Department
for Environment
Food & Rural Affairs

Rapid Pest Risk Analysis (PRA) for *Euwallacea fornicatus sensu lato* ambrosia beetles:

Euwallacea fornicatior

Euwallacea fornicatus sensu stricto

Euwallacea kuroshio

Euwallacea perbrevis

With their associated symbiotic fungi, especially *Fusarium* spp. from the ambrosia *Fusarium* clade

June 2025

Summary and conclusions of the rapid PRA

This PRA covers four species of ambrosia beetle, which are a species complex, and their associated symbiotic fungi. The taxonomy of the beetles has been revised several times, but now appears to be approaching some stability, though there remains the possibility of

undescribed cryptic species within the current species delineation. New fungal species within the main symbiont group (the ambrosia *Fusarium* clade) are also still being isolated and described. All four beetle species are native to south and east Asia, and three have become pests outside their native range. Invasive populations have been found in several countries in the Americas, Hawaii, Israel and South Africa. There have also been outbreaks in Western Australia and mainland Europe which are being controlled by the relevant plant health authorities. These include glasshouse outbreaks, several of which have been successfully eradicated and one where eradication is ongoing.

The beetles feed on a very wide range of hosts, mostly broadleaved woody species, but there have been a few records on other hosts such as palms, bamboo and conifers. They are all ambrosia beetles, meaning they create tunnels in wood and have symbiotic relationships with a range of fungal species in the ambrosia *Fusarium* clade and others. The fungi colonise the tunnels and feed on the wood, and the beetles feed on the fungus and not the host directly. Woody plants can be divided into three broad groups in terms of their suitability as hosts for *E. fornicatus s.l.* It should be noted that these categories are not fixed and some hosts assigned to one category are later found to belong to a different one.

a) Reproductive hosts allow the symbiotic fungi to grow and the relevant beetle species to complete its entire lifecycle
b) Non-reproductive hosts may be attacked by the beetle, fungal growth may occur, but these hosts do not allow the whole beetle lifecycle to be completed
c) Plants not recorded as hosts have not showed evidence of beetle attack or, in some cases, may not allow the fungal symbiont to grow

The scoring in this PRA is complex, as in some instances it was decided that ratings differ according to beetle species, but at other times the same rating was considered to apply to all four species. The summary below does not include all the detail, and the main text should be consulted where details are required. This rapid PRA shows:

Likelihood of entry

Three of the four described beetle species have established outside their native range. Pathways for introduction into wider environment are not known with certainty as it is usually some years before an outbreak is discovered. Glasshouse outbreaks in several countries were linked to the trade in planting material. Host plants for planting were considered **moderately likely** as a pathway for the beetles to enter the UK, with confidence being higher for reproductive hosts than for non-reproductive hosts. Species of woody plants not recorded as hosts were considered **unlikely**, but with low confidence as host lists are continually expanding. Plants stressed by movement in trade may be temporarily susceptible to attack by the beetles, even if they are not normally hosts.

Cut branches and round wood were also considered **unlikely**, with medium confidence: the pest can continue to develop for some months in freshly cut logs, but dried or older cut wood will not be suitable. The other pathways assessed were all considered **very unlikely**

with varying levels of confidence: sawn wood, wood packing material, woodchips and contaminating pest (hitchhiking).

Likelihood of establishment

The very wide host range for several species of *E. fornicatus s.l.* includes tree species or genera commonly found throughout the UK, e.g. *Quercus* or *Salix* (oak and willow). The UK climate is considered to be the factor that is likely to limit establishment. Many parts of the current distributions of these beetles are substantially hotter than the UK, and optimum temperatures for development are 26°C or higher. However, some locations in the invasive range (e.g., Johannesburg, Buenos Aires or Sydney) are more temperate, though all still have warmer summers than are found in any part of the UK. Establishment outdoors was considered moderately likely for two of the beetle species, and unlikely for the other two, which appear to require slightly warmer temperatures. However, there are many uncertainties and all judgements were made with low confidence.

Establishment was considered very likely in indoor botanical collections or other protected cultivation with mature or semi-mature trees. This judgement was made with high confidence for the two species which have been recorded from glasshouses in other parts of Europe, and medium confidence for the other two species.

Economic, environmental and social impact

Impacts in the current range are quite variable and little quantified data are available. Theoretical models tend to predict high costs, but data on actual losses are seldom available. A wide range of crops can be affected, with impacts both from reduced nutrient transport as the fungi block the plant vascular system, and beetle galleries weakening branches leading to breakage. In the invasive range the greatest impact has been on urban trees, but it is unclear how much of the impact is due to primary damage by beetles and fungi, and how much is precautionary felling for public safety. In the current range (including invasive areas), the economic impact was assessed to be medium, environmental impacts small, and social impacts large, mostly due to the loss of urban trees in the invasive range.

The potential impacts in the UK are considered to be smaller, mainly due to the cooler climate limiting population levels (if the pests can establish outdoors at all). The highest impacts are predicted if the pest was able to establish in one or more tropical or subtropical glasshouses, especially those with reasonably mature trees such as botanical collections or butterfly farms. Impacts in these situations could be locally devastating for the infested site, but are likely to be very localised, with other glasshouses unaffected unless infested material had been transferred between sites. Outdoors, it is unclear if damaging populations would be able to build up even in urban heat islands such as London. Overall, potential economic and social impacts in the UK were assessed as small, but with low confidence. Potential environmental impacts were assessed as very small with high confidence.

Endangered area

Individual indoor tropical or subtropical plantings which contain large mature trees are likely to see unacceptable impacts from *E. fornicatus s.l.*, though infestations are likely to be localised to a single site. Examples of such locations are tropical botanical glasshouses, butterfly farms or planted tropical enclosures in zoos. Heated nurseries which grow on woody plants before resale could also experience high impacts.

It is unclear if any outdoor part of the UK would be endangered, but the most likely habitat which might have unacceptable levels of damage would be urban trees. This is where most impacts have been reported from the invasive range, and the urban heat island effect makes establishment outdoors in cities more likely than in cooler rural locations.

Risk management options

As all of the species are absent from the UK, continued exclusion could be considered. However, due to the very wide host range, identifying the most appropriate hosts for specific measures to reduce the likelihood of entry on planting material or wood would be challenging. Due to the range of fungal species associated with the beetle species complex, any quarantine pest listing of individual fungal species would need careful consideration.

Eradication of outbreaks in glasshouses has proved possible in other countries, though if many plants are infested it may involve complete removal of all plants in the infested structure. Due to the pests' cryptic feeding habits, very wide host ranges and ability to fly at least 100 m, eradication in the wider environment is likely to be extremely challenging and could require felling of large numbers of trees. Chemical attractants are known which could be used with traps, both for detection and mass trapping to reduce populations. There has been research in the current range into the efficacy of various insecticides and fungicides, both as surface treatments and trunk injections.

Methods to limit population build up include targeted pruning, use of repellents and planting of hosts that are less attractive to the beetles. Research is ongoing into effective biocontrol options.

Key uncertainties and topics that would benefit from further investigation

Data which can be unambiguously attributed to *E. fornicatior* are very scarce and there are very few scientific papers which specifically mention this species. Nearly all the assessment for this species is by analogy to the other three species for which better data are available. As *E. fornicatior* is the only species of the four considered here that has not spread outside its assumed native range, this may not be a valid assumption. There may be some reason this species has not been able to spread and become an invasive pest in new countries. In particular, the list of recorded hosts for *E. fornicatior* is very short in

comparison to the other species, and a major uncertainty in the PRA is the assumption that *E. fornicatior* is able to utilise a very wide range of hosts as the other species do.

Host ranges are almost certainly incomplete for all four species. *Euwallacea fornicatus sensu stricto* has the largest recorded host range. This is considered unlikely to be due to its biology allowing it to utilise more hosts, and rather due to the fact it is an invasive pest causing impacts in several discrete biogeographical regions, meaning it is well studied and has encountered many different host species. The list of hosts has increased dramatically as it establishes in new areas and will almost certainly increase further in future.

Reproductive host lists are again almost certainly incomplete for all four species, with. *E. fornicatus s.s.* having the most data available. Similarly to the more general host list, the list of reproductive hosts for *E. fornicatus s.s.* is regularly increasing. There have also been several instances of hosts originally classed as non-reproductive being shown to be reproductive hosts.

It is unclear if the comparatively few reproductive hosts recorded for *E. kuroshio* and *E. perbrevis* is due to biological limitations, or lack of records. Data is lacking for *E. kuroshio* as it is a recently described species. Uncertainties over *E. perbrevis* in the native range are due to older records potentially referring to a different species in the complex.

The current four species may undergo further taxonomic revision; there is already some molecular evidence that specimens of *E. fornicatus s.s.* in eastern Asia may be more than one species.

The rapid pace of discovery of new information, especially about *E. fornicatus s.s.* means that critical elements of this PRA may become out of date, even in the next few years. As the beetles become invasive in new areas, more information is discovered about their biology. Also, as their profile rises, more studies are being undertaken in their native ranges.

Images of the pest

Adult *Euwallacea perbrevis* (lateral view). Note that many ambrosia beetles look extremely similar and require specialist identification. Females are up to 2.5 mm long.

© Sarah Smith, Southeast Asian Ambrosia Beetle ID, USDA APHIS PPQ, Bugwood.org

Signs of *Euwallacea fornicatus* sensu lato: emergence holes on a tree trunk and frass strings.

© Wietse den Hartog NVWA (NPPO the Netherlands), via EPPO Global Database https://gd.eppo.int/taxon/XYLBFO/photos

Is there a need for a detailed PRA or for a more detailed analysis of particular sections of the PRA? If yes, select the PRA area (UK or EPPO) and the PRA scheme (UK or EPPO) to be used.

Especially for *E. fornicatus s.s.*, there is a constant flow of new information as more research is done and new information becomes available as the beetles invade new geographic locations. Therefore, it is recommended that a watching brief should be kept for significant new information. If new information was found which could affect the assessment of the risks the species pose, a new PRA or an update to this document may be required, with appropriate re-assessment. Examples of important new information would be if the pest spread into areas with cooler summers, and any impacts which occurred in those locations. Conversely, further expansion of host lists is unlikely to alter this PRA, as most assessments have been made assuming the host range for all species is very broad.

No	✓				
Yes		PRA area: UK or EPPO		PRA scheme: UK or EPPO	

Given the information assembled within the time scale required, is statutory action considered appropriate / justified?

Damaging populations are most likely to develop in heated glasshouses or other indoor locations where reasonably mature trees are grown. Due to the highly polyphagous nature of both the beetles and fungi, many plants could be affected. If the pests were not detected at an early stage and populations were able to build up, the impacts at a single site could be severe. However, an outbreak in protected cultivation is likely to remain localised to one site unless infested plants are moved between sites. Biosecurity guidance on post-entry quarantine and inspection of imported material could be developed for such sites. As part of any such guidance, it would be useful to work out how long material should be quarantined for at specific temperatures, if possible.

It is uncertain if any of the pests under consideration would be able to establish outdoors in any part of the UK. Build up of outdoor populations to a level which would be damaging does not seem very likely, though urban heat islands such as London would be most at risk. If the pest were able to establish in mature trees in the wider environment, eradication would be very challenging. As there are very few control measures currently available, felling would be the only viable option. Depending on the situation, statutory action in an attempt to eradicate an outdoor population may cause more of an impact than the pest itself.

Overall, the recommendation for Great Britain is to retain the existing quarantine pest listing as part of non-European Scolytinae, but not to list any of the beetle species or *Euwallacea fornicatus sensu lato* as quarantine pests individually. Given the very broad host range, specific measures on named hosts are not recommended.

Yes Statutory action	✓	No Statutory action	

Decisions on any changes to the regulation of the symbiotic fungi will require further discussion. These are likely to include whether to regulate individual fungal species (and if so, which), or a broader taxonomic group.

Stage 1: Initiation

1. What is the name of the pest?

This PRA is for four beetle species which are closely related. The taxonomy of this group of beetles has undergone several revisions in recent years. The revision by Smith *et al.* (2019) is the one followed in this PRA, and is primarily based on morphometrics, specifically the length of two characters (elytra and pronotum), at an accuracy of 0.05 mm. These are minute differences on which to separate the four species, and they may not hold up with a larger dataset or new molecular studies. EU reference laboratories consider that species identification of *E. fornicatus, E. kuroshio* and *E. perbrevis* is "barely feasible and/or not reliable" (Appendix F in EFSA, 2024).

It is possible that the taxonomy may change again as new evidence is collated. Wang *et al.* (2022) investigated the species complex using molecular techniques, including a variety of different approaches when constructing phylogenetic trees. The data does appear to support the currently accepted species concepts, but also revealed that *E. fornicatus sensu stricto* as currently delineated showed hidden genetic diversity and the specimens examined could be separated into three groups, with COI divergence of 5-8% (Wang *et al.*, 2022). One of those haplotypes has been reported from Taiwan by subsequent authors, often referred to as H22 (e.g. Liu *et al.*, 2022a; Liao *et al.*, 2023). There is no agreed level of COI difference which defines a species.

Previous names used for the whole group include *Euwallacea fornicatus sensu lato* and *E. fornicatus* species complex. The species synonyms below are as given by Smith *et al.* (2019). This PRA attempts to attribute older information to the species as currently delineated, if it is reasonably certain older information can be unambiguously attributed to a current species. Where the attribution is uncertain (e.g. more than one species known to be present in the area discussed), then the information will be discussed under *E. fornicatus s.l*.

All four beetles have obligate relationships with plant pathogenic fungi. The species of fungi and their taxonomy are discussed further in section 15, though in this PRA the risks from the fungi are considered along with the risks from the beetles throughout the whole of the document. As ambrosia beetles, *E. fornicatus s.l.* cannot survive without their associated symbiotic fungi and so the risks of beetles and fungi cannot be considered separately.

Euwallacea fornicatior (Eggers) (Coleoptera, Curculionidae, Scolytinae)

Synonyms: *Xyleborus fornicatior, Xyleborus fornicatus fornicatior, Xyleborus schultzei.*

Common names: tea shot hole borer (TSHB). Some literature will refer to this species by clade; according to Smith *et al.* (2019): this species includes both TSHB clade 1a and TSHBb.

Euwallacea fornicatus sensu stricto (Eichhoff) (Coleoptera, Curculionidae, Scolytinae)

Synonyms: *Xyleborus fornicatus, Xyleborus fornicatus fornicatus, Xyleborus tapatapaoensis* and *Xyleborus whitfordiodendrus.*

Common names: polyphagous shot hole borer (PSHB).

As mentioned in the general discussion on taxonomy, recent molecular studies of various populations suggest there may be cryptic species within the current delineation of *E. fornicatus s.s.*, but none have been formally described at the time this PRA was written.

Euwallacea kuroshio Gomez & Hulcr (Coleoptera, Curculionidae, Scolytinae)

Synonyms: none known.

Common names: Kuroshio shot hole borer (KSHB).

Euwallacea perbrevis (Schedl) (Coleoptera, Curculionidae, Scolytinae)

Synonym: *Xyleborus perbrevis*.

Common names: tea shot hole borer (TSHB), sometimes TSHBa.

2. What initiated this rapid PRA?

Reports of damage to *Quercus robur* in California in 2013 by *E. fornicatus s.l.* were found through routine horizon scanning, due to the importance of this host to the UK. An entry for *E. fornicatus s.l.* was made on the UK plant health risk register[1] as a result. This rapid screening identified that a PRA was required, and this was completed in 2015. Since that time, there have been several significant developments. The complex of species has been at least partially clarified using molecular and morphological techniques, and while the nomenclature may not yet be completely stable, it is clear that several species are responsible and cause impacts in different parts of the world. There have also been the first recorded outbreaks in botanical gardens (under glass) in several countries in mainland Europe. *Euwallacea fornicatus s.l.* have also been made provisional quarantine pests in Great Britain. During that process, it was identified that the 2015 PRA was no longer up to date, and an updated PRA was requested to aid in deciding whether full quarantine pest status is appropriate for Great Britain, and if so, to help to inform decisions on specific measures which would help to mitigate against entry of the pests.

[1] https://planthealthportal.defra.gov.uk/pests-and-diseases/uk-plant-health-risk-register/

Northern Ireland has a separate plant health regulatory regime and accordingly, different decisions processes apply there.

3. What is the PRA area?

The PRA area is the United Kingdom of Great Britain and Northern Ireland.

Stage 2: Risk Assessment

4. What is the pest's status in the plant health legislation, and in the lists of EPPO[2]?

The legislation for Great Britain is the Phytosanitary Conditions Regulation (assimilated regulation (EU) 2019/2072)[3]. The legislation which applies to Northern Ireland is the EU legislation: 2019/2072[4] and 2016/2031 (both as amended). In summer 2024, both sets of legislation include all four species of *E. fornicatus s.l.* as quarantine pests in the respective legislation under the broad listing of Scolytidae spp. (non-European). There are also more specific listings:

In Great Britain, the list of provisional quarantine pests in Annex 2A includes both *E. fornicatus s.l.* and *Neocosmospora euwallaceae* (a symbiotic fungus, which is also known as *Fusarium euwallaceae*; see section 15 for further details). Listing as a provisional quarantine pest in Great Britain is not associated with specific measures in Annex 7 on named hosts. The specific measures designed to mitigate against introduction of the wider listing of non-European Scolytinae are unlikely to mitigate against the entry of *E. fornicatus s.l.*, as these measures are on conifers and conifer wood, while *E. fornicatus s.l.* are predominantly pests of broadleaved trees.

In Northern Ireland, *E. fornicatus s.l.* and two symbiotic fungi, *Neocosmospora ambrosia* (also known as *Fusarium ambrosium*; see section 15 for details) and *N. euwallaceae* are listed in Annex IIA (pests not known to occur in the EU), having been added to the legislation by Commission Implementing Regulation (EU) 2021/2285. Specific measures against *E. fornicatus s.l*. are included in Annex VII. Plants for planting and wood from a long list of plant species and genera must meet stipulated requirements before they may be imported (see Appendix 2).

The pests are included on the EPPO A2 list, under *E. fornicatus s.l.* and *Fusarium euwallaceae*.

[2] https://www.eppo.int/ACTIVITIES/quarantine_activities
[3] https://www.legislation.gov.uk/eur/2019/2072 (link to latest consolidated version)
[4] The latest consolidated version can be accessed on the left-hand side of https://eurlex.europa.eu/eli/reg_impl/2019/2072/oj

5. What is the pest's current geographical distribution?

Native range

All four species are considered to be native to south east Asia and perhaps parts of Oceania. Sample locations of specimens assigned to the current species concepts may be due to the availability of reference specimens to examine and are unlikely to represent the complete species distributions. Exactly where each species is distributed seems likely to undergo further refinement, as the increasing global profile of the species group leads to further research. For example, molecular analyses by Wang *et al.* (2022) found only *E. fornicatus s.s.* in mainland China, with *E. perbrevis* found in the island province of Hainan (along with *E. fornicatus s.s.*). It is possible that some countries in south east Asia and the Pacific are in fact part of the invasive range for some species.

The status of the pests in Australia is unclear. While there is an invasive population of *E. fornicatus s.s.* in Western Australia, there is a native (or long-established) population of *E. perbrevis* in Queensland. Grove (2000) reported multiple specimens of *E. fornicatus s.l.* from Thompson Creek in the Daintree lowlands, and *E. perbrevis* is known from the Sunshine Coast (Smith *et al.*, 2019).

Tables 1–5. Global distribution of species in the *Euwallacea fornicatus sensu lato* complex. Records are attributed to species using the taxonomy in Smith *et al.* (2019). Outbreaks which either have been eradicated or are under official control with the aim of eradication are in *italics*.

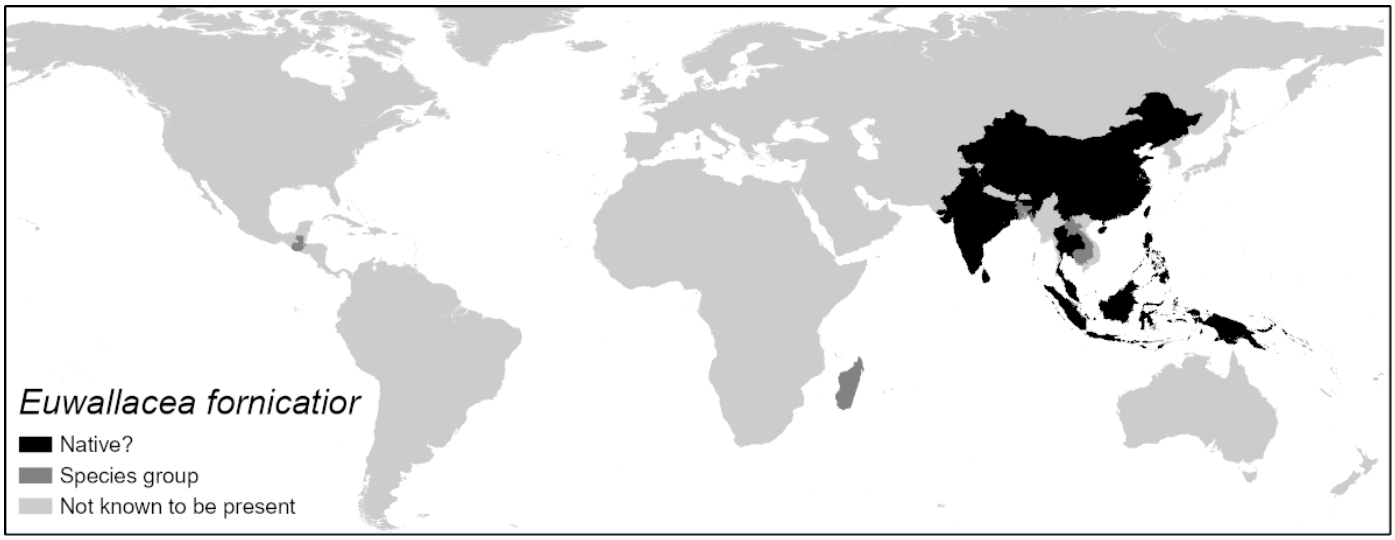
Table 1. *Euwallacea fornicatior*		
Continent	**Country/territory**	**Reference(s)**
Europe	–	
Africa	–	
Americas	–	
Asia	China, India, Indonesia, Malaysia, Philippines, Singapore, Sri Lanka, Taiwan, Thailand	Gomez *et al.* (2018); Smith *et al.* (2019); Smith *et al.* (2020)
Oceania	Micronesia, Papua New Guinea	Gomez *et al.* (2018); Smith *et al.* (2019); Smith *et al.* (2020)

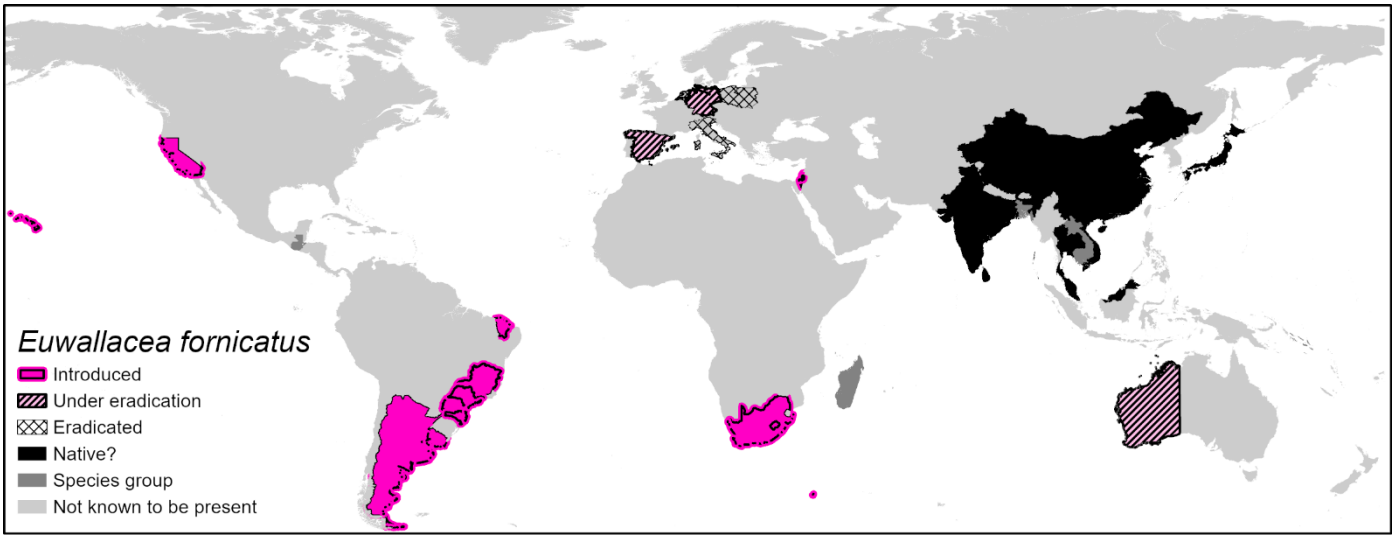
Table 2. *Euwallacea fornicatus sensu stricto*		
Continent	**Country/territory**	**Reference(s)**
Europe	*Outbreak in wider environment under eradication: Spain* *Outbreak in glasshouses under eradication: Germany* *Previous outbreaks in glasshouses, now eradicated: Italy, Netherlands, Poland*	Schuler *et al.* (2023); EPPO (2024); Netherlands NPPO (2021-2022); Goldarazena *et al.* (2025)
Africa	South Africa	Stouthamer *et al.* (2017); Bierman *et al.* (2022)
Americas	Argentina Brazil: Ceará, Minas Gerais, Paraná, Santa Catarina, São Paulo Uruguay USA: California, Hawaii	Ceriani-Nakamurakare *et al.* (2025); Ceriani-Nakamurakare *et al.* (2023); Covre *et al.* (2024); Stouthamer *et al.* (2017); Gomez *et al.* (2018); Smith *et al.* (2019); Rugman-Jones *et al.* (2020)
Asia	China, India, Israel, Japan, Malaysia, Occupied Palestinian Territories, Sri Lanka, Taiwan, Thailand, Vietnam	Mendel *et al.* (2012); Stouthamer *et al.* (2017); Gomez *et al.* (2018); Smith *et al.* (2019); Salman *et al.* (2019)
Oceania	Samoa *Outbreak under eradication: Australia: Western Australia*	Gomez *et al.* (2018); Smith *et al.* (2019), Australian NPPO (2021); Cook and Broughton (2023)

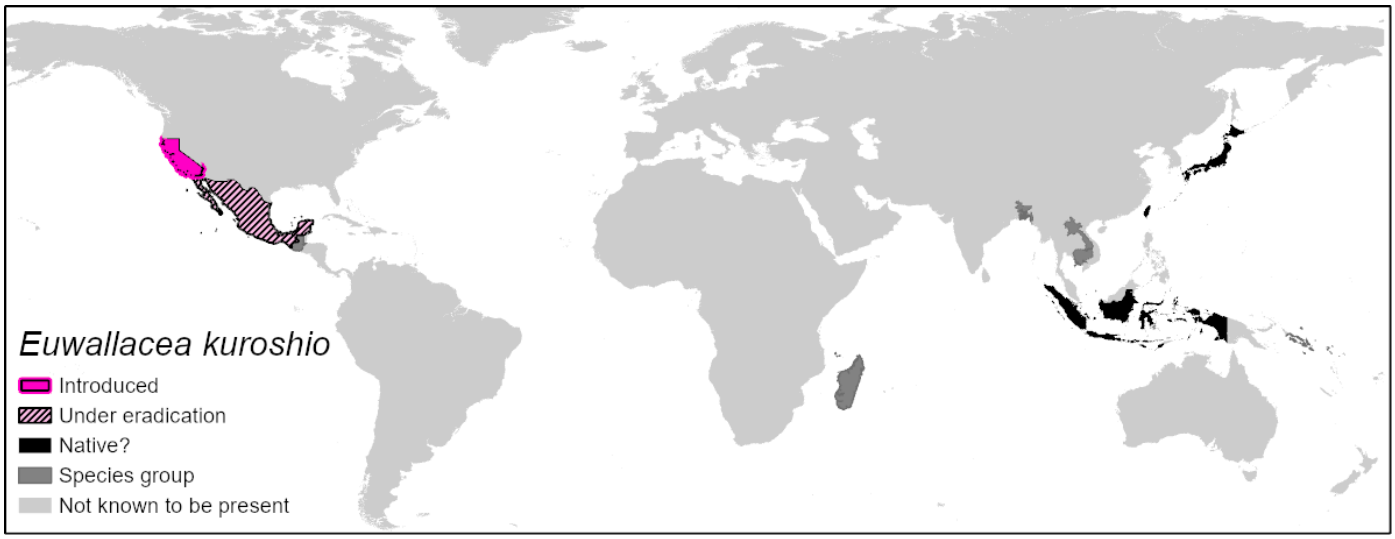
Table 3. *Euwallacea kuroshio*		
Continent	**Country/territory**	**Reference(s)**
Europe	–	
Africa	–	
Americas	USA: California *Outbreak under eradication: Mexico*	De Jesus Garcia-Avila *et al.* (2016); Stouthamer *et al.* (2017); Gomez *et al.* (2018); Méndez-Montiel *et al.* (2019); Smith *et al.* (2019); Dodge and Stouthamer (2021); NAPPO (2024)
Asia	Indonesia, Japan, Taiwan	Stouthamer *et al.* (2017); Gomez *et al.* (2018); Smith *et al.* (2019)
Oceania	American Samoa	Wang *et al.* (2022)

Table 4. *Euwallacea perbrevis*		
Continent	**Country/territory**	**Reference(s)**
Europe	*Previous outbreak in glasshouse, now eradicated: Netherlands*	Schuler *et al.* (2023); EPPO (2024)
Africa	Réunion	Smith *et al.* (2019)
Americas	Costa Rica; Panama; USA: Florida, Hawaii	Kirkendall and Ødegaard (2007); Gomez *et al.* (2018); Owens *et al.* (2018); Smith *et al.* (2019); Rugman-Jones *et al.* (2020)
Asia	Brunei, China, India, Indonesia, Japan, Malaysia, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Timor Leste, Vietnam	Gomez *et al.* (2018); Smith *et al.* (2019); Thube *et al.* (2024)
Oceania	American Samoa, Australia: Queensland, New South Wales, Fiji, Palau, Papua New Guinea	Gomez *et al.* (2018); Smith *et al.* (2019); Callaghan *et al.* (2024)

Table 5. *Euwallacea fornicatus sensu lato.* Records are only included in this table if they cannot be unambiguously attributed to one of the four species listed above.		
Continent	**Country/territory**	**Reference(s)**
Europe	–	
Africa	Comoros, Madagascar	CABI (1973); CABI (2013)
Americas	Guatemala	CABI (2013)
Asia	Bangladesh, Cambodia, Laos	CABI (1973); CABI (2013)
Oceania	New Hebrides, Niue, Solomon Islands	CABI (1973); CABI (2013)







Figures 1 (top), 2 (middle) and 3 (bottom). Known distributions of *Euwallacea fornicatior, E. fornicatus sensu stricto* and *E. kuroshio* respectively. Many records are shown at country/territory level only, and the actual distribution of the beetles will be more limited than depicted here, especially in the larger areas. Some records refer only to the species complex and cannot be unambiguously attributed to species; these are shown as “species group” records on each map. Sources are as cited in Tables 1–3 and 5.

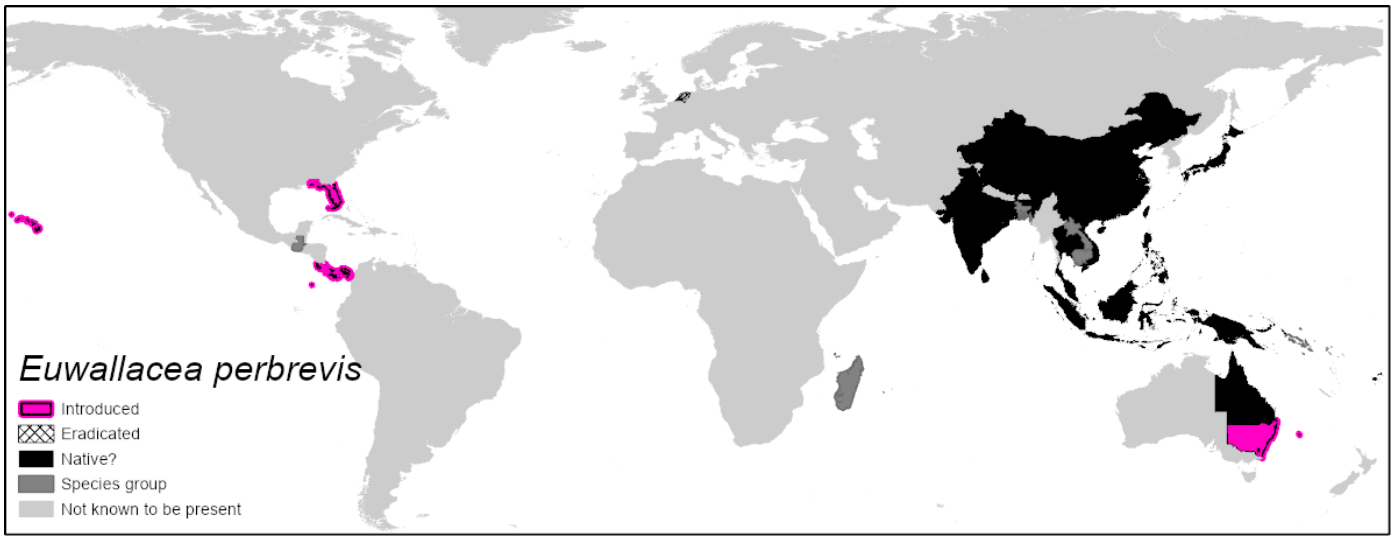


Figure 4. Known distribution of *Euwallacea perbrevis*. Many records are shown at country/territory level only, and the actual distribution of the beetle will be more limited than depicted here, especially in the larger areas. Some records refer only to the species complex and cannot be unambiguously attributed to species; these are shown as “species group” records on the map. Sources are as cited in Tables 4–5.

Invasive range

Three of the four species have become invasive pests outside their native ranges, though as mentioned in the previous section, it is possible that one or more of the species are actually invasive pests in some additional countries in south east Asia, Australia and the Pacific islands. Where data are available, dates of first detection are seldom considered to be the date of introduction. In fact, papers reporting the various findings usually suggest the beetle was present for a number of years before it caused enough damage to be detected.

Euwallacea fornicatior has not been recorded outside its presumed native range.

Euwallacea fornicatus s.s. was first recorded as an invasive pest in the early 2000s in California, USA (Haack, 2006; Stouthamer *et al.*, 2017). Since then, it has also been recorded in Hawaii (Rugman-Jones *et al.*, 2020), Israel (Mendel *et al.*, 2012), South Africa (Paap *et al.*, 2018), in glasshouses in several countries in Europe and outdoors in Spain (discussed in more detail in the next section), in the suburbs of Perth in Western Australia (Cook & Broughton, 2023) and, most recently South America: Buenos Aires in Argentina (Ceriani-Nakamurakare *et al.*, 2023), several states in Brazil (Covre *et al.*, 2024) and in the cities of Rivera and Montevideo in Uruguay (Ceriani-Nakamurakare *et al.*, 2025). The distribution data for this species in particular is likely to become out of date quite rapidly, as there are regular reports of this species establishing in more countries. The South African outbreak appears to be the largest of these, with beetles recorded up to 1000 km from the original locations (van Rooyen *et al.*, 2021). It has been found in locations including Durban, Johannesburg, the southern Cape and Cape Town (van Rooyen *et al.*, 2021).

Euwallacea kuroshio has only been recorded as invasive in Mexico and California in the USA, with the first records dating from the mid 2010s (De Jesus Garcia-Avila *et al.*, 2016).

Euwallacea perbrevis has the earliest known record outside the native range. The first formal record from the Hawaiian island group dates from 1910, but it is thought to have been present for some time before this (Rugman-Jones *et al.*, 2020). Since the finding on the first island of O'ahu, *E. perbrevis* has been recorded from additional islands in the group at various times in the twentieth century (Rugman-Jones *et al.*, 2020). Since then, *E. perbrevis* has also been found in Costa Rica and Panama (Kirkendall & Ødegaard, 2007), Florida in the USA (Haack, 2003; Gomez *et al.*, 2018) and Réunion in the Indian Ocean. It has been recorded from a glasshouse in Europe, discussed in more detail in the next section. Surveys in 2022 for *E. fornicatus s.l.* in Australia in Sydney (New South Wales) detected *E. perbrevis* in a few locations both north and south of the harbour (Callaghan *et al.*, 2024). Given *E. perbrevis* is known to be present in Queensland, this was treated as an extension of geographical range of a pest already known to be present in Australia, and while monitoring of locations in Sydney will continue, eradication will not be attempted (Callaghan *et al.*, 2024).

European findings

The findings in mainland Europe are significant for the UK, given its geographical proximity and consequent high trade volumes. All the findings in northern Europe have been in glasshouses and there are no indications of spread to the wider environment. Species identifications were all supported by molecular analyses.

Unless otherwise cited, the information on the situation in Europe which follows is all from Schuler *et al.* (2023).

POLAND

The first European detection of *E. fornicatus s.s.* was in Poznań, in a *Ficus religiosa* tree in a palm house in March 2017. The tree was traced back to an import from the Netherlands in November 2016, and it seems likely the tree was already infested when introduced to the site in Poland. The tree was heavily infested with over 1,000 beetles detected, but there were no findings on other trees in the glasshouse. The affected tree was covered in insecticide treated insect proof net, and subsequently destroyed and burnt. Attractant traps were set up in the glasshouse and monitored for a year, along with general visual monitoring. To counteract the risks from the associated fungi, soil was removed from around the affected tree, and remaining soil in the area was treated with fungicide. No evidence of further infestation or spread to other plants in the glasshouse was found during any monitoring activities, and there were no catches in the traps. This outbreak is now considered eradicated (EPPO, 2024).

ITALY

Several trees in a tropical glasshouse in Merano were found to be infested by *E. fornicatus s.s.* in April 2020. Most trees in the glasshouse were bought between 2013 and 2014, with one tree replaced in 2018, and it seems most likely that this 2018 tree was the source of the outbreak. Twenty-eight trees were found to be infested. Of these, 21 different host species were attacked, but those which showed most damage were *Annona muricata* and *Bixa orellana*. Ultimately, all the plants in the glasshouse, including roots, were removed and destroyed. The whole glasshouse was treated with solarisation (using a cover on the ground so that the sun's rays heat the soil beneath to lethal temperatures). Attractant traps and trap logs were deployed and checked weekly. Attractant traps were also placed outside the infested glasshouse to monitor for any spread to the wider environment, and known host trees were checked for symptoms. No beetles were detected outside the glasshouse, and the last *E. fornicatus s.s.* detection inside the glasshouse was at the end of May 2020. This outbreak is now considered eradicated (EPPO, 2024).

GERMANY

In January 2021 one *Mangifera indica* and one *Tectona grandis* tree in a tropical glasshouse in Erfurt, Thuringia were found to be infested with *E. fornicatus s.s.* The plants had both been imported from a specialist nursery in the Netherlands. The whole *Tectona* tree was removed, but only the infested *Mangifera* branches. Visual inspections were carried out every week on known hosts, and attractant traps were used both inside and outside the affected glasshouse. No *E. fornicatus s.s.* have been trapped at this site since March 2021, and no symptoms have been detected.

Subsequently a total of 136 plants from four species or genera in a glasshouse in Berlin were found to be infested, again by *E. fornicatus s.s.* Most of these plants had been imported from the same exotic plant nursery in the Netherlands as the Erfurt plants. The infested plants were grown in a site where megabats are kept (also known as fruit bats, or flying foxes), and due to the bats' needs for shelter, only symptomatic trees and branches were removed. Regular visual inspections of hosts were carried out. Attractant traps and trap logs were used both in and around the infested glasshouse. *Euwallacea* beetles were still being caught in September 2022. This Berlin outbreak is considered to be transient, actionable and under eradication (EPPO, 2024).

A third glasshouse, identified in trace forward activity, was found to have an infested plant (EPPO, 2024). The infested tree was destroyed, and further monitoring did not detect the pest and the outbreak at this site is considered to have been eradicated (EPPO, 2024).

NETHERLANDS

Two glasshouses owned by the same company in the area of Westland (province Zuid-Holland) were found to be infested by *E. fornicatus s.s.*, with the first detection being in 2021. One site was identified following trace-back of plants from an infested site in Germany (Netherlands NPPO, 2021-2022). Later molecular analysis showed that one of

the glasshouses also had *E. perbrevis*. One site had 12 infested plants and the other had 15 symptomatic plants, mainly of *Ficus* spp. The company had imported plants from many countries. The evidence of different haplotypes of both species being detected suggests that multiple introductions may have taken place.

All plants were removed in one of the glasshouses, after which time no *Euwallacea* beetles were caught in monitoring traps. In the second site, only infested plants and some showing potential symptoms were removed. Restrictions on the movement of woody plants and palms from the affected glasshouses were implemented. Cross-vane traps and attractant sticky traps were used to monitor the affected glasshouses. In the completely cleared glasshouse, after eleven days without findings eradication was declared in August 2021. The second glasshouse declared eradication in February 2022 after 12 weeks without catching any *E. fornicatus s.l*.

A separate outbreak in the province of Noord Holland was reported by the Netherlands NPPO (2021-2022). This site was found to be infested in July 2021, and this outbreak has also now been eradicated (EPPO, 2024).

Spain

The initial finding of *E. fornicatus s.s.* was in a public garden in Motril, Granada province, Andalucía, where 28 females and two males were collected from a dying *Acer negundo* in April 2022 (Goldarazena *et al.*, 2025). One male and 31 females were collected from the same garden in a *Parkinsonia* tree in 2023, and three females were caught in ethanol traps in 2024. Identification used both morphological and molecular methods. The affected trees were cut down and burnt and an eradication programme has been implemented (Goldarazena *et al.*, 2025). According to a local news website, several adults have been found in the wider environment, associated with ornamental *Persea americana* (avocado) trees (Feixas, 2024).

6. Is the pest established or transient, or suspected to be established/transient in the UK/PRA Area?

None of the four *E. fornicatus s.l.* species covered by this PRA have been found in any part of the UK, neither in the wider environment nor in protected environments such as glasshouses. No interceptions have been recorded by the Plant Health and Seeds Inspectorate (PHSI) in England and Wales and no interceptions are known from other agencies or from other parts of the UK.

7. What are the pest's natural and experimental host plants; of these, which are of economic and/or environmental importance in the UK/PRA area?

Host lists, especially for *E. fornicatus s.s.*, are very long and will only increase in length as more research is done into each species. Therefore, though the host lists in Appendix 1 are as up to date as possible, they can only reflect the current situation. It is virtually certain that many additional hosts will be confirmed as work on the invasive populations continue. Hosts are woody, and most are broadleaved, but some coniferous and palm hosts have been recorded.

Not all recorded hosts allow the beetle to complete its lifecycle. "Reproductive hosts" according to most authors means that galleries and eggs, larvae or multiple adults were found on that host (Eskalen *et al.*, 2013; van Rooyen *et al.*, 2021). Efforts have been made to concentrate only on the reproductive hosts in the data which follows, but the information is likely to be very incomplete for most, if not all, of the beetle species. It is virtually certain that some hosts currently considered non-reproductive may be found to support beetle development in future, as this has already happened for a number of hosts. For example, in South Africa van Rooyen *et al.* (2021) reported *Robinia pseudoacacia* as a non-reproductive host of *E. fornicatus s.s.*, but Bierman *et al.* (2022) found evidence that this host was suitable for breeding. Stressed and dying trees are more likely to prove suitable hosts (Mendel *et al.*, 2017), but *E. fornicatus s.l.* are capable of attacking apparently healthy trees.

Due to the sheer number of recorded hosts, this section of the PRA focuses on highlighting selected hosts of particular interest to the UK. Detailed host lists (according to current knowledge) are provided in Appendix 1 for each of the four species, indicating whether they are reproductive, non-reproductive (or unknown), and which countries each host has been recorded from. The recent revision in taxonomy means that not all host records can be unambiguously attributed to the four beetle species as currently delineated. Very recent host records can be attributed to species. Host records from the invasive ranges can often be attributed to a single species if that species is the only one recorded from that location. For example, records from Florida (USA) can be attributed to *E. perbrevis*, or records from South Africa to *E. fornicatus s.s.* Older host records from Asia can seldom be attributed to one of the four species and thus a fifth host list is provided in Appendix 1 for records from *E. fornicatus s.l.*

Euwallacea fornicatior

This species has the fewest recorded number of host species. This is probably due to this beetle not having been recorded outside its native range, meaning there is little incentive to study it as it is a known pest and management practices in its native range will be well established. Though there are only six species of hosts recorded, none of which are widely grown in the UK, this list is almost certainly extremely incomplete. The recorded hosts are from four different plant families which suggests *E. fornicatior* has the ability to adapt to a

range of host defences in a similar manner to the other three species in the complex. This PRA assumes that if *E. fornicatior* were to be introduced to a new region, it would be able to utilise a very wide range of hosts, in line with the other species considered.

Euwallacea fornicatus sensu stricto

This species has the largest recorded host range of the four beetles in this PRA. This would appear to be primarily because it has been recorded as invasive in several distinct geographical regions each with their own flora, and the species has been intensively studied in each. A selection of reproductive hosts of environmental, social or economic importance to the UK are given here, though many of the recorded hosts are tropical or subtropical trees not commonly grown in the UK. The much longer host list in Appendix 1 should be consulted to give a better idea of the sheer number and range of hosts.

Acer negundo (box elder) appears to be particularly susceptible/attractive to *E. fornicatus s.s.*, for example Cape Town in South Africa (Potgieter *et al.*, 2024) or Western Australia (Cook & Broughton, 2023). *Acer negundo* are sold as garden ornamentals in the UK, and there are records throughout much of the UK, though these are very scattered in all but the southern part of England[5].

The plant family Fabaceae has the highest number of recorded host species, both reproductive and non-reproductive. Though neither species (nor either genus) have been specifically recorded as hosts to date, broom and gorse (*Cytisus scoparius* and *Ulex europaeus*), both woody Fabaceae, are extremely common in the wider environment in the UK.

Recently, *E. fornicatus s.s.* and/or its symbiotic fungus *F. euwallaceae* have been recorded in orchards in South Africa. Susceptible plants in South Africa which are also commonly grown in the UK for fruit include *Malus domestica* (apple) (de Jager & Roets, 2022), *Prunus domestica* (plum) (de Jager & Roets, 2023) and *Pyrus communis* (pear) (Engelbrecht *et al.*, 2024; Neethling *et al.*, 2024). However, *Vitis vinifera* (grapevine), while attacked by the beetles, has not been confirmed to be a breeding host. Artificial inoculation of the fungus on *V. vinifera* showed initial lesions but the fungus could not be re-isolated after three months (de Jager & Roets, 2022).

Platanus × *hispanica* (London plane) is widely planted as a street tree in cities, mostly due to its habit of shedding the outer layer of bark and thus looking clean as the build-up of pollutants is lost along with the outer bark. Fairly widely grown in parks and gardens as ornamentals, plants such as *Ficus* spp. (figs), *Magnolia* spp., *Morus alba* (white mulberry), *Robinia pseudoacacia* (false acacia) and *Wisteria* spp. are all reproductive hosts for *E. fornicatus s.s*. Figs are even grown for some domestic fruit production in very sheltered gardens. *Olea europaea* (olive) trees are commonly sold in the UK and are often grown in pots. Olives are known to be attacked by *E. fornicatus s.s.* and *F. euwallaceae* has been shown to be pathogenic to olives in artificial inoculation experiments (Crous & Roets,

[5] Search on https://bsbi.org/maps (data accessed July 2024)

2024), though at the time of writing, the cultivated subspecies *O. europaea* subsp. *europaea* is not a confirmed reproductive host.

In the wider environment such as woodland or hedgerows, *Acer pseudoplatanus* (sycamore), *Populus* spp. (poplars), *Quercus* spp. (oaks) (including *Q. robur*, English oak) and *Salix* spp. (willows) are confirmed breeding hosts. While the exact reproductive host species may not always be those widely grown in the UK, as the beetle has been recorded from several species in the genera listed, it seems probable that UK native species may also be at risk from *E. fornicatus s.s*. Similarly, while *Fagus sylvatica* (common beech) hasn't been recorded as a breeding host, *Fagus crenata* (Japanese beech) has.

Euwallacea kuroshio

None of the confirmed reproductive host species for *E. kuroshio* are widely grown in the UK, but they do include some tree genera which are widely grown here: *Acer, Platanus, Quercus* and *Salix*.

Euwallacea perbrevis

This species has relatively few confirmed reproductive hosts, with *Camellia sinensis* (tea) being the only host grown outdoors commercially in a few sites across the UK. However, the beetle has been recorded feeding on hosts from a wide range of plant families, suggesting a capacity to feed on a variety of hosts. While there are few records of reproductive hosts, there are also relatively few hosts classified as not suitable for reproduction, suggesting that there has been comparatively little research on this species.

Euwallacea fornicatus sensu lato

These are the host records which cannot be attributed to any one of the four species of *Euwallacea* included in this PRA. Much of the data is simply older, before the species complex was delineated in its current form. Some of the more recent data are from the native range where it is not always clear exactly which species of the complex is being studied. As with the individual species, Appendix 1 should be consulted to get a better idea of the range of hosts which are attacked, as only a selection of hosts which are of some importance to the UK are covered in this section. Again, many of the hosts are tropical and subtropical in distribution, and, if grown at all, are ornamentals in the UK.

Coffea arabica (coffee) plants may be grown in the UK, but as indoor houseplants and seem unlikely to reach a size suitable for development of *E. fornicatus s.l. Ligustrum compactum* (a type of privet) is a recorded breeding host, though the common garden hedge plant in the UK is a different species, *Ligustrum ovalifolium*.

Conifers are an unusual breeding host, but there has been a record on *Pinus massoniana* (Chinese red pine, or Masson's pine), though the affected tree was not in good health (Li *et al.*, 2016).

In Taiwan, the taxon known as H22 appears to prefer *Ricinus communis* (castor bean trees) to *Persea americana* (avocado) (Liu *et al.*, 2022b).

8. Summary of pest biology and/or lifecycle

These four species of *Euwallacea* are ambrosia beetles, living in the sapwood of their hosts. The biology for all four species is likely to be very similar, though not all species have been researched in the same detail. As with other sections of this PRA, the information presented below almost certainly applies to *E. fornicatus s.s.* Enough information is available to suggest *E. kuroshio* and *E. perbrevis* are likely to have the same broad characteristics. With so few data available, there are many uncertainties for *E. fornicatior*.

As with some other Scolytinae, *E. fornicatus s.l.* have a haplodiploid mating system combined with inbreeding via sibling mating (van Rooyen *et al.*, 2021). Haplodiploid reproduction means that fertilised eggs produce female offspring (which can fly), while unfertilised eggs produce males (which are flightless) (Chen *et al.*, 2020). The populations are often heavily female-biased (Cooperband *et al.*, 2016). As adults are relatively long lived and generation time is short, an unfertilised female can lay eggs which develop into adult males, then she can mate with one of her offspring to produce fertilised eggs and female offspring (Cooperband *et al.*, 2016). Another aspect of sibling mating is that in a mixed sex brood, females may mate with their flightless brothers within the natal galleries, meaning that any female which leaves the host could already be mated (Cooperband *et al.*, 2016). This means that a founder population may result from the introduction of a very small number of individuals; indeed, the theoretical minimum required is one female, either mated or unmated. There is no evidence that the populations of *E. fornicatus s.s.* suffer from the effects of inbreeding (cited in van Rooyen *et al.*, 2021), though there do appear to be some mechanisms to encourage outbreeding such as females sometimes emerging first, and males walking outside the galleries and on the bark of their hosts (Cooperband *et al.*, 2016). Detailed information is not available for *E. fornicatior* or *E. kuroshio*, but they are likely to follow the same general strategies.

Unusually for ambrosia beetles, the species included in this PRA have been recorded attacking live and healthy hosts. Adult females fly to locate a new host, or some remain on their natal host and move to a new location by walking on the bark (Liu *et al.*, 2022a). Most adult flight activity (female only) is observed in the daytime, between about 1100 and 1600 hours (Calnaido, 1965; Kendra *et al.*, 2017; Liu *et al.*, 2022a). The initial flight after the female adults emerge from the branches usually involves a vertical upwards flight (Calnaido, 1965). Once a host has been identified, they start tunnelling into the bark to construct galleries to lay their eggs, introducing fungi to the tunnels as they construct them. The life-stage durations which follow are based on Californian populations of *E. fornicatus s.s.* and, it is assumed, reasonably high temperatures. Eggs hatch in around 4 days, then the larvae take around 16-18 days to develop through three instars before pupation in the galleries, which takes around 8-10 days (O'Donnell *et al.*, 2016). Females require around 4-6 days to mature before they disperse to find a new host and start to

construct new galleries (O'Donnell *et al.*, 2016). Entrance holes are small, around 0.85 mm in diameter (Coleman *et al.*, 2019). At 24°C in the laboratory on sawdust based substrate, egg-adult life cycle lasted around 24 days for *E. fornicatus s.s.* and *E. perbrevis* (Cooperband *et al.*, 2016). These times are based on a single mated female placed in a new rearing tube with food (day zero), then examining the galleries visible through the tube walls and/or any life stages visible on the surface of the substrate at regular intervals (Cooperband *et al.*, 2016).

The generalised feeding habits of all four species are similar. All are ambrosia beetles, meaning that the insects do not feed directly on the wood of their hosts. Instead, the beetles have an obligate and symbiotic relationship with fungi. The beetles are not able to digest plant material. The fungus is introduced by the beetles to the host where it grows on the walls of the galleries the beetle excavates in the wood (Lynch *et al.*, 2016). The symbiotic fungi break down the woody host material and then *E. fornicatus s.l.* feed on the fungi. This contributes to the definition of reproductive hosts: if the host is not susceptible to the fungus, then it is not suitable for beetle reproduction, either. Each of the *Euwallacea* species in this PRA have different species of major fungal symbionts (see section 15 of this PRA). As the fungi are so critical to survival, a beetle colonising a host must also introduce their fungal symbiont. To aid this, adult female *Euwallacea* have specialised cavities in their cuticles called mycangia which specifically store and transport fungal conidia. Mycangia in *E. fornicatus s.s.* and *E. kuroshio* are found pre-orally on the heads (Freeman *et al.*, 2016; O'Donnell *et al.*, 2016): Lynch *et al.* (2016) and Na *et al.* (2018) isolated fungi from macerated female beetle heads. Fine details of the location and structure of mycangia are available for other species of *Euwallacea* which are not part of the *E. fornicatus* complex (for example, Jiang *et al.*, 2019; Spahr *et al.*, 2020), which supports the assumption that *E. fornicatior* and *E. perbrevis* also have mycangia.

9. What pathways provide opportunities for the pest to enter and transfer to a suitable host and what is the likelihood of entering the UK/PRA area?

A major consideration for all pathways considered is the mating strategies outlined in the previous section on host biology. Due to sibling mating, many females leave their natal galleries already fertilised. Even a single unfertilised female can theoretically found a population because of haplodiploid mating and overlapping generations of adults.

Due to the very wide host ranges, many pathways remain open to some extent or are not fully mitigated, as host prohibitions and measures on specific hosts do not cover the full range of plants which these beetles are likely to be able to use.

When rating the pathways, it is assumed that all four species are similar. However, most key information is lacking for *E. fornicatior*, while *E. fornicatus s.s.* is very well studied. This applies especially to host ranges, and for some pathways the confidence ratings are split by species to reflect the differing levels of assumptions being made.

Plants for planting of proven reproductive hosts

The outbreaks in European glasshouses were linked to the movement of woody plants from specialist Dutch nurseries to several countries (Schuler *et al.*, 2023). The imported plants are likely to be kept in conditions promoting their survival after arrival, and those conditions are also likely to favour the beetles' ability to survive and reproduce. Traded plants are also likely to be stressed, even if only for a relatively short time around export, and this would promote beetle colonisation and survival. Given the highly polyphagous nature of *E. fornicatus s.l.*, it is very likely that adult females, which can fly, will be able to locate additional hosts in the vicinity after arrival at the destination. Any life stage present inside a reproductive host is likely to be able to complete its lifecycle together with their associated fungal symbionts, and only very low numbers of beetles are required to found a new population.

Plants moved in trade are likely to be smaller and younger. However, even relatively narrow diameters of trees have records of attacks by *E. fornicatus s.l.* and so this would not seem to prevent movement on this pathway. *Camellia sinensis* twigs 0.5-1.3 cm in diameter (reported as 3/16 to 1/2 an inch) are frequently attacked in Sri Lanka (Cranham *et al.*, 1968), or "pencil sized stems" (Kumar *et al.*, 1998). Sivapalan (1975), again studying *C. sinensis* in Sri Lanka, commented that brood galleries are "rarely established" if the branch is less than 5 mm diameter. The outbreak of *E. fornicatus s.s.* in the Italian glasshouse detected boreholes in "twigs less than 2 cm in diameter" (Schuler *et al.*, 2023). In Israel, *E. fornicatus s.s.* was recorded on branches 2-6 cm diameter for both *Persea americana* and *Acer negundo*, though the beetles apparently preferred thinner *P. americana* branches, but thicker *A. negundo* branches (Mendel *et al.*, 2017). Trees of 2.5-4.0 cm diameter attacked by *E. perbrevis* in Florida do have fewer holes per unit area compared to larger trees, indicating a lower rate of attack and infestation (Owens *et al.*, 2018); it should be noted that only branches >2.5 cm in diameter were included in the analysis meaning if thinner branches were attacked, this would not have been recorded. Larger hosts, though less commonly traded, are more likely to allow the pest to enter. The pest is less likely to be detected on inspection due to the physical difficulties posed by the sheer size of large trees. The number of beetles associated with a single large host could be quite high, and difficulties with examination of large trees even one planted could allow very large population build ups before damage to the host was severe enough to be detected. Also, a larger tree is likely to survive the infestation for a longer period of time, allowing the developing beetle population more time to locate new hosts before the old host dies.

Some of the hosts are prohibited pending risk assessment in both Great Britain and Northern Ireland from much of the beetles' range, for example *Acer* spp., *Ficus carica*, *Populus* spp., and *Quercus* spp. As assessments are requested by the country wishing to export the trees, and completed by either EFSA for the EU (applicable to Northern Ireland) or Great Britain, specific measures to mitigate against pests of concern may be added to the relevant legislation. These measures would then permit import of selected prohibited hosts from named countries. For example, following such assessments, measures

specifically designed to mitigate against entry of *E. fornicatus s.l.* have been introduced on *Albizia julibrissin* and *Robinia pseudoacacia* from Israel, in both Great Britain and Northern Ireland. Additionally, Northern Ireland has measures targeted against *E. fornicatus s.l.* on a long list of hosts listed in Annex VII of the EU legislation which applies there (see appendix 2 for the full regulated host list). However, only a proportion of the very long list of reproductive hosts of *E. fornicatus s.s.* are regulated. New reproductive hosts are often added to the lists, especially for *E. fornicatus s.s.* Following each new introduction into a new part of the world with different host species available, the reproductive host lists invariably lengthen further. Therefore, not all reproductive hosts are included in any regulations and thus some reproductive hosts do not have specific mitigations against Scolytinae in general, nor *E. fornicatus s.l.* in particular.

General requirements for trees and shrubs for planting (other than seeds and plants in tissue culture) do apply in all parts of the UK. Such plants, if originating from outside Europe, have to have been grown on a nursery and, among other requirements, inspected prior to export and been found to be free from “signs or symptoms of harmful nematodes, insects, mites and fungi or have been subjected to appropriate treatment to eliminate such organisms.” *Euwallacea fornicatus s.l.* are small beetles and spend much of their lifecycle hidden under the bark, and so may not be detected at inspection. Symptoms of attack which are externally visible vary depending on tree species, but include round holes around 0.85 mm in diameter, with fine dust from the wood boring often stuck together in strands visible on the outside of the trunk (Coleman *et al.*, 2013). Symptoms of early attack are less obviously due to beetle damage, and include wet staining on the bark of the host, and sometimes gumming or other symptoms (Coleman *et al.*, 2013). Depending on species, hosts appear to show different external symptoms (Townsend *et al.*, 2024). If the tree has a high population of beetles, it may show branch or crown dieback and sprouting from the base of the trunk (Coleman *et al.*, 2013), but there can be many other causes of such symptoms and such clearly unhealthy trees are unlikely to be moved in trade. Photos of *E. fornicatus s.l.* damage can be found in many places; the photos in EPPO Global Database are a good starting point (https://gd.eppo.int/taxon/XYLBFO/photos).

Given the very wide range of reproductive hosts (proven for *E. fornicatus s.s.*; assumed by analogy for *E. fornicatior, E. kuroshio* and *E. perbrevis*), the cryptic nature of the lifestyle, and planting material being a proven pathway for introduction to new areas, plants for planting of reproductive hosts is a viable pathway. Factors against entry on this pathway include wood boring beetle damage being detected during pre-export or entry inspections, leading to rejection of the infested consignment. Entry on the pathway of plants for planting of proven reproductive hosts is assessed as **moderately likely.** This judgement is made with **high confidence** for *E. fornicatus s.s.* and, due to the shorter lists of reproductive hosts, **medium confidence** for the other three species.

Plants for planting of non-reproductive hosts

As outlined in the pathway of reproductive host plants for planting, beetles have been found in branches 2 cm or less in diameter, and so even relatively small trees moving in trade could contain the pest.

A non-reproductive host might allow adult survival and even feeding during transport. If the symbiotic fungi are able to temporarily colonise the tunnels of that plant, the beetles would be able to feed and prolong their lifespan, even if the next generation (eggs, larvae) could not develop through to adult. If the plant was non-reproductive because the symbiotic fungus was not able to colonise that host species, beetles would not be able to feed and their lifespan would be shorter and the pathway less likely. *Euwallacea fornicatus s.s.* is known to attack trees which are not reproductive hosts, especially when populations are high (Mendel *et al.*, 2021). Any eggs or larvae associated with non-reproductive hosts are unlikely to be able to complete development to adult and so entry is unlikely for any immature life stage on this pathway. After arrival with a non-reproductive host, adult females would have to locate a reproductive host in which to lay eggs, but as the reproductive host lists are so long (for *E. fornicatus s.s.* and assumed for the other three species), suitable hosts could be readily available. The symbiotic fungi will be available for inoculation into any new plant as they are carried on the beetles' mycangia.

Regulatory controls on non-reproductive hosts are very similar to those outlined under the pathway of reproductive hosts. Some plant genera and species are prohibited in both Great Britain and Northern Ireland. The EU requirements which apply in Northern Ireland against *E. fornicatus s.l.* mainly include reproductive hosts, and thus will not be so relevant here. The general requirements for all trees and shrubs imported from outside Europe to show no signs or symptoms of pests, or to have had an appropriate treatment against them, may help to mitigate against entry.

An additional factor affecting plants moved in trade is that they are likely to be quite stressed and thus more susceptible to pests in general, including *E. fornicatus s.l.* or their symbiotic fungi. As well as potentially having been kept in pots or been dug up with associated root damage, there are general import requirements for non-European plants requiring the removal of much of the growing media which will cause severe stress to the plant (measures applicable in both Great Britain and Northern Ireland). Therefore, transported plants are likely to take some time to recover full health after transport. Stressed plants will be more susceptible to beetle and fungal attack, and, in these instances, even non-reproductive hosts may permit the full beetle lifecycle. For example, the anomalous conifer record for *Pinus massoniana* as a breeding host was based on a tree which was not in good health (Li *et al.*, 2016). Another uncertainty is the continued expansion of both reproductive and non-reproductive host lists, in particular formerly non-reproductive hosts later being found to support reproduction.

Overall, the plants in this category are considered a less favourable pathway than reproductive hosts. These plants are unlikely to allow larval development to adult and they are likely to be less suitable for feeding by any life stage as the ambrosia fungi may not be

able to establish, or might grow slowly (Mendel *et al.*, 2021) which means the beetles have insufficient food. Any adults which arrive on a non-reproductive host will need to locate and move to a reproductive host in order to lay eggs which can successfully develop to the next generation. Entry of all species on this pathway is considered **moderately likely**, but with **low confidence** due to the changing knowledge of suitable hosts.

Plants for planting of woody plants not recorded as hosts

As outlined in the pathway of reproductive host plants for planting, beetles have been found in branches 2 cm or less in diameter, and so even relatively small trees moving in trade could contain the pest. Plants moved in trade are likely to be stressed, and more vulnerable to pest attack even if they would not normally be suitable hosts. *Euwallacea fornicatus s.s.* does not appear to distinguish between hosts and non-hosts when establishing new tunnels, though some trees do not seem to be attacked even when they are growing close to infested trees (Mendel *et al.*, 2021). Additionally, the host lists for *E. fornicatus s.s.* in particular are constantly increasing. As the beetles encounter new plant species in new parts of the world, the host lists invariably lengthen, meaning that plants which are not recorded as hosts at the current time may in fact allow the fungus to colonise and/or complete development of the beetles. Similar to the non-reproductive hosts pathway, adults are likely to have to locate a suitable reproductive host after arrival.

Plant health regulations are equivalent in all parts of the UK, and include prohibitions pending PRA on a number of woody plant species and general requirements on trees and shrubs, as outlined in the plants for planting of proven reproductive hosts pathway.

Entry of all species on this pathway is considered **unlikely** as though there are a lot of similarities to the non-reproductive hosts pathway, there is not a current known association between *E. fornicatus s.l.* and these plants. The assessments were made with **low confidence** due to the regularly changing knowledge of suitable hosts.

Cut branches

This pathway is considered to mean thin branches consisting of fresh (green) wood, with or without leaves, with the intended use for floristry or similar. Wood pathways are discussed later in the PRA. While most tunnels are found on the main trunk or larger branches, some damage is found on smaller branches including those around 2 cm in diameter (Coleman *et al.*, 2019). The outbreak of *E. fornicatus s.s.* in the Italian glasshouse detected boreholes in “twigs less than 2 cm in diameter" of two species (Schuler *et al.*, 2023). Most Scolytinae beetles feed on dead or diseased trees, and *E. fornicatus s.l.* are unusual as they are capable of feeding on living, healthy trees. However, while *E. fornicatus s.l.* can feed on live trees, both the beetles and their associated fungi do not require living hosts to continue development: experiments with cut logs show that development can continue inside cut material for some months (Jones & Paine, 2015). However, the thinner the cut branches, the faster they will dry out and become unsuitable.

Items such as fresh green branches for pet rodents to chew are likely to dry out relatively quickly and become unsuitable, and are often sourced within the PRA area rather than imported from the beetles' current ranges. Cut branches used for floristry are likely to be kept in water to prolong their life, thus also prolonging the time they are suitable for *E. fornicatus s.l.* But such floristry branches are also likely to be thinner and potentially less attractive to the beetles in the first place. In all cases, adults will need to transfer to a growing reproductive host in order for the population to perpetuate. If the cut branches are ornamental and kept indoors, beetles will have more difficulty in locating a suitable growing host, which is more likely to be found outdoors. While the insect holes are quite small and could be overlooked, frass and debris from tunnelling is ejected from the holes, and is likely to be noticed. Infested branches might be rejected for use in decorations or discarded by householders. Depending on the methods of disposal, this might facilitate the beetles' transfer to a suitable growing host (e.g. discard onto a domestic compost heap in summer), or reduce it (e.g. commercial waste collection, possible maceration and industrial composting temperatures).

Overall this pathway is considered **unlikely** for all species, due to the lower chances of association with this commodity, the limited lifespan of the product and the greater difficulties of transfer to a suitable growing host. The assessment is made with **medium confidence** as, though little is known about the trade in cut branches, the difficulties in transfer to a suitable growing host are more certain.

Round wood including firewood

As *E. fornicatus s.l.* are found in the sapwood, not the outer phloem or cambium, this pathway includes wood both with and without bark as both may contain viable beetles.

Experimentally, *E. fornicatus s.s.* has emerged as adults for up to five months after logs have been cut, depending on the tree species (Jones & Paine, 2015; Chen *et al.*, 2020). Within cut logs, full development from egg laying to adult emergence was suspected (but not proven), given the relatively short lifecycle and period of time adults continued to emerge (Chen *et al.*, 2020). Wood moved long distances in trade is likely to be less suitable for continued development, because freight costs mean that the logs are likely to have undergone some form of drying to remove moisture and reduce the weight. The drying process in itself may not kill the beetles and their associated fungi, especially if air-drying is used, but it will make the wood less suitable for fungal growth and continued development of either beetle or fungus. In South Africa, it is suspected that many new outbreaks are linked to the movement of firewood, for example findings in mature forest areas which have facilities for visitors to make their own fires with wood they have brought with them (de Wit *et al.*, 2022; Townsend *et al.*, 2024). Dry, fully seasoned firewood is unlikely to be a pathway, but if green wood is bought and subsequently dried at its destination (e.g. home log piles), then it would provide a pathway of entry. As firewood is often stored in structures which are relatively open to the outside to promote air flow, transfer to a growing host would not be too difficult for emerging adult females.

The regulations on wood of deciduous trees (hardwood) are complex and also divergent between Great Britain and Northern Ireland in terms of *E. fornicatus s.l*. Only a summary is provided here.

In Great Britain, wood of certain named broadleaved tree species have various measures in mitigation against specific pests in Annex 7. None of these measures target *E. fornicatus s.l*., and the regulations against other pests are unlikely to significantly reduce the likelihood of entry of *E. fornicatus s.l.* Wood of most tropical/subtropical hosts is not regulated. Firewood is often composed of poorer-quality wood, and thus is considered more likely to have pests associated with it. Accordingly, in Great Britain there is a scheme encompassing the import of all "non-regulated solid fuel wood"[6], where all such wood must be notified to the Forestry Commission within four days of arriving in Great Britain. Based on the information in each notification, the Forestry Commission decides whether inspection of the firewood is appropriate.

In Northern Ireland there are specific Annex VII measures against *E. fornicatus s.l.* on the wood of a long list of plant species and genera (see Appendix 2). If wood from any of the named plants originates in an area where *E. fornicatus s.l.* is known to occur, it must be either heat treated or kiln dried to specified levels. This will reduce the likelihood of entry of viable insects in the wood of those named plants, but not all reproductive hosts are listed and so the mitigations on the pathway are not fully effective. Additionally, and similarly to Great Britain, certain named hosts have wood mitigations against other pests in Annex VII, but those are unlikely to significantly reduce the likelihood of entry of *E. fornicatus s.l.*

Overall, entry on the pathway of round wood is considered **unlikely** due to the limited suitable lifespan of the commodity, with **medium confidence**. Association with the commodity in general are reasonably well known, but there are uncertainties remaining, such as the suitability of air dried logs for continued development.

Sawn wood

Association of *E. fornicatus s.l.* with sawn wood is possible, as the beetles can continue to develop in cut logs, as discussed under the round wood pathway. These species of *Euwallacea* are found in the sapwood, and so the limited or absent bark in sawn wood (simply due to the way the logs are slices from trunk, so even if bark is present, it is usually restricted to the edges of the planks) does not affect the likelihood of association with this pathway. However, sawn wood is more highly processed and this is considered to reduce the chances of association. To prevent planks shrinking and warping as they dry out, wood is usually kiln or air dried before being sawn. Kiln drying may not reach sufficient temperatures to kill the beetles outright, as temperatures used may be as low as 30°C in dehumidification kilns (Hiziroglu, 2017, values reported in °F and converted). However, the reduction of moisture in the wood from drying of any type is likely to reduce survival of both the beetles and their symbiotic fungi. In addition, the larger surface area of sawn wood will promote drying, thus further reducing the suitability for *E fornicatus s.l*. Adult females are

[6] https://www.gov.uk/guidance/import-firewood-into-great-britain

2.5 mm or less in length, so theoretically even thin planks could harbour insects, but thinner wood will dry out even faster.

There are data available on the import of sawn wood, based on customs declarations (UK trade info, 2024) (Table 6). Countries within the current ranges of *E. fornicatus s.l.* were selected (excluding countries where populations are under eradication). Given the very wide host ranges, all HS6 categories for wood >1 mm were used under the following categories (text descriptions adapted and shortened):

- 440721 Mahogany "*Swietenia* spp."
- 440722 Virola, imbuia and balsa
- 440723 Teak
- 440725 Dark red meranti, light red meranti and meranti bakau
- 440726 White lauan, white meranti, white seraya, yellow meranti and alan
- 440727 Sapelli
- 440728 Iroko
- 440729 Other tropical wood (excluding the previous categories within 44072x)
- 440791 Oak "*Quercus* spp."
- 440792 Beech "*Fagus* spp."
- 440793 Maple "*Acer* spp."
- 440794 Cherry "*Prunus* spp."
- 440795 Ash "*Fraxinus* spp."
- 440796 Birch "*Betula* spp."
- 440797 Poplar and aspen "*Populus* spp."
- 440799 Other non-tropical wood (excluding the previous categories within 44079x)

As far as can be determined from the common names, not all the hosts from the tropical wood list above are proven hosts. *Virola, Ocotea* (imbuia), *Parashorea* (white seraya) and *Entandrophragma* (sapelli) are not currently recorded hosts of any of the four *Euwallacea* species included here. The decision was made to include import data from these hosts on the basis that it is at least possible that they could in fact host one or more of *E. fornicatus s.l.* species discussed here given the degree of polyphagy demonstrated by the beetles.

These data will be overestimates, at least in places. In countries such as the USA and Brazil, the beetles are only present in a relatively small areas of the country, while the data are for the whole country. Thus, although the USA exports most sawn wood to the UK of the countries considered, the tonnage of wood from areas with *E. fornicatus s.s., E. kuroshio* or *E. perbrevis* (California, Florida and Hawaii) will be a great deal less. Over the last ten years, from most countries there appears to be a decline in the level of exports of wood under these codes to the UK. The reasons for this are unclear, though it is possible that some of the reductions may be related changing trade patterns after EU exit.

Table 6. UK imports of sawn wood from countries where *Euwallacea fornicatus sensu lato* are known to be present, 2014-2023 (tonnes). Countries sorted by those exporting the highest amount of sawn wood to the UK. HS6 customs codes used were 440721–440729 and 440791–440799 inclusive.

Country/year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
United States	77,165	69,016	72,814	65,104	65,946	60,813	52,373	56,375	46,473	47,721
Malaysia	15,174	12,495	14,137	13,727	11,134	10,287	7,855	6,135	10,365	7,201
Brazil	565	238	1,261	1,343	2,562	4,829	4,392	2,914	4,766	5,166
China	2,325	1,239	864	866	673	716	524	665	1,302	239
Indonesia	2,167	2,052	2,495	576	298	235	208	434	587	258
Singapore	1,709	1,421	265	127	51	663	92	460	312	27
South Africa		24	20	3	14	230	337		300	4
India	27	29	30	70	70	20	47	36	32	33
Australia	4	4	74	24			1	226	17	11
Vietnam			13		30		63	51	82	6
Israel	5								124	102
Philippines	47	37	30				49			
Costa Rica				7				4	67	
Panama	16	13	16							
Papua New Guinea		28								3
Fiji									10	16
Japan		1		6			12			
Taiwan	18									1
Argentina					15					
Thailand					5				1	
Guatemala				1						

Underestimates in the data may be due to some of the customs code categories in the more specialised uses of sawn wood not being used, though the wood could potentially contain *E. fornicatus s.l.* Codes of particular relevance are 440831 and 440839 (sheets for veneering), 440890 (sheets for veneering and small boards for the manufacture of pencils) and 440922 (tropical wood for parquet flooring). Some of the descriptions of veneer sheets suggest they could be of a thickness which could theoretically contain beetles. However, these codes were excluded from the trade data on the basis of the specialised end uses meaning the wood is likely to have been heavily processed and less favourable for continued beetle development. On wood for veneers in particular, an internal Defra report

(Allen, 2022) has identified that the industry standard production processes for veneers involves soaking wood in water heated to 80°C or more for at least 24 hours before the veneer sheets are cut. The thin sheets are then dried at temperatures in excess of 110°C for 1-2 minutes. The report concludes that, for any insect, “There is no likelihood that insects will survive in wood processed into veneer sheets if all temperature requirements are met during the production process” (Allen, 2022).

As outlined under the round wood pathway, regulations on wood are very complex. The regulations against Scolytinae are targeted against conifer wood and will not affect the risk of movement on deciduous hardwoods. In Great Britain, there are measures on various hardwood species, including some hosts of *E. fornicatus s.l.,* but the measures are targeted against other specific pests, and as such will not fully mitigate against the introduction of *E fornicatus s.l*. In Northern Ireland there are specific Annex VII measures against *E. fornicatus s.l.* on the wood of a long list of plant species and genera (discussed more fully in the roundwood pathway), but not all reproductive hosts are listed and so even here the pathway is not fully mitigated.

Overall, due to nearly all sawn wood being dried before cutting, the risk of viable *Euwallacea* associated with this commodity is considered to be **very unlikely** with **high confidence**.

Wood packaging material

Solid wood packaging material (WPM) will often be made out of poorer quality wood, for example wood with insect tunnels or fungal staining. As with the round wood pathways, there is evidence that cut wood continues to be suitable for the development of at least *E. fornicatus s.s.* for several months (Jones & Paine, 2015; Chen *et al.*, 2020). However, these beetles are not dead wood specialists. Most WPM has a relatively long lifespan as it is re-used. Of WPM in the form of pallets, only a small proportion would be made with recently cut wood (or old broken WPM mended with new wood) and could contain viable *E. fornicatus s.l.* Some WPM may consist of sawn planks with a low likelihood of viable *Euwallacea* present due to the reasons outlined in the sawn wood pathway. However, other WPM (such as dunnage for supporting cargo in a ship’s hold) may contain larger sections of wood, and it is in these that the risks will be greatest. Some WPM such as pallets are commonly stored outside which would facilitate transfer to a suitable living host, but WPM kept indoors would lower the likelihood of beetles being able to transfer.

The International Standard for Phytosanitary Measures (ISPM) number 15 concerns WPM. The ISPM 15 requirements targeted against bark do not mitigate against introduction of *E. fornicatus s.l.*, as they are found deeper, in the sapwood. The requirements for heat treatment or fumigation do reduce the chances of viable beetles being associated with this commodity. If properly implemented, these measures should kill any life stage of *E. fornicatus s.l.* present, as the measures are specifically targeted at pests which live inside wood. All WPM moved into Great Britain from any country, or WPM moved into Northern Ireland from outside the EU, must be treated to ISPM 15 standards.

There have been cases of poor compliance with ISPM 15, including fraudulent markings, identified during EU audits of Chinese WPM procedures (Eyre *et al.*, 2018). Between April 2013 and March 2015, there were 12 interceptions in the EU of Scolytinae (not identified further) on WPM from China used for transporting heavy stone products (Eyre *et al.*, 2018). Between 1999 and 2014, Scolytinae were detected in the EU on general WPM from China, but not the USA (Eyre *et al.*, 2018). As all non-European Scolytinae are quarantine pests in the EU, interceptions are seldom reported to species level (EFSA, 2024), but *E. fornicatus s.l.* have been intercepted by the USA on WPM at least six times, on material originating in China (Haack, 2006). As *E. fornicatus s.l.* are found in southern Asia, including records of three of the species from China, this suggests that there is the potential for some WPM from the current distributions of *E. fornicatus s.l.* to still contain live insects. A factor that will reduce the risk of even non-compliant WPM is *E. fornicatus s.l.* are not pests of dead wood. While they can continue to develop in cut wood for a time, they are not likely to reinfest pallets which have been reused several times and are older, or pallets which have been made of dried wood with a low moisture content.

Overall, due to the limited period WPM would be suitable for continued development of *E. fornicatus s.l.* and the mitigations in ISPM 15 (even though there have been cases of non-compliance) means that entry is considered **very unlikely** on WPM. This judgement is made with **medium confidence** as it is very difficult to accurately assess the current level of non-compliance and only limited data are available. The confidence is not low because ISPM 15 is an internationally well known and understood phytosanitary measure and it is assumed that it is applied correctly more often than not.

Wood chips

Adult beetles are very small with females reaching a maximum length of about 2.5 mm. Wood chips are substantially larger, and so there is a possibility that beetles, pupae or even late instar larvae may be unharmed by the chipping and have enough wood for the symbiotic fungus to survive and the beetles to emerge successfully. Experiments have been done on *E. fornicatus s.s.* survival in chipped *Acer negundo* wood in California (Jones & Paine, 2015). A commercial wood chipper was used on infested trees, and the chips produced sieved and sorted into fine (<2.5 cm), medium (2.5–5 cm) and coarse (>5 cm) size classes, with sections of trunk used as controls. Adult emergence was recorded and production of sawdust in the chippings was monitored as evidence of beetle activity. No beetles emerged from any of the chipped material, but there were some signs of beetle activity in the chippings. Production of sawdust from coarse chips was reduced by 98% compared to logs, and finer chips showed an even greater reduction of beetle emergence (Jones & Paine, 2015). Chipping effectiveness on *A. negundo*, *Platanus racemosa, Quercus agrifolia* and *Salix laevigata* was investigated in California, again using a commercial chipper on trees infested with *E. fornicatus s.s.* (Chen *et al.*, 2020). The results were similar to the previous study: a small number of adults did emerge from the woodchips, but numbers were reduced by 97% or more compared to the control logs, depending on tree species. Another interesting finding is that after 7–9 weeks no further adult emergence from chips occurred, while some emergence from logs was recorded up

to 5 months later, again depending on tree species (Chen *et al.*, 2020). These experiments show that viable *E. fornicatus s.s.*, and presumably the other three species, can be associated with woodchips and survive and likely develop inside for some weeks. Numbers of surviving beetles will be low but a very few beetles can theoretically initiate a founder population.

Wood chips may be imported for a variety of end uses. A major and growing sector is using wood chips as a biomass fuel source, but other uses include the manufacture of paper, garden mulches, playground substrates or bedding for a diverse range of animals including pet rodents, poultry and horses. A major uncertainty is the amount of deciduous wood chips which are imported from countries where *E. fornicatus s.l.* are present, and how much is sourced from UK (or European) timber. Individual companies may state the origin of their product(s), especially if wholly UK-sourced, but general data across the whole sector are hard to find and mostly quite dated.

There are data available on deciduous woodchip import to the UK, based on customs declarations (UK trade info, 2024), but the data quality is uncertain. These data show that from 2021–2023 there were imports of a total of 298.8 tonnes of “Wood in chips or particles (excl. those of a kind used principally for dyeing or tanning purposes, coniferous wood and eucalyptus)” (CN code 44012290) from the USA, 9.6 tonnes from China and less than 1 tonne each from Argentina and Brazil. This code has only been in use since 2021. Data from earlier years under CN 44012200 are not wholly comparable based on the descriptions of the commodities. Between 2017 and 2021, the heading “Wood waste and scrap, not agglomerated (excl. sawdust)” (CN code 44014090) recorded imports from various countries where *E. fornicatus s.l.* are established. The USA (41.2 tonnes), South Africa (34.0 tonnes), Malaysia (26.0 tonnes), Vietnam (21.2 tonnes) and China (20.0 tonnes) exported the most to the UK across the four years from this code. This code was removed in 2021, and earlier data from before 2017 are not comparable either. All these data are subject to errors in classification and may not represent a true picture of imports to the UK. Data collected by different methods on imports of wood products show the HMRC data are significantly different from data from industry experts (cited in Hogan, 2013). Additionally, not all deciduous woodchip species will be suitable hosts for *E. fornicatus s.l.* In the USA, where *E. fornicatus s.l.* are only present in small parts of the country, these data will include woodchips from states where no members of *E. fornicatus s.l.* are known to be present, and are almost certainly an overestimate of trade in potentially infested material.

Wood chips are typically transported in bulk. Any adult which emerges in transit may not be able to move around, depending on how compacted the woodchips are. Individual insects of any life stage may also be killed by the heat generated by the start of decomposition in the central portions of the consignment, though wood chips at the edges are unlikely to heat up to a lethal temperature and will permit more freedom of movement for emerging adults. Records from a UK site storing wood pellets (not wood chips) indoors showed that the temperature had risen to a high of 51°C: the site contained large volumes of material, stored in sections 55 m by 18 m by 10.5 m high and each capable of holding at

least 4,000 tonnes (Simpson *et al.*, 2016). Wood fuel may also be moved from container to transport etc. by screw augers, which are likely to damage or kill some insects. A description of the supply chain in Sweden notes that consignments may be unloaded, temporarily stored, and reloaded multiple times during transport (Enström *et al.*, 2021). The end use of the woodchips also affects the chances of transfer to a growing host in the wider environment, and so they are considered separately here.

The use of wood as a biomass fuel source is increasing, especially for electricity generation. However, many if not all sites appear to use more highly processed wood pellets rather than wood chips, and woodchip is almost entirely from UK stock (Hogan, 2013; Department of Energy & Climate Change, 2015) and no life stage of insects are likely to survive the pelleting process (EPPO, 2019). Other than HMRC data, there appears to be little recent data on import volumes and sources of woodchips for use in power generation. Hogan (2013) provides an overview of the UK trade in wood fuel, but it is likely that the figures presented there will be rather out of date over eleven years on. The data presented suggest that the import of wood chips from outside the EU was not common, though there is some possibility for confusion if wood chips arrived at another EU port initially, and were then transferred to a smaller ship to be transported within the EU (Hogan, 2013). The chances of transfer from wood chips destined to be burnt as fuel to growing trees is relatively small. In transport or storage, the chips will be piled up and only beetles in chips at the edge of the pile/load are likely to be able to move into the wider environment successfully. If the wood chips are burnt quickly, then there is limited opportunity for any individual to complete development and adults to successfully emerge. The greatest risk would be if piles of wood chips were stored outside for a period of time. A report by the Health and Safety Executive on storage of woodfuel (both chips and pellets) for smaller-scale boilers (e.g. schools) found that fuel was contained in specialised indoor storage facilities or sealed outdoor silos; however, the need for adequate ventilation for indoor storage was noted in the report (Simpson *et al.*, 2016). Most ventilation was passive, via slatted openings, and so it would be possible for insects to orient towards the light from the vents and crawl outside. However, there is a lack of information on storage in larger facilities.

Much the same constraints as detailed for biomass fuel will apply to woodchips used for the manufacture of paper or cardboard products. Namely: the manufacturing process will kill all life stages, but outdoor storage (or storage indoors with good ventilation to the outside) for future use will have some risk.

Wood chips used as garden mulches or similar surface coverings, e.g. in playgrounds, are likely to be the riskiest of the end-uses (EPPO, 2019). The wood chips will mostly be spread outside, where any emerging adult beetles will be able to fly off to locate growing trees. In addition, the chips will be in contact with the ground and thus will be slower to dry out as they will absorb some moisture. Therefore, if the insects can survive the chipping process, it is possible that the wood chips will retain enough moisture to allow continued development of some life stages to adults, e.g. late instar larvae, pupae or teneral (newly emerged) adults. Chen *et al.* (2020) showed *E. fornicatus s.s.* can emerge from wood

chips for up to nine weeks in an experimental study where chippings were stored in covered 19 litre plastic containers and monitored weekly for beetle emergence. The amount of mulch spread in domestic gardens is likely to be relatively low and is mostly sold via DIY stores in sealed and compressed plastic sacks which is likely to reduce survival. However, larger volumes of woodchips may be used in landscaping (e.g. retail parks, supermarkets, etc.), and the risk here will be greater.

Woodchip bedding for small animals is not a likely pathway, as the wood particles are likely to be dried and chopped finely for small animals meaning that no individual beetle is likely to survive the chipping process. Woodchips are increasingly popular for horse bedding and are also used by some (mainly domestic) poultry keepers. These wood chips are likely to be bigger in size than rodent bedding, and thus individual beetles may survive the chipping process. Conditions may not be ideal for continued beetle development, as the bedding will mostly be stored in sealed plastic bales, and after use is likely to be put on a manure heap for composting. Stables, manure heaps and some poultry runs are likely to be open to the outside, allowing any emerging beetles to locate hosts in the wider environment. No data could be found on the use of chips as animal bedding overall or for any particular species, only individual anecdotes, and this makes assessment of this end-use of woodchips uncertain.

Non-coniferous woodchips are not regulated as a whole. In Northern Ireland, woodchips are specifically excluded from the *E. fornicatus s.l.* Annex VII measures on named species of wood. In all parts of the UK, woodchips from named species of wood have Annex 7 or Annex VII mitigations against a range of other pests, but these will not fully mitigate against *E. fornicatus s.l.*, due to the measures targeting different pests (thus options such as country or area freedom from the pest in legislation is unlikely to mitigate against *E. fornicatus s.l.*), and the wide host range of the beetles. Many hardwood tree species, including reproductive hosts of *E. fornicatus s.l.*, have no mitigations on the import of woodchips. Therefore, in terms of regulations, the woodchip pathway remains largely open.

While the end use of the woodchips does affect the likelihood of successful transfer to the wider environment, either the volumes are likely to be small and hence the number of adults low (mulch, animal bedding), or if the volume is higher, the end use or storage conditions seem likely to reduce the number of adults successfully emerging into the wider environment (wood chips for fuel, paper or cardboard manufacture). It seems likely that with the switch to woodchips as biofuel and renewable energy, the trade patterns, both in terms of volume and origin, could be quite dynamic in the next few years. Given the process of chipping substantially reduces survival to start with, the likelihood of entry on all forms of wood chips is considered **very unlikely** but with **medium confidence** as data on many elements of this pathway including trade volumes are lacking, or are not provided in great detail. The confidence is not low because many elements of this pathway do not favour survival of the beetles

Contaminating pest (hitchhiking)

Adult females leave the galleries in the wood and, if they do not establish new galleries on their natal host, fly off to locate other trees on which they begin tunnelling into the wood and constructing new galleries. Time spent outside the wood of their hosts is very limited, but it is theoretically possible for an adult to be found on non-host material. A survey of empty shipping containers in Australia detected 20 specimens of *Euwallacea* spp. in 3 containers, though the species was not determined and may not have been one of the species in *E. fornicatus s.l.* (Stanaway *et al.*, 2001). Also, the container may have held plant or wood products and the adults may have emerged during transport. Due to their reproductive biology, one adult female could technically found a new population and so a small number of insects likely to be associated with the pathway is not a limiting factor. The mycangia on the beetles promote transport of the symbiotic fungus. Beetles are likely to survive short journeys or longer journeys with more perishable products e.g. cut flowers or fruit which will be moved in controlled environmental conditions to prolong their shelf life, which will also favour beetle survival. Hitchhiking on other commodities is less likely to result in viable beetles: they are small insects, less than 3 mm long, and likely to be susceptible to dehydration even on relatively short journeys. It is also possible that rapid changes in temperature may be detrimental as most of their lives are spent inside the wood of their hosts, where temperature changes are buffered compared to air temperatures. Overall, entry via hitchhiking is considered **very unlikely** with **high confidence** for all four species, mainly due to the very short time beetles spend outside tunnels in the wood compared to their whole lifecycle.

Summary table of pathways assessed

Plants for planting of proven reproductive hosts (all species)	Very unlikely	☐	Unlikely	☐	Moderately likely	☑	Likely	☐	Very likely ☐
*Confidence (*E. fornicatus s.s.*)*	High Confidence	☑	Medium Confidence	☐	Low Confidence	☐			
*Confidence (*E. fornicatior, E. kuroshio *and* E. perbrevis*)*	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐			

Plants for planting of non-reproductive hosts (all species)	Very unlikely	☐	Unlikely	☐	Moderately likely	☑	Likely	☐	Very likely ☐
Confidence (all species)	High Confidence	☐	Medium Confidence	☐	Low Confidence	☑			
Plants for planting of woody plants not recorded as hosts (all species)	Very unlikely	☐	Unlikely	☑	Moderately likely	☐	Likely	☐	Very likely ☐
Confidence (all species)	High Confidence	☐	Medium Confidence	☐	Low Confidence	☑			
Cut branches (all species)	Very unlikely	☐	Unlikely	☑	Moderately likely	☐	Likely	☐	Very likely ☐
Confidence (all species)	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐			
Round wood (all species)	Very unlikely	☐	Unlikely	☑	Moderately likely	☐	Likely	☐	Very likely ☐
Confidence (all species)	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐			
Sawn wood (all species)	Very unlikely	☑	Unlikely	☐	Moderately likely	☐	Likely	☐	Very likely ☐
Confidence (all species)	High Confidence	☑	Medium Confidence	☐	Low Confidence	☐			

Wood packaging material (all species)	Very unlikely	✓	Unlikely	☐	Moderately likely	☐	Likely	☐	Very likely ☐
Confidence (all species)	High Confidence	☐	Medium Confidence	✓	Low Confidence	☐			
Wood chips (all species)	Very unlikely	✓	Unlikely	☐	Moderately likely	☐	Likely	☐	Very likely ☐
Confidence (all species)	High Confidence	☐	Medium Confidence	✓	Low Confidence	☐			
Contaminating pest (hitchhiking) (all species)	Very unlikely	✓	Unlikely	☐	Moderately likely	☐	Likely	☐	Very likely ☐
Confidence (all species)	High Confidence	✓	Medium Confidence	☐	Low Confidence	☐			

Pathways not assessed in detail

- **Bark**
  These beetles feed in the xylem (sapwood) and are not associated with the bark or cambium. Adults may be found outside the tree including on the bark, but this is covered under the contaminating pest pathway discussed above.
- **Soil and growing media**
  No part of the lifecycle of these insects takes place in the soil, with all immature life stages occurring in galleries in the sapwood of their hosts. There are reports of attacks on exposed roots and root collars by *E. kuroshio* (Coleman *et al.*, 2019), and *E. fornicatus s.l.* in the underground part of the main stem (Liao *et al.*, 2023). However, the insects are still very much associated with plant material and will not be present in small diameter roots which might contaminate soil.
- **Natural spread**
  While there have been outbreaks in mainland Europe, this is not a migratory species adapted to sustained flights. Adult females can fly, but there is no record of them being capable of moving the sort of distances that would have allowed them to cross the North Sea from the nearest outbreak location in the Netherlands.
- **Manufactured wood products**

Most manufactured wood products will be made out of dried wood which has undergone some processing. These are unlikely to be suitable for continued *E. fornicatus s.l.* development. Many such items will also be destined for indoor use, meaning transfer to a living host would be more difficult. Manufactured wood products made out of green wood would be a risk while the wood is still fresh. However, this is a niche market with low volume, and in addition most green wood used is likely to be locally sourced.

10. If the pest needs a vector, is it present in the UK/PRA area?

The beetles are free living insects which do not require a vector. The associated symbiotic fungi (see section 15) are carried with the beetles on specialised cuticular structures called mycangia (see section 8) and it is almost certain that any adult *E. fornicatus s.l.* will arrive with their associated fungi. Beetles could not survive without at least one fungal symbiont.

11. How likely is the pest to establish outdoors or under protection in the UK/PRA area?

Outdoors

Given the wide host ranges of the four species, including plant genera widespread in the UK such as *Acer, Populus, Quercus* and *Salix*, host availability is very unlikely to be limiting. A number of species grown in the UK are recorded hosts of at least one species of *E. fornicatus s.l.* Even for deciduous woody plant species not currently recorded as hosts, it seems likely they could be at risk, especially if other species in the same genus are recorded as hosts. While *E. fornicatior* does not have an extensive host list, it has been recorded from plants in four different families and it seems likely that this apparently limited host range is due to under-recording rather than a real limitation on plant species it can use, and therefore the host distribution in the UK is not considered to be limiting for this species either.

Climatic factors such as temperature are far more likely to be limiting in the UK. The known distributions in both the native and invasive ranges of all four species have much warmer summers. A large number of countries in the current range are tropical or subtropical. South Africa in the invasive range has a climate which is more temperate, and there are good data available about where *E. fornicatus s.s.* has been found in that country (van Rooyen *et al.*, 2021; Bierman *et al.*, 2022; FABI, 2024). Comparing actual climate data from South African towns in regions where *E. fornicatus s.s.* has been recorded by FABI (2024) with some of the warmer parts of the UK show that mean monthly maximum temperatures are notably higher in all South African locations (Fig. 5) (World Meteorological Organisation, 2024). Most South African locations also show less seasonal variation in the mean monthly maxima compared to the UK locations. South African mean

daily minima are warmer than the southern UK locations in the summer, though in winter South African Bloemfontein does have lower mean daily minima compared to the southern UK sites. Buenos Aires in Argentina, where *E. fornicatus s.s.* has recently been detected (Ceriani-Nakamurakare *et al.*, 2023) and Sydney in Australia where *E. perbrevis* been found (Callaghan *et al.*, 2024), have similar monthly minimum and maximum temperatures to the locations used from South Africa (data not shown). However, as the beetles' range is still expanding, the lower limits of the climate envelope for *E. fornicatus s.l.* is not known, and therefore the areas suitable for establishment cannot be determined with accuracy with the current state of knowledge. Other exotic Scolytinae have established in Great Britain, including *Xylosandrus germanus*, a polyphagous species native to Asia with sibling inbreeding (Inward, 2020).

UK winter temperatures may not be sufficiently cold to limit *E. fornicatus s.l.* establishment, especially in urban heat islands or very sheltered locations. The UK has a maritime climate, with relatively warm winters for its latitude. Using the mean of global gridded data from 1988-2017, much of lowland UK has between 30 and 100 days of frost per year ((data not shown) CRU, 2019). *Euwallacea fornicatus s.s.* is invasive in areas which have similar number of mean annual days of frost, notably inland parts of South Africa and parts of California including inland areas in the south of the state ((data not shown) CRU, 2019). *Euwallacea fornicatus s.s.* is known to be established in Bloemfontein, South Africa, and the mean monthly minimum temperatures recorded there are below freezing in winter, colder than southern parts of the UK (Fig. 5) (World Meteorological Organisation, 2024). Experimental data suggests that brief exposure to temperatures of 0°C allow most specimens of *E. fornicatus s.s.* to survive, though temperatures of 1°C and 5°C caused significant mortality (Cooperband *et al.*, 2016). It should be noted that this was an experimental set up, where colonies kept on an artificial medium at 24°C were placed in a freezer: the recorded rate of temperature drop was 0.08–0.25°C per minute (Cooperband *et al.*, 2016). Temperatures are likely to fall more slowly in nature, especially for insects living in the wood of their hosts, buffered from rapid changes in air temperature. A slower drop in temperature may allow the beetles more time for cold adaptation, and thus their survival at lower temperatures could be higher than estimated by this experimental data. Additionally, beetles may well acclimate to lower temperatures as autumn progresses, and therefore their cold tolerance could again be higher than the experimental data may suggest.

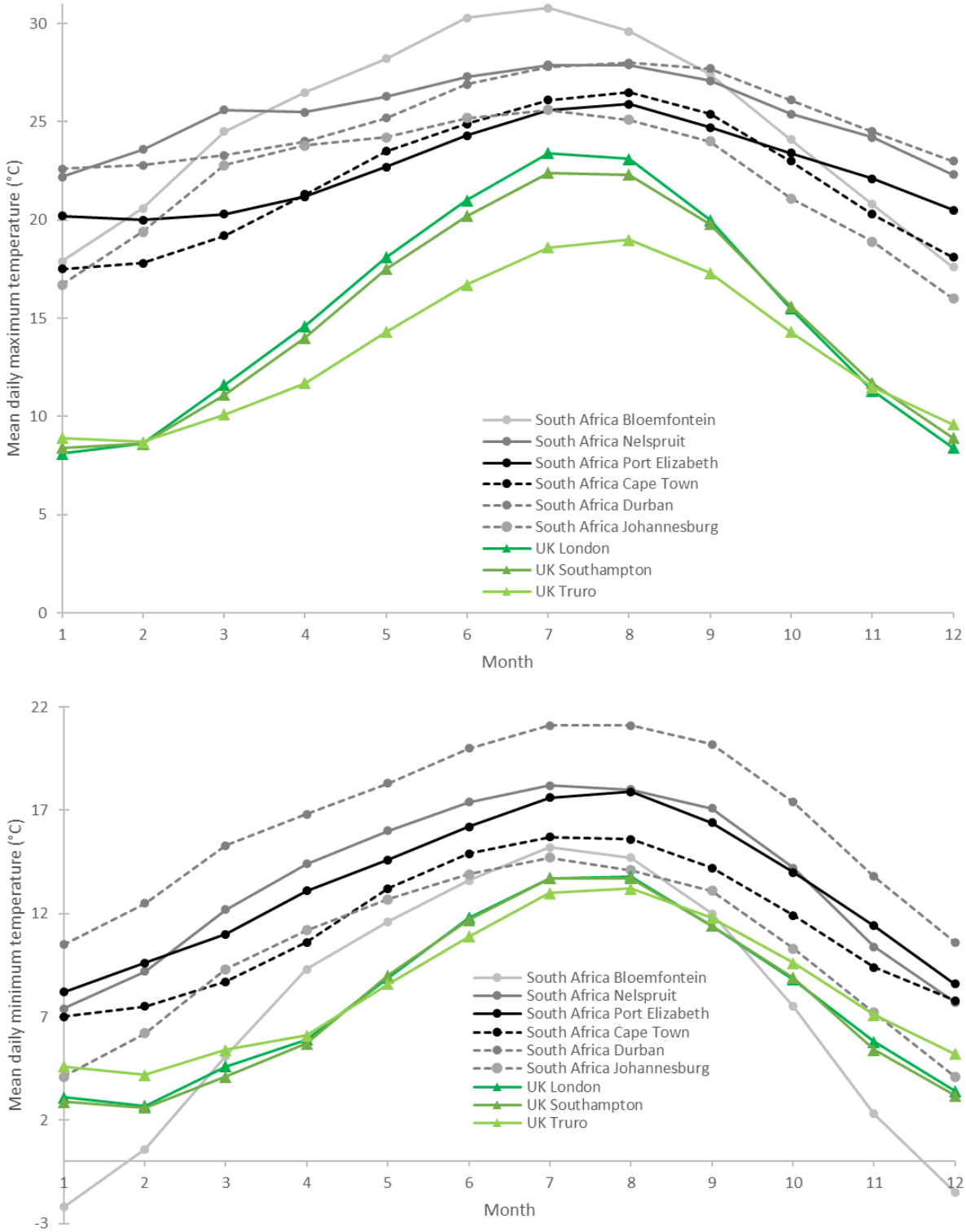


Figure 5. Mean daily maximum (top) and mean daily minimum (bottom) temperatures in locations where *Euwallacea fornicatus sensu stricto* has been recorded in South Africa (greyscale with round markers), compared with parts of southern England (green with triangular markers). Data are averages from 1981-2010 (solid lines) or 1961-1990 (dotted lines). South African data has been offset by 6 months for ease of comparison with the northern hemisphere. Data source: World Meteorological Organisation (2024).

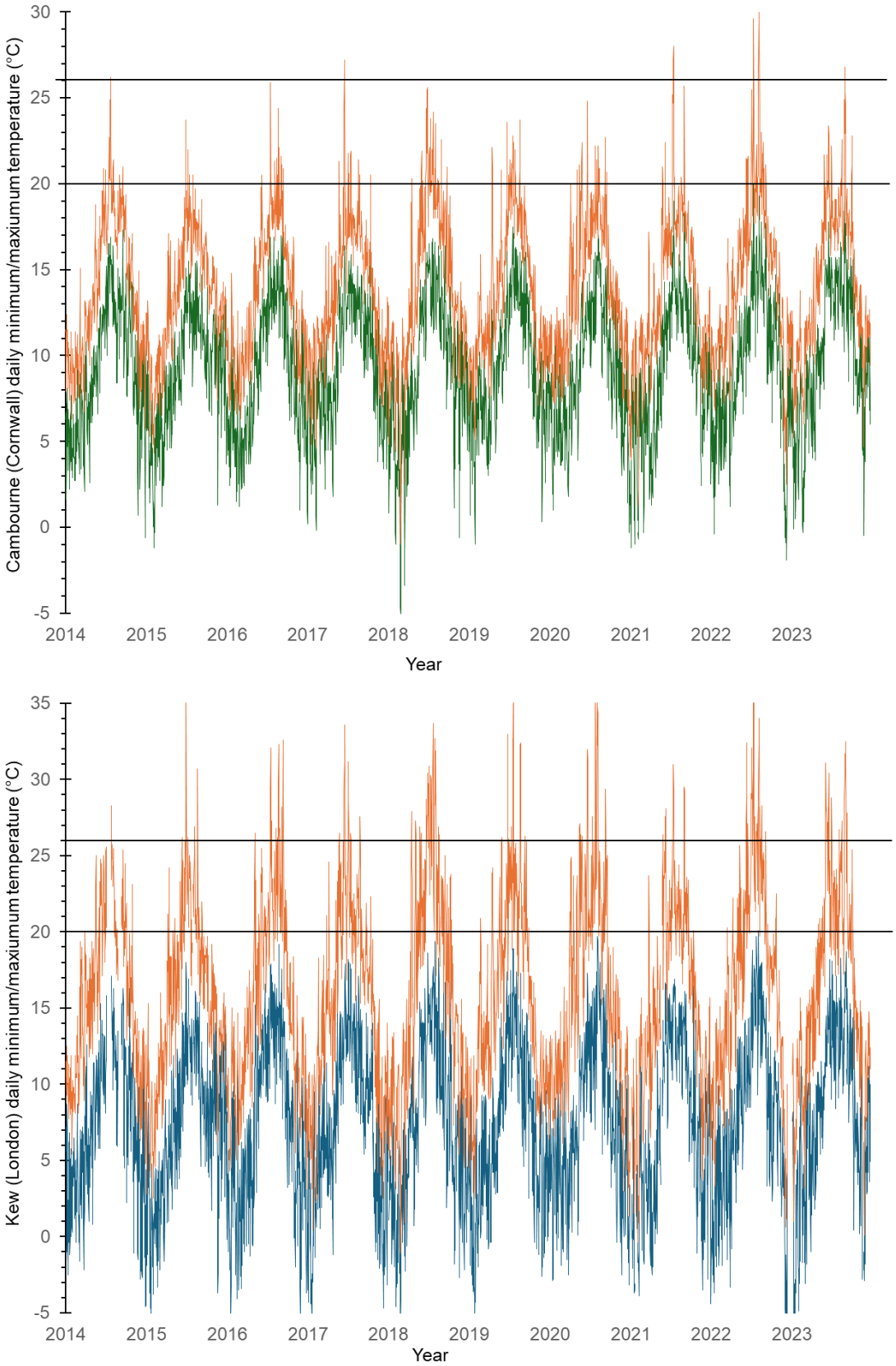


Figure 6. Daily minimum (blue) and maximum (red) temperatures from two UK weather stations, Cambourne in Cornwall and Kew Gardens in Greater London, 2014-2023 inclusive. Daily minimum and maximum values taken from hourly data. Horizontal lines mark minimum (20°C) and lower peak flight temperatures (26°C) for each location. Data source: Met Office (2024).

Considering general climatic classifications which consider more than just temperature, much of the UK falls into the Köppen-Geiger classification Cfb (warm temperate, fully humid and warm summer), using the updated high resolution dataset 1986-2010 (as discussed by Kottek *et al.*, 2006). South Africa has some areas which are classified as Cfb, including areas where *E. fornicatus s.s.* has been recorded, such as around George in the Western Cape (FABI, 2024). It must be noted that any climatic classification which divides the whole world into a relatively small number of types does, of necessity, provide a rather broad view of climate "similarity". For example, the cities of Bordeaux and Lyons in the southern half of France are classified as Cfb, as are the Shetland Islands in the extreme north of the UK. Sharing a Köppen-Geiger climate classification does not necessarily indicate that a pest can establish in all locations within that classification.

Experimental studies rearing *E. perbrevis* (unconfirmed species identity, work done before the concept of cryptic species was established) (Walgama & Zalucki, 2007), *E. fornicatus s.s.* (Umeda & Paine, 2018) and *E. kuroshio* (Dodge & Stouthamer, 2021) found very little development took place at 15°C for *E. fornicatus s.s.* and *E. perbrevis*, and only limited breeding success was seen at 16°C and 18°C for *E. kuroshio*. Optimum temperatures for development were considered to be around 26-30°C for all three species. Adult flight takes place between 20 and 30°C, with peak flight at 26°C for beetles in Sri Lanka, assumed to be *E. perbrevis* (cited in Liu *et al.*, 2022a). These temperatures are seldom reached in the UK for any significant length of time (Fig. 6 for two southern locations in the UK). Mean summer temperatures only exceed 17°C in a few locations such as London and the Thames estuary, or around Southampton (30 year average 1991-2020) (Met Office, 2022), though individual days can be warmer (Fig. 6). For the well-described species of symbiotic fungi where appropriate research has been done, optimum temperatures vary, but plated colonies in the laboratory have optimum growth temperatures of around 25-30°C for many species (for example, Aoki *et al.*, 2019; Lynn *et al.*, 2021).

Experimental thermal development parameters have been calculated for these three species:

- For *E. fornicatus s.s.* egg to adult emergence, i.e. not including the preoviposition period, values were calculated as a developmental threshold of 15°C with 398.41 accumulated day degrees (Umeda & Paine, 2018), though the authors considered the minimum threshold temperature for development to be 13.34°C.
- The threshold temperature for *E. kuroshio* was calculated as 12.77°C with 318 accumulated day degrees (Dodge & Stouthamer, 2021). These values appear to be for egg to adult emergence, i.e. do not include the preoviposition period.
- Work on what may be *E. perbrevis* (the species was identified at the time as *Xyleborus fornicatus*, but context suggests it may be what is now considered to be *E. perbrevis*) considered the threshold temperature to be 15°C, averaged across all life stages (Walgama & Zalucki, 2007). The thresholds for egg to adult emergence required about 237 accumulated degree days (i.e. development similar to the two previous species). Accumulated day degrees for egg-egg lifecycle (including the

preoviposition period where the adults are maturing) were 373 with the same threshold temperature of 15°C (Walgama & Zalucki, 2007).

In the current range, multiple generations per year are predicted from thermal data. Up to 12 generations per year could occur in parts of Sri Lanka, though as few as two are predicted at elevations over 1,200 m (Walgama & Zalucki, 2007). Four to eight generations per year of *E. kuroshio* are predicted in the invasive range in California (Dodge & Stouthamer, 2021). Rearing on an artificial substrate at 24°C demonstrated that *E. fornicatus s.s.* could complete development from egg to adult in approximately 22 days (Cooperband *et al.*, 2016). Israeli populations took around 45 days at 25°C for egg to emergence of the first adult female, reared on artificial media (Freeman *et al.*, 2012). In the absence of thermal development data for *E. fornicatior* this PRA assumes that it is within the range of the other species discussed here, though this is not supported by any data and must be noted as an uncertainty. As *E. fornicatior* has not been detected outside its native range, it is possible that it requires more stringent conditions for establishment, perhaps including relatively specific climatic conditions.

Maps of the theoretical number of generations possible in the UK for each of these thresholds for each year 2018–2023 are presented in Fig. 7. For *E. fornicatus s.s.*, only the south-east of England is theoretically suitable for one generation (egg-adult, not including a pre-oviposition period), and in cool years, only London would be warm enough. Again discounting the pre-oviposition period, *E. kuroshio* could theoretically have two generations most years in the south-east of England, and one generation in much of the rest of lowland UK. Three generations of *E. kuroshio* would only be possible in London, and even then only in two out of the six years analysed (2018-2023). Egg-adult only, beetles likely to belong to *E. perbrevis* suggest they could theoretically have two generations most years around London, and one generation in southern England. However, if the pre-oviposition period is added (the only species where these extra data are available), only the south-east of England would regularly accumulate enough degree days for one complete generation. It is uncertain if this would actually permit establishment outdoors. For a species which normally has multiple generations in a year, individuals are likely to experience significant thermal stress if the environment only has sufficient day degree accumulations to enable one full generation. This stress is likely to reduce the ability of any founder populations to establish or thrive.

Modelling using CLIMEX has been used to predict suitable and unsuitable areas in China (Ge *et al.*, 2018). The day degree values were based on Walgama and Zalucki (2007) and other model parameters used CLIMEX's wet tropical template values as a starting point, with refinements as the model was fitted by Ge *et al.* (2018) to the known distribution. The model suggests that the north and west of China are unsuitable (too cold and dry), but the south-eastern regions have very favourable Ecoclimatic Indices (EI) of >20 (Ge *et al.*, 2018). Using the final parameters from Ge *et al.* (2018) and climate data from several different sources and time periods (most recent data up to 2018), all model runs predict that no part of the UK would be suitable (EI = 0) (example outputs shown in Appendix 3, using CLIMEX's default 1961-1990 station data).

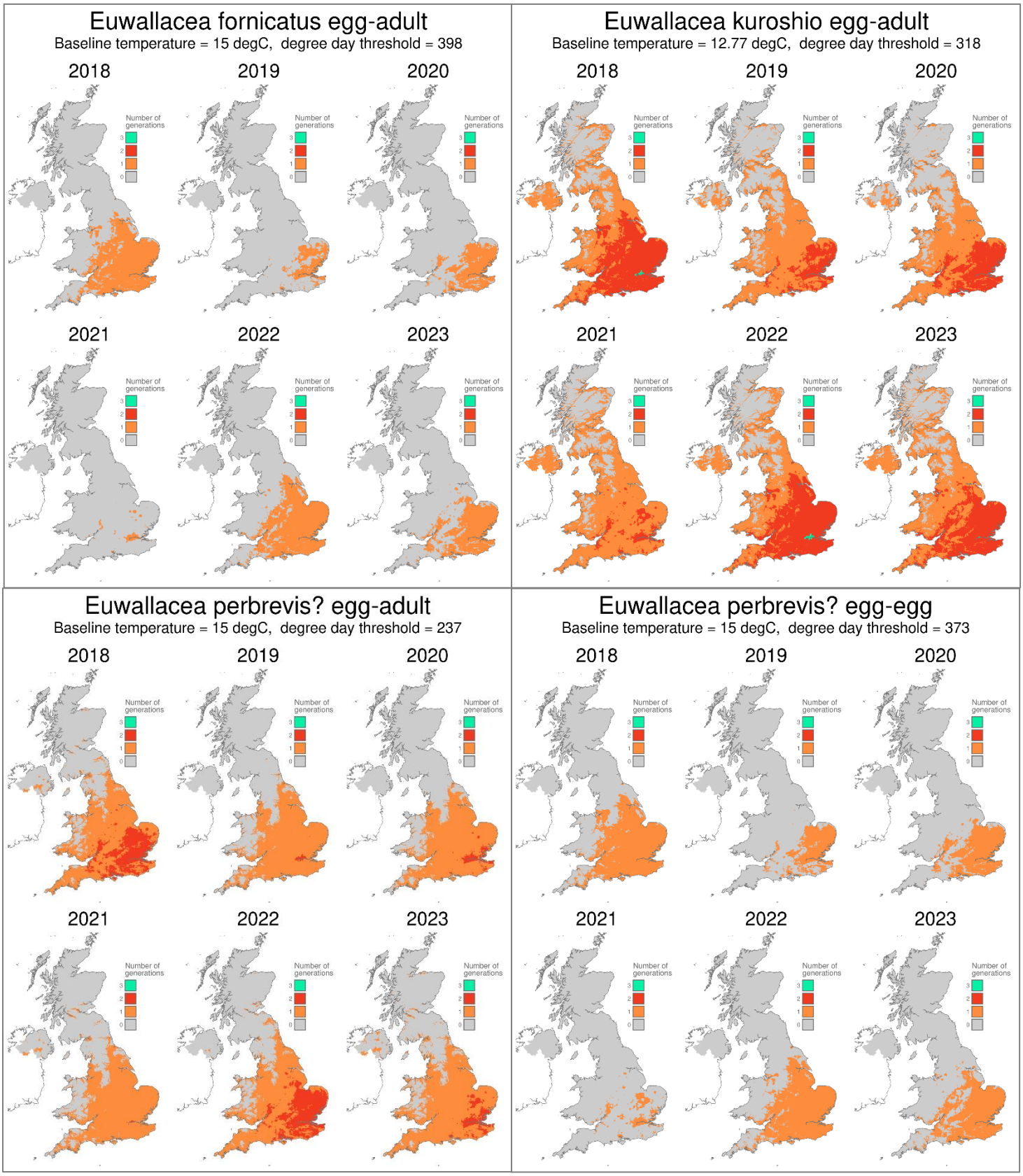


Figure 7. Maps showing the theoretical number of generations of *Euwallacea fornicatus sensu lato* in the UK. Grey <1 generation, orange = 1, red = 2 and green 3 generations for that year. See text for sources of the published thermal thresholds for each species. The maps were generated by Neil Kaye of the UK Met Office using the 1 km HadUK-Grid dataset 2018–2023.

In summary, though they are found in warmer parts of the world, all three of the species which are invasive have indications they may be able to tolerate cooler conditions, though still warmer than those in much of the UK. *Euwallacea fornicatus s.s.* is found in parts of South Africa which are relatively temperate (van Rooyen *et al.*, 2021). *Euwallacea kuroshio* has lower calculated threshold temperature for development and day degree accumulations than the other two species for which data are available (Dodge & Stouthamer, 2021). *Euwallacea* sp. (likely *E. perbrevis*) has been found at high altitudes in Sri Lanka where only two generations are predicted to be possible (Walgama & Zalucki, 2007). However, no indications of spread to the wider environment was found in the outbreaks in European glasshouses (Schuler *et al.*, 2023). All outdoor records have been from locations with warmer summers than are found in any part of the UK. While warmer years in the UK may allow transient populations to develop, it is unclear how well any of the species would survive in cooler years. However, London is significantly warmer due to the urban heat island effect, has a lot of stressed amenity trees, and beetle populations may be able to persist in warm microclimates in the city, even if nowhere else. Overall, establishment outdoors for ***E. kuroshio*** and ***E. perbrevis*** was considered **moderately likely** for the warmest parts of the UK, as these two species appear to have lower thermal requirements. Establishment outdoors was considered **unlikely** for ***E. fornicatior*** and ***E. fornicatus s.s.*** as these two species appear to require slightly warmer temperatures. All assessments were made with **low confidence** due to the lack of data and uncertainty over what environmental requirements might actually be.

Heated glasshouses (botanical collections etc.)

Euwallacea fornicatus s.s. and *E. perbrevis* have both been found in glasshouses in Europe (Schuler *et al.*, 2023), and the climate in glasshouses seems likely to be suitable for all four species to develop and have multiple generations per year.

Considering glasshouse cultivation as a whole, host availability is more likely to be limiting given woody plants are less likely to be grown in commercial production sites, and woody plants which are grown under protection are mostly seedlings for the first year or so before being moved outdoors. More mature trees which would be most suitable for *E. fornicatus s.l.* are only likely to be found in glasshouses belonging to botanical collections, or in visitor attractions such as butterfly farms or tropical cages in zoos. However, within those sites, many of the trees and shrubs planted are likely to be suitable for the beetles given the very wide host range. Experience in the Italian glasshouse outbreak showed that the infestation may spread to multiple genera of hosts within a glasshouse (Schuler *et al.*, 2023). Therefore, the risk of establishment under protection has been refined in this PRA to mean sites growing larger woody plants, such as botanical collections. As *E. fornicatus s.s.* is likely to have been present in an Italian glasshouse for at least two years before detection (Schuler *et al.*, 2023), this species at least seems capable of genuine establishment, i.e. a breeding population which is likely to persist for the foreseeable future. It is considered likely that the other three species are also capable of persisting if they were to enter a suitable glasshouse with reasonably mature woody hosts. Establishment in heated glasshouses with reasonably mature woody plants is considered to be **very likely** for all

four species. This judgement was made with **high confidence** for *E. fornicatus s.s.* and *E. perbrevis*, which have both been found in heated glasshouses. Confidence was **medium** for the other two species *E. fornicatior* and *E. kuroshio*, as no records of these species in protected cultivation have been found and thus there is more uncertainty.

*Outdoors (*E. kuroshio *and* E. perbrevis*)*	Very unlikely	☐	Unlikely	☐	Moderately likely	☑	Likely	☐	Very likely ☐
*Outdoors (*E. fornicatior *and* E. fornicatus s.s.*)*	Very unlikely	☐	Unlikely	☑	Moderately likely	☐	Likely	☐	Very likely ☐
Confidence (all species)	High Confidence	☐	Medium Confidence	☐	Low Confidence	☑			
Heated glasshouses (botanical collections etc.) (all species)	Very unlikely	☐	Unlikely	☐	Moderately likely	☐	Likely	☐	Very likely ☑
*Confidence (*E. fornicatus s.s. *and* E. perbrevis*)*	High Confidence	☑	Medium Confidence	☐	Low Confidence	☐			
*Confidence (*E. fornicatior *and* E. kuroshio*)*	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐			

12. How quickly could the pest spread in the UK/PRA area?

Natural spread

Only females are capable of flight (Chen *et al.*, 2020), but even an unmated female can found a new population due to the haplodiploid mating system combined with inbreeding (see section 8 on biology for more details).

Experiments have been carried out on *E. perbrevis* dispersal based on populations from the invasive area in Florida. Mark-release-recapture experiments used females marked with fluorescent powder and traps with chemical lures (Owens *et al.*, 2019b). Beetles were recaptured in traps over 100 m distant from the release point, with one marked individual found over 150 m away from the release point (Owens *et al.*, 2019b). It should be noted that this was not random dispersal, but that attractants were being used as part of the recapture trapping. Flight mill data were also collected on the same population of *E. perbrevis* at a temperature of 24°C, over a 24 hour period (Owens *et al.*, 2019b). The average total flight distance per beetle over this period was around 80 m, but there was a lot of variation. “Up to half” of the individuals flew less than 20 m, but one female flew over 400 m (Owens *et al.*, 2019b). Flight mill data do tend to overestimate spread (Robinet *et al.*, 2019), as in the wider environment insects will often stop travelling once they have identified the resource they need, e.g. food or a mate. The data also show the broad pattern demonstrated by many Scolytinae: that many individuals don’t disperse very far, some travel a reasonable distance, and a very few undertake long flights.

Older literature on the dispersal of one of the species present in the tea fields of Sri Lanka is available, with the species studied given the name of *Xyleborus fornicatus* (Calnaido, 1965), though it is unclear exactly which current species this would refer to. Observing flight speed and duration from beetles in a closed room, Calnaido (1965) considered that the dispersal ability of the females was likely to be around 430–860 m without wind. Given the experimental methods, the extrapolated data on potential distances is not considered that reliable, though the observations of peak flight times are considered to be better quality.

Data on spread, assumed to be natural, is available for *E. fornicatus s.s.* in South Africa. van Rooyen *et al.* (2021) reported that in the Somerset West area, beetles moved against the prevailing wind around 3 km in 2 months. It must be noted that the initial point of this outbreak is not known for certain. In Brazil, *E. fornicatus s.s.* was detected in five states, four of them adjacent in the south of the country, though locations were still hundreds of kilometres apart (Covre *et al.*, 2024). As previous surveys had not detected the pest, it is suggested that this spread has taken place in the last ten years (Covre *et al.*, 2024). Again, some of the spread in Brazil may have been human-mediated spread, especially as one finding of *E. fornicatus s.s.* was in a northern state, distant from all the other known locations.

Data on the spread potential of *E. fornicatior* and *E. kuroshio* are not available. As the beetles are a similar size to the other two species, it is assumed that the females have similar flight capabilities to the data presented above, but this is an uncertainty.

Overall, natural spread is assessed as **moderate** as there is some evidence of the ability to move reasonable distances in a comparatively short time. The assessment is made with **medium confidence** as accurate data on three of the species are lacking.

Spread with trade

All four species spend the majority of their lives within their host trees, and infestations can be hard to detect. There is thus the potential for infested material to be traded unknowingly. For *E. fornicatus s.s., E. kuroshio* and *E. perbrevis* there is evidence that the species have moved internationally, and usually more than once. In the glasshouse outbreaks of *E. fornicatus s.s.* in Europe, trade within the EU in ornamental plants for botanical collections has been identified as the source for several of the outbreaks (Schuler *et al.*, 2023). In South Africa, new findings of *E. fornicatus s.s.* have been up to 500 km distant from known outbreaks, and this is assumed to be due to human activity aiding the spread (van Rooyen *et al.*, 2021). Genetic analysis of the South African populations of *E. fornicatus s.s.* revealed two different haplotypes, suggesting that there were at least two separate introductions (Bierman *et al.*, 2022). Likewise, the genetic evidence points towards there being several lineages present in the European glasshouse outbreaks (Schuler *et al.*, 2023). Though there is no evidence *E. fornicatior* has moved in trade, available information suggests this species has similar biology and lifecycle to the other three species, and no reasons could be found as to why it might differ in the potential for spread in traded plant material. Overall, spread with trade is assessed as **very quickly with high confidence** for ***E. fornicatus s.s., E. kuroshio*** and ***E. perbrevis***. Spread with trade is considered to be **very quickly** for ***E. fornicatior*** too, but with **medium confidence** as this species has not, so far, been detected moving in traded plant material and the reasons for this are unclear.

Natural spread (all species)	Very slowly	☐	Slowly	☐	Moderate pace	☑	Quickly	☐	Very quickly ☐
Confidence (all species)	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐			
With trade (all species)	Very slowly	☐	Slowly	☐	Moderate pace	☐	Quickly	☐	Very quickly ☑

Confidence (E. fornicatus s.s., E. kuroshio *and* E. perbrevis)	High Confidence	☑	Medium Confidence	☐	Low Confidence	☐
Confidence (E. fornicatior)	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐

13. What is the pest's economic, environmental and social impact within its existing distribution?

Unlike many species of ambrosia beetles, *E. fornicatus s.l.* can attack apparently healthy trees and this, combined with the wide host ranges, contribute to their impacts. In general, papers written soon after one of the species was discovered in a new area tend to predict high impacts (especially in the introductions and discussions), but quantifiable data on actual damage are harder to find. In areas where the beetles have been invasive for some years, there seem to be a lack of follow-up reports on actual damage. Multiple generations per year in the current range are predicted from thermal data. Up to 12 generations per year could occur in lowland Sri Lanka, though as few as two are predicted at higher elevations (Walgama & Zalucki, 2007). Four to eight generations per year of *E. kuroshio* are predicted in the invasive range in California (Dodge & Stouthamer, 2021). Even in laboratory cultures, it can be hard to identify the number of generations which have elapsed, as adults are long-lived and generations quickly start to overlap (Cooperband *et al.*, 2016). Therefore, it is uncertain how many annual generations actually develop in regoins where damage occurs, but very high population densities can occur. For example, in Argentina, some trees have had up to 1,200 attacks on a single trunk (Ceriani-Nakamurakare *et al.*, 2023), though it is unclear how long it took for this level of damage to occur.

Modelling potential impacts

As invasive species, theoretical impact modelling has been carried out a number of times, mainly on *E. fornicatus s.s.* Such modelling is usually carried out relatively soon after detection in a new area, when data on actual impacts are scarce. Also, *E. fornicatus s.l.* has been invasive for less than 20 years in many areas, and it could take several decades for populations to build up and full ecosystem impacts to become apparent, especially on trees which have long replacement times.

McPherson *et al.* (2017) modelled urban tree values and losses in **California (USA)**, and used *E. fornicatus s.l.* as a case study (most likely to be *E. fornicatus s.s.* but potentially including *E. kuroshio*). Almost a third of the total urban trees were potential hosts for *E.*

fornicatus s.l., and assuming 50% mortality of those susceptible trees, the cost of removal and replacement of affected trees was forecast to be US $15.9 billion over ten years (just in California), with a loss to ecosystem services of another $616.8 million (McPherson *et al.*, 2017). It was stated that these values do not include weakened trees causing damage (either to people or buildings), and so the true figures could be even greater (McPherson *et al.*, 2017). Jetter *et al.* (2022) again modelled *E. fornicatus s.l.* in urban trees in California, considering management costs of tree removal, ecosystem services lost, and landscape aesthetic values of trees. Trees were divided into three susceptibility classes (not a host, colonised but not killed, and susceptible to being killed), and the costs were modelled over ten years (Jetter *et al.*, 2022). The data used in this model suggest only 8-10% of the total trees in two Californian counties are susceptible to being killed by *E. fornicatus s.l.* The modelled costs were still very high. In only one country (Orange County, just south of Los Angeles), if 10% of the most susceptible trees were killed over ten years, total costs were modelled as US $156 million, but if 70% of the most susceptible trees died, costs would be over $1 billion (Jetter *et al.*, 2022).

In **South Africa**, de Wit *et al.* (2022) forecast potential impacts resulting from *E. fornicatus s.s.* in all trees, whether urban, agricultural crops, forestry or natural forests using a model incorporating feedback loops, and beetle and fungus density as separate variables. Using mortality rates from published literature from across the globe, informed by preliminary data from South Africa, de Wit *et al.* (2022) used a baseline mortality of 15.5% over ten years, and costs included loses for all the habitat types. Unsurprisingly, the model predicts increasing numbers of *E. fornicatus s.s.* over time, and a general decrease in numbers of trees in all habitats at the end of the ten year forecast (de Wit *et al.*, 2022). Costs were reported in “international dollars”, essentially a way of converting any local currency to US dollars, and the economic cost to South Africa of *E. fornicatus s.s.* over ten years was estimated at over $18.4 billion (around 0.66% of South Africa’s GDP), with $17.5 billion of this attributed to costs of removal of affected urban trees. As with any modelling, selection of scenario is crucial: the $18 billion was the middle estimate of the three scenarios considered. The low range estimate was $2.7 billion, while the high estimate was in excess of $164 billion. De Wit *et al.* (2022) went on to estimate details of potential future loses in terms of social costs, loss of ecosystem services and loss of production for black wattle and avocado crops.

In **Western Australia**, the finding in Perth prompted modelling on potential impacts and costs of eradication (Cook & Broughton, 2023; Cook *et al.*, 2023). Agricultural impacts to *Persea americana* (avocado) had a median modelled cost of Australian $90,000 at year 30, while the cost in urban environments was far higher, the median modelled figure calculated as $6.8 million (Cook & Broughton, 2023). The mortality rates were considered to be lower than those used in South Africa, as Cook and Broughton (2023) did not consider widespread tree mortality to be likely ten years after introduction; also they considered that some control in urban environments could be achieved by pruning and insecticides rather than outright tree removal. The eradication programme being considered in Perth was forecast to cost around Australian $45 million over 3 years, which leads to a net cost in the short term, but over longer timescales of 10-15 years or more,

would provide a net saving compared to the costs of no action and projected damage from uncontrolled *E. fornicatus s.s.* (Cook & Broughton, 2023). Later work considered costs and benefits of reducing spread rates over a 50 year time period, if eradication were to prove impossible. Cook *et al.* (2023) modelled three different strategies (removal of infested trees and replacement with non-hosts; targeted pruning and insecticides; or removal of very susceptible hosts and targeted pruning and insecticides on other hosts), each strategy considered for a wider or narrower host range scenario. Whether a broad or a narrow host range was considered, in terms of slowing spread, the targeted pruning of infested branches and use of systemic insecticides was the most cost-effective over the 50 year time period considered (Cook *et al.*, 2023). Tree removal and replacement with non-hosts is very expensive (hence the high costs for urban trees in other models discussed), and so even though pruning and insecticides are an ongoing cost, the model still suggested that this would be a better strategy to slow the spread (Cook *et al.*, 2023).

Economic

In South-East Asia, historically *E. fornicatus s.l.* has been recorded as a pest of **tea (*Camellia sinensis*)** in Sri Lanka. A great many older papers are available, though only a few are cited here. Production practices and chemicals have changed a great deal, and the older papers are unlikely to fully reflect the current situation. Past losses in yield were due to the breakage of infested branches and secondary rots which entered through the wounds (separate from the ambrosial fungal infections) (Gadd, 1944; 1949). Loss of harvestable tea leaves was also attributed to beetle galleries causing reduction of sap flow within the branch (Cranham *et al.*, 1968). Visual estimates were that “not more than 20 per cent.” of the crop bearing shoots were broken in the first two years following pruning, and even then most broken shoots were in the peripheral parts of each bush and not the higher-yielding centre (Cranham *et al.*, 1968). However, the peak losses in harvest were up to 24–37% and Cranham *et al.* (1968) noted that fresh beetle galleries “had a marked effect on shoot growth”, potentially explaining the yield loss over and above that caused by broken branches. Sivapalan (1975) studied the distribution of galleries on primary, secondary and tertiary branches on untreated bushes at the end of a 3-year pruning cycle (i.e. 3 years’ growth had occurred since the last pruning, and the bushes were due to be cut back again). *Euwallacea fornicatus s.l.* galleries were significantly more numerous on the older primary branches near the main stem, with comparatively few galleries in the most distal, tertiary growth branches (Sivapalan, 1975). Current management practices in tea are focussed on reducing attacks on the primary branches near the main stem, mainly by adjusting pruning times to avoid peak beetle flight periods, though this strategy only appears to work in some parts of Sri Lanka (Walgama, 2012). In Taiwan in 2020, surveys across the island detected *E. fornicatus s.s.* and *E. kuroshio* in 32 tea gardens out of 120 surveyed (Liao *et al.*, 2023). Only five infested tea gardens had “high” levels of infestation, defined as >20 bushes out of 30 displaying evidence of beetle galleries on visual examination (Liao *et al.*, 2023). However, economic damage to tea plants in Taiwan does not seem to have been recorded. Liao *et al.* (2023) suggest this may be due to the galleries being found much lower in the bole (main trunk) and even in underground plant

parts, meaning the damage is largely unnoticed or just appears as general dieback, and is not specifically attributed to *E. fornicatus s.l.*

Avocado (*Persea americana*) has been attacked in the invasive range. In Israel, where *E. fornicatus s.s.* is invasive, symptomatic trees often show bark discolouration and potentially leaf wilting, branch breakage and tree death (both young and old trees) (Mendel *et al.*, 2012). In some Israeli locations, 100% of avocado trees were infested, and while not dead, were no longer economically viable (Eskalen, 2012). This is backed up by Byers *et al.* (2016-2018) who state avocado trees in Israel are not usually killed, but limbs do die back and tree growth is reduced. By 2016 *E. fornicatus s.s.* had been found in "nearly all the avocado cultivation areas" in Israel (Mendel *et al.*, 2017). The cultivar Hass appeared to be most susceptible to attack, with up to 30% of branches showing wilting; the more resistant cultivar Ettinger had only 2% branch wilting (Mendel *et al.*, 2017). Even in the most susceptible avocado cultivar, tree death is "quite rare in Israel" (Mendel *et al.*, 2017). Jones and Paine (2017) studied *E. fornicatus s.s.* in southern California (stating that the species studied was genetically identical to that found in Israel, hence the species attribution here). Mature trees of the cultivars Fuerte and Hass were naturally infested, with two Fuerte trees showing very high infestation levels and dying branches (Jones & Paine, 2017). Overall, there was no statistically significant difference in the rates of attack between the two cultivars. Field trials where three year old trees were exposed to *E. fornicatus s.s.* showed that the cultivar Zutano was more heavily attacked, though other cultivars also showed high levels of beetle infestation (Jones & Paine, 2017). In an avocado orchard in Taiwan, beetle population numbers showed rapid declines over a two year study for all species of *E. fornicatus s.l.* present (Liu *et al.*, 2022a), suggesting that populations may be quite variable between years. Though the Spanish outbreak was only reported in August 2024 and investigations are ongoing, so far only ornamental avocado trees appear to be affected (Feixas, 2024).

In the presumed native range of **southern and eastern Asia**, reports of damage are sporadic. Coleman *et al.* (2019) assessed tree injury and death due to *E. fornicatus s.s.* (as *E. whitfordiodendrus*) in four ***Acacia mangium*** plantations in north west Vietnam. Almost 30% of trees showed signs of infestation out of 116 surveyed, though tree mortality was less than 2% (Coleman *et al.*, 2019). Thu *et al.* (2021) comment that *E. fornicatus s.l.* has had an "apparently rapid spread" in Vietnamese ***Acacia*** species, with data showing that it was recorded over more parts of Vietnam in 2020 compared to 2013. Young trees around three years old were more susceptible to attack, and *Acacia* mortality was estimated at 2–5% (Thu *et al.*, 2021). Jiang *et al.* (2023) reported impacts on Japanese **mango (*Mangifera indica*)** orchards in parts of the southern archipelago of islands: in 2000 in Tokuno-shima Island and, since 2007, "severe damage" in Okinawa, though further details of damage are not available. Indian crops of **cocoa (*Theobroma cacao*)** were severely attacked in Karnataka by *E. perbrevis* in 2017–18, with the trees showing "severe wilting" (Thube *et al.*, 2024).

In **South Africa** where it is invasive, *E. fornicatus s.s.* has been present since at least 2012, though the first detection was only in 2017 as part of a sentinel plant project (van

Rooyen *et al.*, 2021). By 2021, *E. fornicatus s.s.* was found in locations across most of South Africa. However, though many urban and garden trees have been found to be infested, van Rooyen *et al.* (2021) considered that the only agricultural crops attacked were pecan and macadamia, but “the effect on these crops appears limited”, possibly because they are not reproductive hosts of *E. fornicatus s.s.* Twiddy *et al.* (2021) states that ***Macadamia integrifolia*** branches in a commercial orchard displayed *E. fornicatus s.s.* damage, and multiple beetles emerged after cut branches were taken to the laboratory and monitored. Inoculation experiments of the symbiotic fungus *F. euwallaceae* on macadamia demonstrated the fungus could survive for extended periods, but did not aggressively colonise the plant, thus potentially limiting the damage possible (Twiddy *et al.*, 2021). As an emerging pest in South Africa, there is a great deal of research being published about the potential impacts and novel hosts, but little quantitative data on yield loss at the time of writing. Neethling *et al.* (2024) were able to collect preliminary data on the effects of *E. fornicatus s.s.* in a **pear (*Pyrus communis*)** orchard, one year after detection of the beetles at the site. At this stage, no branch dieback or tree mortality was seen, but more heavily attacked trees showed greater variability in various measures of fruit quality such as mass or sugar content (Neethling *et al.*, 2024). The authors recommend continuing the monitoring over a lengthier time period to determine longer-term impacts. In **Argentina**, branch dieback was observed within 12 months and tree death was reported to take around 24 months (Ceriani-Nakamurakare *et al.*, 2023). *Acer* trees seem to be preferred hosts, and up to 1,200 attacks have been observed on a single trunk (Ceriani-Nakamurakare *et al.*, 2023).

Outbreaks in protected cultivation, though easier to control, also have an economic cost. Many glasshouses with mature trees are visitor attractions. The Italian outbreak involved completely clearing the affected glasshouse (including roots), followed by 3 months of treatment (Schuler *et al.*, 2023; Netherlands NPPO, 2021-2022). In addition to the cost of plant removal, obviously this level of treatment will close the site to visitors. However, the Merano glasshouse is part of the Gardens of Trauttmansdorff and it is likely that visitor numbers to the attraction in general would not have been too badly affected by the closure of the glasshouse. The two commercial glasshouses in the Netherlands which had outbreaks of *E. fornicatus s.l.* had all movement of plants put on hold (Schuler *et al.*, 2023). One site removed all plants and, after cleaning, was able to declare eradication after eleven days free from plants and no findings of beetles in baited traps (Schuler *et al.*, 2023) using the lures quercivorol and α-copaene (Netherlands NPPO, 2021-2022). The other infested glasshouse removed symptomatic or suspicious plants only, and monitored for beetles using baited traps. After 12 weeks without detecting beetles, eradication was declared (Schuler *et al.*, 2023; Netherlands NPPO, 2021-2022). Though the costs of the different actions are not covered in the paper, it is clear that either strategy would have had considerable impacts on the business involved.

In summary, economic impacts are very variable between different hosts, locations and potentially also over time. The situation is also complicated in the invasive range as populations may not have had sufficient time to build up to damaging levels. However, in terms of economic loss over the whole current range, *E. fornicatus s.l.* do not appear to

have had particularly high impacts despite some of the headlines. Tea in Sri Lanka and avocados in Israel are the crops worst affected, but even here, quantified data on crop loses could not be found or was dated. There is a lot of variability in the data which make giving a single rating difficult, but overall the **economic impact** across the existing range was assessed as **medium**, with **medium confidence**. Confidence is not low, because it seems very likely that, if substantial losses were being incurred in many more areas, this information would be available.

Environmental

Boland (2016) assessed the damage by *E. kuroshio* to natural riparian (riverside) habitats in the Tijuana River Valley in southern California. Within months of the first detection of *E. kuroshio* (though this was almost certainly after it had already built up high populations in the area), “tens of thousands of trees were visibly infested”, parts of the landscape were essentially denuded of living trees, and local news outlets picked up the story (Boland, 2016). The riparian habitats were dominated by a few species of *Salix*, and especially in the wetter parts of the habitat, these trees were very susceptible to beetle attack. Structural weakening by the beetle galleries then allowed winter storms to cause breakage of trunks or major limbs (Boland, 2016). Still in the Tijuana River Valley, *E. kuroshio* caused tree mortality of 97% at one site of the nine studied, though another site (with 17% infestation rate) did not show any tree mortality (Boland & Woodward, 2019). This was linked to sewage pollution: the high levels of sewage caused nutrient enrichment, which resulted in faster tree growth and wood which was wetter and less dense. These wood conditions apparently favoured beetle and/or fungus colonisation in those trees and resulted in high levels of mortality (Boland & Woodward, 2019). However, three years later there had been substantial regrowth in the Tijuana River Valley, to the extent that photographs taken in August 2019 are all but indistinguishable from pre-outbreak images from May 2015 (Boland & Uyeda, 2020). Peak infestation levels were around 80% in 2016, but by 2019 it was only 9%, and the low infestation levels were not due to a lack of willow trees which had showed very substantial regrowth and were of a size that had previously been attacked by *E. kuroshio* (Boland & Uyeda, 2020). An important conclusion from the five-year study of the Tijuana River Valley was that generalisations were not appropriate. Different habitats within the river valley showed different infestation trajectories and differing impacts, despite the same willow species being present in all sites (Boland & Uyeda, 2020).

Outside the Tijuana River Valley, Coleman *et al.* (2019) assessed tree injury and death in both urban sites and native forests in southern California. Three species of trees infested by *E. kuroshio* in the south of California had mortality rates between 5 and 10%: *Populus fremontii, Salix gooddingii* and *S. lasiolepis* (Coleman *et al.*, 2019). In a natural forest in South Africa, 9% of individual trees (from a total of 2,195 surveyed) were infested by *E. fornicatus s.s.* (de Wit *et al.*, 2022). Townsend *et al.* (2024) further evaluated the infestation levels of *E. fornicatus s.s.* by using surveys over 51 forest plots in the southern coastal region of South Africa. A range of native Afro-temperate forest species showed evidence of *E. fornicatus s.s.* infestation, but new infestations were recorded at a low rate

and impact data beyond the number of entry holes on infested hosts were not reported (Townsend *et al.*, 2024). Therefore, discussion about potential ecosystem impacts in native South African forests remains speculative.

In summary, the only unequivocal environmental impact data found was for one species and based on one specific, highly polluted river valley in southern California for a short time period. Impacts were undoubtedly very high here in the early years of the outbreak, with the whole ecosystem having been altered through extremely high tree mortality rates. However, longer term surveys demonstrated substantial recovery after less than five years, and only limited levels of re-infestation. High environmental impacts have not been reported in any other location from any *E. fornicatus s.l* species. Overall, **environmental impacts** across the current range were assessed as **small** with **medium confidence**.

Social

Urban trees appear to be suffering the most impacts in the invaded range. This may be due to a number of factors, including stressed trees, urban heat islands, rapid spread due to movement of infested wood or plants, and potentially beetle damage is more likely to be seen and reported. It is also not always clear if urban tree impacts are due to primary damage by the beetles, or if trees are felled due to safety concerns, or to slow the spread.

Box elder (*Acer negundo*) appear to be one of the species worst affected. Box elder is used in citizen science projects to monitor the spread of *E. fornicatus s.s.* around Cape Town in South Africa due to its susceptibility and high infestation rates (Potgieter *et al.*, 2024). Around Los Angelos in California, box elder started to die due to *E. fornicatus s.l.* in 2010, with garden avocado tree mortality detected in 2012 (Rabaglia *et al.*, 2013). In Israel Mendel *et al.* (2017) state that *A. negundo* is killed within a year of infestation by *E. fornicatus s.s*. Visual surveys of trees in various locations in South Africa suggest that *Acer* spp. including *A. negundo* and *Quercus robur* “will die when infested” by *E. fornicatus s.s.* (van Rooyen *et al.*, 2021).

In the native range, Coleman *et al.* (2019) assessed tree injury and death due to *E. fornicatus s.s.* (as *E. whitfordiodendrus*) in four urban sites in south west China. A range of species showed high infestation rates, with more than half of *Acer buergerianum* and *Platanus orientalis* surveyed showing infestation, though no tree mortality was observed (Coleman *et al.*, 2019).

Both *E. fornicatus s.s.* and *E. kuroshio* are invasive in California, and Coleman *et al.* (2019) assessed tree injury and death caused by each species, in both urban sites and native forests. Overall tree mortality caused by either species was quite low (5–8% of trees surveyed in total, set against a background mortality rate of around 2%), but some tree species were more susceptible than others. Between 10 and 50% of surveyed *Ailanthus altissima, Acer macrophyllum, A. negundo, Ricinus communis, Salix laevigata* and *S. lasiolepis* were killed by *E. fornicatus s.s.* (Coleman *et al.*, 2019). *Euwallacea kuroshio* caused lower mortality rates: the worst-affected trees were willows and poplar (see environmental impact section for details).

Trees in a residential suburb in Johannesburg (South Africa) were monitored by citizen scientists for signs of *E. fornicatus s.s.,* with validation of a proportion of their findings by an experienced professional (Mudede *et al.*, 2024). There were a total of 157 trees in the survey which were validated, of which around 30% were infested (the citizen scientists recorded 44 infested trees, while the validator recorded 48 infested trees) (Mudede *et al.*, 2024). *Platanus* × *hispanica* (as *Platanus* × *acerifolia*) was the only species to have evidence of beetles on the canopy branches, while the other two dominant tree species, *Betula pendula* and *Quercus robur* had verified attacks only on the trunks and main branches (Mudede *et al.*, 2024).

The major impacts from the outbreaks in botanical glasshouses in Europe were due to the actions taken to eradicate the outbreaks rather than primary damage from the beetles. Outbreaks detected when only a few plants were affected, such as in Poznań (Poland) or Erfurt (Germany), meant eradication measures could be very localised and only the affected trees or branches were removed (Schuler *et al.*, 2023). However, in Merano (Italy), the population of *E. fornicatus s.s.* had built up to substantial levels and every plant in the glasshouse was removed, including the roots, followed by several months of soil treatment (Schuler *et al.*, 2023). Though this was not mentioned, it is clear that the Merano glasshouse could not have been a visitor attraction during the eradication period.

In summary, social impacts are caused due to the loss or dieback of urban trees which are important to the quality of life for the humans who live in cities. *Euwallacea fornicatus s.l.* have been recorded on high proportions of total urban trees, and can reach very high levels of infestation on their preferred hosts. Infested trees are structurally weaker, leading to a greater potential for branches and trunks to snap in high winds. It is unclear how much tree loss is due to control efforts (including pre-emptive pruning or felling of weakened trees), and how much damage is due to the beetle itself. In the current range, **social impacts** are assessed as **large** but with **low confidence** as quantifiable data are lacking.

Economic impacts (all species)	Very small	☐	Small	☐	Medium	☑	Large	☐	Very large ☐
Confidence (all species)	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐			

Environmental impacts (all species)	Very small	☐	Small	☑	Medium	☐	Large	☐	Very large ☐
Confidence (all species)	High Confidence	☐	Medium Confidence	☑	Low Confidence	☐			

Social impacts (all species)	Very small	☐	Small	☐	Medium	☐	Large	☑	Very large ☐
Confidence (all species)	High Confidence	☐	Medium Confidence	☐	Low Confidence	☑			

14. What is the pest's potential to cause economic, environmental and social impacts in the UK/PRA area?

Outdoors, if establishment is possible at all, it is likely that only two generations per year will be possible in even the warmest parts of the UK. Though there are no data on the number of generations which would be damaging, the predicted number of generations is higher in the existing species range. For example, *E. kuroshio* is predicted to have four to eight generations per year in California (Dodge & Stouthamer, 2021). Heated glasshouses are likely to allow more generations and thus populations would be more likely to reach damaging levels.

Economic

Euwallacea fornicatus s.l. are considered most likely to be able to build up to damaging population levels in heated botanical collections containing relatively mature trees. Populations detected early are likely to have little impact from control measures, as the beetles are less likely to have spread to many hosts and any measures could be more restricted in scope. The European outbreaks under glass in Poznań or Erfurt involved the removal of only a few infested trees and branches and the outbreaks were quickly eradicated (Schuler *et al.*, 2023). However, if the outbreak was larger before it was detected, such as in Merano, then control will be far more expensive as more trees would be involved. If many large trees need to be removed, this could impact on the number of visitors to an attraction, and, as happened in Italy, might even force closure of the glasshouse for months of treatment followed by costs of replanting. Control in a large glasshouse can be very costly and difficult. Data for *Bemisia tabaci*, a whitefly found on foliage, suggests that the costs of eradication in the Eden project in Cornwall were "conservatively estimated at approximately £250,000" before eradication could be declared in 2004 (Treseder *et al.*, 2011). These costs included the chemicals and cost of spraying treatments, as well as lost revenue from closure to the public and publicity to explain why the closures were necessary (Treseder *et al.*, 2011). As *E. fornicatus s.l.* would be inside the plants and not on their foliage, the control costs would almost certainly be significantly greater.

If *E. fornicatus s.l.* were to be found in a site with live animals, such as a zoo enclosure or butterfly farm, harsh eradication methods are unlikely to be suitable and there would be an ongoing cost of long term control. If no control measures were applied, the beetles and

fungi could build up to damaging levels inside a heated glasshouse, potentially leading to death of reproductive hosts.

Glasshouses which grow tropical or subtropical plants for later distribution and sale could also be impacted by any findings of *E. fornicatus s.l.* Woody plants grown indoors in the UK such as figs or palms are known hosts of *E. fornicatus s.l.*, and could be grown on in specialist heated nurseries before distribution to garden centres and final sale. If there was an outbreak of *E. fornicatus s.l.* in such a nursery, due to the very wide host range, it is likely that the movement of all woody plants out of the site would be stopped until it was demonstrated that any outbreak had been eradicated. This would be very damaging to the business concerned. However, this impact, though devastating at the local level, is likely to be relatively small on a national scale as outbreaks are unlikely to spread to several locations (unless infested plants are widely moved between sites before detection).

Outdoors, there is high uncertainty about whether any species of *E. fornicatus s.l.* could establish, or if they can, build up to damaging levels. The crops of most economic concern are likely to be orchards in south east England. This is one of the warmer parts of the country, and data from South Africa suggest that *E. fornicatus s.s.* is naturally infesting orchards of apples, plums, pears and other species commonly grown in the UK.

In an urban environment, if *E. fornicatus s.l.* were able to build up high populations, even if only locally, it is likely that there will need to be management of affected street trees. Beetle galleries structurally weaken branches and trunks, meaning that severe pruning or felling may need to be carried out for safety reasons. When impacts are modelled (see section 13), urban tree removal is the factor that contributes by far the most to the estimated costs of beetle outbreaks.

Overall, potential economic impacts in the UK are considered to be **small**, but with **low confidence**. High population levels could build up in heated glasshouses, but these outbreaks are also very likely to be localised to single sites and be relatively easy to control, though very damaging and expensive for the affected glasshouse. It is uncertain if *E. fornicatus s.l.* could build up to damaging populations in any outdoor location, but potential impacts on urban trees would be the most costly, because of the need to fell or prune affected trees for public safety.

Environmental

Establishment outdoors in most of the UK is considered to be marginal. Even if some populations were able to persist in warmer areas, it is not likely that they will be capable of building up to populations levels which would cause serious damage to more than a few localised trees. Therefore, although many hosts are grown in the UK and are important ecosystem species, all of the *E. fornicatus s.l.* species are considered to have **very small** potential environmental impacts in the UK with **high confidence**, mostly due to the limited population levels that are expected.

Social

The main social impacts in the UK are considered to be linked to outbreaks in heated botanical collections planted with relatively mature trees. If *E. fornicatus s.l.* were to build up to substantial population levels in such an environment, the site could be closed for a long period of time while eradication was attempted, such as occurred in the Italian glasshouse outbreak. Even after restocking, it would take time for the site to recover and the new plantings to establish and be attractive to visitors once again. It is also possible that, during the closure, staff would need to be redeployed or even have their working hours reduced if the closure was for a significant period. However, if the outbreak was detected at an early stage, such as happened in Poland, the impact on visitors and tourism would be much less as it is likely the site might only need to be closed to visitors for a short time (hours or days) while localised treatments were applied. Even a large outbreak in one site is unlikely to spread to other indoor glasshouses in the UK, and so while it might be devastating for tourism and employees at a particular site, at a national scale the impacts would be less.

The impact on outdoor urban trees is less certain. London would seem to be the most vulnerable city: it is the warmest location in the UK, though based on current data, establishment here is still uncertain. Suitable hosts are widely planted, in particular London plane (*P.*× *hispanica*), which is known to be very susceptible to at least *E. fornicatus s.s.* It is unclear if high population levels of any of the four species would be able to build up, but loss or severe pruning of large numbers of urban trees would reduce people's quality of urban environment.

The overall potential social impact in the UK is assessed as **small**. In protected environments, though potentially devastating at an individual site level, across all such sites in the UK, the impact would be lower. Outdoors, even in London, it seems likely that beetle populations would take a very long time to build up to damaging levels, if at all. Due to the many uncertainties over establishment, this judgement is made with **low confidence**.

Economic Impacts (all species)	Very small	☐	Small	☑	Medium	☐	Large	☐	Very large ☐
Confidence (all species)	High Confidence	☐	Medium Confidence	☐	Low Confidence	☑			

Environ - mental Impacts (all species)	Very small	✓	Small		Medium		Large		Very large	
Confidence (all species)	High Confidence	✓	Medium Confidence		Low Confidence				
Social Impacts (all species)	Very small		Small	✓	Medium		Large		Very large	
Confidence (all species)	High Confidence		Medium Confidence		Low Confidence	✓			

15. What is the pest's potential as a vector of plant pathogens?

Euwallacea fornicatus s.l. are ambrosia beetles, meaning they have an obligate and symbiotic association with plant pathogenic fungi. Some of the fungal symbionts, if artificially inoculated into a susceptible plant, can cause severe damage or even death while others do not seem to be so pathogenic. The beetles transfer the fungi to a new host via their galleries, then the fungus colonises the wood and the beetles feed on the fungi. Each species of beetle has different species of fungus primarily associated with it, though there are reports of natural and experimental cross-associations (for example, Carrillo *et al.*, 2020; Jiang *et al.*, 2023). Fungal taxonomy has undergone revision and so one species may be referred to under several different names. An added complication is many fungal associations were identified at a time that the beetle taxonomy was also not settled, and so both organisms were referred to using temporary names.

Many symbionts are from the ambrosia *Fusarium* clade (AFC), a monophyletic grouping within the *Fusarium solani* species complex (FSSC). Though some of the information is no longer current (especially concerning species names for both fungi and beetles), O'Donnell *et al.* (2016) gives an introductory review of the *E. fornicatus s.l.* and AFC relationship, designed to be accessible to non-mycologists, and the introduction by Short *et al.* (2017) gives another useful overview. Several distinct AFC lineages have been associated with *E. fornicatus s.l.* across their range (Kasson *et al.*, 2013; O'Donnell *et al.*, 2015). Many of these fungal species have not been formally described, and are referred to as *Fusarium* sp. AF-1 to AF-19 in an informal nomenclature (Aoki *et al.*, 2019; Aoki *et al.*, 2021), though this number is almost certain to increase again in future. For example, following the findings of *E. fornicatus s.s.* and *E. perbrevis* in Dutch glasshouses, four fungal species were isolated which were not *F. euwallaceae, F. ambrosium*, or other described species in

the AFC (Netherlands NPPO, 2021). The AFC are associated with beetles in the genus *Euwallacea* more generally, not just *E. fornicatus s.l.* (Aoki *et al.*, 2019). There has been a proposal to move species in the AFC to the genus *Neocosmospora* (Sandoval-Denis *et al.*, 2019). This generic placement is subject to debate and many researchers, e.g. Aoki *et al.* (2021), consider all AFC to be *Fusarium* species, rejecting *Neocosmospora* as a generic concept and building on the principles suggested by Geiser *et al.* (2013) for *Fusarium* as a whole.

In Northern Ireland, both *F. ambrosium* and *F. euwallacea* are quarantine pests, while in Great Britain, *F. euwallacea* is a provisional quarantine pest. Both sets of legislation use the generic placement of *Neocosmospora*.

As well as the symbiotic fungi on which the beetles depend, many other fungal species can usually be isolated from a given beetle head or gallery tunnels, for example the lists provided by Jiang *et al.* (2023) or Carrillo *et al.* (2016). This section does not attempt to list all fungi which have ever been isolated from *E. fornicatus s.l.* or its galleries, but instead concentrates on species in the AFC, and any other fungi which have specifically been named as symbionts by authors. There are reports of fungal associations from the wider FSSC, e.g. Thube *et al.* (2024), but as their status as true symbionts is unclear, they too have not been discussed.

Euwallacea fornicatior

No records have been found of specific fungal species associated with this specific beetle species. Jiang *et al.* (2023) do list named fungi against *E. fornicatior*, but when their cited references are followed, the original papers do not refer unambiguously to *E. fornicatior* as the beetle from which the fungi discussed were isolated.

Euwallacea fornicatus sensu stricto

Within the AFC, *Fusarium euwallaceae* (synonym: *Neocosmospora euwallaceae*) appears to be the main fungal symbiont (Freeman *et al.*, 2016; Lynch *et al.*, 2016; Na *et al.*, 2018; Sandoval-Denis *et al.*, 2019; van Rooyen *et al.*, 2021). Other AFC have been reported: *Fusarium kuroshium* (synonym: *Neocosmospora kuroshio*), normally associated with *E. kuroshio*, on *Mangifera indica* in Japan (Jiang *et al.*, 2023). Though not yet formally published, a presentation to an EPPO workshop in Estonia in 2025 suggests that six novel species from the AFC have now been identified from Dutch glasshouses associated with *E. fornicatus s.s.*, but neither *F. euwallaceae* nor *F. ambrosium* were present (van de Vossenberg, 2025).

Outside the AFC, *Graphium euwallaceae* and *Paracremonium pembeum* have been named as symbionts (Lynch *et al.*, 2016).

In avocados, *G. euwallaceae* and *P. pembeum* could not be detected in the xylem of living trees 2–4 months after artificial inoculation, though they persist in beetle galleries in living trees and appear to be the predominant species in galleries in dead and drying wood

(Carrillo *et al.*, 2019). *Fusarium euwallaceae* could be recovered from artificially inoculated living trees for much longer periods and also persists in beetle galleries, but fungal populations declined in dead wood as it dried (Carrillo *et al.*, 2019). In experimental studies, both *F. euwallaceae* and *G. euwallaceae* allowed *E. fornicatus s.s.* larvae to develop to adult when this was their sole food source; but if fed exclusively on *P. pembeum*, full development to adult did not occur (Freeman *et al.*, 2016).

Euwallacea kuroshio

The main symbiotic species in the AFC is *F. kuroshium*, which has been found associated with *E. kuroshio* in California (Carrillo *et al.*, 2017; Na *et al.*, 2018; Sandoval-Denis *et al.*, 2019; Boland & Woodward, 2021). Ibarra-Laclette *et al.* (2017) report *F. euwallaceae* from *E. kuroshio* in Mexico.

Outside the AFC, *Graphium kuroshium* is another symbiont (Carrillo *et al.*, 2017).

Euwallacea perbrevis

Several fungi in the AFC have been found associated with this beetle species, though the focus of many papers has been on species descriptions of the fungi. The relative importance of different fungal species to the beetles or their pathogenicity to host plants is seldom reported. In Sri Lanka *E. perbrevis* has had long-recorded symbiotic associations with "*Monacrosporium arnbrosium*" in *Camellia sinensis* plantations (many older references, such as Kumar *et al.*, 1998); this fungus is now regarded as *Fusarium ambrosium* (Kasson *et al.*, 2013; Aoki *et al.*, 2018), though it has also been placed in *Neocosmospora* (Sandoval-Denis *et al.*, 2019). *Fusarium akasia, F. rekanum* and *F. warna* have all been associated with heads of *E. perbrevis* in Indonesia (Lynn *et al.*, 2020; Lynn *et al.*, 2021). It is possible that *F. variasi* is also associated with *E. perbrevis* in Indonesia, but the fungus was not isolated from the beetles' heads, only from trees which were infested (Lynn *et al.*, 2021). *Fusarium obliquiseptatum* is associated with *E. perbrevis* in Australia (Aoki *et al.*, 2021; Callaghan *et al.*, 2024). *Fusarium* sp. AF-6 and *F. duplospermum* have been isolated from *E. perbrevis* in Florida, and *F. papillatum* from Sri Lanka (Carrillo *et al.*, 2016; Aoki *et al.*, 2018; Aoki *et al.*, 2021). A third species has isolated from beetles in Florida, molecular methods classifying it as closely related to *F. ambrosium* (Carrillo *et al.*, 2016).

Outside the AFC, *Graphium euwallaceae* is a symbiont reported from Florida (Carrillo *et al.*, 2016).

16. What is the area endangered by the pest?

Indoor tropical or subtropical plantings which contain large mature trees are likely to see unacceptable impacts from *E. fornicatus s.l.* Examples are tropical botanical glasshouses, butterfly houses or planted tropical cages in zoos. Heated nurseries which grow on woody plants before resale could also have high impacts.

It is unclear if any outdoor part of the UK would be endangered, but the most likely habitat which might have unacceptable levels of damage would be urban trees. This is where most impacts have been reported from the invasive range, and the urban heat island effect makes establishment outdoors in cities a little more likely than in cooler suburban or rural locations.

Stage 3: Pest Risk Management

17. What are the risk management options for the UK/PRA area?

Trapping

Attractants are known for three species in the complex, and could form part of the response for several options within pest risk management. No authorisation for use in the UK would be required if attractants were used to monitor for pest presence. However, if they were used to control pest populations by mass trapping, authorisation by the Chemical Regulations Division (CRD) would be required, both in Great Britain and Northern Ireland. It would be useful to identify the species of *E. fornicatus s.l.* before attractants were deployed, as *E. perbrevis* responses have been shown to differ from *E. fornicatus s.s.* and *E. kuroshio*. Quercivorol (*p*-menth-2-en-1-ol) is attractant to all three invasive species in laboratory bioassays (Cooperband *et al.*, 2017). Testing the volatiles from cultures of fungi associated with *E. perbrevis* showed that all six species of the tested fungi emitted the trans isomer of quercivorol (Kendra *et al.*, 2022), potentially explaining the attraction. When the ethanol component of the quercivorol lures was removed, the traps were more attractive to *E. fornicatus s.s.* and *E. kuroshio* (Dodge *et al.*, 2017; Byers *et al.*, 2018). In contrast, *E. perbrevis* in Florida showed higher responses when quercivorol was combined with ultra high release ethanol lures (Carrillo *et al.*, 2015). Dose-response curves to quercivorol were investigated for *E. fornicatus s.s.* in Israel, to help to inform optimal trap placement, spacing and release rates (Byers *et al.*, 2017). Another attractant has been identified for *E. perbrevis*, (-)-α-copaene, and when this is combined with quercivorol, the mix catches over twice the number of beetles compared to either lure alone (Kendra *et al.*, 2017; Owens *et al.*, 2019a). Using field trapping in Taiwan and California, Liu *et al.* (2022b) showed that α-copaene was not attractive to either *E. fornicatus s.s.* or *E. kuroshio* (nor to the potentially undescribed taxon in the complex known as H22). It should be noted that quercivorol (and quercivorol and α-copaene mix) are also attractive to other species of Scolytinae, and beetles which are attracted to lures would require specialist identification. In the case of *E. fornicatus s.l.*, further molecular analysis would be required to confirm which species had been caught, which may be problematic. EU reference laboratories consider that species identification of *E. fornicatus, E. kuroshio* and *E. perbrevis* is “barely feasible and/or not reliable” (Appendix F in EFSA, 2024). Identification of trap catches in avocado orchards in Florida showed that for an

orchard with little dead wood, over 98% of the trap catch was *E. perbrevis*, but in an orchard with numerous dead trees, other scolytines comprised almost 60% of the trap catch (Owens *et al.*, 2019a). Similarly, trapping *E. perbrevis* in avocado orchards in Florida with quercivorol and α-copaene, Kendra *et al.* (2019b) found that around 75% of beetles trapped were *E. perbrevis*. Limonene is another candidate attractant, at least for *E. perbrevis* (Kendra *et al.*, 2022), but further work on beetle responses to this chemical needs to be done.

Some research has been done into species-specific pheromones, though it is unclear if they would be effective attractants under field conditions. Cooperband *et al.* (2017) found that the ketones 2-heneicosanone and 2-tricosanone are produced in species-specific ratios by *E. fornicatus, E. kuroshio* and *E. perbrevis*, though the evidence suggested they were not sex pheromones. The authors speculate that they might be used to mediate behaviour inside the beetles' galleries.

Attractants are used in combination with traps to physically capture the beetles, and the design of the trap can influence catches. In avocado groves in Florida, Kendra *et al.* (2019b) tested four different trap designs: a Lindgren funnel trap, 3-vane flight interception traps in both green and black, and flat sticky traps, mounted back to back, hung from the tree canopy and provided with a plastic plate as cover from rain. The traps were baited with quercivorol and α-copaene, known to be attractive to *E. perbrevis*, and sticky traps showed the highest catches; Lindgren funnels (the traditional sampling method for scolytines) showed the lowest catches of the four baited traps tested (Kendra *et al.*, 2019b).

Chemical controls

While reading this section, it must be noted that chemical approvals differ markedly between countries, and also change over time. Many of the products discussed here will not be approved for use in any part of the UK. Even if there is existing approval for the chemical, it may not extend to use on trees, especially in an urban setting or in the wider environment. The register for plant protection products with current approvals for use in Great Britain or Northern Ireland, and the plants on which they may be used, can be searched here: https://secure.pesticides.gov.uk/pestreg/ProdSearch.asp

There have been a number of studies in the field and in the laboratory, on both beetle and fungal susceptibility to a range of compounds. In California, sprays and trunk injections for a range of fungicides and insecticides, both separately and in combination, were tested for their effect on *E. fornicatus s.s.* and *F. euwallaceae* in mature *Platanus racemosa* trees (Jones *et al.*, 2017). None of the individual treatments or combinations reduced the number of attacks over the whole six month period, though some treatments showed limited control one month after application, and the combination of a contact insecticide, systemic insecticide and a fungicide showed the best overall control in the trees studied (Jones *et al.*, 2017). Continuing the work in California on *E. fornicatus s.s.*, the effect of several insecticides on naturally infested *Ricinus communis* trees were tested using

destructive sampling a month after treatment (Jones & Paine, 2018). There were fewer beetles in the bifenthrin (a pyrethroid) and imidacloprid (a neonicotinoid) treated trees compared to the untreated control, but the difference was not statistically significant, perhaps because only four trees were tested per experimental treatment (Jones & Paine, 2018). A range of fungicides and two insecticides were tested on Californian infestations at three locations, with somewhat confusing results (Mayorquin *et al.*, 2018). Depending on the level of background beetle infestation, different pesticides used alone and in combination showed greater or lesser efficacy, and when background infestation rates were low, none of the compounds or combinations tested significantly reduced the level of attacks (Mayorquin *et al.*, 2018). In South Africa, Roberts *et al.* (2024) tested a range of insecticides and fungicides on “mildly infested” *Liquidambar styraciflua*. This experiment used artificial introductions of both *F. euwallaceae* and *E. fornicatus s.s.* to selected branches on growing trees, application of one of four treatments a week later, and removal of the branches after three months followed by destructive analysis (Roberts *et al.*, 2024). All four treatments (injected fungicide propiconazole, injected insecticide emamectin benzoate and two trunk sprayed insecticides, bifenthrin and cypermethrin) showed significantly less beetle establishment than the untreated control, and the two surface treatments reduced additional (natural) colonisation attempts (Roberts *et al.*, 2024). The systemic fungicide reduced the mean fungal lesion length (Roberts *et al.*, 2024).

Considering trunk injections in particular, preliminary bioassay data are available on the concentrations of the emamectin benzoate which are effective against *E. kuroshio* in avocado in California (Byrne *et al.*, 2020). The effects of trunk injections in protecting *Platanus racemosa* were investigated by Grosman *et al.* (2019) in several Californian study sites. Treatments used were the insecticide emamectin benzoate, the fungicide propiconazole, or both in combination. As might be expected, the combination fungicide + insecticide had the greatest effect on tree condition, reduction in mortality, and number of attacks per m^2 of bark, followed by the insecticide alone, and the fungicide alone was the least protective of the treatments (Grosman *et al.*, 2019). However in either Great Britain or Northern Ireland, approval would need to be sought from CRD before any trunk injections of any chemical could be used against *E. fornicatus s.l.* or their fungi. Additionally, due to the cost and need for repeated treatments every few years, it is unlikely that more than a few especially valuable or iconic trees could be protected through the use of trunk injections.

Options for control using inorganic chemicals have also been investigated, namely copper nanoparticles against the fungi. Three AFC fungal species associated with *E. perbrevis* were tested from Florida cultures: AF-6, *F. duplospermum* (as AF-8) and an undescribed *Fusarium* sp. (Cruz *et al.*, 2021). The copper nanoparticles reduced lab culture mycelial growth of all three species in a dose-dependent response (Cruz *et al.*, 2021). In laboratory rearing experiments with *E. perbrevis*, no life stages were found after either 20 or 40 days on medium supplemented with 1 mg ml^{-1} copper nanoparticles (the highest concentration tested) (Cruz *et al.*, 2021). Ibarra-Laclette *et al.* (2022) tested copper nanoparticles against *F. kuroshium* in laboratory cultures. Again, the inhibition of growth was dose-dependent with most inhibition at the highest concentration tested (1 mg ml^{-1}), and the copper

nanoparticles inhibited colony growth significantly more than the positive control using cupric hydroxide (Ibarra-Laclette *et al.*, 2022).

Exclusion

As *E. fornicatus s.l.* are not known to be present in any part of the UK, continued exclusion of these pests is an option. Northern Ireland already has *E. fornicatus s.l., N. ambrosia* and *N. euwallaceae* listed as regulated quarantine pests with associated measures on specified hosts in Annex VII. Therefore, the rest of this section on potential exclusion methods is mostly applicable to Great Britain.

If quarantine pest status were to be considered, it would need to be determined which organisms are appropriate to list. For the beetles, in Great Britain the current listing is for *E. fornicatus s.l.* (as a provisional quarantine pest), and keeping the listing at the level of the species complex is an option. This would cover all four species in this PRA, and also any new species in the complex which may be formally identified in future. However, the four currently described beetle species do differ in various aspects, and individual listing might be appropriate. Listing the species of fungal symbionts is more problematic. The most pathogenic fungal species, *Fusarium euwallaceae* (synonym *Neocosmospora euwallaceae*), which is usually associated with *E. fornicatus s.s.*, is currently listed as a provisional quarantine pest in Great Britain. However, as discussed in section 15, other species within *E. fornicatus s.l.* are associated with different species of fungi, and *E. fornicatus s.s.* has more symbionts than just *F. euwallaceae*. Many symbionts are in the ambrosia *Fusarium* clade, a group of closely related species, but there are associations with other fungi which do appear to be true symbionts, notably *Graphium* spp. While the pathogenicity of *F. euwallaceae* and *F. ambrosium* are reasonably well known, there is less information available on other species, and some are not yet formally described.

Due to the very wide host ranges, especially for *E. fornicatus s.s.*, identification of which species of trees and wood would be most at risk of carrying the beetles is challenging. Identification of named hosts would probably be a pre-requisite before any Annex 7 measures could be introduced; measures on broader categories such as “woody plants” are difficult to define in scope and also very difficult to technically justify. In order to significantly reduce the risk of entry, potential measures would have to apply to a very wide range of plant species. Even so, any measures are unlikely to completely remove the risk from more minor hosts, or plants which are not currently recorded as hosts, but which are in fact suitable for the beetles.

If lists of hosts for Annex 7 measures were compiled, a number of measures could be considered. Country freedom or area freedom could be considered for both planting material and wood of all types. Due to the cryptic lifecycle, low levels of infestation of *E. fornicatus s.l.* may be hard to detect, and the pest can be present for some years in a country before the outbreak is detected. However, these undetected populations are more likely also to be low in density and/or restricted in distribution, meaning the risk of association with exported plants or wood could be acceptable.

For growing plants, place of production freedom could be difficult. Complete physical protection would be challenging as the beetles are a maximum of 2.5 mm long meaning that screens etc. would need to be made of very fine mesh as they could enter through gaps smaller than this. Visual surveys of growing plants may not detect low levels of infestation as the majority of the lifecycle is spent concealed in the wood and exit holes are small. Some plants produce clear symptoms of infestation, but other host species do not. Attractants are known and traps could be used to monitor for pest presence, but could run the risk of attracting beetles from outside the production site. The attractants are not specific to *E. fornicatus s.l.*, therefore beetles caught would need to be identified. This would require specialists and, to determine *E. fornicatus s.l.* species, molecular methods. Destructive sampling would help to detect infestations, but may not reliably detect low population levels or localised infestations.

Pre-export chemical treatment of plants is unlikely to be fully effective as the beetles and fungi are in galleries in the wood which spray treatments would not wholly penetrate. Heat or cold treatment of plants is also unlikely to be effective. Even if temperatures lethal to the beetles were known with certainty, gradual temperature changes are often more survivable by insects and beetles will be buffered from rapid temperature changes inside the wood of their hosts. It seems likely that any heat or cold treatment that will kill a significant proportion of beetles would also severely damage or kill the living plants.

Post entry quarantine is another option for living plants, and could be relatively short. If the plants were kept indoors at temperatures of 25°C, experimental data suggests two complete lifecycles of *E. fornicatus s.s.* might be expected in 90 days (Freeman *et al.*, 2012). Attractant traps could also be used to monitor for any emerging beetles, though any adults caught would require specialist identification and molecular techniques to confirm the species.

For wood of all types, heat treatment for wood of all types should be effective if applied properly: wood can be heated to much higher temperatures than growing plants. Though there are no details on exact temperatures which would be lethal for *E. fornicatus s.l.* or their fungi, heat treatment against wood boring insects, including different species of Scolytinae, have been well-researched and it seems very likely thermal regimes (both minimum temperature and duration) that are lethal for other species, would also kill *E. fornicatus s.l.* Similarly, kiln drying of wood to reduce moisture below a certain level is likely to prove as lethal to *E. fornicatus s.l.* and their fungi as it is to other wood-boring insects against which the treatment regimes were based.

Eradication or containment

In a contained structure such as a glasshouse, eradication has proved possible in other countries. The outbreaks in Germany, Italy, the Netherlands and Poland were all under protection, and most have been successfully eradicated, whether they were in plant nurseries or public attractions (Schuler *et al.*, 2023). Depending on the situation, both targeted removal of infested plants and the removal of all plants from the infested

glasshouse have been used successfully (Schuler *et al.*, 2023). The ongoing outbreak in Germany is because it is large (over 130 affected plants) and in an enclosure with fruitbats which need trees for shelter (Schuler *et al.*, 2023). This means that control measures have had to be balanced against the bats' needs and only symptomatic plant material is removed and destroyed (Schuler *et al.*, 2023). None of the outbreaks in European glasshouses had any evidence of spread to the wider environment (Schuler *et al.*, 2023), suggesting that containment could also be a viable strategy for an infested UK glasshouse. As well as the chemical attractants previously discussed, trap logs of *A. negundo* were used to monitor for beetles in several of the outbreaks in European glasshouses (Schuler *et al.*, 2023) and these could be an option in the UK, too. It would be necessary to restrict any movement of potential host plants out of the affected site to prevent spread of the pest, as well as continued monitoring of the wider environment around the infested building.

Eradication or strict containment in the wider environment could be very challenging. Various insecticides and fungicides have been tested in the current ranges of the pests, though so far all treatments tested have, at best, reduced populations of the pests and not eliminated them from the treated trees. Therefore, it seems very likely that felling of infested trees with secure phytosanitary disposal of the infested wood would be the only method of eradicating the pests. The very wide host ranges mean that it would be difficult to remove all potential hosts from an infested zone, as well as damaging to the local neighbourhood. The highly cryptic nature of the pests, feeding inside trees including large mature specimens, mean that in many parts of the invasive range it has taken several years to detect the pests' presence. This has allowed a local population to build up and spread before detection, making eradication attempts harder. Though population build up is expected to be slower in the cooler UK climate, low levels of infestation are likely to delay detection for longer. This, combined with the ability of beetles to fly over 100 m, mean that it would be very difficult to be confident of complete eradication from an infested area, or to be sure the pest had not spread to new infested locations. The haplodiploid mating system means that theoretically only one female needs to survive or disperse from the infested area in order to found a new satellite population. Conversely, the lower number of generations expected in the UK climate mean populations would be slower to build up and a number of successive cool summers might reduce pest populations naturally. Traps could be used in the wider environment to monitor spread and potentially reduce populations. Attractants are known and have been researched for *E. fornicatus s.s., E. kuroshio* and *E. perbrevis*, though the current options are not specific and also attractive to other Scolytinae species. Longer term, the use of highly attractive trap trees, such as *A. negundo* for *E. fornicatus s.s.*, may work as a way of determining if an area remains infested.

Non-statutory controls

As a quarantine pest or provisional quarantine pest in all parts of the UK, non-statutory controls are not appropriate under the current regulations. If this status was to change in

future, some of the methods outlined in this section could be considered to limit populations and reduce impacts.

Pruning of heavily infested branches (with appropriate phytosanitary secure disposal/destruction of the wood) can help to limit population build up if the beetles are localised in small parts of the tree. As establishment outdoors in the UK is uncertain, and build-up of widespread damaging populations is considered unlikely, pruning to remove any local hot-spots may be an effective way of limiting damage. In models, the costs of pruning and systemic insecticides were compared to costs of removal of infested trees (followed by replanting of non-hosts) (Cook *et al.*, 2023). The initial cost of tree removal is so high that pruning and insecticides were modelled as far more cost effective over a 50 year time period, even though this method has ongoing annual costs (Cook *et al.*, 2023).

Repellent chemicals have been identified, though they would only be effective at a level of individual branches at most and would need regular reapplications. Before any of these repellents could be used in the UK, authorisation by CRD would be required, both in Great Britain and Northern Ireland. In the current range, both verbenone and methyl salicylate were repellent to *E. fornicatus s.s.* at 40 cm spacing in Israeli avocado orchards, though direct methyl salicylate application appeared to cause injury to the trees and it was recommended that bag dispensers should be used in preference to spreading on the bark (Byers *et al.*, 2021). Piperitone is another chemical with repellent qualities for *E. perbrevis* in Florida (Kendra *et al.*, 2019a; Kendra *et al.*, 2023) and *E. fornicatus s.s.* in Israel (Byers *et al.*, 2018). In California, *E. kuroshio* and/or *E. fornicatus s.s.* are repelled by piperitone more than verbenone (Dodge *et al.*, 2017).

Especially valuable or iconic trees could be protected through the use of trunk injections of systemic chemicals. The treatments would need to be repeated every year or two and, though long-term studies are lacking, this treatment does not appear to provide complete protection, but merely reduces the populations. Also, as outlined in the chemical control section, approval from CRD would need to be sought before any authorisation of trunk injections of systemic chemicals.

Biocontrol options could be considered, either against the fungi or the beetles, with the aim of reducing populations levels to levels which are not damaging. No evidence of routine use of biocontrol in any part of the range of *E. fornicatus s.l.* could be found, but it does seem to be an area of active research. Laboratory studies exist for a range of potential control organisms, but usually the papers come with warnings that further testing under field conditions will be necessary. It is unclear how effective applications of most biocontrol agents would be in the natural environment, where the beetles and fungi spend much of their lifecycle inside trees and protected from most surface treatments.

Previous work has been done with generalist biocontrol options already used in this country (though not necessarily approved for use on trees, either outdoors or indoors, in any part of the UK). Laboratory susceptibility of the beetles to the fungus *Beauveria bassiana* has been shown for *E. perbrevis* in Florida (Chavez *et al.*, 2023) and *E. fornicatus s.s.* in South Africa (Nel *et al.*, 2023). Experience in the tea plantations of Sri

Lanka suggests that *B. bassiana* did not provide control of *E. fornicatus s.l.* in field conditions (Walgama, 2012). Applications of *B. bassiana* are likely to be even less effective in the UK, as the beetle lifecycle is expected to take longer in the cooler climate, and thus susceptible adults outside the wood tunnels would only be available for comparatively short periods of time. Trunk sprays of a microbial fungicide *Bacillus subtilis*, plus a surfactant, appeared to reduce attacks of *E. fornicatus s.s.* in California one month after application, though the effect did not last long (Jones *et al.*, 2017).

Targeted biocontrol tends to be species-specific and candidates which have been identified for *E. fornicatus s.l.* or any of their fungi in other countries are unlikely to have pre-existing approval for release in any part of the UK. Before any non-native biocontrol agent can be used in the UK, risk assessments need to be conducted. Approvals for release of biocontrol agents are a devolved matter, with each of the four countries within the UK considering any proposed release through their own processes. In Taiwan (part of the native range), three parasitoid species associated with *E. fornicatus s.l.* have been identified, all of which were new to science (Husein *et al.*, 2023). Attempts had been made to introduce a range of predatory and parasitoid insects to tea plantations in Sri Lanka, but none proved successful against *E. fornicatus s.l.* (Walgama, 2012). Preliminary screening of fungi and bacteria which inhibit *F. euwallaceae* growth was carried out by Na *et al.* (2014), who found some bacterial candidates for further study. Several species of bacteria from the genus *Bacillus* which experimentally inhibit the growth of *F. euwallaceae* and *Graphium* spp. (including *G. euwallaceae*) were identified by Guevara-Avendaño *et al.* (2018).

Longer term strategies for limiting populations could include changing the species of trees planted. Depending on exact circumstances, it might be possible to plant or replant an infested area/site with non-hosts or less preferred hosts, mixed with trap trees which are highly attractive (such as *Acer negundo*). Work on diversionary hosts has been carried out in Sri Lanka, on what may be *E. perbrevis* (Amarasinghe & Devy, 2003). This strategy is unlikely to work in the wider environment, especially London which is widely planted with *Platanus* × *hispanica* (London plane) which are attractive to at least *E. fornicatus s.s.* However, in a glasshouse situation where multiple plants are infested and complete clearance is not practical, the use of highly attractive trap plants combined with less attractive or non-hosts to maintain the appearance of the glasshouse could be explored. Preferred hosts of *E. fornicatior, E. kuroshio* and *E. perbrevis* are less well known and thus it could be difficult to determine which tree species to plant. Thick tree bark appears to reduce attacks by *E. kuroshio* on *Salix gooddingii*, with virtually no attacks on bark thicker than 1 cm (Boland & Woodward, 2021). Assuming this is due to the bark forming a physical barrier, the other beetle species are likely to show similar preferences. Thus, even if non-hosts are not known, it might be possible to plant trees with thick bark on the assumption they would be less attractive. However, younger trees will always have relatively thin bark and planting older, larger trees with thick bark carries other biosecurity risks.

18. References

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Name of Pest Risk Analysts(s)

Anastasia Korycinska

Appendix 1

Detailed host lists for each species within *E. fornicatus s.l.*

The host lists are as complete as possible at the time of writing, but it is virtually certain they will expand in future. Every effort has been made only to include hosts which can be unambiguously attributed to one of the four species listed here, but errors may remain. For hosts which are attributable only to *E. fornicatus s.l.* a table is provided at the end. Host family attributions and other taxonomy have been updated in line with information from Plants of the World Online (hosted by Kew Royal Botanic Gardens), and thus may differ from the taxonomy stated in the cited sources. The website was checked during summer 2022, with later corrections and custom names reconciliation by Andrew Budden, Defra, if the original data was of sufficient quality.

Detailed host lists for all species in the tribe Xyleborini (which includes *Euwallacea* spp.) have been published (Ruzzier *et al.*, 2022; Ruzzier *et al.*, 2023). The main bulk of the host lists for this PRA were created before publication of Ruzzier *et al.* (2022)'s lists, and due to time constraints, systematic cross checking was not carried out. Spot checks of particular hosts and references used suggests the lists are in general agreement. The differences which have been detected appear to be mainly due to uncertainty over the *Euwallacea* species attribution given in the source data, and so it is recommended that the original sources are consulted.

"Reproductive hosts" usually means that galleries and eggs, larvae or multiple adults were found on this host (Eskalen *et al.*, 2013; van Rooyen *et al.*, 2021). Hosts which are not confirmed as reproductive hosts at the time of writing may in fact support the full life cycle. For example van Rooyen *et al.* (2021) reported *Robinia pseudoacacia* as a non-reproductive host of *E. fornicatus s.s.* in South Africa, but Bierman *et al.* (2022) found evidence that this host was suitable for breeding. It is possible that a particularly stressed individual plant permits the full lifecycle and thus the species is marked as a reproductive host, even if healthy plants of that species would not be suitable. In the tables which follow, hosts are marked as reproductive hosts if one reference records this information, even if other authors do not agree. The following tables contain three values in the "reproductive host?" column:

- "Yes" if the authors of a paper state unambiguously that this host was a reproductive host or information is provided that allows this decision to be made with certainty
- "Unknown" if the host is listed without context or there is uncertainty
- "No" if the authors of a paper explicitly state this is not a reproductive host. However, it must be noted that hosts considered to be non-reproductive may later prove to be suitable

Euwallacea fornicatior host lists

Even within hosts known to be suitable for reproduction, it is still possible that some species allow greater potential for the beetles to multiply than others.

The tables which follow are sorted by reproductive host status (proven reproductive hosts first), then by plant family, then by the genus and species.

Euwallacea fornicatior

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Moraceae	*Artocarpus altilis*	Yes	Papua New Guinea, native range	(Smith *et al.*, 2019); (Gomez *et al.*, 2019); (Wang *et al.*, 2022)
Leguminosae	*Albizia*	Unknown	Native range	(Smith *et al.*, 2019)
Leguminosae	*Tephrosia*	Unknown	Native range	(Smith *et al.*, 2019)
Malvaceae	*Durio zibethinus*	Unknown	Native range	(Smith *et al.*, 2019)
Theaceae	*Camellia sinensis*	Unknown	Native range	(Smith *et al.*, 2019)

Euwallacea fornicatus sensu stricto

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Oleaceae	*Fraxinus excelsior*	Yes	South Africa, Uruguay	(van Rooyen *et al.*, 2021); (Ceriani-Nakamurakare *et al.*, 2025)
Achariaceae	*Kiggelaria africana*	Yes	South Africa	(van Rooyen *et al.*, 2021)
Adoxaceae	*Viburnum sodoratissimum*	Yes	South Africa, USA: California	(van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021)
Altingiaceae	*Liquidambar styraciflua*	Yes	Australia, Israel, South Africa, USA: California	(Eskalen *et al.*, 2013); (Cooperband *et al.*, 2016); (Mendel *et al.*, 2017); (Coleman *et al.*, 2019); (van Rooyen *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Anacardiaceae	*Harpephyllum caffrum*	Yes	Australia, South Africa	(van Rooyen *et al.*, 2021) ; (FABI, 2024); (Department of Primary Industries and Regional Development, 2023)
Anacardiaceae	*Loxostylis alata*	Yes	South Africa	(FABI, 2024)
Anacardiaceae	*Mangifera indica*	Yes	Australia, Germany	(Schuler *et al.*, 2023); (Australian NPPO, 2021); (Department of Primary Industries and Regional Development, 2023)
Anacardiaceae	*Schinus longifolia*	Yes	Argentina	(Ceriani-Nakamurakare *et al.*, 2023)
Anacardiaceae	*Schinus polygama*	Yes	Israel	(Mendel *et al.*, 2021)
Annonaceae	*Annona muricata*	Yes	Italy	(Schuler *et al.*, 2023)
Annonaceae	*Cananga odorata*	Yes	Italy, South Africa, [unknown]	(Gomez *et al.*, 2019); (Schuler *et al.*, 2023); (FABI, 2024)
Apocynaceae	*Plumeria rubra*	Yes	Australia, South Africa	(van Rooyen *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Apocynaceae	*Plumeria* sp.	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Aquifoliaceae	*Ilex cornuta*	Yes	USA: California	(Eskalen *et al.*, 2013); (Cooperband *et al.*, 2016)
Araliaceae	*Cussonia spicata*	Yes	South Africa, USA: California	(Eskalen *et al.*, 2013); (van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021); (FABI, 2024)
Araliaceae	*Heptapleurum actinophyllum*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Araliaceae	*Heptapleurum arboricola*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Arecaceae	*Archontophoenix alexandrae*	Yes	USA: California	(Mendel *et al.*, 2021)
Arecaceae	*Archontophoenix cunninghamiana*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Arecaceae	*Howea forsteriana*	Yes	Australia, USA: California	(Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Asparagaceae	*Dracaena reflexa* var. *angustifolia*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Asteraceae	*Brachylaena discolor*	Yes	South Africa	(van Rooyen *et al.*, 2021)
Betulaceae	*Alnus rhombifolia*	Yes	USA: California	(Cooperband *et al.*, 2016); (Coleman *et al.*, 2019)
Bignoniaceae	*Jacaranda campanulate* (not a valid name, possibly *Spathodea campanulata*)	Yes	USA: California	(Mendel *et al.*, 2021)
Bignoniaceae	*Jacaranda mimosifolia*	Yes	Australia, Israel, South Africa, USA: California	(Mendel *et al.*, 2017); (van Rooyen *et al.*, 2021); (University of California, 2022); (Department of Primary Industries and Regional Development, 2023)
Bixaceae	*Bixa orellana*	Yes	Italy	(Schuler *et al.*, 2023)
Bracteolaria	*Bracteolaria racemosa* (as *Baphia racemosa*)	Yes	South Africa	(FABI, 2024)
Buxaceae	*Buxus sempervirens*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Cannabaceae	*Celtis australis*	Yes	Israel	(Mendel *et al.*, 2021)
Cannabaceae	*Trema orientale*	Yes	South Africa	(van Rooyen *et al.*, 2021)
Casuarinaceae	*Casuarina cunninghamiana*	Yes	Argentina, Australia, Israel, South Africa, USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2017); (van Rooyen *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023); (Ceriani-Nakamurakare *et al.*, 2023)
Casuarinaceae	*Casuarina obesa*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Celestraceae	*Gymnosporia buxifolia*	Yes	South Africa	(van Rooyen *et al.*, 2021); (Townsend *et al.*, 2024)
Combretaceae	*Combretum erythrophyllum*	Yes	South Africa	(van Rooyen *et al.*, 2021)
Combretaceae	*Combretum kraussii*	Yes	South Africa	(van Rooyen *et al.*, 2021); (Bierman *et al.*, 2022)
Ebenaceae	*Diospyros dichrophylla*	Yes	South Africa	(van Rooyen *et al.*, 2021); (FABI, 2024)
Ebenaceae	*Diospyros glabra*	Yes	South Africa	(van Rooyen *et al.*, 2021)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Ebenaceae	*Diospyros inconstans*	Yes	Uruguay	(Ceriani-Nakamurakare *et al.*, 2025)
Ebenaceae	*Diospyros whyteana*	Yes	South Africa	(van Rooyen *et al.*, 2021); (FABI, 2024)
Euphorbiaceae	*Acalypha glabrata*	Yes	South Africa	(Bierman *et al.*, 2022)
Euphorbiaceae	*Acalypha wilkesiana*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Euphorbiaceae	*Mallotus apelta*	Yes	China	(Gomez *et al.*, 2019); (Wang *et al.*, 2022)
Euphorbiaceae	*Ricinocarpos pinifolius*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Euphorbiaceae	*Ricinocarpos tuberculatus* × *cyanescens*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Euphorbiaceae	*Ricinus communis*	Yes	Australia, China, India, Israel South Africa, USA: California	(Cooperband *et al.*, 2016); (Mendel *et al.*, 2017); (Coleman *et al.*, 2019); (Smith *et al.*, 2019); (van Rooyen *et al.*, 2021); (Wang *et al.*, 2022); (Department of Primary Industries and Regional Development, 2023)
Euphorbiaceae	*Triadica sebifera* (as *Sapium sebiferum*)	Yes	Australia, Israel, USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2017); (Department of Primary Industries and Regional Development, 2023)
Fabaceae	*Acacia longifolia*	Yes	Australia, South Africa	(van Rooyen *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Fabaceae	*Acacia mangium*	Yes	Brazil, Vietnam	(Covre *et al.*, 2024); (Coleman *et al.*, 2019); (Ceriani-Nakamurakare *et al.*, 2025)
Fabaceae	*Acacia mearnsii*	Yes	South Africa	(van Rooyen *et al.*, 2021)
Fabaceae	*Acacia melanoxylon*	Yes	South Africa, USA: California	(van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021)
Fabaceae	*Acacia* sp.	Yes	USA: California	(Cooperband *et al.*, 2016)
Fabaceae	*Acacia stenophylla*	Yes	USA: California	(Eskalen *et al.*, 2013); (Gomez *et al.*, 2019); (Mendel *et al.*, 2021)
Fabaceae	*Afzelia quanzensis*	Yes	South Africa	(van Rooyen *et al.*, 2021); (Bierman *et al.*, 2022)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Fabaceae	*Albizia julibrissin*	Yes	Argentina, Australia, Israel, USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2017); (Cooperband *et al.*, 2016); (Department of Primary Industries and Regional Development, 2023); (Ceriani-Nakamurakare *et al.*, 2023)
Fabaceae	*Albizia lebbek*	Yes	Australia, Israel	(Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Fabaceae	*Bauhinia forficata*	Yes	Uruguay	(Ceriani-Nakamurakare *et al.*, 2025)
Fabaceae	*Bauhinia galpinii*	Yes	South Africa, USA: California	(Eskalen *et al.*, 2013); (van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021)
Fabaceae	*Bauhinia variegata*	Yes	Australia, Israel, Samoa, South Africa, USA: California	(Mendel *et al.*, 2017); (Smith *et al.*, 2019); (van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Fabaceae	*Bossiaea linophylla*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Fabaceae	*Calpurnia aurea*	Yes	South Africa, USA: California	(Eskalen *et al.*, 2013); (van Rooyen *et al.*, 2021)
Fabaceae	*Cassia fistula*	Yes	Australia, South Africa	(FABI, 2024); (Department of Primary Industries and Regional Development, 2023)
Fabaceae	*Castanospermum australe*	Yes	Australia, USA: California	(Eskalen *et al.*, 2013); (Cooperband *et al.*, 2016); (Department of Primary Industries and Regional Development, 2023)
Fabaceae	*Ceratonia siliqua*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Fabaceae	*Delonix regia*	Yes	Australia	(Australian NPPO, 2021); (Cook *et al.*, 2023)
Fabaceae	*Dichrostachys cinerea*	Yes	South Africa	(FABI, 2024)
Fabaceae	*Erythrina × sykesii*	Yes	Australia, USA: California	(Eskalen *et al.*, 2013); (Cook *et al.*, 2023)
Fabaceae	*Erythrina americana* (including *Erythrina coralloides*)	Yes	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021); (University of California, 2022)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Fabaceae	*Erythrina caffra*	Yes	Australia, South Africa, USA: California	(van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023); (FABI, 2024)
Fabaceae	*Erythrina corallodendron*	Yes	Israel, USA: California	(Eskalen *et al.*, 2013); (Cooperband *et al.*, 2016); (Mendel *et al.*, 2021)
Fabaceae	*Erythrina falcata*	Yes	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Erythrina lysistemon*	Yes	Australia, South Africa, USA: California	(Eskalen *et al.*, 2013); (van Rooyen *et al.*, 2021); (Bierman *et al.*, 2022); (Department of Primary Industries and Regional Development, 2023); (FABI, 2024)
Fabaceae	*Erythrina subumbrans* (as *E. lithosperma*)	Yes	India, Sri Lanka	(Amarasinghe & Devy, 2003); (Smith *et al.*, 2019)
Fabaceae	*Geoffroea decorticans*	Yes	Uruguay	(Ceriani-Nakamurakare *et al.*, 2025)
Fabaceae	*Gleditsia triacanthos*	Yes	Australia, South Africa, USA: California	(van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Fabaceae	*Indigofera jucunda*	Yes	South Africa	(Bierman *et al.*, 2022)
Fabaceae	*Inga edulis*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Fabaceae	*Neltuma caldenia*	Yes	Uruguay	(Ceriani-Nakamurakare *et al.*, 2025)
Fabaceae	*Parkinsonia* × *sonorae* (as *Cercidium* × *sonorae*)	Yes	USA: California	(Eskalen *et al.*, 2013); (Cooperband *et al.*, 2016); (Mendel *et al.*, 2021)
Fabaceae	*Parkinsonia aculeata*	Yes	USA: California	(Eskalen *et al.*, 2013); (Cooperband *et al.*, 2016)
Fabaceae	*Parkinsonia florida* (as *Cercidium floridum*)	Yes	USA: California	(Eskalen *et al.*, 2013); (Cooperband *et al.*, 2016)
Fabaceae	*Podalyria calyptrata*	Yes	South Africa	(van Rooyen *et al.*, 2021)
Fabaceae	*Prosopis articulata*	Yes	USA: California	(Cooperband *et al.*, 2016)
Fabaceae	*Psoralea affinis*	Yes	South Africa	(FABI, 2024)
Fabaceae	*Psoralea aphylla*	Yes	South Africa	(van Rooyen *et al.*, 2021)
Fabaceae	*Psoralea pinnata*	Yes	South Africa	(van Rooyen *et al.*, 2021)
Fabaceae	*Robinia pseudoacacia*	Yes	Australia, South Africa, USA: California	(Bierman *et al.*, 2022); (Mendel *et al.*, 2021); (Cook *et al.*, 2023)
Fabaceae	*Senna multijuga*	Yes	South Africa	(FABI, 2024)
Fabaceae	*Sindora glabra*	Yes	China	(Gomez *et al.*, 2019); (Wang *et al.*, 2022)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Fabaceae	*Vachellia sieberiana*	Yes	Israel, South Africa	(van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021)
Fabaceae	*Virgilia oroboides*	Yes	South Africa	(van Rooyen *et al.*, 2021)
Fabaceae	*Wisteria floribunda*	Yes	Australia, USA: California	(Cooperband *et al.*, 2016); (Department of Primary Industries and Regional Development, 2023)
Fabaceae	*Wisteria sinensis*	Yes	Australia, South Africa, USA: California	(Eskalen *et al.*, 2013); (van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Fagaceae	*Fagus crenata*	Yes	USA: California	(Cooperband *et al.*, 2016)
Fagaceae	*Quercus agrifolia*	Yes	South Africa, USA: California	(Cooperband *et al.*, 2016); (Coleman *et al.*, 2019); (Bierman *et al.*, 2022)
Fagaceae	*Quercus chrysolepis*	Yes	USA: California	(Eskalen *et al.*, 2013); (Coleman *et al.*, 2019); (Mendel *et al.*, 2021); (University of California, 2022)
Fagaceae	*Quercus coccifera* (as *Q. calliprinos*)	Yes	Israel	(Mendel *et al.*, 2017)
Fagaceae	*Quercus conferta* (as *Q. frainetto*)	Yes	USA: California	(Mendel *et al.*, 2021)
Fagaceae	*Quercus engelmannii*	Yes	USA: California	(Cooperband *et al.*, 2016); (Coleman *et al.*, 2019)
Fagaceae	*Quercus infectoria*	Yes	Israel	(Mendel *et al.*, 2017); (Mendel *et al.*, 2021)
Fagaceae	*Quercus ithaburensis*	Yes	Israel	(Mendel *et al.*, 2017)
Fagaceae	*Quercus lobata*	Yes	USA: California	(Cooperband *et al.*, 2016)
Fagaceae	*Quercus palustris*	Yes	South Africa, USA: California	(van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021)
Fagaceae	*Quercus petraea*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Fagaceae	*Quercus robur*	Yes	Australia, Israel, South Africa, USA: California	(Cooperband *et al.*, 2016); (Mendel *et al.*, 2017); (van Rooyen *et al.*, 2021); (Bierman *et al.*, 2022); (Department of Primary Industries and Regional Development, 2023)
Fagaceae	*Quercus robur* subsp. *pedunculiflora* (as *Q. pedunculiflora*)	Yes	Israel	(Mendel *et al.*, 2017)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Fagaceae	*Quercus suber*	Yes	Australia, Israel, South Africa, USA: California	(Cooperband *et al.*, 2016); (Mendel *et al.*, 2017); (van Rooyen *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Fagaceae	*Quercus virginiana*	Yes	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Juglandaceae	*Carya illinoinensis*	Yes	Australia, South Africa, USA: California	(Eskalen *et al.*, 2013); (van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021); (Bierman *et al.*, 2022); (Department of Primary Industries and Regional Development, 2023); (FABI, 2024)
Juglandaceae	*Pterocarya stenoptera*	Yes	USA: California	(Mendel *et al.*, 2021)
Lauraceae	*Persea americana*	Yes	Australia, Brazil, Israel, Italy, South Africa, USA: California	(Cooperband *et al.*, 2016); (Mendel *et al.*, 2017); (Coleman *et al.*, 2019); (Smith *et al.*, 2019); (Schuler *et al.*, 2023); (van Rooyen *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023); (Covre *et al.*, 2024)
Magnoliaceae	*Magnolia grandiflora*	Yes	Australia, Israel, South Africa, USA: California	(Mendel *et al.*, 2017); (van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Magnoliaceae	*Magnolia virginiana*	Yes	USA: California	(Mendel *et al.*, 2021)
Malvaceae	*Anisodontea scabrosa*	Yes	South Africa	(van Rooyen *et al.*, 2021)
Malvaceae	*Bombax ceiba*	Yes	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Malvaceae	*Brachychiton acerifolius*	Yes	Australia, Israel, USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2017); (Department of Primary Industries and Regional Development, 2023)
Malvaceae	*Brachychiton discolor*	Yes	South Africa, USA: California	(Eskalen *et al.*, 2013); (van Rooyen *et al.*, 2021)
Malvaceae	*Brachychiton populneus*	Yes	Argentina, Australia, Israel, USA: California	(Cooperband *et al.*, 2016); (Mendel *et al.*, 2017); (Department of Primary Industries and Regional Development, 2023); (Ceriani-Nakamurakare *et al.*, 2023)
Malvaceae	*Dombeya cacuminum*	Yes	USA: California	(Eskalen *et al.*, 2013); (University of California, 2022)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Malvaceae	*Dombeya tiliacea*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Malvaceae	*Grewia occidentalis*	Yes	Australia, South Africa	(van Rooyen *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023); (FABI, 2024)
Malvaceae	*Hibiscus mutabilis*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Malvaceae	*Hibiscus rosa-sinensis*	Yes	Australia, South Africa	(van Rooyen *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Malvaceae	*Hibiscus tiliaceus*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Malvaceae	*Sparrmannia africana*	Yes	South Africa	(van Rooyen *et al.*, 2021)
Malvaceae	*Sterculia murex*	Yes	South Africa	(FABI, 2024)
Malvaceae	*Theobroma cacao*	Yes	Italy, [unknown]	(Gomez *et al.*, 2019); (Schuler *et al.*, 2023)
Meliaceae	*Toona ciliata*	Yes	Australia, Brazil	(Department of Primary Industries and Regional Development, 2023); (Covre *et al.*, 2024)
Meliaceae	*Trichilia emetica*	Yes	South Africa	(van Rooyen *et al.*, 2021)
Menispermaceae	*Cocculus laurifolius*	Yes	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Moraceae	*Artocarpus heterophyllus*	Yes	Italy, [unknown]	(Gomez *et al.*, 2019); (Schuler *et al.*, 2023)
Moraceae	*Ficus altissima*	Yes	Italy, USA: California	(Schuler *et al.*, 2023); (Mendel *et al.*, 2021)
Moraceae	*Ficus aspera*	Yes	Uruguay	(Ceriani-Nakamurakare *et al.*, 2025)
Moraceae	*Ficus benjamina*	Yes	Australia, Netherlands, USA: California	(Eskalen *et al.*, 2013); (Schuler *et al.*, 2023); (Department of Primary Industries and Regional Development, 2023)
Moraceae	*Ficus carica*	Yes	Australia, China, South Africa, USA: California	(Cooperband *et al.*, 2016); (van Rooyen *et al.*, 2021); (Wang *et al.*, 2022); (Department of Primary Industries and Regional Development, 2023)
Moraceae	*Ficus elastica*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Moraceae	*Ficus macrophylla*	Yes	Australia, USA: California	(Eskalen *et al.*, 2013); (Cook *et al.*, 2023)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Moraceae	*Ficus microcarpa*	Yes	Australia, China, Netherlands	(Coleman *et al.*, 2019); (Gomez *et al.*, 2019); (Schuler *et al.*, 2023); (Wang *et al.*, 2022); (Department of Primary Industries and Regional Development, 2023)
Moraceae	*Ficus natalensis*	Yes	South Africa	(van Rooyen *et al.*, 2021); (FABI, 2024)
Moraceae	*Ficus religiosa*	Yes	Poland, Uruguay	(Schuler *et al.*, 2023); (Ceriani-Nakamurakare *et al.*, 2025)
Moraceae	*Ficus rubiginosa*	Yes	Australia, USA: California	(Mendel *et al.*, 2021); (Cook *et al.*, 2023)
Moraceae	*Ficus sycomorus*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Moraceae	*Ficus trichopoda*	Yes	South Africa	(FABI, 2024)
Moraceae	*Morus alba*	Yes	Argentina, Australia, China, Israel, USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2017); (Coleman *et al.*, 2019); (Wang *et al.*, 2022); (Cook *et al.*, 2023); (Ceriani-Nakamurakare *et al.*, 2023)
Moraceae	*Morus nigra*	Yes	Australia, South Africa	(van Rooyen *et al.*, 2021); (Cook *et al.*, 2023)
Myrtaceae	*Corymbia calophylla*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Myrtaceae	*Corymbia ficifolia*	Yes	Australia, USA: California	(Cooperband *et al.*, 2016); (Department of Primary Industries and Regional Development, 2023)
Myrtaceae	*Corymbia ficifolia* (as *Eucalyptus ficifolia*)	Yes	USA: California	(Eskalen *et al.*, 2013); (Eskalen, 2015)
Myrtaceae	*Eucalyptus cladocalyx*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Myrtaceae	*Eucalyptus diversicolor*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Myrtaceae	*Eucalyptus globulus*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Myrtaceae	*Eucalyptus leucoxylon*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Myrtaceae	*Eucalyptus robusta*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Myrtaceae	*Eucalyptus rudis*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Myrtaceae	*Melaleuca quinquenervia*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Myrtaceae	*Melaleuca rhaphiophylla*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Myrtaceae	*Melaleuca teretifolia*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Myrtaceae	*Melaleuca viminalis* (as *Callistemon viminalis*)	Yes	Australia, USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Myrtaceae	*Psidium guajava*	Yes	South Africa, Sri Lanka	(Amarasinghe & Devy, 2003); (van Rooyen *et al.*, 2021)
Myrtaceae	*Syzygium smithii*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Oleaceae	*Ligustrum japonicum*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Oleaceae	*Olea europaea* subsp. *cuspidata* (as *O. europeana* subsp. *africana*)	Yes	South Africa	(FABI, 2024)
Oleaceaee	*Fraxinus angustifolia*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Platanaceae	*Platanus* × *hispanica* (as *Platanus* × *acerifolia*)	Yes	Argentina, Australia, South Africa, USA: California	(Cooperband *et al.*, 2016); (Coleman *et al.*, 2019); (van Rooyen *et al.*, 2021); (Cook *et al.*, 2023); (Ceriani-Nakamurakare *et al.*, 2023)
Platanaceae	*Platanus mexicana*	Yes	Israel, USA: California	(Cooperband *et al.*, 2016); (Mendel *et al.*, 2021)
Platanaceae	*Platanus occidentalis*	Yes	Australia, Israel, South Africa, USA: California	(Mendel *et al.*, 2017); (Coleman *et al.*, 2019); (van Rooyen *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Platanaceae	*Platanus orientalis*	Yes	Australia, China, Israel, USA: California	(Mendel *et al.*, 2017); (Coleman *et al.*, 2019); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Platanaceae	*Platanus racemosa*	Yes	Israel, South Africa, USA: California	(Cooperband *et al.*, 2016); (Mendel *et al.*, 2017); (Coleman *et al.*, 2019); (van Rooyen *et al.*, 2021)
Podocarpaceae	*Afrocarpus falcatus*	Yes	South Africa	(van Rooyen *et al.*, 2021); (FABI, 2024)
Primulaceae	*Maesa lanceolata*	Yes	South Africa	(FABI, 2024)
Primulaceae	*Myrsine laetevirens*	Yes	Uruguay	(Ceriani-Nakamurakare *et al.*, 2025)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Proteaceae	*Banksia littoralis*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Proteaceae	*Banksia prionotes*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Proteaceae	*Grevillea robusta*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Proteaceae	*Macadamia integrifolia*	Yes	Australia, Israel, USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2017); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Proteaceae	*Xylomelum occidentale*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Rhamnaceae	*Rhamnus prinoides*	Yes	South Africa	(FABI, 2024)
Rhamnaceae	*Spyridium globulosum*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Rosaceae	*Malus domestica*	Yes	Israel (as *Pyrus malus*), South Africa	(Mendel *et al.*, 2017); (van Rooyen *et al.*, 2021); (de Jager & Roets, 2022)
Rosaceae	*Photinia × fraseri*	Yes	South Africa	(van Rooyen *et al.*, 2021)
Rosaceae	*Prunus armeniaca*	Yes	Australia, South Africa	(de Jager & Roets, 2023); (Department of Primary Industries and Regional Development, 2023)
Rosaceae	*Prunus cerasifera*	Yes	Australia, South Africa	(van Rooyen *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023); (FABI, 2024)
Rosaceae	*Prunus domestica*	Yes	Israel, South Africa	(Mendel *et al.*, 2017); (Mendel *et al.*, 2021); (de Jager & Roets, 2023)
Rosaceae	*Prunus dulcis*	Yes	South Africa	(de Jager & Roets, 2023)
Rosaceae	*Prunus nigra*	Yes	South Africa	(van Rooyen *et al.*, 2021)
Rosaceae	*Prunus persica*	Yes	South Africa, USA: California	(Eskalen *et al.*, 2013); (van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021); (de Jager & Roets, 2023)
Rosaceae	*Pyrus calleryana*	Yes	Australia, USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Rosaceae	*Pyrus communis*	Yes	South Africa	(Engelbrecht *et al.*, 2024)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Rosaceae	*Rhaphiolepis bibas* (as *Eriobotrya japonica*)	Yes	Australia, South Africa, USA: California	(Eskalen *et al.*, 2013); (van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Rosaceae	*Rosa setigera*	Yes	South Africa	(FABI, 2024)
Rubiaceae	*Coprosma repens*	Yes	Western Australia	(Cook *et al.*, 2023)
Rubiaceae	*Gardenia thunbergia*	Yes	Uruguay	(Ceriani-Nakamurakare *et al.*, 2025)
Rutaceae	*Calodendrum capense*	Yes	Australia, South Africa	(van Rooyen *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023); (FABI, 2024)
Rutaceae	*Citrus* × *aurantium* (as *Citrus sinensis*)	Yes	Australia, South Africa, USA: California	(Eskalen *et al.*, 2013); (van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Rutaceae	*Citrus* × *latifolia*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Rutaceae	*Vepris lanceolata*	Yes	South Africa	(van Rooyen *et al.*, 2021)
Salicaceae	*Dovyalis caffra*	Yes	Australia, South Africa, USA: California	(van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Salicaceae	*Populus* × *canescens*	Yes	South Africa, USA: California	(van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021)
Salicaceae	*Populus alba*	Yes	Israel, South Africa	(van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021)
Salicaceae	*Populus deltoides*	Yes	Argentina, Australia	(Department of Primary Industries and Regional Development, 2023); (Ceriani-Nakamurakare *et al.*, 2023)
Salicaceae	*Populus euphratica*	Yes	Israel	(Mendel *et al.*, 2021)
Salicaceae	*Populus fremontii*	Yes	USA: California	(Cooperband *et al.*, 2016); (Coleman *et al.*, 2019)
Salicaceae	*Populus nigra*	Yes	Australia, South Africa, USA: California	(Coleman *et al.*, 2019); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023); (FABI, 2024)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Salicaceae	*Populus simonii*	Yes	Australia, South Africa	(van Rooyen *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Salicaceae	*Populus tristis* (as *P. trichocarpa*)	Yes	USA: California	(Cooperband *et al.*, 2016)
Salicaceae	*Salix alba*	Yes	Australia, South Africa	(van Rooyen *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Salicaceae	*Salix babylonica*	Yes	Australia, South Africa, USA: California	(Cooperband *et al.*, 2016); (van Rooyen *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Salicaceae	*Salix gooddingii*	Yes	USA: California	(Cooperband *et al.*, 2016); (Coleman *et al.*, 2019)
Salicaceae	*Salix humboldtiana*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Salicaceae	*Salix laevigata*	Yes	USA: California	(Cooperband *et al.*, 2016); (Coleman *et al.*, 2019)
Salicaceae	*Salix lasiolepis*	Yes	USA: California	(Coleman *et al.*, 2019); (Mendel *et al.*, 2021)
Salicaceae	*Salix mucronata*	Yes	South Africa	(van Rooyen *et al.*, 2021)
Salicaceae	*Salix nigra*	Yes	Israel, USA: California	(Mendel *et al.*, 2021)
Salicaceae	*Xylosma congesta*	Yes	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Sapindaceae	*Acer* × *freemanii*	Yes	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Sapindaceae	*Acer buergerianum*	Yes	Australia, China, Israel, South Africa, USA: California	(Cooperband *et al.*, 2016); (Mendel *et al.*, 2017); (Coleman *et al.*, 2019); (van Rooyen *et al.*, 2021); (Bierman *et al.*, 2022); (Department of Primary Industries and Regional Development, 2023)
Sapindaceae	*Acer japonicum*	Yes	Argentina	(Ceriani-Nakamurakare *et al.*, 2023)
Sapindaceae	*Acer macrophyllum*	Yes	USA: California	(Cooperband *et al.*, 2016); (Coleman *et al.*, 2019)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Sapindaceae	*Acer negundo*	Yes	Argentina, Australia, Israel, South Africa, USA: California	(Cooperband *et al.*, 2016); (Mendel *et al.*, 2017); (Coleman *et al.*, 2019); (van Rooyen *et al.*, 2021); (Australian NPPO, 2021); (Bierman *et al.*, 2022); (Cook & Broughton, 2023); (Ceriani-Nakamurakare *et al.*, 2023)
Sapindaceae	*Acer obtusifolium*	Yes	Israel	(Mendel *et al.*, 2017)
Sapindaceae	*Acer palmatum*	Yes	Australia, South Africa, USA: California	(Cooperband *et al.*, 2016); (van Rooyen *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Sapindaceae	*Acer paxii*	Yes	USA: California	(Cooperband *et al.*, 2016)
Sapindaceae	*Acer pseudoplatanus*	Yes	Israel, South Africa	(Mendel *et al.*, 2017); (Bierman *et al.*, 2022)
Sapindaceae	*Acer saccharinum*	Yes	Australia, South Africa, USA: California	(van Rooyen *et al.*, 2021); (Australian NPPO, 2021); (University of California, 2022)
Sapindaceae	*Alectryon excelsus*	Yes	USA: California	(Cooperband *et al.*, 2016)
Sapindaceae	*Allophylus natalensis*	Yes	South Africa	(FABI, 2024)
Sapindaceae	*Cupaniopsis anacardioides*	Yes	USA: California	(Mendel *et al.*, 2021); (University of California, 2022)
Sapindaceae	*Harpullia pendula*	Yes	Australia, USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Sapindaceae	*Koelreuteria bipinnata*	Yes	Israel, USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2017); (Mendel *et al.*, 2021)
Sapindaceae	*Koelreuteria paniculata*	Yes	Australia, China, South Africa	(Bierman *et al.*, 2022); (Wang *et al.*, 2022); (Department of Primary Industries and Regional Development, 2023)
Sapindaceae	*Sapindus drummondii*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Sapindaceae	*Sapindus saponaria*	Yes	USA: California	(Mendel *et al.*, 2021)
Simaroubaceae	*Ailanthus altissima*	Yes	USA: California	(Cooperband *et al.*, 2016); (Coleman *et al.*, 2019)
Solanaceae	*Brugmansia arborea*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Solanaceae	*Brugmansia suaveolens*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Solanaceae	*Cestrum nocturnum*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Solanaceae	*Solanum granulosoleprosum*	Yes	Argentina	(Ceriani-Nakamurakare *et al.*, 2023)
Solanaceae	*Solanum mauritianum*	Yes	Brazil, South Africa	(van Rooyen *et al.*, 2021); (Covre *et al.*, 2024)
Stilbaceae	*Halleria lucida*	Yes	South Africa	(van Rooyen *et al.*, 2021); (FABI, 2024)
Theaceae	*Camellia semiserrata*	Yes	USA: California	(Eskalen *et al.*, 2013); (Cooperband *et al.*, 2016)
Ulmaceae	*Ulmus glabra*	Yes	Australia, Israel	(Mendel *et al.*, 2017); (Department of Primary Industries and Regional Development, 2023)
Ulmaceae	*Ulmus parvifolia*	Yes	South Africa, USA: California	(Eskalen *et al.*, 2013); (van Rooyen *et al.*, 2021); (Bierman *et al.*, 2022); (Mendel *et al.*, 2021)
Ulmaceae	*Zelkova serrata*	Yes	Australia, USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Verbenaceae	*Duranta erecta*	Yes	Australia	(Department of Primary Industries and Regional Development, 2023)
Acanthaceae	*Justicia* sp.	Unknown	Italy	(Schuler *et al.*, 2023)
Adoxaceae	*Sambucus mexicana*	Unknown	USA: California	(Coleman *et al.*, 2019)
Araliaceae	*Aralia* sp.	Unknown	China	(Wang *et al.*, 2022)
Araliaceae	*Heteropanax* sp.	Unknown	Germany	(Schuler *et al.*, 2023)
Betulaceae	*Alnus rubra*	Unknown	USA: California	(CABI, 2022)
Bignoniaceae	*Crescentia cujete*	Unknown	Italy	(Schuler *et al.*, 2023)
Clusiaceae	*Clusia rosea*	Unknown	Germany	(Schuler *et al.*, 2023)
Combretaceae	*Terminalia buceras*	Unknown	Italy	(Schuler *et al.*, 2023)
Combretaceae	*Terminalia catappa*	Unknown	Italy	(Schuler *et al.*, 2023)
Cupressaceae	*Cunninghamia*	Unknown	Vietnam	(Smith *et al.*, 2019)
Fabaceae	*Callerya*	Unknown	Unknown	(Smith *et al.*, 2019)
Fabaceae	*Millettia brandisiana*	Unknown	Italy	(Schuler *et al.*, 2023)
Fabaceae	*Samanea saman*	Unknown	USA: Hawaii	(Rugman-Jones *et al.*, 2020)
Fabaceae	*Wisteria* sp.	Unknown	China	(Coleman *et al.*, 2019)
Lamiaceae	*Tectona grandis*	Unknown	Germany	(Schuler *et al.*, 2023)
Magnoliaceae	*Magnolia champaca*	Unknown	Italy, USA: California	(Eskalen *et al.*, 2013); (Schuler *et al.*, 2023)
Magnoliaceae	*Magnolia fordiana* (as *Manglietia*)	Unknown	China	(Wang *et al.*, 2022)
Malvaceae	*Hibiscus* sp.	Unknown	USA: Hawaii	(Rugman-Jones *et al.*, 2020)
Malvaceae	*Ochroma pyramidale* (as *O. lagopus*)	Unknown	Samoa	(Smith *et al.*, 2019)
Meliaceae	*Khaya grandifolia*	Unknown	Brazil	(Ceriani-Nakamurakare *et al.*, 2025)
Moraceae	*Ficus lyrata*	Unknown	Netherlands	(Schuler *et al.*, 2023)
Moraceae	*Ficus maclellandii*	Unknown	Netherlands	(Schuler *et al.*, 2023)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Moraceae	*Ficus* sp. (includes records as "*Ficus foliole*" but this is a cultivar not a species)	Unknown	Italy, Germany, Netherlands	(Schuler *et al.*, 2023)
Moraceae	*Milicia excelsa*	Unknown	Samoa	(Smith *et al.*, 2019)
Oleaceae	*Fraxinus* spp.	Unknown	Argentina	(Ceriani-Nakamurakare *et al.*, 2023)
Oleaceae	*Ligustrum lucidum*	Unknown	China	(Wang *et al.*, 2022)
Oxalidaceae	*Averrhoa carambola*	Unknown	Italy	(Schuler *et al.*, 2023)
Rutaceae	*Clausena lansium*	Unknown	Italy	(Schuler *et al.*, 2023)
Sapindaceae	*Dimocarpus longan*	Unknown	Italy	(Schuler *et al.*, 2023)
Sapindaceae	*Melicoccus bijugatus*	Unknown	Italy	(Schuler *et al.*, 2023)
Sapotaceae	*Planchonella sandwicensis*	Unknown	USA: Hawaii	(Rugman-Jones *et al.*, 2020)
Urticaceae	*Oreocnide frutescens* subsp. *frutescens* (as *Debregeasia edulis*)	Unknown	Italy	(Schuler *et al.*, 2023)
Zygophyllacea	*Bulnesia arborea*	Unknown	Italy	(Schuler *et al.*, 2023)
Malvaceae	*Ceiba speciosa*	Yes	Israel, South Africa, USA: California, Urugauy	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2017); (FABI, 2024); (Ceriani-Nakamurakare *et al.*, 2025)
Achariaceae	*Xylotheca kraussiana*	No	South Africa	(FABI, 2024)
Adoxaceae	*Viburnum lantana* (as *Lantana viburnum* which is not a valid name)	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Alangiaceae	*Alangium chinense*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Altingiaceae	*Liquidambar formosana*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Anacardiaceae	*Pistacia atlantica*	No	Israel	(Mendel *et al.*, 2017); (Mendel *et al.*, 2021)
Anacardiaceae	*Pistacia chinensis*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Anacardiaceae	*Pistacia terebinthus* (as *P. palestina*)	No	Israel	(Mendel *et al.*, 2021)
Anacardiaceae	*Schinus molle*	No	South Africa, USA: California	(Coleman *et al.*, 2019); (van Rooyen *et al.*, 2021)
Anacardiaceae	*Schinus terebinthifolia*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Anacardiaceae	*Sclerocarya birrea*	No	South Africa	(FABI, 2024)
Anacardiaceae	*Searsia chirindensis*	No	South Africa	(van Rooyen *et al.*, 2021)
Anacardiaceae	*Searsia lancea*	No	South Africa	(van Rooyen *et al.*, 2021)
Anacardiaceae	*Searsia lucida*	No	South Africa	(Townsend *et al.*, 2024)
Annonaceae	*Annona reticulata*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Annonaceae	*Monoon longifolium*	No	South Africa	(FABI, 2024)
Apiaceae	*Heteromorpha arborescens*	No	South Africa	(Bierman *et al.*, 2022)
Apocynaceae	*Cascabela thevetioides* (as *Thevetia*)	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Aquifoliaceae	*Ilex aquifolium*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Aquifoliaceae	*Ilex latifolia*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Aquifoliaceae	*Ilex mitis*	No	South Africa	(van Rooyen *et al.*, 2021)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Araliaceae	*Fatsia japonica*	No	Australia, USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Araliaceae	*Tetrapanax papyrifer*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Araucariaceae	*Araucaria columnaris*	No	Uruguay	(Ceriani-Nakamurakare *et al.*, 2025)
Arecaceae	*Brahea armata*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Arecaceae	*Butia capitata*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Arecaceae	*Chamaedorea elegans*	No	USA: California	(Mendel *et al.*, 2021)
Arecaceae	*Livistona chinensis*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Arecaceae	*Roystonea regia*	No	Israel	(Mendel *et al.*, 2017)
Arecaceae	*Washingtonia filifera*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Asparagaceae	*Cordyline stricta*	No	Australia, South Africa	(van Rooyen *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Asparagaceae	*Dracaena draco*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Asparagaceae	*Dracaena* sp.	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Asteraceae	*Neomirandea* sp.	No	USA: California	(Mendel *et al.*, 2021)
Asteraceae	*Osteospermum moniliferum*	No	South Africa	(van Rooyen *et al.*, 2021)
Asteraceae	*Verbesina gigantea*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Betulaceae	*Alnus cordata*	No	Israel	(Mendel *et al.*, 2017)
Betulaceae	*Alnus glutinosa*	No	Israel	(Mendel *et al.*, 2021)
Betulaceae	*Alnus incana*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Betulaceae	*Betula pendula*	No	South Africa, USA: California	(Eskalen *et al.*, 2013); (van Rooyen *et al.*, 2021)
Betulaceae	*Corylus colurna*	No	Israel, USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2017)
Bignoniaceae	*Catalpa speciosa*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Bignoniaceae	*Handroanthus impetiginosus*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Bignoniaceae	*Jacaranda cuspidifolia*	No	USA: California	(Mendel *et al.*, 2021)
Bignoniaceae	*Kigelia africana*	No	Australia, Italy	(Schuler *et al.*, 2023); (Department of Primary Industries and Regional Development, 2023)
Bignoniaceae	*Tecoma stans*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Bignoniaceae	*Tecomaria capensis* (as *Tecoma*)	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Boraginaceae	*Cordia caffra*	No	South Africa	(van Rooyen *et al.*, 2021)
Boraginaceae	*Cordia myxa*	No	South Africa	(FABI, 2024)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Boraginaceae	*Ehretia latifolia*	No	USA: California	(Mendel *et al.*, 2021)
Boraginaceae	*Wigandia urens*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Burseraceae	*Bursera hindsiana*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Burseraceae	*Commiphora harveyi*	No	South Africa	(van Rooyen *et al.*, 2021)
Cannabaceae	*Celtis africana*	No	South Africa	(van Rooyen *et al.*, 2021)
Cannabaceae	*Celtis bungeana*	No	USA: California	(Mendel *et al.*, 2021)
Cannabaceae	*Celtis laevigata*	No	USA: California	(Mendel *et al.*, 2021)
Cannabaceae	*Celtis sinensis*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Cannabaceae	*Celtis tala*	No	Uruguay	(Ceriani-Nakamurakare *et al.*, 2025)
Cannabaceae	*Chaetachme aristata*	No	South Africa	(FABI, 2024)
Casuarinaceae	*Allocasuarina decussata*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Casuarinaceae	*Casuarina equisetifolia*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Combretaceae	*Terminalia mantaly*	No	Israel	(Mendel *et al.*, 2021)
Cornaceae	*Cornus controversa*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Cornaceae	*Cornus drummondii*	No	Israel	(Mendel *et al.*, 2021)
Cornaceae	*Cornus florida*	No	USA: California	(Mendel *et al.*, 2021)
Cornaceae	*Davidia involucrata*	No	USA: California	(Mendel *et al.*, 2021)
Cunoniaceae	*Cunonia capensis*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Cupressaceae	*Juniperus chinensis*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Cupressaceae	*Juniperus virginiana*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Cupressaceae	*Metasequoia glyptostroboides*	No	South Africa, USA: California	(Eskalen *et al.*, 2013); (van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021)
Cupressaceae	*Taxodium distichum*	No	Israel, South Africa	(Mendel *et al.*, 2017); (van Rooyen *et al.*, 2021)
Cupressaceae	*Widdringtonia nodiflora*	No	South Africa	(Bierman *et al.*, 2022)
Ebenaceae	*Diospyros kaki*	No	Israel, South Africa, USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2017); (van Rooyen *et al.*, 2021)
Ebenaceae	*Diospyros lycioides*	No	South Africa, USA: California	(Eskalen *et al.*, 2013); (van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021)
Elaeocarpaceae	*Crinodendron patagua*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Elaeocarpaceae	*Elaeocarpus decipiens*	No	USA: California	(Mendel *et al.*, 2021)
Elaeocarpaceae	*Elaeocarpus* sp.	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Ericaceae	*Arbutus unedo*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Euphorbiaceae	*Aleurites moluccanus*	No	Australia	(Department of Primary Industries and Regional Development, 2023)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Euphorbiaceae	*Euphorbia tirucalli*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Euphorbiaceae	*Jatropha cinerea*	No	USA: California	(Mendel *et al.*, 2021)
Euphorbiaceae	*Jatropha mcvaughii*	No	USA: California	(Mendel *et al.*, 2021)
Euphorbiaceae	*Manihot esculenta*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Euphorbiaceae	*Vernicia fordii* (as *Aleurites*)	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Fabaceae	*Acacia floribunda*	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Acacia retinodes*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Fabaceae	*Acacia saligna*	No	Australia, South Africa, USA: California	(Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023); (FABI, 2024)
Fabaceae	*Acacia victoriae*	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Albizia adianthifolia*	No	South Africa	(van Rooyen *et al.*, 2021); (Bierman *et al.*, 2022)
Fabaceae	*Albizia kalkora*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Fabaceae	*Bauhinia* × *blakeana*	No	Netherlands, USA: California	(Eskalen *et al.*, 2013); (Schuler *et al.*, 2023)
Fabaceae	*Bauhinia petersiana*	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Bauhinia purpurea*	No	South Africa	(van Rooyen *et al.*, 2021)
Fabaceae	*Calliandra surinamensis*	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Cassia brewsteri*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Fabaceae	*Cassia leptophylla*	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Cercis canadensis*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Fabaceae	*Cercis chinensis*	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Cercis siliquastrum*	No	Israel	(Mendel *et al.*, 2021)
Fabaceae	*Cladrastis delavayi* (as *Cladrastris sinensis*)	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Fabaceae	*Dahlstedtia pinnata*	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Dalbergia sissoo*	No	Israel	(Mendel *et al.*, 2017)
Fabaceae	*Desmodium elegans*	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Ebenopsis ebano*	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Enterolobium contortisiliquum*	No	Israel	(Mendel *et al.*, 2021)
Fabaceae	*Erythrina* × *bidwillii*	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Erythrina chiriquensis*	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Erythrina crista-galli*	No	Australia, USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Fabaceae	*Erythrina flabelliformis*	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Erythrina folkersii*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Fabaceae	*Erythrina humeana*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Fabaceae	*Erythrina livingstoniana*	No	South Africa	(van Rooyen *et al.*, 2021)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Fabaceae	*Erythrina macrophylla*	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Erythrina variegata* (as *E. orientalis*)	No	Australia, Samoa	(Smith *et al.*, 2019); (Department of Primary Industries and Regional Development, 2023)
Fabaceae	*Erythrostemon mexicanus* (as *Caesalpinia mexicana*)	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Gleditsia japonica*	No	Israel, USA: California	(Mendel *et al.*, 2017); (Mendel *et al.*, 2021)
Fabaceae	*Inga feuillei*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Fabaceae	*Inga insignis*	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Inga uraguensis*	No	Argentina	(Ceriani-Nakamurakare *et al.*, 2023)
Fabaceae	*Inga vera*	No	Argentina, Israel	(Mendel *et al.*, 2017); (Ceriani-Nakamurakare *et al.*, 2023)
Fabaceae	*Lonchocarpus nitidus*	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Lysiphyllum carronii*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Fabaceae	*Mezoneuron kauaiense* (as *Caesalpinia kauaiensis*)	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Olneya tesota*	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Pararchidendron pruinosum*	No	Australia, USA: California	(Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Fabaceae	*Parasenegalia visco* (as *Acacia*)	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Fabaceae	*Peltophorum africanum*	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Pithecellobium* sp.	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Fabaceae	*Prosopis glandulosa*	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Schotia brachypetala*	No	Australia, South Africa, USA: California	(Eskalen *et al.*, 2013); (van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Fabaceae	*Senegalia burkei*	No	South Africa	(van Rooyen *et al.*, 2021)
Fabaceae	*Senegalia caffra* (as *Acacia*)	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Senegalia galpinii*	No	South Africa	(van Rooyen *et al.*, 2021)
Fabaceae	*Senna candolleana*	No	USA: California	(Eskalen *et al.*, 2013)
Fabaceae	*Senna floribunda*	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	Senna japonica (not a valid name and correct species could not be determined)	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Senna racemosa*	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Senna racemosa* var. *liebmanni*	No	USA: California	(Eskalen *et al.*, 2013)
Fabaceae	*Senna spectabilis* var. *spectabilis*	No	USA: California	(Eskalen *et al.*, 2013)
Fabaceae	*Styphnolobium japonicum*	No	Australia, USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Fabaceae	*Tamarindus indica*	No	Israel	(Mendel *et al.*, 2017)
Fabaceae	*Tara cacalaco* (as *Caesalpinia cacalaco*)	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Templetonia retusa*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Fabaceae	*Tipuana tipu*	No	Argentina, Australia, USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023); (Ceriani-Nakamurakare *et al.*, 2023)
Fabaceae	*Vachellia caven* (as *Acacia*)	No	USA: California	(Eskalen *et al.*, 2013)
Fabaceae	*Vachellia cochliacantha* (as *Acacia*)	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Vachellia farnesiana* (as *Acacia*)	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Vachellia karroo*	No	South Africa	(van Rooyen *et al.*, 2021)
Fabaceae	*Vachellia tortuosa* (most likely match for *Acacia albida*)	No	USA: California	(Mendel *et al.*, 2021)
Fabaceae	*Virgilia divaricata*	No	South Africa	(van Rooyen *et al.*, 2021)
Fabaceae	*Zenia insignis*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Fagaceae	*Fagus sylvatica*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Fagaceae	*Quercus* × *rosacea*	No	USA: California	(Mendel *et al.*, 2021)
Fagaceae	*Quercus* × *turneri*	No	USA: California	(Mendel *et al.*, 2021)
Fagaceae	*Quercus acutissima*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Fagaceae	*Quercus alba*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Fagaceae	*Quercus brantii*	No	Israel	(Mendel *et al.*, 2021)
Fagaceae	*Quercus castaneifolia*	No	USA: California	(Mendel *et al.*, 2021)
Fagaceae	*Quercus chihuahuensis*	No	USA: California	(Mendel *et al.*, 2021)
Fagaceae	*Quercus dentata* subsp. *yunnanensis*	No	USA: California	(Mendel *et al.*, 2021)
Fagaceae	*Quercus hartwissiana*	No	Israel	(Mendel *et al.*, 2017); (Mendel *et al.*, 2021)
Fagaceae	*Quercus ilex*	No	USA: California	(Eskalen *et al.*, 2013); (Coleman *et al.*, 2019); (Mendel *et al.*, 2021)
Fagaceae	*Quercus look*	No	Israel	(Mendel *et al.*, 2021)
Fagaceae	*Quercus macrocarpa*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Fagaceae	*Quercus mexicana*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Fagaceae	*Quercus myrsinifolia*	No	USA: California	(Mendel *et al.*, 2021)
Fagaceae	*Quercus nigra*	No	South Africa	(FABI, 2024)
Fagaceae	*Quercus pontica*	No	Israel	(Mendel *et al.*, 2017)
Fagaceae	*Quercus rubra*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Fagaceae	*Quercus rugosa*	No	South Africa	(van Rooyen *et al.*, 2021)
Juglandaceae	*Juglans californica*	No	USA: California	(Coleman *et al.*, 2019); (Mendel *et al.*, 2021)
Juglandaceae	*Juglans mandshurica*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Juglandaceae	*Juglans nigra*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Juglandaceae	*Juglans regia*	No	Israel	(Mendel *et al.*, 2017)
Lamicaeae	*Leonotis leonurus*	No	South Africa	(van Rooyen *et al.*, 2021)
Lauraceae	*Beilschmiedia miersii*	No	USA: California	(Mendel *et al.*, 2021)
Lauraceae	*Cinnamomum camphora*	No	South Africa, USA: California	(Eskalen *et al.*, 2013); (van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021)
Lauraceae	*Cinnamomum glanduliferum*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Lauraceae	*Cinnamomum tenuifolium* (as *C. japonicum*)	No	USA: California	(Mendel *et al.*, 2021)
Lauraceae	*Machilus thunbergii*	No	USA: California	(Eskalen *et al.*, 2013)
Lauraceae	*Machilus thunbergii* (as *Persea thunbergia*)	No	USA: California	(Mendel *et al.*, 2021)
Lauraceae	*Neolitsea sericea*	No	USA: California	(Mendel *et al.*, 2021)
Lauraceae	*Phoebe cavaleriei* (as *Nothaphoebe*)	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Lauraceae	*Umbellularia californica*	No	USA: California	(Eskalen *et al.*, 2013); (Coleman *et al.*, 2019); (Mendel *et al.*, 2021)
Magnoliaceae	*Liriodendron tulipifera*	No	USA: California	(Mendel *et al.*, 2021)
Magnoliaceae	*Magnolia × denudata*	No	USA: California	(Mendel *et al.*, 2021)
Magnoliaceae	*Magnolia × loebneri*	No	USA: California	(Mendel *et al.*, 2021)
Magnoliaceae	*Magnolia × soulangeana*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Magnoliaceae	*Magnolia × veitchii*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Magnoliaceae	*Magnolia campbellii*	No	USA: California	(Mendel *et al.*, 2021)
Magnoliaceae	*Magnolia compressa*	No	USA: California	(Mendel *et al.*, 2021)
Magnoliaceae	*Magnolia cylindrica*	No	USA: California	(Mendel *et al.*, 2021)
Magnoliaceae	*Magnolia delavayi*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Magnoliaceae	*Magnolia denudata*	No	USA: California	(Mendel *et al.*, 2021)
Magnoliaceae	*Magnolia doltsopa*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Magnoliaceae	*Magnolia figo*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Magnoliaceae	*Magnolia foveolata*	No	USA: California	(Mendel *et al.*, 2021)
Magnoliaceae	*Magnolia grandis*	No	USA: California	(Mendel *et al.*, 2021)
Magnoliaceae	*Magnolia guatemalensis*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Magnoliaceae	*Magnolia hodgsonii*	No	USA: California	(Mendel *et al.*, 2021)
Magnoliaceae	*Magnolia liliiflora*	No	USA: California	(Mendel *et al.*, 2021)
Magnoliaceae	*Magnolia pacifica*	No	USA: California	(Mendel *et al.*, 2021)
Magnoliaceae	*Magnolia sargentiana*	No	USA: California	(Mendel *et al.*, 2021)
Magnoliaceae	*Magnolia sharpii*	No	USA: California	(Mendel *et al.*, 2021)
Magnoliaceae	*Magnolia sprengeri*	No	USA: California	(Mendel *et al.*, 2021)
Magnoliaceae	*Magnolia tamaulipana*	No	USA: California	(Mendel *et al.*, 2021)
Magnoliaceae	*Magnolia yunnanensis*	No	USA: California	(Mendel *et al.*, 2021)
Malphighiaceae	*Bunchosia armeniaca*	No	USA: California	(Mendel *et al.*, 2021)
Malpighiaceae	*Heteropterys purpurea*	No	USA: California	(Mendel *et al.*, 2021)
Malvaceae	*Adansonia digitata*	No	South Africa	(van Rooyen *et al.*, 2021)
Malvaceae	*Brachychiton australis*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Malvaceae	*Brachychiton bidwillii*	No	USA: California	(Mendel *et al.*, 2021)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Malvaceae	*Brachychiton diversifolius*	No	USA: California	(Mendel *et al.*, 2021)
Malvaceae	*Brachychiton rupestris*	No	Israel, USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2017)
Malvaceae	*Ceiba pentandra*	No	South Africa	(van Rooyen *et al.*, 2021)
Malvaceae	*Chiranthodendron pentadactylon*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Malvaceae	*Cola natalensis*	No	South Africa	(FABI, 2024)
Malvaceae	*Dombeya acutangula*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Malvaceae	*Dombeya rotundifolia*	No	South Africa	(van Rooyen *et al.*, 2021)
Malvaceae	*Firmiana simplex*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Malvaceae	*Heliocarpus donnellsmithii*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Malvaceae	*Hibiscus martianus*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Malvaceae	*Lagunaria patersonia*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Malvaceae	*Leucaena leucocephala*	No	Israel	(Mendel *et al.*, 2021)
Malvaceae	*Pseudobombax ellipticum*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Malvaceae	*Quararibea funebris*	No	USA: California	(Mendel *et al.*, 2021)
Malvaceae	*Robinsonella discolor*	No	USA: California	(Mendel *et al.*, 2021)
Malvaceae	*Sterculia quadrifida*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Meliaceae	*Aglaia odorata*	No	USA: California	(Mendel *et al.*, 2021)
Meliaceae	*Chukrasia tabularis* (as *Swietenia chickrassa*)	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Meliaceae	*Ekebergia capensis*	No	South Africa	(van Rooyen *et al.*, 2021)
Meliaceae	*Melia azedarach*	No	South Africa, USA: California	(Eskalen *et al.*, 2013); (van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021)
Meliaceae	*Trichilia glabra*	No	Uruguay	(Ceriani-Nakamurakare *et al.*, 2025)
Melianthaceae	*Melianthus major*	No	South Africa, USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021); (FABI, 2024)
Menispermaceae	*Cocculus orbiculatus*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Monimiaceae	*Peumus boldus*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Moraceae	*Broussonetia papyrifera*	No	USA: California	(Eskalen *et al.*, 2013) ; (Mendel *et al.*, 2021)
Moraceae	*Ficus benghalensis*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Moraceae	*Ficus maxima*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Moraceae	*Ficus obliqua*	No	Israel	(Mendel *et al.*, 2021)
Moraceae	*Ficus platypoda*	No	USA: California	(Eskalen *et al.*, 2013)
Moraceae	*Ficus racemosa*	No	Australia	(Department of Primary Industries and Regional Development, 2023)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Moraceae	*Ficus sur*	No	South Africa	(van Rooyen *et al.*, 2021)
Moraceae	*Morus rubra*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Moringaceae	*Moringa* sp.	No	Israel	(Mendel *et al.*, 2017)
Myrtaceae	*Agonis flexuosa*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Myrtaceae	*Blepharocalyx salicifolius*	No	Uruguay	(Ceriani-Nakamurakare *et al.*, 2025)
Myrtaceae	*Eucalyptus camaldulensis*	No	Australia, South Africa, USA: California	(Eskalen *et al.*, 2013); (van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Myrtaceae	*Eucalyptus cinerea*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Myrtaceae	*Eucalyptus froggattii*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Myrtaceae	*Eucalyptus gomphocephala*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Myrtaceae	*Eucalyptus kitsoniana*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Myrtaceae	*Eucalyptus perriniana*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Myrtaceae	*Eucalyptus polyanthemos*	No	Australia, USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Myrtaceae	*Eucalyptus torquata*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Myrtaceae	*Feijoa sellowiana*	No	Uruguay	(Ceriani-Nakamurakare *et al.*, 2025)
Myrtaceae	*Melaleuca lophantha* (as *Callistemon salignus*)	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Myrtaceae	*Syzygium cordatum*	No	South Africa	(van Rooyen *et al.*, 2021)
Myrtaceae	*Syzygium cumini*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Nyctaginaceae	*Bougainvillea* sp.	No	Australia, South Africa	(van Rooyen *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Nyssaceae	*Camptotheca acuminata*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Oleaceae	*Chionanthus retusus*	No	USA: California	(Eskalen *et al.*, 2013)
Oleaceae	*Fraxinus americana*	No	South Africa	(van Rooyen *et al.*, 2021)
Oleaceae	*Fraxinus angustifolia* subsp. *oxycarpa*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Oleaceae	*Fraxinus griffithii*	No	Australia, USA: California	(Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Oleaceae	*Fraxinus uhdei*	No	Israel?, USA: California	(Eskalen *et al.*, 2013); (Coleman *et al.*, 2019); (Mendel *et al.*, 2021)
Oleaceae	*Fraxinus velutina*	No	USA: California	(Eskalen *et al.*, 2013); (Coleman *et al.*, 2019)
Oleaceae	*Ligustrum ovalifolium*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Oleaceae	*Ligustrum sinense*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Oleaceae	*Ligustrum vulgare*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Oleaceae	*Olea europaea*	No	Israel, South Africa, USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2017); (van Rooyen *et al.*, 2021)
Oleaceae	*Olea europaea* subsp. *europaea*	No	Australia, South Africa	(Department of Primary Industries and Regional Development, 2023); (FABI, 2024)
Oleaceae	*Osmanthus fragrans*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Onagraceae	*Hauya elegans* subsp. *cornuta*	No	USA: California	(Mendel *et al.*, 2021)
Onagraceae	*Hauya elegans* subsp. *cornuta* (as *H. microcerata*)	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Papaveraceae	*Bocconia arborea*	No	USA: California	(Mendel *et al.*, 2021)
Paulowniaceae	*Paulownia tomentosa*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Penaeaceae	*Olinia ventosa*	No	South Africa	(van Rooyen *et al.*, 2021)
Phyllanthaceae	*Bischofia javanica*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Pinaceae	*Cedrus atlantica*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Pinaceae	*Keteleeria delavayi* (not a valid name, possibly *Keteleeria evelyniana*)	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Pinaceae	*Pinus*	No	South Africa	(Bierman *et al.*, 2022)
Pinaceae	*Pinus densiflora*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Pinaceae	*Pinus douglasiana*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Pittosporaceae	*Hymenosporum flavum*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Pittosporaceae	*Pittosporum undulatum*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Platanaceae	*Platanus wrightii*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Poaceae	*Bambusa* sp.	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Podocarpaceae	*Afrocarpus gracilior*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Podocarpaceae	*Podocarpus henkelii*	No	South Africa	(van Rooyen *et al.*, 2021)
Primulaceae	*Myrsine melanophloeos* (as *Rapanea melanophloeos*)	No	South Africa	(van Rooyen *et al.*, 2021)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Proteacea	*Hakea multilineata*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Proteacea	*Hakea prostrata*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Proteacea	*Hakea salicifolia*	No	South Africa	(van Rooyen *et al.*, 2021)
Proteaceae	*Banksia grandis*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Proteaceae	*Banksia integrifolia*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Proteaceae	*Banksia menziesii*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Proteaceae	*Banksia saxicola*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Proteaceae	*Grevillea banksii*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Proteaceae	*Grevillea olivacea*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Proteaceae	*Lambertia orbifolia*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Proteaceae	*Macadamia*	No	South Africa	(van Rooyen *et al.*, 2021)
Proteaceae	*Protea mundii*	No	South Africa	(van Rooyen *et al.*, 2021)
Proteaceae	*Stenocarpus sinuatus*	No	Australia, South Africa	(Department of Primary Industries and Regional Development, 2023); (FABI, 2024)
Rhamnaceae	*Ceanothus caeruleus*	No	USA: California	(Mendel *et al.*, 2021)
Rhamnaceae	*Colletia paradoxa*	No	USA: California	(Mendel *et al.*, 2021)
Rhamnaceae	*Frangula californica* (as *Rhamnus*)	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Rhamnaceae	*Hovenia dulcis*	No	Israel	(Mendel *et al.*, 2017)
Rhamnaceae	*Rhamnus alaternus*	No	Israel	(Mendel *et al.*, 2017)
Rhamnaceae	*Scutia myrtina*	No	South Africa	(Townsend *et al.*, 2024)
Rhamnaceae	*Ziziphus jujuba*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Rhamnaceae	*Zizyphus spina-cristi*	No	Israel, USA: California	(Mendel *et al.*, 2021)
Rosaceae	*Crataegus pubescens*	No	USA: California	(Mendel *et al.*, 2021)
Rosaceae	*Malus* × *floribunda*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Rosaceae	*Malus* sp. (“crab apple”)	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Rosaceae	*Prunus africana*	No	South Africa	(van Rooyen *et al.*, 2021)
Rosaceae	*Prunus avium*	No	South Africa	(van Rooyen *et al.*, 2021)
Rosaceae	*Prunus caroliniana*	No	Australia, USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Rosaceae	*Prunus cerasoides*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Rosaceae	*Prunus ilicifolia var. occidentalis* (as *P. ilicifolia* subsp. *lyonia*)	No	USA: California	(Mendel *et al.*, 2021)
Rosaceae	*Prunus mexicana*	No	USA: California	(Mendel *et al.*, 2021)
Rosaceae	*Prunus mume*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Rosaceae	*Prunus serrulata*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Rosaceae	*Pseudocydonia sinensis* (as *Chaenomeles sinensis*)	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Rosaceae	*Rosa* sp. 'Restless'	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Rubiaceae	*Burchellia bubalina*	No	South Africa	(Townsend *et al.*, 2024)
Rubiaceae	*Canthium inerme*	No	South Africa	(Townsend *et al.*, 2024)
Rutaceae	*Citrus* × *limon*	No	Australia, South Africa	(van Rooyen *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Rutaceae	*Geijera parviflora*	No	USA: California	(Mendel *et al.*, 2021)
Rutaceae	*Phellodendron amurense*	No	USA: California	(Mendel *et al.*, 2021)
Salicaceae	*Oncoba spinosa*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Salicaceae	*Populus brandegeei*	No	USA: California	(Mendel *et al.*, 2021)
Salicaceae	*Salix acmophylla*	No	Israel	(Mendel *et al.*, 2021)
Salicaceae	*Salix eastwoodiae*	No	Israel	(Mendel *et al.*, 2017)
Salicaceae	*Salix exigua*	No	USA: California	(Mendel *et al.*, 2021)
Sapindaceae	*Acer campestre*	No	Israel	(Mendel *et al.*, 2017)
Sapindaceae	*Acer caudatifolium*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Sapindaceae	*Acer davidii*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Sapindaceae	*Acer mono*	No	USA: California	(Mendel *et al.*, 2021)
Sapindaceae	*Acer pectinatum* subsp. *laxiflorum*	No	USA: California	(Mendel *et al.*, 2021)
Sapindaceae	*Allophylus decipiens*	No	South Africa	(FABI, 2024)
Sapindaceae	*Diploglottis australis* (as *D. cunninghamii*)	No	USA: California	(Mendel *et al.*, 2021)
Sapindaceae	*Harpullia arborea*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Sapindaceae	*Koelreuteria elegans*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Sapindaceae	*Koelreuteria elegans* subsp. *formosana*	No	USA: California	(Eskalen *et al.*, 2013)
Sapindaceae	*Ungnadia speciosa*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Scrophulariaceae	*Buddleja saligna*	No	South Africa	(van Rooyen *et al.*, 2021)
Solanaceae	*Brugmansia* × *candida*	No	Uruguay	(Ceriani-Nakamurakare *et al.*, 2025)
Stilbaceae	*Nuxia floribunda*	No	South Africa, USA: California	(Eskalen *et al.*, 2013); (van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021)

Euwallacea fornicatus sensu stricto host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Strelitziaceae	*Strelitzia nicolai*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Theaceae	*Camellia* × *williamsii*	No	USA: California	(Mendel *et al.*, 2021)
Theaceae	*Camellia chrysanthoides*	No	USA: California	(Mendel *et al.*, 2021)
Theaceae	*Camellia drupifera*	No	USA: California	(Mendel *et al.*, 2021)
Theaceae	*Camellia grijsii*	No	USA: California	(Mendel *et al.*, 2021)
Theaceae	*Camellia hiemalis*	No	USA: California	(Mendel *et al.*, 2021)
Theaceae	*Camellia indochinensis*	No	USA: California	(Mendel *et al.*, 2021)
Theaceae	*Camellia japonica*	No	Australia, South Africa, USA: California	(Eskalen *et al.*, 2013); (van Rooyen *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Theaceae	*Camellia oleifera*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Theaceae	*Camellia reticulata*	No	USA: California	(Eskalen *et al.*, 2013)
Theaceae	*Camellia rosiflora*	No	USA: California	(Mendel *et al.*, 2021)
Theaceae	*Camellia saluenensis* (as *C. aluenensis*)	No	USA: California	(Mendel *et al.*, 2021)
Theaceae	*Cleyera japonica*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Tiliaceae	*Luehea divaricata*	No	USA: California	(Eskalen *et al.*, 2013)
Tiliaceae	*Tilia americana* (as *T. caroliniana*)	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Ulmaceae	*Ulmus alata*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Ulmaceae	*Ulmus americana*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Ulmaceae	*Ulmus davidiana* var. *japonica*	No	USA: California	(Mendel *et al.*, 2021)
Ulmaceae	*Ulmus minor* (as *U. procera*)	No	Australia, South Africa	(van Rooyen *et al.*, 2021); (Department of Primary Industries and Regional Development, 2023)
Ulmaceae	*Ulmus pumila*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Ulmaceae	*Zelkova carpinifolia*	No	Israel	(Mendel *et al.*, 2017)
Urticaceae	*Pipturus argenteus*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Verbenaceae	*Aloysia virgata*	No	USA: California	(Eskalen *et al.*, 2013); (Mendel *et al.*, 2021)
Verbenaceae	*Citharexylum montevidense* (as *C. barbinerve*)	No	USA: California	(Mendel *et al.*, 2021)
Verbenaceae	*Citharexylum spinosum*	No	Australia	(Department of Primary Industries and Regional Development, 2023)
Vitaceae	*Vitis vinifera*	No	South Africa, USA: California	(Eskalen *et al.*, 2013); (van Rooyen *et al.*, 2021); (Mendel *et al.*, 2021)

When reporting the host lists provided by Eskalen *et al.* (2013), this work was done before the current species concepts had been proposed. However, the GenBank accession

number JX912724 cited in Eskalen *et al.* (2013) (as part of a range) is reported as *E. fornicatus s.s.* in the supplementary information provided by Wang *et al.* (2022). Additionally, Cooperband *et al.* (2016) state that the species of *Euwallacea* in the region of California the Eskalen *et al.* (2013) work was based on were genetically identical to the species in Israel, which is *E. fornicatus.*

Eskalen *et al.* (2013), Mendel *et al.* (2017) and Mendel *et al.* (2021) appear to be creating lists based from the same source database which is regularly updated. Therefore, these sources should probably not be treated as independent.

Euwallacea kuroshio

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Asteraceae	*Baccharis salicifolia*	Yes	USA: California	(Boland, 2016); (University of California, 2022)
Casuarinaceae	*Casuarina cunninghamiana*	Yes	Mexico	(Equihua Martínez *et al.*, 2016)
Fabaceae	*Erythrina humeana*	Yes	USA: California	(Eskalen, 2015)
Fagaceae	*Quercus agrifolia*	Yes	USA: California	(Eskalen, 2015); (Coleman *et al.*, 2019)
Fagaceae	*Quercus suber*	Yes	USA: California	(Eskalen, 2015)
Lauraceae	*Persea americana*	Yes	USA: California	(Eskalen, 2015)
Platanaceae	*Platanus racemosa*	Yes	USA: California	(Eskalen, 2015); (Boland, 2016); (Coleman *et al.*, 2019)
Salicaceae	*Salix goodingii*	Yes	Mexico, USA: California	(Boland, 2016); (Coleman *et al.*, 2019); (Boland & Woodward, 2021)
Salicaceae	*Salix lasiolepis*	Yes	USA: California	(Boland, 2016); (Boland & Woodward, 2019); (Coleman *et al.*, 2019)
Sapindaceae	*Acer macrophyllum*	Yes	USA: California	(Eskalen, 2015)
Tamaricaceae	*Tamarix ramosissima*	Yes	USA: California	(Boland, 2016); (University of California, 2022)
Altingiaceae	*Liquidambar*	Unknown	Unknown	(Smith *et al.*, 2019)
Anacardiaceae	*Schinus*	Unknown	Unknown	(Smith *et al.*, 2019)
Anacardiaceae	*Schinus terebinthifolia*	Unknown	USA: California	(Boland, 2016)
Anacardiaceae	*Searsia*	Unknown	Unknown	(Smith *et al.*, 2019)
Asteraceae	*Ambrosia*	Unknown	Unknown	(Smith *et al.*, 2019)
Asteraceae	*Ambrosia monogyra*	Unknown	USA: California	(Boland, 2016)
Asteraceae	*Baccharis*	Unknown	Unknown	(Smith *et al.*, 2019)
Asteraceae	*Baccharis pilularis*	Unknown	USA: California	(Boland, 2016)
Betulaceae	*Alnus*	Unknown	Unknown	(Smith *et al.*, 2019)
Betulaceae	*Alnus rhombifolia*	Unknown	USA: California	(Coleman *et al.*, 2019)
Euphorbiaceae	*Ricinus*	Unknown	Unknown	(Smith *et al.*, 2019)
Euphorbiaceae	*Ricinus communis*	Unknown	USA: California	(Boland, 2016); (Coleman *et al.*, 2019)
Fabaceae	*Cassia*	Unknown	Unknown	(Smith *et al.*, 2019)
Fabaceae	*Cassia leptophylla*	Unknown	USA: California	(Coleman *et al.*, 2019)
Fagaceae	*Quercus*	Unknown	Unknown	(Smith *et al.*, 2019)
Juglandaceae	*Juglans*	Unknown	Unknown	(Smith *et al.*, 2019)
Juglandaceae	*Juglans californica*	Unknown	USA: California	(Coleman *et al.*, 2019)
Juglandaceae	*Pterocarya*	Unknown	Unknown	(Smith *et al.*, 2019)
Lauraceae	*Persea*	Unknown	Unknown	(Smith *et al.*, 2019)
Magnoliaceae	*Magnolia*	Unknown	Unknown	(Smith *et al.*, 2019)
Magnoliaceae	*Magnolia grandiflora*	Unknown	USA: California	(Coleman *et al.*, 2019)
Moraceae	*Ficus*	Unknown	Unknown	(Smith *et al.*, 2019)
Myrtaceae	*Eucalyptus* spp.	Unknown	USA: California	(Boland, 2016); (Smith *et al.*, 2019)
Oleaceae	*Fraxinus*	Unknown	Unknown	(Smith *et al.*, 2019)
Platanaceae	*Platanus*	Unknown	Unknown	(Smith *et al.*, 2019)
Platanaceae	*Platanus* × *hispanica* (as *Platanus* × *acerifolia*)	Unknown	USA: California	(Coleman *et al.*, 2019)
Salicaceae	*Populus*	Unknown	Unknown	(Smith *et al.*, 2019)
Salicaceae	*Populus fremontii*	Unknown	USA: California	(Boland, 2016); (Coleman *et al.*, 2019)
Salicaceae	*Salix*	Unknown	Unknown	(Smith *et al.*, 2019)

Euwallacea kuroshio host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Salicaceae	*Salix exigua*	Unknown	USA: California	(Boland, 2016)
Salicaceae	*Salix laevigata*	Unknown	USA: California	(Boland, 2016)
Solanaceae	*Nicotiana*	Unknown	Unknown	(Smith *et al.*, 2019)
Solanaceae	*Nicotiana glauca*	Unknown	USA: California	(Boland, 2016)
Tamaricaceae	*Tamarix*	Unknown	Unknown	(Smith *et al.*, 2019)
Viburnaceae	*Sambucus*	Unknown	Unknown	(Smith *et al.*, 2019)

Additional hosts for *E. kuroshio* are listed in the dataset by Ruzzier *et al.* (2023). These have not been included in this list as the reference cited is a Californian website (University of California, 2022). While an authoritative source, the site names both *E. fornicatus s.s.* and *E. kuroshio* in the introductory page about the beetles, then groups the detailed information under the common name “invasive shot hole borers (ISHB)”. It is entirely possible that the reproductive hosts listed on the website apply to both species, but this is not explicitly stated. Therefore, records whose only source is University of California (2022) have not been included in this table and this list is shorter than that provided by Ruzzier *et al.* (2023).

The record on *Casuarina* from Mexico was assumed to be *E. kuroshio* based on the species known to be in Mexico and southern California (Equihua Martínez *et al.*, 2016).

Euwallacea perbrevis

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Fabaceae	*Lysiloma latisiliquum*	Yes	USA: Florida	(Owens *et al.*, 2018)
Lauraceae	*Persea americana*	Yes	USA: Florida	(Carrillo *et al.*, 2016)
Theaceae	*Camellia sinensis*	Yes	Unknown	(Danthanarayana, 1968); (Smith *et al.*, 2019)
Acanthaceae	*Avicennia alba*	Unknown	Singapore	(Smith *et al.*, 2019)
Anacardiaceae	*Mangifera indica*	Unknown	Indonesia, Malaysia, USA: Florida	(Carrillo *et al.*, 2016); (Smith *et al.*, 2019)
Annonaceae	*Annona muricata*	Unknown	USA: Florida	(Owens *et al.*, 2018)
Annonaceae	*Cyathocalyx*	Unknown	China	(Smith *et al.*, 2019)
Annonaceae	*Xylopia pacifica*	Unknown	China	(Smith *et al.*, 2019)
Burseraceae	*Bursera simaruba*	Unknown	Panama, USA: Florida	(Owens *et al.*, 2018); (Smith *et al.*, 2019)
Burseraceae	*Protium panamense*	Unknown	Costa Rica	(Kirkendall & Ødegaard, 2007)
Combretaceae	*Terminalia myriocarpa*	Unknown	Vietnam	(Smith *et al.*, 2019)
Euphorbiaceae	*Aleurites*	Unknown	USA: Hawaii	(Smith *et al.*, 2019)
Fabaceae	*Acacia crassicarpa*	Unknown	Indonesia	(Lynn *et al.*, 2020)
Fabaceae	*Acacia mangium*	Unknown	Malaysia	(Smith *et al.*, 2019)
Fabaceae	*Albizia lebbeck*	Unknown	USA: Florida	(Owens *et al.*, 2018)
Fabaceae	*Delonix regia*	Unknown	USA: Florida	(Carrillo *et al.*, 2016)
Fabaceae	*Erythrina*	Unknown	USA: Hawaii	(Smith *et al.*, 2019)
Fabaceae	*Samanea saman*	Unknown	USA: Hawaii	(Rugman-Jones *et al.*, 2020)
Fabaceae	*Sindora glabra*	Unknown	China	(Wang *et al.*, 2022)
Lauraceae	*Persea palustris*	Unknown	USA: Florida	(Carrillo *et al.*, 2016)
Malvaceae	*Hibiscus* sp.	Unknown	USA: Hawaii	(Rugman-Jones *et al.*, 2020)
Malvaceae	*Theobroma cacao*	Unknown	Malaysia, Philippines, Timor Leste	(Smith *et al.*, 2019); (Thube *et al.*, 2024)
Malvaceae	*Trichospermum*	Unknown	China	(Smith *et al.*, 2019)
Meliaceae	*Cedrela odorata*	Unknown	Costa Rica	(Kirkendall & Ødegaard, 2007)
Moraceae	*Artocarpus altilis*	Unknown	China	(Smith *et al.*, 2019)
Moraceae	*Brosimum utile*	Unknown	Panama	(Kirkendall & Ødegaard, 2007)
Moraceae	*Ficus macrophylla*	Unknown	Australia	(Callaghan *et al.*, 2024)
Myristicaceae	*Myristica castaneifolia*	Unknown	China	(Smith *et al.*, 2019)
Proteaceae	*Macadamia* sp. (dead branches)	Unknown	USA: Hawaii	(Rugman-Jones *et al.*, 2020)
Rubiaceae	*Tocoyena pittieri*	Unknown	Panama	(Kirkendall & Ødegaard, 2007)
Rutaceae	*Citrus*	Unknown	Malaysia	(Smith *et al.*, 2019)
Salicaceae	*Casearia richii* (as *C. disticha*)	Unknown	China	(Smith *et al.*, 2019)
Sapindaceae	*Acer negundo*	Unknown	Australia	(Callaghan *et al.*, 2024)
Sapindaceae	*Acer paxii*	Unknown	Australia	(Callaghan *et al.*, 2024)
Sapindaceae	*Cupaniopsis anacardioides*	Unknown	Australia	(Callaghan *et al.*, 2024)

Euwallacea perbrevis host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Sapindaceae	*Litchi chinensis* (as *L. sinensis*)	Unknown	Réunion	(Smith *et al.*, 2019)

The records of *E. fornicatus* from Central America, cited by Kirkendall and Ødegaard (2007) are assumed to refer to *E. perbrevis* as this is the species which is known to be present in this region.

The datasheet by CABI (2022) for *E. perbrevis* lists a number of hosts which are included in the general *E. fornicatus sensu lato* list here. The CABI references cited are all to papers from before the time the species complex was split, and it is not known on what basis they were assigned to *E. perbrevis*. Therefore they are not included in the above table.

Euwallacea fornicatus sensu lato: hosts not included in the other lists

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Anacardiaceae	*Spondias dulcis*	Yes	Indonesia	(Danthanarayana, 1968)
Apocynaceae	*Alstonia macrophylla*	Yes	Unknown	(Gomez *et al.*, 2019)
Araliaceae	*Aralia decaisneana*	Yes	Unknown	(Gomez *et al.*, 2019)
Arecaceae	*Archontophoenix cunninghamiana*	Yes	USA: California	(University of California, 2022)
Bignoniaceae	*Spathodea campanulata*	Yes	USA: California	(University of California, 2022)
Burseraceae	*Canarium* sp. (as *Canarium commune* which may be one of several species)	Yes	Indonesia	(Danthanarayana, 1968)
Burseraceae	*Protium serratum*	Yes	Indonesia	(Danthanarayana, 1968)
Dipterocarpaceae	*Shorea robusta*	Yes	India	(Danthanarayana, 1968)
Euphorbiaceae	*Hevea brasiliensis*	Yes	China, Indonesia, Malaysia, Sri Lanka	(Danthanarayana, 1968); (Li *et al.*, 2016)
Euphorbiaceae	*Vernicia montana*	Yes	Unknown	(Gomez *et al.*, 2019)
Fabaceae	*Acacia mangium* × *auriculiformis*	Yes	Unknown	(Gomez *et al.*, 2019)
Fabaceae	*Albizia* sp.	Yes	Unknown	(Gomez *et al.*, 2019)
Fabaceae	*Archidendron jiringa* (as *Pithecolobium lobatum*)	Yes	Indonesia	(Danthanarayana, 1968)
Fabaceae	*Archidendron pauciflorum* (Gomez *et al.* (2019) as synonym of *A. jiringa*?)	Yes	Unknown	(Gomez *et al.*, 2019)
Fabaceae	*Calliandra houstoniana* var. *calothyrsus* (as *C. calothyrsus*)	Yes	Sri Lanka	(Amarasinghe & Devy, 2003)
Fabaceae	*Cassia sp.*	Yes	Sri Lanka	(Amarasinghe & Devy, 2003)
Fabaceae	*Crotalaria pallida*	Yes	Unknown	(Gomez *et al.*, 2019)
Fabaceae	*Crotalaria* sp. (as *C. striata* which may be one of two species)	Yes	Sri Lanka	(Danthanarayana, 1968)
Fabaceae	*Crotalaria trichotoma* (as *C. usaramoensis*)	Yes	Sri Lanka	(Danthanarayana, 1968)
Fabaceae	*Cynometra* (also as *Maniltoa*)	Yes	Unknown	(Gomez *et al.*, 2019)
Fabaceae	*Falcataria falcata* (as *Albizia*)	Yes	Sri Lanka	(Danthanarayana, 1968)
Fabaceae	*Mimosa scabrella* (as *M. bracaatinga*)	Yes	Sri Lanka	(Danthanarayana, 1968)
Fabaceae	*Parkinsonia* × *sonorae*	Yes	USA: California	(University of California, 2022)
Fabaceae	*Parkinsonia florida*	Yes	USA: California	(University of California, 2022)
Fabaceae	*Tephrosia candida*	Yes	Sri Lanka	(Danthanarayana, 1968)
Fabaceae	*Tephrosia vogelii*	Yes	Sri Lanka	(Danthanarayana, 1968)
Lauraceae	*Litsea sp.*	Yes	Unknown	(Gomez *et al.*, 2019)
Lauraceae	*Machilus gamblei* (as *Persea bombycina*)	Yes	India	(Kumar *et al.*, 2011); (Gomez *et al.*, 2019)

Euwallacea fornicatus sensu lato host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Magnoliaceae	*Magnolia lucida* (as *Manglietia*)	Yes	Unknown	(Gomez *et al.*, 2019)
Malvaceae	*Durio* sp.	Yes	Unknown	(Gomez *et al.*, 2019)
Malvaceae	*Pterocymbium beccarii*	Yes	Unknown	(Wood & Bright, 1992); (Gomez *et al.*, 2019)
Meliaceae	*Aglaia cucullata*	Yes	Unknown	(Gomez *et al.*, 2019)
Meliaceae	*Azadirachta indica*	Yes	Sri Lanka	(Amarasinghe & Devy, 2003); (Walgama, 2012)
Moraceae	*Artocarpus integer* (assumed, as "Artocarpus integra")	Yes	Indonesia	(Danthanarayana, 1968)
Moraceae	*Ficus padana* (as *F. toxicaria*)	Yes	Indonesia	(Danthanarayana, 1968)
Moraceae	*Ficus polyantha*	Yes	Unknown	(Gomez *et al.*, 2019)
Moraceae	*Ficus racemifera* (as *F. nodosa*)	Yes	Unknown	(Gomez *et al.*, 2019)
Moringaceae	*Moringa oleifera*	Yes	Indonesia	(Danthanarayana, 1968)
Olaeaceae	*Ligustrum compactum*	Yes	China	(Li *et al.*, 2016); (Gomez *et al.*, 2019)
Pinaceae	*Pinus massoniana*	Yes	China	(Li *et al.*, 2016)
Rubiaceae	*Coffea arabica*	Yes	Sri Lanka	(Amarasinghe & Devy, 2003)
Rubiaceae	*Nauclea orientalis*	Yes	Unknown	(Gomez *et al.*, 2019)
Salicaceae	*Populus × canadensis*	Yes	Unknown	(Gomez *et al.*, 2019)
Sapindaceae	*Aesculus californica*	Yes	USA: California	(University of California, 2022)
Sapindaceae	*Litchi chinensis*	Yes	China	(Li *et al.*, 2016); (Gomez *et al.*, 2019)
Sapindaceae	*Schleichera oleosa*	Yes	Indonesia	(Danthanarayana, 1968)
Sapotaceae	*Pouteria* sp.	Yes	Unknown	(Gomez *et al.*, 2019)
Actinidiaceae	*Saurauia tristyla*	Unknown	China	(Li *et al.*, 2016)
Asteraceae	*Podachaenium eminens*	Unknown	Unknown	(Spanish PRA, 2015)
Betulaceae	*Betula alnoides*	Unknown	China	(Li *et al.*, 2016)
Euphorbiaceae	*Mallotus barbatus*	Unknown	China	(Li *et al.*, 2016)
Fabaceae	*Adinobotrys atropurpureus* (as *Whitfordiodendron pubescens*)	Unknown	Unknown	(Wood & Bright, 1992)
Fabaceae	*Dalbergia odorifera*	Unknown	China	(Li *et al.*, 2016)
Fabaceae	*Erythrina variegata* (as *E. indica*)	Unknown	China	(Li *et al.*, 2016)
Fabaceae	*Senna siamea* (as *Cassia siamea*)	Unknown	China	(Li *et al.*, 2016)
Fabaceae	*Xylia xylocarpa*	Unknown	Unknown	(Wood & Bright, 1992)
Fagaceae	*Castanea* sp.	Unknown	China	(Li *et al.*, 2016)
Fagaceae	*Castanopsis fargesii*	Unknown	China	(Li *et al.*, 2016)
Lamiaceae	*Clerodendrum colebrookeanum*	Unknown	Unknown	(Wood & Bright, 1992)
Lythraceae	*Punica granatum*	Unknown	India	(Mote & Tambe, 2000); (Spanish PRA, 2015)
Primulaceae	*Embelia* cf. *incumbens*	Unknown	Unknown	(Wood & Bright, 1992)
Rubiaceae	*Cinchona officinalis*	Unknown	Unknown	(Spanish PRA, 2015)
Rutaceae	*Citrus × aurantiifolia*	Unknown	Unknown	(CABI, 2022)

Euwallacea fornicatus sensu lato host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Sapindaceae	*Nephelium lappaceum var. lappaceum*	Unknown	Unknown	(Spanish PRA, 2015)
Anacardiaceae	*Lannea coromandelica* (as *Odina wodier*)	No	India	(Danthanarayana, 1968)
Annonaceae	*Mitrella elegans* (as *Fissistigma elegans* and (Gomez *et al.* (2019) regards as *Mitrella kentii*)	No	Malaysia	(Danthanarayana, 1968)
Apocynaceae	*Amalocalyx microlobus* (as *A. yunnanensis*)	No	Unknown	(Gomez *et al.*, 2019)
Apocynaceae	*Kopsia flavida*	No	Indonesia	(Danthanarayana, 1968)
Araliaceae	*Polyscias diversifolia* (the most likely current name for *Arthrophyllum diversifolium*)	No	Malaysisa	(Danthanarayana, 1968)
Araliaceae	*Polyscias sandwicensis*	No	Unknown	(Gomez *et al.*, 2019)
Arecaceae	*Caryota urens*	No	Sri Lanka	(Danthanarayana, 1968)
Asteraceae	*Austroeupatorium inulifolium* (as *Eupatorium inulifolium*)	No	Sri Lanka	(Amarasinghe & Devy, 2003)
Asteraceae	*Montanoa bipinnatifida*	No	Unknown	(Gomez *et al.*, 2019)
Bignoniaceae	*Pajanelia longifolia*	No	Malaysisa	(Danthanarayana, 1968)
Bignoniaceae	*Tecoma stans*	No	Sri Lanka	(Amarasinghe & Devy, 2003)
Caricaceae	*Carica papaya*	No	Unknown	(Gomez *et al.*, 2019)
Casuarinaceae	*Casuarina equisetifolia*	No	Sri Lanka	(Danthanarayana, 1968)
Dipterocarpaceae	*Shorea* sp.	No	Malaysia	(Danthanarayana, 1968)
Euphorbiaceae	*Triadica sebifera*	No	Unknown	(Gomez *et al.*, 2019)
Fabaceae	*Acacia auriculiformis*	No	Sri Lanka	(Amarasinghe & Devy, 2003)
Fabaceae	*Acacia decurrens*	No	Sri Lanka	(Amarasinghe & Devy, 2003)
Fabaceae	*Albizia carbonaria* (as *A. sumatrana*)	No	Sri Lanka	(Danthanarayana, 1968)
Fabaceae	*Albizia chinensis*	No	Sri Lanka	(Danthanarayana, 1968)
Fabaceae	*Albizia odoratissima*	No	India	(Danthanarayana, 1968)
Fabaceae	*Albizia procera*	No	Indonesia	(Danthanarayana, 1968)
Fabaceae	*Brachypterum robustum* (as *Derris*)	No	Sri Lanka	(Danthanarayana, 1968)
Fabaceae	*Cassia fistula*	No	Indonesia	(Danthanarayana, 1968)
Fabaceae	*Crotalaria micans* (as *C. anagyroides*)	No	Sri Lanka	(Danthanarayana, 1968)
Fabaceae	*Dalbergia latifolia*	No	Indonesia	(Danthanarayana, 1968)
Fabaceae	*Dendrolobium triangulare* subsp. *triangulare* (as *Desmodium cephalotes*)	No	Sri Lanka	(Danthanarayana, 1968)
Fabaceae	*Derris elliptica*	No	Indonesia	(Danthanarayana, 1968)

Euwallacea fornicatus sensu lato host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Fabaceae	*Flemingia macrophylla* (as *Flemingea conjesta*, assumed to be a misspelling of *F. congesta*)	No	Sri Lanka	(Amarasinghe & Devy, 2003)
Fabaceae	*Gliricidia sepium*	No	Sri Lanka	(Danthanarayana, 1968)
Fabaceae	*Intsia palembanica*	No	Malaysia	(Danthanarayana, 1968)
Fabaceae	*Parkia speciosa*	No	Indonesia	(Danthanarayana, 1968)
Fabaceae	*Peltophorum pterocarpum* (as *P. ferrugenium*)	No	Indonesia	(Danthanarayana, 1968)
Fabaceae	*Piliostigma malabaricum* (as *Bauhinia*)	No	Indonesia	(Danthanarayana, 1968)
Fabaceae	*Senna alata* (as *Cassia*)	No	Sri Lanka	(Danthanarayana, 1968)
Fabaceae	*Tephrosia maxima*	No	Sri Lanka	(Danthanarayana, 1968)
Fabaceae	Tephrosia mozuma: not a valid name. Perhaps *Tephrosia maxima*	No	Indonesia	(Danthanarayana, 1968)
Fagaceae	*Castanopsis* spp.	No	Malaysia	(Danthanarayana, 1968)
Gentianaceae	*Cyrtophyllum giganteum* (as *Fagraea*)	No	Malaysia	(Danthanarayana, 1968)
Lamiaceae	*Clerodendrum indicum* (as *C. siphonanthus*)	No	Sri Lanka	(Danthanarayana, 1968)
Lamiaceae	*Clerodendrum infortunatum*	No	Sri Lanka	(Danthanarayana, 1968)
Lamiaceae	*Gmelina arborea* (assumed, as “Camelina arborea”)	No	India, Malaysia	(Danthanarayana, 1968)
Lamiaceae	*Gmelina chinensis*	No	Unknown	(Gomez *et al.*, 2019)
Lamiaceae	*Vitex pinnata* (as *V. pubescens*)	No	Indonesia	(Danthanarayana, 1968)
Lauraceae	*Cinnamomum parthenoxylon* (as *C. porrectum*)	No	Unknown	(Gomez *et al.*, 2019)
Lauraceae	*Neolitsea cassia*	No	Unknown	(Gomez *et al.*, 2019)
Lecythidaceae	*Planchonia* sp.	No	Sri Lanka	(Danthanarayana, 1968)
Magnoliaceae	*Magnolia* sp. (as *Michelia velutina* which may be one of two species)	No	Indonesia	(Danthanarayana, 1968)
Malvaceae	*Bombax ceiba* (as *B. malabathricum*)	No	Sri Lanka	(Danthanarayana, 1968)
Malvaceae	*Grevillea pteridifolia*	No	Sri Lanka	(Amarasinghe & Devy, 2003)
Malvaceae	*Lagunaria patersonia*	No	Unknown	(Gomez *et al.*, 2019)
Malvaceae	*Luehea divaricata*	No	Unknown	(Gomez *et al.*, 2019)
Malvaceae	*Pseudobombax septenatum* (as *Gossampinus heptaphylla*)	No	Indonesia	(Danthanarayana, 1968)
Malvaceeae	*Scaphium affine*	No	Malaysia	(Danthanarayana, 1968)
Meliaceae	*Lansium domesticum*	No	Indonesia	(Danthanarayana, 1968)

Euwallacea fornicatus sensu lato host lists (continued)

Plant family	Plant species	Reproductive host?	Geographical region(s)	Reference(s)
Meliaceae	*Swietenia mahagoni*	No	Indonesia	(Danthanarayana, 1968)
Meliaceae	*Toona ciliata* (as *Cedrela toona*)	No	Sri Lanka	(Danthanarayana, 1968)
Moraceae	*Ficus hispida*	No	Sri Lanka	(Danthanarayana, 1968)
Moraceae	*Ficus nervosa*	No	Sri Lanka	(Danthanarayana, 1968)
Moraceae	*Ficus septica*	No	Indonesia	(Danthanarayana, 1968)
Myristicaceae	*Myristica fragrans*	No	Malaysia, Sri Lanka	(Danthanarayana, 1968)
Myrtaceae	*Eucalyptus alba*	No	Sri Lanka	(Amarasinghe & Devy, 2003)
Phyllanthaceae	*Phyllanthus emblica*	No	Indonesia	(Danthanarayana, 1968)
Proteaceae	*Grevillea robusta*	No	Sri Lanka	(Danthanarayana, 1968); (Amarasinghe & Devy, 2003)
Rosaceae	*Malus toringo* (as *M. sieboldii*)	No	Unknown	(Gomez *et al.*, 2019)
Rosaceae	*Photinia japonica*	No	Sri Lanka	(Danthanarayana, 1968)
Rubiaceae	*Breonia chinensis* (as *Anthocephalus indicus*)	No	India	(Danthanarayana, 1968)
Rubiaceae	*Cinchona calisaya*	No	India, Sri Lanka	(Danthanarayana, 1968)
Rubiaceae	*Ixora parviflora*	No	India, Sri Lanka	(Danthanarayana, 1968)
Rubiaceae	*Neolamarckia cadamba*	No	Unknown	(Gomez *et al.*, 2019)
Rutaceae	*Citrus × aurantium*	No	Sri Lanka	(Danthanarayana, 1968)
Salicaceae	*Dovyalis hebecarpa* (as *Aberia gardneri*)	No	Sri Lanka	(Danthanarayana, 1968)
Sapindaceae	*Allophylus cobbe*	No	Sri Lanka	(Danthanarayana, 1968)
Sapindaceae	*Sapindus mukorossi*	No	Unknown	(Gomez *et al.*, 2019)
Sapotaceae	*Manilkara zapota*	No	Unknown	(Gomez *et al.*, 2019)
Solanaceae	*Datura metel*	No	Sri Lanka	(Amarasinghe & Devy, 2003)
Theaceae	*Schima noronhae*	No	Indonesia	(Danthanarayana, 1968)
Urticaceae	*Oreocnide pedunculata*	No	Unknown	(Gomez *et al.*, 2019)
Verbenaceae	*Lantana camara* subsp. *aculeata*	No	Sri Lanka	(Danthanarayana, 1968)
Verbenaceae	*Petrea volubilis*	No	Sri Lanka	(Danthanarayana, 1968)

Excluded from the host lists

Sequoia sempervirens (Cupressaceae).

This is reported as a host in the Spanish PRA (2015), but no other evidence could be found for this tree as a host. No records of *E. fornicatus s.l.* attack on other members of the genus could be found. Eskalen *et al.* (2013) and Mendel *et al.* (2021) report that *S. sempervirens* is not attacked even if other species in the vicinity are damaged by *E. fornicatus s.l.*

Appendix 2

Annex VII of EU regulation 2019/2072

The following hosts are listed in the EU regulations (as amended in 2021 to include measures against *E. fornicatus s.l.*). Plants for planting are covered in part 32.1, and wood in point 102; these measures applying to all third country imports into the European Union and Northern Ireland. The original regulations (latest consolidated version via the left-hand side of https://eurlex.europa.eu/eli/reg_impl/2019/2072/oj) should be consulted for full details as this section has been abstracted from the original regulations. The host lists are identical for plants for planting and wood.

EU host list

Acacia Mill.
Acer buergerianum Miq.
Acer macrophyllum Pursh
Acer negundo L.
Acer palmatum Thunb.
Acer paxii Franch.
Acer pseudoplatanus L.
Aesculus californica (Spach) Nutt.
Ailanthus altissima (Mill.) Swingle
Albizia falcate Backer ex Merr.
Albizia julibrissin Durazz.
Alectryon excelsus Gärtn.
Alnus rhombifolia Nutt.
Archontophoenix cunninghamiana H. Wendl. & Drude
Artocarpus integer (Thunb.) Merr.
Azadirachta indica A. Juss.
Baccharis salicina Torr. & A.Gray
Bauhinia variegata L.
Brachychiton discolor F.Muell.
Brachychiton populneus R.Br.
Camellia semiserrata C.W.Chi
Camellia sinensis (L.) Kuntze
Canarium commune L.
Castanospermum australe A.Cunningham & C.Fraser
Cercidium floridum Benth. ex A.Gray
Cercidium sonorae Rose & I.M.Johnst.
Cocculus laurifolius DC.
Combretum kraussii Hochst.
Cupaniopsis anacardioides (A.Rich.) Radlk.
Dombeya cacuminum Hochr.
Erythrina corallodendron L.
Erythrina coralloides Moc. & Sessé ex DC.
Erythrina falcata Benth.

Erythrina fusca Lour.
Eucalyptus ficifolia F.Müll.
Fagus crenata Blume
Ficus L.
Gleditsia triacanthos L.
Hevea brasiliensis (Willd. ex A.Juss) Muell.Arg.
Howea forsteriana (F.Müller) Becc.
Ilex cornuta Lindl. & Paxton
Inga vera Willd.
Jacaranda mimosifolia D.Don
Koelreuteria bipinnata Franch.
Liquidambar styraciflua L.
Magnolia grandiflora L.
Magnolia virginiana L.
Mimosa bracaatinga Hoehne
Morus alba L.
Parkinsonia aculeata L.
Persea americana Mill.
Pithecellobium lobatum Benth.
Platanus x *hispanica* Mill. ex Münchh.
Platanus mexicana Torr.
Platanus occidentalis L.
Platanus orientalis L.
Platanus racemosa Nutt.
Podalyria calyptrata Willd.
Populus fremontii S.Watson
Populus nigra L.
Populus trichocarpa Torr. & A.Gray ex Hook.
Prosopis articulata S.Watson
Protium serratum Engl.
Psoralea pinnata L.
Pterocarya stenoptera C.DC.
Quercus agrifolia Née
Quercus calliprinos Webb.
Quercus chrysolepis Liebm
Quercus engelmannii Greene
Quercus ithaburensis Dence.
Quercus lobata Née
Quercus palustris Marshall
Quercus robur L.
Quercus suber L.
Ricinus communis L.
Salix alba L.
Salix babylonica L.
Salix gooddingii C.R.Ball
Salix laevigata Bebb
Salix mucronata Thnb.
Shorea robusta C.F.Gaertn.
Spathodea campanulata P.Beauv.
Spondias dulcis Parkinson
Tamarix ramosissima Kar. ex Boiss.

Virgilia oroboides subsp. *ferrugine* B.-E.van Wyk
Wisteria floribunda (Willd.) DC.
Xylosma avilae Sleumer

EU requirements for plants for planting

Plants for planting other than plants in tissue culture, pollen and seeds [abstracted description, see original regulation for full details]:

Official statement that the plants:

(a) have a diameter of less than 2 cm at the base of the stem,

or

(b) originate in a country recognised as being free from *Euwallacea fornicatus sensu lato* in accordance with the relevant International Standards for Phytosanitary Measures,

or

(c) originate in an area established by the national plant protection organisation in the country of origin as being free from *Euwallacea fornicatus sensu lato*, in accordance with the relevant International Standards for Phytosanitary Measures. The name of the area shall be mentioned on the phytosanitary certificate,

or

(d) have been grown:

(i) in a site of production with physical isolation against the introduction of *Euwallacea fornicatus sensu lato* at least during six months prior to export, which is subjected to official inspections at appropriate times and has been found free from the pest, confirmed at least with traps which are checked at least every four weeks, including immediately prior to export,

or

(ii) in a site of production which has been found free from *Euwallacea fornicatus sensu lato* since the beginning of the last complete cycle of vegetation, confirmed at least with traps, during official inspections carried out at least every four weeks; in case of suspicion of the presence of the pest at the site of production, appropriate treatments against the pest have been carried out to ensure the absence of the pest; a surrounding zone of 1 km is established, which is monitored at appropriate times for *Euwallacea fornicatus sensu lato* and where the pest is found, those plants should be immediately rogued out and destroyed,

and

immediately prior to export, consignments of the plants have been subjected to an official inspection for the presence of the pest, in particular in stems and branches of the plants, including destructive sampling. The size of the sample for inspection shall be such as to enable at least the detection of 1 % level of infestation with a level of confidence of 99 %.

EU requirements for wood

Wood (other than chips, sawdust, shavings and wood waste, wood packaging material and some other exclusions) [highly abstracted description, see original regulation for full details]:

Official statement that the wood:

(a) originates in a country recognised as being free from *Euwallacea fornicatus sensu lato* in accordance with the relevant International Standards for Phytosanitary Measures,

or

(b) originates in an area established by the national plant protection organisation in the country of origin as being free from *Euwallacea fornicatus sensu lato*, in accordance with the relevant International Standards for Phytosanitary Measures. The name of the area shall be mentioned on the phytosanitary certificate,

or

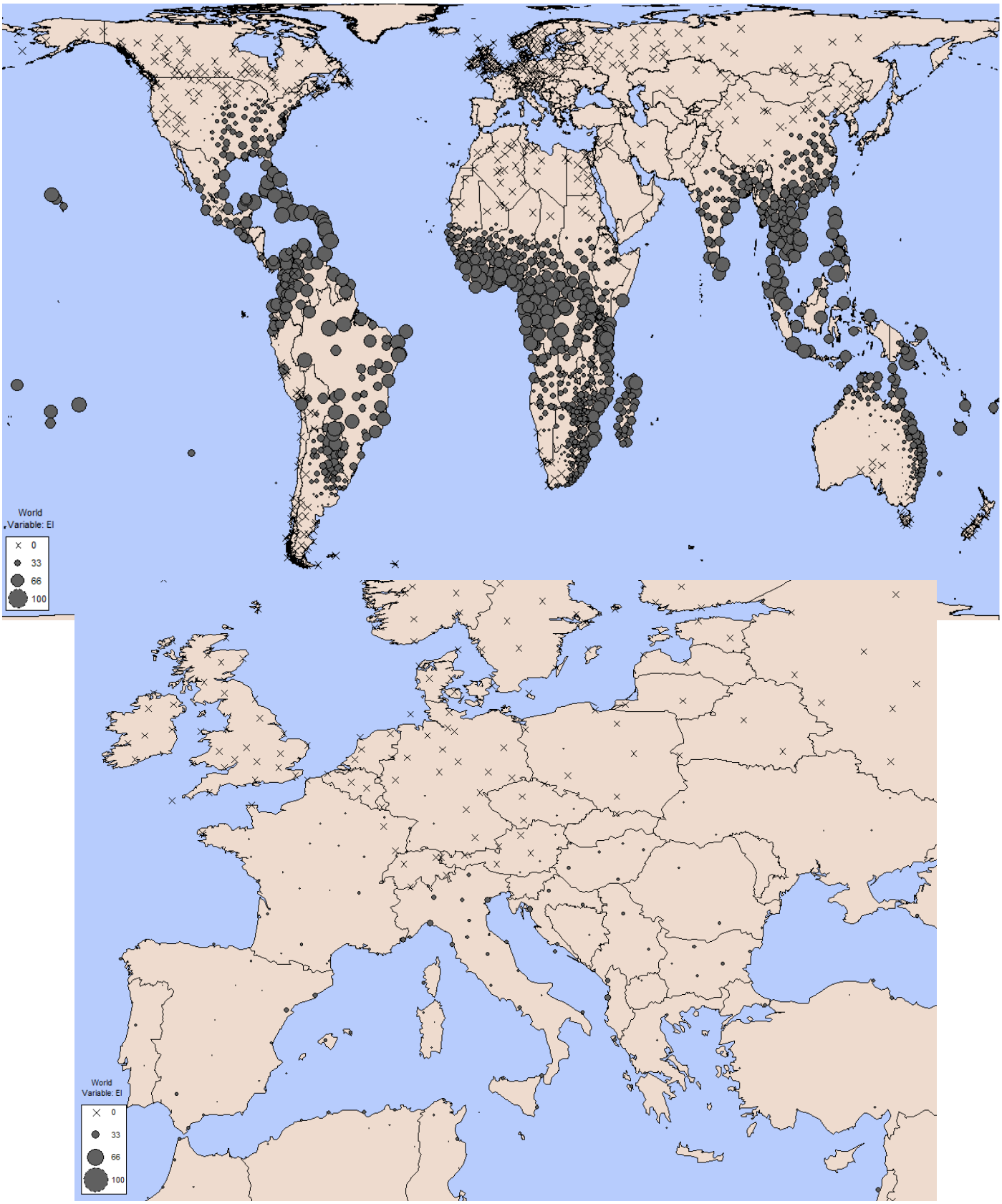
(c) has undergone an appropriate heat treatment to achieve a minimum temperature of 56°C for a minimum duration of 30 continuous minutes to ensure freedom from *Euwallacea fornicatus sensu lato*, throughout the entire profile of the wood, which is to be indicated on the phytosanitary certificate,

Or

(d) has undergone kiln-drying to below 20 % moisture content, expressed as a percentage of dry matter achieved through an appropriate time/temperature schedule, and indicated by the mark ‘Kiln-dried’ or ‘K.D.’ or another internationally recognised mark, put on the wood or on any wrapping in accordance with current usage.

Appendix 3

CLIMEX modelling for *E. fornicatus s.l.* using the final parameters from Ge *et al.* (2018) and station meteorological data from the default CLIMEX dataset (1961-1990). Global map (top) and detail for Europe (bottom).



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This PRA has been undertaken following IPPC International Standards for Phytosanitary Measures (ISPMs 2 and 11) and it provides technical evidence relating to the risk assessment and risk management of this pest.

This PRA has been undertaken taking into account the environmental principles laid out in the Environment Act 2021. Of particular relevance are:

> The **prevention principle**, which means that any policy on action taken, or not taken should aim to prevent environmental harm.
> The **precautionary principle**, which assists the decision-making process where there is a lack of scientific certainty.

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