quercinum" OR "Polyporus lepideus" OR "Pratylenchoides alkani" OR "Pratylenchus penetrans" OR "Pratylenchus vulnus" OR "Prociphilus erigeronensis" OR "Pseudargyrotoza conwagana" OR "Pseudaulacaspis cockerelli" OR "Pseudaulacaspis pentagona" OR "Pseudocercospora berberidis-vulgaris" OR "Pseudocercospora nandinae" OR "Pseudococcus comstocki" OR "Pseudococcus maritimus" OR "Pseudococcus viburni" OR "Pseudoglaea olivata" OR "Pseudomonas syringae pv. Berberidis" OR "Pseudotelphusa tessella" OR "Puccinia barri-aranae" OR "Puccinia berberidis" OR "Puccinia berberidis-darwinii" OR "Puccinia brachypodii" OR "Puccinia brachypodii-phoenicoidis" OR "Puccinia culmicola" OR "Puccinia droogenis" OR "Puccinia droogensis" OR "Puccinia fendleri" OR "Puccinia graminis" OR "Puccinia graminis subsp. graminis" OR "Puccinia koeleriae" OR "Puccinia magelhaenica" OR "Puccinia magellanica" OR "Puccinia meyeri-alberti" OR "Puccinia minshanensis" OR "Puccinia montanensis" OR "Puccinia neglecta" OR "Puccinia poculiformis" OR "Puccinia pseudostriiformis" OR "Puccinia pygmaea" OR "Puccinia rameliana Puccinia ramelianoides" OR "Puccinia striiformis" OR "Puccinia striiformoides" OR "Pucciniastrum clemensiae" OR "Pucciniosira clemensiae" OR "Pulvinaria floccifera" OR "Pyrenochaeta berberidis" OR "Ramaria subaurantiaca" OR "Ramularia berberidis" OR "Rebentischia pomiformis" OR "Rebentischia unicaudata" OR "Rhabdospora berberidis" OR "Rhagastis mongoliana mongoliana" OR "Rhagastis mongoliana centrosinaria" OR "Rhagastis mongoliana pallicosta" OR "Rhagoletis berberidis" OR "Rhagoletis cerasi" OR "Rhagoletis meigenii" OR "Rhaphigaster nebulosa" OR "Rheumaptera cervinalis" OR "Rheumaptera undulata" OR "Rhizoctonia solani" OR "Rhopalosiphum rufiabdominale" OR "Rhopobota myrtillana" OR "Rigidoporus vinctus" OR "Rotylenchus buxophilus" OR "Saccardoella berberidis" OR "Saccardoella transylvanica" OR "Samia cynthia" OR "Sarcostroma berberidis" OR "Sarcostroma berberidis" OR "Scirtothrips dorsalis" OR "Sclerotinia sclerotiorum" OR "Sclerotium dothideoides" OR "Scolypopa australis" OR "Scutellinia minutella" OR "Scutylenchus tartuensis" OR "Scytinostroma duriusculum" OR "Seimatosporium berberidicola" OR "Seimatosporium berberidicola" OR "Seimatosporium vitis" OR "Selenia lunularia" OR "Somena scintillans" OR "Sonotetranychus albiflorae" OR "Sphaceloma sorbi" OR "Sphaeronaema rostratum" OR "Sphaeropsis berberidis" OR "Sphaerulina berberidis" OR "Sphenoraia berberii" OR "Sphenoraia yajiangensis" OR "Sphrageidus similis" OR "Spilosoma lutea" OR "Spiroporococcus braggi" OR "Sporoschisma hemipsilum" OR "Stagonospora berberidina" OR "Stagonosporopsis crystalliniformis" OR "Stagonosporopsis cucurbitacearum" OR "Stemphylium vesicarium" OR "Stenoluperus nipponensis" OR "Stictis polycocca" OR "Stilbocrea banihashemiana" OR "Strickeria cerasi" OR "Strophosoma melanogrammum" OR "Strymonidia pruni" OR "Stylodothis indica" OR "Stylodothis indica" OR "Tachystola acroxantha" OR "Taeniothrips inconsequens" OR "Taeniothrips meridionalis" OR "Tetranychus turkestani" OR "Tetranychus urticae" OR "Thrips difficilis" OR "Thrips latiareus" OR "Thrips major" OR "Thrips obscuratus" OR "Thrips tabaci" OR "Thrips trehernei" OR "Thyatira batis" OR "Thyridaria macrostomoides" OR "Thyridaria triseptata" OR "Thyridium vestitum" OR "Thyridopteryx ephemeraeformis" OR "Thyronectria berberidis" OR "Thyronectria caudata" OR "Thyronectria lamyi" OR "Timora beatrix" OR "Tomato spotted wilt orthotospovirus" OR "Trabala vishnou" OR "Trachyspora wurthii" OR "Trametes versicolor" OR "Trialeurodes vaporariorum" OR "Tricaudatus polygoni" OR "Trichoferus berberidis" OR "Trioza berbericola" OR "Trioza berberidis" OR "Trioza fissa" OR "Trioza inlechsis" OR "Trioza lischines" OR "Trioza longipennis" OR "Trioza nilisches" OR "Trioza scottii" OR "Trioza striacauda" OR "Trioza subberbericola" OR "Triphosa haesitata" OR "Triposporium pannosum" OR "Trophorus impar" OR "Tryblidaria esfandiarii" OR "Tryblidaria pakistani" OR "Tryblidaria pakistani" OR "Tylenchus bhitaii" OR "Uredo berberidis" OR "Uromyces graminis" OR "Uropyxis naumanniana" OR "Valsaria insitiva" OR "Verticillium alboatrum" OR "Verticillium dahliae" OR "Wahlgreniella nervata" OR "Wiesneriomyces laurinus" OR "Xenosiphonaphis conandri" OR "Xiphinema brevicolle" OR "Xiphinema globosum" OR "Xyleborus brevis" OR "Xylella fastidiosa" OR "Xylella fastidiosa subsp. Multiplex" OR "Xylodon sambuci" OR "Xylosandrus compactus" OR "Zasmidium quitense" OR "Zasmidium quitense" OR "Zeugophora cyanea" OR "Zeuzera pyrina" OR "Zignoella longispora"

APPENDIX C

Excel file with the pest list of *Berberis thunbergii* species

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