

Pest categorisation of non-EU Scolytinae on non-coniferous hosts

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Abstract

The EFSA Panel on Plant Health performed a group pest categorisation for the EU territory of non-EU Scolytinae (Coleoptera: Curculionidae) on non-coniferous hosts, which total 6495 known species. Most species attack apparently healthy, weakened or dead trees, either feeding on the phloem ('bark beetles' subgroup) or on fungi inoculated into the sapwood ('ambrosia beetles' subgroup). Smaller subgroups feed and reproduce in seeds and fruits, or in herbaceous plants. Some species are polygynous, the males initiate a gallery or a chamber on or in a new host and attract females. Others are monogamous, and the females initiate the new galleries. Many species respond to primary volatile attractants emitted by the hosts, and some produce aggregation pheromones that attract conspecifics of both sexes. The species attacking living hosts are often associated with fungi that contribute to weakening the host defences and provide nutrients to the insects. Some are inbreeding; the males in the offspring mate with their sisters and rarely leave their natal tree. The larvae of all species develop and pupate within their hosts. Based on catalogues and other published data, a database was constructed providing information on hosts, feeding and reproductive habits, geographic distribution and the Köppen–Geiger climate types in countries where species occur. The Scolytinae were screened to exclude species in the following categories: (i) 708 species attacking conifers; (ii) 127 species present in at least four EU Member States and (iii) 440 species occurring in areas with climatic conditions not occurring in the EU. Among the remaining 5220 species, 88 species known for their mobility, occupying at least two landmasses separated by geographical barriers and some of which had impact levels documented in literature, were extracted. They were grouped into four subcategories: (i) 12 species with high impact on plant health; (ii) 16 species with low or doubtful impact; (iii) 48 species with no impact; (iv) 12 species with no impact and which had never been recorded as 'introduced' in the consulted catalogues but occurring on at least two landmasses. All 88 species could enter the EU with wood or wood products, or with plants for planting, and could establish because host plants are available, and climate is suitable in parts of the EU. Control measures to inhibit introduction are available. There is considerable uncertainty regarding the potential impact of many species. Methods for

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the reliable identification of many species are lacking. For some species of non-EU Scolytinae on non-coniferous hosts, all criteria assessed by EFSA for consideration as potential quarantine pest are met. Nevertheless, the Panel was not able to develop a method to discriminate confidently between species that clearly meet the criteria for potential quarantine pest status and those that do not.

KEY WORDS

ambrosia beetles, bark beetles, broadleaf, pest risk, plant health, plant pest, quarantine

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1 | INTRODUCTION

1.1 | Background and Terms of Reference as provided by the requestor

1.1.1 | Background

The new Plant Health Regulation (EU) 2016/2031, on the protective measures against pests of plants, is applying from 14 December 2019. Conditions are laid down in this legislation in order for pests to qualify for listing as Union quarantine pests, protected zone quarantine pests or Union regulated non-quarantine pests. The lists of the EU regulated pests together with the associated import or internal movement requirements of commodities are included in Commission Implementing Regulation (EU) 2019/2072. Additionally, as stipulated in the Commission Implementing Regulation 2018/2019, certain commodities are provisionally prohibited to enter in the EU (high risk plants, HRP). EFSA is performing the risk assessment of the dossiers submitted by exporting to the EU countries of the HRP commodities, as stipulated in Commission Implementing Regulation 2018/2018. Furthermore, EFSA has evaluated a number of requests from exporting to the EU countries for derogations from specific EU import requirements.

In line with the principles of the new plant health law, the European Commission with the Member States are discussing monthly the reports of the interceptions and the outbreaks of pests notified by the Member States. Notifications of an imminent danger from pests that may fulfil the conditions for inclusion in the list of the Union quarantine pest are included. Furthermore, EFSA has been performing horizon scanning of media and literature.

As a follow-up of the above-mentioned activities (reporting of interceptions and outbreaks, HRP, derogation requests and horizon scanning), a number of pests of concern have been identified. EFSA is requested to provide scientific opinions for these pests, in view of their potential inclusion by the risk manager in the lists of Commission Implementing Regulation (EU) 2019/2072 and the inclusion of specific import requirements for relevant host commodities, when deemed necessary by the risk manager.

1.1.2 | Terms of Reference

EFSA is requested, pursuant to Article 29(1) of Regulation (EC) No 178/2002, to provide scientific opinions in the field of plant health.

EFSA is requested to deliver 53 pest categorisations for the pests listed in Annex 1A, 1B, 1D and 1E (for more details see mandate M-2021-00027 on the [Open.EFSA portal](#)). Additionally, EFSA is requested to perform pest categorisations for the pests so far not regulated in the EU, identified as pests potentially associated with a commodity in the commodity risk assessments of the HRP dossiers (Annex 1C; for more details see mandate M-2021-00027 on the [Open.EFSA portal](#)). Such pest categorisations are needed in the case where there are not available risk assessments for the EU.

When the pests of Annex 1A are qualifying as potential Union quarantine pests, EFSA should proceed to phase 2 risk assessment. The opinions should address entry pathways, spread, establishment, impact and include a risk reduction options analysis.

Additionally, EFSA is requested to develop further the quantitative methodology currently followed for risk assessment, in order to have the possibility to deliver an express risk assessment methodology. Such methodological development should take into account the EFSA Plant Health Panel Guidance on quantitative pest risk assessment and the experience obtained during its implementation for the Union candidate priority pests and for the likelihood of pest freedom at entry for the commodity risk assessment of High Risk Plants.

1.2 | Interpretation of the Terms of Reference

Non-EU Scolytinae on non-coniferous hosts are listed as a group in Annex 1B of the Terms of Reference (ToR) to be subject to pest categorisation to determine whether they fulfil the criteria of potential Union quarantine pests for the area of the EU excluding Ceuta, Melilla and the outermost regions of Member States referred to in Article 355(1) of the Treaty on the Functioning of the European Union (TFEU), other than Madeira and the Azores, and so inform EU decision making as to its appropriateness for potential inclusion in the lists of pests of Commission Implementing Regulation (EU) 2019/2072. If a pest fulfils the criteria to be potentially listed as a Union quarantine pest, risk reduction options will be identified.

For this group pest categorisation, the terms of reference requests all members of the wider group to be considered. Although the term 'Scolytinae (non-European)' is used in Annex II of Commission Implementing Regulation 2019/2072, the phrase 'non-European' is understood to mean 'non-EU' and refers to all territories with exception of the Union territories as defined in Article 1 point 3 of Regulation (EU) 2016/2031.

In this opinion, non-EU species are interpreted as being species that are not known to be established in the EU, or if present in the EU, they are not widespread or are under official control (i.e. currently treated as Union quarantine pests). Not widespread is understood, in this scientific opinion, to mean occurring in up to three EU Member States.

Species that occur in four or more EU Member States are assumed, in this scientific opinion, to be widely distributed in the EU; such species are excluded from detailed consideration in this categorisation and will not be regarded as non-EU

Scolytinae. Nevertheless, the Panel will begin by compiling a comprehensive global list of species of Scolytinae and filter out species using relevant factors to narrow down and focus the categorisation on the species with the highest potential to satisfy the criteria, which are within the remit of the European Food Safety Authority (EFSA) to assess, necessary to allow a species to be regarded as a potential Union quarantine pest.

This opinion focuses only on species that are using non-coniferous plant species as their hosts. The non-EU Scolytinae on coniferous host plants have been addressed in two previous scientific opinions (EFSA PLH Panel, 2020a, 2020b, 2020c).

2 | DATA AND METHODOLOGIES

2.1 | Data

2.1.1 | Literature search

The searches for relevant information on the natural history (i.e. feeding and reproductive habits) and distribution of Scolytinae species, as well as pest-specific information, were primarily performed in Google Scholar (GS) and in both relevant international and grey literature. Specifically, we looked for known hostplants, feeding and reproductive habits, and geographic distribution of each species.

The beetle-plant associations were retrieved from different bibliographic resources (Browne, 1961; Schedl, 1962; Smith et al., 2020), but most of them come from authoritative world catalogues and checklists (Atkinson, 2023; Bright, 2014, 2019; Bright & Skidmore, 1997, 2002; Wood, 2007; Wood & Bright, 1992). Additionally, this data was integrated with multiple records coming from a metasearch carried out in GS. Quotation marks (") were used to search for specific keywords, such as the combination of genus and species names. These searches allowed to check online literature in multiple languages, although most of them in English. In order not to get iterative results during each search, the GS option 'include citations' was kept unchecked. As a final step, all GS results linked to accessible digital resources (e.g. pdf, html, text files, etc.) were checked one-by-one for relevant information, and specifically bark beetle-broadleaves associations and new distributional records. Records referring to trapping experiments by means of luring substances (e.g. semiochemicals) were excluded because they don't demonstrate the beetle-plant association clearly, but rather the attractiveness for bark beetles of specific 'baits'. Therefore, only direct observations of beetles feeding or breeding on plant(s) were considered sufficiently reliable to be included in the dataset.

When available, information on the feeding and reproductive habits of the Scolytinae was obtained directly from relevant literature at species level (e.g. Kirkendall et al., 2015; Wood, 1986), or in some cases at genus level.

The geographic distribution of the Scolytinae species (i.e. every country where the species is considered established) was obtained from the catalogues of Bright (2021) and of Alonso-Zarazaga et al. (2017, 2023) for the distribution of Palearctic Scolytinae. The geographical units are individual countries or, for large countries (Australia, Brazil, Canada, China, India, Russia and United States), sub-units such as states or provinces. Geographic distribution was continuously kept updated according to new records published in national and international taxonomic and ecological papers.

2.1.2 | Scolytinae database development methodology

Based on the information collected on the biology, host plants and distribution of Scolytinae species, a [database](#) was created by the University of Padova, DAFNAE department, under an EFSA art. 36 Tasking Grant (Specific Agreement n. 2 of SA2-GP/EFSA/ALPHA/2019/01/Lot 3). The database is supported by the following three excel files:

1. **The first file** (called 'Full-List-General') contains the information on the species regarding:

- **Taxonomy** (i.e. species name including author and year of description and tribe to which it belongs);
- **Biology** (i.e. type of reproduction – monogamous, bigamous, polygamous and inbreeding polygynous – and feeding habits – herbiphagous, mycophagous, myelomycetophagous, myelophagous, phloeophagous, spermatophagous, xy-lomycetophagous and xylophagous);
- **Impact**, reflected by the number of citations in Google Scholar.

For the type of reproduction and feeding habits, the most relevant bibliographic sources are given in two separate columns. When this information was missing, 'Unknown' is reported.

A glossary, specific to this opinion, explaining terms used to describe feeding habits and reproductive behaviour of Scolytinae is provided at the end of this opinion.

2. **The second file** (called 'Full-List-Hosts') refers to the host plants of the Scolytinae species. The information in the database is reported in rows, where each row corresponds to a host plant associated with a specific scolytine species, with information regarding host plant family, genus and species (in three different columns), as well as the relevant bibliographic source. Thus, based on the number of host species, the degree of polyphagy of a species

can be quantified. If there are no host plants known for a scolytine species, 'Unknown' is reported in the three columns for host plant family, genus and species. When the hosts are conifers, the word 'Conifers' is reported in the same three columns.

- The third file** (called 'Full-List-Geo') contains information on the worldwide distribution of species. Each row in the database corresponds to a country in which a species occurs, with a hierarchical classification including biogeographic realm (i.e. Africa, Atlantic, Australasia, Indian Ocean, Nearctic, Neotropical, Oriental, Pacific and Palearctic) and Area (federations of states or provinces such as USA, China, Brazil or macro-areas such as Asia, Central America, Europe). Then, the status of the species in that country (i.e. 'Native' or 'Introduced') and the bibliographic source is given. Finally, in 31 columns for each species, all the climatic areas according to the Köppen–Geiger classification (Kottek et al., 2006) are given, with the percentage that these climatic areas occupy in each country where the scolytine species occurs. [Appendix J](#) shows a simplified map of biogeographic realms.

2.1.3 | Database search

Pest information, on host(s) and distribution, was retrieved from the European and Mediterranean Plant Protection Organisation (EPPO) Global Database (EPPO, [online](#)), the CABI Compendium ([online](#)), Atkinson (2023) and relevant scientific literature (Bright, 2014; Bright, 2019; Bright & Skidmore, 1997, 2002; Wood, 2007; Wood & Bright, 1992).

Data about the import of commodity types (non-coniferous wood products) that could potentially provide a pathway for the pest to enter the EU were obtained from EUROSTAT (Statistical Office of the European Communities).

The Europhyt and TRACES databases were consulted for genus- and pest-specific notifications on interceptions and outbreaks. Europhyt is a web-based network run by the Directorate General for Health and Food Safety (DG SANTÉ) of the European Commission as a subproject of PHYSAN (Phyto-Sanitary Controls) specifically concerned with plant health information. TRACES is the European Commission's multilingual online platform for sanitary and phytosanitary certification required for the importation of animals, animal products, food and feed of non-animal origin and plants into the European Union, and the intra-EU trade and EU exports of animals and certain animal products. Up until May 2020, the Europhyt database managed notifications of interceptions of plants or plant products that do not comply with EU legislation, as well as notifications of plant pests detected in the territory of the Member States and the phytosanitary measures taken to eradicate or avoid their spread. The recording of interceptions switched from Europhyt to TRACES in May 2020. TRACES separates pest interceptions and records of non-compliance and was searched for each; records began in June 2020.

2.2 | Methodologies

The Panel performed the pest categorisation for non-EU Scolytinae on non-coniferous hosts, following guiding principles and steps presented in the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018a, 2018b), the EFSA guidance on the use of the weight of evidence approach in scientific assessments (EFSA Scientific Committee, 2017) and the International Standards for Phytosanitary Measures No. 11 (FAO, 2013).

The criteria to be considered when categorising a pest as a potential Union quarantine pest (QP) is given in Regulation (EU) 2016/2031 Article 3 and Annex I, Section 1 of the Regulation. [Table 1](#) presents the Regulation (EU) 2016/2031 pest categorisation criteria on which the Panel bases its conclusions. In judging whether a criterion is met the Panel uses its best professional judgement (EFSA Scientific Committee et al., 2017) by integrating a range of evidence from a variety of sources (as presented above in Section 2.1) to reach an informed conclusion as to whether or not a criterion is satisfied.

The Panel's conclusions are formulated respecting its remit and particularly with regard to the principle of separation between risk assessment and risk management (EFSA founding regulation (EU) No 178/2002); therefore, instead of determining whether the pest is likely to have an unacceptable impact, deemed to be a risk management decision, the Panel will present a summary of the observed impacts in the areas where the pest occurs and make a judgement about potential likely impacts in the EU. Whilst the Panel may quote impacts reported from areas where the pest occurs in monetary terms, the Panel will seek to express potential EU impacts in terms of yield and quality losses and not in monetary terms, in agreement with the EFSA guidance on quantitative pest risk assessment (EFSA PLH Panel, 2018a, 2018b). Article 3(d) of Regulation (EU) 2016/2031 refers to unacceptable social impact as a criterion for quarantine pest status. Assessing social impact is outside the remit of the Panel.

TABLE 1 Pest categorisation criteria under evaluation, as derived from Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column).

Criterion of pest categorisation	Criterion in regulation (EU) 2016/2031 regarding union quarantine pest (article 3)
Identity of the pest (Section 3.1)	Is the identity of the pest clearly defined, or has it been shown to produce consistent symptoms and to be transmissible?
Absence/presence of the pest in the EU territory (Section 3.2)	Is the pest present in the EU territory? If present, is the pest in a limited part of the EU or is it scarce, irregular, isolated or present infrequently? If so, the pest is considered to be not widely distributed
Pest potential for entry, establishment and spread in the EU territory (Section 3.4)	Is the pest able to enter into, become established in and spread within, the EU territory? If yes, briefly list the pathways for entry and spread
Potential for consequences in the EU territory (Section 3.5)	Would the pests' introduction have an economic or environmental impact on the EU territory?
Available measures (Section 3.6)	Are there measures available to prevent pest entry, establishment, spread or impacts?
Conclusion of pest categorisation (Section 4)	A statement as to whether (1) all criteria assessed by EFSA above for consideration as a potential quarantine pest were met and (2) if not, which one(s) were not met

For this pest categorisation, a stepwise dichotomous decision tree was developed and used to narrow down the number of species to be considered more fully in the pest categorisation process (Figure 1). A similar approach was used by EFSA PLH Panel (2020a, 2020b, 2020c) for the pest categorisation of non-EU Tephritidae.

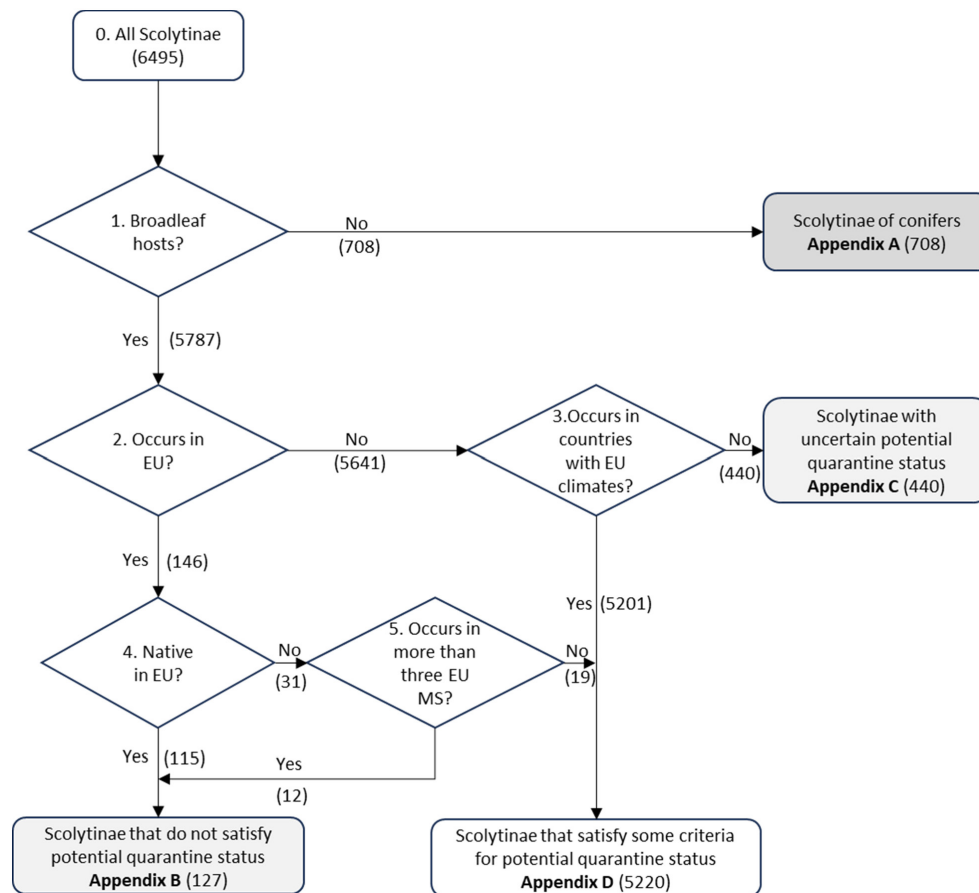


FIGURE 1 Decision tree to support the categorisation of Scolytinae (numbers in brackets indicate the number of species).

The first step in the decision tree was to exclude all the Scolytinae species that develop in conifers only (Appendix A, 708 spp.). Then, from the remaining 5787 species, all those already known to be present in the EU were excluded, either because they are native, or because they are alien but already widespread in the EU (Appendix B; 127 spp.). A previous pest categorisation of non-EU Scolytinae on coniferous hosts determined that occurrence in at least four EU MS was an appropriate threshold to consider a species as widespread in the EU (EFSA PLH Panel, 2020a, 2020b, 2020c). For consistency, the Panel used the same threshold for this opinion. All remaining species occurring in countries having climatic conditions not fitting with those occurring in the EU were also excluded (Appendix C; 440 spp.). Finally, all species that meet the criteria of having broadleaf hosts, not occurring in the EU but in countries with EU type climates or not occurring widely in the EU, were grouped for further consideration in Appendix D (5220 spp.).

For the species listed in Appendix D, a 'degree of polyphagy' was also introduced. A species that feeds on plant species belonging to a single genus was classified as 'monophagous'; a species that feeds on different plant species belonging to a single family was classified as 'oligophagous'; a species that feeds on plant species belonging to at least two families was classified as 'polyphagous'.

The list of 163 species with high mobility (species that have colonised at least two landmasses, i.e. pieces of land surrounded by ocean or sea) listed by Grégoire et al. (2023) was used to identify the species within Appendix D, potentially associated with a higher risk of introduction to the EU (excluding those species belonging to Appendices A, B and C). Then, endemic species within the EU but with very restricted distribution (i.e. *Aphanarthrum* and *Liparthrum* species) and species with peculiar hosts mostly absent from the EU, i.e. *Hypothenemus hampei* (attacking coffee berries) and *Coccotrypes rhizophorae* (attacking *Rhizophora* spp.) were removed. Finally, two species absent from the list (*Pseudopityophthorus minutissimus* and *P. pruinus*) were added because they are included in the EPPO A1 list of quarantine species. Thus, from the initial 5220 species present in Appendix D (see Figure 1), 88 species were extracted (Table 2). These 88 species were finally organised in four lists (Appendix E1):

- List 1–12 species with high impact on plant health according to the literature (reviewed in Grégoire et al., 2023);
- List 2–16 species with low or doubtful impact on plant health;
- List 3–48 species with no impact on plant health and recorded as 'introduced' or 'alien' in at least one country in the catalogues cited in Section 2.1.1;
- List 4–12 species with no impact on plant health and not recorded as alien in the main taxonomic catalogues but regarded as mobile by Grégoire et al. (2023).

The species in List 1 are most likely to satisfy the criteria to qualify as potential EU quarantine pests. Appendix E1 presents these four lists in more details, including the following fields:

- Present in the EU (Y/N);
- Species name;
- Impact on plant health according to literature: 0 – no reported impact; 1 – occasional, limited impact; 2 – high impact (Grégoire et al., 2023);
- Google Scholar (GS) citations: number of citations addressing the particular species;
- Risk Score: score of 0–9, based on the sum of the scores of three traits (reproduction, feeding habits and degree of polyphagy) scoring 0–3 each (see more details below);
- Spread score: 0 – species has not spread/invaded elsewhere; 1 – species has spread/invaded at least one area other than the native area (based on information in the different catalogues listed in Section 2.1.3);
- Identification methods: A – Readily identifiable with both morphological and molecular methods; B – Identifiable with morphological methods but not by DNA barcoding; C – Identifiable with molecular methods but not by a reliable morphological method; D – No reliable or applicable morphological or molecular tools available (for more information see Appendix F).

TABLE 2 List of highly mobile Scolytinae species: See Appendix E for details regarding the four list subcategories within the table.

List 1 (species with high impact)

Euwallacea fornicatus (Eichhoff, 1868)
Euwallacea interjectus (Blandford, 1894)
Euwallacea kuroshio Gomez & Hulcr, 2018
Euwallacea perbrevis (Schedl, 1951)
Euwallacea validus (Eichhoff, 1875)
Hypothenemus crudiae (Panzer, 1791)
Pityophthorus juglandis Blackman, 1928
Pseudopityophthorus minutissimus (Zimmermann, 1868)
Pseudopityophthorus pruinus (Eichhoff, 1878)
Scolytus schevyrewi Semenov, 1902
Xyleborus ferrugineus (Fabricius, 1801)
Xyleborus glabratus Eichhoff, 1877

List 2 (species with low or doubtful impact)

Amasa parviseta Knizek & Smith, 2024
Ambrosiodmus rubricollis (Eichhoff, 1875)
Ambrosiophilus compressus (Lea, 1894)

(Continues)

TABLE 2 (Continued)

Coccotrypes carpophagus (Hornung, 1842)
Cryphalus dilutus Eichhoff, 1878
Cryphalus discretus Eichhoff, 1878
Cryphalus mangiferae Stebbing, 1914
Euwallacea piceus (Motschulsky, 1863)
Euwallacea similis (Ferrari, 1867)
Hypothenemus areccae (Hornung, 1842)
Hypothenemus birmanus (Eichhoff, 1878)
Hypothenemus obscurus (Fabricius, 1801)
Hypothenemus seriatus (Eichhoff, 1872)
Phloeotribus liminaris (Harris, 1852)
Xyleborus affinis Eichhoff, 1868
Xyleborus perforans (Wollaston, 1857)

List 3 (species with no impact but introduced or alien)

Ambrosiodmus lewisi (Blandford, 1894)
Ambrosiodmus minor (Stebbing, 1909)
Ambrosiophilus atratus (Eichhoff, 1875)
Ambrosiophilus osumiensis (Murayama, 1934)
Anisandrus maiche (Kurentzov, 1941)
Cnestus mutilatus (Blandford, 1894)
Cnestus pseudosolidus (Schedl, 1936)
Coccotrypes aciculatus Schedl, 1952
Coccotrypes advena Blandford, 1894
Coccotrypes cyperi (Beeson, 1929)
Coccotrypes robustus Eichhoff, 1878
Coccotrypes rutschuruensis Eggers, 1940
Coccotrypes vulgaris (Eggers, 1923)
Coptoborus ricini (Eggers, 1932)
Cryphalus waplery Eichhoff, 1872
Cryptocarenum heveae (Hagedorn, 1912)
Cyclorhipidion distinguendum (Eggers, 1930)
Cyclorhipidion pelliculosum (Eichhoff, 1878)
Dryocoetoides cristatus (Fabricius, 1801)
Dryoxylon onoharaense (Murayama, 1934)
Eccoptopterus spinosus (Olivier, 1795)
Eidophelus jalappae (Letzner, 1849)
Heteroborips seriatus (Blandford, 1894)
Hypothenemus africanus (Hopkins, 1915)
Hypothenemus brunneus (Hopkins, 1915)
Hypothenemus californicus Hopkins, 1915
Hypothenemus columbi Hopkins, 1915
Hypothenemus elephas (Eichhoff, 1872)
Hypothenemus erectus LeConte, 1876
Hypothenemus javanus (Eggers, 1908)
Hypothenemus pubescens Hopkins, 1915
Hypothenemus setosus (Eichhoff, 1868)
Liparthrum mandibulare Wollaston, 1854
Microborus boops Blandford, 1897
Monarthrum mali (Fitch, 1855)
Pagiocerus frontalis (Fabricius, 1801)
Premnobius ambitiosus (Schaufuss, 1897)

TABLE 2 (Continued)

Premnobius cavipennis Eichhoff, 1878
Xyleborinus andrewesi (Blandford, 1896)
Xyleborinus artestriatus (Eichhoff, 1878)
Xyleborinus exiguus (Walker, 1859)
Xyleborinus gracilis (Eichhoff, 1868)
Xyleborinus octiesdentatus (Murayama, 1931)
Xyleborus bispinatus Eichhoff, 1868
Xyleborus spinulosus Blandford, 1898
Xyleborus volvulus (Fabricius, 1775)
Xylosandrus amputatus (Blandford, 1894)
Xyloterinus politus (Say, 1826)

List 4 (species with no impact and not recorded as alien)

Ambrosiodmus obliquus (LeConte, 1878)
Coccotrypes distinctus (Motschulsky, 1866)
Cryphalus pallidus Eichhoff, 1872
Hypothenemus plumeriae (Nordlinger, 1856)
Microperus eucalypticus (Schedl, 1938)
Microperus quercicola (Eggers, 1926)
Planiculus bicolor (Blandford, 1894)
Scolytoplatypus tycon Blandford, 1893
Scolytus dimidiatus Chapuis, 1869
Truncaudum agnatum (Eggers, 1923)
Xyleborus africanus Eggers, 1927
Xylosandrus mancus (Blandford, 1898)

Within Appendix D, three criteria identified in previous studies were considered (i.e. type of reproduction, type of feeding habits and degree of polyphagy) (EPPO, 2020; Grousset et al., 2020; Lantschner et al., 2020; Grégoire et al., 2023). These criteria were analysed in all the species recorded as 'introduced' in at least one country in the database (not only the species belonging to Appendix D). All the traits of these three criteria were ranked in three risk groups with different points (PT) assigned (based on the percentage of species with an invasion history sharing that type of characteristic) from 'low risk' (1 PT – if a given trait is present in less than 10% of the species), to 'medium risk' (2 PT – if a given trait is present in between 10% and 40% of the species), up to 'high risk' (3 PT – if a given trait is present in more than 40% of the species). Concerning reproduction, 50% of alien species in the world are inbreeding polygynous, so this characteristic was assigned the highest score (3 PT); the same for feeding habits where phloeophagy (50%) or xylomycetophagy (42%) (3 PT) characterise most of the alien species. Finally, a high degree of polyphagy (i.e. polyphagous species) is shared among most alien species (67%) (3 PT). Species with unknown traits, both at genus and tribe levels, scored zero points for those traits. Table 3 presents the scores assigned to each type of the three categories.

TABLE 3 'Risk scores' expressed as point (PT) for the traits of the three categories: Reproduction, Feeding Habits and Degree of polyphagy.

Biological feature	Low risk (1 PT)	Medium risk (2 PT)	High risk (3 PT)
Reproduction	Bigamous [2%]	Monogamous [35%] Polygamous [16%]	Inbreeding polygynous [50%]
Feeding Habits	Myelophagous [8%] Herbiphagous [2%] Xylophagous [2%] Mycophagous [1%]	Spermatophagous [11%]	Phloeophagous [50%] Xylomycetophagous [42%]
Degree Of Polyphagy	Monophagous [8%]	Oligophagous [21%]	Polyphagous [67%]
Known To Be Invasive	–	–	+1 PT

Notes: Square brackets show the percentage of species that share each trait. The sum of the percentages within a feature may be greater than 100% because, for species with unknown traits, all features known at the genus or tribe level were included.

Thus, a 'risk score' based on three traits was calculated for each species in Appendix D, ranging from a minimum of 0, where details of traits were unknown for each category, to a maximum of 9 (high risk for each category). Lastly, an additional point was assigned to those species that have already spread into new territories, i.e. considered mobile according to Grégoire et al. (2023), raising the maximum total score to 10 points (i.e. species with 'high risk' traits score for each of the three categories and that are known to have invaded at least one state/country).

Consultation with the European Union Reference Laboratory¹

EFSA has consulted the European Union Reference Laboratory (EURL) for Insects and Mites on the identification of Scolytinae species. The EU reference laboratory considered whether national reference laboratories of Member States would realistically be able to identify Scolytinae to species level. More specifically, they analysed whether individual species could be reliably distinguished from other Scolytinae. To inform such judgement, the EU reference laboratory considered whether there were reliable morphological or molecular methods available to identify the 88 species listed in Appendix E1 and E2, i.e. the Scolytinae with broadleaf hosts that are found in separate landmasses and in countries with an EU type climate and are either not present or have limited distribution in the EU. A reliable morphological identification of adults was judged feasible if it was supported by published methods which were deemed sufficiently discriminative and robust. In addition, also the experience by the EURL in applying the method was taken into account. Furthermore, the EURL had to consider whether the method could be used by generalist entomological diagnosticians working in a national reference laboratory i.e. diagnosticians not specialised in the identification of species of Scolytinae (see excerpt from report of EURL insects and mites in Appendix F of this opinion, where a synoptic table is presented of the EURL evaluation of the 88 species listed in Appendix E, with reference to available morphological and molecular diagnostic methods).

3 | PEST CATEGORISATION

3.1 | Identity and biology of the pest

3.1.1 | Identity and taxonomy

Is the identity of the pest clearly defined, or has it been shown to produce consistent symptoms and/or to be transmissible?

Yes, the identity of the pest is well established, and the non-EU Scolytinae species are described in worldwide, regional or national catalogues and faunas.

The subfamily Scolytinae is a hyper-diverse insect group of coleopterans belonging to the large weevil family Curculionidae, currently including 6495 known species worldwide. Traditionally, Scolytinae are separated into two major ecological subgroups: (i) **bark beetles** that feed on inner bark of woody plants; and (ii) **ambrosia beetles** that farm fungi inside the xylem of the host trees and feed on them. In addition, another subgroup of species feed and reproduce also in seeds and fruits, or in herbaceous plants, especially in tropical and sub-tropical areas. Scolytines were fully listed in the world catalogue of Bright (2021) and in other publications (i.e. Bright, 2014; Bright & Skidmore, 1997, 2002; Wood & Bright, 1992), as well as in the online catalogue of Atkinson (2023) for species native to, or introduced in, the Americas. Keys and documentation have been published, e.g. by Wood (1982, 2007), Gomez et al. (2018) and Atkinson (2023) for the Nearctic and Neotropic regions; and by Schedl (1981) and Pfeffer (1994) for the Western Palearctic region. The taxonomy is continuously evolving, e.g. with the reassignment of species to different genera, new synonymies or the description of new species.

The EPPO code² (EPPO, 2019; Griessinger & Roy, 2015) for the Scolytinae is 1SCOLS (EPPO, [online](#)).

3.1.2 | Biology of the pest

Scolytinae are associated with a remarkable variety of plants (Marchioro et al., 2024; Ruzzier et al., 2023). Both adults and larvae feed and develop either in the sapwood or phloem of recently dead or dying trees, or in different parts of live plants (i.e. phloem or sapwood, seeds, fruits, shoots, roots) according to species. Also, many species rely on symbiotic and mutualistic relationships with yeasts and other fungi (often phytopathogenic), and bacteria carried on the body surface or stored inside specific exoskeletal cavities (a.k.a., mycangia). Some of these microorganisms invade the plant tissues and contribute to overcome the constitutive and induced defences of living hosts, causing strong dieback and wood degradation (e.g. Beaver et al., 1989; Hulcr & Stelinski, 2017). Some species are thus economically important pests, weakening and

¹The European Council and the Commission have designated [EU Reference Laboratories \(EURL\)](#) with the aim to ensure high-quality, uniform testing in the EU and support Commission activities on risk management and risk assessment in the area of laboratory analysis. The consortium between [ANSES](#) (France) and [AGES](#) (Austria) is designated as the European Union Reference Laboratory for the identification of regulated insect and mite species under Commission Implementing Regulation (EU) 2019/530 of 27 March 2019.

²An EPPO code, formerly known as a Bayer code, is a unique identifier linked to the name of a plant or plant pest important in agriculture and plant protection. Codes are based on genus and species names. However, if a scientific name is changed the EPPO code remains the same. This provides a harmonised system to facilitate the management of plant and pest names in computerised databases, as well as data exchange between IT systems (EPPO, 2019; Griessinger & Roy, 2015).

killing healthy trees and, in many cases, damaging the wood because of the staining caused by their associated fungi and the structural weakening caused by their galleries (Hofstetter et al., 2015; Raffa et al., 2015).

A general introduction to the biology of bark and ambrosia beetles is provided by Raffa et al. (2015) and Kirkendall et al. (2015). Many scolytine species live in the inner bark of trees (phloem and cambium) and often also slightly engraving the outer sapwood. Other species are instead xylophagous (i.e. feed directly in the wood) or xylomycetophagous (i.e. feed on symbiotic fungi that they farm in the galleries, or the chambers excavated in the wood). Other species are pith-feeding (myelophagous) or seed/fruit-feeding (spermatophagous).

Among the majority of Scolytinae, males remain with females in their tunnel systems until most or all eggs have been laid. Species may be polygamous (harem polygyny) or monogamous. In the polygamous bark beetles, the males leave their natal system, create a new gallery in a new host and attract several females, which will excavate their own egg tunnel. Instead, in the monogamous species, each female initiates the colonisation of a new host by boring a new gallery and attracts one male. In the ambrosia beetles, polygyny is much more common than among bark beetles, and mating occurs among siblings (inbreeding) in the natal system before emergence of the females, which initiate alone a new colony. Currently, 1627 species are known to have adopted an inbreeding strategy; all the remaining species are outbreeders (Kirkendall et al., 2015).

The galleries or the brood chambers vary in shape and size between the different species, often creating specific patterns (Faccoli, 2015). Each female excavates an egg gallery or an egg chamber. The eggs are either laid individually in niches along the gallery or in batches in a chamber. The larvae develop either in individual galleries at the end of which they pupate or gregariously in a common chamber. In some species, the young adults must proceed to maturation feeding, before or after emergence from the natal tree. In the latter case, they may feed on fresh bark tissues or on young twigs of healthy trees, in some case vectoring plant disease. Dispersal occurs by flight, except for the males of many inbreeding species, which do not fly but die within the natal galleries after mating with siblings.

The chemical ecology of Scolytinae is very complex (Raffa et al., 2015). Most species respond to primary volatile attractants released from their hosts, such as alpha-pinene and other monoterpenes, or ethanol when the hosts are dying or dead, and their tissues start to ferment. In addition to primary attractants, during the process of host colonisation, many species produce aggregation pheromones that attract conspecifics of both sexes. This results in the mass attack and quick colonisation of the new hosts, overcoming their defences.

3.1.3 | Host range/species affected

3387 plant species in 207 families and 1437 genera are recorded as hosts in the database for the 6495 Scolytinae species investigated. For 2652 species of Scolytinae the hosts are however unknown (most of them originated from Neotropical and Oriental regions), and 152 species develop on both broadleaves and conifers. The most attacked families are Fabaceae (attacked by 11% of the Scolytinae species), Fagaceae (7%), Moraceae (6%), Lauraceae (6%) and Malvaceae (5%). The most attacked genera are *Quercus* (5%), *Ficus* (4%), *Shorea* (3%), *Theobroma* (2%) and *Dipterocarpus* (2%). In Table 4, the 10 most attacked families and genera are reported with the corresponding number of Scolytinae species infesting them.

TABLE 4 The most attacked host plant families and genera with the number of Scolytinae species recorded on them.

Family	No of Scolytinae species	Genus	No of Scolytinae species
Fabaceae	736	<i>Quercus</i>	311
Fagaceae	424	<i>Ficus</i>	286
Moraceae	408	<i>Shorea</i>	201
Lauraceae	368	<i>Theobroma</i>	133
Malvaceae	348	<i>Dipterocarpus</i>	116
Euphorbiaceae	329	<i>Prunus</i>	112
Dipterocarpaceae	291	<i>Inga</i>	112
Anacardiaceae	255	<i>Acacia</i>	106
Burseraceae	237	<i>Albizia</i>	106
Sapindaceae	229	<i>Artocarpus</i>	106

3.1.4 | Detection and identification of the pest

Are detection and identification methods available for the pest?

Yes, visual detection and trapping allow Scolytinae to be detected, although detection accuracy depends on the target species. Morphological and molecular identification methods are available.

Detection

Scolytinae can be detected visually by the symptoms caused by their own activity and by the fungi they often vector:

- White wood sawdust from entry holes produced by wood-inhabiting species ('ambrosia beetles');
- Brown sawdust from entry holes produced by phloem-inhabiting species ('bark beetles');
- Galleries excavated in the phloem by bark beetle parent adults and their larvae. These galleries often show distinct patterns characterising particular species;
- Circular or oval entry or exit holes and galleries and chambers excavated in the sapwood by ambrosia beetle parent adults (a single female in inbreeding species) and their larvae;
- Blue-black discolouration of the attacked wood due to symbiotic fungi inoculated by the insects;
- On living trees, sap bleeding/oozing from entry and exit holes, gum or sugar exudates at entry holes, wilting, leaf die-back, loss of bark, epicormic growth and, ultimately, dying of the tree.

Scolytinae can also be monitored by trapping. Most species respond to semiochemicals, either produced by conspecifics (pheromones), or by the living or dying hosts (e.g. ethanol in non-conifer species). A comprehensive list of these semiochemicals is provided by the Pherobase (El-Sayed, 2024). Different trap models and colours are commercially available: vane-traps, flight barriers, funnel-traps. Recent comparisons of trap models and colours have been published by Allison and Redak (2017) and Cavaletto et al. (2020), respectively. Ideally, traps should be at the same time very sensitive and very cheap, to allow for maximal chances to detect low density populations (Liebhold & Tobin, 2008). Host volatiles attract a very large number of species and are used for monitoring entries near entry points (Rabaglia et al., 2008, 2019; Rassati et al., 2014; Rassati, Faccoli, Marini, et al., 2015; Rassati, Faccoli, Petrucco Toffolo, et al., 2015). As host volatiles are not specific, an enormous work of sorting and analysis is necessary for identifying the catches. However, specific pheromones can be used for detecting previously identified high risk species (Rabaglia et al., 2008, 2019).

For clearly recognisable species, or symptoms, or for specific host-trees, a citizen science approach can be developed. Based on iNaturalist records and host-plant distribution maps, Potgieter et al. (2024) developed a citizen monitoring program for the polyphagous shot hole borer, *Euwallacea fornicatus* in South Africa.

Identification

Based on the consultation with the EURL Insects and Mites, it is important to recognise that the identification of Scolytinae is based primarily on adult morphological characters and that there is a lack of information to distinguish between species if only immature stages are found (see Appendix F, excerpt from EURL report). Nevertheless, Hulcr et al. (2015) provide a comprehensive synthesis of the taxonomy and phylogenetics of the Scolytinae including an overview of the identification keys, picture databases, catalogues and methods currently available. They point out, however, that no more than 25% of the Scolytine species are listed in identification keys. After the fundamental contributions of Wood (1982), Wood & Bright (1992) and Bright (2021), considerable additions and corrections are still made annually to the taxonomy of the Scolytinae, with hundreds of new species added or moved to different genera and hundreds of synonymies detected since 1992. A recent global catalogue updating previous work (Wood, 1982; Wood & Bright, 1992) has been published by Bright (2021). Wood (1986) also published a world reclassification of the genera of the Scolytinae.

Dichotomic keys are available for North and Central America (Wood, 1982), South America (Wood, 2007), Europe (e.g. Balachowsky, 1949; Freude et al., 1981; Pfeffer, 1994), and various other areas in the world, or for particular groups in a limited area (Rabaglia et al., 2006). Hulcr et al. (2015) also provide a list of public databases on Scolytinae taxonomy and images.

DNA barcoding is increasingly used for species identification, with some accuracy (for example, Jordal and Kambestad (2014) report one misidentification out of 70 species analysed). However, Cognato et al. (2020) created COI and CAD DNA barcode databases including 165 species of Xyleborini (out of 316 species in the whole Southeast Asian fauna), and matched their analyses to morphological identifications by taxonomic experts. They concluded that barcoding alone is often uncertain without the support of morphological expertise. In addition to adults or immature stages, indirect identification can also be achieved: three *Xylosandrus* species and *Xyleborinus saxesenii* were also identified from DNA extracted from their frass or from gallery sections (Rizzo et al., 2021, 2024).

Available methods for identification: A summary of the feedback by the EURL indicating how many of the 88 species in Appendix E have reliable morphological and/or molecular methods available for their identification is shown in Table 5. For more details on EURL feedback on the individual species, see Appendix F.

TABLE 5 The number of Scolytinae species from Appendix E in four categories (A–D) indicating whether reliable morphological or molecular methods are available for their identification (Only adults can be identified using morphological methods).

Category	Number of species	Reliable morphological methods available	Reliable molecular methods available
A	20	Yes	Yes
B	47	Yes	No
C	1	No	Yes
D	20	No	No
	88		

Key to categories:

- A. Readily identifiable with current tools: both reliable morphological and molecular identification is possible.
- B. Morphologically-based identification possible: reliable morphological methods possible but cannot be reliably confirmed by DNA barcoding.
- C. Molecularly-based identification possible but cannot be confirmed by a reliable morphological identification.
- D. Identification currently problematic: there are no reliable or applicable morphological or molecular tools.

Of the 88 taxa categorised in Appendix E, 20 cannot reliably be identified at present. If only immature specimens are available, only 21 of the 88 species can be reliably identified (see Appendix F, excerpt from EURL report).

The *E. fornicatus* species complex contains harmful invasive species with traits that score highly. There are, however, challenges in identifying species within the complex. Defining the species in the complex is evolving, and accurate identification requires specialist expert experience.

3.2 | Pest distribution

3.2.1 | Pest distribution outside the EU

Most of the non-EU Scolytinae on non-coniferous hosts, with known hosts, occur in the Americas (3230 species, among which 2078 species occur in North America, Central America and West Indies, and 1536 species occur in South America), and Asia (1916 species) (Figure 2). Moreover, 1704 and 1281 species, respectively are distributed only in North America and in Asia (Figure 3). 915 species are spread in more than one continent, and 13 species have a pan-global distribution covering six continents (Figure 4).

Among the 88 species at high risk of introduction (Appendix E), most occur in the Americas (72 species, in particular 71 species in North and Central America, and 45 species in South America), and in Asia (59 species). Eight species (*Ambrosiophilus compressus*, *Cnestus pseudosolidus*, *Cryphalus pallidus*, *Microperus quercicola*, *P. minutissimus*, *Pseudopityophthorus pruinosis*, *Scolytoplatypus tycoon* and *Xyleborus africanus*) occur in only one continent, whereas three species (*E. fornicatus*, *Hypothenemus seriatus* and *Xyleborus affinis*) occur in all the six inhabited continents.

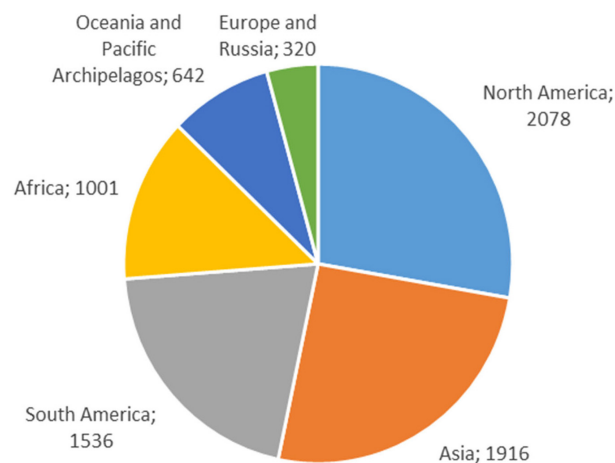


FIGURE 2 Global distribution of non-EU Scolytinae on non-coniferous hosts (Source: Literature; for details see Appendix B).

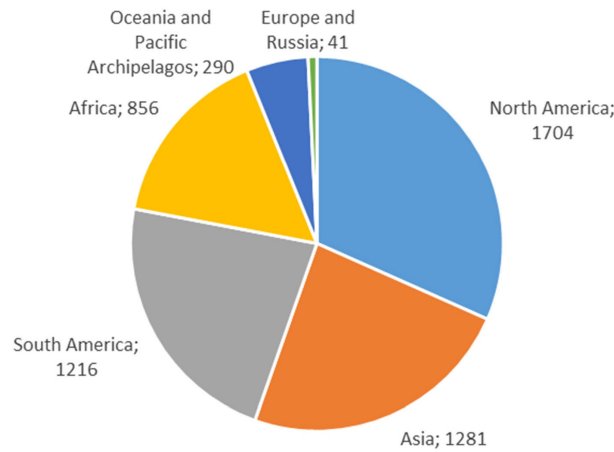


FIGURE 3 Number of non-EU Scolytinae species on non-coniferous hosts reported exclusively from one continent.

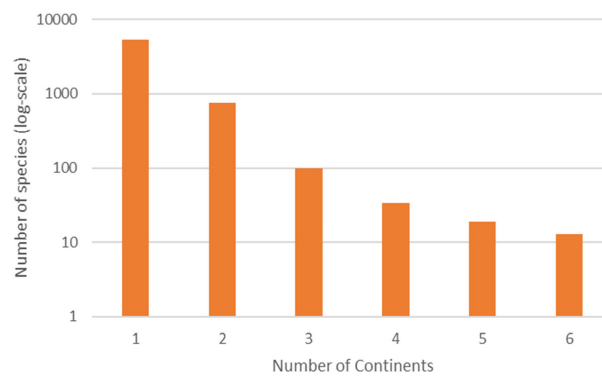


FIGURE 4 Number of non-EU Scolytinae species on non-coniferous hosts distributed in world continents.

3.2.2 | Pest distribution in the EU

Is the pest present in the EU territory? If present, is the pest in a limited part of the EU or is it scarce, irregular, isolated or present infrequently? If so, the pest is considered to be not widely distributed.

By definition, non-EU Scolytinae are not present in the EU, or if present are not widely distributed (here considered to mean that they occur in up to three EU Member States) and are under official control.

19 non-native species are present in three or less EU Member States (Table 6).

TABLE 6 Non-native non-EU Scolytinae species present in three or less EU Member States, and their impact at world level.

Species	EU MSs	Impact*	
		Score	Reference
<i>Amasa parviseta</i> Knížek & Smith (until recently described as <i>Amasa</i> sp. near <i>truncata</i>)	ES; FR; PT	1	Flechtmann and Cognato (2011)
<i>Ambrosiodmus rubricollis</i> (Eichhoff, 1875)	IT; PT; SL	1	Kirkendall and Faccoli (2010)
<i>Ambrosiophilus atratus</i> (Eichhoff, 1875)	IT; SL	0	Rabaglia et al. (2006)
<i>Anisandrus maiche</i> (Kurentzov, 1941)	IT; SL	0	Terekhova and Skrylnik (2012)
<i>Cnestus mutilatus</i> (Blandford, 1894)	IT	0	CABI (2009)
<i>Coleobothrus luridus</i> (Wollaston, 1860)	HR	0	Jordal (2006)
<i>Cryphalus dilutus</i> Eichhoff, 1878	FR; IT; MT	1	Gugliuzzo et al. (2023)
<i>Cyclorhipidion distinguendum</i> (Eggers, 1930)	FR	0	Barnouin et al. (2020)
<i>Cyclorhipidion pelliculosum</i> (Eichhoff, 1878)	DE	0	No data on damage
<i>Dryoxylon onoharaense</i> (Murayama, 1934)	IT	0	No data on damage

Species	EU MSs	Impact*	
		Score	Reference
<i>Euwallacea fornicatus</i> sensu lato (Eichhoff, 1868)	(DE)**	2	Smith et al. (2019)
<i>Euwallacea validus</i> (Eichhoff, 1875)	FR	2	Cognato et al. (2015)
<i>Liparthrum mandibulare</i> Wollaston, 1854	FR; IT; ES	0	No data on damage
<i>Monarthrum mali</i> (Fitch, 1855)	IT	0	Kirkendall et al. (2008)
<i>Phloeotribus liminaris</i> (Harris, 1852)	BE; IT	1	Pennacchio et al. (2004)
<i>Pityophthorus juglandis</i> Blackman, 1928	FR; IT	2	EPP0 (2020)
<i>Pityophthorus juglandis</i> Blackman, 1928	FR; IT	2	Rabaglia et al. (2006)
<i>Xyleborus bispinatus</i> Eichhoff, 1868	FR; IT; ES	0	Faccoli et al. (2016)
<i>Xyloterinus politus</i> (Say, 1826)	FR	0	No data on damage

*Impact (from the literature, in Grégoire et al., 2023) – 0: no recorded impact in the reference provided or no data on damage available; 1: moderate or doubtful impact; 2: high impact. Impact scores are based on literature around the world and not specific to the EU. Impact scores relate both to the insect and their associated fungi.

**In brackets: transient, under eradication.

3.3 | Regulatory status

3.3.1 | Commission Implementing Regulation 2019/2072

Non-EU Scolytinae species are listed in Commission Implementing Regulation 2019/2072 as Scolytinae spp. (non-European). Details are presented in Table 7.

TABLE 7 Non-EU Scolytinae spp. in Commission Implementing Regulation 2019/2072.

Annex II	List of Union quarantine pests and their respective codes assigned by EPP0
Part A	Pests not known to occur in the Union territory
3. Insects and mites	
72.	Scolytinae spp. (non-European) [1SCOLF]

As described in Section 1.2, the phrase ‘non-European’ is understood to mean ‘non-EU’ and refers to all territories with exception of the Union territories as defined in Article 1 point 3 of Regulation (EU) 2016/2031.

3.3.2 | Hosts or species affected that are prohibited from entering the Union from third countries

The list of hosts affected by non-EU Scolytinae and prohibited from entering the EU is shown in Table 8.

TABLE 8 List of plants, plant products and other objects that can be hosts for non-EU Scolytinae, whose introduction into the Union from certain third countries is prohibited (Source: Commission Implementing Regulation (EU) 2019/2072, Annex VI).

List of plants, plant products and other objects whose introduction into the union from certain third countries is prohibited		
Description	CN code	Third country, group of third countries or specific area of third country
2. Plants of <i>Castanea</i> Mill. and <i>Quercus</i> L., with leaves, other than fruit and seeds	ex 0602 10 90	Third countries other than Albania, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canary Islands, Faeroe Islands, Georgia, Iceland, Liechtenstein, Moldova, Monaco, Montenegro, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (Severo-Zapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo-Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug)), San Marino, Serbia, Switzerland, Turkey, Ukraine and the United Kingdom
	ex 0602 20 20	
	ex 0602 20 80	
	ex 0602 90 41	
	ex 0602 90 45	
	ex 0602 90 46	
	ex 0602 90 48	
	ex 0602 90 50	
	ex 0602 90 70	
	ex 0602 90 99	
	ex 0604 20 90	
	ex 1404 90 00	

(Continues)

TABLE 8 (Continued)

List of plants, plant products and other objects whose introduction into the union from certain third countries is prohibited		
Description	CN code	Third country, group of third countries or specific area of third country
3. Plants of <i>Populus</i> L., with leaves, other than fruit and seeds	ex 0602 10 90 ex 0602 20 20 ex 0602 20 80 ex 0602 90 41 ex 0602 90 45 ex 0602 90 46 ex 0602 90 48 ex 0602 90 50 ex 0602 90 70 ex 0602 90 99 ex 0604 20 90 ex 1404 90 00	Canada, Mexico, United States
4. Isolated bark of <i>Castanea</i> Mill.	ex 1404 90 00 ex 4401 40 90	All third countries
5. Isolated bark of <i>Quercus</i> L., other than <i>Quercus suber</i> L.	ex 1404 90 00 ex 4401 40 90	Canada, Mexico, United States
6. Isolated bark of <i>Acer saccharum</i> Marsh.	ex 1404 90 00 ex 4401 40 90	Canada, Mexico, United States
7. Isolated bark of <i>Populus</i> L.	ex 1404 90 00 ex 4401 40 90	The Americas
8. Plants for planting of <i>Chaenomeles</i> Ldl., <i>Crateagus</i> L., <i>Cydonia</i> Mill., <i>Malus</i> Mill., <i>Prunus</i> L., <i>Pyrus</i> L. and <i>Rosa</i> L., other than dormant plants free from leaves, flowers and fruits	ex 0602 10 90 ex 0602 20 20 ex 0602 20 80 ex 0602 40 00 ex 0602 90 41 ex 0602 90 45 ex 0602 90 46 ex 0602 90 47 ex 0602 90 48 ex 0602 90 50 ex 0602 90 70 ex 0602 90 91 ex 0602 90 99	Third countries other than Albania, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canary Islands, Faeroe Islands, Georgia, Iceland, Liechtenstein, Moldova, Monaco, Montenegro, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (Severo- Zapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo-Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug)), San Marino, Serbia, Switzerland, Turkey, Ukraine and the United Kingdom
9. Plants for planting of <i>Cydonia</i> Mill., <i>Malus</i> Mill., <i>Prunus</i> L. and <i>Pyrus</i> L. and their hybrids, and <i>Fragaria</i> L., other than seeds	ex 0602 10 90 ex 0602 20 20 ex 0602 90 30 ex 0602 90 41 ex 0602 90 45 ex 0602 90 46 ex 0602 90 48 ex 0602 90 50 ex 0602 90 70 ex 0602 90 91 ex 0602 90 99	Third countries other than Albania, Algeria, Andorra, Armenia, Australia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canada, Canary Islands, Egypt, Faeroe Islands, Georgia, Iceland, Israel, Jordan, Lebanon, Libya, Liechtenstein, Moldova, Monaco, Montenegro, Morocco, New Zealand, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (SeveroZapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (Severo- Kavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug)), San Marino, Serbia, Switzerland, Syria, Tunisia, Turkey, Ukraine, the United Kingdom and United States other than Hawaii
10. Plants of <i>Vitis</i> L., other than fruits	0602 10 10 0602 20 10 ex 0604 20 90 ex 1404 90 00	Third countries other than Switzerland
11. Plants of <i>Citrus</i> L., <i>Fortunella</i> Swingle, <i>Poncirus</i> Raf. and their hybrids, other than fruits and seeds	ex 0602 10 90 ex 0602 20 20 0602 20 30 ex 0602 20 80 ex 0602 90 45 ex 0602 90 46 ex 0602 90 47 ex 0602 90 50 ex 0602 90 70 ex 0602 90 91 ex 0602 90 99 ex 0604 20 90 ex 1404 90 00	All third countries

TABLE 8 (Continued)

List of plants, plant products and other objects whose introduction into the union from certain third countries is prohibited			
	Description	CN code	Third country, group of third countries or specific area of third country
12.	Plants for planting of <i>Photinia</i> Ldl., other than dormant plants free from leaves, flowers and Fruits	ex 0602 10 90 ex 0602 90 41 ex 0602 90 45 ex 0602 90 46 ex 0602 90 47 ex 0602 90 48 ex 0602 90 50 ex 0602 90 70 ex 0602 90 91 ex 0602 90 99	China, Democratic People's Republic of Korea, Japan, Republic of Korea and United States
13.	Plants of <i>Phoenix</i> spp. other than fruit and seeds	ex 0602 20 20 ex 0602 20 80 ex 0602 90 41 ex 0602 90 45 ex 0602 90 46 ex 0602 90 47 ex 0602 90 50 ex 0602 90 70 ex 0602 90 99 ex 0604 20 90 ex 1404 90 00	Algeria, Morocco
18.	Plants for planting of Solanaceae other than seeds and the plants covered by entries 15, 16 or 17	ex 0602 90 30 ex 0602 90 45 ex 0602 90 46 ex 0602 90 48 ex 0602 90 50 ex 0602 90 70 ex 0602 90 91 ex 0602 90 99	Third countries other than: Albania, Algeria, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canary Islands, Egypt, Faeroe Islands, Georgia, Iceland, Israel, Jordan, Lebanon, Libya, Liechtenstein, Moldova, Monaco, Montenegro, Morocco, North Macedonia, Norway, Russia (only the following parts: Central Federal District (Tsentralny federalny okrug), Northwestern Federal District (Severo-Zapadny federalny okrug), Southern Federal District (Yuzhny federalny okrug), North Caucasian Federal District (SeveroKavkazsky federalny okrug) and Volga Federal District (Privolzhsky federalny okrug)), San Marino, Serbia, Switzerland, Syria, Tunisia, Turkey, Ukraine and the United Kingdom

3.3.3 | Legislation addressing the organisms vectored by Scolytinae (Commission Implementing Regulation 2019/2072)

Many symbiotic organisms (fungi, bacteria, yeasts, nematodes) are vectored by Scolytinae (Hofstetter et al., 2015; Kirisits, 2004; Raffa et al., 2015). Several common genera of fungi associated with bark and ambrosia beetles, *Ophiostoma*, *Ceratocystiopsis*, *Grosmannia*, *Ceratocystis*, *Leptographium* include recognised phytopathogenic species. In the 20th century, the world spread of the Dutch elm disease was caused by *Ophiostoma ulmi* and *O. novo-ulmi* vectored by *Scolytus* species (Brasier & Buck, 2001; Smith & Hulcr, 2015). The recently emerged pest, *Pityophthorus juglandis* kills walnuts because of its association with the ascomycete *Geosmithia morbida* (EPPO, 2020). The North American *P. minutissimus* and *P. pruinosus* qualify as potential quarantine species in the EU because they vector the oak pathogen *Bretziella (Ceratocystis) fagacearum* (EFSA PLH Panel, 2019). It is the combined action of the scolytine *Xyleborus glabratus* and of its symbiont *Harringtonia (Raffaelea) lauricola* that caused the death of millions of *Persea borbonia* after the pair had arrived in North America (Smith & Hulcr, 2015). Four phytopathogenic species are regulated in the EU (Table 9). See also Appendix G.

TABLE 9 Organisms vectored by non-EU Scolytinae spp. in Commission Implementing Regulation 2019/2072 (9 October 2023).

Annex II	Union quarantine pests Part A (not known to occur in the EU)
	B. Fungi and oomycetes
5.	<i>Bretziella fagacearum</i> m (Bretz) Z.W de Beer, T.A. Duong & M.J. Wingfield, comb. nov. [CERAFA]
20.	<i>Neocosmospora ambrosia</i> (Gadd & Loos) L. Lombard & Crous [FUSAAM]
21.	<i>Neocosmospora euwallaceae</i> (S. Freeman, Z. Mendel, T. Aoki & O'Donnell) Sandoval-Denis, L. Lombard & Crous [FUSAEW]
	Union quarantine pests Part B (known to occur in the EU)
	B. Fungi and oomycetes
1.	<i>Geosmithia morbida</i> Kolarik, Freeland, Utley & Tisserat [GEOHMO]

3.4 | Entry, establishment and spread in the EU

3.4.1 | Entry

Is the pest able to enter into the EU territory? If yes, identify and list the pathways.

Yes, non-EU Scolytinae can enter the EU. Interceptions are reported in Europhyt and Traces.

Comment on plants for planting as a pathway.

Plants for planting (excluding pollen) provide a pathway for entry (9 out of 216 interceptions were on plants). Most interceptions are on wood and wood packaging material.

Potential pathways for non-EU Scolytinae into the EU are summarised in [Table 10](#).

TABLE 10 Potential pathways for non-EU Scolytinae into the EU.

Pathways (e.g. host/intended use/source)	Life stage	Relevant mitigations within Implementing Regulation 2019/2072
Host plants for planting	All stages	Annex VII, point 32
Cut branches	All stages	Annex VII, point 32
Dunnage (solid wood packaging material)	All stages	ISPM 15
Wood with bark	All stages	Annex VII, points 79 and 81

Annex VII of EU 2019/2072 details the special requirements necessary for specified plants, plant products and other objects originating from third countries which could provide a pathway for entry of non-EU Scolytinae. Details are at points 32, 79 and 81 of Annex VII.

Analysis of import data

Import data for 13 different HS codes of selected non-coniferous wood and wood products (Appendix H) were extracted from Eurostat for the 6-year period 2017–2022. The sum of annual imports from the world's biogeographic realms are shown in [Figure 5](#). A global map indicating the realms is shown in Appendix J. Details of imports by HS code from each realm are provided in Appendix H. Most of the non-coniferous wood is sourced from the Palearctic, Asia and Oriental region. Strictly, non-EU European countries (and EU countries) would be considered as within the Palearctic region but have been shown separately for the purposes of this of opinion.

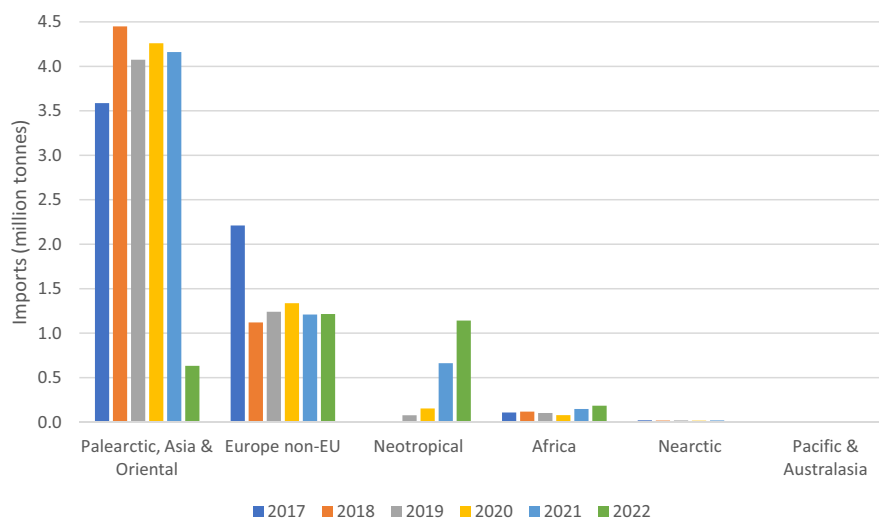


FIGURE 5 EU annual imports on non-coniferous wood (selected HS codes) from the world's biogeographic realms (in million tonnes).

Approximately 48% of non-native Scolytinae established in the EU originate from the Palearctic, Asia and Oriental region. Table 11 summarises EU imports by HS code from all realms in descending order of total imports in the period 2017 to 2022.

TABLE 11 Summary of EU annual imports of selected non-coniferous woods, 2017–2022 (in tonnes). Detailed descriptions of HS codes are provided in Appendix H. (Source Eurostat, <https://trade.ec.europa.eu/access-to-markets/en/statistics>).

HS code Short description	2017	2018	2019	2020	2021	2022	Mean
4403 95 <i>Betula</i> > 15 cm	2,742,345	3,352,120	3,027,133	3,360,609	3,370,329	415,457	2,711,332
4415 Boxes, crates	813,936	977,812	974,836	945,571	1,085,232	1,147,349	990,789
4403 96 <i>Betula</i> < 15 cm	1,130,244	849,722	938,010	846,014	719,047	201,870	780,818
4403 98 <i>Eucalyptus</i>	1068	1636	70,996	147,066	695,660	1,194,634	351,843
4403 97 <i>Populus</i>	568,484	315,954	300,040	392,856	158,079	33,911	294,887
4403 49 Tropical wood	104,455	107,887	94,407	66,670	93,551	106,723	95,616
4403 12 Non-coniferous rough wood	478,085	139	680	3382	469	1664	80,737
4403 93 <i>Fagus</i> > 15 cm	24,245	42,718	45,988	31,707	35,807	64,584	40,842
4403 91 <i>Quercus</i>	31,381	23,740	24,547	19,227	23,895	10,057	22,141
4403 94 <i>Fagus</i> < 15 cm	26,500	29,147	24,960	20,931	17,030	8509	21,180
4406 12 Railway sleepers	18,992	20,473	19,408	19,889	12,936	14,137	17,639
4403 42 Teak wood	0	0	0	0	0	3186	531
4403 41 Maranti wood	13	1	20	0	1513	0	258
Sum	5,939,748	5,721,349	5,521,025	5,853,922	6,213,548	3,202,081	5,408,612

Interceptions

In assembling information for this group categorisation, we found that 165 Scolytinae species had already invaded areas outside of their native range, including into the EU. Interception data in the Traces and Europhyt databases indicate imported wood and wood packaging material provide the most interceptions. This aligns with the Scolytinae literature which reports that the primary pathways facilitating international spread are traded wood and wood packaging material (Brockerhoff et al., 2003; Lantschner et al., 2020; Ward et al., 2023).

Notifications of interceptions of harmful organisms began to be compiled in Europhyt in May 1994 and in TRACES in May 2020. A search of the Europhyt and Traces databases revealed 216 unique records where 'Scolytidae' were recorded as the harmful organism intercepted. Previously Scolytidae was regarded as a family of Coleoptera but nowadays the members are classified as Scolytinae, a subfamily of weevils (Curculionidae). Because all non-EU Scolytinae are regarded as quarantine pests (EU 2019/2072, Annex II, Part A point 65), it was not necessary for interceptions to be identified further (Appendix I). Almost 95% of EU interceptions of 'Scolytidae' were associated with traded wood or wood packaging material. The majority of interceptions (67.6%, 146 of 216) were intercepted with wood and bark commodities such as CN 4407 (Sawn wood of a thickness exceeding 6 mm). 27.3% (59 of 216) of the interceptions were associated with wooden packaging material such as crates, dunnage and pallets; 4.2% (9 of 216) were associated with plants and two records (0.9%) did not indicate what the Scolytidae were found on or in. Table 12 shows the sources of interceptions of Scolytidae on wood and bark.

TABLE 12 Scolytidae interceptions associated with coniferous and non-coniferous wood and bark.

Year																
Country of origin	2002	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Sum
Cameroon						8	5	13	14	3	12	2	1	1		59
Congo						5	6	6	3	5	8	3	1	1	1	39
United States	1						1		2	3	1	2	2		1	13
Russian Federation		1		2	4											7
Central African Republic								2		1	2		1			6
Equatorial Guinea						1		1	1	1						4
Gabon						2	2									4
Bulgaria*			2	1												3
Dem. Rep. Congo									3							3
Ukraine					3											3
Romania*		2														2
Switzerland												2				2
Canada					1											1
Sum	1	3	2	3	8	16	14	22	23	13	23	9	5	2	2	146

*Bulgaria and Romania joined the EU on 1st January 2007.

Note that the interceptions above include interceptions with coniferous and non-coniferous wood.

Table 13 shows the sources of interceptions of Scolytidae with wood packaging material.

TABLE 13 Scolytidae interceptions with coniferous and non-coniferous wood packaging material.

Year																
Country of origin	1999	2000	2001	2005	2006	2007	2008	2009	2012	2013	2014	2015	2016	2017	2018	Sum
China	3	5		1	1		2		1	4	7	4	8	1	2	39
India						2		3	1		1					7
Brazil				1		1				1						3
Portugal								1	1							2
Russian Federation					1		1									2
Canada			1													1
Honduras			1													1
Pakistan						1										1
Romania*				1												1
Turkey					1											1
Unknown			1													1
Sum	3	5	3	3	3	4	3	4	3	5	8	4	8	1	2	59

*Bulgaria and Romania joined the EU on 1st January 2007.

Some EU interceptions of Scolytinae have been identified to genus and/or species level. These are shown as separate records to interceptions of 'Scolytidae' in EuroPhyt and Traces. Individual searches of each of the 39 genera known to have spread and become invasive were searched in EuroPhyt and Traces. Six of the 39 genera have been intercepted in the EU (Table 14). *Xyleborus* represent over 35% of interceptions where a scolytine genus is named. The majority of interceptions of named genera are from Asia (82.9%, 150 of 181 interceptions) (See also Appendix I).

TABLE 14 Country of origin and year of interception for named genera of Scolytinae reported in Europhyt or Traces.

Genus	From	2011	2014	2015	2016	2017	2018	2019	2020	2021	Sum
<i>Xyleborus</i>	China				38	13					51
	Vietnam		6								6
	Cameroon				2					1	3
	India	2									2
	USA							2			2
	Costa Rica									1	1
<i>Sub-total</i>											65
<i>Xylosandrus</i>	China			5	28	8					41
	USA							6	2	7	15
<i>Sub-total</i>											56
<i>Xyleborinus</i>	China				11	15	4	10	5		45
	USA							3			3
<i>Sub-total</i>											48
<i>Scolytus</i>	USA						3	4			7
<i>Sub-total</i>											7
<i>Cryphalus</i>	China									1	1
	Malaysia									2	2
<i>Sub-total</i>											3
<i>Coccotrypes</i>	China			2							2
<i>Sub-total</i>											2
Sum											181

The following species are recorded in Europhyt or TRACES: *Coccotrypes cyperi*, *Scolytus multistriatus*, *Xyleborinus artestriatus*, *X. saxesenii*, *X. affinis*, *X. volvulus*, *Xylosandrus compactus* and *Xylosandrus crassiusculus*.

3.4.2 | Establishment

Is the pest able to become established in the EU territory?

Yes, some of the Scolytinae species are able to establish in the EU territory because a) their host plants are present, or they are sufficiently polyphagous to attack new hosts; and b) some are found in countries with climates matching those in the EU.

Climatic mapping is the principal method for identifying areas that could provide suitable conditions for the establishment of a pest, taking key abiotic factors into account (Baker, 2002). The availability of hosts is considered in Section 3.4.2.1. Climatic factors are considered in Section 3.4.2.2.

3.4.2.1 | EU distribution of main host plants

Among the 65 species within Appendix D that scored 10/10, all showing a very high degree of polyphagy, 52 are xylomycetophagous and 13 show different feeding habits. In this respect, xylomycetophagous species find suitable hosts more easily, as the only limitation for their establishment is the survival of the symbiont fungus on which the insect feeds, and these fungi can generally grow in many different plants. Thus, the xylomycetophagous species may infest large numbers of host plants (a mean of 20 host families with a range of 2–90, and 69 host plants with a range of 3–703 per species), many of which are even still unknown because never recorded so far. For these reasons, the risk of establishment in the EU Member States of xylomycetophagous species is less dependent upon the availability of known hosts. Moreover, the 13 non-xylomycetophagous species in the list also have many recorded hosts (mean of 22 host families with a range of 3–53, and 50 host plants with a range of 3–156 per species).

A range of broadleaf trees grow widely within the EU. In European deciduous forests, common broadleaved species include *Quercus* spp. (oaks), *Fagus sylvatica* (European beech), *Carpinus betulus* (hornbeam), *Fraxinus* spp. (ash) and *Castanea*

spp. (chestnut); at higher altitudes *Fagus* spp. are the dominant broadleaf deciduous species (Dreiss & Volin, 2014). The distribution of broadleaf forests in Europe is shown in Figure 6 (CORINE Land Cover, 2018).

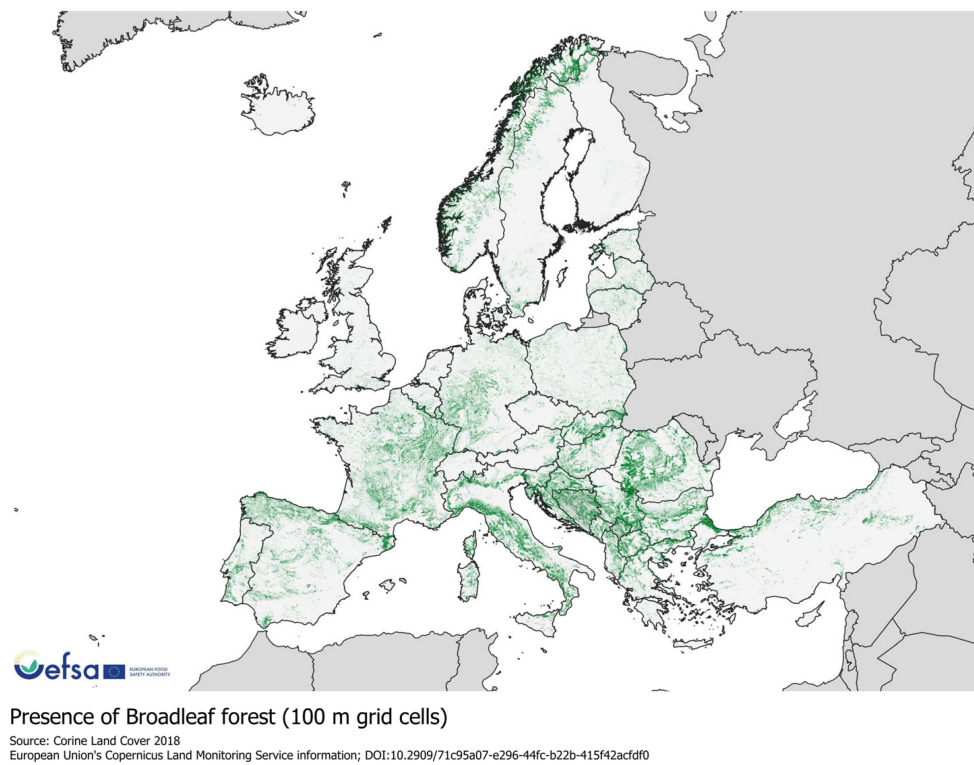


FIGURE 6 The distribution of European broadleaf forests (data source: CORINE Land Cover, 2018).

The distribution of specific broadleaf tree species is shown in Figure 7.

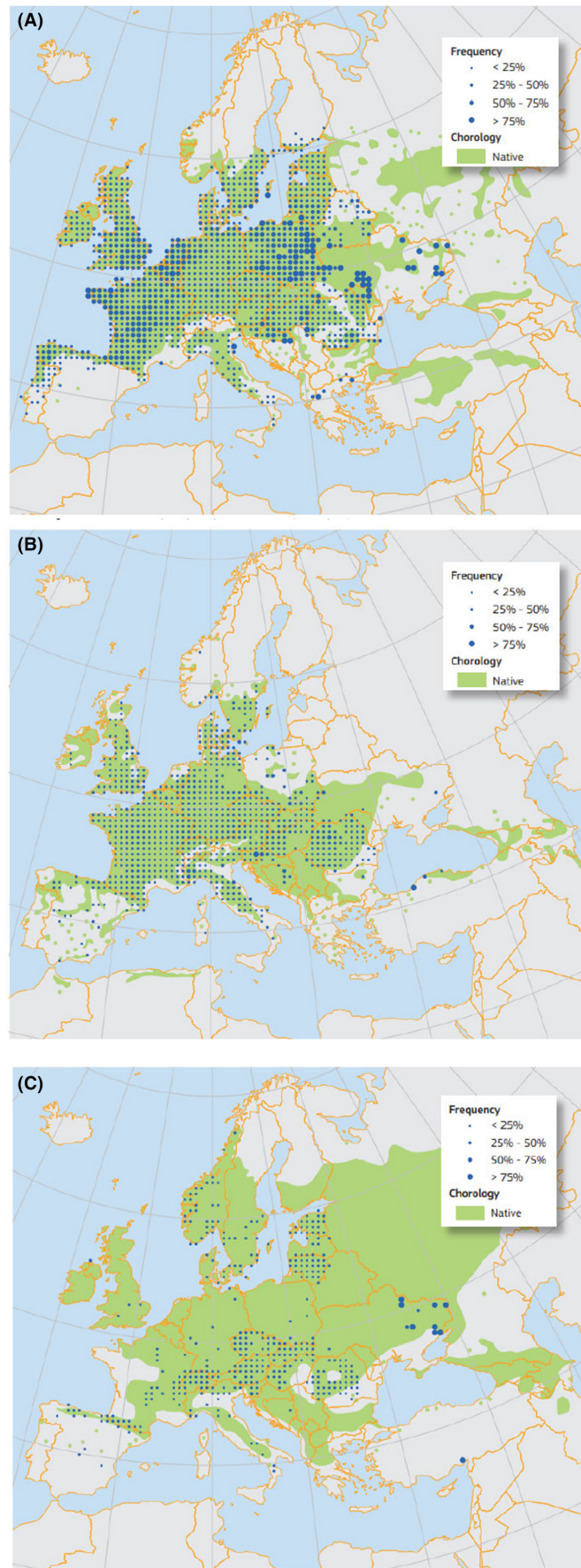


FIGURE 7 (a) Plot distribution and simplified chorology map for *Quercus robur*. Frequency of *Quercus robur* occurrences within the field observations as reported by the National Forest Inventories (Eaton et al., 2016). https://ies-ows.jrc.ec.europa.eu/efdac/download/Atlas/pdf/Quercus_robur_petraea.pdf. (b) Plot distribution and simplified chorology map for *Prunus avium*. Frequency of *Prunus avium* occurrences within the field observations as reported by the National Forest Inventories (Welk et al., 2016). (c) Plot distribution and simplified chorology map for *Ulmus glabra*. Frequency of *Ulmus glabra* occurrences within the field observations as reported by the National Forest Inventories (Caudullo & de Rigo, 2016). (a–c) Plot distributions and simplified chorology maps for specific broadleaf tree (non-coniferous) hosts of non-EU Scolytinae.

3.4.2.2 | Climatic conditions affecting establishment

All the species within Appendix D associated with a higher risk of introduction in the EU are distributed in non-European countries having at least 50% of climatic compatibility with the EU MSs, and half of these species present a compatibility of 92%. Moreover, 57, 46 and 38 out of 57 species, respectively, show compatibility with 'Temperate oceanic', 'Continental uniform precipitation cold summer', and 'Temperate dry hot summer' climatic areas, the most highly represented climatic types in the EU with a surface of 50%, 14% and 13%, respectively. Considering this, climate compatibility does not seem to be a limitation for the establishment of these species in the EU.

3.4.3 | Spread

Describe how the pest would be able to spread within the EU territory following establishment?

The pest would be able to spread within the EU territory by autonomous or semi-passive flight, or transported in wood, wood products, solid wood packaging material, plants for planting (excluding pollen) and, possibly, by hitchhiking.

Comment on plants for planting as a mechanism of spread.

Living plants can be infested by Scolytinae, especially by xylomycetophagous species, often with little external symptoms except a few small entry holes and some sawdust.

Spread can occur by flight, with transported wood and wood products, or with plants for planting. An example of a probable combination of factors is given by Marchioro and Faccoli (2021), on the spread of *P. juglandis* in the Veneto region (Italy) during the 2013–2020 period. They measured an average annual spread of 9.4 km, likely to be due to direct flight but also recorded single dispersal events at longer distances (maximum 40 km), possibly due to the transportation of infested material.

Spread by flight. Only a few examples of wind-tunnel experiments on non-coniferous Scolytinae are available. Kees et al. (2017) found that *P. juglandis* could fly at most 3.6 km in 24 h. Seo et al. (2017) recorded shorter distances for *X. glabratus* and *Monarthrum mali* (an average 17.6 m in 24 h for *X. glabratus*; over 100 m for *M. mali*). More examples relating to species attacking coniferous hosts are provided and will be considered here, as these species do not differ in size or behaviour from the species attacking non-coniferous hosts. Anecdotal information is available regarding conifer bark beetles found in the tundra as far as 170 km north of the limit of spruce in Finland (Nilssen, 1984). Flight-mill experiments suggest that a fraction of an *Ips sexdentatus* population is able to fly more than 45 km (Jactel & Gaillard, 1991). In field experiments in New-Zealand, Chase et al. (2017) trapped *Hylurgus ligniperda* and *Hylastes ater* more than 25 km from the nearest host-trees. The capacity of *Dendroctonus ponderosae* to travel long distances by flight has been demonstrated in British Columbia by Jackson et al. (2008), using meteorological radar recordings coupled with aerial samplings with a drogue net pulled by an airplane. Beetles were caught up to 800 m above the forest canopy at a mean density of 4950 beetles/ha and covering 30–110 km/day. Semi-passive, wind-directed high-altitude flight is reported or strongly suspected among many insect species (Reynolds et al., 2017), including plant pests (EFSA PLH Panel, 2018a, 2018b) or vectors of animal or human diseases (Hendrickx et al., 2008). Recent experimental results based on pheromone trap transects from an outbreak hotspot in the French Ardennes to the French and British coasts along the English Channel provide evidence that *Ips typographus* can fly several hundreds of km (Inward et al., 2024). This could explain the recent establishment of breeding populations in southern England (Blake et al., 2024).

Transportation with wood, wood products and solid wood packaging material. Recent reviews are provided by Meurisse et al. (2019) and Turner et al. (2021). Large numbers of interceptions have been reported from these commodities.

Plants for planting (excluding pollen) are a known pathway, including for species developing in young twigs, such as *Xylosandrus morigerus* (Kirkendall & Faccoli, 2010), *X. crassiusculus* (EFSA PLH Panel, 2020a, 2020b, 2020c) or *X. compactus* (Anses, 2017).

3.5 | Impacts

Would the pests' introduction have an economic or environmental impact on the EU territory?

Yes, as illustrated by the large impact of native Scolytinae species and of species introduced in new territories, some non-EU Scolytinae species would have an economic or environmental impact on hosts in the EU territory.

The history of forest health includes many episodes of damaging outbreaks caused by native or introduced Scolytinae, causing economic, environmental and social damage (Smith & Hulcr, 2015). Some native species are major pests in their range. In Canada, *D. ponderosae* killed about 730 million m³ of *Pinus contorta* in British Columbia between 1999 and 2015 (British Columbia Government, 2024). In Europe, more than 25 million m³ of spruce were killed by *I. typographus* in the Czech Republic alone, between 2018 and 2019 (Hlásny et al., 2021). These well-known species, however, attack conifers and are not known to have crossed geographic barriers, except *D. ponderosae* taking advantage of winter warming to cross the Rocky Mountains from British Columbia to Alberta (Robertson et al., 2009), and *I. typographus* crossing the English Channel by flight (Inward et al., 2024). Most of the Scolytinae attacking non-coniferous hosts that cause massive outbreaks are known as very mobile, especially when associated with pathogenic fungi that help them to overcome tree resistance. A classic example is the Eurasian species *S. multistriatus*, vector of the highly virulent pathogens associated with the Dutch elm disease. The disease was caused in a first trans- and inter-continental wave by *O. ulmi* and, in a second wave, by *O. novo-ulmi* and developed devastating pandemics in the twentieth century (Brasier, 1991; Brasier & Buck, 2001). During the spread of *O. novo-ulmi* in the 1970s, most mature European elms were killed, as well as hundreds of millions in North America (Brasier & Buck, 2001). More recently, in the early 2000s, the redbay ambrosia beetle, *X. glabratus*, innocuous in its native range in southeast Asia, was introduced into southeastern US (Smith & Hulcr, 2015), together with its associated fungus *Raffaelea lauricola*. The pair killed more than 300 million redbay trees (*Persea borbonia* L. Spreng.) as well as attacking several other Lauraceae, including avocado, *Persea americana* Mill. (Hughes et al., 2017). Similarly, the walnut twig beetle, *P. juglandis* and its associated fungus, *G. morbida*, were living innocuously on weakened branches and twigs of *Juglans major* in their native range in Arizona and New Mexico. They encountered *J. nigra* and *J. regia* at the end of the 20th century or the very beginning of this century and started massively killing these new hosts (EPPO, 2024). They also rapidly spread along the west coast of the USA as well as to several states in the east of the country, crossed the Atlantic and established in Italy (Montecchio & Faccoli, 2014) and France (Saurat et al., 2023). Other examples involving introduced Scolytinae, their associated fungi and their impact in newly invaded areas include *E. fornicatus*, *X. crassiusculus* and *X. compactus*.

Broadleaf trees provide a range of ecosystem services, including provisioning services, (e.g. timber and fruit production), carbon sequestration, clean drinking water, erosion prevention, recreation, tourism, aesthetics, property value security and others (Dreiss & Volin, 2014). In addition to killing trees and damaging their wood (staining due to fungal activity and structural weakening caused by the galleries), Scolytinae exert an important environmental impact in all these respects (Grégoire et al., 2015).

Major uncertainties in predicting impact: (i) the possible future international spread of species so far only known as local pests (review of North American harmful species by Smith & Hulcr, 2015); (ii) the emergence of novel insect-pathogen-host associations after establishment in a new territory, with major consequences on new hosts. Examples: *Ophiostoma novo-ulmi* (Brasier & Buck, 2001); *X. glabratus* and *R. lauricola* (Smith & Hulcr, 2015).

The emergence of unexpected pests ('unknown unknowns') is documented by the history of the Google Scholar citations used in this study, as illustrated for three recently emerged pests, *X. glabratus*; *P. juglandis* and *G. morbida* (the bark beetle vector and fungal agent of the Thousand Canker Disease of walnuts); *E. fornicatus* (Figure 8). These three species were almost unknown and would have been considered harmless before 2005.

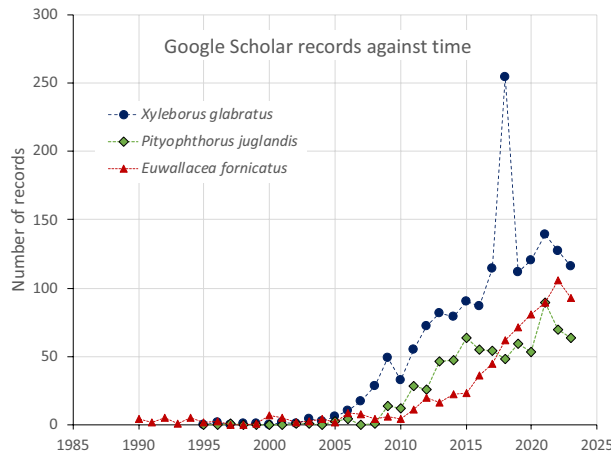


FIGURE 8 Google Scholar citations against time for three scolytine species that recently established and caused damage in new territories.

3.6 | Available measures and their limitations

Are there measures available to prevent pest entry, establishment, spread or impacts such that the risk becomes mitigated?

Yes, see Sections 3.3, 3.4 and 3.6.1.

3.6.1 | Identification of potential additional measures

Phytosanitary measures (prohibitions) are currently applied to some host plants for planting (see 3.3.2).

Additional potential risk reduction options and supporting measures are shown in Sections 3.6.1.1 and 3.6.1.2.

3.6.1.1 | Additional potential risk reduction options

Potential additional control measures are listed in Table 15.

TABLE 15 Selected control measures (a full list is available in EFSA PLH Panel, 2018a, 2018b) for pest entry/establishment/spread/impact in relation to currently unregulated hosts and pathways. Control measures are measures that have a direct effect on pest abundance.

Control measure/risk reduction option (blue underline = Zenodo doc, blue = WIP)	RRO summary	Risk element targeted (entry/establishment/spread/impact)
<u>Require pest freedom</u>	Plant or plant product comes from country officially free from pest or from pest free area or (plants for planting) from pest free production sites or places of production	Entry/Spread
<u>Growing plants in isolation</u>	Places of production of plants for planting are insect proof, with complete physical isolation	Entry/Spread
<u>Managed growing conditions</u>	Plants collected directly from natural habitats, have been grown, held and trained for at least two consecutive years prior to dispatch in officially registered nurseries, which are subject to an officially supervised control regime	Entry/Spread
<u>Roguing and pruning</u>	Plants which have shown symptoms giving rise to the suspicion of contamination by the pests have been rogued out at that place and the plants have undergone appropriate treatment to rid them of specified pests	Entry/Spread/Impact

TABLE 15 (Continued)

Control measure/risk reduction option (<u>blue underline = Zenodo doc</u> , <u>blue = WIP</u>)	RRO summary	Risk element targeted (entry/establishment/spread/impact)
<u>Biological control and behavioural manipulation</u>	<p><u>Biological control</u>: many natural enemies (predators, parasitoids and pathogens) of scolytine species have been recorded and have a variable and fluctuating impact on natural populations, but none have so far been successfully released against Scolytinae attacking non-coniferous hosts (Kenis et al., 2004; Wegensteiner et al., 2015)</p> <p><u>Pheromone mass-trapping</u> has been unsuccessfully attempted against <i>Scolytus multistriatus</i> (Birch et al., 1982). In spite of previous claims, recent experimental results demonstrate that mass-trapping is also inefficient against conifer Scolytinae (Kuhn et al., 2022)</p> <p><u>Mating disruption</u> appears ineffective to date, as illustrated by the lack of effectiveness of pheromone mass-trapping</p> <p><u>Push-pull strategies</u> (repelling the pest from stands under protection while attracting them to non-host stands) is under investigation (e.g. Rivera et al., 2020), but no practical application has been developed so far</p> <p><u>Sterile Insect Techniques (SIT)</u> have not been used against Scolytinae. One difficulty would be to mass-produce the insects</p>	Spread/Impact
<u>Chemical treatments on crops including reproductive material</u>	Contact insecticides can be applied on wood and wood products; contact and systemic insecticides can be used to protect plants for planting	Entry/Spread/ Establishment/ Impact
<u>Chemical treatments on consignments or during processing</u>	<p>Use of chemical compounds that may be applied to plants or to plant products after harvest, during process or packaging operations and storage.</p> <p>The treatments addressed in this risk mitigation measure are:</p> <ol style="list-style-type: none"> fumigation; spraying/dipping pesticides; surface disinfectants; process additives; protective compounds <p>Host wood has been treated (e.g. fumigation, chemical pressure impregnation, ionising irradiation) prior to export</p>	Entry/Spread
<u>Physical treatments on consignments or during processing</u>	<p>The following categories of physical treatments belong to this measure: irradiation /ionisation; mechanical cleaning (brushing, washing); sorting and grading, and; removal of plant parts (e.g. debarking wood)</p> <p>Host wood is bark free and free from holes;</p> <p>Host wood bark and at least 2.5 cm of the outer sapwood are removed;</p> <p>Wood chips processed into pieces of not more than specified thickness and width</p>	Entry/Spread
<u>Cleaning and disinfection of facilities, tools and machinery</u>	<p>The physical and chemical cleaning and disinfection of facilities, tools, machinery, transport means, facilities and other accessories (e.g. boxes, pots, pallets, palox, supports, hand tools). The treatments addressed in this risk mitigation measure are: washing, sweeping and fumigation</p> <p>Prior to their export, machinery and vehicles which have been operated for agricultural or forestry purposes are cleaned and free from soil and plant debris</p>	Entry/ Spread
<u>Waste management</u>	Treatment of the waste from roguing and pruning (deep burial, composting, incineration, chipping, production of bio-energy...) in authorised facilities and official restriction on the movement of waste	Establishment/ Spread
<u>Heat and cold treatments</u>	<p>Controlled temperature treatments aimed to kill or inactivate pests without causing any unacceptable prejudice to the treated material itself. The measures addressed here are: autoclaving; steam; hot water; hot air; cold treatment</p> <p>Host wood is heat treated to achieve a minimum temperature of 56°C for a minimum duration of 30 continuous minutes throughout the entire profile of the wood</p> <p>Host wood is kiln dried to below 20% moisture</p>	Entry/ Spread
<u>Conditions of transport</u>	Commodities can be handled and packaged in ways to prevent infestation after leaving the place of production	Entry/ Spread
<u>Controlled atmosphere</u>	Treatment of plants by storage in a modified atmosphere (including modified humidity, O ₂ , CO ₂ , temperature, pressure)	Entry/ Spread (via commodity)
<u>Post-entry quarantine and other restrictions of movement in the importing country</u>	<p>This measure covers post-entry quarantine (PEQ) of relevant commodities; temporal, spatial and end-use restrictions in the importing country for import of relevant commodities; Prohibition of import of relevant commodities into the domestic country</p> <p>'Relevant commodities' are plants, plant parts and other materials that may carry pests, either as infection, infestation or contamination</p>	Establishment/ Spread

3.6.1.2 | *Additional supporting measures*

Potential additional supporting measures are listed in [Table 16](#).

TABLE 16 Selected supporting measures (a full list is available in EFSA PLH Panel, [2018a](#), [2018b](#)) in relation to currently unregulated hosts and pathways. Supporting measures are organisational measures or procedures supporting the choice of appropriate risk reduction options that do not directly affect pest abundance.

Supporting measure (blue underline = Zenodo doc, blue = WIP)	Summary	Risk element targeted (entry/establishment/ spread/impact)
Inspection and trapping	ISPM 5 (FAO, 2023) defines inspection as the official visual examination of plants, plant products or other regulated articles to determine if pests are present or to determine compliance with phytosanitary regulations. The effectiveness of sampling and subsequent inspection to detect pests may be enhanced by including trapping and luring techniques	Entry/Establishment/ Spread
Laboratory testing	Examination, other than visual, to determine if pests are present using official diagnostic protocols. Diagnostic protocols describe the minimum requirements for reliable diagnosis of regulated pests	Entry/Spread
Sampling	According to ISPM 31 (FAO, 2008), it is usually not feasible to inspect entire consignments, so phytosanitary inspection is performed mainly on samples obtained from a consignment. It is noted that the sampling concepts presented in this standard may also apply to other phytosanitary procedures, notably selection of units for testing. For inspection, testing and/or surveillance purposes the sample may be taken according to a statistically based or a non-statistical sampling methodology	Entry/Establishment/Spread
Phytosanitary certificate and plant passport	According to ISPM 5 (FAO, 2023) a phytosanitary certificate and a plant passport are official paper documents or their official electronic equivalents, consistent with the model certificates of the IPPC, attesting that a consignment meets phytosanitary import requirements: (a) export certificate (import) (b) plant passport (EU internal trade)	Entry/establishment/Spread
Certified and approved premises	Mandatory/voluntary certification/approval of premises is a process including a set of procedures and of actions implemented by producers, conditioners and traders contributing to ensure the phytosanitary compliance of consignments. It can be a part of a larger system maintained by the NPPO in order to guarantee the fulfilment of plant health requirements of plants and plant products intended for trade. Key property of certified or approved premises is the traceability of activities and tasks (and their components) inherent the pursued phytosanitary objective. Traceability aims to provide access to all trustful pieces of information that may help to prove the compliance of consignments with phytosanitary requirements of importing countries	Entry/Spread
Certification of reproductive material (voluntary/official)	Plants come from within an approved propagation scheme and are certified pest free (level of infestation) following testing; Used to mitigate against pests that are included in a certification scheme	Entry/Spread
Delimitation of Buffer zones	ISPM 5 (FAO, 2023) defines a buffer zone as 'an area surrounding or adjacent to an area officially delimited for phytosanitary purposes in order to minimise the probability of spread of the target pest into or out of the delimited area, and subject to phytosanitary or other control measures, if appropriate'. The objectives for delimiting a buffer zone can be to prevent spread from the outbreak area and to maintain a pest free production place (PFPP), site (PFPS) or area (PFA)	Spread
Surveillance	Surveillance to guarantee that plants and produce originate from a pest free area could be an option	Entry/Spread

3.6.1.3 | *Biological or technical factors limiting the effectiveness of measures*

- Identification of species if species names are used in phytosanitary regulation rather than 'non-EU Scolytinae'.
- Use of chemical or biological treatments in large natural areas (woods, forests), or in urban areas where no pesticides are allowed, or their use is regulated.
- Surveillance of large, wooded areas (also surrounding production places and points of introduction) is challenging.

3.7 | Uncertainty

At this point in a pest categorisation for a single species, only key uncertainties are normally considered. However, in this group pest categorisation a wider discussion of the uncertainties in determining the species most likely to satisfy quarantine pest status for the EU is warranted. There are uncertainties regarding species identification, entry, establishment and impact.

- **Species identification:** as noted in Section 3.1.4, no more than 25% of the Scolytine species are listed in identification keys, reliable methods for the identification of many species are not currently available, and many that are available rely on adult specimens. It may be difficult for non-specialised laboratories to identify some species. Dealing with a group consisting of several thousand species does not lend itself to having stable species nomenclature and it is inevitable that changes in taxonomy will occur; consequently, maintaining a correct species identification is challenging and could result in some uncertainties due to recent taxonomic reviews (e.g. Knizek & Smith, 2024) which may change species names causing a mismatch between the names reported in previous morphological identification keys and the new nomenclature. Finally, updated and reliable tools for molecular and/or morphological identification are not available for all species or genera, although protocols for molecular identification are quickly improving.
- **Entry:** Whilst some species absent from the EU are known to have colonised new territories, the vast majority are not known to have displayed any mobility. This, however, largely depends upon the specificities of international trade (origin, destination and nature of the commodities).
- **Establishment:** even though the range of host plants has been described for many species, some of these are very polyphagous or could adapt to new hosts, allowing establishment in areas devoid of the recognised normal hosts.
- **Impact:** Two different scales have been used in this study to assess impact: (a) direct information from the literature, for a limited number of species; (b) a risk score based upon biological features. These scales are not always congruent. The uncertainties associated with the Google Scholar citations have been discussed in Section 3.5.

As a group, some species in Appendix D will likely be able to enter, establish, spread and cause impact in the EU. The challenge is to identify which of the species from Appendix D are most likely to do this. Two approaches were used. One focused on those species that are known to have spread between land masses (Appendix E1); the other focussed on species traits and developed 'risk scores' (Appendix D and E2). A summary of the number of species with risk scores from 10 (strong likelihood of satisfying criteria for EU quarantine pest status) to 0 (weak likelihood of satisfying criteria for EU quarantine pest status) is provided in Table 17.

TABLE 17 The number of species in each risk score category and mean number of google scholar citations (Source: Appendix D).

'Risk score'	Number of species	% of species	Mean number of Google scholar citations per species	Standard deviation of mean citations
10	57	1.1	117.0	222.3
9	454	8.7	9.0*	24.4
8	547	10.5	10.7	35.0
7	490	9.4	3.7	10.7
6	1656	31.7	2.7	16.6
5	1506	28.9	1.6	2.5
4	218	4.2	2.2	2.9
3	172	3.3	1.5	2.0
2	26	0.5	1.7	2.2
1	34	0.7	1.0	1.2
0	60	1.1	1.0	1.0
	5220	100.0		

*Mean and standard deviation of Google Scholar citations for species with risk score 9 excludes coffee berry borer which has 11,500 citations (outlier).

Of 88 non-EU Scolytinae on non-coniferous hosts occurring on distinct land masses (i.e. indicating mobility as per Grégoire et al. (2023)), 12 species can be regarded as most likely to satisfy the criteria for EU potential quarantine pest status (Table 2: List 1 and Appendix E1, List 1). The cases for other species in Table 2, Lists 2–4 and Appendix E1, Lists 2–4) become progressively weaker.

When categorising species from a group as either quarantine or non-quarantine organisms there could be two possible types of error. One error type is to consider a species a quarantine pest erroneously because in truth it fails to satisfy the necessary criteria for quarantine pest status. This type of error can impact trade and gives the exporters and inspectors more work but its effects on the plants in the EU are minimal or non-existent because no harm would result if the organism was introduced into the risk assessment area. The other error is that an organism that does satisfy the criteria to be a quarantine pest is judged not to be a quarantine pest. The consequences resulting from this type of error could be much

larger to its hosts in the risk assessment area. Considering the lack of information for very many of the 4384 species of Scolytinae identified as having non-coniferous hosts, the resulting uncertainty makes it very likely that both types of errors are possible.

Using 'highly mobile' in the sense of Grégoire et al. (2023) and only listing the 12 species in Table 2, List 1, as EU quarantine pests is likely to result in some harmful non-EU Scolytinae not being categorised as quarantine pests. However, categorising the 44 species with risk scores of 10 in Appendix E2 as EU quarantine pests is likely to result in some species being categorised as quarantine species when in reality their introduction into the EU will not have significant impact.

4 | CONCLUSIONS

Some species among the non-EU Scolytinae attacking non-coniferous hosts more strongly satisfy the criteria that are within the remit of EFSA to assess for them to be regarded as a potential Union quarantine pest (e.g. the 12 species in Table 2, List 1 or the 44 species with risk scores of 10 in Appendix E2) than others. Uncertainties exist over the magnitude of potential impacts for many species in the entire group.

Table 18 provides a summary of the PLH Panel conclusions.

TABLE 18 The Panel's conclusions on the pest categorisation criteria defined in Regulation (EU) 2016/2031 on protective measures against pests of plants (the number of the relevant sections of the pest categorisation is shown in brackets in the first column).

Criterion of pest categorisation	Panel's conclusions against criterion in regulation (EU) 2016/2031 regarding union quarantine pest	General uncertainties
Identity of the pest (Section 3.1)	The identity of the pest is well established, and the non-EU Scolytinae species are described in worldwide, regional or national catalogues and faunas	Although the identity is well established, species identification may prove difficult
Absence/presence of the pest in the EU (Section 3.2)	By definition, non-EU Scolytinae are not present in the EU, or if present are not widely distributed (here considered to mean that they occur in up to three EU Member States) and are under official control 5201 species are absent from the EU; an additional 19 spp. are present in three EU MSs or less	None presently, but when dealing with such a large number of species, the distribution of an individual species could change rapidly
Pest potential for entry, establishment and spread in the EU (Section 3.4)	Yes, many species are able to enter into, become established in, and spread within, the EU territory. Their main pathways are wood, solid wood packaging material and plants for planting (excluding pollen)	None
Potential for consequences in the EU (Section 3.5)	Some species in the group have demonstrated their capacity to have a high economic and environmental impact	There is a high uncertainty regarding the potential impact of species that have not (yet) expanded beyond their native range
Available measures (Section 3.6)	Yes, measures are available	There is a high uncertainty regarding the possibility to detect and hence prevent entry of many of the species of the group which have immature stages hidden deep in the sapwood
Conclusion (Section 4)	For some species of non-EU Scolytinae on non-coniferous hosts, all criteria assessed by EFSA above for consideration as a potential quarantine pest are met (the 12 species in Table 2, List 1 or the 44 species with risk scores of 10 in Appendix E2). However, other species with lower scores still present a plant health risk to the EU The Panel was not able to develop a method to discriminate confidently between species that clearly meet the criteria for potential quarantine pest status and those that do not	
Aspects of assessment to focus on/scenarios to address in future if appropriate	Research on the following issues would be beneficial: <ul style="list-style-type: none"> • Molecular and morphological identification methods for all Scolytinae species. • Generic detection methods for Scolytinae along the pathways (trapping, sound recording, portable GC–MS devices, ...). • More thorough understanding of the biology of many species and their associations with their host plants and with potential plant pathogens. 	

GLOSSARY

Containment (of a pest)

Application of phytosanitary measures in and around an infested area to prevent spread of a pest (FAO, 2023).

Control (of a pest)

Suppression, containment or eradication of a pest population (FAO, 2023).

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, 2023).

Eradication (of a pest)	Application of phytosanitary measures to eliminate a pest from an area (FAO, 2023).
Establishment (of a pest)	Perpetuation, for the foreseeable future, of a pest within an area after entry (FAO, 2023).
Greenhouse	A walk-in, static, closed place of crop production with a usually translucent outer shell, which allows controlled exchange of material and energy with the surroundings and prevents release of plant protection products (PPPs) into the environment.
Hitchhiker	An organism sheltering or transported accidentally via inanimate pathways including with machinery, shipping containers and vehicles; such organisms are also known as contaminating pests or stowaways (Toy & Newfield, 2010).
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, 2023).
Pathway	Any means that allows the entry or spread of a pest (FAO, 2023).
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, 2023).
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, 2023).
Risk reduction option (RRO)	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 RRO 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, 2023).

GLOSSARY SPECIFIC TO THIS OPINION AND THE BIOLOGY OF SCOLYTINAE

Feeding habit

Herbiphagous	eats herbaceous (non-woody) plants
Mycophagous	eats fungi (not growing in wood)
Myelophagous	eats pith in twigs and branches
Phloeophagous	feeds on phloem
Spermatophagous	eats seeds and fruits
Xylomycetophagous	eats fungi growing in wood
Xylophagous	eats woods

Reproduction

Bigamous	a male mates with only two females
Inbreeding polygynous	a male mates with multiple female siblings
Monogamous	a male mates with one female
Polygamous	a male mates with multiple females

Number of hosts

Monophagous	hosts are species in one genus
Oligophagous	more than one genus but all in the same plant family
Polyphagous	hosts in more than one plant family

ABBREVIATIONS

EPPO	European and Mediterranean Plant Protection Organization
FAO	Food and Agriculture Organization
IPPC	International Plant Protection Convention
ISPM	International Standards for Phytosanitary Measures
MS	Member State
PLH	EFSA Panel on Plant Health
PZ	Protected Zone
TFEU	Treaty on the Functioning of the European Union
ToR	Terms of Reference

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CONFLICT OF INTEREST

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SUPPORTING INFORMATION

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

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APPENDIX A

Scolytinae of conifers

These 708 species have coniferous hosts and are therefore outside the scope of this pest categorisation.

Appendix A is available under the [Supporting Information](#) section on the online version of the scientific output.

APPENDIX B

Scolytinae with broadleaf hosts, native or widespread in the EU

These 127 species of Scolytinae have broadleaf hosts and are either native to the EU or occur in four or more EU Member States. They do not satisfy criteria for further consideration as potential EU quarantine pests.

Appendix B is available under the [Supporting Information](#) section on the online version of the scientific output.

APPENDIX C

Scolytinae with broadleaf hosts, not present in the EU, occurring in countries with non-EU climate types

These 440 species of Scolytinae have broadleaf hosts and are not known to occur in the EU; they occur in countries with non-EU climate types. It is not clear that they satisfy all criteria to be potential EU quarantine pests.

Appendix C is available under the [Supporting Information](#) section on the online version of the scientific output.

APPENDIX D

Scolytinae with broadleaf hosts, not present in the EU or present with limited distribution occurring in countries which have an EU climate type

Scolytinae that have broadleaf hosts, are not known to occur in the EU or are present with limited distribution (i.e. occur in 3 or less EU Member States) and the countries in which they occur share a climate type with the EU are listed in the Excel sheet (5220 species).

Appendix D is available under the [Supporting Information](#) section on the online version of the scientific output.

APPENDIX E

Scolytinae from Appendix D with high mobility across landmasses

From the list of 5220 species in Appendix D, 88 species that show high mobility across landmasses (Gregoire et al., 2023) most likely satisfy the required criteria for potential EU quarantine pest status. They have been further subdivided into 4 lists:

List 1–12 species with high impact on plant health according to the literature (reviewed in Grégoire et al., 2023) (most likely to satisfy EU potential quarantine pest status);

List 2–16 species with low or doubtful impact on plant health (could be potential quarantine pests but no current strong evidence for likely significant impact in the EU if introduced. However, recall the examples of *Xyleborus glabratus*, *Pityophthorus juglandis* and *Euwallacea fornicatus* in Section 3.5 as organisms that would have been considered harmless before 2005, but are now causing significant impact where introduced).

List 3–48 species with no impact on plant health and recorded as 'introduced' or 'alien' in at least one country in the catalogues cited in Section 2.1.1 (could be potential quarantine pests but as with list 2, there is a lack of evidence for impact).

List 4–12 species with no impact on plant health and never recorded as alien (could be potential quarantine pests but as with list 2, there is a lack of evidence for impacts) (see Appendix E1).

The same 88 species are also shown in Appendix E2 with 'risk scores' shown.

Appendices E1 and E2 are available under the [Supporting Information](#) section on the online version of the scientific output.

APPENDIX F

Synoptic table of EURL evaluation of the 88 species in Appendix E, with reference to available morphological and molecular diagnostic methods

Species	Morphology		Molecular		Synthesis	
	Nb of methods	References ^a	Sequences available?	Barcoding possible? ^b	Category ^c	EURL comments
<i>Euwallacea fornicatus</i>	8	1, 2, 3, 4, 6, 17, #18, #42	x	Q	D	<i>Euwallacea fornicatus</i> species complex (lacking <i>E. fornicator</i>); complex identifiable with morphological and molecular tools but specific resolution barely feasible and/or not reliable; RT-PCR usable as alternative to barcoding
<i>Euwallacea kuroshio</i>	6	1, 4, 6, 17, #18, #42	x	Q	D	
<i>Euwallacea perbrevis</i>	6	1, 4, 6, 17, #18, #42	x	Q	D	
<i>Euwallacea interjectus</i>	7	2, 3, 5, 6, 17, #18, #42	x	Q	B	ITP sequence available; DNA barcoding gap
<i>Euwallacea validus</i>	6	2, 3, 6, 17, #18, #42	x	Y	A	ITP sequence and sequence records sufficient
<i>Hypothenemus crudiae</i>	5	7, #18, 24, 25, 28		N	D	Morphological identification of <i>Hypothenemus</i> species difficult (cf 3.2)
<i>Pityophthorus juglandis</i>	4	7, 8, 9, #18	x	Y	A	Q-Bank sequence; sequence records sufficient
<i>Pseudopityophthorus minutissimus</i>	2	7, #18	x	Q	B	DNA barcoding gap
<i>Pseudopityophthorus pruinosis</i>	2	7, #18	x	Q	B	DNA barcoding gap; taxonomic data uncertainties
<i>Scolytus schevyrewi</i>	2	10, #18	x	Q	A	Q-Bank sequence available; DNA barcoding gap
<i>Xyleborus ferrugineus</i>	10	2, 3, 6, 7, 17, #18, 24, 28, 35, #42	x	Y	A	ITP sequence and sequence records sufficient
<i>Xyleborus glabratus</i>	6	2, 3, 6, 17, #18, #42	x	Y	A	ITP and Q-Bank sequences; sequence records sufficient
<i>Amasa truncata</i>	2	#19, 22		N	B	Not actually an invasive species (11, 22)? (cf. 3.1)
<i>Ambrosiodmus rubricollis</i>	5	2, 3, 7, #18, #42	x	Y	A	ITP sequence and sequence records sufficient
<i>Ambrosiophilus compressus</i>	2	17, #19		N	B	Taxonomy to be updated (13) (cf. 3.1)
<i>Coccotrypes carpophagus</i>	5	7, 14, #18, 24, 28	x	Q	B	DNA barcoding gap
<i>Cryphalus dilutus</i>	3	15, #18, #42	x	Q	B	Taxonomic data uncertainties; DNA barcoding gap
<i>Cryphalus discretus</i>	3	37, 38, #42		N	B	Not an invasive species (15) (cf. 3.1)
<i>Cryphalus mangiferae</i>	5	14, #18, 28, 37, 38	x	Y	A	Sequence records sufficient; taxonomic data uncertainties; DNA barcoding gap
<i>Euwallacea piceus</i>	3	6, 12, 17	x	Q	B	Taxonomy to be updated (16) (cf. 3.1); ITP sequence available; DNA barcoding gap
<i>Euwallacea similis</i>	6	2, 3, 6, 14, 17, #42	x	Q	B	ITP sequence available; DNA barcoding gap
<i>Hypothenemus areccae</i>	6	7, 14, #18, #19, 24, 28	x	Q	D	Morphological identification of <i>Hypothenemus</i> species difficult (cf 3.2); DNA barcoding gap

(Continues)

(Continued)

Species	Morphology		Molecular		Synthesis	
	Nb of methods	References ^a	Sequences available?	Barcoding possible? ^b	Category ^c	EURL comments
<i>Hypothenemus birmanus</i>	3	7, 14, #18	x	Q	D	Morphological identification of <i>Hypothenemus</i> species difficult (cf 3.2); DNA barcoding gap
<i>Hypothenemus obscurus</i>	5	7, 14, #18, 24, 28	x	Y	C	Morphological identification of <i>Hypothenemus</i> species difficult (cf 3.2); Q-Bank sequence and sequence records sufficient
<i>Hypothenemus seriatus</i>	4	7, 14, #18, 24	x	Q	D	Sometimes considered as a synonym of <i>H. obscurus</i> ; morphological identification of <i>Hypothenemus</i> species difficult (cf 3.2); DNA barcoding gap
<i>Phloeotribus liminaris</i>	3	7, #18, 20	x	Q	D	DNA barcoding gap
<i>Xyleborus affinis</i>	11	2, 3, 6, 7, 14, 17, #18, #19, 24, 28, #42	x	Y	A	ITP sequence and sequence records sufficient
<i>Xyleborus perforans</i>	4	6, 17, #19, 21	x	Y	A	ITP sequence and sequence records sufficient
<i>Ambrosiodmus lewisi</i>	6	2, 3, 6, 17, #18, #42	x	Q	B	ITP sequence available; DNA barcoding gap
<i>Ambrosiodmus minor</i>	5	3, 6, 17, #18, #42	x	Q	B	ITP sequence available; DNA barcoding gap
<i>Ambrosiophilus atratus</i>	7	2, 3, 6, 17, #18, 36, #42	x	Q	B	ITP sequence available; DNA barcoding gap
<i>Ambrosiophilus nodulosus</i>	4	3, 6, 17, #42		N	B	Taxonomy to be updated (6) (cf. 3.1)
<i>Anisandrus maiche</i>	5	3, 6, 17, #18, #42	x	Y	A	ITP sequence and sequence records sufficient
<i>Cnestus mutilatus</i>	7	2, 3, 6, 14, 17, #18, #42	x	Y	A	ITP sequence and sequence records sufficient
<i>Cnestus pseudosolidus</i>	1	23		N	B	Barely invasive species (cf. 3.3)
<i>Coccotrypes aciculatus</i>	3	7, 14, #18	x	Q	B	DNA barcoding gap
<i>Coccotrypes advena</i>	5	7, 14, #18, 24, 28	x	Q	B	DNA barcoding gap
<i>Coccotrypes cyperi</i>	5	7, 14, #18, 24, 28	x	Q	B	DNA barcoding gap
<i>Coccotrypes robustus</i>	5	7, 14, #18, 24, 28		N	B	
<i>Coccotrypes rutschuruensis</i>	2	14, #18		N	B	
<i>Coccotrypes vulgaris</i>	2	#18,40		N	B	
<i>Coptoborus ricini</i>	4	2, 3, 14, #18		N	B	
<i>Cryphalus waplery</i>	1	41		N	B	Barely invasive species (cf. 3.3)
<i>Cryptocarenum heveae</i>	5	7, 14, #18, 24, 28		N	B	Taxonomic data uncertainties
<i>Cyclorhipidion distinguendum</i>	3	17, #18, #42	x	Y	A	ITP sequence and sequence records sufficient; taxonomic data uncertainties
<i>Cyclorhipidion pelliculosum</i>	6	2, 3, 14, 17, #18, #42	x	Y	A	ITP sequence and sequence records sufficient; taxonomic data uncertainties
<i>Dryocoetoides cristatus</i>	4	14, #18, 24, 28	x	Q	B	DNA barcoding gap
<i>Dryoxylon onoharaense</i>	4	3, 17, #18, #42	x	Q	B	ITP sequence available; DNA barcoding gap
<i>Eccoptyterus spinosus</i>	2	17, #18	x	Q	B	ITP sequence available; DNA barcoding gap
<i>Eidophelus jalappae</i>	3	7, 14, #18		N	B	
<i>Heteroborips seriatus</i>	3	3, 17, #18	x	Q	B	ITP sequence available; DNA barcoding gap

(Continued)

Species	Morphology		Molecular		Synthesis	
	Nb of methods	References ^a	Sequences available?	Barcoding possible? ^b	Category ^c	EURL comments
<i>Hypothenemus africanus</i>	5	7, 14, #18, 24, 28		N	D	Morphological identification of <i>Hypothenemus</i> species difficult (cf 3.2)
<i>Hypothenemus brunneus</i>	5	7, 14, #18, 24, 28		N	D	Morphological identification of <i>Hypothenemus</i> species difficult (cf 3.2)
<i>Hypothenemus californicus</i>	5	7, 14, #18, 24, 28		N	D	Morphological identification of <i>Hypothenemus</i> species difficult (cf 3.2)
<i>Hypothenemus columbi</i>	5	7, 14, #18, 24, 28		N	D	Morphological identification of <i>Hypothenemus</i> species difficult (cf 3.2)
<i>Hypothenemus elephas</i>	2	#18, 25		N	D	Morphological identification of <i>Hypothenemus</i> species difficult (cf 3.2); not an invasive species (25) (cf. 3.1)
<i>Hypothenemus erectus</i>	3	7, 14, #18		N	D	Morphological identification of <i>Hypothenemus</i> species difficult (cf 3.2)
<i>Hypothenemus javanus</i>	3	#7, 14, 18		N	D	Morphological identification of <i>Hypothenemus</i> species difficult (cf 3.2)
<i>Hypothenemus pubescens</i>	5	7, 14, #18, 24, 28		N	D	Morphological identification of <i>Hypothenemus</i> species difficult (cf 3.2)
<i>Hypothenemus setosus</i>	5	7, 14, #18, 24, 28		N	D	Morphological identification of <i>Hypothenemus</i> species difficult (cf 3.2)
<i>Liparthrum mandibulare</i>	2	26, 27	x	Q	B	Actually present in Europe (26, 27) (cf. 3.3); DNA barcoding gap.
<i>Microborus boops</i>	4	7, 14, #18, 28	x	Q	B	DNA barcoding gap
<i>Monarthrum mali</i>	4	7, #18, 24, 28	x	Y	A	Sequence records sufficient
<i>Pagiocerus frontalis</i>	4	7, 14, #18, 28	x	Y	A	Sequence records sufficient
<i>Premnobius ambitiosus</i>	3	7, 14, #18	x	Y	A	Sequence records sufficient
<i>Premnobius cavipennis</i>	6	2, 7, 14, #18, 24, 28	x	Q	B	DNA barcoding gap
<i>Xyleborinus andrewesi</i>	6	3, 6, 17, #18, 28, #42	x	Q	B	ITP sequence available; DNA barcoding gap; taxonomic data uncertainties
<i>Xyleborinus artestriatus</i>	5	3, 6, 17, #18, #42	x	Y	A	ITP sequence and sequence records sufficient
<i>Xyleborinus exiguus</i>	3	6, 17, #18	x	Q	B	ITP sequence available; DNA barcoding gap; taxonomic data uncertainties
<i>Xyleborinus gracilis</i>	7	2, 3, 14, #18, 24, 28, #42	x	Q	B	DNA barcoding gap
<i>Xyleborinus octiesdentatus</i>	5	3, 6, 17, #18, #42	x	Q	B	ITP sequence available but DNA barcoding gap
<i>Xyleborus bispinatus</i>	7	3, 7, 14, #18, 28, 35, #42	x	Q	B	DNA barcoding gap
<i>Xyleborus spinulosus</i>	7	3, 7, 14, #18, 24, 28, #42	x	Q	B	DNA barcoding gap; taxonomic data uncertainties
<i>Xyleborus volvulus</i>	9	2, 3, 7, 14, 17, #18, 24, 28, #42	x	Q	B	DNA barcoding gap; taxonomic data uncertainties
<i>Xylosandrus amputatus</i>	6	3, 6, 17, #18, 39, #42	x	Y	A	DNA barcoding gap
<i>Xyloterinus politus</i>	3	7, 14, #18	x	Y	A	Sequence records sufficient
<i>Ambrosiodmus obliquus</i>	5	2, 3, #18, 28, #42	x	Q	B	DNA barcoding gap

(Continues)

(Continued)

Species	Morphology		Molecular		Synthesis	
	Nb of methods	References ^a	Sequences available?	Barcoding possible? ^b	Category ^c	EURL comments
<i>Coccotrypes distinctus</i>	2	14, #18	x	Q	B	DNA barcoding gap
<i>Cryphalus pallidus</i>	1	33		N	D	Only one description of poor quality available for morphological identification
<i>Hypothenemus plumeriae</i>	2	#18, 28		N	D	Morphological identification of <i>Hypothenemus</i> species difficult (cf 3.2)
<i>Microperus eucalypticus</i>	1	32		N	B	Only one description available for morphological identification
<i>Microperus quercicola</i>	3	17, 29, 30	x	Q	B	DNA barcoding gap
<i>Planiculus bicolor</i>	2	6, 17	x	Q	B	ITP sequence available; DNA barcoding gap
<i>Scolytoplatypus tycon</i>	1	31	x	Q	B	DNA barcoding gap
<i>Scolytus dimidiatus</i>	3	17, #18, 28	x	Q	B	DNA barcoding gap
<i>Truncaudum agnatum</i>	2	6, 17	x	Q	B	ITP sequence available; DNA barcoding gap; taxonomic data uncertainties
<i>Xyleborus africanus</i>	1	34		N	D	Only one illustrated description available for morphological identification
<i>Xylosandrus mancus</i>	3	6, 17, 39	x	Y	A	ITP sequence and sequence records sufficient

Note: # indicates a picture resource without discriminating key.

^aDetailed reference list below.

^bYes, No or Questionable.

^cThe categorisation of identification feasibility is based on one of the following scores: (A) Readily identifiable with the current tools: both reliable morphological and molecular identification is possible. (B) Morphologically-based identification possible: reliable morphological methods possible but can currently not be reliably confirmed by DNA barcoding. (C) Molecularly-based identification possible but cannot be confirmed by a reliable morphological identification. (D) Identification currently problematic: to date, there are no reliable or applicable morphological or molecular tools.

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APPENDIX G

EU regulated plant pathogens vectored by Scolytinae

Table G.1 shows which species of Scolytinae from List 1 and List 2 of Appendix E are known vectors of EU regulated plant pathogens, together with the name of the pathogens they vector (source: EPPO, [online](#)). The Scolytinae species from list 1 are species with high impact on plant health according to the literature reviewed in Grégoire et al. (2023) and most likely satisfy EU potential quarantine pest status. Table G.1 also indicates the names of non-regulated plant pathogens vectored by the Scolytinae in List 1 or 2 from Appendix E.

TABLE G.1 Non-EU Scolytinae vectors of EU regulated and non-regulated plant pathogens (Source EPPO, [online](#), June 2024).

Appendix E List	Scolytinae species	Vectored pathogen. (EU regulatory status is shown in brackets)									
		<i>Bretziella agacearum</i> (Annex II A)	<i>Fusarium euwallaceae</i> ^a (Annex II A)	<i>Fusarium ambrosium</i> (Annex II A)	<i>Geosmithia morbida</i> (Annex II B)	<i>Harringtonia lauricola</i> EPPO Alert list, 2014	<i>Neocosmospora akasia</i>	<i>Neocosmospora awan</i>	<i>Neocosmospora rekana</i>	<i>Neocosmospora warna</i>	<i>Neocosmospora meka</i>
1	<i>Euwallacea fornicatus</i> (Eichhoff, 1868) sensu stricto		✓								
	<i>Euwallacea fornicatus</i> sensu lato		✓	✓			✓		✓	✓	
2	<i>Euwallacea similis</i> (Ferrari, 1867)						✓	✓	✓	✓	
1	<i>Xyleborus glabratus</i> Eichhoff, 1877					✓					
1	<i>Euwallacea perbrevis</i> (Schedl, 1951)			✓			✓		✓	✓	
1	<i>Pityophthorus juglandis</i> Blackman, 1928				✓						
1	<i>Pseudopityophthorus minutissimus</i> (Zimmermann, 1868)	✓									
1	<i>Pseudopityophthorus pruinus</i> (Eichhoff, 1878)	✓									

^aAs the taxonomic controversy about *Fusarium* and *Neocosmospora* has not been resolved, the EPPO Secretariat prefers to use the name *Fusarium euwallaceae* S. Freeman, Z. Mendel, T. Aoki & O'Donnell rather than *Neocosmospora euwallaceae* (S. Freeman, Z. Mendel, T. Aoki & O'Donnell) Sandoval-Denis, L. Lombard & Crous to minimise confusion (EPPO [online](#), June 2024).

EPPO ([online](#), June 2024) also report *Scolytus intricatus*, *Xyleborus affinis*, *Xyleborinus gracilis*, *Xyleborinus saxeseni*, *Xyleborus bispinatus*, *Xyleborus volvulus* and *Xylosandrus crassiusculus* as potential vectors of *Harringtonia lauricola* the pathogen causing laurel wilt and which has been on the EPPO Alert list since 2014.

EPPO ([online](#), June 2024) does not indicate that all Scolytinae species in Appendix E List 1 and List 2 are vectors of plant pathogens (Table G.2). However, information on vectors and their associated pathogens is a relatively new feature of the EPPO online database (vector information in place since April 2023) and additional data will be added over time with a focus on regulated (quarantine) pests (EPPO, [online](#), June 2024).

TABLE G.2 Non-EU Scolytinae not reported as vectors of EU regulated or non-regulated plant pathogens in EPPO online (June 2024).

Appendix E list	Scolytinae species
1	<i>Euwallacea kuroshio</i> Gomez & Hulcr, 2018
1	<i>Euwallacea validus</i> (Eichhoff, 1875)
1	<i>Hypothenemus crudiae</i> (Panzer, 1791)
1	<i>Scolytus schevyrewi</i> Semenov, 1902
1	<i>Euwallacea interjectus</i> (Blandford, 1894)
1	<i>Xyleborus ferrugineus</i> (Fabricius, 1801)
2	<i>Amasa parviseta</i> Knizek & Smith, 2024
2	<i>Ambrosiodmus rubricollis</i> (Eichhoff, 1875)
2	<i>Ambrosiophilus compressus</i> (Lea, 1894)
2	<i>Coccotrypes carpophagus</i> (Hornung, 1842)
2	<i>Cryphalus dilutus</i> Eichhoff, 1878
2	<i>Cryphalus discretus</i> Eichhoff, 1878
2	<i>Cryphalus mangiferae</i> Stebbing, 1914
2	<i>Euwallacea piceus</i> (Motschulsky, 1863)
2	<i>Hypothenemus areccae</i> (Hornung, 1842)
2	<i>Hypothenemus birmanus</i> (Eichhoff, 1878)
2	<i>Hypothenemus obscurus</i> (Fabricius, 1801)
2	<i>Hypothenemus seriatus</i> (Eichhoff, 1872)
2	<i>Phloeotribus liminaris</i> (Harris, 1852)
2	<i>Xyleborus perforans</i> (Wollaston, 1857)

APPENDIX H

HS import codes and import data for selected non-coniferous wood

HS import codes and their text descriptions of selected non-coniferous wood are shown below. The quantity of EU imports from third countries for each code were extracted from Eurostat for the 6 year period 2017–2022. Code HS 4415 may contain a mix of coniferous and non-coniferous wood products.

HS code	Description
4403 12	Wood in the rough, treated with paint, stains, creosote or other preservatives, non-coniferous (excl. rough-cut wood for walking sticks, umbrellas, tool shafts and the like; wood in the form of railway sleepers; wood cut into boards or beams, etc.)
4403 41	Dark red meranti ^a , light red meranti and meranti bakau wood in the rough, whether or not stripped of bark or sapwood, or roughly squared (excl. rough-cut wood for walking sticks, umbrellas, tool shafts and the like; wood cut into boards or beams, etc.; wood treated with paint, stains, creosote or other preservatives)
4403 42	Teak wood in the rough, whether or not stripped of bark or sapwood, or roughly squared (excl. rough-cut wood for walking sticks, umbrellas, tool shafts and the like; wood cut into boards or beams, etc.; wood treated with paint, stains, creosote or other preservatives)
4403 49	Tropical wood in the rough, whether or not stripped of bark or sapwood, or roughly squared (excl. teak, dark red meranti, light red meranti, meranti bakau, acajou d'Afrique, iroko, sapelli, okoumé and sipo; rough-cut wood for walking sticks, umbrellas, tool shafts and the like; wood cut into boards or beams, etc.; wood treated with paint, stains, creosote or other preservatives)
4403 91	Oak ' <i>Quercus</i> spp.' in the rough, whether or not stripped of bark or sapwood, or roughly squared (excl. rough-cut wood for walking sticks, umbrellas, tool shafts and the like; wood in the form of railway sleepers; wood cut into boards or beams, etc.; wood treated with paint, stains, creosote or other preservatives)
4403 93	Beech ' <i>Fagus</i> spp.' in the rough, of which the smallest cross-sectional dimension is ≥ 15 cm, whether or not stripped of bark or sapwood, or roughly squared (excl. wood in the form of railway sleepers; wood cut into beams, etc.; wood treated with paint, stains, creosote or other preservatives)
4403 94	Beech ' <i>Fagus</i> spp.' in the rough, of which the smallest cross-sectional dimension is < 15 cm, whether or not stripped of bark or sapwood, or roughly squared (excl. rough-cut wood for walking sticks, umbrellas, tool shafts and the like; wood in the form of railway sleepers; wood cut into boards or beams, etc.; wood treated with paint, stains, creosote or other preservatives)
4403 95	Birch ' <i>Betula</i> spp.' in the rough, of which the smallest cross-sectional dimension is ≥ 15 cm, whether or not stripped of bark or sapwood, or roughly squared (excl. sawlogs; wood in the form of railway sleepers; wood cut into beams, etc.; wood treated with paint, stains, creosote or other preservatives)
4403 96	Birch ' <i>Betula</i> spp.' in the rough, of which the smallest cross-sectional dimension is < 15 cm, whether or not stripped of bark or sapwood, or roughly squared (excl. rough-cut wood for walking sticks, umbrellas, tool shafts and the like; wood in the form of railway sleepers; wood cut into boards or beams, etc.; wood treated with paint, stains, creosote or other preservatives)
4403 97	Poplar and aspen ' <i>Populus</i> spp.' in the rough, whether or not stripped of bark or sapwood, or roughly squared (excl. rough-cut wood for walking sticks, umbrellas, tool shafts and the like; wood in the form of railway sleepers; wood cut into boards or beams, etc.; wood treated with paint, stains, creosote or other preservatives)
4403 98	Eucalyptus ' <i>Eucalyptus</i> spp.' in the rough, whether or not stripped of bark or sapwood, or roughly squared (excl. rough-cut wood for walking sticks, umbrellas, tool shafts and the like; wood in the form of railway sleepers; wood cut into boards or beams, etc.; wood treated with paint, stains, creosote or other preservatives)
4406 12	Railway or tramway sleepers 'cross-ties' of wood, not impregnated, non-coniferous
4415	Packing cases, boxes, crates, drums and similar packings, of wood; cable-drums of wood; pallets, box pallets and other load boards, of wood; pallet collars of wood (excl. containers specially designed and equipped for one or more modes of transport)

^aMeranti wood is a hardwood (non-coniferous) tropical wood from species of *Shorea*.

EU imports of non-coniferous wood and wood products from biogeographic realm by HS code for the years 2017–2022 (tonnes) (Note: Europe, non-EU is not a biogeographic realm but was separated out for this opinion) See Appendix J for a simplified map of realms.

Realm	HS code	2017	2018	2019	2020	2021	2022
Palaearctic, Asia and Oriental	4403 95	2,697,332	3,346,032	3,026,855	3,359,572	3,363,217	411,659
	4403 96	632,528	711,209	733,445	567,947	529,585	91,604
	4403 97	180,276	296,000	225,129	247,967	155,671	28,634
	4415	73,895	93,798	86,004	80,428	111,697	92,021
	4403 49	1438	745	218	921	92	8386
	4406 12	208	496	2069	1014	252	0
	4403 91	567	70	454	490	186	136
	4403 93	696	444	0	359	170	199
	4403 12	35	1	305	58	64	372
	4403 94	6	0	0	435	36	136
	4403 98	0	0	58	0	7	4
	4403 41	12	1	20	0	0	0
	4403 42	0	0	0	0	0	16
	Europe non-EU³	4415	721,189	865,796	870,819	847,242	945,265
440396		497,716	138,513	204,564	278,068	189,462	107,761
440397		388,144	19,927	74,823	144,889	2318	5109
440312		478,030	91	348	3306	385	1238
440393		23,527	42,274	45,988	31,349	35,637	64,357
440394		26,494	29,147	24,960	20,496	16,994	8371
440391		20,672	14,105	12,692	7729	10,267	9287
440395		45,012	6083	278	1037	7112	3797
440612		3276	3941	4814	2994	1622	820
440349		6346	983	1809	301	36	51
440398		15	25	35	4	1	1580
440341		0	0	0	0	35	0
440342		0	0	0	0	0	34
Neotropical		440398	54	234	69,598	145,892	649,724
	4415	2966	3578	3437	4007	7090	16,971
	440349	2849	2929	3788	3897	3277	5303
	440342	0	0	0	0	0	3017
	440341	0	0	0	0	1479	0
	440612	0	0	0	0	53	0
	440312	0	47	0	1	0	0
	440391	12	23	0	0	1	0
	440397	0	0	0	0	0	17
Africa	440349	93,764	103,214	88,582	61,456	89,959	92,980
	440398	984	1376	1252	1161	45,924	77,239
	440612	12,620	13,752	11,881	15,666	11,008	13,317
	4415	116	149	34	46	90	256
	440342	0	0	0	0	0	115
	440312	0	0	27	17	19	28
	440391	0	0	0	0	0	0

(Continues)

³Europe non-EU is not a realm but is shown to distinguish imports between non-EU Europe and other parts of the Palaearctic and Oriental realms.

(Continued)

Realm	HS code	2017	2018	2019	2020	2021	2022
Nearctic	440391	10,104	9542	11,402	10,961	13,441	627
	4415	7829	6181	6364	5500	5432	8715
	440612	2889	2285	645	208	0	0
	440397	65	27	88	0	90	152
	440349	51	3	2	87	176	0
	440393	22	0	0	0	0	28
	440398	12	0	31	6	0	0
	440312	20	0	0	0	0	25
	440395	0	6	0	0	0	0
	440342	0	0	0	0	0	3
	440394	0	0	0	0	0	2
	440341	1	0	0	0	0	0
	440396	0	0	0	0	0	0
Pacific and Australasia	4415	93	118	71	249	237	679
	440349	7	12	7	9	10	3
	440398	3	1	22	3	4	5
	440391	0	0	0	0	0	6
	440312	0	0	0	0	0	1
	440612	0	0	0	0	0	0

APPENDIX I

Invasive genera of Scolytinae and whether they have been intercepted in the EU

Recognising that all non-EU Scolytinae are regarded as quarantine pests (EU 2019/2072, Annex II, Part A point 65), it is not necessary for interceptions of Scolytinae to be identified to genus or species level. As such, only genera that were identified to genus or species level can be positively regarded as having been intercepted. Six genera of Scolytinae are reported as having been intercepted in the EU:

1. *Coccotrypes*
2. *Cryphalus*
3. *Scolytus*
4. *Xyleborinus*
5. *Xyleborus*
6. *Xylosandrus*

Other genera are known to contain invasive species and searches were conducted in Europhyt and Traces but no positive identifications were found for the 33 genera listed below:

- | | | |
|---------------------------|--------------------------|--------------------------|
| 1. <i>Amasa</i> | 12. <i>Diuncus</i> | 23. <i>Liparthrum</i> |
| 2. <i>Ambrosiodmus</i> | 13. <i>Dryocoetoides</i> | 24. <i>Microborus</i> |
| 3. <i>Ambrosiophilus</i> | 14. <i>Dryoxylon</i> | 25. <i>Monarthrum</i> |
| 4. <i>Anisandrus</i> | 15. <i>Eccoptopterus</i> | 26. <i>Pagiocerus</i> |
| 5. <i>Arxyleborus</i> | 16. <i>Eidophelus</i> | 27. <i>Phloeotribus</i> |
| 6. <i>Chramesus</i> | 17. <i>Ernoporos</i> | 28. <i>Pityophthorus</i> |
| 7. <i>Cnestus</i> | 18. <i>Euwallacea</i> | 29. <i>Premnobius</i> |
| 8. <i>Coleobothrus</i> | 19. <i>Gnathoraptus</i> | 30. <i>Sueus</i> |
| 9. <i>Coptoborus</i> | 20. <i>Heteroborips</i> | 31. <i>Tricosa</i> |
| 10. <i>Cryptocarenum</i> | 21. <i>Hyledius</i> | 32. <i>Truncaudum</i> |
| 11. <i>Cyclorhipidion</i> | 22. <i>Hypothenemus</i> | 33. <i>Xylosterinus</i> |

It is possible that some or all of the 33 genera above have been intercepted in the EU but were recorded as 'Scolytidae'.

APPENDIX J

World biogeographic realms

