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SCIENTIFIC OPINION

Commodity risk assessment of *Castanea sativa* plants from the United Kingdom

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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'. This Scientific Opinion covers plant health risks posed by graftwood, whips, bare root plants and potted plants of *Castanea sativa* imported from the United Kingdom. The assessment was performed considering the available scientific information, including the technical information provided by the UK. All pests associated with the commodities were evaluated against specific criteria. Three EU regulated pests (*Cryphonectria parasitica, Dryocosmus kuriphilus, Phytophthora ramorum*), present in the UK and associated with the commodity, were considered relevant for this opinion. One pest that is not regulated in the EU (*Phytophthora kernoviae*) fulfilled all relevant criteria and was selected for further evaluation. For the selected pest, the risk mitigation measures described in the submitted technical dossier were evaluated. An expert judgement was 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 varied among the commodities evaluated, with *P. kernoviae* being most frequently expected on the imported bare root and potted plants. The Expert Knowledge Elicitation indicated with 95% certainty that 9060 or more units per 10,000 will be free from *P. kernoviae*.

KEYWORDS

European Union, pathway risk assessment, plant health, plant pest, sweet chestnut

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1 | INTRODUCTION

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

1.1.1 | Background

The new Plant Health Regulation (EU) 2016/2031,[1] on the protective measures against pests of plants, has been applied from 14 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 (MSs) in the work connected to Article 42 of Regulation (EU) 2016/2031, as stipulated in the terms of reference.

1.1.2 | Terms of Reference

In view of the above and in accordance with Article 29 of Regulation (EC) No 178/2002,[3] the Commission asks EFSA to provide Scientific Opinions in the field of plant health. In particular, EFSA is expected to prepare and deliver risk assessments for commodities listed in the relevant Implementing Act as 'High risk plants, plant products and other objects'. Article 42, paragraphs 4 and 5, establishes that a risk assessment is needed as a follow-up to evaluate whether the commodities will remain prohibited, removed from the list and additional measures will be applied or removed from the list without any additional measures. This task is expected to be on-going, with a regular flow of dossiers being sent by the applicant required for the risk assessment.

Therefore, to facilitate the correct handling of the dossiers and the acquisition of the required data for the commodity risk assessment, a format for the submission of the required data for each dossier is needed.

Furthermore, a standard methodology for the performance of 'commodity risk assessment' based on the work already done by MSs 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 asks EFSA to provide a Scientific Opinion in the field of plant health for *Castanea sativa* from the United Kingdom (UK) taking into account the available scientific information, including the technical dossier provided by the Department for Environment, Food and Rural Affairs of the United Kingdom (DEFRA).

1.2 | Interpretation of the Terms of Reference

The EFSA Panel on Plant Health (hereafter referred to as 'the Panel') was requested to conduct a commodity risk assessment of *Castanea sativa* Miller, EPPO code: CSNSA, from the UK following the Guidance on commodity risk assessment for the evaluation of high-risk plant dossiers (EFSA PLH Panel, 2019), taking into account the available scientific information, including the technical information provided by DEFRA.

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 the species level.

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

Annex VII of the same Regulation, in certain cases (e.g. point 32), makes reference to the following countries that are excluded from the obligation to comply with specific import requirements for those non-European populations, or isolates, or species referred to Annex II of Implementing Regulation (EU) 2019/2072: Albania, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canary Islands, Faeroe Islands, Georgia, Iceland, Liechtenstein, Moldova, Monaco, Montenegro, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny

[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, p. 1–279.

okrug), Northwestern Federal District (SeveroZapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo-Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug), San Marino, Serbia, Switzerland, Türkiye, Ukraine and the United Kingdom (except Northern Ireland[5])). 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;
(ii) any pest found in a European country that belongs to the same denomination as the pests listed as non-European populations or isolates in Annex II of Implementing Regulation (EU) 2019/2072 should be considered as European populations or isolates and should not be considered in the assessment of those countries.

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

Any pests regulated both as an RNQP and a protected zone quarantine pest will be treated as EU regulated quarantine pest in this opinion.

In its evaluation, the Panel:

(i) checked whether the information in the technical dossier (hereafter referred to as 'the Dossier') provided by the applicant (DEFRA) was sufficient to conduct a commodity risk assessment. When necessary, additional information was requested from the applicant;
(ii) selected the relevant EU regulated pests (excluding RNQP) and other relevant pests not regulated in the EU present in the UK and potentially associated with the commodity;
(iii) assessed the effectiveness of measures for pests that are not regulated in the EU;
(iv) did not assess the effectiveness of measures for the following EU regulated pests: (1) union quarantine pests, (2) protected zone quarantine pests, (3) emergency measures pests listed in (EU) 2022/1941.

Risk management decisions are not within EFSA's remit. Therefore, the Panel provided a rating based on expert judgement regarding the likelihood of pest freedom for each relevant pest given the risk mitigation measures implemented by the UK. The Plant Health Commodity Risk Assessment Opinions are prepared following the EFSA Standard Protocol for Commodity Risk Assessment (Gardi et al 2025).

2 | DATA AND METHODOLOGIES

2.1 | Data provided by DEFRA

The Panel considered all the data and information provided by DEFRA on 2 May 2024, including the additional information provided by DEFRA on 6 October 2025, after EFSA's request. The dossier is managed by EFSA. The structure and overview of the dossier are 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	
2	Pest list	Castanea_final.xlsx
3	Producers sample product list	Castanea_producers_sample_product_list.xlsx
4	Distribution of *Castanea sativa* plants	Castanea_sativa_distribution.pdf
5.1	Additional information: answers	Castanea sativa additional information 29 September 2025.pdf

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

[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.

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 *Castanea sativa*. The following searches were combined: (i) a general search to identify pests reported on *C. sativa* in the databases, (ii) a search to identify any EU quarantine pest reported on *C. sativa* and (iii) a tailored search to identify whether the above pests are present or not in the UK. The databases used for each of the above searches are specified in Table 2. The searches were run between 20 March 2025 and 10 October 2025. No language, date or document type restrictions were applied in the search strategy.

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

As for Web of Science, the literature search was performed using a specific, ad hoc established search string (Supporting information). 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 2 Databases used by EFSA for the compilation of the pest list associated with *Castanea sativa*.

Database	Platform/link	Database use
Aphids on World Plants	https://www.aphidsonworldsplants.info/C_HOSTS_AAIntro.htm	*Host plant records*
BIOTA of New Zealand	https://biotanz.landcareresearch.co.nz/	*Host plant records*
CABI Crop Protection Compendium	https://www.cabi.org/cpc/	*Pest distribution and host plant records*
Database of Insects and their Food Plants	http://www.brc.ac.uk/dbif/hosts.aspx	*Host plant records*
Database of the World's Lepidopteran Hostplants	https://www.nhm.ac.uk/our-science/data/hostplants/search/index.dsml	*Host plant records*
EPPO Global Database	https://gd.eppo.int/	*Regulated status, pest status, pest distribution and host plant records*
EUROPHYT	https://food.ec.europa.eu/plants/plant-health-and-biosecurity/europhyt_en	*Pest interceptions and outbreak reports*
Gallformers	https://www.gallformers.org/	*Host plant records*
Leaf-miners	https://www.leafmines.co.uk/html/plants.htm	*Host plant records*
GBIF	https://www.gbif.org/	*Arthropods distribution in EU ('human observation' category) only for validated records*
MyCoPortal	https://www.mycoportal.org/portal/collections/harvestparams.php	*Pest distribution*
Nemaplex	https://nemaplex.ucdavis.edu/Nemabase2010/PlantNematodeHostStatusDDQuery.aspx	*Pest distribution*
PESI portal	https://www.eu-nomen.eu/portal/	*Pest distribution*
Plant Parasites of Europe	https://bladmineerders.nl/scientific-plant-names-genera/	*Host plant records*
Plant Pest Information Network	https://www.mpi.govt.nz/news-and-resources/resources/registers-and-lists/plant-pest-information-network/	*Host plant records*
Scalenet	https://scalenet.info/associates/	*Pest distribution and host plant records*
Scolytinae hosts and distribution database	https://www.scolytinaehostsdatabase.eu/site/it/home/	*Host plant records and pest distribution*
Spider Mites Web	https://www1.montpellier.inra.fr/CBGP/spmweb/	*Host plant records*
USDA ARS Fungal Database	https://fungi.ars.usda.gov/	*Pest distribution and host plant records*
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	*Host plant records and evidence of impact (for actionable pests)*
World Agroforestry	https://www.worldagroforestry.org/treedb2/speciesprofile.php?Spid=1749	*Host plant records*

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

2.3 | Methodology

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

Pests potentially associated with the commodity in the country of origin and fulfilling the selection criteria (see Section 2.3.2) are identified as relevant pests.

For those that are not regulated in the EU, all relevant risk information was summarised in a pest datasheet (Appendix B), and a conclusion on the likelihood of the commodity being free from each of the relevant pests was determined, and uncertainties identified using expert judgements (Expert Knowledge Elicitation, see Section 2.3.4).

Relevant pests with a quarantine status in the EU are prohibited from being introduced to the EU according to Article 5(1) of Regulation (EU) 2016/2031 and therefore should not be present on imported plant commodities. Consequently, no specific measures are defined in the Annex to Implementing Regulation (EU) 2020/1213. For these pests, no assessment of likelihood of pest freedom on the exported commodity is performed, unless the Panel considers it appropriate to conduct such an evaluation or if specifically requested by the European Commission.

Pest freedom was assessed by estimating the number of infested/infected single plants or bundles out of 10,000 exported single plants or bundles. The assessment is based on independent evaluations for each individual pest and does not consider correlations. Further details on the methodology used to estimate the likelihood of pest freedom are provided in Section 2.3.4.

2.3.1 | Commodity information

Based on the information provided by DEFRA from the UK, the characteristics of the commodity were 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 *Castanea sativa* from the UK, a pest list was compiled. The pest list is a compilation of all identified plant pests associated with *C. sativa* based on information provided in the dossier and on further literature searches performed by the panel.

The scientific name of the host plant (i.e. *C. sativa*) was used when searching in the EPPO Global database, CABI Crop Protection Compendium and other databases (Table 2), with the exception of EUROPHYT and Web of Science for which the search procedure is described below in the text. EUROPHYT was consulted by searching for interceptions associated with commodities imported from the UK, at species level, from 1995 to May 2020, and TRACES for interceptions from May 2020 to present. For the pests selected for further evaluation, a search in the EUROPHYT and/or TRACES was performed for the interceptions from the whole world, at species level.

The search strategy used for Web of Science databases was designed by combining common names of pests and diseases, terms describing symptoms of plant diseases and the scientific and common names of the commodity. All pests already retrieved using other databases were removed from the search terms in order to be able to reduce the number of records to be screened. The established search string is detailed in the Supporting information and was run on 28 March 2025.

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

The compiled pest list (Supporting information) includes all pests and other entities reported as associated with *C. sativa*.

The evaluation of the compiled pest list was done in two steps: first, the relevance of EU regulated pests was evaluated (Section 4.1); second, the relevance of any other plant pests was evaluated (Section 4.2).

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

(i) *Castanea sativa* is a host of the pest
(ii) the pest is present in the UK;
(iii) one or more life stages of the pest can be associated with the specified commodity.

Pests that fulfilled all criteria were selected as relevant.

To identify pests that are not regulated in the EU and associated with the commodity, the same criteria used for EU-regulated pests were applied. In addition, further criteria were considered: if the pest is (i) absent or (ii) has a limited distribution in the EU and if the pest (iii) might have an impact in the EU. Pests that fulfilled all criteria were selected for further evaluation. Pests for which limited information was available on one or more criteria used to identify them as relevant for this opinion, e.g. on potential impact, are listed in Section 4.3.

2.3.3 | Listing and evaluation of risk mitigation measures

All implemented risk mitigation measures were listed. When evaluating the likelihood of pest freedom at origin, the following types of potential infection sources for *Castanea sativa* in nurseries were considered (see also Figure 1):

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

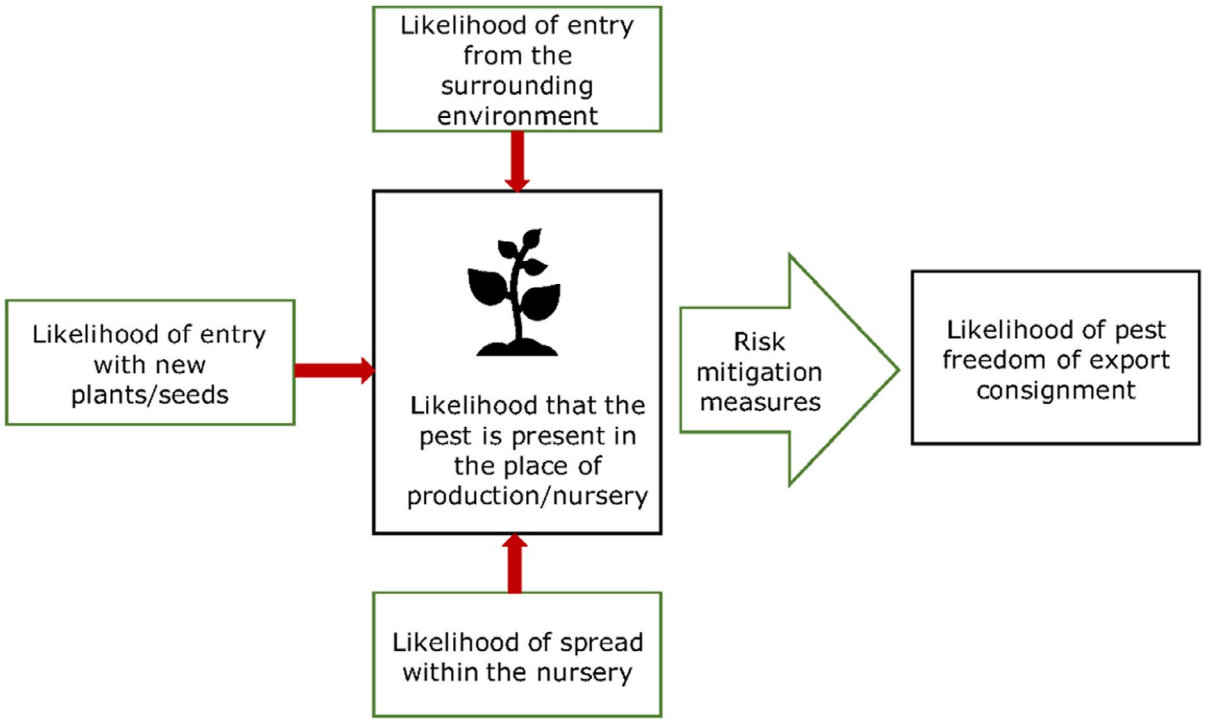


FIGURE 1 Conceptual framework to assess the likelihood that plants are exported free from relevant pests (Source: EFSA PLH Panel, 2019).

The risk mitigation measures adopted in the plant nurseries (as communicated by DEFRA) were evaluated with Expert Knowledge Elicitation (EKE) according to the Guidance on uncertainty analysis in scientific assessment (EFSA Scientific Committee, 2018).

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

2.3.4 | Expert Knowledge Elicitation

To estimate the pest freedom of the plant commodities, an EKE was performed following EFSA guidance (Annex B.8 of EFSA Scientific Committee, 2018). The EKE evaluation considered the whole area of the applicant country and the uncertainties on the pest pressure in the surrounding environment (i.e. presence of host plants in the surrounding environment, distribution of the pest in the country). 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 plants/units will be infested with the relevant pest when arriving in the EU?'. The plant commodity units are defined in Section 3.1. The risk assessment considered the grouping of commodities with similar characteristics (Section 3.4).

The uncertainties associated with the EKE were taken into account and quantified in the probability distribution derived using the semi-formal method described in section 3.5.2 of the EFSA-PLH Guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018a, 2018b). Finally, the results were reported in terms of the likelihood of pest freedom. The lower 5% percentile of the probability distribution reflects the opinion that pest freedom is with 95% certainty above this limit.

3 | COMMODITY INFORMATION

All the information presented in this section has been retrieved from the dossier submitted by DEFRA. The panel assumes that the information retrieved from the dossier submitted by the applicant country are applicable to all nurseries seeking authorisation to export the commodity to the EU in the future.

3.1 | Description of the commodity

According to the dossier provided by DEFRA, the commodities intended for import are classified under ISPM 36 (FAO, 2019) as graftwood, whips, bare root plants and rooted plants in pots of *Castanea sativa* Miller (common name: Sweet chestnut; family: *Fagaceae)* of various varieties as described in detail below (Figure 2):

1. **Graftwood**: This commodity consists of young shoots suitable for chip budding or grafting. Each shoot typically bears 9–10 or more buds, and no leaves. Depending on their size, they are grouped in bundles of 10–20 units. These shoots are up to 2 years old, with a maximum diameter of 1.2 cm and a maximum length of 40 cm.
2. **Whips**: This commodity consists of slender, unbranched bare root trees that are not pruned. Whips may have some leaves at the time of export, especially in early winter. Depending on their size, they are grouped in bundles of 5, 10 or 15 units. The whips are up to 2 years old, with a maximum diameter of 1 cm and a maximum height of 100 cm.
3. **Bare root plants**: This commodity consists of more mature trees than whips and may be pruned as required. Like whips, they may retain some leaves at the time of export, especially in early winter. The bare root plants are up to 7 years old, with a maximum diameter of 4 cm and a maximum height of 200 cm.
4. **Rooted plants in pots**: This commodity can be grown entirely in EU-compliant growing media, or initially cultivated in the field, before being lifted, root-washed and potted in EU-compliant media. They may be pruned as required and can be exported with leaves, especially when shipped early in winter. The rooted plants in pots are up to 15 years old, with a maximum diameter of 6 cm and a maximum height of 5 m.

FIGURE 2 Rooted plants in pots of *Castanea sativa* grown on membrane on top of a gravel bed (source: DEFRA).

3.2 | Description of the production areas

The technical dossier identifies two nurseries in the United Kingdom that produce *C. sativa* plants for export. Both nurseries are located in rural areas, one near Birmingham and the other between Leeds and York. These nurseries are registered as professional operators with the UK National Plant Protection Organization (NPPO), under the authority of either the Animal and Plant Health Agency (APHA) for England and Wales or the Scottish Government, and are authorised to issue UK plant passports.

The size of nurseries growing *C. sativa* depends on the production method. For container-grown stock, the area ranges from a minimum of 8 hectares to a maximum of 150 hectares. For field-grown stock, the maximum area extends up to 325 hectares.

In addition to *C. sativa*, the exporting nurseries grow a wide range of other plant species, which may vary between years. The dossier lists a total of 245 species, including woody plants such as oak (*Quercus* spp.), beech (*Fagus* spp.), elm (*Ulmus* spp.) and pine (*Pinus* spp.). The proportion of *C. sativa* within the overall nursery production ranges from 0.1% to 1%.

The nurseries' surrounding land is predominantly composed of arable farmland, with some pasture and small areas of woodland.

According to the dossier, the minimum distance between the nursery growing areas and the nearest *C. sativa* plants in the surrounding environment is 10 m.

As reported, one of the nurseries is bordered directly by woodland that could have a range of native trees such as oak (*Quercus robur*), pine (*Pinus* spp.), poplar (*Populus* spp.), ash (*Fraxinus* spp.), sycamore (*Acer pseudoplatanus*), holly (*Ilex* spp.), Norway maple (*Acer platanoides*) and field maple (*Acer campestre*). Hedges are often used to define field boundaries, and lines of roadsides are typically composed of hazel (*Corylus avellana*), yew (*Taxus baccata*), holly (*Ilex*), ivy (*Hedera*), alder (*Alnus glutinosa*), laurel (*Prunus laurocerasus*), hawthorn (*Crataegus*), blackthorn (*Prunus spinosa*) and leylandii (*Cupressus × leylandii*). Other and typical arable crops in the region include oilseed rape (*Brassica napus*), wheat (*Triticum* spp.), barley (*Hordeum vulgare*), turnips (*Brassica rapa* subsp. *rapa*), potatoes (*Solanum tuberosum*) and maize (*Zea mays*). Pasture is predominantly ryegrass (*Lolium* spp.).

3.3 | Production and handling processes

3.3.1 | Growing conditions

Castanea sativa plants are either grown in containers (cells, pots, tubs, etc.) outdoors in the open air or directly in the field. Since the plants are intended for outdoor cultivation, only the early growth stages, such as young plants or seedlings, may be maintained under protection during periods of increased vulnerability to climatic conditions including frost. Growth under plastic polytunnels or in glasshouses is primarily to protect against external climatic conditions rather than pests. Additionally, plants grown in containers are kept in trays placed on protective plastic membranes or on raised benches standing on gravel as a barrier against soil pests.

According to the submitted dossier, growers typically use virgin peat or peat-free compost (made from coir, bark, wood fibre, etc.) complying with the requirements for growing media as specified in Annex VII of Commission Implementing Regulation 2019/2072. This compost is heat-treated to eliminate pests and pathogens, then delivered in sealed bulk bags or shrink-wrapped bales and stored hygienically on pallets. When delivered in bulk, it is stored in the nurseries in dedicated bunkers, either indoors or covered outdoors, ensuring no contamination from soil or other materials.

According to the dossier, growers implement an effective weed management programme. Growing areas are kept clear from non-cultivated herbaceous plants, which are restricted to access paths and nursery boundaries, covering less than 1% of the site. The predominant species is rye grass (*Lolium* spp.), with the occasional presence of dandelions (*Taraxacum officinale*), hairy bittercress (*Cardamine hirsuta*), common daisy (*Bellis perennis*), creeping cinquefoil (*Potentilla reptans*) and bluebells (*Hyacinthoides non-scripta*).

Irrigation of trees in nurseries is done on a need basis using overhead, sub-irrigation or drip systems. Growers are required to assess water sources, irrigation and drainage systems used in plant production. The water can be drawn from the mains supply, boreholes or rainwater collections or watercourses. The main water supply sources comply with 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), ensuring it is free from human and plant pathogens. The water is regularly sampled and analysed, and no quarantine pests have been detected. According to the dossier, none of the nurseries have reported pest or disease issues associated with water contamination.

Routine hygiene measures are implemented in the nurseries, including disinfecting tools and equipment between batches and plant species. Tools are dipped in disinfectant (e.g. Virkon S) and wiped between trees to reduce the risk of pest transmission. All plant residues, waste materials and weeds are removed post-harvest and during autumn/winter to minimise overwintering sites for pests.

3.3.2 | Source of planting material

The starting material consists of a combination of seeds and seedlings, depending on the nursery. One nursery produces plants by grafting from *Castanea sativa* mother plants maintained in the nursery, while the other uses only seeds and

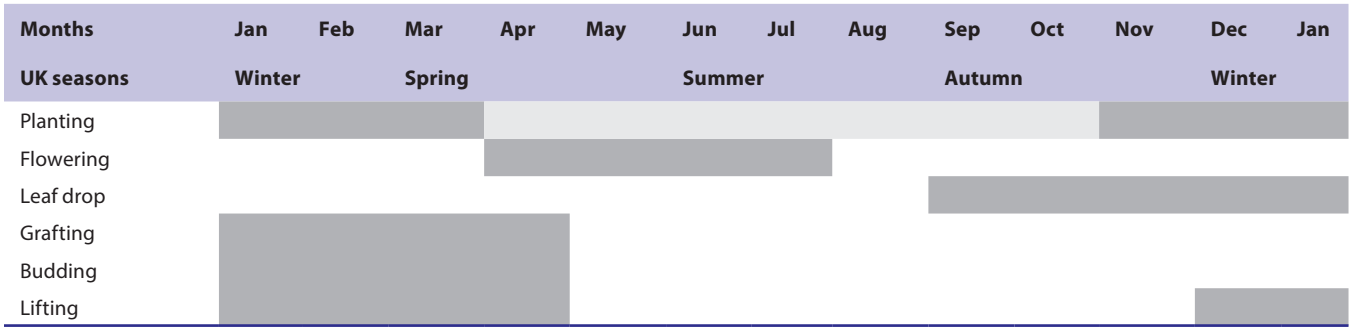
seedlings. For chip budding, the scion wood is taken from 2- to 3-year-old stock trees. Seed purchased in the UK is certified, seedlings sourced within the UK carry UK Plant Passports, and those imported from the EU are certified with phytosanitary certificates.

3.3.3 | Production cycle

According to the dossier, planting of bare root trees occurs from late autumn to early spring (November–March), whereas rooted plants in pots can be planted year-round, with winter being the most common period. Grafting methods vary: side-spliced grafting is done in late winter or early spring before bud break, whip-and-tongue grafting in March–April and budding to reproduce trees in August. Flowering occurs in late spring to summer (April–July), depending upon the variety and weather conditions (Table 3).

Whips are not pruned, whereas bare root and potted plants are pruned as needed. Field-grown trees are transplanted approximately every 2 years to maintain adequate spacing as they grow. Bare root plants are lifted from the fields and harvested in winter during dormancy. Rooted plants in pots are lifted from the field, root-washed and potted in EU-compliant media at least one growing season prior to export. Although some trees may reach 15 years old, they are removed from the field at no more than 6 years old. To maintain healthy root architecture, potted plants are re-potted every 2–3 years into larger containers with fresh EU-compliant media.

TABLE 3 Crop phenology, and harvesting and processing, of *Castanea sativa* commodity intended for export during an UK growing season. Rooted plants in pot can be planted (including sowing) in any time of the year, though winter is most common. Dark grey indicates most common months for the particular activity while light grey indicates less common months).



3.3.4 | Pest monitoring during production

According to the submitted dossier, the plant material is regularly monitored for plant health issues. Pest monitoring is carried out visually by trained nursery staff through regular crop walking, with records kept for traceability. Unless a pest can be immediately and definitively identified as non-quarantine, growers are required to treat it as a suspect quarantine pest and notify the competent authority. These assessments are verified by qualified agronomists who also undertake regular crop walks. Curative or preventative actions, as described below, are implemented together with an assessment of phytosanitary risk. In addition, all incoming plant material and goods that could harbour pests are inspected upon arrival at the nursery. Growers keep records allowing traceability for all plant material handled. These records must allow a consignment or consignment in transit to be traced back to the original source, as well as forward to identify all trade customers.

There are also official surveys targeting regulated quarantine pests. The intensity of these surveys varies according to the business size, activity and source material and is designed to detect an incidence of 1.5% with a probability of 95%.

Official inspections during the growing season are undertaken by the UK Plant Health Service taking into consideration factors such as the likelihood of pest presence and the growth stage of the crop. Those inspections are conducted at least once a year and may include sampling and laboratory analysis. Surveillance of *C. sativa* is primarily based on visual inspection, with samples taken from symptomatic trees. Currently, there is no asymptomatic sampling regime. Specific attention is given to *Phytophthora ramorum*, *Phytophthora kernoviae* and *Cryphonectria parasitica*. During field inspections, lateral flow device (LFD) kits are employed to screen for *P. ramorum*.

The UK NPPO carries out inspections and testing, where required by the plant health legislation of the destination country, to ensure all requirements are met and a valid phytosanitary certificate with the correct additional declarations is issued.

3.3.5 | Pest management during production

Chemical treatments are only applied when necessary and depend on the specific conditions, including disease pressure, growth stage and environmental factors. In case of finding pests, the protocol is to treat the plants if they are on site for a sufficient period of time or to destroy any plants infested by pests otherwise. All other host plants in the nursery would also be treated. Due to the variation in pest pressure, some years require minimal or no treatments, while others necessitate

preventative and/or curative treatments. Crop protection is achieved using a combination of measures including approved plant protection products (fungicides, herbicides or pesticides), biological control or physical measures. Plant protection products are used only when necessary, and records of all plant protection treatments are kept. The treatments listed below have been used by growers over the past 5 years:

- For *Phytophthora* spp., Subdue (metalaxyl-M), Previcur Energy (propamocarb hydrochloride and fosetyl-Al), Paraat (dimethomorph) and HortiPhyte (potassium phosphite) were applied as needed from April to June.
- Against leaf miner infestations, insecticidal treatments used include Dynamec (abamectin), Hallmark WZT (lambda-cyhalothrin) and paraffin-based spraying oil. Dynamec was applied monthly during the active periods of March–May and July–September. Spraying oil was used in February and November, while Hallmark WZT was applied in February, June and August.
- For bacterial infections, growers utilised Amylo-X (*Bacillus amyloliquefaciens*); applications were carried out as needed, with monthly treatments from April to September.

3.3.6 | Post-harvest processes and export procedure

Graftwood is grouped in bundles of 10–20 units, wrapped in plastic and packed in cardboard boxes or Dutch crates on ISPM 15 certified wooden or metal pallets, depending on quantity.

After harvest and root washing, whips and bare root plants can be stored in cold storage for up to 5 months. Only whips are grouped into bundles of 5, 10 or 15 units before being wrapped in plastic, packed and distributed on ISPM 15 certified wooden or metal pallets.

Rooted plants in pots can be exported at any time of year to meet customer demand. They are transported on Danish trolleys for smaller containers, and on ISPM 15 certified pallets, or individually in pots for larger containers. Depending on timing and species, both bare root and rooted plants in pots may still have some leaves at the time of export, especially when shipped early in winter.

Separate from any official inspection, plant material is visually checked by growers for plant health issues prior to dispatch.

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

Plants are transported by lorry that might be temperature-controlled if weather conditions during transit are likely to be very cold.

3.4 | Definition of plant units and groups for Expert Knowledge Elicitation

For the purpose of the EKE, the commodities (Section 3.1) were grouped as follows:

(i) Graftwood and whips
(ii) Bare root plants and rooted plants in pots

The following reasoning is given for grouping:

(i) Graftwood and whips – both commodities are up to 2 years old, have similar diameters, are unpruned and are grouped into bundles of similar number of items.
(ii) Bare root plants and rooted plants in pots – both commodities can be grown in the field for several years, are pruned and are exported as single plants.

4 | IDENTIFICATION OF PESTS POTENTIALLY ASSOCIATED WITH THE COMMODITY

The search for potential pests associated with the *Castanea sativa* (as described in Section 2.3.2) rendered a total of 957 (for search string and pest list, see Supporting information).

4.1 | EU regulated pests associated with the commodity

Thirteen EU regulated species are reported to use *C. sativa* as a host plant (Table 4). Of the EU regulated pest species evaluated, three species were listed as relevant since they are present in the UK and can be associated with the commodity (Table 4).

TABLE 4 Overview of the evaluation of the 13 EU regulated pest species (excluding RNQPs) known to use *Castanea sativa* as a host plant for their relevance for this opinion.

No.	Pest name according to EU Legislation[a]	EPPO code	Group[b]	Pest present in the UK	*Castanea sativa* confirmed as a host (reference)	Pest can be associated with the commodity		Pest relevance for the opinion
						Commodity #1	*Commodity #2*	
1	*Anoplophora chinensis*[c]	ANOLCN	Insect	Absent, intercepted	*Castanea* spp. EPPO	NA	NA	No
2	Beet necrotic yellow vein virus (BNYVV) *(Benyvirus necrobetae)*[c]	BNYVV0	Virus	Yes	*Castanea* spp. EFSA PLH Panel (2020)	No	No	No
3	*Bretziella fagacearum*	CERAFA	Fungi	Not known to occur	EPPO	NA	NA	No
4	*Cronartium quercuum*[c]	CRONQU	Fungi	Yes	*Castanea* spp. UK Dossier, EPPO	No	No	No
5	*Cryphonectria parasitica*	ENDOPA	Fungi	Yes	CABI, EPPO, USDA	Yes	Yes	Yes
6	*Dryocosmus kuriphilus*	DRYCKU	Insect	Yes	CABI, EPPO	Yes	Yes	Yes
7	*Lopholeucaspis japonica*[c]	LOPLJA	Insect	Not known to occur	*Castanea* spp. EFSA PLH Panel (2018a, 2018b)	NA	NA	No
8	*Lycorma delicatula*[c]	LYCMDE	Insect	Not known to occur	*Castanea* spp. CABI	NA	NA	No
9	*Oemona hirta*	OEMOHI	Insect	Not known to occur	EPPO	NA	NA	No
10	*Phymatotrichopsis omnivora*	PHMPOM	Fungi	Not known to occur	EPPO	NA	NA	No
11	*Phytophthora ramorum* non EU isolates	PHYTRA	Fungi	Yes	CABI, EPPO, USDA	Yes	Yes	Yes
12	*Thaumetopoea processionea*[c]	THAUPR	Insect	Yes	*Castanea* spp. CABI EFSA 2009	No	No	No
13	*Xylella fastidiosa*	XYLEFA	Bacteria	Not known to occur	EPPO	NA	NA	No

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

[b]Group names correspond to common names used in Commission Implementing Regulation (EU) 2019/2072.

[c]There is uncertainty about *Castanea sativa* being a host.

4.2 | Other relevant pests associated with the commodity

The information provided by DEFRA, integrated with the search EFSA performed, was evaluated in order to assess whether there are other potentially relevant pests of *Castanea sativa* present in the country of export. For these potential pests that are non-regulated in the EU, pest risk assessment information on the probability of entry, establishment, spread and impact is usually lacking. Therefore, these pests were also evaluated based on the methodology described in Section 2.3.2.

Nine hundred and twenty-three pest species not regulated in the EU are reported to be associated with *Castanea sativa* commodity. Of these, one *Phytophthora kernoviae* was selected for further evaluation. More information on this species can be found in the pest datasheets (Appendix A).

4.3 | List of potential pests not further assessed

The panel identified three species for which there was uncertainty in at least one of the criteria to be selected for further evaluation in this opinion. A specific justification of the inclusion in this list is provided for each species in Table 5.

TABLE 5 List of pests not further assessed due to uncertainties in the inclusion criteria and proposed for further Horizon scanning.

No.	Pest name	EPPO code	Group[a]	Pest present in *the* UK	Present in the EU	*Castanea sativa* confirmed as a host (reference)	Pest can be associated with the commodity	Impact	Justification for inclusion in this list
1	*Calonectria kyotensis*	CALOKY	Fungi	Yes	Restricted	USDA	Uncertain association	No data	Uncertain association and impact
2	*Mycosphaerella castaneicola*		Fungi	Yes	Restricted	USDA	Uncertain association	No data	Uncertain association and impact
3	*Phytophtora castanetoroum*		Oomycete	Uncertain presence	Restricted	USDA		Uncertain impact	Presence in UK is uncertain

[a]Group names correspond to common names used in Commission Implementing Regulation (EU) 2019/2072.

4.4 | Summary of pests selected as relevant for this opinion

The four pests satisfying all the relevant criteria listed above in Sections 4.1 and 4.2 are included in Table 7. The efficacy of the risk mitigation measures applied to the commodity was evaluated for these selected pests.

TABLE 6 List of relevant pests selected for further evaluation.

No.	Current scientific name	EPPO code	Name used in the EU Legislation[b]	Taxonomic information	Group[a]	Regulatory status
1	*Cryphonectria parasitica*	ENDOPA	*Cryphonectria parasitica*	Order: Diaporthales Family: Cryphonectriaceae	Fungi	EU Quarantine Pest according to Commission Implementing Regulation (EU) 2019/2072
2	*Dryocosmus kuriphilus*	DRYCKU	*Dryocosmus kuriphilus*	Order: Hymenoptera Family: Cynipidae	Insect	EU Protected Zone Quarantine Pest according to Commission Implementing Regulation (EU) 2019/2072
3	*Phytophthora kernoviae*	PHYTKE	–	Order: Peronosporales Family: Peronosporaceae	Oomycete	Pests not regulated in the EU
4	*Phytophthora ramorum*	PHYTRA	*Phytophthora ramorum* non EU isolates	Order: Peronosporales Family: Peronosporaceae	Oomycete	EU Protected Zone Quarantine Pest according to Commission Implementing Regulation (EU) 2019/2072

[a]Group names correspond to common names used in Commission Implementing Regulation (EU) 2019/2072.
[b]Commission Implementing Regulation (EU) 2019/2072.

5 | RISK MITIGATION MEASURES

For each selected pest (Table 6), the panel assessed the possibility that it could be present in *Castanea sativa* nursery 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 a pest data sheet (Appendix A).

5.1 | Risk mitigation measures applied in applicant country

With the information provided by DEFRA, the Panel summarised the risk mitigation measures (Table 7) that are implemented in the production nurseries.

TABLE 7 Overview of implemented risk mitigation measures for *Castanea sativa* plants designated for export to the EU from the United Kingdom.

Risk mitigation measure	Implementation in the United Kingdom
Registration of production sites	All nurseries are registered as professional operators with the UK NPPO, either by the Animal and Plant Health Agency (APHA) in England and Wales, or by the Scottish Government, and are authorised to issue UK plant passports.
Certification of propagation material	Seeds purchased in the UK are certified under The Forest Reproductive Material (Great Britain) Regulations 2002 (legislation.gov.uk); seedlings sourced in the UK are certified with UK Plant Passports; seedlings from EU countries (mostly Netherlands, Belgium and France) are certified with phytosanitary certificates. The EU is the only source of plants obtained from abroad.
Surveillance, monitoring and sampling	Crops are inspected visually on a regular basis by competent nursery staff as part of the growing process. All plants are also carefully inspected by nurseries on arrival and dispatch for any plant health issues. The UK carries out surveys for regulated quarantine pests. UK surveillance is based on visual inspection with samples taken from symptomatic material. Currently, no asymptomatic sampling regime is conducted by inspectors for *Castanea sativa*. However, inspectors are equipped with field LFD (Lateral Flow Device) kits to screen for *Phytophthora ramorum*.

TABLE 7 (Continued)

Risk mitigation measure	Implementation in the United Kingdom
Application of phytosanitary products (pesticides) and biocontrol	Chemical treatments are only applied when required and depend on the situation at that time (disease pressure, growth stage, etc., and environmental factors). Over the past 5 years, growers have implemented the following phytosanitary treatments upon detection of the specified pest. For *Phytophthora* spp., Subdue (metalaxyl-M), Previcur Energy (propamocarb hydrochloride and fosetyl-Al), Paraat (dimethomorph) and HortiPhyte (potassium phosphite) were applied as needed from April to June, depending on disease pressure and environmental conditions. Against leaf miner infestations, insecticidal treatments used include Dynamec (abamectin), Hallmark WZT (lambda-cyhalothrin) and paraffin-based spraying oil. Dynamec was applied monthly during the active periods from March to May and July to September. Spraying oil was used in February and November, while Hallmark WZT was applied in February, June and August. For bacterial infections, growers utilised Amylo-X (*Bacillus amyloliquefaciens*), applications were carried out as needed, with monthly treatments from April to September.
Dissemination of warning notices to farmers	Pest and disease training and information is provided by the Competent Authority to professional operators to assist with identification of pests. Some professional operators are also qualified Plant Health Professionals with the Royal Society of Biology (RSB).
Other Risk Mitigation Measures can be added	There are no specific measures/treatments against soil pests. However, growing media are treated (heat treated) before planting and containerised plants are grown in trays on top of protective plastic membranes to prevent contact with the soil. Membranes are regularly refreshed when needed. Alternatively, plants may be grown on raised galvanised steel benches stood on gravel as a barrier between the soil and the bench feet, and/or on concreted surfaces.
Root washing	Bare root plants and whips have their roots washed free of soil using a low-pressure washer before export. For rooted plants in pots, the roots are also washed to remove soil before they are potted in EU-compliant growing media.
Cleaning and disinfection of facilities, tools and machinery	General hygiene measures are undertaken as part of routine nursery production, including disinfection of tools and equipment between batches/lots.
Rouging and pruning	Leaves, prunings and weeds are all removed from the nursery to reduce the number of overwintering sites for pests and diseases.
Inspection and management of plants before export	Separate to any official inspection, plant material is checked by growers for plant health issues prior to dispatch.

5.2 | Evaluation of the risk mitigation measures for the selected pests not regulated in EU

For pests not regulated in the EU, 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, is 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 (*Cryphonectria parasitica, Dryocosmus kuriphilus, Phytophthora kernoviae, Phytophthora ramorum*) is summarised in the sections below (Sections 5.2 and 5.3). For more details on the pest for which EKE was performed, see the pest datasheets in Appendix A.

5.2.1 | Overview of the evaluation of *Phytophthora kernoviae*

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 for graftwood and whips	***9981*** out of 10,000 plants	***9985*** out of 10,000 plants	***9990*** out of 10,000 plants	***9995*** out of 10,000 plants	***99,999*** out of 10,000 plants
Percentile of the distribution	5%	25%	Median	75%	95%
Proportion of pest-free plants for bare root plants and potted plants	***9962*** out of 10,000 plants	***9970*** out of 10,000 plants	***9980*** out of 10,000 plants	***9990*** out of 10,000 plants	***9998*** out of 10,000 plants

(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 *Castanea sativa*. 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 cause bark and leaf infections on the commodity. **Applied pest mitigation measures that have an effect on the pest** *Phytophthora kernoviae* is a provisional quarantine pest in the UK and under official control. General measures taken by the nurseries are effective against the pathogen. **Evaluation of control measures** These measures include (a) the use of certified plant material and growing media; (b) inspections, surveillance, monitoring, sampling and laboratory testing; and (c) application of pest control products **Main uncertainties** Whether symptoms may be promptly detected. The presence/abundance of the pathogen in the area where the nurseries are located. Effect of fungicide treatments against the pathogen.

5.2.2 | Overview of the evaluation of *Cryphonectria parasitica*

Reasonings that the pest can be associated with the commodity

Castanea sativa is reported to be a major host of *Cryphonectria parasitica* (Lovat & Donnelly, 2019; Rigling & Prospero, 2018). According to EPPO (2024), *C. parasitica* surveys detected the disease at different sites in Berkshire, Derbyshire, Devon, Dorset and London, Buckinghamshire, Cornwall, Derbyshire, Devon, London, West Sussex and Jersey. It has been observed that chestnut galls provoked by the chestnut gall wasp *Dryocosmus kuriphilus* can be colonised by virulent strains of *C. parasitica* (Meyer et al., 2015) causing future cankers from the growth of mycelia into the host tissue (Lovat & Donnelly, 2019).

5.2.3 | Overview of the evaluation of *Dryocosmus kuriphilus*

Reasonings that the pest can be associated with the commodity

According to Brussino et al. (2002), *Castanea sativa* is a major host of *Dryocosmus kuriphilus*. Dryocosmus *D. kuriphilus* was first reported in the United Kingdom in 2015 in Kent (Herefordshire) and subsequently reported on sweet chestnut in 2018 and 2019 (Malumphy, C. 2015, Pérez-Sierra et al., 2020). *Dryocosmus kuriphilus* is considered as one of the most important pests of *Castanea* spp. and causes galls which can be colonised by virulent strains of *C. parasitica* (Meyer et al., 2015; Pérez-Sierra et al., 2020).

5.2.4 | Overview of the evaluation of *Phytophthora ramorum*

Reasonings that the pest can be associated with the commodity

It has been reported by Brasier et al. (2004) that *Castanea sativa* is a host of *Phytophthora ramorum*. According to EPPO (2024), current pest situation in the UK is present, restricted distribution. Brasier and Webber (2012) reports *P. ramorum* in Somerset on Lawson cypress (*Chamaecyparis lawsoniana*). In UK, symptoms such as leaf blackening and water soaking on *C. sativa* caused by *P. ramorum* have been reported (Hansen et al., 2005).

5.3 | Outcome of the assessment of selected pests and Expert Knowledge Elicitation

Table 8 and Figure 3 summarise the outcome of the EKE regarding pest freedom after the evaluation of the implemented risk mitigation measures for all the evaluated pests.

Figure 4 provides an explanation of the descending distribution function describing the likelihood of pest freedom after the evaluation of the implemented risk mitigation measures for *Castanea sativa plants* designated for export to the EU for *Phytophthora kernoviae*.

TABLE 8 Relevant quarantine pests (*Cryphonectria parasitica, Dryocosmus kuriphilus, Phytophthora ramorum)* and assessment of the likelihood of pest freedom following evaluation of current risk mitigation measures against *Phytophthora kernoviae* on *Castanea sativa* 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.

No.	Group	Pest species	Lower	Medium	Upper	Sometimes pest free	More often than not pest free	Frequently pest free	Very frequently pest free	Extremely frequently pest free	Pest free with some exceptional cases	Pest free with few exceptional cases	Almost always pest free
1	Fungi	*Cryphonectria parasitica*	*Pest freedom level not assessed with EKE*										
2	Insect	*Dryocosmus kuriphilus*	*Pest freedom level not assessed with EKE*										
3	Oomycete	*Phytophthora ramorum*	*Pest freedom level not assessed with EKE*										
5	Oomycete	*Phytophthora kernoviae – Graftwood and whips*	**9980**	**9990**	**10,000**						**LM**		**U**
6	Oomycete	*Phytophthora kernoviae – Bare root and potted plants*	**9960**	**9980**	**9999**						**LM**		**U**

PANEL A

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

PANEL B

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

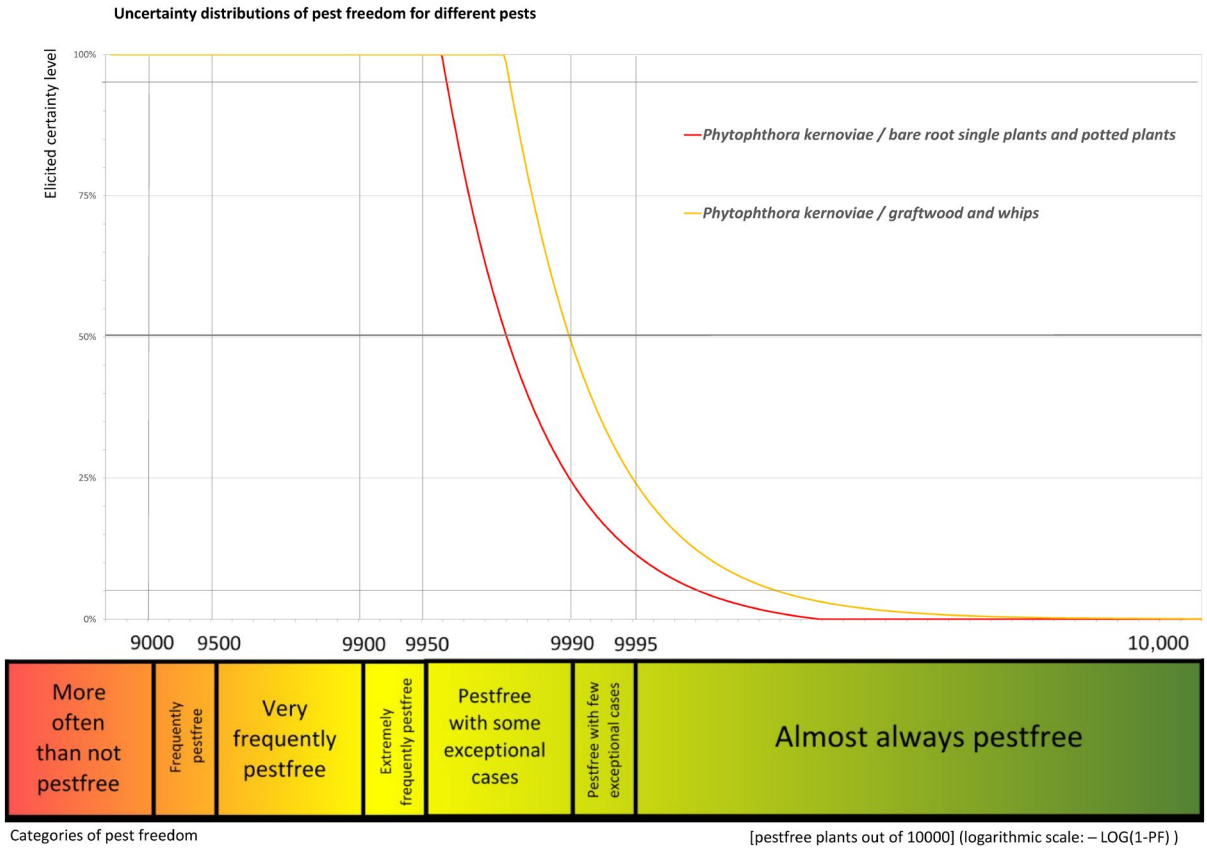


FIGURE 3 Elicited certainty (*y*-axis) of the number of pest-free graftwood, whips, bare root and potted plants of *Castanea sativa* (*x*-axis; log-scaled) out of 10,000 plants designated for export to the EU from the UK for all evaluated pests visualised as a descending distribution function. Horizontal lines indicate the percentiles (starting from the bottom 5%, 25%, 50%, 75%, 95%). The Panel is 95% confident that 9960 (bare root or potted single plants) and 9980 (graftwood and whips) per 10,000 will be free from *Phytophthora kernoviae*.

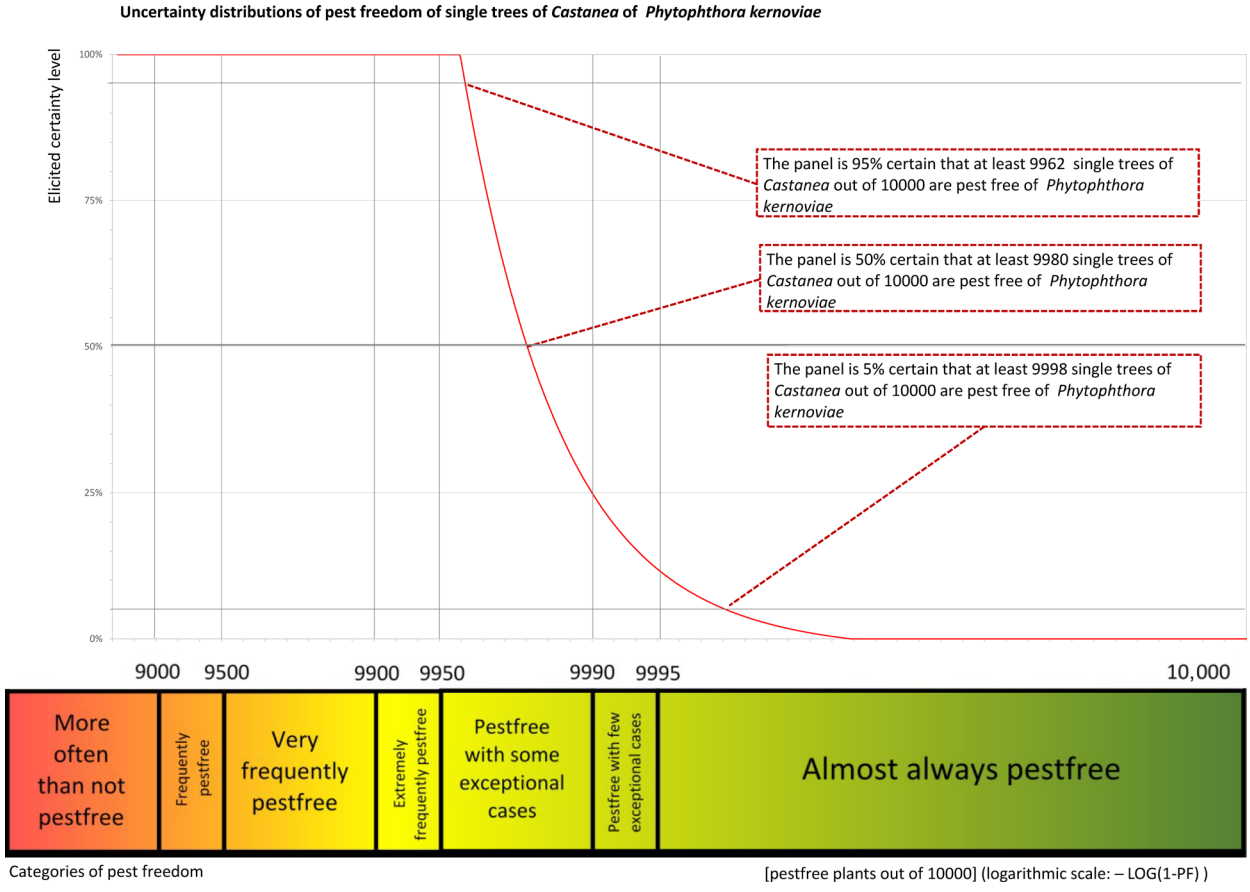


FIGURE 4 Explanation of the descending distribution function describing the likelihood of pest freedom after the evaluation of the implemented risk mitigation measures for plants designated for export to the EU based on the example of *Phytophthora kernoviae*.

6 | CONCLUSIONS

There were four pests identified to be present in the UK and considered to be potentially associated with graftwood, bare root plants, potted plants of *C. sativa* imported from the UK and relevant for the EU. These pests are *Cryphonectria parasitica, Dryocosmus kuriphilus, Phytophthora ramorum* and *Phytophthora kernoviae*. For the pest not regulated in the EU, the likelihood of pest freedom after the evaluation of the implemented risk mitigation measures for *C. sativa* graftwood, bare root plants and potted plants designated for export to the EU was estimated and summarised in Table 8.

For *Phytophthora kernoviae*, on imported bundles of graftwood and whips, the likelihood of pest freedom 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 9080 and 10,000 bundles per 10,000 will be free from *P. kernoviae* (Table 8).

For *Phytophthora kernoviae*, on imported bare root plants and potted plants, the likelihood of pest freedom 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 9060 and 10,000 plants per 10,000 will be free from *P. kernoviae* (Table 8).

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 allow 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

CABI	Centre for Agriculture and Bioscience International
EKE	Expert Knowledge Elicitation
EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization
ISPM	International Standards for Phytosanitary Measures
NPPO	National Plant Protection Organisation
PLH	Plant Health
PRA	Pest Risk Assessment
RNQPs	Regulated Non-Quarantine Pests

REQUESTOR

European Commission

QUESTION NUMBER

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SUPPORTING INFORMATION

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APPENDIX A

Data sheets of pests selected for further evaluation

A.1 | *PHYTOPHTORA KERNOVIAE*

A.1.1 | Organism information

Taxonomic information	Current valid scientific name: *Phytophthora kernoviae* Brasier, Beales & S.A. Kirk EPPO code: PHYTKE Name used in the EU legislation: – Synonyms: Group: *Oomycetes* Order: Peronosporales Family: Peronosporales Common name: – Name used in the Dossier: *Phytophthora kernoviae*
Regulated status	*Phytophthora kernoviae* is not regulated in the EU. The pathogen is included in the EPPO A2 list (EPPO, online_a). *Phytophthora kernoviae* is a quarantine pest in Morocco. It is on A1 list of Chile, Egypt, Kazakhstan, and EAEU (=Eurasian Economic Union: Armenia, Belarus, Kazakhstan, Kyrgyzstan and Russia) and on A2 list of the United Kingdom (EPPO, online_b). There are import requirements in place for *P. kernoviae* on *Quercus* spp. from the UK (Commission Implementing Regulation (EU) 2023/27437).
Pest status in the UK	*Phytophthora kernoviae* has been reported on *C. sativa*, and on other hosts in England, Scotland and Wales (Farr & Rossman, online; EPPO, online_c; Brasier et al., 2005; Elliot et al., 2013; Webber, 2008). From 2003 to 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, *P. kernoviae* is present in the UK but not widely distributed. In the UK, it is listed as a provisional quarantine pest and 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 *Castanea sativa*	*Castanea sativa* is a host of *Phytophthora kernoviae* (EPPO, 2024, CABI, 2024)) and other species within the Fagaceae family such as *Fagus sylvatica* are listed as major host (Brasier et al., 2005, CABI, 2024)
PRA information/CRA 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). – Commodity risk assessment of *Berberis thunbergii* from the UK (EFSA PLH Panel, 2025)
Other relevant information for the assessment	
Biology	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 & 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 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 two 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).

(Continued)

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. For *Castanea sativa*, only leaf symptoms late in the season have been observed in the UK (EPPO Bulletin, 2013). 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 (Beales et al., 2006; Brasier et al., 2005). 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). There is limited information about symptoms in *C. sativa*, and only foliar symptoms have been reported late in the season in the UK (EPPO Bulletin, 2013).
	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 pathogenfree (DEFRA, 2008).
	Confusion with other pests	*Phytophthora kernoviae* can be 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), but symptoms are similar to those caused by *P. ramorum* (EPPO Bulletin, 2013).
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., *Blechnum novae-zelandiae, 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. × brooklynensis, M. × 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; O'Hanlon et al., 2016; EPPO, online_e; Farr & Rossman, online,). Experimental hosts are *R. macrophyllum, R. occidentale* and *Umbellularia californica* (EPPO, online_e; Fichtner et al., 2012). 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).
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 or needle blight of *Pinus radiata* (McDougal & Ganley, 2021). However, it has rarely been associated with plant disease (Scott & 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.
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. It has not been recorded in Northern Ireland (EPPO, 2024). 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 according to the dossier.

A.1.2 | Possibility of pest presence in the nursery

A.1.2.1 | Possibility of entry from the surrounding environment

Phytophthora kernoviae is present in the UK; it has been found in England, Scotland and Wales (Farr & Rossman, online; EPPO, online_c; Brasier et al., 2005; Elliot et al., 2013; Webber, 2008). The possible entry of *P. kernoviae* from the 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 a wide host range and can infect different plants. According to the dossier, 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 (EPPO,online_e).

Uncertainties:

- The degree to which the pathogen can reproduce on *C. sativa*
- The dispersal range of *P. kernoviae* sporangia.
- The distance of the nurseries to sources of pathogens 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 the 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.1.2.2 | Possibility of entry with new plants/seeds

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

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 *C. sativa*.

A.1.2.3 | Possibility of spread within the nursery

Castanie sativa plants are either grown in containers (cells, pots, tubes, etc.) outdoors/in the open air or in the field. According to the dossier, one of the exporting nurseries has mother plants of *C. sativa*. There are no other mother plants of any species present in that particular nursery. The pathogen can infect other plants present within the nurseries, such as *Fagus* spp. [(*F. sylvatica* is a 'Major host', according to EPPO (2024)], *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* (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:

- Host species present in the nurseries and their phytosanitary status.

Taking into consideration the above evidence and uncertainties, the panel considers that it is likely for the pathogen to spread within the nurseries.

A.1.3. | Information from interceptions

In the EUROPHYT; TRACES- NT database, there are no records of notification of *C. sativa* plants for planting neither from the UK nor from other countries due to the presence of *P. kernoviae* between the years 1995 and October 2025 (EUROPHYT; TRACES-NT, 2024).

A.1.4 | Evaluation of the risk mitigation options

In the table below, all risk mitigation measures implemented in the UK are listed and an indication of their effectiveness on *Phytophthora kernoviae* is provided. The description of the implemented risk mitigation measures is provided in Table 7.

Risk mitigation measure	Evaluation and uncertainties
Registration of production sites	All production sites are registered as professional operators with the UK NPPO. The competent authority inspects crops at least once a year. Uncertainty: - None
Certification of propagation material	Seeds and seedlings are certified with phytosanitary certifications Uncertainty: Unclear if a specific test is conducted for *P. kernoviae*.

(Continued)

Risk mitigation measure	Evaluation and uncertainties
Sanitation and inspection	General hygiene measures are undertaken including disinfection of tools and equipment. Leaves, prunings and weeds are removed to reduce overwintering sites for pests and diseases. Uncertainty: Asymptomatic infections may be overlooked.
Surveillance, monitoring and sampling	Visual inspections of infected foliage and tree stems. It should be noted that *P. kernoviae* has also been isolated from asymptomatic plants and roots. Uncertainty: Asymptomatic infections may be overlooked.
Application of phytosanitary products (pesticides)	Application of chemical products have been applied against *Phytophtora* spp. in nurseries (Subdue (metalaxyl-M), Previcur Energy (propamocarb and fosetyl), Paraat (dimethomorph), HortiPhyte (Potassium Phosphite)). Some fungicides may mask symptoms but allow the pathogen to survive. Uncertainty: The efficiency of chemical treatments to eradicate *P. kernoviae* is unclear.
Dissemination of warning notices to farmers	Pest and disease training is provided to professional operators. Uncertainty: Quality of implementation is uncertain.
Sorting and storage	For potted plants, leaf symptoms could be identified. Uncertainties: Infection efficiency of *P. kernoviae* under storage is uncertain.
Irrigation and water quality	Growers are required to assess water sources, irrigation and drainage systems for the potential to harbour and transmit plant pests. Water used for irrigation can be drawn from main supply, boreholes or rainwater collection. Rainwater is passed through a sand filtration system and contained in storage tanks prior to use. Uncertainties: – The efficiency of assessment of water sources for contamination of *P. kernoviae*. – The efficiency of sand filtration for removal of *P. kernoviae*.
Washing of the roots (bare root plants)	Trees lifted from the field will be root washed Uncertainty: The efficiency of washing for removal of potential *P. kernoviae* root infections or contaminated soil.
Rouging and pruning	Bare-rooted plants and rooted plants in pots will be pruned as required. Uncertainty: Asymptomatic infections may be overlooked.
Inspection and management of plants before export)	A final pre-export inspection is undertaken as part of issuing phytosanitary certificate, usually within 1–2 days and not more than 2 weeks before export. Uncertainty: Symptomatic infections may be overlooked.
Other risk mitigation measures	Containerised plants are grown in trays on top of protective plastic membranes or on raised steel benches placed on gravel or concreted surfaces.

A.1.5 | Overall likelihood of pest freedom

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

Young material up to 2-year-old is less likely to get infected.
Inspections and surveys are conducted for *Phytophthora* diseases.

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

Pathogen is present in the UK and has a broad host range.
Latent and undetected infections are overlooked.
Presence of leaves on the commodity.

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

The pathogen is a provisional quarantine pest in the UK and under official control.

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

The pest pressure from the surroundings is expected to be low, giving less uncertainties for rates above the median.

A.1.5.5 | Elicitation outcomes of the assessment of the pest freedom for *Phytophthora kernoviae*

The following tables show the elicited and fitted values for pest infestation/infection (Tables A.1 and A.3) and pest freedom (Tables A.2 and A.4).

TABLE A.1 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					5		10		15					20
EKE	0.212	0.521	1.03	2.03	3.37	5.02	6.66	10.0	13.3	15.0	16.7	18.1	19.2	19.7	20.1

Note: The EKE results are *BetaGeneral (1.019, 1.0443, 0, 20.3)* fitted with @Risk version *number of the version*.

Based on the numbers of estimated infested graftwood and whips, the pest freedom was calculated (i.e. = 10,000 – the number of infested graftwood and whips 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 *Phytophthora kernoviae* per 10,000 graftwood and whips calculated in Table A.1.

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9980					9985		9990		9995					10,000
EKE results	9980	9980	9981	9982	9983	9985	9987	9990	9993	9995	9997	9998	9999.0	9999.5	9999.8

Note: The EKE results are the fitted values.

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

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Elicited values	1					10		20		30					40
EKE	0.99	1.52	2.43	4.28	6.82	10.0	13.2	19.8	26.5	29.9	33.3	36.1	38.2	39.2	39.9

Note: The EKE results is *BetaGeneral (0.96955, 1.0166, 0.653, 40.5)* fitted with @Risk version *number of the version*.

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

TABLE A.4 The uncertainty distribution of single bare root plants and potted plants free of *Phytophthora kernoviae* per 10,000 plants calculated in Table A.3.

Percentile	1%	2.5%	5%	10%	17%	25%	33%	50%	67%	75%	83%	90%	95%	97.5%	99%
Values	9960					9970		9980		9990					9999
EKE results	9960	9961	9962	9964	9967	9970	9973	9980	9987	9990	9993	9996	9998	9998	9999

Note: The EKE results are the fitted values.

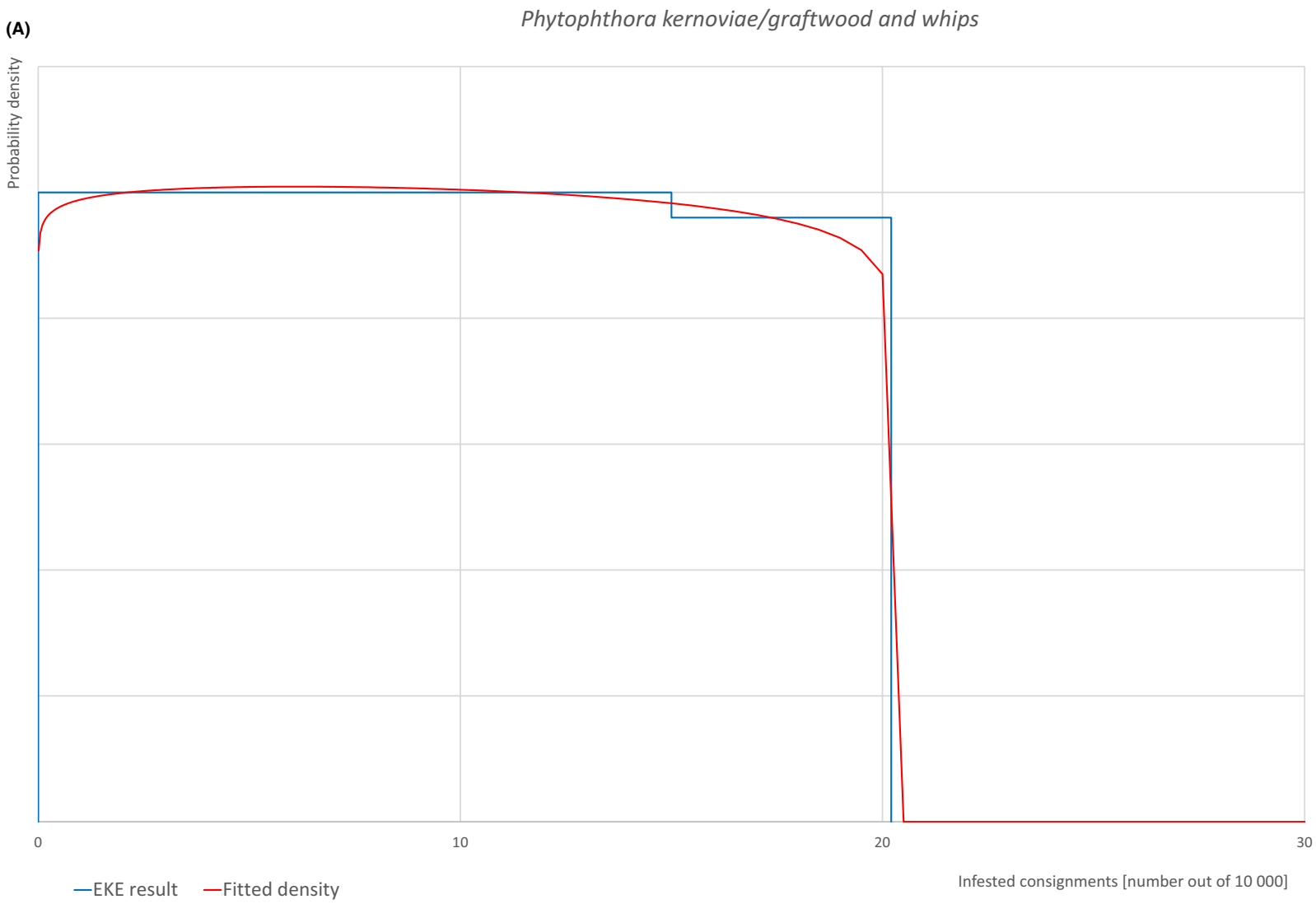

FIGURE A.1 (Continued)

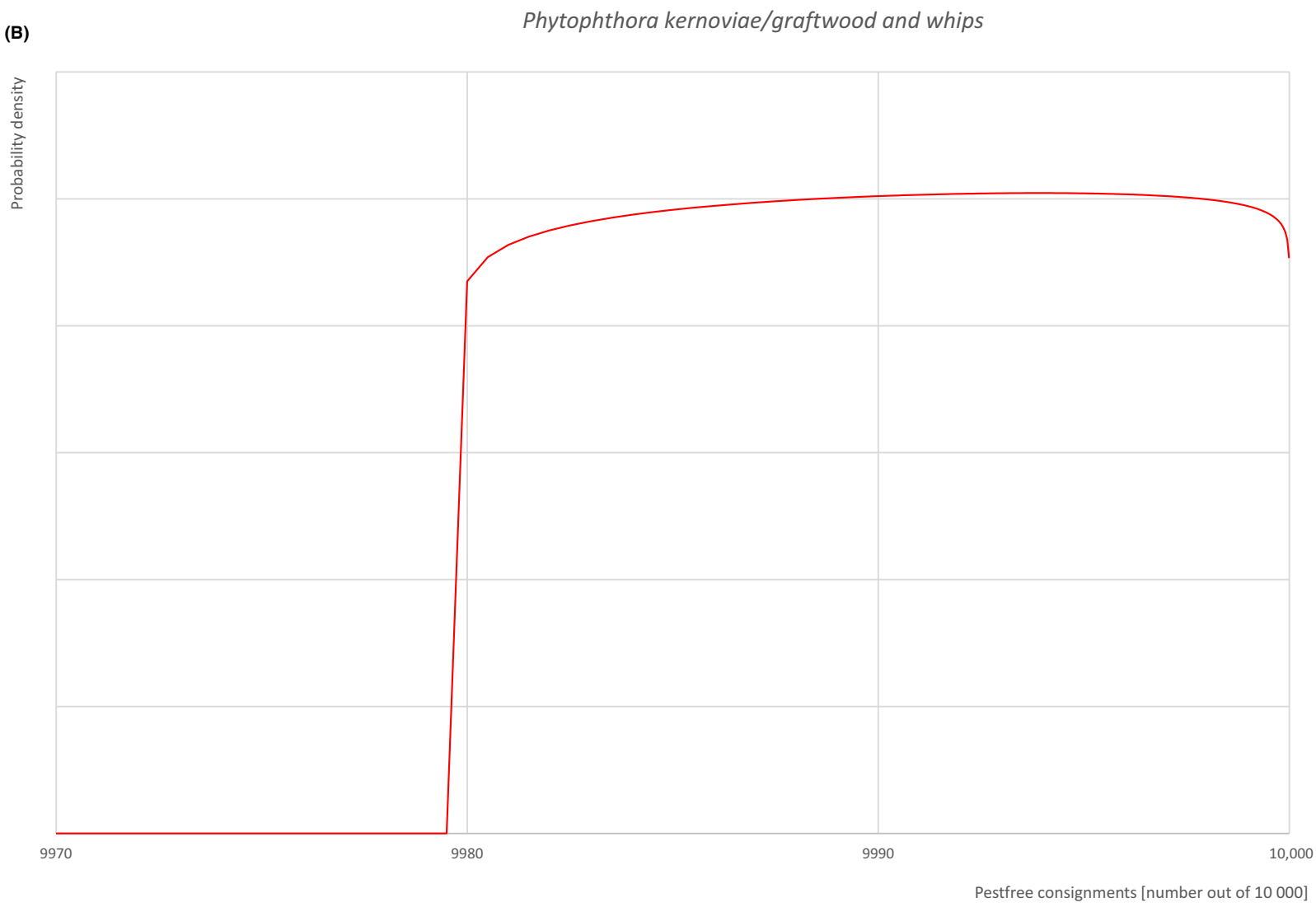

FIGURE A.1 (Continued)

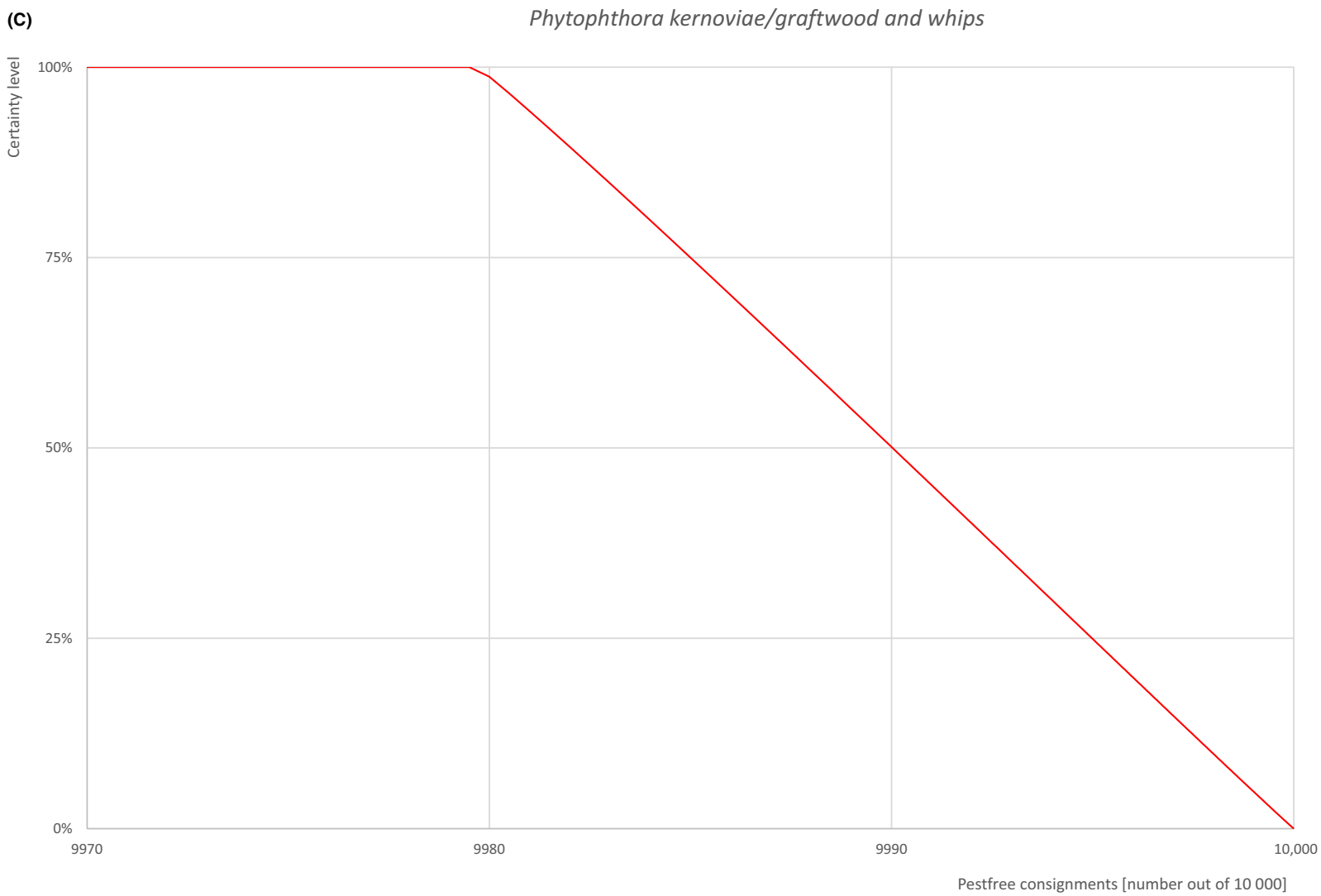

FIGURE A.1 (A) Elicited uncertainty of pest infestation per 10,000 plants (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (B) uncertainty of the proportion of pest-free plants per 10,000 (i.e. =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

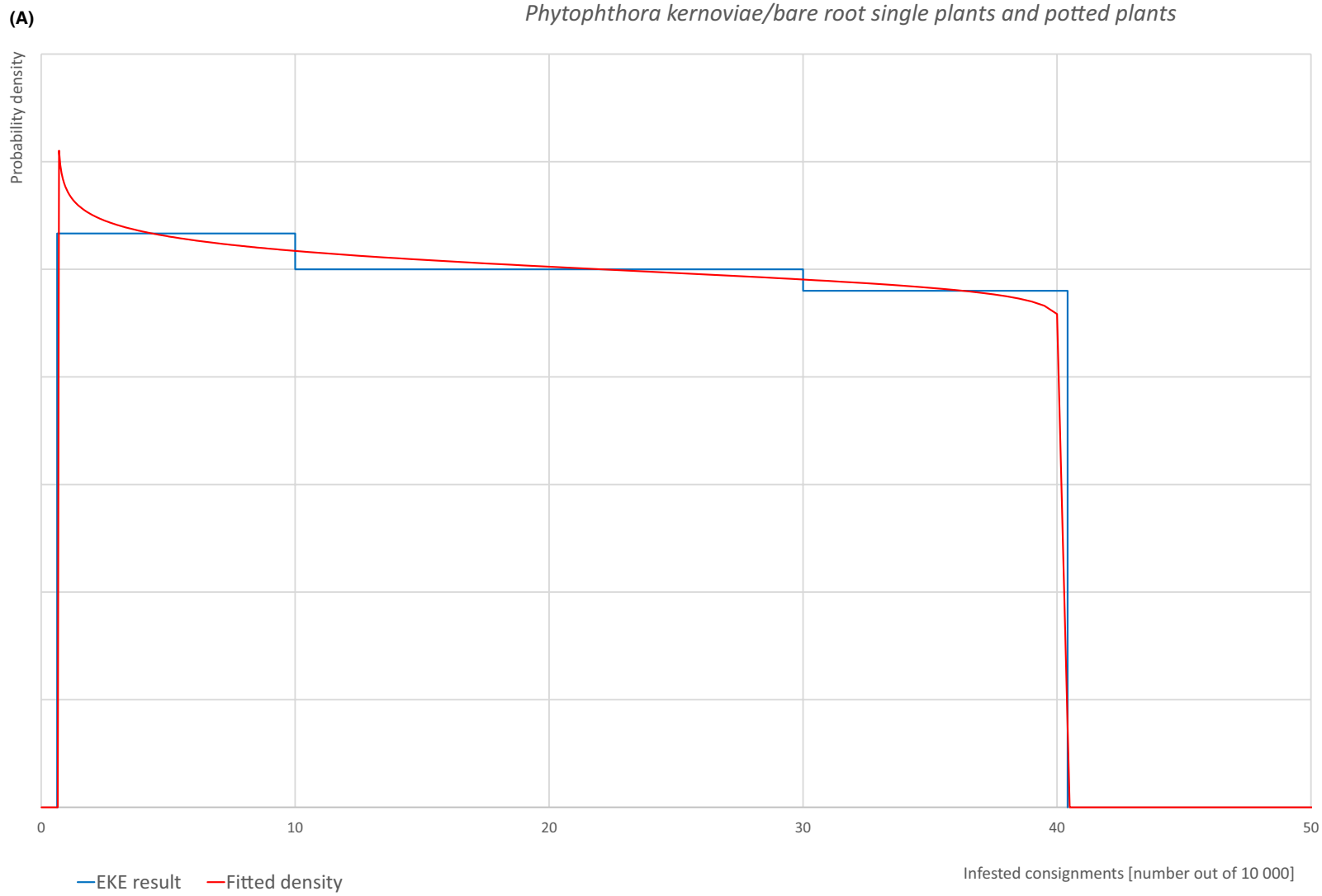

FIGURE A.2 (Continued)

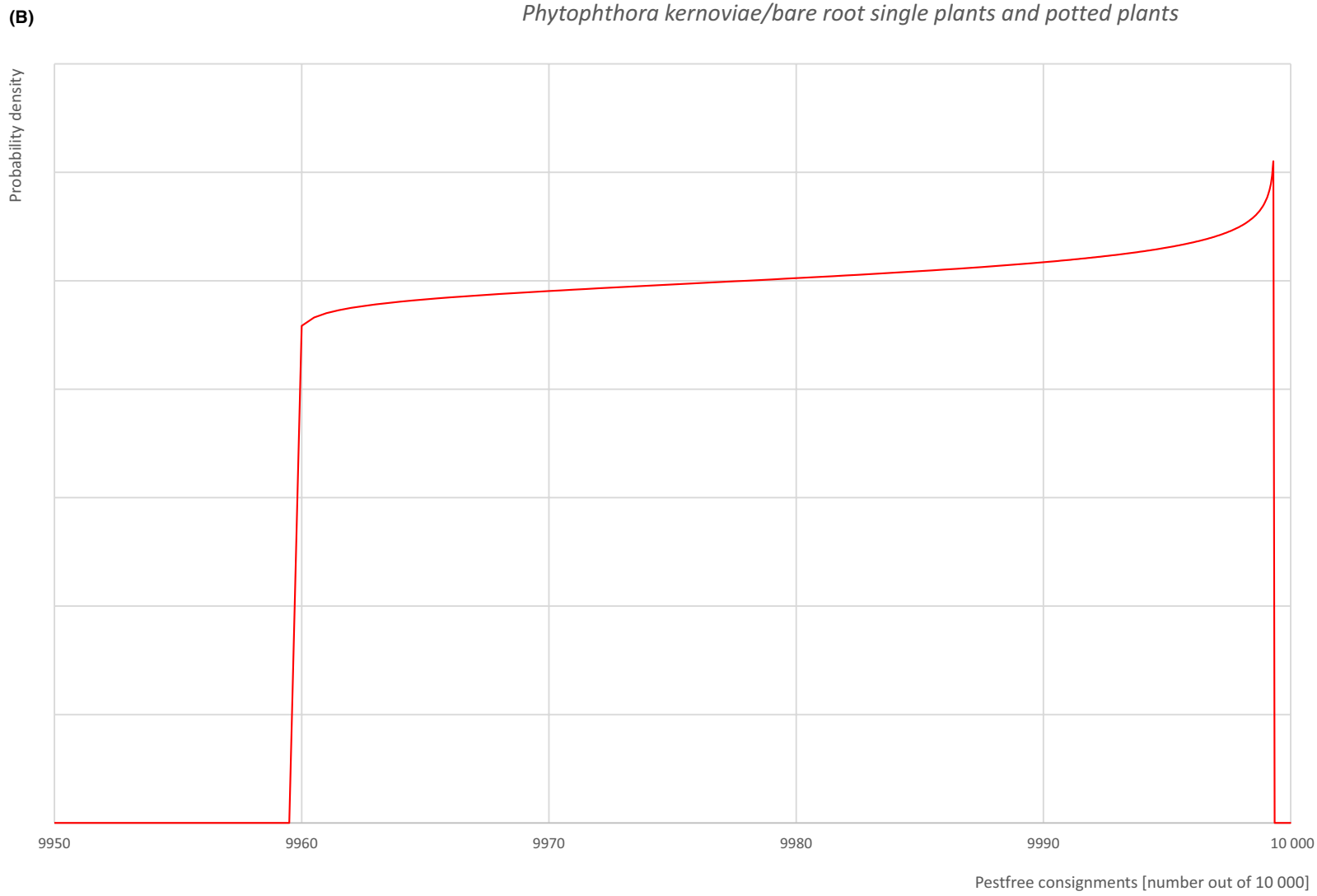

FIGURE A.2 (Continued)

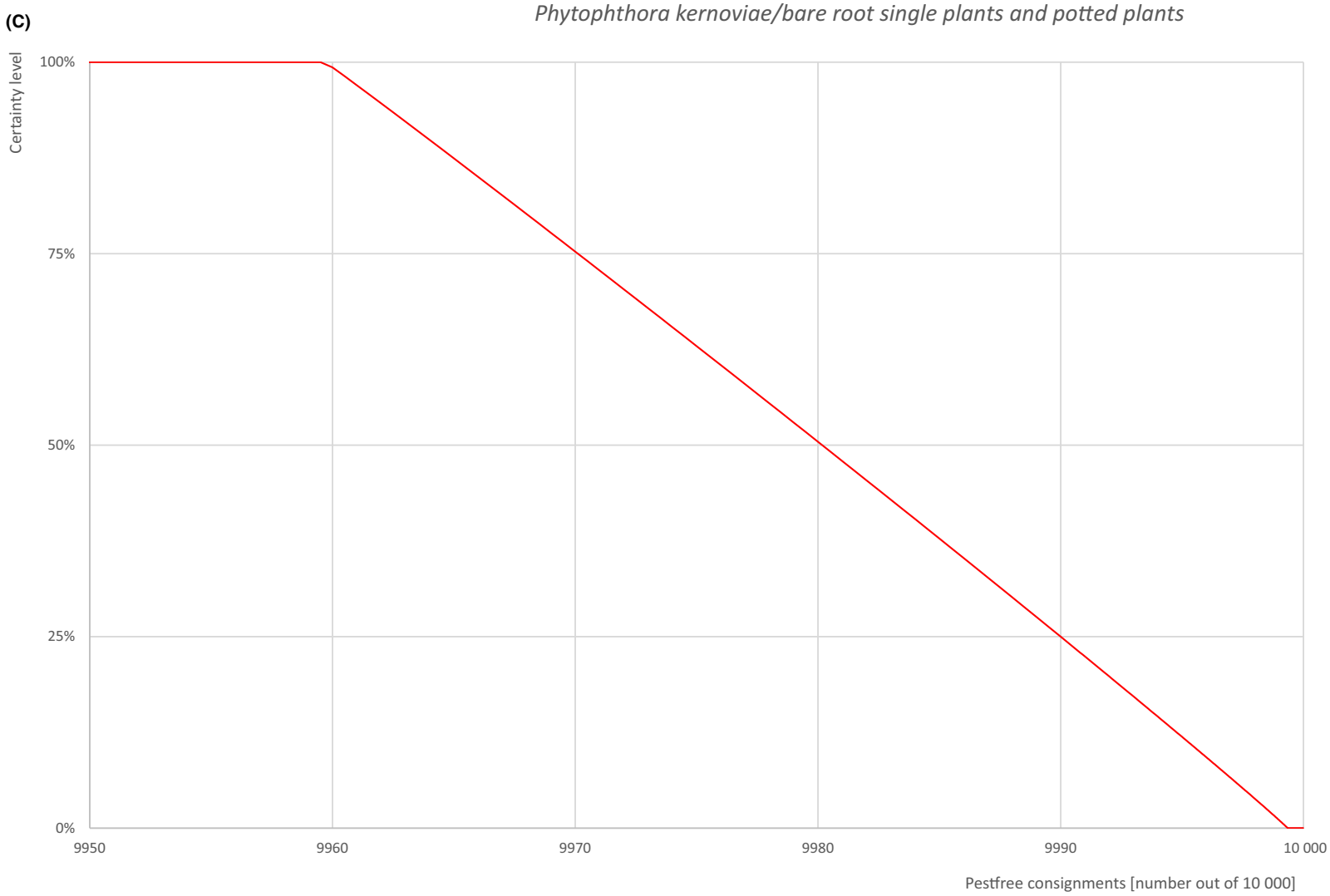

FIGURE A.2 (A) Elicited uncertainty of pest infestation per 10,000 plants (histogram in blue–vertical blue line indicates the elicited percentile in the following order: 1%, 25%, 50%, 75%, 99%) and distributional fit (red line); (B) uncertainty of the proportion of pest-free plants per 10,000 (i.e. =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

APPENDIX B

Databases Search String

In the table below, the search string used in the Web of Science All Databases is reported. In total, 428 papers were retrieved up to the date of the last research. Titles and abstracts were screened, and 235 pests were added to the list of pests (Supporting information).

Web of Science All databases	*TOPIC: ("Castanea sativa" OR "Spanish chestnut" OR "sweet chestnut")* *AND* *TOPIC: ("pathogen*" OR "fung*" OR "oomycet*" OR "myce*" OR "disease$" OR "infecti*" OR "damag*" OR "symptom*" OR "pest$" OR "vector" OR "host plant$" OR "host-plant$" OR "host" OR "root lesion$" OR "decline$" OR "infestation$" OR "damage$" OR "dieback*" OR "die back*" OR "die-back*" OR "blight$" OR "canker" OR "scab$" OR "rot" OR "rots" OR "rotten" OR "damping-off" OR "smut" OR "mould" OR "mold" OR nematod* OR "root knot" OR "root-knot" OR root tip OR cyst$ OR "dagger" OR "plant parasitic" OR "root feeding" OR "root$ feeding" OR "plant$parasitic" OR "root lesion$" OR "damage$" OR "infestation$" OR "symptom*" OR "pest$" OR "pathogenic bacteria" OR "mycoplasma*" OR "bacteri*" OR "phytoplasma*" OR "wilt$" OR "wilted" OR "canker" OR "witch*" OR "yellowing" OR "leafroll" OR "bacterial gall" OR "crown gall" OR "spot" OR "blast" OR "pathogen*" OR "virus*" OR "viroid*" OR "disease$" OR "infecti*" OR "damag*" OR "symptom*" OR "pest$" OR "decline$" OR "infestation$" OR "damage$" OR "virosis" OR "canker" OR "blister$" OR "mosaic" OR "leaf curl" OR "latent" OR "insect$" OR "mite$" 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 "caterpillar$" OR "foliar feeder$" OR "root feeder$")* *NOT* *TOPIC: ("heavy metal$" OR "pollut*" OR "weather" OR "propert*" OR probes OR "spectr*" OR "antioxidant$" OR "transformation" OR "RNA" OR "peel" OR "resistance" OR gene OR "DNA" OR "Secondary plant metabolite$" OR "metabolite$" OR "Catechin" OR "Epicatechin" OR "Rutin" OR "Phloridzin" OR "Chlorogenic acid" OR "Caffeic acid" OR "Phenolic compounds" OR "Quality" OR "Appearance" OR "Postharvest" OR "Antibacterial" OR "Abiotic" OR "Storage" OR "Pollin* "OR "Ethylene" OR "Thinning" OR "fertil*" OR "Mulching" OR "Nutrient$" OR "Pruning" OR "human virus" OR "animal disease$" OR "plant extracts" OR "immunological" OR "purified fraction" OR "traditional medicine" OR "medicine" OR "mammal$" OR "bird$" OR "human disease$" OR "esca" OR "black measles" OR "grape leaf disease" OR "Phylloxera" OR "downy mildew" OR "powdery mildew" OR "grey mould" OR "eutypa dieback" OR "botryosphaeria dieback" OR "excoriosis")* *NOT* *TOPIC: ("Acanthococcus roboris" OR "Acanthococcus rosannae" OR "Acronicta americana" OR "Acronicta lithospila" OR "Acrospeira mirabilis" OR "Actias luna" OR "Actinopelte dryina" OR "Adoxophyes privatana" OR "Agrilus angustulus" OR "Agrilus biguttatus" OR "Agrilus bilineatus" OR "Agrilus laticornis" OR "Agrilus pannonicus" OR "Agrotera nemoralis" OR "Alebra albostriella" OR "Alebra wahlbergi" OR "Amanita muscaria" OR "Amaurodon mustialaensis" OR "Amaurodon viridis" OR "Amorpha juglandis" OR "Amphiporthe castanea" OR "Anavirga laxa "OR "Ancylis burgessiana" OR "Anisota finlaysoni" OR "Anisota peigleri" OR "Anisota senatoria" OR "Anisota stigma" OR "Anisota virginiensis" OR "Anoplophora chinensis" OR "Antheraea polyphemus" OR "Antheraea proylei" OR "Antheraea × proylei" OR "Aphis gossypii" OR "Aphrophora alni" OR "Apiognomonia errabunda" OR "Apocheima hispidaria" OR "Aradus aterrimus Fieber" OR "Archips fuscocupreanus" OR "Argyresthia castaneella" OR "Armillaria gallica" OR "Armillaria mellea" OR "Armillaria ostoyae" OR "Arthonia tenellula" OR "Aspergillus niger" OR "Asterobemisia avellanae" OR "Asteromella maculiformis" OR "Asteromella quercifolii" OR "Attelabus nitens" OR "Aulacorthum solani" OR "Beauveria bassiana" OR "Biscogniauxia mediterranea" OR "Biston betularia" OR "Botryosphaeria dothidea" OR "Bretziella fagacearum" OR "Bucculatrix demaryella" OR "Cadra figulilella" OR "Calonectria colhounii" OR "Calonectria kyotensis" OR "Calosphaeria wahlenbergii" OR "Calycina cortegadensis" OR "Cameraria castaneaeella" OR "Campaea margaritata" OR "Candelabrum spinulosum" OR "Capronia kleinmondensis" OR "Carcina quercana" OR "Cercospora castaneae" OR "Chionaspis salicis" OR "Chondrostereum purpureum" OR "Choristoneura longicellana" OR "Ciboria candolleana" OR "Cladosporium aggregatocicatricatum" OR "Cladosporium astroideum var. astroideum" OR "Cladosporium fumago" OR "Coccomyces dentatus" OR "Coccus hesperidum hesperidum" OR "Codinaea fertilis" OR "Codinaea matsushimae" OR "Coleophora anatipennella" OR "Coleophora leucochrysella" OR "Coleophora lutipennella" OR "Coleophora violacaea" OR "Coleophora violacea" OR "Colletotrichum acutatum" OR "Collophora hispanica" OR "Comstockaspis perniciosa" OR "Coniella castaneicola" OR "Coniophora arida" OR "Coniophora puteana" OR "Conogethes punctiferalis" OR "Coriolus versicolor" OR "Corizus hyoscyami" OR "Coryneum castaneicola" OR "Coryneum modonium" OR "Coryneum pustulatum" OR "Coryneum umbonatum" OR "Corythucha arcuata" OR "Craterellus cornucopioides" OR "Craterellus tubaeformis" OR "Cronartium cerebrum" OR "Cryphonectria decipiens" OR "Cryphonectria naterciae" OR "Cryphonectria parasitica" OR "Cryphonectria radicalis" OR "Cryptodiaporthe castanea" OR "Cryptosporiopsis grisea" OR "Curculio dentipes" OR "Curculio elephas" OR "Curculio glandium" OR "Curreya proteae" OR "Cydia amplana" OR "Cydia fagiglandana" OR "Cydia kurokoi" OR "Cydia pomonella" OR "Cydia splendana" OR "Cylindrocladium floridanum" OR "Cylindrodendrum hubeiense" OR "Cylindrosporium castaneae" OR "Cylindrosporium castanicolum" OR "Cylindrosporium ochroleucum" OR "Cytospora ambiens" OR "Cytospora ceratophora f. minor" OR "Daedalea quercina" OR "Daedalea unicolor" OR "Dasyscyphella montana" OR "Datana contracta" OR "Datana ministra" OR "Dematophora necatrix" OR "Dendroleptosphaeria castaneicola" OR "Dendrophora versiformis" OR "Dendrostoma atlanticum" OR "Dendrostoma castaneum" OR "Dendrostoma luteum" OR "Diaporthe eres" OR "Diaporthe foeniculina" OR "Diaporthe nobilis" OR "Diaporthe rudis" OR "Diaspidiotus baiati" OR "Diaspidiotus wuenni" OR "Diaspidiotus zonatus" OR "Diatrype flavovirens" OR "Diatrype stigma" OR "Diplodia castaneae" OR "Diplodia seriata" OR "Diplodina castaneae" OR "Discohainesia oenotherae" OR "Discula umbrinella" OR "Dolycoris baccarum" OR "Dothidotthia celtidis" OR "Dothiorella iberica" OR "Drosicha corpulenta" OR "Drymus sylvaticus" OR "Dryocoetinus villosus" OR "Dryocosmus kuriphilus" OR "Dyseriocrania auricyanea" OR "Dyseriocrania subpurpurella" OR "Eacles imperialis" OR "Ectoedemia albifasciella" OR "Ectoedemia castaneae" OR "Ectoedemia heringi" OR "Ectoedemia phleophaga" OR "Ectoedemia subbimaculella" OR "Ectomyelois ceratoniae" OR "Edwardsiana frustrator" OR "Edwardsiana hippocastani" OR "Edwardsiana rosae" OR "Elfvingia mastopora" OR "Endophragmiella ovoidea" OR "Endothia gyrosa" OR "Endothia parasitica" OR "Endothia radicalis" OR "Endothiella parasitica" OR "Eotetranychus carpini" OR "Eotetranychus coryli" OR "Eotetranychus tiliarium" OR "Epicoccum nigrum" OR*

(Continues)

(Continued)

TOPIC: ("Acanthococcus roboris" OR "Acanthococcus rosannae" OR "Acronicta americana" OR "Acronicta lithospila" OR "Acrospeira mirabilis" OR "Actias luna" OR "Actinopelte dryina" OR "Adoxophyes privatana" OR "Agrilus angustulus" OR "Agrilus biguttatus" OR "Agrilus bilineatus" OR "Agrilus laticornis" OR "Agrilus pannonicus" OR "Agrotera nemoralis" OR "Alebra albostriella" OR "Alebra wahlbergi" OR "Amanita muscaria" OR "Amaurodon mustialaensis" OR "Amaurodon viridis" OR "Amorpha juglandis" OR "Amphiporthe castanea" OR "Anavirga laxa "OR "Ancylis burgessiana" OR "Anisota finlaysoni" OR "Anisota peigleri" OR "Anisota senatoria" OR "Anisota stigma" OR "Anisota virginiensis" OR "Anoplophora chinensis" OR "Antheraea polyphemus" OR "Antheraea proylei" OR "Antheraea × proylei" OR "Aphis gossypii" OR "Aphrophora alni" OR "Apiognomonia errabunda" OR "Apocheima hispidaria" OR "Aradus aterrimus Fieber" OR "Archips fuscocupreanus" OR "Argyresthia castaneella" OR "Armillaria gallica" OR "Armillaria mellea" OR "Armillaria ostoyae" OR "Arthonia tenellula" OR "Aspergillus niger" OR "Asterobemisia avellanae" OR "Asteromella maculiformis" OR "Asteromella quercifolii" OR "Attelabus nitens" OR "Aulacorthum solani" OR "Beauveria bassiana" OR "Biscogniauxia mediterranea" OR "Biston betularia" OR "Botryosphaeria dothidea" OR "Bretziella fagacearum" OR "Bucculatrix demaryella" OR "Cadra figulilella" OR "Calonectria colhounii" OR "Calonectria kyotensis" OR "Calosphaeria wahlenbergii" OR "Calycina cortegadensis" OR "Cameraria castaneaeella" OR "Campaea margaritata" OR "Candelabrum spinulosum" OR "Capronia kleinmondensis" OR "Carcina quercana" OR "Cercospora castaneae" OR "Chionaspis salicis" OR "Chondrostereum purpureum" OR "Choristoneura longicellana" OR "Ciboria candolleana" OR "Cladosporium aggregatocicatricatum" OR "Cladosporium astroideum var. astroideum" OR "Cladosporium fumago" OR "Coccomyces dentatus" OR "Coccus hesperidum hesperidum" OR "Codinaea fertilis" OR "Codinaea matsushimae" OR "Coleophora anatipennella" OR "Coleophora leucochrysella" OR "Coleophora lutipennella" OR "Coleophora violacaea" OR "Coleophora violacea" OR "Colletotrichum acutatum" OR "Collophora hispanica" OR "Comstockaspis perniciosa" OR "Coniella castaneicola" OR "Coniophora arida" OR "Coniophora puteana" OR "Conogethes punctiferalis" OR "Coriolus versicolor" OR "Corizus hyoscyami" OR "Coryneum castaneicola" OR "Coryneum modonium" OR "Coryneum pustulatum" OR "Coryneum umbonatum" OR "Corythucha arcuata" OR "Craterellus cornucopioides" OR "Craterellus tubaeformis" OR "Cronartium cerebrum" OR "Cryphonectria decipiens" OR "Cryphonectria naterciae" OR "Cryphonectria parasitica" OR "Cryphonectria radicalis" OR "Cryptodiaporthe castanea" OR "Cryptosporiopsis grisea" OR "Curculio dentipes" OR "Curculio elephas" OR "Curculio glandium" OR "Curreya proteae" OR "Cydia amplana" OR "Cydia fagiglandana" OR "Cydia kurokoi" OR "Cydia pomonella" OR "Cydia splendana" OR "Cylindrocladium floridanum" OR "Cylindrodendrum hubeiense" OR "Cylindrosporium castaneae" OR "Cylindrosporium castanicolum" OR "Cylindrosporium ochroleucum" OR "Cytospora ambiens" OR "Cytospora ceratophora f. minor" OR "Daedalea quercina" OR "Daedalea unicolor" OR "Dasyscyphella montana" OR "Datana contracta" OR "Datana ministra" OR "Dematophora necatrix" OR "Dendroleptosphaeria castaneicola" OR "Dendrophora versiformis" OR "Dendrostoma atlanticum" OR "Dendrostoma castaneum" OR "Dendrostoma luteum" OR "Diaporthe eres" OR "Diaporthe foeniculina" OR "Diaporthe nobilis" OR "Diaporthe rudis" OR "Diaspidiotus baiati" OR "Diaspidiotus wuenni" OR "Diaspidiotus zonatus" OR "Diatrype flavovirens" OR "Diatrype stigma" OR "Diplodia castaneae" OR "Diplodia seriata" OR "Diplodina castaneae" OR "Discohainesia oenotherae" OR "Discula umbrinella" OR "Dolycoris baccarum" OR "Dothidotthia celtidis" OR "Dothiorella iberica" OR "Drosicha corpulenta" OR "Drymus sylvaticus" OR "Dryocoetinus villosus" OR "Dryocosmus kuriphilus" OR "Dyseriocrania auricyanea" OR "Dyseriocrania subpurpurella" OR "Eacles imperialis" OR "Ectoedemia albifasciella" OR "Ectoedemia castaneae" OR "Ectoedemia heringi" OR "Ectoedemia phleophaga" OR "Ectoedemia subbimaculella" OR "Ectomyelois ceratoniae" OR "Edwardsiana frustrator" OR "Edwardsiana hippocastani" OR "Edwardsiana rosae" OR "Elfvingia mastopora" OR "Endophragmiella ovoidea" OR "Endothia gyrosa" OR "Endothia parasitica" OR "Endothia radicalis" OR "Endothiella parasitica" OR "Eotetranychus carpini" OR "Eotetranychus coryli" OR "Eotetranychus tiliarium" OR "Epicoccum nigrum" OR

Pest list of *Castanea sativa*

Excel file with ***Castanea sativa*** pest list string can be found in the online version of this output in the 'Supporting Information section'.