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WPPR Point
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REINO DE ESPAÑA

MINISTERIO DE AGRICULTURA, ALIMENTACION Y MEDIO AMBIENTE
Dirección General de Sanidad de la Producción Agraria
Subdirección General de Sanidad e Higiene Vegetal y Forestal

KINGDOM OF SPAIN
MINISTRY OF AGRICULTURE, FOOD AND ENVIRONMENT
General Directorate of Health in Agronomical Production
Sub-directorate General for Forestry and Plant Health and Hygiene

PEST RISK ANALYSIS FOR THE AMBROSIA* BEETLE *Euwallacea* sp.

Including all the species within the genus *Euwallacea* that are morphologically similar to *E.fornicatus*

* **Associated fungi:** *Fusarium* sp. (E.g: *F. ambrosium, Fusarium euwallaceae)* or other possible symbionts.

Sources: Mendel *et al*, 2012a; Rabaglia *et al*. 2006; UCR_Eskalen Lab. Riverside

November 2015

Express Pest Risk Analysis for

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çThis PRA follows the EPPO Standard PM 5/5(1) Decision support Scheme for an Express Pest Risk Analysis

Summary

PRA area: The European Union (EU), excluding the French overseas territories (DOMS-Departments d'Outre-Mer), Spanish Canary Islands, Azores and Madeira.

Describe the endangered area:

The European Union (EU), excluding the French overseas territories (DOMS-Departments d'Outre-Mer), Spanish Canary Islands, Azores and Madeira.

Main conclusions:

Overall assessment of risk:

	Rating	Uncertainty
Entry		
Plants for planting (except seed) of host species from where *Euwallacea* spp. occur	High	Low
Wood of host species (round or sawn, with or without bark) from where *Euwallacea* spp. occur	High	Low
Non compliant WPM	High	Low
Hitchhiking	Low	High
Establishment outdoors		
(in Southern Europe)	High	Low
(in Northern Europe)	Moderate	Moderate
Establishment under protected conditions	High	Low
Magnitude of the spread		
Natural spread	Moderate	Moderate
Human assisted spread	High	Low
Impact in the current area of distribution		
In Asia	High	Low
In Israel and USA	High	Low
In Australia, Central America	Unknown	High
Potential impact in the PRA area		
Southern Europe	High	Low
Northern Europe	Moderate	Moderate

Phytosanitary risk for the *endangered area* (*Individual ratings for likelihood of entry and establishment, and for magnitude of spread and impact are provided in the document*)	High	☑	Moderate	☐	Low	☐
Level of uncertainty of assessment (see Q 17 for the justification of the rating. Individual ratings of uncertainty of entry, establishment, spread and impact are provided in the document)	High	☐	Moderate	☐	Low	☑

Other recommendations:

Express Pest Risk Analysis: THE AMBROSIA* BEETLE *Euwallacea* sp. Including all the species within the genus Euwallacea that are morphologically similar to E.fornicatus *Associated fungi: Fusarium sp. (E.g: F. ambrosium, Fusarium euwallaceae) or other possible symbionts.	
Prepared by: Subdirección General de Sanidad e Higiene Vegetal y Forestal. MAGRAMA and Tecnologías y Servicios Agrarios, S.A. (TRAGSATEC)	**Date:** Last update November 2015

Stage 1. Initiation

Reason for performing the PRA:

Euwallacea fornicatus (Tea Shot Hole Borer-TSHB) is an important pest of tea in Asia, which also attacks other plant species there.

In 2009, what was supposed to be TSHB, was detected in Israel attacking avocado and becoming a serious problem for the avocado industry in Israel. Spanish avocado growers were deeply concerned by this pest and that is why in 2012 it was decided to initiate a pest risk assessment on *E.fornicatus* for the EU.

Afterwards, molecular analysis showed that the beetle found in Israel, and also detected in California attaking avocados, as well as other trees in the urban and the wild, is a different *Euwallacea* species (although morphologically is similar to *E.fornicatus*), which was named Poliphagous Shot Hole Borer (PSHB). The origin of this species is probably Vietnam (Kabashima *et al*. 2014).

Subsequent research in molecular taxonomy has determined that what had always been morphologically described as *E.fornicatus*, actually group several species level lineages worldwide within the **morphological concept of *Euwallacea fornicatus*.** [e.g: O'Donnell *et al*. (2014a) have identified six phylogenetically distinct "*E.fornicatus*-like" species]. In the USA, 4 different *Euwallacea* species have been identified within the "*E.fornicatus*-like" group. Since these species have always been described as "*E.fornicatus*", it is not possible to distinguish how many species exist in the bibliography to date.

Euwallacea sp. is an ambrosia beetle. Therefore it is associated with a fungus. This complex beetle-fungus attacks trees and could ultimately lead them to their death. References all over the world describe this beetle as a poliphagous, invasive and damaging pest whose associated fungus can kill trees.

All of these *Euwallacea* species that are morphologically indistinguishable from the TSHB are poliphagous, change their behaviour when they colonize new habitats, and have common characteristics that lead them to become very dangerous. This, and the uncertainty related to the identity, taxonomy, distribution, preferred hosts, hybridation, etc. for each of them, take the assesors to **focus this PRA on all those species within the genus *Euwallacea* that are morphologically similar to *Euwallacea fornicatus* and their mutualistic symbiotic fungi.**

Below, the main points which make these species very dangerous have been extracted from the PRA:

This beetle-fungus mutualist threatens urban landscapes (e.g: *Platanus* spp., *Salix* spp.), forests (*Acer* spp., *Populus nigra, Quercus* spp. and *Salix* spp. among many others) and crop production (avocado, citrus, grapes, etc.) in the PRA area. The following characteristics make this complex beetle-fungus dangerous and threatening:

1- Its minuscule size (< 2mm)
2- Its haplodiploid genetic system (mating between haploid male and diploid female)
3- Inbreeding reproduction (sib-mating system).
4- Polygynous reproduction (one male mates several females)
5- Possible hybrid introgression between *Euwallacea* species is suspected .
6- Mature females emerge from their larval hosts already fertilized.
7- The introduction of a single mated female may lead to the establishment of a new population of *E. fornicatus*
8- Sex ratio offspring is very female biased.
9- As it feeds from ectosymbiotic fungi, it has low specificity to tree hosts being able to greatly increase its range of woody hosts.
10- Broad host range: 97 species in 35 families attacked by TSHB in Asia (Danthanarayana, 1968). Over 300 tree species attacked by *Euwallacea* sp. in California.
11- The beetle–disease complex may potentially establish in a variety of plant communities worldwide.
12- Non-pathogenic saprotrophy in native ranges is changing to a prolific tree-killing in invaded ranges causing significant damage.
13- Although most *Euwallacea* spp. seem to be associated with a specific species of *Fusarium*, beetles have switched fusarial symbionts (i.e., host shifts) at least five times during their evolution (~ 19-24Mya). It has the potential for and frequency of host-switching between *Euwallacea* and other fungi. These shifts may bring

together more aggressive and virulent combinations of these invasive mutualists.

14- Recent research in California suggests some species are able to carry more than one fungal species, what makes this beetle-disease complex more dangerous since it may potentially establish in a broader host range over the world.

15- Although it seems to prefer tropical, subtropical and Mediterranean climates, it must not be underestimated that other ambrosia beetles originating from Asia have been able to adapt to different and colder climates. E.g: *Euwallacea validus*, originating from Japan and detected in Ontario (Canada).

16- As it spends almost its entire life within their hosts, climate could not be very critical for its establishment.

PRA area: European Union (EU), excluding the French overseas territories (DOMS-Departments d'Outre-Mer), Spanish Canary Islands, Azores and Madeira.

Stage 2. Pest risk assessment

1. Taxonomy:

Euwallacea is a genus of over 40 species that belongs to the subfamily Scolytinae, which was historically treated as a separate family (Scolitidae), but it is now considered to be a specialised subfamily within the Curculionidae. It has historically been included into the tribe *Xyleborini* (Brownee, 1961) a tribe of ambrosia beetles of the subfamily Scolytinae. (Alternatively named as subtribe *Xyleborina* within tribe *Scolytini*)

Biologically, tribe *Xyleborini* is defined by the combination of a haplodiploid genetic system and inbreeding reproduction which means that the great majority of matings occur within a family between a single haploid male and his diploid sisters. These biological features are probable causes of **unclear species limits**.

THE BEETLE:

Classification: (Species 2000 & ITIS Catalogue of Life: 2015).

- Kingdom: **Animalia**
  - Phylum: **Arthropoda**
    - Class: **Insecta**
      - Order: **Coleoptera**
        - Superfamily: **Curculionoidea**
          - Family: **Curculionidae**
            - Subfamily: **Scolytinae**
              - Genus: **Euwallacea**

Every species within this genus is registered with a provisionally accepted name.

***Euwallacea* species within the morphological concept of "Euwallacea fornicatus"**

(Recent research shows that there are several species within what had always been morphologically identified as *E.fornicatus*. Nevertheless all of them have been assessed as a whole since they are similar to each others, poliphagous and it is not possible to distinbuish their references in the bibliography about hosts, distribution, et.). Further information about taxonimy is included in **Annex 2**)

The following names can be found in the bibliography (sometimes erroneously):
Tea Shot Hole Borer; TSHB, *Euwallacea fornicatus, Xyleborus fornicatus*, Poliphagous Shot Hole Borer, PSHB, Avocado ambrosia beetle , *Euwallacea* nr.*fornicatus, Euwallacea* aff. fornicate, *Euwallacea* sp. IS/CA,.
Kuroshio Shot Hole Borer, KSHB,
Shot Hole Borers (SHB); *Euwallacea* sp.#1-6.

There are morphological keys with the features that distinguish this Euwallacea species from others such as *E.validus*, *E.interjectus*,among others: *Rabaglia et al.* 2006; Walker 2008; Cognato 2008.

THE FUNGUS:

Ambrosia fungi associated with this beetle are mostly *Fusarium* species. Nevertheless, research on this, the different beetle-fungus associations, as well as other possible associated fungi within other genera is still needed .

After the attack of the beetle, the fungus spreads from the galleries to attack the tree's vascular tissue. This causes a disease called **"Fusarium Dieback" (FD),** which has been found to interrupt the transport of water and nutrients in more than 100 tree species. (Eskalen *et al.* 2014a)
(see **Annex 2**)

2. Pest overview

The following descriptions varies depending on the part of the world where the species has been reported. Therefore, sometimes the text refers to the pest as *E.fornicatus*, TSHB, PSHB, *Euwallacea* sp.IS/CA, etc. depending on the author and the origin of the reference.

2.1. Summary

(a) Life stages:

E. fornicatus is a holometabolous insect (i.e: it has complete metamorphism) (Walgama, 2012). A detailed study about life stages was described by Kumar *et al*. (2011) in *Persea bombycina*.

- Eggs are laid in groups inside the galleries, the mean number being 14.52 ± 2.92 per gallery. The egg is white oval-shaped, 0.23 ± 0.04 mm x 0.01 mm wide with a hatch rate of 84.90%.
- 1st instar larvae: are white in color and feed inside the galleries. Their size is 0.92±0.07 mm x 0.37±0.05 mm.
- 2nd instar larvae are white in color and feed inside the galleries. Their size is 1.30 ±0.06 mm x 0.44 ±0.06 mm.
- 3rd instar larvae are much transparent and slightly yellowish in color with their head shield becoming more prominent. Their size is 1.80±0.05 mm x 0.60 ± 0.07 mm.
- Pupae: Brown and yellowish in color. Pupation takes place on or inside the galleries of twigs. Their size is 1.97±0.10 mm x 0.97 ±0.10 mm.
- Adults: The adult female is very dark-brown to black, 1.83± 0.07 mm x 0.80 ±0.6 mm. The small wingless males are 1.45 ± 0.10 mm x 0.59±0.11 mm.
  The ratio of females to males is lower than in many other ambrosia beetles. Anyway, offspring is very female biased. In Java, it has been estimated as 9:1 (Kalshoven, 1958), and in Sri Lanka as 4:1 (Beeson, 1941) and 3:1 (Judenko, 1956). In Malaysia, Browne (1961) examined several complete broods and reported there were four or five females to each male. [CABI (2015)]

(b) Length of life cycle:

- Development cycle of *Euwallacea* sp. in Israel and California may last between five and eight weeks. Adult brood emergence is dependent on the deterioration of surrounding tissue. (Mendel & Freeman, 2015).

- In India, the length of life cycle of *E. fornicatus* has been described in a field trial in *Persea bombycina*. Length of each stage was described at 26-35 ºC and relative humidity 75-95 % Kumar *et al*. (2011); results are summarized in the following table:

Table 1. *E. fornicatus*: Length of life cycle (temperature, 26-35 ºC; relative humidity, 75-95 %).

Stage	Length (days)
Eggs	7.86 ± 0.63
1st instar	5.37 ± 0.49
2nd instar	6.77 ± 0.42
3rd instar	5.81 ± 0.39
Pupae	9.78 ± 0.79
Adults	Male: 5.84 ± 0.36; Female: 7.90 ± 0.45
Total	**Male: 41.43 ± 0.51; Female: 43.49 ± 0.52**

(c) Location of the different life stages:

***Euwallacea* sp.** resides in the xylem and spends almost its entire life within galleries of living branches (Walgama, 2012; CABI (2015)). Gallery construction for new broods is done only by females after their dispersal flights (Calnaido, 1965). Each mated female first bores into the woody stem, making a characteristic gallery or tunnel, and lays her eggs within these tunnels. Eggs, larvae, and pupae are all found together in the tunnels. With regard to adults, males are flightless dwarfs and never leave the gallery, a feature common to all known *Xyleborus* species (Browne, 1961, Walgama, 2012). Females remain in the galleries for several days after emergence, mating takes place within the gallery between male and female offspring of the parent female "inbreeding polygynous" (Walgama, 2012). After mating, mated females emerge through the original entrance tunnel and fly to new hosts (CABI (2015)).The fact that mature females emerge from their larval hosts already fertilized, probably accounts for the much higher rate of successful introductions (Atkinson, 2013; Atkinson, 2014)

(d) Temperature/Humidity requirements:

E. fornicatus in Asia has a distribution limited to tropical and subtropical regions. Nevertheless, ***Euwallacea* sp**. in Israel and California is located in Mediterranean climate.

***Euwallacea* spp. spend almost their entire life within their hosts, and thus, they are well concealed against sudden changes of temperatures and humidity** (Walgama, 2012).

According to Walgama & Zalucki, (2007), in Sri Lanka the optimum temperature for development of ***E. fornicatus*** is around 30℃ for all stages, requiring 373 degree-da ys based on the lower development threshold of 15℃ for the development of one generation. Estimates of lower development thresholds were obtained for eggs (15.7±0.5℃), larvae (15.8±0.8℃) and pupae (14.3±1.4℃) and the degree days (DD) for development were 70±4.4, 95±8.5 and 72±5.1 DD, respectively.

Altitudinal distribution of the **THSB** across tea growing areas in Sri Lanka is mainly governed by temperature. Further studies undertaken by Walgama (2008) using the modeling toolkit, DYMEX®, established that ***E. fornicatus*** is a perennial pest, with an elevational range from 200 – 1400 m in Sri Lanka. The temperature dependence of the immature stages suggests that the beetle could be active in a temperature range of 15 – 32ºC and this is amply supported by the general abundance of TSHB across the elevational range above.

(e) Number of generations:

In Sri lanka, based on thermal requirements and the accumulation of degree-days in locations representing major tea growing areas, it is predicted that ***E. fornicatus*** has 2, 6, 9, and 12 generations per year for up country (elevation above 1,200 m), mid country dry zone (eastern slopes at 600–1,200 m), mid country wet zone (western slopes at 600–1,200 m) and the low country (600 m), respectively (Walgama, 2012).

In Israel, several generations per year were also observed. Mendel *et al.*, (2012a) described the stage distribution of ***Euwallacea* sp.** in avocado and castor bean stems sampled in the central coast area. Adults are present on the crop during all the growing cycle, with at least 3 flight peaks in late April or early May, early August and early October (Figure 1). In addition, it presents several overlapping generations after its settlement.

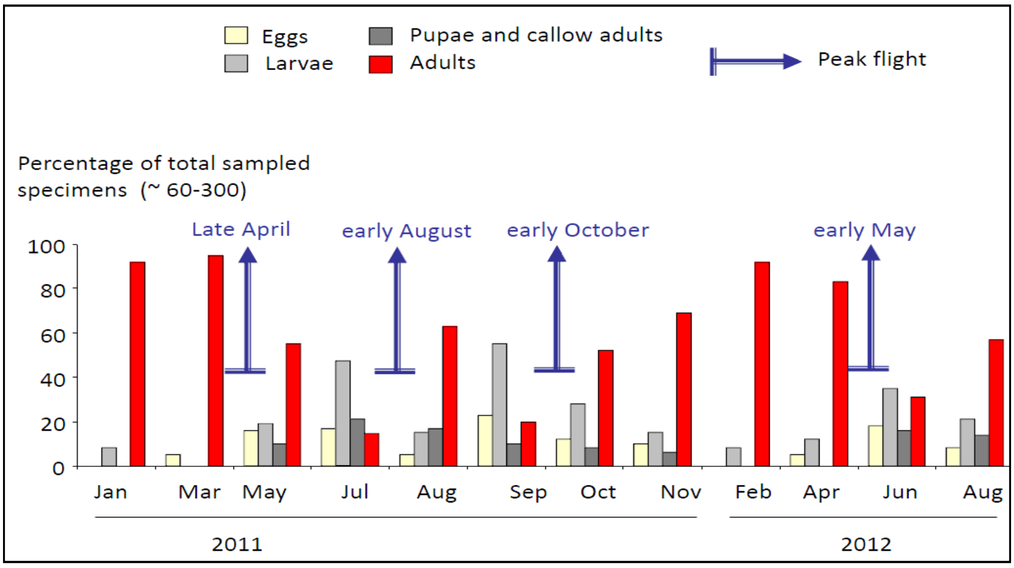

Figure 1. Stage distribution of *Euwallacea* sp. in avocado and castor bean stems sampled in the central coast area of Israel (Mendel *et al.*, 2012a).

2.2. Host plants of Euwallacea sp. morphologically similar to Euwallacea fornicatus

Ambrosia beetles typically attack dead or dying hosts where they are native; however, they are able to kill a healthy tree after a massive attack by the beetles (Ploetz, 2012). On the other hand, there is an atypical colonization of diverse healthy trees as these invasive insect–fungus symbioses are prolific tree-killing in invaded ranges, and are causing significant damage. ***Euwallacaea* sp. is being founded attacking healthy trees and causing dieback in the agricultural, urban, botanical gardens, wildland (including National Forests).** (Eskalen *et al*., 2014c)

Hulcr *et al*.2011b theorised that sudden emergence of pathogenicity is a new evolutionary phenomenon with global biogeographical dynamics. To date, evidence suggests that virulence of the symbioses in invaded ranges is often triggered when several factors coincide: (i) invasion into territories with naive trees, (ii) the ability of the fungus to either overcome resistance of the naive host or trigger a suicidal over-reaction, and (iii) an ‘olfactory mismatch’ in the insect whereby a subset of live trees is perceived as dead and suitable for colonization.

Conifers were likely the ancestral hosts of these insects, but subsequent shifts to angiosperm hosts occurred, many of which were concurrent with the development of the ambrosia beetle lifestyle (Farrel *et al.*, 2001). Some reversion to conifer hosts occurred, but most extent ambrosia beetles are found in angiosperms (Ploetz *et al*, 2013). Ambrosia beetles concentrate nutrients from living xylem tissue, thus allowing the beetles to greatly increase their range of woody hosts (Jordal *et al*., 2000).

E. fornicatus is mainly an important pest of tea in southern India and Sri-Lanka (CABI, 2015; Walgama, 2012); although it also attacks other plants of agricultural value as avocado, cocoa, citrus, rambutan, macadamia, castor, quinine and rubber (Browne, 1961; Walker 2008). Danthanarayana (1968) lists in Asia 99 species in 36 families, and states that this list could be further extended. Among the host families, the Leguminosae, Verbinaceae, Moraceae and Euphorbiaceae seem to have a general attraction for the beetle.

A study conducted by Eskalen *et al.* (2013b), to determine the plant host range of *Euwallacea* sp. in two heavily infested botanical gardens in southern California (Los Angeles (LA) Arboretum and The Huntington Library, Art Collections and Botanical Gardens) suggest the beetle–disease complex potentially may establish in a variety of plant communities locally and worldwide. Currently, the plant host range has increased since 2012 to 2014: the number of tree species prone to attack by both the beetle and *F.euwallaceae* increased from 111 to 139, and the number of trees susceptible to the beetle itself increased from 207 to 303. The number of tree species that function as reproductive hosts for PSHB has increased from 19 to 33, representing 15 plant families, and including 12 species that are native to California (Lynch *et al*, 2014).

In this study, the different outcomes of *Euwallacea* sp. attacks that have been observed are from less to more damaging:

I. The beetle is repealed, and *Fusarium* sp. is not able to infect the tissue.
II. The beetle drills into the tree and there is fungus infection but the beetle does not produce offspring on the tree. An attempted beatle attack may serve as an infection site for *Fusarium* sp. damaging the tree.
III. The beetle drills into the tree, there is fungus infection and the beetle reproduces in the tree (**real host ([=reproductive host] [=true host])**). All tree species considered to be reproductive hosts had severe branch dieback, and the death of mature reproductive hosts that were infested with Fusarium Dieback was observed for *Quercus robur, Acer negundo*, and *R. communis. A. negundo* and *Q. robur* also exhibited leaf wilting and discoloration on the branches prior to dieback and tree death.

All of them can produce damage in the tree. Nevertheless, reproductive hosts suffer the most severe decline symptoms; There is a correlation between severity of the beetle attack (which thereby increases severity of infection by *Fusarium* sp.) and the observed dieback. Even on known hosts of the fungus, tree infection required penetration into at least the cambium layer, which generally varied in depth below the outer bark between species; ie: infection is most likely due to susceptibility of the tree to the fungus if the beetle is able to penetrate into or through this critical layer of tissue. Over time, infection by *Fusarium* sp. may lead to tree death in some species.

Tree susceptibility is ranked according to three main parameters: frequency of attack, gallery density and offspring production. Differences in susceptiblility to the beetle and the fungal symbiont complex were observed between several avocado varieties in the following order (most affected to least): Fino > **Hass**>Reed> Pinkerton> nabal> Ettinger + Fuerte> Galir + Ardit. (Mendel & Freeman, 2015)

In Annex 3, it is included a list of most of the species that have been reported being attacked by any *Euwallacea* sp. morphologically similar to *Euwallacea fornicatus*, including real and not-real hosts. Nevertheless, due to all the above mentioned, the list probably would be broader (Eskalen *et al.* 2013a).

2.3. Symptoms

Each host tree shows different symptoms mostly depending on the response to the fungus infection.
Attack symptoms, a host tree's visible response to stress, vary among host species. Staining, sugary exudate, gumming, and/or frass may be noticeable before the tiny beetles (females are typically 1.8-2.5 mm long). Beneath or near these symptoms the beetle's entry/exit holes, which are ~0.85 mm in diameter may also be seen. The abdomen of the female beetle can sometimes be seen sticking out of the hole.(Eskalen 2015)

Symptoms of *Euwallacea* sp. described in Asia:

In tea:
Beetle boring into tea leads to two forms of injury. Mechanical injury to the plant occurs during the construction of the galleries in the stems which results in breakage of shoot bearing branches. A secondary injury is the debilitation of the wood frame. This injury can be classed in two types: 1) die back and 2) wood rot. Branch breakages and die back facilitate the entry of wood rot. Wood rot describes the decayed condition of woody parts of stem brought about mainly by fungi and accumulation of wood rot in bush frames leads to debilitation and premature death of tea bushes (Walgama, 2012).

In pomegranate:
In *Punica granatum* in India, *E. fornicatus* has become a major pest infesting the collar region of the plant. Innumerable pin or shot holes made by the pest in the conducting vessels affect water conduction the upper portion of the plant. Consequently, the twigs dry off. The drying progress from the tip towards the base and in severe cases the entire plant dried up (Balikai *et al*., 2011).

Symptoms of *Euwallacea* sp. described in a huge amount of hosts in California:

Description and images of symptoms in California are available in a Field Identification Guide published by the Univerity of California (Eskalen *et al*, 2014a)

Symptoms described in avocado in Israel:

According to Mendel *et al.*, (2012b;), stems and branches of various diameters (from 2 to >30 cm, corresponding to 1- to 30-yr-old growth) may become infested by the beetle. Newly infested trees exhibited few external symptoms. The most obvious was discoloration of an area of the outer bark surrounding the penetration spot which was covered by a large amount of the white powdery exudate. While there was no visible injury to the cortex at this stage of colonization, examination of the wood under the infested spot bored by the beetle, revealed a brownish staining of the xylem and necrosis caused by the fungus. Additional symptoms include: (i) wilting of branches and discoloration of leaves; (ii) branches with heavy yield break down often in heavily infested plantations; branches are frequently broken at the section where the beetle galleries are located and (iii) death of young and mature trees.
Successful reproduction occurs mainly in thin branches, and attacks on the stem and large diameter branches do not terminate in brood galleries. (In other suitable reproductive trees such as *Quercus* spp., *Acer negundo* or *Platanus* spp. the beetle attack and establishment is more successful on the trunks and large diameter branches. After the emergence of adults, small tubes of compacted sawdust can be observed. The thin branches usually desiccate after about two beetle generations. In tree species where the beetle colonizes much larger branches, they survive for longer periods, and may produce more generations before moving to a new breeding site (branch, tree or plantation) (Mendel & Freeman, 2015)

This pattern of tree colonization comparison of different host trees, may partly explain why reproductive success also varies among suitable hosts. **Some tree species produce large number of beetles which eventually emerge and disperse during a rather short period**, **when the tree succumbs to the mass beetle colonization and dies** (i.e: successful colonization aimed at the stem and the main thick branches). Avocado trees behave differently and **produce relatively low numbers of beetles for a certain period, while emergence continues over a long time which may last a few years** (i.e: successful colonization in thin woody branches).(Mendel *et al*. 2014)

2.4. Detection and identification (note if a diagnostic protocol is available). State if and how the pest can be trapped.

(a) Detection methods

There are different kinds of traps that can be used to capture ambrosia beetles. In a study focused on the efficiency of different traps (i.e.: funnel vane trap, cross vane trap and sticky board trap), the most effective was a multiple funnel trap with synthetic attractants added to the first funnel (James, 2007). Traps are generally most effective when placed low to the ground (Reding *et al.* 2010). Traps with 8 funnels are named Lindgren.

Hulcr *et al.*, (2011a) showed that ambrosia beetles are attracted to volatiles from their fungal symbionts. After recent research, the lure that is currently being used is Quercivorol (1-methyl-2-cyclohexen-1-ol). This lure is developed from aggregation pheromone (males) of *Platypus quercivorus* vector of Japanese oak wilt. (Carrillo *et al*. 2005)

Monitoring should include looking for the many signs of beetle in tree nurseries, arboreta, highway rest-areas, and semi-urban forested area, near to places considered of high-risk for importation, movement, or establishment of exotic species, and in proximity to ports-of-entry (Lightle *et al.*, 2007).

Visual detection is difficult, according to the biology of the pest and due to the fact that it is difficult to detect early stages of infestation.

(b) Identification/Diagnose protocol

As it was explained in point 1 (Taxonomy) and **Annex 2,** most challenging aspects of research on the identification of *Euwallacea sp.* morphologically similar to *E.fornicatus* and their fungal symbionts have been defining taxonomic units, particularly species. It is important to identify both, the species and the fungus since it is the latter who finally kills the tree.

O'Donnell *et al*, 2014a isolated total genomic DNA from the female beetles and from the mycelium of each Fusarium in the mycangia and carried out a phylogenetic analyses and a cophylogenetic analysis of the Euwallacea-Fusarium mutualism.

Comparing *F. ambrosium* and *F.euwallaceae*, both exhibit distinctive ecologies and produce calvate macroconidia, and comprise a genealogically exclusive lineage within Clade 3 of the *Fusarium solani* species complex (FSSC) that can be differentiated with primed PCR. Currently, these fusaria can also be distinguished only phenotypically by the abundant production of blue to brownish macronidia in *F.euwallaceae* sp.nov and their rarity or absence in *F. ambrosium*. (Freeman *et al*. 2013b). Nevertheless, recent research from O'Donnell (2013), shows that there are other species of Fusaria and other species that can be associated with *Euwallacea* sp. (See point 1-Taxonomy and **Annex 2**)

3. Is the pest a vector?

Yes ☒ **No** ☐

Yes, the beetle bores into a tree to create tunnels (galleries) for its eggs and larvae and, in the process, inoculates the tunnels with its symbiotic fusaria in order to feed them. Subsequently fusaria clog the surrounding water conducting tissue, or xylem.

4. Is a vector needed for pest entry or spread?

Yes ☐ **No** ☒

The genus *Euwallacea* as an ambrosia beetle, do not need a vector but it is closely associated with its symbiotic fungi as adults and larvae feed on it.

5. Regulatory status of the pest

Any species of the genus *Euwallacea* do not appear in the EPPO alert list. Nevertheless, in the 46th meeting of the Panel on Phytosanitary Measures celebrated in Changins-Wädenswills (Switzerland, 2012) there were suggested emerging pests that could be added to the alert list, being *E. fornicatus* one of them.

Directive/2000/29/EC includes in Annex IIAI *Scolitydae* spp. (non-European) as organism banned on plants of conifers, over 3 m in height, other than fruit and seeds, wood of conifers with bark and isolate bark on conifers originating in non-European countries, but *Euwallacea* spp. morphologically similar to *E.fornicatus* has mainly been reported attacking non-conifer species. **There are no conifers reported as real hosts.** There have been some pinaceae and some cupresaceae attacked by *Euwallacea* sp. in California, but only *Juniperus chinensis* and *Metasequoia glyptostroboides* were susceptible to Fusarium dieback. None of them is a real host. (Eskalen *et al*., 2013a)

Euwallacea fornicatus is included in the A1 list in other Regional Protection Organizations as **CAN** (1992), **OIRSA** (1992), **East Africa** (2001) and **Southern Africa** (2001).

In the U.S.A, the APHIS-USDA (coordinates a program for Early Detection and Rapid Response to Non-Native Bark and Ambrosia Beetles (Rabaglia *et al.*, 2008). In addition, PSHB is a Q-rated[1] pest which is a temporary designation of a pest that is suspected to be of economic importance: if it is found on nursery stock during inspections the plants would be placed on hold for treatment or destruction. (NPAG 2013). In 2015 Leathers concludes that "*PSHB is expected to have significant economic and environmental impacts as it expands its range in California. However, an "A"-rating[2] is not justified because the pest has been present in the state since 2003 and is not under official control. A "B"-rating[3] is justified*". (Leathers, 2015; CDFA, 2015)

In Mexico, it has phytosanitary requirements for plants of pomegranates (*Punica granatum*) from the U.S.A. and it was included in the NOM-EM-FITO-007-1994 for plant material for propagation as *Xyleborus fornicatus* in buds or budwoods of *Hevea brasiliensis* from Malaysia. Recently, SAGARPA (Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food) and SENASICA (Directorate General of Plant Protection) have implemented a National emergency program and an Action Plan against Ambrosia-complexes: *Xyleborus glabratus-Raffaelea lauricola* and *Euwallacea fornicatus-Fusarium* sp. (SAGARPA-SENASICA 2013; 2015)

1 A "Q" rating is assigned to an organism or disorder requiring a temporary "A" action pending determination of a permanent rating. The organism is suspected to be of economic importance but its status is uncertain because of incomplete identification or inadequate information. In the case of an established infestation, at the discretion of the Director, the Department may conduct surveys and may convene the Division Pest Study Team to determine a permanent rating.

2 An "A" rating is assigned to an organism of known economic importance subject to state (or commissioner when acting as a state agent) enforced action involving: eradication, quarantine regulation, containment, rejection, or other holding action.

3 A "B" rating is assigned to an organism of known economic importance subject to: eradication, containment, control or other holding action at the discretion of the individual county agricultural commissioner OR; An organism of known economic importance subject to state endorsed holding action and eradication only when found in a nursery.

6. Distribution

Taxonomy and distribution of every species within the species of *Euwallacea* that are morphologically similar to *E.fornicatus* is no clear.This table shows the reports of all of them as a whole. It must be noticed that it is present in all the continents except Europe.

Table 2: Distribution of *Euwallacea* sp. morphologically similar to "*Euwallacea fornicatus.*

Continent	***Distribution*** *(list countries, or provide a general indication , e.g. present in West Africa)*	***Provide comments on the pest status in the different countries where it occurs*** *(e.g. widespread, native, introduced….)*	***References***
Africa	Comoros - Grande*	Present, no details Introduced	CABI (2015) *Wood & Bright (1992)
	Madagascar	Present, no details Introduced	CABI (2015) EPPO (2015)
	Réunion Island -Niue*	Present, no details Introduced	CABI (2015) EPPO (2015) *Wood & Bright (1992)
	Sierra Leona	Unreliable record	CABI (2015)
	South Africa	(PSHB)	Mendel & Freeman (20015) (pers. com. from Stouhamer and Eskalen)
America	United States of America (USA)		CABI (2015); Thomas, (2005); Spann, (2013a; b; c); Stouthamer *et al*., (2012a); UCR-Eskalen Lab Web (2015)
	Florida**	First reports in Florida in 2000 and 2003 Miami-Dade County and Homestead (*Euwallacea sp.*morphologically similar to *E. fornicatus* in *Persea americana)* **	** Freeman *et al.* (2013a; b) Carrillo *et al.* (2005)
	California**	Los Angeles, Orange, San Bernandino, Riverside and San Diego counties **; Santa Cruz County (a single insect in 2014) (PSHB, KSHB, other Euwallacea sp.)	** Eskalen *et al.* (2013a); Pittalwala (2013) UCR-CISR 2014; UCR-Eskalen Lab Web (2015) Tjosvold, S. 2014
	U.S.A. Hawaii	Present, no details (TSHB)	EPPO (2015) Leathers, 2015
	Brazil	Present, no details	Coleoptera Neotropical, (2014a)
	Panama -Colón-San Lorenzo Protected Area -Panamá-Camino del Oleoducto	Present, no details Introduced	CABI (2015) EPPO (2015) Kirkendall *et al.* (2007) Coleoptera Neotropical, (2014b)

Continent	***Distribution*** *(list countries, or provide a general indication , e.g. present in West Africa)*	***Provide comments on the pest status in the different countries where it occurs*** *(e.g. widespread, native, introduced….)*	***References***
	Colombia	Present, no details	Coleoptera Neotropical, (2014c)
	Costa Rica (Eastern part) -Heredia	Established	Kirkendall *et al.* (2007)
	Venezuela	Present, no details	Coleoptera Neotropical, (2014d)
Asia	Bangladesh*, Burma* Cambodia, China (Guangdong*, Sichuan*, Tibet*, Yunnan*) Hong Kong Indonesia (Java*, Kalimantan, Sumatra*), Laos, Myanmar, Philippines (Rizal*) Sri Lanka (Kandi**, Peradeniya* Ratnapura** Talawakelle**, Sri Lanka*), Taiwan*, Thailand★ Vietnam	Present, no details Native to India and Sri Lanka and through Malaysia to Indonesia *Firt report in Sri Lanka in 1892, at Craighead estate, Nawalapitiya identified as Xyleborus fornicatus Eichh.* (*Euwallacea sp.*morphologically similar to *E. fornicatus* in in *Camellia sinensis)* ** (PSHB) (PSHB)	EPPO (2015) CABI (2015) *Wood & Bright (1992) ★ Spann (2013c) ** Freeman *et al.* (2013a; b) Sivapalan, 1985
	India (in saplings), (Assam*, Bengal*, Karnataka, Kerala, Maharashtra*, Tamil Nadu*, Uttar Pradesh*, West Bengal) Malaysia (Peninsular Malasya, Kelantan** Pasoh**,	Present, widespread	EPPO (2015) *Wood & Bright (1992) **Browne, (1961)

Continent	***Distribution*** *(list countries, or provide a general indication , e.g. present in West Africa)*	***Provide comments on the pest status in the different countries where it occurs*** *(e.g. widespread, native, introduced….)*	***References***
	Sabah, Sarawak)		
	Japan (Bonin Island; Ryukyu Archipelago,)	Restricted distribution	EPPO (2015)
	Israel	(PSHB) It was first recorded in Israel in 2009 It is present in central coastal region of Israel and the northern Negev. Currently, it has also been found in the Upper Galilee at Kibbutz Hagoshrim (*Euwallacea sp.*morphologically similar to *E. fornicatus* in *Persea americana* (avocado) and in Acer negundo (Nordia))	Mendel *et al* (2012a;b;c) Arpaia & Obenland (2013) Freeman *et al.* (2013a; b)
	Brunei Darussalam	Unpublished records	R.A. Beaver, Chiangmai, Thailand, personal communication, (2004), as cited in CABI (2015)
Europe	-----	------	-----
Oceania	Australia	Present, no details Sunshine Coast, Queensland (*Euwallacea sp.*morphologically similar to *E. fornicatus* in *Persea americana)* Introduced Established	EPPO (2015) Campbell and Geering (2011). Freeman *et al.* (2013a; b) Walker 2008
	Fiji Micronesia Papua New Guinea Samoa Solomon Islands Vanuatu	Present, no details Introduced	CABI (2015)
	Palau	Present, no details	CABI (2015)
	New Caledonia	Unpublished records	RA Beaver, Chiangmai, Thailand, personal communication, (2004), as cited by CABI (2015)
	Niue	Present, no details. Introduced	CABI (2015)

7. Host plants and their distribution in the PRA area

In the PRA area there are many agricultural, forest and urban species that could be attacked. It includes real hosts, but also non-real hosts that nevertheless could be infested by the symbiont fungi (see point 2.2) **(e.g: avocado, citrus, olive, peach, kaki, grape, pomegranate, *Populus* sp., *Quercus* sp., *Salix* sp., *Fagus sylvatica*, among many others.**

From the table of hosts showed in **Annex 3**, there have only been chosen those marked as real hosts since they are much more affected than those that only get fungus infection, or only get a trying attack. They are collected in the following table, where they have been highlighted those which are present in the PRA area .

All the species in table 3 need to be analized as a possible origin of the risk:

Table3: Real hosts of *Euwallacea* sp. (also named in the literature as "Reproductive hosts" or "True hosts")

Host scientific name (common name)	Present in EU	Common Use	Comments	Reference
Acacia spp.(Acacia)	Yes	Ornamental trees	Ornamental and wood	
Acacia visco (Arca)	No	Ornamental trees or trees for wood	Originated to South America	
Acer buergerianum (Trident maple)	No	Ornamental	Native to eastern China and Japan. It is also used as bonsai	Missouri botanical garden (2014)
Acer macrophyllum (Big leaf maple)	No	Ornamental trees or trees for wood	Native to western coast of USA. Other relevant uses, wood	Cal Poly (2014a); López González (2006)
Acer negundo (Box elder)	Yes	Ornamental trees or trees for wood	Native to California (USA). Widespread in EU. Other relevant uses, wood	CABI (2015)
Acer palmatum (Japanese maple)	No	Ornamental trees	Native to Asia. It is also used as bonsai	López González (2006)
Acer paxii (Evergreen maple)	No	Ornamental trees	Native to southwestern China. It is also used as bonsai	Cal Poly (2014b)
Afrocarpus falcatus	No	Ornamental trees or trees for wood	Native to Africa. Other relevant uses, wood	Chudnoff (1979); Hodel (2012); World Agroforestry Center (2013k)
Albizia falcata	No	Ornamental trees or trees for wood	Native to the eastern islands of the Indonesian archipelago and New Guinea. Other relevant uses, wood	Chudnoff (1979); NewCrops, (2013)
Albizia julibrissin (Silk tree)	Yes	Ornamental trees	Widely distributed in EU	CABI (2015); López González (2006)
Alectryon excelsus (Titoki tree)	No	Ornamental trees	Native to New Zealand	New Zealand native plants (2013)
Alianthus altissima (Tree of heaven)	Yes	Ornamental trees or trees for wood	Invasive. Originated in China, ailanthus was planted throughout Europe and the United States during the nineteenth century	California Invasive Plant Council (2013)
Alnus rhombifolia (White Alder)	No	Ornamental trees or trees for wood	Commonly occurring species in the western United States	IUCN Red List of Threatened Species. 2015
Artocarpus integer (Jack tree, cempedak)	No	Ornamental trees or trees for wood	Native to India and Sri Lanka. The unripe fruit is used as a vegetable or is made into pickle. In Kerala and Bengal in India, the leaves are lopped for fodder. Other relevant uses, wood	Chudnoff (1979); World Agroforestry Center (2013b)
Azadiractha indica (Neem tree)	No	Ornamental trees or trees for wood	Native to Afghanistan, Pakistan, India, Sri Lanka, Bangladesh, Myanmar and China. Relevant uses, insecticide, wood	Chudnoff (1979); CABI (2015)
***Brachychiton populneus* (Kurrajong)**	No Aisolated ornamental trees in Spain	Ornamental trees	Native to Australia.	
Camellia semiserrata	No	Ornamental trees		UCR 2015
Camellia sinensis (Tea)	No*	Cultivated plants	(Present in Azores Islands (Portugal); not included in the PRA area *Present in UK, (100-acre (40 ha aprox.) in Tregothnan Estate near Truro, Cornwall where it has been growing tea since 2000 and is being	FAOSTAT (2015) *https://tregothnan.co.uk/about/tea-plantation/

Host scientific name (common name)	Present in EU	Common Use	Comments	Reference
			sold locally. Now it is to supply supermarkets.	
Canarium commune (Java almond) [Canarium indicum var. *indicum*]	No	Ornamental trees or trees for wood	Native to eastern Indonesia, Solomon Islands, Papua New Guinea, Vanuatu. Other relevant uses, nuts, medicine, wood	Agroforestry (2013); Chudnoff (1979); World Agroforestry Center (2013l)
Castanospermun australe (Black bean)	No	Ornamental trees or trees for wood	Native to Australia. Other relevant uses wood	World Agroforestry Center (2013c)
Cercidium floridum (Blue Palo Verde)	No	Ornamental trees	Native to the American southwest and northern Mexico	Arid Zone Trees (2013)
Cercidium sonorae (Brea tree)	No	Ornamental trees		UCR-Eskalen Lab Web 2015.
Citrus spp.	Yes	Cultivated plants	Major crop in EU. Cultivated for fruit. Othe relevant uses, ornamental tree	CABI (2015)
Crotalaria striata (Smooth rattlebox)	No	Wild plants/Weed	Associated with citrus groves	Watson (1931)
Crotalaria usaramoensis	No	Cultivated plants	Native to Mozambique and Tanzania. Cultivated as fodder.	Dantharanayana (1968); World Agroforestry Center (2013a)
Cupaniopsis anarcardioides (Carrotwood)	No	Ornamental trees	Native to northern and eastern regions of Australia	CABI (2015)
Erythrina corallodendrum (Coral tree)	No	Ornamental trees or trees for wood	Native to Asia. Other relevant uses, wood, medicine, folklore	CABI (2015)
Erythrina humeana (Dwarf coral tree)	No Aisolated trees	Ornamental trees	Native to Southafrica	
Eucaliptus ficifolia (Red flowering gum)	No	Ornamental trees	Native to Australia	University of Florida (2013a)
Ficus carica (fig)	Yes	Planted		CABI (2015)
Ficus toxicaria	No	Ornamental trees	Native to Asia	Dantharanayana (1968)
Geijera parviflora (Wilga)	No	Ornamental trees	Native to Australia	Hodel (2012); University of Florida (2013b)
Gmelllina arborea (Candahar)	No	Ornamental trees or trees for wood	Native to Asian southeastern. It is a woody species of great commercial and ecological interest due to its rapid growth and the timber´s quality	Álvarez *et al.*(2011), World Agroforestry Center (2013d)
Grevillea robusta (Silky oak)	Yes	Ornamental trees or trees for wood	Present in Cyprus. Other relevant uses, wood	CABI (2015); Chudnoff (1979); López González (2006)
Hevea brasiliensis (Rubber tree)	No	Ornamental trees or trees for wood	Native to South America. Relevant use, rubber and wood	CABI (2015) ; Chudnoff (1979)
Ilex cornuta (Chinese holly)	No	Ornamental trees or trees for wood		University of Arkansas (2013)
Inga vera (River koko)	No	Ornamental trees or trees for wood	Native to Dominican Republic, Haiti, Jamaica, Puerto Rico. Other relevant uses, wood	World Agroforestry Center (2013e)
Koelreuteria elegans (Flamegold)	No	Ornamental trees	Native to Asia	University of Florida (2013c)
Liquidambar styraciflua (Liquidambar, Sweet gum)	Yes	Ornamental trees or trees for wood	Other relevant uses, wood	CABI (2015); López González (2006)
Litchi chinensis (Lychee)	Yes	Cultivated plants	Minor crop in EU. It is present in Spain. Cultivated for fruit	García (1990)
Magnolia grandiflora (Southern magnolia)	Yes	Ornamental trees		López González (2006)

Host scientific name (common name)	Present in EU	Common Use	Comments	Reference
Mimosa bracaatinga	No	Ornamental trees or trees for wood	Native to Brazil. Other relevant uses, wood	World Agroforestry Center (2013f)
Moringa oleifera (Horse raddish tree)	No	Cultivated plants	Native to Asia. Cultivated for fodder	US Forest Service, (2013a)
Nephelium lappaceum (Rambutan)	No	Cultivated plants	Native to Asia. Cultivated for fruit	CABI (2015)
Paraserianthes falcataria (Moluca, albizia)	No	Ornamental trees or trees for wood	Native to Haiti, Indonesia, Papua New Guinea, Solomon Islands. Other relevant uses, wood	World Agroforestry Center (2013g)
Parkinsonia aculeata (Palo verde)	Yes	Ornamental trees or trees for wood	Present in Spain, Italy and Greece. Other relevant uses, wood	CABI (2015)
Persea americana (Avocado)	Yes	Cultivated plants	Minor crop in EU. Portugal (10.981 ha), Spain (10.558 ha), Greece (412 ha), Cyprus (99 ha), France (3 ha). Cultivated for fruit. Other relevant uses, ornamental tree	CABI (2015) ; FAOSTAT (2015)
Persea bombycina (Som)	No	Cultivated plants	Native to Asia. Cultivated for breeding the silkworn	Kumar *et al.* (2011)
Pithecelobium lobatum	No	Ornamental trees or trees for wood	Native to southeast Asia	Bunawan *et al.*, 2013
Platanus acerifolia (London Plane)	Yes	Ornamental trees or trees for wood	Widespread in EU. Other relevant uses, wood	CABI (2015)
***Platanus mexicana* (Mexican sycamore)**	No	Ornamental trees		
Platanus racemosa (Californica sycamore)	No	Ornamental trees	Native to California (USA)	UCR, 2015
Protium serratum	No	Ornamental trees or trees for wood	Other relevant uses, wood	Chudnoff (1979), Dantharanayana (1968)
Polulus fremontii (Cottonwood)	No	Ornamental trees	Ornamental	USDA_NRCS (2015)
Polulus nigra (Black Polar)	Yes	Ornamental trees or trees for wood	The natural distribution of P. nigra ranges from western, central and southern Europe to West and Central Asia, reaching the Yenisei River in Siberia. It is also found in isolated localities in North Africa (FAO, 1980; Allegri, 1971).	CABI (2015) EUFORGEN, 2015a
Polulus trichocarpa (Black cottonwood)	No	Ornamental trees	Native to western North America. It is used for timber,	USDA_NRCS (2015) http://www.na.fs.fed.us/pubs/silvics_manual/volume_2/populus/trichocarpa.htm
Prosopis articulate (Mesquite)	No	Ornamental trees	Native to California (USA)	USDA_NRCS (2015)
Punica granatum (Pomegranate)	Yes	Cultivated plants	Minor crop in EU. Spain (2.325 ha), it is also present in Belgium and Cyprus. Cultivated for fruit. Other relevant uses, ornamental tree	CABI (2015) , Melgarejo, Pablo (2007)
Quercus agrifolia (California coast live oak)	No	Ornamental trees	Native to California (USA)	US Forest Service (2013b)
Quercus engelmanni (Engelmann oak)	No	Ornamental trees	Native to California (USA)	UCR, 2015
Quercus lobata (Valley oak)	No	Ornamental trees	Native to California (USA)	UCR, 2015
Quercus robur (English oak)	Yes	Ornamental trees or trees for wood	Widespread in EU. Other relevant uses, wood	CABI (2015) EUFORGEN, 2015b
Ricinus communis (Castor bean)	Yes	Cultivated plants	Minor crop in EU. Present in Austria, France, Poland and Spain. Cultivated for industrial use (seed oil)	CABI (2015)
Robinia pseudoacacia (Black locus)	Yes	Ornamental trees or trees for wood	Widespread in EU. Other relevant uses, wood	CABI (2015)

Host scientific name (common name)	Present in EU	Common Use	Comments	Reference
Salix babylonica (Weeping willow)	Yes	Ornamental trees or trees for wood	Widespread in EU. Other relevant uses, wood	CABI (2015)
Salix gooddingii (Goodding's black willow)	No	Ornamental trees	Native to California (USA)	USDA_NRCS (2015)
Salix laevigata (Red willow)	No	Ornamental trees	Native to USA (southern Oregon & northern Nevada, south through California, Arizona)	California Native Plant Society (2013)
Salix lasiolepsis (Arroyo willow)	No		Native to USA and Mexico	
Salix matsudana (Corkcrew willow)	Yes	Ornamental trees	Native to Asia. Present in EU	University of Florida (2013d)
Salix nigra (Black Willow)	Yes		Native to USA	CABI, 2015
Schleichera oleosa (Kesambi, Macassar oil tree)	No	Cultivated plants	Native to Asia. Cultivated for fodder	HEAR (2014)
Shorea robusta (Sal)	No	Ornamental trees or trees for wood	Native to India, Myanmar, Nepal. Uses, fodder, food and wood at origin. Possibly ornamental tree in EU	Chudnoff (1979); World Agroforestry Center (2013h)
Spondias dulcis (Polynesian plum)	No	Cultivated plants	Native to Asia. Cultivated for fruit	FAO (2009)
Tephrosia candida	No	Cultivated plants	Native to Asia. Cultivated for fodder	World Agroforestry Center (2013i)
Tephrosia vogelii	No	Cultivated plants	Native to tropical Africa. Cultivated for insecticide and medicinal use	World Agroforestry Center (2013j)
Theobroma cacao (Cocoa)	No	Cultivated plants	Native to Central America. Cultivated for fruit	CABI (2015)
Ulmus parvifolia (Chinese elm)	No	Ornamental trees or trees for wood	Native to Asia. It is also used as bonsai. Other relevant uses, wood	Oklahoma forestry services (2013)
Wisteria floribunda (Japanese wisteria)	Yes	Ornamental trees or trees for wood	Ornamental. Native to Japan	Encyclopedia Of Life (2015)

In addition, there are non-real hosts of *Euwallacea* sp. present in the PRA area that, although the beetle can not reproduce in them, they could be affected by the symbiont fungi: i.e: *Betula pendula, Fagus sylvatica, Quercus ilex, Quercus suber, Vitis vinifera, Prunus persica, Olea europaea, Diospyros kaki,* among others.

8. Pathways for entry

It is not known how these beetles originated in Asia have reached new areas, although it is thought that plants for planting and packing crates (Wood Packaging Material-WPM) could have been probable pathways for entry. Thus, Asia (as place of origin) and many other parts of the world where *Euwallacea* sp. (*Euwallacea fornicatus*-like) have been reported are possible origins to take into account for the studied pathways into the EU.

In the USA, port interceptions of *Xyleborus* sp. (since 2006) include wood packaging material (dunnage, pallets, crating), and hitchhiking in fruit, cut flowers, and plant parts; interceptions were primarily on general or permit cargo (Agricultural Quarantine Activiy System-USDA (AQAS 2012) cited in NPAG, 2013).

In the EU, there are frequent interceptions of "**Scolitidae**" in "wood and bark" and "packaging material". (EUROPHYT 2015)

Assessors have only taken into account real hosts as pathways of entry because they are able to carry out both the beetle and the fungus therefore posing a higher risk.

Therefore, non-real hosts have not further been studied as a pathway of entry since the beetle is repealed and the likelihood of being associated with the commodity is very low. As explained in point 2.2., there can be two kind of situations with non-real hosts where the beetle is repealed, and it si not probably associated with the commodity:

- The beetle can attack the plant, but it is not able to grow the fungus in it. Neither the beetle or the fungus is able to reproduce in the plant.

- The beetle can attack the tree without producing offspring. Nevertheless, the tree can get infected by the fungus Transfer from this plants is not possible since the fungus would need the beetle inside as a vector.

Nevertheless, if a non-real hosts, became a real-host, it should be included in the list of hosts to take into account.

On the other hand, tables 4 and 5 show real hosts not further considered as a pathway of entry for the pest because they have not relevant economic importance (Table 3), or because they are traded as commodities that are not liable to carry the pest (Table 4)

Table 4. Real hosts of *Euwallacea* spp. **without relevant economic importance**. International trade unlikely, thus not considered as a pathway of entry for the pest.

Species	Comments
Crotalaria striata (Smooth rattlebox)	Weed associates to citrus groves

Table 5. Real hosts of *Euwallacea* spp. commonly traded as **commodities that are not liable to carry the pest**. Therefore, they are not considered as a pathway of entry for the pest.

Cultivated for	Species
Fruit	*Nephelium lappaceum* (Rambutan), *Theobroma cacao* (Cocoa)
Fodder	*Crotalaria usaramoensis*, *Moringa oleifera*, *Tephrosia candida*, *Schleichera oleosa*
Industrial use	*Ricinus communis* (Castor bean)
Other uses (See point 7)	*Persea bombycina* (Som), *Tephrosia vogelii*

More likely pathways and therefore further studied:

Pathway: Plants for planting (except seeds) of reproductive host species from where *Euwallacea* sp. (*Euwallacea fornicatus*-like) occurs.

Reasons for considering this pathway:

Plants for planting of host plants can support all life stages of *Euwallacea* sp.

The ambrosia beetle commonly attacks the main stem and larger branches of trees and shrubs, but **injury can be found on branches and twigs as small as 2 cm or 2.5 cm in diameter.** (Mendel *et al.*, (2012b), Coleman *et al.* 2013).

During the past two decades, several species within this genus (including *E. fornicatus, E. validus* and *E. interjectus)* have been introduced from their native areas in Asia into Israel, Central America, Oceania and several different locations within the USA, presumably on infested wood packaging or **plant material.**

Fusarium euwallaceae was found in one nursery in California, indicating that PSHB could have been present. (Leathers, 2015)

Assessors have not found available data on trade of plants for planting of the specific real host species from those countries where *Euwallacea* sp. occurs into the EU. Data found in FAOSTAT, have been included in **Annex 6**, but it is not possible to make a proper searching for data of the relevant hosts imported.

Higher volumes of imports are from Asia [taric codes that may include deciduous trees or bushes or woody plants for planting] have been 27,864.00; 23,303.90; 21,248.00; 17.288,80 and 16.515,40 tonnes (years 2010, 2011, 2012, 2013 and 2014 respectively). (see **Annex 6**)

Pest already intercepted on the pathway?

Not in the EU

Pathway prohibited in the PRA area?

According to Council Directive 2000/29/EC The common characteristic of all plants for planting is the requirement of a phytosanitary certificate to entry into the EU. In addition, **consignments are inspected in both the port of origin and the port of entry. Nevertheless, the pest is hard to detect and these measure would not prevent the entry of *Euwallacea* spp.**

Prohibitions and restrictions have been studied in detail in **Annex 5**.

Consequently, plants for planting of reproductive hosts from where *Euwallacea* sp. is present may pose a risk of entry of *Euwallacea* sp. (morphollogycally similar to *E.fornicata*), except the following that are regulated in the EU legislation:

- plants of *Citrus* L.;
- plants of *Quercus* L. with leaves;
- plants of *Acer* spp., *Alnus* spp., *Platanus* spp., *Populus* spp., *Salix* spp. and *Ulmus* spp. originating in countries where *Anoplophora chinensis* is present (e.g: China, Indonesia, Japan, Korea Dem. People´s Republic, Korea republic, Malaysia, Myanmar, Philippines, Taiwan and Vietnam).
- plants of *Acer* spp., *Alnus* spp., *Koelreuteria* spp., *Platanus* spp., *Populus* spp., *Salix* spp. and *Ulmus* spp. originating in countries where *Anoplophora glabripennis* is present (e.g: USA, China, Korea).

Pathway: Wood(*)(round or sawn, with or without bark) of reproductive host species from where *Euwallacea* sp. (*Euwallacea fornicatus*-like) occurs.

(*)wood within the meaning of Article 2(2) of Directive 2000/29/EC, other than wood packaging material, including wood that has not retained its natural round surface

Reasons for considering this pathway:

All life stages may be present in round wood and sawn wood (with or without bark). In addition, there is trade of both types of commodities from where *Euwallacea* sp. occurs into the PRA area:

Industrial round wood (no conifer species of origin other than tropical). One of the most important exporters is USA, which exported 602,898.00 m^3 of this commodity to EU (28 countries) in 2011 (FAOSTAT, 2014).

Industrial round wood (no conifer species of tropical origin). One of the most important exporters is Malaysia, which exported 29,068.00 m^3 of this commodity to EU (28 countries) in 2011 (FAOSTAT, 2014).

Sawn wood (no conifer species). USA and Malaysia are among the most important exporters, which exported 398,518.00 m^3 and 181,249.00 m^3 of this commodity to EU (28 countries) in 2011, respectively (FAOSTAT, 2014).

Sawn wood (no conifer species of tropical origin). There are no specific data on trade from countries where *Euwallacea* spp. occur to EU. However, the volume of imports from third countries to the EU is 1,012.02 thousand m^3 (EUROSTAT, 2014).

Tropical wood imports to the EU in form of **wood, wood articles and wood charcoal.** Malaysia and Indonesia are among the most important Asian exporters, which exported 124,590.9 t and 61,641.7 t of these commodities to EU in 2012, respectively (EUROSTAT, 2014).

Wood chips All life stages of the pest may be associated with this comodity.
The volumen of wood chips and particles (including conifers and non conifers species) imported from third countries to EU is 4,414.91 thousand m^3, which may be used for paper, energy production,fibreboard production and mulch. If this commodity is used to be industrially processed, then the probability of transfer is very unlikely. In the case of being used as mulch, the process of producing wood chips, i.e. chipping and grinding, is generally considered as destructive to wood inhabiting insect pests. Chipping is a method used to eliminate infected material of *E. fornicatus* on tea crops in Sri Lanka (Coleman, 2012). Trials carried out on *Euwallacea* sp. IS/CA by Dr. Paine (2012) showed that, chipping (>2 inch (5,08cm), 1-2 inch, <1 inch (2,54cm)) was effective, reducing dramatically the number of beetles that emerged of infected material (Spann, 2013a). However, due to the small size of *Euwallacea* spp. (adult females, approximately 1.83±0.07 mm. long and 0.80±0.6 mm wide), the process of **wood chipping is likely to reduce the concentration, but it will not guarantee completely the elimination of the pest.**

Wood waste: The intended use of imported wood waste is not known. Survival of all life stages of the pest will depend if wood pieces were subjected to processing. If it is used for energy production, then the probability of transfer is very unlikely. It may be higher if the wood waste is stored outdoors for some weeks in suitable condition for pest emergence in the vicinity of host plants.

Pest already intercepted on the pathway?

No. But there are interceptions in wood and bark only identified as " Scolitidae" (EUROPHYT 2015)

Pathway prohibited in the PRA area?

There are no prohibitions. Restrictions have been studied in detail in **Annex 5**.

Consequently, reproductive hosts commonly used as wood may be considered a risk for *Euwallacea* spp. (morphollogically similar to *E.fornicatus*)] entry except the following that are regulated in the EU legislation:

- wood of *Platanus* L. originating in the USA, Switzerland and Armenia
- bark free sawn wood of *Quercus* L. originating in the USA.

Pathways not further studied as considered less likely:

Pathway: Wood packaging material (WPM) such as crates, boxes, packing cases, dunnage, pallets, cable drums and spools/reels treated according to ISPM 15:2009.

All life stages may be present in wood packaging material. This pathway is probably one of the most relevant, however, it was not studied in detail in this PRA as pest risk management is already in place. Since the first adoption of International Standards for Phytosanitary Measures (ISPM) nº 15 in 2002, all wood packaging material moved in international trade should be debarked and then heat treated, or fumigated with methyl bromide and stamped or branded, with a mark of compliance. **These treatments are internationally considered as adequate to eliminate pests that are present in wood packaging material at the time of treatment.** Furthermore, **the material most commonly used to make WPM is conifers wood, which is not a *Euwallacea* spp. real host.**

Nevertheless, if it is introduced in the EU, this pathway should be revised, since ISPM N. 15 is not applied for internal movements of WPM.

On the other hand, it must be noticed that WPM that is not compliant with ISPM N.15 could provide a pathway of entry for *Euwallacea* spp. Scolytinae are commonly intercepted on non-compliant WPM. In the EU, there are interceptions of Scolitidae in WPM. Management of this kind of WPM during inspeccion or after rejection must avoid transfer.

Scolytids are among the most commonly intercepted families of insects on solid wood packing materials at U.S. ports of entry, representing 93–94% of all reported insects. (Haack, 2003; Haack *et al*. 2013)). Scolytids were also the most commonly intercepted group of insects found in association with solid wood packing materials in Chile (Beeche-Cisternas 2000) and New Zealand.(Haack, 2003)

Lastly, WPM of a thickness of LESS than 6 mm is exempted from ISPM 15. Due to the small size of adult females (1.83±0.07 mm. long and 0.80±0.6 mm wide), it can not be completely dismissed an attack in WPM of a thickness of less than 6 mm. Nevertheless, according to literature, there is not evidence that this beetle colonizes so small wood material.

Pathway: Hitchhiking in contamined crates, sea containers, etc.

According to Haack, 2003, in the past many insects (most of the Heteroptera and Orthoptera) found in association with wood articles were likely hitchhikers, occurring as a result of handling practices, and were not directly associated with the wood articles. According to NPAG, 2013 and Leathers, 2015, ambrosia beetles may hitchhike on shipments of cut flowers and fruit. E.g: "*Unidentified beetles (Euwallacea sp. possibly fornicatus) have been intercepted seven times on bamboo, cut flowers, ginger, macadamia, and Draceana compacta from Hawaii*". (Leathers, 2015). But no further information is provided.

Nevertheless, assesors have not found quantitative data about interceptions in this pathway to analize it.

There are old data about interceptions of *Euwallacea* sp. as hitchhiker in sea cargo containers (20 insects in 3 containers) (Stanaway *et al*., 2001). This pathway needs a broader approach and the IPPC is currently developing an international standard on **Minimizing pest movement by sea containers (2008-001).**

It is not clear how in Israel the beetle entered into the northern location distant from the other infestation and across the Carmel range. There is speculation that the beetle may have arrived on contaminated packing crates from a shared packinghouse. (Eskalen 2012); (Arpaia & Obenland, 2013). Nevertheless, packing crates are not usually shared between countries. This pathway should be evaluated for spread, if the pest entries into Europe.

There is a high uncertainty that enable deciding the actual risk of this pathway. Nevertheless, assesors consider that it has a low risk due to that explained above. Sanitary measures for packing crates should be taken into account if further information lead to increase the rate for the likelihood of introduction given.

Pathway: Cut branches of host species from where *Euwallacea* sp. (*Euwallacea fornicatus*-like) occur.

Cut branches can support all life stages of *Euwallacea* sp. However, **there are not data on trade** of the relevant hosts species in the form of cut branches. Conifer species, are not reproductive hosts. In **Annex 6** it is found that higher volumes are from the USA, although quantities are decreasing.

Cut branches are plant parts. When traded, host and non-host species are included within the same Taric code (06042090). Further information is needed in order to assess this pathway.

If cut branches traded were from relevant real hosts, there are some restrictions for plants pointed in Council Directive 2000/29/EC, but they may not be suficient to prevent the entry of *Euwallacea* sp. Emergency phytosanitary measures against *Anoplophora glabripennis, Anoplophora chinensis* does not affect to plants from the USA.Emergency phytosanitary measures against *Phytophthora ramorum* may not be sufficient.

If the beetle were able to enter into the EU with cut branches, transfer is not probable since this commodities are suposed to be traded only for ornamental purposes. **Then the likelihood of introduction is low mainly due to the difficulties associated with the transfer to a suitable host.**

Pathway: Natural spread.

This pest is not present in the PRA area at the moment. The nearest area where it is present is Israel, so natural spread is not currently probable. However, this pathway would become a likely pathway of movement within the PRA area following an introduction.

Although there are divergences in the literature about the flying capacity of *E. fornicatus*. **In both cases (the beetle and the fungus) dispersal is only regarded as local.**

Pathway: Bark of host species from where Euwallacea sp. (Euwallacea fornicatus-like) occur.

After an early attack, adult females of *Euwallacea* spp. may be present in bark of host species, but they will go deep to the xylem. The pest would not be able to complete its life cycle in the bark, as it resides and mates in the xylem of plants. Therefore **the asociation of the pest with this comodity is negligible.**

Pathway: Fruits, seeds of host plants, soil.

There are not references in the literature about the transmission of *Euwallacea* spp. by means of fruits, seeds and soil. According to CABI 2015, this pest is not able to be carried with these commodities.

CONCLUSION:

Rating of the likelihood of entry	*Low* ☐	*Moderate* ☐	***High*** ☒
Rating of uncertainty	***Low*** ☒	*Moderate* ☐	*High* ☐

Pathways	Rating of the likelihood of entry	Rating of uncertainty
Plants for planting (except seeds) of reproductive host species from where *Euwallacea* sp. (*Euwallacea fornicatus*-like) occurs.	**High** • All life stages may be present in this commodity • It is presumable the main cause of new introductions in many locations • There is trade of plants of planting of hosts from where *Euwallacea* sp. occurs into the PRA area • Current egulations are not enough against the introduction of this pest • The associated fungus was found in a nursery in California	Low
Wood (round or sawn, with or without bark) of reproductive host species from where *Euwallacea* sp. (*Euwallacea fornicatus*-like) occurs.	**High** • All life stages may be present in this commodity • There is trade of wood of hosts from where *Euwallacea* sp. occurs, into the PRA area. • Current regulations are not sufficient to avoid the entry of the pest.	Low
Wood packaging material (WPM) such as crates, boxes, packing cases, dunnage, pallets, cable drums and spools/reels treated according to NIMF 15.	**Negligible** • NIMF 15 • Wheather the pest is introduced in the EU, this pathway should be revised. **High for WPM not compliant with ISPM15** • Interceptions of Scolitidae in no-compliant WPM occur.	Low
Hitchhiking in contaminated crates , etc.	**Low** • Not probably from its current distribution	High
Cut branches of host species from where *Euwallacea* sp. (*Euwallacea fornicatus*-like) occur.	**Likelihood of introduction: Negligible** • The probability of transfer to a suitable host is **Negligeble**	Moderate
Natural spread.	**Negligible** • Due to its current distribution	Low
Bark of host species from where Euwallacea sp. (Euwallacea fornicatus-like) occur.	**Negligible** • The pest reside in the xylem	Low
Fruits, seeds of host plants, soil.	**Negligible** • The pest is not carried in these commodities.	Low

9. Likelihood of establishment outdoors in the PRA area

9.1 Climatic conditions

According to the maps of Köppen-Geiger climate zones and taking into account the distribution of the pest (See point 6), *Euwallacea* spp. are able to establish in several climates. The beetle is native to equatorial climates (Af, Aw, As). However, it has also successfully established in temperate climates (Csa, Cfa, Cwa, Cwb). In contrast, there are no data on its presence in arid, snow or polar climates. The following climatic zones are present in the PRA area, warm temperate (Csa, Csb and Cfb), snow (Dfb, Dfc) and polar (ET) (See **Annex 4**)

Southern Europe:

The existence of an established population in Israel and USA (California) (both of them temperate climates, Csa) indicates that there are ecoclimatic conditions suitable in the PRA area. In particular, the following countries have the temperate climate Csa: southern France, Greece, Cyprus, south-southwestern Italy, south Spain and south Portugal. Therefore, the likelihood of establishment outdoors is high.

Northern Europe:

Taking into account that *E.fornicatus*-like *Euwallacea* sp. have not been reported in warm temperate (Csb and Cfb), snow (Dfb, Dfc) and polar (ET) climatic zones, it could be assumed that the same scenario could occur in northern Europe. Nevertheless, uncertainties concerning the establishment of *Euwallacea* spp. in this area are rated as high, especially for temperate climates Csb and Cfb. These climatic conditions are not the most favourable for the development of this beetle; however, **as it spends almost its entire life within their hosts, climate could be less critical for its establishment.**

It is important to notice that other ambrosia beetles originating from Asia have been **able to adapt to different and colder climates. It is the case of *Euwallacea validus*,** originating from Japan and detected in Ontario (Canada) (Douglas *et al*. 2013).

9.2 Biological considerations

The introduction of a single mated female may lead to the establishment of a new population of *E. fornicatus* (Stouthamer *et al.*, 2012a). Due to the haplo-diploidy (matings between a haploid male and diploid females), almost clonal reproduction, a skewed sex-ratio with a sib-mating system, and nearly unlimited host range helps xyleborines readly establish in new regions (Kirkendall, 1983; Hulcr *et al*, 2011b; Rabaglia *et al*., 2013).

The presence of several fungal species apart from *F.euwallaceae* in the head and abdomen of *Euwallacea* sp. (i.e: *Graphium* sp.; *Acremonium* sp,), may suggest this beetle-disease complex potentially may establish in a variety of plant communities locally and worldwide (Lynch *et al*. 2014)

As a consequence of climatic conditions and biological considerations, the likelihood of establishment and the uncertainty has been rated as moderate for northern Europe, whereas for southern Europe the likelihood of establishment has been rated as high and the uncertainty as low.

CONCLUSION:

Rating of the likelihood of establishment outdoors in Southern Europe	*Low* ◻	*Moderate* ◻	***High*** ☒
Rating of uncertainty	***Low*** ☒	*Moderate* ◻	*High* ◻

Rating of the likelihood of establishment outdoors in Northern Europe	*Low* ◻	***Moderate*** ☒	*High* ◻
Rating of uncertainty	*Low* ◻	***Moderate*** ☒	*High* ◻

10. Likelihood of establishment in protected conditions in the PRA area

Hosts of *Euwallacea* sp. are outdoors trees (crops, ornamental trees in gardens, parks and streets). Nevertheless, areas where hosts are grown under protected cultivation in the PRA area (e.g: glasshouses in botanical gardens), are likely to be at risk. Management in glasshouses maintains average temperatures suitable for the development of the pest (See point 2.1.e).

Rating of the likelihood of establishment in protected conditions	*Low* ◻	*Moderate* ◻	***High*** ☒
Rating of uncertainty	***Low*** ☒	*Moderate* ◻	*High* ◻

11. Spread in the PRA area

Taking into account that in California the infestation has spread from a single county in 2012 to six counties in 2014 and originally, and currently the infestation has spread from urban forests and lanscape trees, to native forests and commercial avocado groves (Lynch *et al*., 2014), it may be expected something similar in the PRA area if the pest entries.

- ***Natural spread***

Dispersal is regarded as local only. Thus, natural spread into the PRA area is not possible from Israel (nearest location from EU).

There are divergences in the literature about the flying capacity of *Euwallacea sp.* The studies carried out by Sachin *et al*., (2007) showed that the adult is not a good flyer. It was observed that the majority of the beetles flew to a distance of **1–3 m in one leap and reached a height of 1 m**. In some cases, beetles flew to a distance of **10-12 m at a height of 1-3 m.** However, according to CABI (2015) adult females fly readily and flight is one of the main means of movement and dispersal to previously uninfected areas. In agreement with these results, Dr. Arif Eskalen stated that "in spite of its small size (2-2.8 mm. long), the beetle is able to fly up to 500 yards (**≈457 m**)". With regard to the symbiotic fungus, preliminary observations suggest that it may spread from the infestation point to a distance of at least 1.5 m. along the tracheids within the tree (Mendel *et al.*, 2012b).

The pest is not present in the PRA area, but once it were introduced, natural spread within the PRA area would occur at a moderate rating.

CONCLUSION:

Rating of the magnitude of spread	*Low* ☐	***Moderate*** ☒	*High* ☐
Rating of uncertainty	*Low* ☐	***Moderate*** ☒	*High* ☐

- ***Human assisted spread***

In California, the major pathways of spread are related to **movement of infested firewood, wood and infested trees present in nurseries**, since it can form a source of a new infestation in distant locations (Coleman, 2012; Stouthamer, 2012b). In Israel, the beetle population has already spread outside from the initial infested area (central coastal region), as it has also been found in the Upper Galilee at Kibbutz Hagoshrim (in the north of Israel), where it seems that beetles were **introduced through bins** originating of coastal area (Arpaia & Obenland, 2013).

CONCLUSION:

Rating of the magnitude of spread	*Low* ☐	*Moderate* ☐	***High*** ☒
Rating of uncertainty	***Low*** ☒	*Moderate* ☐	*High* ☐

12. Impact in the current area of distribution

12.1 Economic impact

In Asia, *E. fornicatus* is an **important pest of tea crops** in southern India and Sri Lanka (CABI (2015); Walgama, 2012), but there is little precise information about quantified losses caused. In Sri Lanka, , this pest has a wide distribution covering more than 3/4ths of the total tea growing extent (Walgama, 2014). The loss of crop caused by *E. fornicatus* in 1953-1955 was estimated as 8-9% and possibly over 20% in some cases. Its concealed habit, wide distribution and wide host preference make pest control difficult. (Walgama, 2014).

In southern India, *E. fornicatus* has recently become a **serious pest of pomegranate**. It was found that damage caused by the fungus which is vectored by the beetle, caused monetary loss worth ruppee 67.45 lakhs (≈93,000 Euros) during 1996-1997 and ruppe 26.9 lakhs (≈37,000 Euros) during 1999-2000 (CABI (2015)).

Currently, the beetle is present in avocado orchards in Israel where is found the largest economic impact of this pest on crops. Avocado crops in Israel cover approximately 7,000 ha and about two-thirds of the total production is exported. According to researchers and consultants, approximately 60% of the total avocado growing region is infested with *Euwallacea* sp. (Mendel & Freeman, 2015; SAGARPA-SENASICA,2015b). The damage caused by this pest is likely to increase crop production costs by triggering new pest management programs. The damage level is ranked as **moderate to severe**. The treatment applications that leave low residues have not been effective but growers do not want to spray more powerful insecticides because they will not be able to export their crop, as residues are not suitable for European standards (Eskalen, 2012)

In California, the beetle also threatens an important fruit tree: avocado. The losses **could be high**, taking into account that California is the main producer of avocado in the USA, and avocado market is estimated at $350 million per year (Ploetz *et al*. 2013). *E. fornicatus* and *Euwallacea* sp. are listed as quarantine pests by several of California´s trading partners. The presence of this pest on consignments may disrupt trade. As the pest could lower the crop yield and value, trigger the loss of markets and can vector another pestiferous organism, the economic impact of the pest in California is rated as **high**. (Leathers, 2015)

12.2 Ecological or environmental impact

Currently, the pest is strongly attacking several ornamental trees in the **urban landscape, botanical gardens**. In February 2013, the pest complex was first detected in the wild, on the Angeles **National Forest** as well as **native forests** in Orange County.

12.3 Social impact

Social damage at origin was not found in the literature. Nevertheless, in avocados in Israel and in urban, botanical gardens and forests of California is triggering a big concern for the society.

In California, there have been significant impacts on trees in the urban environment leading to social impacts. Numerous amenity and garden trees have been infested and have either died or been destroyed. The LA Times reported that a tree weakened by disease toppled into a neighbours garden, and that there was concern that infested street trees could pose a hazard to members of the public if they dropped branches since many recorded hosts are commonly planted as street trees . The cost of the control of PSHB in street trees is not known, but it has been reported in newspapers that hundreds of trees in the Los Angeles area have been removed and such removals cost at least $1000 each. There have been several publicity campaigns (published in both English and Spanish) to raise awareness of the beetle and give advice on how to deal with infested trees, and public meetings have also been held to inform residents about the pest. Social impacts have potential to increase if the pest continues to spread. (FERA, 2014; 2015)

It has not been found any data about the impact in Australia or Central America.

12.4 Possible options for control

Monitoring

See answer for detection methods (2.4).

Chemical control

Chemical control is mainly focussed on the control of adults. Due to life stages of *Euwallacea* spp. spend almost its entire life hidden in galleries (Gadd, 1944), **insecticides have a limited effectiveness after its establishment on the crop**. In this case, systemic insecticides as acetamiprid, emamectin benzoate and imidacloprid, have been evaluated for avocado crops (Mendel *et al.*, 2012d). However, they are forbidden in some European countries since they are noxious for bees. In addition, according to Mendel & Freeman (2015), **systemic compounds were subsequently ruled out** due to a combination of inefficient transport through the water system, residue hazard and cost. On the other hand, **cover sprays are not considered a routine measure** since they were not suficiently effective and pose a risk to disrupt the biological balance of many potential insect pests.

Implementation of monitoring tactics and **preventative applications of insecticides** could be the most useful tool for minimizing ambrosia beetle attacks (Mendel *et al.*, 2012d; Gorzlancyk, 2013). This strategy has been carried out in nursery trees against *X. crassiusculus* and *X. germanus*, where trunk sprays of permethrin and bifenthrin (both pyrethroids) have been found to be most effective in minimizing attacks (Reding *et al.* 2013). Furthermore, identification and implementation of repellents could be used as another tool and possible alternative to conventional treatments. Verbenone, a bark beetle anti-aggregation pheromone, reduces ambrosia beetle attacks on individual trees or on a small spatial scale (Ranger *et al.* 2013).

With regard to the fungus, according to Batra 1985, since mutualistic insect pests in general will not survive or reproduce in nature without their mycosymbionts, it is evident that controlling the fungus may also control the insect. Several fungicides as carbenzamin, prochloraz and tebuconazole, have been evaluated on avocado crops. In laboratory experiments, all of them seemed to inhibit fungus growth, **however fungicides were not effective in field trials** (Freeman *et al*., 2012; Mendel *et al.*, 2012d).

It is important to take into account that there are **very few active substances authorized for avocado crop in Spain. It would not be possible chemical control against *Euwallacea* sp. in avocados.**

Biological control

With regard to biocontrol agents, the biology of *Euwallacea sp.* make it a challenging candidate for biological control because all life stages are protected within the wood. The chalcid *Perniphora robusta* (Ruschka), a principal parasite of bark beetles in Europe was imported to Sri Lanka in 1970, whereas a braconid, *Heterospilus ater* Fischer were imported and released in the tea plantations in midcountry but with no success as the parasites failed to establish.

Preliminary treatments with commercial fungus *Beauveria bassiana* (entomopathogenic fungus) products as a preventive measure were disappointing (Mendel & Freeman, 2015).

Research on endophytic bacteria and fungi obtained from members of known host trees species, as well as commercially available biological control agent known to be effective against fusarium species *(B.subtilis* strain AST713) is being carried out.(Lynch *et al*. 2014)

Cultural practises

In Sri Lanka, due to restrictions in the use of chemicals on this beverage crop (tea) and since it is not a good candidate for biological control, more emphasis is placed on cultural and/or agronomic control of the pest. (Walgama, 2014).

Keeping the trees in good health may limit infestation, as most pest ambrosia beetles preferentially colonize dead and stressed hosts (Ploetz *et al*, 2013), but it is not enough since *Euwallace* sp. is also attacking health trees in the new area were it has been introduced.

After detecting the presence of *Euwallacea* sp., the removal of infested trees, branches, logs and alternative host plants may help to reduce the level of attacks, at least locally. Furthermore, this material should not be removed from the infested areas.

There is increasing concern that felled trees and pruned branches infested with polyphagous shot hole borer should receive sanitation treatment to reduce the potential spread of the beetle from the movement of untreated wood. Both chipping and solarization decreases beetle emergence and boring activity compared to untreated control logs. Chipping was most effective for chip sizes <5 cm. Solarization was most effective using clear polyethylene sheeting during hot summer months, particularly August, when daily maximum temperatures were ≥35℃. Beetles persisted for 2 months or more when solarization was applied during the spring or fall. (Jones and Paine, 2015).

SAGARPA-SENASICA (2013) report covering the tree trunks before adults emergence with plastic as control method.

According to Mendel & Freeman (2015), current recomended management in moderately infested avocado orchards is: (1) extensive monitoring; (2) removing thin (<6 cm diam.) infested branches; (3) removing wilted branches and treating cuts on a main branch with Bifenthrin, a pyrethroid and (4) the bark area around the lesions on >2.5 inches (6,35 cm) diametter thick branches should be treated wiht Bifenthrin 12 inches (30,48cm) beyond the lesion on both sides of the branch in order to prevent further beetle attack. The effect of additional treatment with Acetamiprid, aimed to kill the fungal symbiont, is under study.

CONCLUSION:

Rating of the magnitude of impact in the current area of distribution (Asia):	*Low* ◻	*Moderate* ◻	***High*** ⊠
Rating of uncertainty	***Low*** ⊠	*Moderate* ◻	*High* ◻

Rating of the magnitude of impact in the current area of distribution (Israel and California):	*Low* ◻	*Moderate* ◻	***High*** ⊠
Rating of uncertainty	***Low*** ⊠	*Moderate* ◻	*High* ◻

13. Potential impact in the PRA area

Will impacts be largely the same as in the current area of distribution? Yes

Several crops could be endangered both real hosts (e.g: *Citrus spp.* (*Citrus sinensis* and *Citrus aurantium*, 310,966 ha), avocado (22,053 ha), pomegranate (3,000 ha)) and susceptible to Fusarium Dieback non-reproductive hosts (e.g: *Vitis vinifera* (3,223,300 ha), *Olea europaea* (4,825,000 ha), *Prunus persicae* (165,200), *Diospyros kaki,*). Currently, the main agricultural threat is focused on avocado crops, where the pest is already present in Israel and the USA. The number of hectares susceptible to attack in the EU are 22,053 ha, distributed among Portugal (10,981 ha), Spain (10,558 ha), Greece (412 ha), Cyprus (99 ha) and France (3 ha) (CABI (2015)).

In those areas where avocado is cultivated in the EU, farmers live from the incomes of this crop. And there are no phytosanitary products available for it. Therefore the social impact in those areas could be devastating.

In addition, results of attacks in the botanical gardens in California are frightening. **There is a high risk of establishment and spread to other species of ornamental or wood importance present in the PRA area in urban landscapes or in the forest such as the geni *Acer*, *Betula, Fagus, Platanus, Populus, Robinia, Salix* and *Quercus* among others** (see point 7). Therefore, it is likely that the presence of *Euwallacea* spp. will have an impact on internal markets and on exports of wood and plants for planting, as well as in the environment.

CONCLUSION:

Rating of the magnitude of impact in Southern Europe	*Low* ◻	*Moderate* ◻	***High*** ☒
Rating of uncertainty	***Low*** ☒	*Moderate* ◻	*High* ◻

Rating of the magnitude of impact in Northern Europe	*Low* ◻	***Moderate*** ☒	*High* ◻
Rating of uncertainty	*Low* ◻	***Moderate*** ☒	*High* ◻

14. Identification of the endangered area

According to Köppen-Geiger climate classification, this pest is most likely to establish outdoors in Southern Europe (i.e: southern France, Greece, Cyprus, Malta, south-southwestern Italy, south of Spain and south of Portugal). Nevertheless, there is a moderate probability of establishment in northern areas with moderate uncertainty.
With regard to protected conditions, the pest has the potential of establishing in greenhouses of botanical gardens in the entire PRA area.

15. Overall assessment of risk

	Rating	Uncertainty
Entry		
Plants for planting (except seed) of host species from where *Euwallacea* spp. occur	High	Low
Wood of host species (round or sawn, with or without bark) from where *Euwallacea* spp. occur	High	Low
Non compliant WPM	High	Low
Hitchhiking	Low	High
Establishment outdoors (in Southern Europe)	High	Low
(in Northern Europe)	Moderate	Moderate
Establishment under protected conditions	High	Low
Magnitude of the spread Natural spread	Moderate	Moderate
Human assisted spread	High	Low
Impact in the current area of distribution In Asia	High	Low
In Israel and USA	High	Low
In Australia, Central America	Unknown	High
Potential impact in the PRA area Southern Europe	High	Low
Northern Europe	Moderate	Moderate

Assesors have concluded that phytosanitary measures are necessary.

Stage 3. Pest risk management

16. Phytosanitary measures

-Pathways identified for phytosanitary measures:

- Plants for planting (except seeds) of host species from where *Euwallacea* spp. occur.
- Wood of host species (round or sawn, with or without bark) from where *Euwallacea* spp. occur.

- Identification of possible measures:

(I) Plants for planting (except seeds) of host species from where *Euwallacea* spp. occur.		
EVALUATION OF POSSIBLE MEASURES IDENTIFIED:	**Effectiveness**	**Feasibility**
Options at the place of production:		
1-Detection of the pest at the place of production by inspection or testing There are no tests for detecting *E.fornicatus* Efficiency of different traps is being studied. It seems that currently the best option is a multiple funnel trap (Lindgren) with synthetic attractants added to the first funnel (James *et al*., 2007). Visual detection is **difficult** as all life stages are hidden and their exit holes are about 0.85 mm in diameter. The presence of *Euwallacea* spp. is not easy to detect during the early stages of infestation, wet stains and discoloration on the bark of the main stem and branches are early symptoms of beetle attack. Depending on the tree species attacked, injury can be identified either by staining, gumming, or a sugaring response on the outer bark (Coleman *et al*., 2013). Consequently, infestation can be **difficult** to detect in the early stages, and visual inspection is unlikely to be completely effective.	Low (but could be useful as part of a systems approach)	High
2- Prevention of infestation of the commodity at the place of production		
2.1—Specified treatment of the crop: As it is an internal borer, the efficacy of treatments in the field is considered to be low and treatments are basically used to prevent the plants from being infested.	Low (but it could be useful as part of a systems approach)	High
2.2.- Resistant or less susceptible varieties As far as it is known, there are no resistant or less susceptible varieties	-	No
2.3- Growing the crop in specified conditions Plants for planting can be grown under complete physical protection (screened greenhouses) with sufficient measures to exclude the pest. Trapping shall be necessary to verify pest freedom in the greenhouse.	High	Medium
2.4.- Prepare the commodity at certain times of the year or growth stages The pest is present on the crops during all the growing cycle and presents several overlapping generations. Plants in vitro or plants with twigs thinner than 2 or 2.5 cm have been identified as possible measures. 2.4.1- Plants in vitro or produced at early growth stages do not pose risk of *E.fornicatus.* 2.4.2- Plants thinner than 2.5 cm According to the literature *Euwallacea* sp. usually attacks trunks and thick branches. Nevertheless, in some hosts (i.e: avocado) this beetle colonizes branches of 2 cm or 2.5 cm (Mendel *et al.* 2012b; Coleman *et al.* 2013) . Due to the small size of adult females (approximately 1.83±0.07 mm. long and 0.80±0.6 mm wide), it can not be completely dismissed an attack in thinner stems or branches.	2.4.1: High 2.4.2: Medium	2.4.1: High 2.4.2: Medium
2.5. Production in a Certification scheme Not applicable for insects	-	No

<u>3-Pest free place of production (PFPP)- Establishment and maintenance</u> Plants for planting originating from a place of production declared free from the pest on official inspections carried out at appropriate times. Sampling and trapping shall be necessary to verify pest freedom. Designation of a PFPP could be possible, but there are not data about places of production free from the pest in the countries where *Euwallacea* spp. originates. It is unknown whether the apparent absence of the pest from certain areas is because of a lack of host plants or a lack of records and an effective monitoring system. In addition, the establishment and maintenance of a PFPP is **difficult**, due to the wide range of hosts and enviroments (agricultural crops, gardens, streets) as well as the length of the fly (up to ≈457 m) . Early detection is also very **difficult**.	Medium	Low
<u>4-Pest free areas (PFA):</u> The requirements for the establishment of a pest-free area are outlined in ISPM No. 4 Designation of a PFA could be possible, but there are not data about areas free of the pest in the countries where *Euwallacea* spp. originates. It is unknown whether the apparent absence of the pest from certain areas is because of a lack of host plants or a lack of records and an effective monitoring system. In addition, the establishment and maintenance of a PFA is **difficult**, due to the wide range of hosts and enviroments (agricultural crops, gardens, streets). In order to guarantee the level of assurance of pest freedom in countries where *Euwallacea* spp. is established, detailed surveys and monitoring should be conducted in the area prior to establishment of the PFA and continued every year. Specific surveys should also be carried out in the zone between the PFA and known infestation to demonstrate pest freedom.	High	Low
<u>5-Pest-free country</u> Not possible for the countries where it is already present	High	No
Options after harvest, at pre-clearance or during transport:		
<u>6-Pest freedom: Detection of the pest in consignments by inspection or testing</u> There are no tests for detecting *E.fornicatus*		
<u>6.1.Visual inspection:</u> The pest would be **difficult** to detect in a large consignment of plants for planting, as all stages of *Euwallacea* spp. are hidden. Furthermore, plants for planting are generally traded during the dormant season and transported at cool temperatures, which will make the pest less active and therefore **more dificult** its detection. <u>6.2.Destructive inspection:</u> If this measure was carried out, it could be taken into account existing emergency measures to prevent the introduction into and the spread within the EU of *A. chinensis* or *A.glabripennis*(1). Inspections carried out for these *Anoplophora* spp. could be adapted. Inspection methods applied shall ensure the detection of any sign of the specified organism, in particular in stems of the plants. This inspection shall include targeted 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 %.	Low (but it could be useful as part of a systems approach) Medium	High Medium
<u>7- Removal of the pest from the consignment by treatment or other phytosanitary procedures</u>		
<u>7.1--Treatments to the commodity:</u> As it is an internal borer, the efficacy of treatments to the commodity is considered to be low and treatments are basically used to prevent the plants from being infested. Some treatments could kill the plants.	Low (but it could be useful as part of a systems approach)	Medium
7.2- <u>Prohibition of parts of the hosts or specific genotypes of the host (Removal of certain parts)</u> Not applicable	-	-

7.3- Preparation of the consignment (Handling and packaging) Handling and packing should also be done in isolated conditions and transport should be carried out avoiding infestation, but as it is an internal borer this measure can only prevent the consignment from new infestations.	Low (useful in a systems approach)	Medium (this measure is difficult to implement due to the tiny size of the insect)
7.4- Specific conditions during transport Transport conditions have very little influence in wood internal borers.	-	-
7.5- Pre-entry quarantine system Import of the consignment under special license/permit and pre-entry quarantine: This would require keeping the plants in pre-entry quarantine for a sufficient time to detect the emergence of adults (it could be a minimum of 45 days at a temperature between 26 and 35 ºC, and relative humidity, between 75 and 95 %). This measure is likely to be applicable only for **small scale imports** and the risks and costs are borne by the importer.	High	Medium
8- Phytosanitary Certificate and other compliance methods. Attestation by the exporting country that the requirements of the importing country have been fulfilled is implemented by IPPC members.	(EFSA, 2012) no scientific publications were found in their support as a Risk Reduction Option	High
Options that can be implemented after entry of consignments:		
9- Detection during post entry quarantine: Import of the consignment under special license/permit and post-entry quarantine: This would require keeping the plants in post-entry quarantine for a sufficient time to detect the emergence of adults (it could be a minimum of 45 days at a temperature between 26 and 35 ºC, and relative humidity, between 75 and 95 %). This measure is likely to be applicable only for **small scale imports** and the risks and costs are borne by the importer.	High	Medium
10- Restriction on end use, distribution and periods of entry Entry of plants for planting in winter in the north of Europe, might pose a lower risk than for the rest of the year, since it would limit the flight of adults. Nevertheless, several generations and stages could stay inside the plant where ambrosia beetles are supposed not to be very much conditionated by the climate conditions. Additionally, once introduced in a northern EU country, movement of the consignments within the EU to the southern part of Europe can not be controlled.	Low	Low (due to internal market within the EU)
Prohibition Although effectiveness of prohibiting this pathway would be high, it is not a feasible option	High	Low

(1) EU Decision 2012/138/UE and EU Implementing Decision 2015/893/EU.

Specific requirements similar to those included in EU Decision 2012/138/UE and EU Implementing Decision 2015/893/EU, could be adapted for *Euwallacea* sp. A possible starting point is proposed below:

“The plants should be grown, for at least 6 months* in a site of production established as free from *Euwallacea* spp. in accordance with International Standards for Phytosanitary Measures:

(i) which is registered and supervised by the NPPO in the country of origin; and

(ii) which has been subjected to official meticulous inspections for any sign of *Euwallacea* spp. carried out at appropriate times and no signs of the organism have been found; and

(iii) where the plants have been grown in a site:

with traps and the application of appropriate preventive treatments and surrounded by a buffer zone with a radius of at least 2 km** where official surveys for the presence or signs of *Euwallacea* spp. are carried out annually at appropriate times. In case signs of *Euwallacea* spp. are found, eradication measures are immediately taken to restore the pest freedom of the buffer zone; and

(iv) where immediately prior to export consignments of the plants have been subjected to a meticulous official inspection, for the presence of the specified organism, in particular in stems and branches of the plants. This inspection shall include targeted 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 %. Where consignments include plants originating in sites which at the time of their production were located in a buffer zone where presence or signs of the specified organism had been found, destructive sampling of the plants of that consignment shall be carried out”.

According to the biology of the pest and due to the fact that it is difficult to detect early stages of infestation by visual inspection, it is estimated that a minimum of generations should be developed to show any symtom.

*** As according to Dr. Arif Eskalen the beetle is able to fly up to 500 yards (≈457 m.)*

(II). Wood of host species (round or sawn, with or without bark) from where *Euwallacea* spp. occur.		
EVALUATION OF POSSIBLE MEASURES IDENTIFIED:	**Effectiveness**	**Feasibility**
Options at the place of production:		
1. Detection of the pest at the place of production by inspection or testing See answer for the pathway of plants for planting of host species. **It is considered that detection is easier in a nursery than in a forest.**	Low (but could be useful as part of a systems approach)	Low
2. Prevention of infestation of the commodity at the place of production		
2.1- -Specified treatment of the crop See answer for the pathway of plants for planting of host species. **It is considered that treatments in adult trees will be more difficult than in plants for planting**	Low (but it could be useful as part of a systems approach)	Medium
2.2.- Resistant or less susceptible varieties As far as it is known, there are no resistant or less susceptible varieties	-	No
2.3. - Growing the crop in specified conditions, Tree profitability under physical protection is questionable	High	Low
2.4.- Prepare the commodity at certain times of the year or growth stages The pest is present in the tree during all the growing cycle and presents several overlapping generations.	-	No
2.5. Production in a Certification scheme Not applicable for insects	-	No
3. Pest free place of production (PFPP): Wood originating from a place of production declared free from the pest on official inspections carried out at appropriate times. Trapping shall be necessary to verify pest freedom	Medium (it could be useful as part of a systems approach)	Low
4. Pest free areas (PFA): See answer for the pathway of plants for planting of host species. **There should be restrictions on the movement of firewood into the PFA, and into the area surrounding the PFA, especially the area between the PFA and the closest area of known infestation.**	High	Low
5. Pest-free country Not possible for the countries where it is already present	High	No
Options after harvest, at pre-clearance or during transport:		
6. Pest freedom: Detection of the pest in consignments by inspection or testing The inspection of consignments of wood is difficult, and especially in the case of *Euwallacea* spp. since all life stages are hidden.	Low (but it could be useful as part of a systems approach)	High

7. Removal of the pest from the consignment by treatment or other phytosanitary procedures		
7.1-Specific treatment of the consignment: **-Heat treatment. (HT)** According to **EPPO Standard PM 10/6(1)** heat treatment of wood to control insects and wood-borne nematodes, Scolytidae are killed in round wood and sawn wood which have been heat-treated throughout the profile of the **wood at least 56 °C for at least 30 min** (EPPO, 2009a). It should be noted that wood packaging material with ISPM 15 mark had been found infested with scolytids (Brockerhoff *et al*., 2006; Haack, 2003, 2006), which may question the efficacy of the heat treatment at 56 °C for 30 min (it might also be that the treatment was not properly applied and the temperatures required were not reached). **With regard to *Euwallacea* spp., it is likely to be effective a heat treatments at 71ºC for 75 minutes, although may not be cost effective (Coleman, 2012).**	High (at 71ºC for 75 minutes)	Medium
-Kiln drying. (KD) Tropical wood and non-tropical wood species should be undergone kiln-drying to below 20% moisture content, expressed as a percentage of dry matter, at time of manufacture, achieved through an appropriate time/temperature schedule. Kiln drying in general can be carried out at different treatment temperatures which may be below temperatures commonly used to eliminate harmful organisms from wood, such as 56°C for at least 30 minutes, the heat treatment parameter used for phytosanitary treatment of wood packaging laid down in the IPPC International Standard for Phytosanitary Measures No. 15. “Regulation of Wood Packaging in International Trade” (ISPM No. 15). **This treatment is considered sufficient as a phytosanitary treatment, based on the results from the EUPHRESCO project (PEKID) for other Scolytidae as *Pityogenes chalcographus, Ips sexdentatus* and *Ips tyographus*.**	High	Medium
-Fumigation. **Methyl bromide fumigation** of wood is **unlikely to be effective,** because of the presence of bark and size of the material. According to EPPO Standard PM 10/7(1) Methyl bromide fumigation of wood to control insects (EPPO, 2009b), only wood without bark and whose dimensions does not exceed 200 mm cross section can be fumigated to destroy insect pests. In addition, methyl bromide is forbiden in the EU and its use is not favoured in many other EPPO countries because of its environmental consequences. Coleman (2012) reports that sulfuryl fluoride, candidate fumigant to replace methyl bromide, could be effective against *Euwallacea* spp. in wood infested material.	Low	Depends on the country
-Irradiation. According to EPPO Standard PM 10/8(1) disinfestation of round and sawn wood (with or without bark) either of conifer or deciduous tres with ionizing radiation, **Scolytidae are killed after an irradiation of 1kGy (EPPO, 2009c).**	High	Depends on the country
7.2- Prohibition of parts of the hosts or specific genotypes of the host_(Removal of certain parts) Not applicable	-	-
7.3- Preparation of the consignment (Handling and packaging) (See pathway P-I)	Low (useful in a systems approach)	High
7.4- Specific conditions during transport Transport conditions have very few influence in wood internal borers	-	-
7.5- Pre-entry quarantine system Import of the consignment under special license/permit and pre-entry quarantine: This would require keeping the wood in pre-entry quarantine for a sufficient time to detect the emergence of adults (a minimum of 45 days at a temperature between 26 and 35 ºC, and relative humidity, between 75 and 95 %). This measure is likely to be applicable only for **small scale imports** and the risks and costs are borne by the importer.		
8. Phytosanitary Certificate and other compliance methods. Attestation by the exporting country that the requirements of the importing country have been fulfilled is implemented by IPPC	(EFSA, 2012) no scientific publications	High

members.	were found in their support as a Risk Reduction Option	
Options that can be implemented after entry of consignments:		
9. Detection during post entry quarantine Import of the consignment under special license/permit and post-entry quarantine: This would require keeping the wood in post-entry quarantine for a sufficient time to detect the emergence of adults (it could be a minimum of 45 days at a temperature between 26 and 35 ºC, and relative humidity, between 75 and 95 %). This measure is likely to be applicable only for **small scale imports** and the risks and costs are borne by the importer.	High	Low
10. Restriction on end use, distribution and periods of entry Not restrictions on end use have been identified for that specific host, apart from incineration or production of sawdust. These are not likely end uses regarding the kind of wood considered under this pathway. Entry of wood in winter in the north of Europe, might pose a lower risk than for the rest of the years, unless wood internal borers are supposed not to be very much conditionated by the climate conditions. Additionally, once introduced in a northern EU country, movement of the consignments within the EU to the southern part of Europe can not be controlled.	Low	Low (due to internal market within the EU)
Prohibition Although effectiveness of prohibiting this pathway would be high, it is not a feasible option	High	Low

OUTBREAKS- Measures for delimitation, containment and eradication		
Measures identified	Effectiveness	Feasibility
- **Delimitation:** Delimitation althoug not easy, would be posible. Based on the guidance for emergency measures in Mexico (SAGARPA-SENASICA,2013) and the Action Plan (SAGARPA-SENASICA, 2015a) the delimitation of an outbreak would be undertaken by the initial capture of adults in traps or the presence of over symptoms caused by ambrosia beetles. Next, the area would be identified to study the spatial and temporal distribution of this borer by using traps and sampling methods. A **monitoring** perimeter would be established from the initial outbreak. White sticky traps (50 x 50 cm) baited with quercivorol, or other possibilities available (see point 3.1. Detection methods) would be placed low to the ground (see point 3.1.Detection methods) in the monitoring perimeter. The distribution of the traps will be homogeneous, giving preference to areas where primary hosts are present. In addition, at least the trunk of 10 trees will be covered from the base to a height of 1.5 m by a plastic film in the safety zone. Trees will be chosen according to the presence of mechanical injuries or stress symptoms, which make them better candidates to be colonized by ambrosia beetles. White sticky traps baited with quercivorl, and plastic film surrounding the trunk of the trees will be replaced every month and 3 months, respectively. **Visual inspections** would be carried out to detect damages and/or symptoms caused by ambrosia beetles in the delimited area. All the safety zone would be sampled (64 ha), and the buffer zone would be divided in quadrants of 16 ha, where 320 trees would be inspected per quadrant.	High	Low
- **Containment** According to recent experiences in California and Israel, containment of this pest is very difficult The wide distribution of host plants and the current lack of effective disease control strategies have resulted in uncontrolled proliferation of the beetle-fungus complex in California. Based on the guidance for emergency measures in Mexico (SAGARPA-SENASICA,2013) and the Action Plan (SAGARPA-SENASICA, 2015a) some measures would be implemented to **contain and eradicate** the pest. Among them, 15 sticky traps of white colour (50 x 50 cm) baited with quercivorol, will be placed per ha, and the number of trunk of the trees covered by plastic films will be increased to 30. In addition, chemical products could be sprayed if the time of detection is less than 1 week. After that period, insecticide should be applied by microinjection or soil application. Cultural methods are also recommended as removal of infested trees, disinfection of pruning material and mantaining the trees in good phytosanitary conditions.	High	Low
- **Eradication**	High	Low

According to recent experiences in California and Israel, eradication of this pest is **very difficult** According to the Action Plan (SAGARPA-SENASICA, 2015a), an outbreak will be considered eradicated, when the presence of the pest in monitoring traps is zero and no symptoms are observed for two years.		
- **Public awareness** An important element already taken into account in the USA and Mexico is to raise public awareness about the risk of spread.	Medium	High

17. Uncertainty

Main uncertainties are:

- During many years, all the species that morphologically are similar to *E.fornicatus*, have been reported in the bibliography as *Euwallacea fornicatus* in different parts of the world. Currently, is not possible to distinguish origins and host of each one. Something similar occurs with the associated fungi.
- Pathways of entry have been analized with a higher risk for those hosts in which the beetle is able to produce offspring (real hosts). This list will probably increase since:
    - Further spread into new or current areas could add more real hosts to the list.
    - Some hosts still not identified as real hosts, could became real host.
- Since this PRA was started up to now, both the list of host and the list of real-hosts have increased considerably.
- Volume and frequency of import of plants for planting considered hosts. Search has included general groups that may contain woody plants from Asia (Non-hosts cannot be excluded from the statistic). There is lack of detailed trade data and it is not possible to obtain data by species which are hosts for *Euwallacea* sp.
- There is lack of detailed data of tropical wood traded of specific species that are real-hosts of *Euwallacea* sp.
- There is lack of detailed data of cut branches traded of specific species that are real-hosts. *Euwallacea* sp.
- Suitability for these internal borers in Northern Europe. It seems the beetle could be able to switch to new hosts in colder climates.
- It has not still been clarified how spread between avocado plantations in Israel occurred. It is thought it was due to hitchhiking on packing crates.
- The rate of natural spread of the pest is not clear.
- Further informacion about the statement of Leathers, 2015 about *Euwallacea sp (probably fornicatus)* intercepted in USA mainland from Hawaii in bamboo, cut flowers, is needed.
- Coleman (2012) reports that sulfuryl fluoride, candidate fumigant to replace methyl bromide, could be effective against *Euwallacea* spp. in wood infested material
- Some species have not been considered in the pathway because there is no trade. Nevertheless if trade changes, they should be revised.

18. Remarks

It is recommended monitoring of *Euwallacea* spp. (morphologically similar to E.fornicatus) and other ambrosia beetles in potential ports of entry. Some ambrosia species are well known and are causing severe damages in some parts of the world. i.e: *Xyleborus glabratus*, the redbay ambrosia beetle which specifically attacks members of the Laurel tree family (which includes avocado), and inoculates to the trees with the fungus *Raffaela lauricola*, that causes laurel wilt disease which is lethal to avocado and other trees.

It would be important to do further research on:

- Taxonomic identification and distribution of the pests.
- Studing the process involved in the chemical perception, acceptance and colonization in new hosts in order to find out why why this exotic species are killing wild and cultivated host species that seem healthy and that frequently are taxonomically different from their original host species. (Macías, 2014)
- Undertanding the potential for and frequency of host-switching between *Euwallacea* and the *Fusaria* they cultivate for food, (*Euwallacea* beetles have switched *Fusarium* symbionts multiple times during the evolution of this 20 million year old mutualism) given that these shifts amy bring together more virulen and aggressive combinations of these invasive mutualists. (O'Donnell *et al.* 2014b)
- Developing a most effective detection method.

- An effective strategy of integrated pest management (IPM).
- Further studies about insecticides, biological control and repellents should be undertaken.
- It is also necessary to do further research on fungicides.
- There are several available tools to eliminate the infested material as, chipping, grinding, burning and solarization, but further studies are being carried out to determine their efficacy.
- With regard to invasion epidemiology: rate of development of the pest, presence of host trees on which development can take place and speed of infestation.

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Annex 1. Relevant illustrative pictures (for information)

-The beeatle:

-Left: Eggs of *Euwallacea* sp.IS/CA in the tunnel constructed by the female on *Ricinus communis*. (Mendel *et al*., 2012b).

-Center: Larvae of *Euwallacea* sp.IS/CA in the tunnel constructed by the female on *Ricinus communis*. (Mendel, 2012b).

-Right: Adults. The sexually dimorphic *Euwallacea* sp.IS/CA female (top) and male (bottom). (Walgama *et al., 2012*).

-Size comparison of both male (left) and female (right) on a penny from Eskalen, *et al*. 2013.

-Symptoms:

- Left: Attack in a thin branch of avocado. (Eskalen 2014b)

The ambrosia beetle commonly attacks the main stem and larger branches of trees and shrubs, but injury can be found on twigs as small as 2.5 cm in diameter. (Coleman *et al*. 2013)

According to (Sachin 2007) "*E. fornicatus* of tea is a polyphagous beetle; mainly attacks pencil thick stems of tea. Selvasundaram *et al*. (2001) reported that the partially dried cut stems of *M. bipinnatifida* (C. Koch) (Compositae: Asteraceae), with 2.5-3.0 mm thickness and 90 cm long attracted a large number of shot hole borer beetles"

-Left: Bark of the stem and branches of avocado tree with typical lesions formed around beetles´ entrance spots. Exudation of a large amount oh white powdery "persein" is typical at these points of attack during the early phase of tree colonization (Mendel *et al*., 2012a).

-Center/Right: Typical symtoms on *Quercus pedunquifolia*. Center, Canker in the branches; Right, Wetting in the branches (Mendel, 2012b).

Find more pictures on the Field Identification Guide of Eskalen Lab (Eskalen *et al*., 2014a)

Source: www.eskalenlab.ucr.edu

Annex 2. Remarks on taxonomy (point 1 of the PRA)

THE BEETLE:

- ***Euwallacea fornicatus* Wood & Bright, 1992** was described by Eichhoff in 1868 as *Xyleborus fornicatus*. Currently, the taxonomic identity of the original beetle is unclear. It is not possible to carry out a molecular phylogenetic analysis, since the type specimen was lost from the museum where it was originally deposited. Thus, there is absence of robust species-level molecular phylogenetic and type studies to determine what species represents it. (O'Donnell *et al*., 2014a)

Other Scientific Names [CABI, 2015]

Anisandrus fornicatus (Eichhoff)
Xyleborus fornicatior Eggers, 1923
Xyleborus fornicatus Eichhoff, 1868
Xyleborus perbrevis Schedl, 1951
Xyleborus schultzei Schedl, 1951
Xyleborus tapatapaoensis Schedl, 1951
Xyleborus whitfordiodendrus Schedl, 1942
Xylosandrus fornicatus (Eichhoff)

More synonyms (Cognato, 2008): *Euwallacea perbrevis.*

Common names: Tea shot-hole borer (TSHB), Shot-hole borer of tea, Scolyte du Ceylon Theier, Teezweig-bohrer,

Recent research from O'Donnell *et al*. (2014) shows that actually, there are several species level lineages within the morphological concept of ***Euwallacea fornicatus* ('*E.fornicatus*-like' species).** In a sample of 103 adult female Euwallacea ambrosia beetles collected within the USA, Israel, Sri Lanka, Papua New Guinea and Australia he identified six phylogenetically distinct species (as *Euwallacea* sp.#1-6):

• ***Euwallacea* sp. #1** **(PSHB)** **Polyphagous Shot Hole Borer**	From **Israel** and Los Angeles, Orange, Riverside and San Bernardino in **California (USA).** The origin of the polyphagous shot hole borer is unknown, but it may have come from somewhere between northern Thailand and southern Japan (Coleman *et al*. 2013). **Vietnam** can be the origin of this beetle (Kabashima *et al*. 2014).
• ***Euwallacea* sp. #2**	From Miami-Dade Co.-**Florida (USA)**
• ***Euwallacea* sp. #3**	From Queensland (**Australia**)
• ***Euwallacea* sp. #4**	From Kandy and Talawakelle (**Sri Lanka**)
• ***Euwallacea* sp. #5** **Kuroshio Shot Hole Borer (KSHB)**	From San Diego Co.in **California (USA)** *"**Taiwan** is the suspected origin of the infestation in San Diego County" (Kabashima et al. 2014)* *Euwallacea sp. (#5), carrying new species of Fusarium and Graphium. (Eskalen Lab Web 2015)*
• ***Euwallacea sp. #6*** ***Euwallacea 'fornicatus'?*** *(Cognato et al. 2011)*	From **Papua New Guinea**

- **Hybrid *E.validus-Euwallacea* sp. #2:** This hybrid was found in this research in Miami-Dade Co.in **Florida**. (This may suggest introgressive hybridization between species (O'Donnell *et al*. 2014)

THE FUNGUS:

Most of the ambrosia fungi associated to *Euwallacea* sp. belong to the Ambrosia Fusarium Clade (AFC), within Clade 3 of the *Fusarium solani* species complex (FSSC) (Freeman *et al*. 2013). Research points to a strong evolutionary trend towards obligate symbiosis of *Euwallacea-Fusarium* coupled with secondary contact and interspecific hybridization (Kasson *et al*, 2013). Nevertheless, there is uncertainty with the identity of these *Fusarium* spp. and the different beetle-fungus associations, as well as other possible associated fungi within other genera (O'Donnell *et al.* 2014a). In California and Israel, *Euwallacea* sp. carries within its mandibular mycangia three primary fungal symbionts: ***Fusarium euwallacea***, ***Graphium* sp**. and ***Sarocladium* sp.** (formerly ***Acremonium* sp**); these fungi also being cultivate in beetle brood galleries. Larvae and adult beetles feed on *F.euwallaceae* and *Graphium* sp. (Mendel & Freeman, 2015)

Recent research from O'Donnell also shows that most *Euwallacea* spp. seem to be only associated with one species of Fusarium although some exemptions have been found. On the other hand, cophylogenetic analyses indicate that the *Euwallacea* and *Fusarium* phylogenies were largely incongruent during the evolution of this mutualism, apparently due to the beetles switching fusarial symbionts (i.e., host shifts) at least five times during the evolution. (The origin of this mutualism is estimated near the Oligocene-Miocen boundary ~ 19-24Mya). This host-switching can became very dangerous (O'Donnell *et al*. 2014a).

After the attack of the beetle, the fungus spreads from the galleries to attack the tree's vascular tissue. This causes a disease called **"Fusarium Dieback" (FD),** which has been found to interrupt the transport of water and nutrients in more than 100 tree species. (Eskalen *et al*. 2014a)

Classification: (Species 2000 & ITIS Catalogue of Life: 2015).
Kingdom: **Fungi**
Phylum: **Ascomycota**
Class: **Orbiliomycetes**
Order: **Orbiliales**
Family: **Orbiliaceae**

Genus: **Fusarium**
Several species of Ambrosia Fusarium Clade (AFC) within Clade 3 of the *Fusarium solani* species complex (FSSC).

The initial collection of ***Fusarium ambrosium*** from galleries in Chinese tea (*Camellia sinensis*) in Sri Lanka (as Ceylon) was described as *Monacrosporium ambrosium* Gadd &Loos (Gadd and Loos 1947). Bayford (1987) redescribed this species four decades later as *Fusarium bugnicourtii*. Subsequently, Nirenberg (1990) named it as *Fusarium ambrosium.*

On the other hand, Freeman *et al*., (2013b) have identified the fungus associated to the beetle in California and Israel as ***Fusarium euwallaceae* sp.nov.** Results of rearing experiments showed that larvae can complete their cycle of life on a culture of this fungus but not on that of *F. ambrosium*, the symbiont of *E. fornicatus*.

In the sample of 103 adult female *Euwallacea ambrosia* beetles collected, O'Donnell found seven different species-level lineages among the *Fusarium*-farming *Euwallacea* within the monophyletic AFC (O'Donnell *et al*. 2014a):

• ***Fusarium ambrosium*** **[AF-1]**	Associated with ***Euwallacea* 'fornicatus'? (Euwallacea sp. #*6*-TSHB)** *in* Papua NewGuinea Associated with ***Euwallacea* sp *#4*** in Sri Lanka
• ***Fusarium euwallaceae*** **[AF-2]**	Associated with ***Euwallacea* sp. #1** (**PSHB**) in Israel and Los Angeles-California, USA.
• ***Fusasium* sp.** **[AF-6]**	Associated with ***Euwallacea* sp. *#2*** in Miami-Florida, USA
• ***Fusasium* sp.** **[AF-7]**	Associated with ***Euwallacea* sp. #3** in Queensland, Australia.
• ***Fusasium* sp.** **[AF-8]**	Associated with ***Euwallacea* sp. #2** in Miami-Dade County, USA
• ***Fusarium sp.*** ***[AF-11]***	Associated with ***Euwallacea* sp *#4*** in Sri Lanka
• ***Fusasium* sp.** **[AF-12]**	Associated with ***Euwallacea* sp. #5** (**KSHB**) in San Diego County, USA.

More different Fusarium species (i.e: AF-3; AF-4; AF-5; AF-9; AF-10) where found in other *Euwallacea* species, *Xyleborus ferrugineus*, and in other unknown species collected in this research.

Euwallacea sp #4 in Sri Lanka was found farming *Fusarium ambrosium* AF-1 and *Fusarium* sp. AF-11 on Chinese tea.
Euwallacea sp. #2 in Miami-Dade County, Florida was found cultivating *Fusarium* spp. AF-6 and AF-8 on avocado.

Annex 3. More information about hosts:

There have been included in this table, most of the species that have reported attacked by any *Euwallacea* sp. morphologically similar to *Euwallacea fornicatus*, including real and not-real hosts. **This list is constantly growing.**

The species shadowed in green have been described as "**real host ([=reproductive host] [=true host])**." (It has been reported that the beetle is able to have offspring).

There is a huge potential for and frequency of host-switching between Euwallacea and Ambrosia Fusaria (AFC), and this shifts may bring together more aggressive and virulent combinations of these invasive mutualists.

For more information on other possible hosts, consult the studies of Eskalen *et al*., (2014c) where up to date 303 species have been reported having been attacked by *Euwallacea* sp. (PSHB) in California. (Lynch *et al*, 2014)

A3-Table 1: Real and non-real hosts of Euwallacea sp.morphologically similar to "E.fornicatus"

Hosts	Family	References
Acacia spp. (Acacia)	FABACEAE	UCR-Eskalen Lab Web 2015
Acacia visco (Arca)	FABACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Acer buergerianum (Trident maple)	ACERACEAE (SAPINDACEAE)	Eskalen *et al.* (2013); UCR-CISR (2014); UCR-Eskalen Lab Web (2015) *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Acer macrophyllum (Big leaf maple)	SAPINDACEAE	Eskalen *et al.* (2013); UCR-CISR (2014); UCR-Eskalen Lab Web (2015) Euwallacea sp. in California. Host susceptible to Fusarium Dieback
Acer negundo (Box elder)	SAPINDACEAE	Eskalen *et al.* (2013); UCR-CISR (2014); UCR-Eskalen Lab Web (2015) As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback As *Euwallacea* sp. in Israel
Acer obtusifolium	SAPINDACEAE	Mendel *et al.* (2012a)
Acer palmatum (Bonfire Japanese maple)	SAPINDACEAE	Eskalen *et al.* (2013); UCR-CISR (2014); UCR-Eskalen Lab Web (2015) *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Acer paxii (Evergreen Maple)	SAPINDACEAE	Eskalen *et al.* (2013); UCR-CISR (2014) ; UCR-Eskalen Lab Web (2015) *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Acer pseudoplatanus	SAPINDACEAE	Spann (2013b)
Afrocarpus falcatus	PODOCARPACEAE	Hodel (2012)
Ailanthus altissima (Tree of heaven)	SIMAROUBACEAE	UCR-Eskalen Lab Web (2015)
Alangium chinensis	CORNACEAE	Eskalen *et al.* (2013); Host susceptible to Fusarium Dieback
Alberia gardneri	FLACOURTIACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* inCeylon [=Sri Lanka]
Albizia falcata	PODOCARPACEAE	Hodel (2012); Danthanarayana (1968) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Albizia julibrissin (Silk tree/Mimosa)	FABACEAE	Eskalen *et al.* (2013); Hodel (2012); UCR-CISR (2014); UCR-Eskalen Lab Web (2015) *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback As KSHB (Euwallacea sp. #5 in San Diego Co-California. (Eskalen lab website)
Albizia odoratissima	FABACEAE	Walker (2008); Wood &Bright (1992) As *Xyleborus fornicatus* in India
Albizia procera	FABACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Albizia sumatrana	FABACEAE	Walker (2008); Wood &Bright (1992) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Alectryon excelsus (Titoki tree)	SAPINDACEAE	UCR-CISR (2014); Eskalen *et al.* (2013); *EEuwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Allophyllus cobbe	SAPINDACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Alnus rhombifolia (White Alder)	BETULACEAE	UCR-Eskalen Lab Web (2015)
Alnus rubra (Red Alder)	BETULACEAE	CABI (2015); Haack (2006)
Anthocephalus indicus	RUBIACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in India
Arthrophyllum diversifolium	ARALIACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* inMalayaand Sunda Islands.
Artocarpus spp.	MORACEAE	Wood &Bright (1992)
Artocarpus integer (Jack tree, cempedak)	MORACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Azadirachta indica (Neem)	MELEACEAE	Walgama (2012)
Bansia saxicola (Grampians banksia)	PROTEACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.

Hosts	Family	References
Bauhinia x blakeana (Orchid tree)	FABACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Bauhinia malabarica	FABACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Bauhinia variegata	FABACEAE	Mendel *et al.* (2012a); Walker (2008); Wood &Bright (1992)
Betula pendula (Silver birch)	BETULACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Bischofia javanica (Bishop wood)	EUPHORBIACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Bixa orellana (Annatto)	BIXACEAE	CABI (2015); Danthanarayana (1968) As *Xyleborus fornicatus* inCeylon [=Sri Lanka] and Malaya
Bombix malabraricum	BOMBACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Brachychiton acerifolius (Illawara flame tree)	MALVACEAE	Mendel *et al.* (2012a); Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Brachychiton australis (Kurrajong)	MALVACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Brachychiton discolor (Lacebark tree)	MALVACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Brachychiton populneus	MALVACEAE	Mendel *et al.* (2012a)
Brachychiton rupestris (Queensland bottle tree)	MALVACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Brosimum utile	MORACEAE	Kirkendall & ∅dergaard (2007)
Calleria atropurpurea *[=Whitfordiodendron pubescens] [=W.atropurpureum][=Pongamia atropurpurea]*	FABACEAE	Walker (2008); Wood &Bright (1992)
Calpurnia aurea	FABACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Camellia reticulata (Camellia)	THEACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Camellia semiserrata	THEACEAE	Eskalen *et al.* (2013); University of California-Riverdide (2014c); (2015) *Euwallacea* sp. in California
Camellia sinensis (tea)	THEACEAE	Danthanarayana (1968); EPPO (2015); Walgama (2012) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka], India, Indonesia and Formosa.
Camptotheca acuminata (Happy tree)	CORNACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Canarium commune (Java almond)	BURSERACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Cariota urens	PALMACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Carya illinoinensis (Hickory)	JUGLANDACEAE	Eskalen *et al.* 2013 As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Casia alata	FAGACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Casia brewsteri (Casia pea)	FABACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Casia fistula	FAGACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Castamopsis spp (Evergreen chinkapin) *Castanopsis (D. Don) Spach, nom. cons.*	FAGACEAE	CABI (2015); Danthanarayana (1968) As *Xyleborus fornicatus* in Malaya and Sunda Islands.
Castanospermum australe (Black bean/ Moreton Bay Chestnut)	FABACEAE	Eskalen *et al.* (2013); UCR-CISR (2014); UCR-Eskalen Lab Web (2015) *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Casuarina equisetifolia (Australian oak)	CASUARINACEAE	Walker (2008); Wood &Bright (1992); Danthanarayana (1968) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka].
Catalpa speciosa (Northern catalpa)	BIGNONIACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California
Cedrela odorata	MELIACEAE	Attkinson (2013); Kirkendall & ∅dergaard (2007)
Ceiba pentandra (kapok)	MALVACEAE	CABI (2015); Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Ceiba speciosa	MALVACEAE	Mendel *et al.* (2012a); Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Cercidium floridum (Blue Palo Verde)	FABACEAE	Eskalen *et al.* (2013); UCR-CISR (2014); UCR-Eskalen Lab Web (2015)

Hosts	Family	References
		Euwallacea sp. in California. Host susceptible to Fusarium Dieback.
Cercidium sonorae (Brea)	FABACEAE	Eskalen *et al.* (2013); UCR-CISR (2014); UCR-Eskalen Lab Web (2015) *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Chionanthus retusus (Chinese fringetree)	OLEACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Chlorophora excelsa (Afrikan oak)	MORACEAE	Wood &Bright (1992)
Cinchona calisaya (Quinine)	RUBIACEAE	CABI (2015); Danthanarayana (1968) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka] and India
Cinchona officinalis (Quinine)	RUBIACEAE	EPPO (2012)
Cinnamomum sp.	LAURACEAE	Walker (2008); Wood &Bright (1992)
Cinnamomum camphora (Camphor tree)	LAURACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
***Citrus* spp.**	RUTACEAE	EPPO (2015); Walker (2008); It is important to note that the complex has been found on three citrus species in southern California (**orange, lime, and kumquat**). The beetle is not reproducing on the citrus species but the fungus has been isolated (Eskalen, 2012).(NPAG, 2013)
Citrus aurantium	RUTACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Citrus sinensis (Orange)	RUTACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Clerodendrum colebrookianum	LAMIACEAE	Walker (2008); Wood &Bright (1992)
Clerodendrum infortunatum	LAMIACEAE	Walker (2008); Wood &Bright (1992) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Clerodendron siphonantus	VERBENACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Cleyera japonia (Sakaki)	THEACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Cocculus laurifolius (Laurel-leaved snail tree)	MENISPERMACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Cocculus orbiculatus (=C.trilobus)	MENISPERMACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Cornus controversa (Giant dogwood)	CORNACEAE	Eskalen *et al.* (2013); As Euwallacea sp. in California. Host susceptible to Fusarium Dieback.
Corylus colurna (Turkish hazelnut)	BETULACEAE	Eskalen *et al.* (2013); As Euwallacea sp. in California. Host susceptible to Fusarium Dieback.
Crotalaria *Crotalaria L., nom. cons. prop.*	FABACEAE	CABI (2015); Wood &Bright (1992)
Crotalaria anagyroides	FABACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Crotalaria striata [=*Crotalaria pallida* Aiton var. *obovata* (G. Don) Polhill]	FABACEAE	Danthanarayana (1968); Wood &Bright (1992) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Crotalaria usaramoensis [=*Crotalaria trichotoma*] [=*Crotalaria zanzibarica*]	FABACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Cupaniopsis anacardioides (Carrotwood)	SAPINDACEAE	Hodel (2012)
Cussonia spicata (Spiked cabbage tree)	ARALIACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Dalbergia latifolia	FABACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Delonix regia (Royal poinciana)	FABACEAE	Attkinson (2013); Haack (2003); Danthanarayana (1968) as Poinciana regia. As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Derris eliptica	FABACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Derris robusta	FABACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Desmodium cephalotes	FABACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Diospyros kaki	EBENACEAE	Eskalen *et al.* (2013); Mendel *et al.* (2012a) As *Euwallacea* sp. in California.
Diospyros lycidioides	EBENACEAE	Eskalen *et al.* (2013); Mendel *et al.* (2012a) As *Euwallacea* sp. in California.Host susceptible to Fusarium Dieback.
Dombeya cacuminum (Strawberry tree)	MALVACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Durio zibethinus (Durian)	MALVACEAE	CABI (2015); Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Embelia cf. insumbens	PRIMULACEAE	Walker (2008); Wood &Bright (1992)

Hosts	Family	References
Eriobotrya japonica (Loquat)	ROSACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Erythrina corallodendrum (Coral tree)	FABACEAE	Eskalen *et al.* (2013); UCR-CISR (2014); UCR-Eskalen Lab Web (2015) *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Erythrina crista-galli (Ceibo)	FABACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Erythrina folkersii (Coral tree)	FABACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Erythrina humeana (Dwarf coral tree)	FABACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback. As KSHB (Euwallacea sp. #5 in San Diego Co-California. UCR-Eskalen Lab Web (2015)
Erythrina indica	FABACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in India
Erythrina lysistemon (Common coral tree)	FABACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Erythrina orientalis	FABACEAE	Walker (2008); Wood & Bright (1992)
Erythrina subumbrans (December tree) [=*E.lithosperma*] [=*Hypaphorus subumbrans*]	FABACEAE	CABI (2015); Wood & Bright (1992)
Erythrina x sykesii (Coral tree)	FABACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Eucalyptus ficifolia (Red Flowering Gum)	MYRTOIDEAE	UCR-CISR (2014); UCR-Eskalen Lab Web (2015) *Euwallacea* sp. in California
Eucalyptus polyanthemos (River red gum)	MYRTACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Eucalyptus torquata (Red box)	MYRTACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Fagus sylvatica (European beech)	FAGACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Fatsia japonica (Japanese aralia)	ARALIACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Ficus carica (Black mission fig)	MORACEAE	UCR-Eskalen Web Lab 2015 as PSHB
Ficus hispida	MORACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Ficus macrophylla (Moreton Bay fig)	MORACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Ficus nervosa	MORACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Ficus platypoda (Desert rock fig)	MORACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Ficus septica	MORACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Ficus toxicaria *[=Ficus padana]*	MORACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Fissistigma elegans	ANNONACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Malaya
Firmiana simplex (Chinese parasol tree)	MALVACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Fragaea gigantea	LOGANIACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Malaya
Fraxinus uhdei (Shamel ash)	OLEACEAE	Eskalen *et al.* 2013. As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Geijera parviflora (Wilga)	RUTACEAE	Hodel (2012)
Gleditsia triacanthos Honey Locust	FABACEAE	Eskalen *et al.* (2014a). Host susceptible to Fusarium Dieback.
Gliricidia sepium (madreado)	FABACEAE	Walker (2008); Wood & Bright (1992); Danthanarayana (1968)

Hosts	Family	References
		As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Gmelina arborea (Candahar)	LAMIACEAE	CABI (2015); Nair & Mathew (1988); Wood & Bright (1992)
Gossampinus hexaphylla	MALVACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Grevillea robusta (Silky oak)	PROTEACEAE	CABI (2015); Hodel (2012); Wood & Bright (1992); Danthanarayana (1968) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Harpullia arborea (Tulip-wood tree)	SAPINDACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Heliocarpus donnellsmithii	MALVACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Hevea brasiliensis	EUPHORBIACEAE	CABI (2015); Danthanarayana (1968); EPPO (2015); Wood & Bright (1992) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka], Java, Malaya
Hymenosporum flavum (Native frangipani)	PITTOSPORACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Ilex aquifolium	AQUIFOLIACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California
Ilex cornuta (Chineese holly)	AQUIFOLIACEAE	Eskalen *et al.* (2013); UCR-CISR (2014); UCR-Eskalen Lab Web (2015) *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Ilex latifolia (Tarajo holly)	AQUIFOLIACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Inga feuilleii (Pacay)	FABACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Inga vera	FABACEAE	Danthanarayanaw (1968) As *Xyleborus fornicatus* in Java
Intsia palembanica	FABACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Malaya
Ixora parviflora	RUBIACEAE	Danthanarayana (1968); Walker (2008); Wood &Bright (1992) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka] and India
Jatropha cf. cinerea (Limberbush)	LIMBERBUSH	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Juniperus chinensis (Chines juniper)	CUPRESSACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Koelreuteria bipinnata	SAPINDACEAE	Eskalen et *al.* (2015). Host susceptible to Fusarium Dieback.
Koelreuteria elegans	SAPINDACEAE	Hodel (2012)
Koelreuteria paniculata *(Golden Rain)*	SAPINDACEAE	Spann (2013b); Eskalen *et al.* (2013); Host susceptible to Fusarium Dieback.
Kopsia flavida	FAGACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Lansium domesticum	MELIACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Lantana aculeata	VERBENACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Litchi chinensis (Lychee)	SAPINDACEAE	CABI (2015); Euler *et al*., (2006); Walker (2008)
Liquidambar formosana (Chinese sweet gum)	ALTINGIACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Liquidambar styraciflua (Liquidambar/ American Sweetgum)	ALTINGIACEAE	Eskalen *et al.* (2013); Hodel (2012); UCR-CISR (2014); UCR-Eskalen Lab Web (2015) As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Livistona chinensis (Chinese fan palm)	ARECACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Luehea divaricata (Açoita-cavalo)	MALVACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Lysiphyllum carronii (Queensland ebony)	FABACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Macadamia integrifolia (Macadamia nut)	PROTEACEAE	CABI (2015); Walker (2008); Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback. Leathers (2015): Unidentified beetles (*Euwallacea* sp. possibly *fornicatus*) have been intercepted on macadamia from Hawaii.
Machilus thunbergii (=Persea thunbergii) (Asian avocado)	LAURACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Magnolia grandiflora (Southern magnolia)	MAGNOLIACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Magnolia x vitchii	MAGNOLIACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Mangifera indica (Mango)	ANACARDIACEAE	CABI (2015)
***Melastoma* sp.**	MELASTOMACEAEA	Danthanarayana (1968)
Melastoma malabathricum	MELASTOMACEAEA	Danthanarayana (1968)

Hosts	Family	References
		As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Melianthus major (Giant honey flower)	MELIANTHACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Metasequoia glyptostroboides (Dawn redwood)	CUPRESSACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Michelia vulutina	MAGNOLIACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Mimosa bracaatinga	FABACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Moringa oleifera (Horse-raddish)	MORINGACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Morus alba (White mulberry)	MORACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Myristica fragrans	MYRISTICACEAE	Walker (2008); Wood &Bright (1992) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka] and Malaya
Nephelium lappaceaum (rambutan)	SAPINDACEAE	Walker (2008)
Ochroma lagopus	MALVACEAE	Walker (2008); Wood &Bright (1992)
Odina wodier	ANACARDIACEAE	Walker (2008); Wood &Bright (1992); Danthanarayana (1968) As *Xyleborus fornicatus* in India
Olea europea (Olive tree)	OLEACEAE	UCR-CISR (2014); Freeman *et al.* 2013; Eskalen *et al.* 2013. Eskalen *et al.* (2014a) As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Pajanella longifolia	BIGNONACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Malaya
Paraserianthes falcataria	FABACEAE	CABI (2015); Danthanarayana (1968); Nair & Mathew (1988); Wood &Bright (1992)
Parkia speciosa	FABACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Petraea volubilis	VERBENACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Parkinsonia aculeata (Palo verde)	FABACEAE	Eskalen *et al.* (2013); UCR-CISR (2014); UCR-Eskalen Lab Web (2015) As *Euwallacea* sp. in California.Host susceptible to Fusarium Dieback.
Peltaphorum ferrigenium	FABACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Persea americana (Avocado)	LAURACEAE	Eskalen *et al.* (2013); EPPO (2015); Mendel *et al.* (2012a); UCR-CISR (2014); UCR-Eskalen Lab Web (2015) Freeman *et al.* (2013) As *PSHB.* in California. Host susceptible to Fusarium Dieback. As Euwallacea sp. in Israel As *Xyleborus fornicatus* in Ceylon [=Sri Lanka] (Persea gratissima) As KSHB (Euwallacea sp. #5 in San Diego Co-California. UCR-Eskalen Lab Web (2015)
Persea bombycina (Som plant)	LAURACEAE	CABI (2015); Kumar *et al.* (2011)
Photinia japonica	ROSACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Phyllanthus embilica	EUPHORBIACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Pipturus argenteus	URTICACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Pithecolobium lobatum	FABACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Pittosporum undulatum (Victorian box)	PITTOSPORACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
***Planchonia* sp.**	ROSACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Platanus x acerifolia (London Plane) *[Platanus x hispanica]*	PLATANACEAE	Hodel (2012); UCR-Eskalen Lab Web (2015) *Euwallacea* sp. in California
Platanus mexicana (Mexican sycamore)	PLATANACEAE	Eskalen *et al.* (2013); Real host UCR-Eskalen Lab Web (2015) As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Platanus occidentalis (American sycamore)	PLATANACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Platanus orientalis	PLATANACEAE	Mendel *et al.* (2012a)
Platanus racemosa (California sycamore)	PLATANACEAE	Eskalen *et al.* (2013); Haack (2006), Hodel (2012); UCR-CISR (2014); UCR-Eskalen Lab Web (2015) As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback

Hosts	Family	References
		As *Euwallacea* sp. in Israel As KSHB (Euwallacea sp. #5 in San Diego Co-California. (UCR-Eskalen lab website 2015)
Platanus wrightii (Arizona sycamore)	PLATANACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback
Podachaenium eminens (Giant daisy tree)	ASTERACEAE	UCR-CISR (2014)
Populus **spp.**	SALICACEAE	Wood &Bright (1992)
Polulus fremontii (Cottonwood/Fremont Cottonwood)	SALICACEAE	UCR-Eskalen Lab Web (2015) As KSHB (Euwallacea sp. #5 in San Diego Co-California.
Populus nigra (Black Polar)	SALICACEAE	UCR-Eskalen Lab Web (2015)As KSHB (Euwallacea sp. #5 in San Diego Co-California.
Polulus trichocarpa (Black cottonwood)	SALICACEAE	UCR-Eskalen Lab Web (2015)
Prosopis articulata (Mesquite)	FABACEAE	UCR-Eskalen Lab Web (2015) *Euwallacea* sp. in California
Protium panamense (copal, chutra)	BURSERACEAE	Attkinson (2013); Kirkendall & ∅dergaard (2007)
Protium serratum	BURSERACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in in Java
Prunus mume (Chinese plum)	ROSACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Prunus persica (Peach)	ROSACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Prunus serrulata (Japanese cherry)	ROSACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Psidium guajava (Guava)	MYRTACEAE	CABI (2015); Danthanarayana (1968) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Pterocymbium beccarii	MALVACEAE	Walker (2008); Wood &Bright (1992)
Punica granatum (Pomegranate)	LYTHRACEAE	Balikai *et al.*, (2011); CABI (2015)
Pyrus kawakamii (Evergreen pear)	ROSACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Quercus agrifolia (California coast live oak)	FAGACEAE	Eskalen *et al.* (2013); University of California-Riverdide (2014c); University of California-Riverdide (2015) *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback UCR-Eskalen Lab Web (2015) As KSHB (Euwallacea sp. #5 in San Diego Co-California.
Quercus chrysolepis (Canyon live oak)	FAGACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Quercus engelmannii (Engelmann Oak)	FAGACEAE	UCR-CISR (2014); UCR-Eskalen Lab Web (2015) *Euwallacea* sp. in California
Quercus ilex (Holly oak)	FAGACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Quercus lobata (Valley oak)	FAGACEAE	UCR-CISR (2014); UCR-Eskalen Lab Web (2015) *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Quercus macrocarpa (Bur oak)	FAGACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Quercus mexicana (Cozahuatl)	FAGACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Quercus robur (=*Q.pedunculiflora*) (English oak)	FAGACEAE	Eskalen *et al.* (2013); UCR-CISR (2014); UCR-Eskalen Lab Web (2015) As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback. As *Euwallacea* sp. in Israel
Quercus suber (Cork Oak)	FAGACEAE	UCR-CISR (2014); UCR-Eskalen Lab Web (2015) *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback. UCR-Eskalen Lab Web (2015) As KSHB (Euwallacea sp. #5 in San Diego Co-California
Quercus virginiana (Southern live oak)	FAGACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Ricinus communis (Castor bean)	EUPHORBIACEAE	Eskalen *et al.* (2013); CABI (2015); Danthanarayana (1968), EPPO (2015); Mendel *et al* (2012b); UCR-CISR (2014); UCR-Eskalen Lab Web (2015) As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback. As *Euwallacea* sp. in Israel As *Xyleborus fornicatus* in Ceylon, Java and Sumatra UCR-Eskalen Lab Web (2015) As KSHB (Euwallacea sp. #5 in San Diego Co-California.
Robinia pseudoacacia (Black locust)	FABACEAE	Attkinson (2013); CABI (2015); Haack (2006); Hodel (2012); Wood &Bright

Hosts	Family	References
		(1992) UCR-Eskalen Lab Web (2015): As KSHB (Euwallacea sp. #5 in San Diego Co-California.
Roystonea regia	ARECACEAE	Mendel *et al.* (2012a)
Salix babylonica (Weeping willow)	SALICACEAE	UCR-CISR (2014); UCR-Eskalen Lab Web (2015) *Euwallacea* sp. in California
Salix gooddingii (Goodding's black willow)	SALICACEAE	UCR-Eskalen Lab Web (2015)
Salix lasolepsis (Arroyo Willow)	SALICACEAE	UCR-Eskalen Lab Web (2015) As KSHB (Euwallacea sp. #5 in San Diego Co-California
Salix laevigata (Red Willow)	SALICACEAE	UCR-CISR (2014); UCR-Eskalen Lab Web (2015) *Euwallacea* sp. in California As KSHB (Euwallacea sp. #5 in San Diego Co-California.
Salix matsudana (Tortuosa)	SALICACEAE	University of California-Riverdide (2014c)
Salix nigra (Black Willow)	SALICACEAE	UCR-Eskalen Lab Web (2015) As KSHB (Euwallacea sp. #5 in San Diego Co-California.
Salmalia malabarica *[=Bombax ceiba]*	MALVACEAE	Walker (2008); Wood &Bright (1992)
Sapium sebiferum (Chinese tallow tree)	EUPHORBIACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. . Host susceptible to Fusarium Dieback.
Scaphium affine	STERCULIACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Malaya
Schima noronhae	EUPHORBIACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Schinus terebinthifolius (Brazilian pepper tree)	ANACARDIACEAE	Eskalen *et al.* (2013); Mc Donough, (2013); NPAG (2013) Host susceptible to Fusarium Dieback
Schleichera olesa (Kesambi, Macassar oil tree)	SAPINDACEAE	CABI (2015); Danthanarayana (1968) As *Xyleborus fornicatus* in Java and Sumatra
Schotia bracypetala (Huilboerboon)	FABACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Senna racemosa var.liebmanni	FABACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Senna siamea *[=Cassia siamea]*	FABACEAE	Wood &Bright (1992)
Sequoia sempervirens (Coast Redwood)	CUPRESSACEAE	Eskalen *et al.* (2014a). Host susceptible to Fusarium Dieback.
Shorea robusta	DIPTEROCARPACEAE	Danthanarayana (1968); Walker (2008); Wood &Bright (1992); As *Xyleborus fornicatus* in in India
Spondias dulcis	ANACARDIACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java. Able to breed in
Swietenia mahagoni	MELIACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java and Sumatra
Tamarindus indica	FABACEAE	Mendel *et al.* (2012a)
Tectona grandis (Teak)	LAMIACEAE	CABI (2015); Wood &Bright (1992); Danthanarayana (1968) As *Xyleborus fornicatus* in Java and Burma
Tephrosia *Tephrosia Pers., nom. cons.* (hoary-pea)	FABACEAE	CABI (2015);
Tephrosia candida	FABACEAE	Danthanarayana (1968); Walker (2008); Wood &Bright (1992) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Tephrosia vogelii	FABACEAE	Danthanarayana (1968); Walker (2008); Wood &Bright (1992) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Terminalia catappa (Singapore almond)	COMBRETACEAE	CABI (2015); Wood &Bright (1992); Danthanarayana (1968) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka]
Theobroma cacao (Cocoa)	STERCULIACEAE	CABI (2015); Danthanarayana (1968); EPPO (2015); Walker (2008); Wood &Bright (1992) As *Xyleborus fornicatus* in Ceylon [=Sri Lanka], Java, Malaya and Sunda Islands
Tilia americana (Basswood)	MALVACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Tocoyena pittieri	RUBIACEAE	Kirkendall & ∅dergaard (2007)
Trema orientalis	URTICACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java
Ungnadia speciosa (Mexican buckeye)	SAPINDACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Ulmus americana (American elm)	ULMACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Ulmus parvifolia *[=Ulmus chinensis]*	ULMACEAE	Hodel (2012); Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Umbellularia californica (California bay laurel)	LAURACEAE	Eskalen *et al.* (2013);

Hosts	Family	References
		Euwallacea sp. in California. Host susceptible to Fusarium Dieback.
Vitex pubescens	VERBENACEAE	Danthanarayana (1968) As *Xyleborus fornicatus* in Java and Sumatra
Vitis vinifera (Grapevine)	VITACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Washingtonia filifera (Desert fan palm)	ARECACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Wisteria floribunda (Japanese wisteria)	FABACEAE	UCR-Eskalen Lab Web (2015)
Wisteria sinensis (Chinese wisteria)	FABACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Xylia xylocarpa	FABACEAE	Walker (2008); Wood &Bright (1992)
Xylosma congestum (Dense logwood)	SALICACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Zelkova serrata (Ju shu)	ULMACEAE	Eskalen *et al.* (2013); As *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.
Ziziphus jujuba (Chinese date)	RHAMNACEAE	Eskalen *et al.* (2013); *Euwallacea* sp. in California. Host susceptible to Fusarium Dieback.

Unidentified beetles (*Euwallacea* sp. possibly *fornicatus*) have been intercepted seven times on **bamboo, cut flowers, ginger,** macadamia**,** and *Dracaena compacta* from **Hawaii**. PSHB is not known to occur in Hawaii so these interceptions are likely **tea shot hole borer**. (Leathers, 2015).

It seems it refers to hitchhiking. Further details are not provided.

Annex 4. Climate comparison.

Köppen-Geiger climate zones

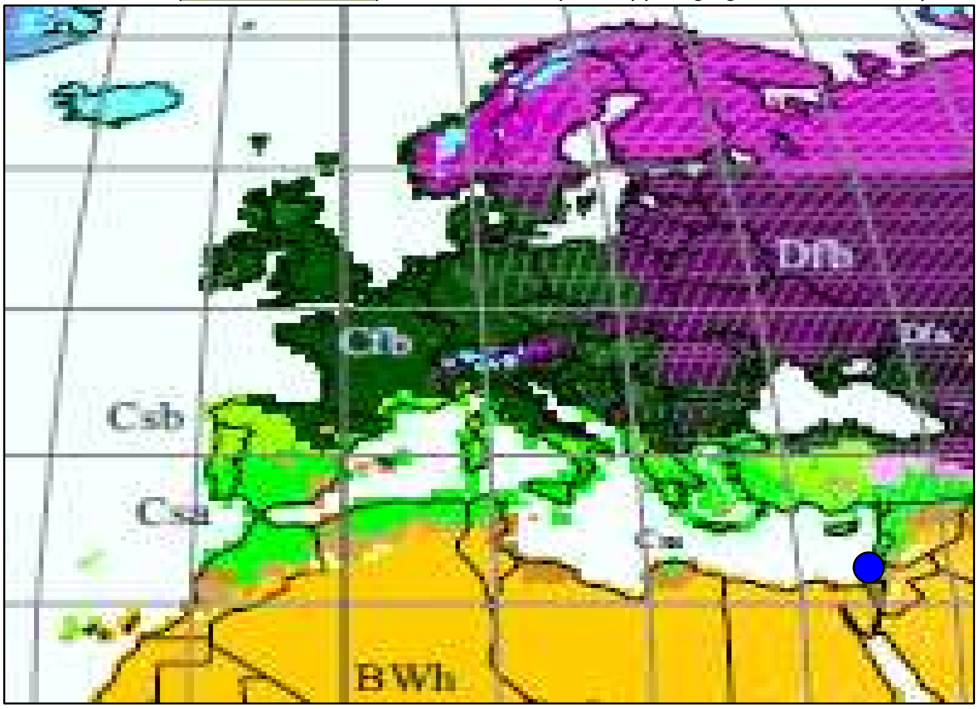
Euwallacea spp. occurs in at least 7 Köppen-Geiger climate zones (Af, Aw, As, Csa, Cfa, Cwa, Cwb).
The following climatic zones are present in the PRA area, warm temperate (Csa, Csb and Cfb), snow (Dfb, Dfc) and polar (ET) (see A4-Table I and A4-Figures 1-5).

A4-Table I. The Köppen-Geiger climate zones where *Euwallacea* spp. *(E.fornicatus-like)* occur are indicated by asterisks**.**

Köppen-Geiger climate zones					
Code	**Main Climate**	**Precipitation**	**Temperatures**	**Presence of Euwallace sp. (E.fornicatus-like)**	**Climate zones in the PRA area**
Af	Equatorial	Fully humid		*	No
Am	Equatorial	Monsoonal		*	No
Aw	Equatorial	Winter dry		*	No
Cfa	Warm temperate	Fully humid	Hot summer	*	No
Cfb	Warm temperate	Fully humid	Warm summer		YES
Csa	**Warm temperate**	**Dry summer**	**Hot summer**	*	**YES**
Csb	Warm temperate	Steppe	Warm summer		YES
Cwa	Warm temperate	Desert	Hot summer	*	No
Cwb	Warm temperate	Desert	Warm summer	*	No
Dfb	Snow	Fully humid	Warm summer		YES
Dfc	Snow	Fully humid	Cool summer		YES
ET	Polar		Polar tundra		YES

Af: Tropical wet-No dry season.
Am: Tropical monsoonal-Short dry season; heavy monsoonal rains in other months.
Aw: Tropical savannah-Winter dry season.
Cfa: Humid subtropical-Mild with no dry season, hot summer.
Cfb: Marine west coast-Mild with no dry season, warm summer
Csa: Mediterranean-Mild with dry, hot summer.
Csb: Mediterranean-Mild with dry, warm summer
Cwa: Humid subtropical -Mild with dry winter, hot summer.
Cwb: Humid subtropical - Mild with dry winter, warm summer.
Dfb: Humid continental-Humid with severe winter, no dry season, warm summer
Dfc: Subarctic-Severe winter, no dry seaon, cool summer
ET: Tundra, polar tundra, no true summer

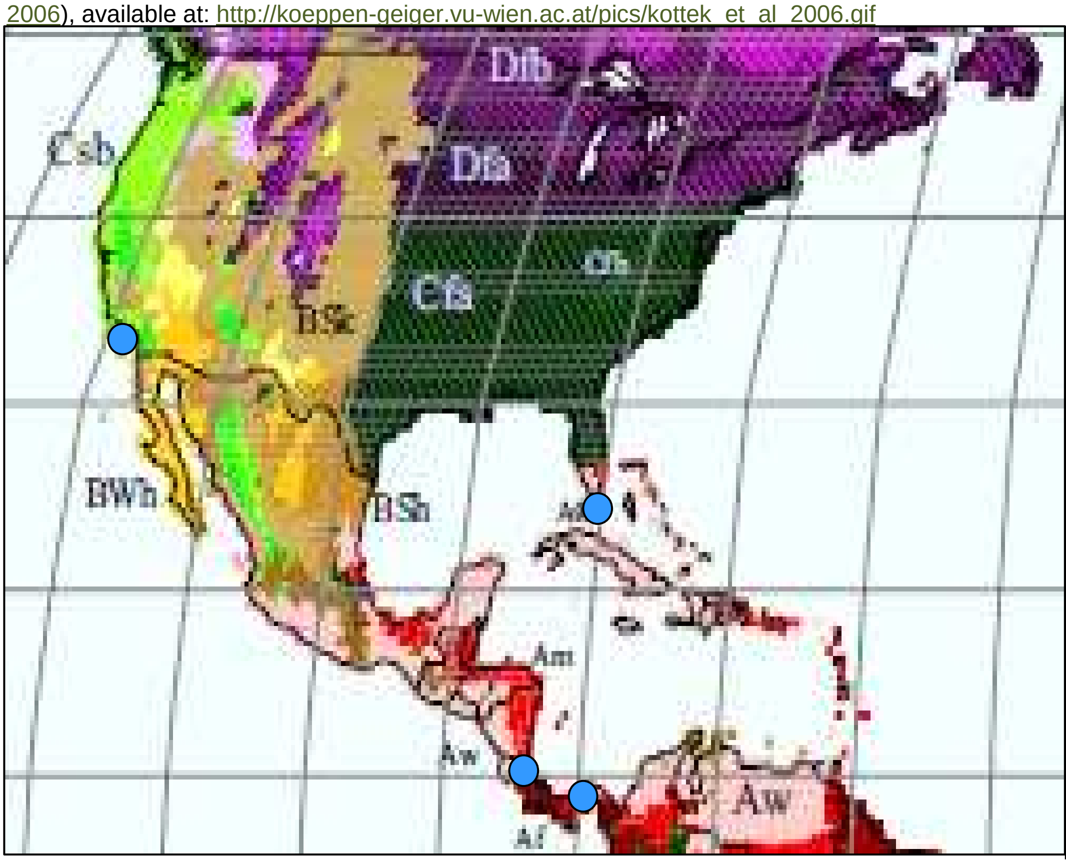
A4-Figure 1. Europe and Mediterranean Region (EPPO region): Detail of the updated Köppen-Geiger Climate Classification (Kottek *et al.*, 2006), available at: http://koeppen-geiger.vu- wien.ac.at/pics/kottek_et_al_2006.gif



The blue dot indicates detection of *Euwallacea sp.* IS/CA. in avocado in Israel.

Csa: Mediterranean-Mild with dry, hot summer

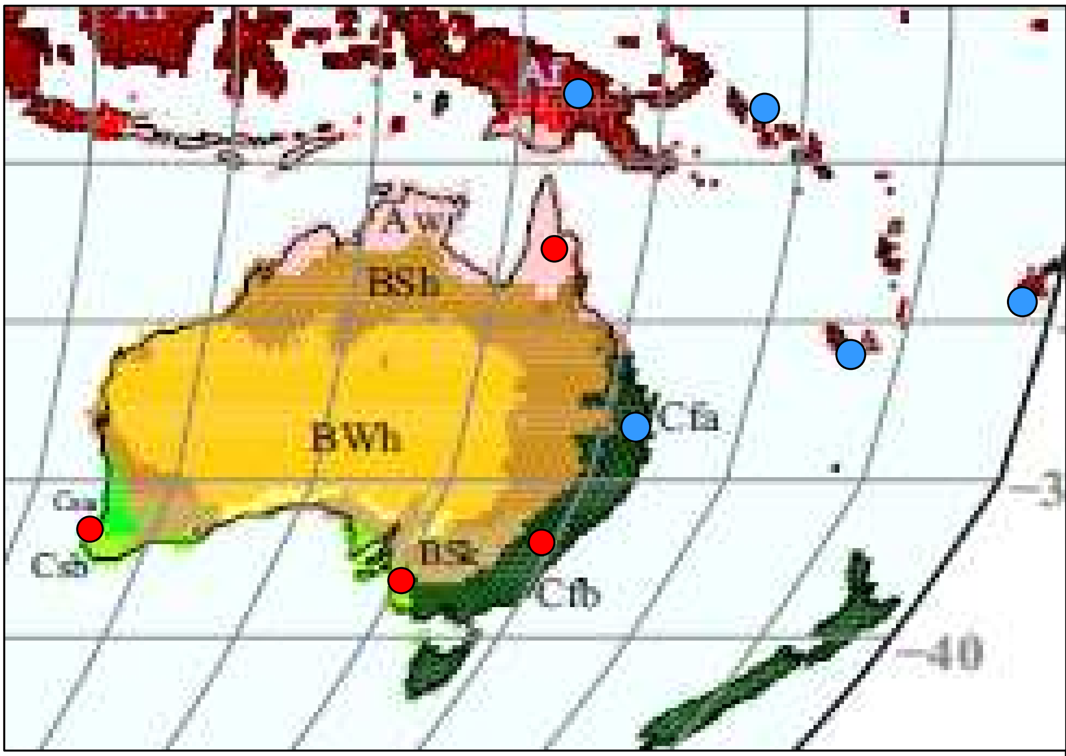
A4-Figure 2. USA and Center America: Detail of the updated Köppen-Geiger Climate Classification (Kottek *et al.*, 2006), available at: http://koeppen-geiger.vu-wien.ac.at/pics/kottek_et_al_2006.gif



Blue dots indicate detection of *Euwallacea* sp. IS/CA. in California
And *Euwallacea* sp. (morphologicaly similar to *E.fornicatus*) in California, Florida (USA); Panamá; Heredia (Costa Rica).

Csa: Mediterranean-Mild with dry, hot summer.
Af: Tropical wet-No dry season.
Am: Tropical monsoonal-Short dry season; heavy monsoonal rains in other months.
Aw: Tropical savanna-Winter dry season.

AF-Figure 3. Oceania: Detail of the updated Köppen-Geiger Climate Classification (Kottek *et al.*, 2006), available at: http://koeppen-geiger.vu-wien.ac.at/pics/kottek_et_al_2006.gif

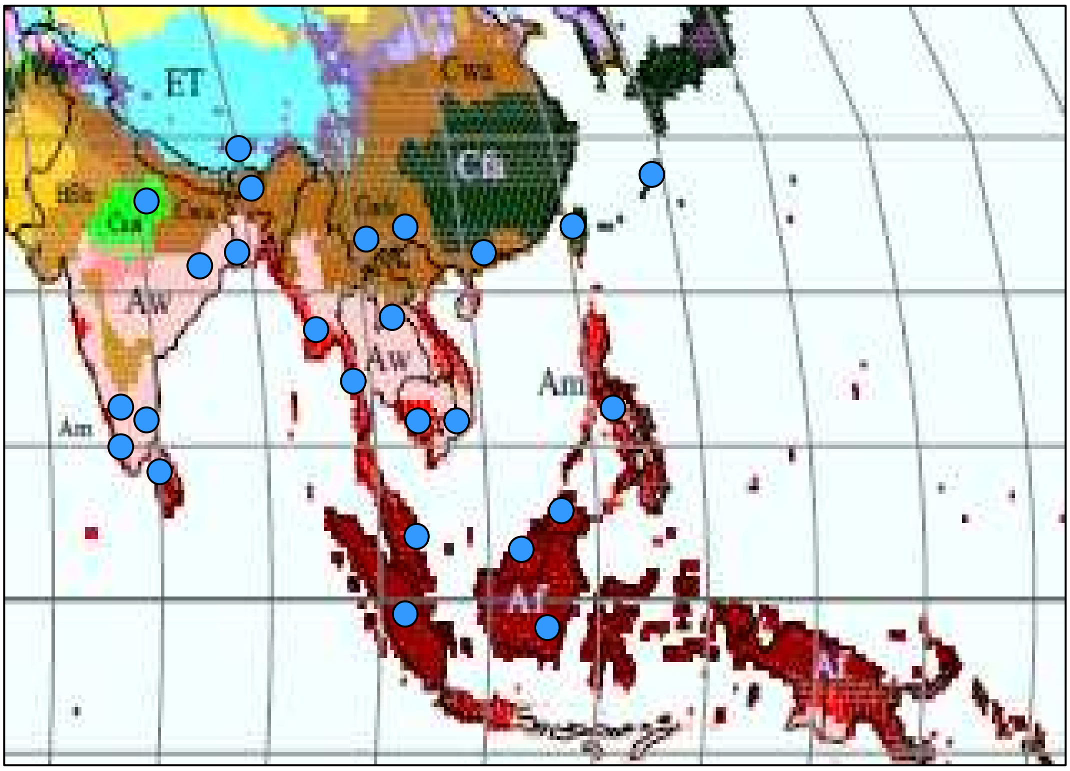


Blue dots indicate detection of *Euwallacea sp.* (morphologicaly similar to *E.fornicatus*) in Australia, Fiji, New Caledonia, Solomon Islands, Papua New Guinea.

Red dots indicate avocado crops in Australia (Geering & Campbel, 2012).

Cfa: Humid subtropical Mild with no dry season, hot summer

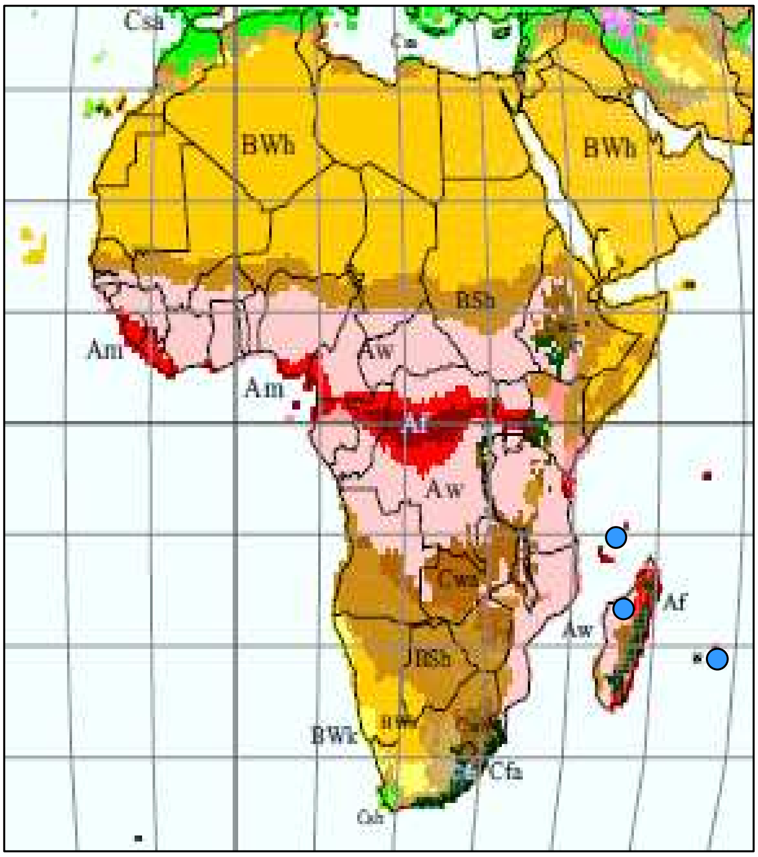
AF-Figure 4. Asia: Detail of the updated Köppen-Geiger Climate Classification (Kottek *et al*., 2006), available at: http://koeppen-geiger.vu-wien.ac.at/pics/kottek_et_al_2006.gif



Blue dots indicate detection of *Euwallacea* sp. (morphologicaly similar to *E.fornicatus*) in Bangladesh; Cambodia; Guangdon, Sichuan,Tibet,Yunnan (China); Assam, Karnata, Kerala, Tamil Naud**, Utar Pradesh (India)**; Java, Kalimantan (Indonesia); Ryukyu Islands (Japan);Laos; Peninsular Malaysia, Sabah, Sarawak (Malaysia); Myanmar; Philippines; Sri Lanka; Taiwan;. [CABI (2013)]

Csa: Mediterranean-Mild with dry, hot summer.
Cfa: Humid subtropical-Mild with no dry season, hot summer.
Af : Tropical wet-No dry season.
Am: Tropical monsoonal-Short dry season; heavy monsoonal rains in other months.
Aw: Tropical savannah-Winter dry season
Cwa: Humid subtropical-Mild with dry winter, hot summer
Cwb?: Humid subtropical-Mild with dry winter, warm summer.

AF-Figure 5. Africa: Detail of the updated Köppen-Geiger Climate Classification (Kottek *et al.*, 2006), available at: http://koeppen-geiger.vu-wien.ac.at/pics/kottek_et_al_2006.gif



Blue dots indicate detection of *Euwallacea sp.* (morphologicaly similar to *E.fornicatus*) in Comoros, Madagascar and Reunion Island.

Af: Tropical wet-No dry season.
Aw: Tropical savanna-Winter dry season.

Annex 5. Prohibitions and restrictions in the following pathways:

Pathway: Plants for planting (except seeds) of reproductive host species from where *Euwallacea* sp. (*Euwallacea fornicatus*-like*)* occurs.

(a) Prohibited species according to Council Directive 2000/29/EC:

-Plants of *Citrus* L., when they are imported from third countries [Annex III/A/(16)].

-Plants of *Quercus* L., with leaves, when they are imported from non-European countries [Annex III/A/(2)].

(However, dormant plants free from leaves, intended for planting are not forbidden and they could carry the pest. (Annex IV/AI/(40)))
i.e: Dormant plants of Quercus L. free from leaves intended for planting could pose a risk.

-Plants of *Populus* L., with leaves, when they are imported from North American countries [Annex III/A/(3º)].

(However, dormant plants free from leaves, intended for planting from North American countries are not forbidden and they could carry the pest. (Annex IV/AI/(40)))
(Plants of Populus from countries apart from North American countries are not included in this article)

(b) Regulated species according to Council Directive 2000/29/EC:

-Plants of *Ficus* L. intended for planting originating in non-European countries.

This regulation for *B.tabaci* (non European populations) is not sufficient to prevent the entry of *Euwallacea* sp. into the EU (Annex IV/AI/(45.1)).

-Plants of *Platanus* L., originating in USA, Switzerland or Armenia.

This regulation for *Ceratocystis platanus* is not sufficient to prevent the entry of *Euwallacea* sp. into the EU (Annex IV/AI/(12)).

-Plants of *Populus* L., intended for planting, other than seeds, originating in third countries.

This regulation for *Melamsora medusae* is not sufficient to prevent the entry of *Euwallacea* sp. into the EU (Annex IV/AI/(13.1)).

-Plants of *Populus* L., other than seeds, originating in countries of the American continent.

This regulation for *Mycosphaerella populorum* is not sufficient to prevent the entry of *Euwallacea* sp. into the EU (Annex IV/AI/(13.2)).

-Plants of *Quercus* L., intended for planting, other than seeds originating in non-European countries.

This regulation for *Cronartium* spp. (non-european) is not sufficient to prevent the entry of *Euwallacea* sp. into the EU (Annex IV/AI/(11.1)).

-Plants of *Persea* spp., rooted or with growing medium attached or associated. L., intended for planting, other than seeds.

This regulation for *Radopholus citrophilus* and *Radopholus similis*is not sufficient to prevent the entry of *Euwallacea* sp. into the EU (Annex IV/AI/(18)).

-Plants of *Ulmus* L., intending for planting , other than seeds, originating in North American countries.

This regulation for Elm phlöem necrosis mycoplasm is not sufficient to prevent the entry of *Euwallacea* sp. into the EU (Annex IV/AI/(14)).

-Plants with roots, planted or intended for planting, grown in the open air, originating in third countries.

This regulation for *Clavibacter michiganensis* ssp. *sepedonicus* and *Synchytrium endobioticum*, *Globodera pallida* and *Globodera rostochiensis* is not sufficient to prevent the entry of *Euwallacea* sp. into the EU (Annex IV/AI/(33)).

- Trees and shrubs, intended for planting, other than seeds and plants in tissue culture, originating in thrid countries other than European and Mediterranean countries.

This regulation is not sufficient to prevent the entry of *Euwallacea* sp. into the EU (Annex IV/AI/(39)).

(It is not easily detected by visual inspection)

(This measure does not include Mediterranean non European countries)

- Deciduous trees and shrubs, intended for plantin, other than seeds and plants in tissue culture, originating in third countries other than European and Mediterranean countries

This regulation is not sufficient to prevent the entry of *Euwallacea* sp. into the EU (Annex IV/AI/(40)).
(The pest is in the stems or trunks)

c) According to Commission Decision of 19 September 2002 on provisional emergency phytosanitary measures to prevent the introduction into and the spread within the Community of ***Phytophthora ramorum*:**

-Plants of *Acer macrophyllum*, *Camellia* spp. L., *Magnolia* spp. L. and *Quercus* spp. L. from the USA.

This regulation is not sufficient to prevent the entry of *Euwallacea* sp. into the EU [Annex I.1A.].
(It only applies to plants originated in the USA)

(It is not easily detected by visual inspection)

d) According to Commission implementingdecision of 1 March 2012 as regards emergency measures to prevent the introduction into and the spread within the Union of ***Anoplophora chinensis*:**

-Plants of *Acer* spp., *Alnus* spp. *Citrus* spp., *Platanus* spp., *Populus* spp., *Salix* spp. and *Ulmus* spp. originating in countries were *A.chinensis* is present (e.g: China, Indonesia, Japan, Korea Dem. People´s Republic, Korea republic, Malaysia, Myanmar, Philippines, Taiwan, and Vietnam).

Specific import requirements applied for *Anoplophora chinensis* **could be sufficient** (i.e: Annex I; (1.A.2) and (1.B.2)) to prevent the entry of *Euwallacea* sp. [Annex I], but only from those countries and species where *A.chinensis* is present, and whenever these measures are in force.

According to Commission implementing decision of 9 June 2015 as regards emergency measures to prevent the introduction into and the spread within the Union of ***Anoplophora glabripennis*:**

-Plants of *Acer* spp., *Alnus* spp., *Koelreuteria* spp., *Platanus* spp., *Populus* spp., *Salix* spp. and *Ulmus* spp. originating in countries were *A.glabripennis* is present (e.g: USA, China, Korea)

Specific import requirements applied for *Anoplophora glabripennis* **could be sufficient** to prevent the entry of *Euwallacea* sp. [Annex II (1.A.2)], but only from those countries and species where *A.glabripennis* is present, and while these measures are in force.

Pathway: Wood(*)(round or sawn, with or without bark) of reproductive host species from where *Euwallacea* sp. (*Euwallacea fornicatus*-like*)* occurs.

(*) wood within the meaning of Article 2(2) of Directive 2000/29/EC, other than wood packaging material, including wood that has not retained its natural round surface

a) There are no prohibitions.

b) Regulated species according to Council Directive 2000/29/EC:

-**Wood of *Platanus* L. (except that in the form of chips, particles, sawdust, shavings, wood waste and scrap, but including wood which has not kept its natural round surface) originating in USA, Switzerland and Armenia.**

The special requirement (Kiln-drying) **may be sufficient** to prevent the entry of *Euwallacea* sp, but only from the countries included in this article [Directive 200/29/EC Annex IV/AI/(5)].

-Wood in the form of chips, particles, sawdust, shavings, wood waste and scrap and obtained in whole or in part from (...) *Platanus* L., originating in Armenia, Switzerland or the USA.

The special requirements (Kiln-drying, fumigation or heat tretment) **may be sufficient** to prevent the entry of *Euwallacea* spp. ut only from the countries included in this article. (Directive 200/29/EC Annex IV/AI/(7.1.2)).

-**Wood of *Quercus* L. originating in North American countries.**

The special requirements **are not sufficient** to prevent the entry of *Euwallacea* spp. (Directive 200/29/EC Annex IV/AI/(3)). (However, see **Commission Decision 2002/757/EC** below)

-Wood in the form of chips, particles, sawdust, shavings, wood waste and scrap and obtained in whole or in part from (...) *Quercus* L., originating in the USA.

The special requirements (Kiln-drying, fumigation or heat tretment) **may be sufficient** to prevent the entry of *Euwallacea* spp. but only from the USA (Directive 200/29/EC Annex IV/AI/(7.2)).

- Wood of *Populus* L., (except that in the form of chips, particles, sawdust, shavings, wood waste and scrap, WPM (...) but including wood which has not kept its natural round surface) originating in countries of the American continent.

The special requirements (bark free option) **may not be sufficient** to prevent the entry of *Euwallacea* spp. (Directive 200/29/EC Annex IV/AI/(6)).

-Wood in the form of chips, particles, sawdust, shavings, wood waste and scrap and obtained in whole or in part from (...) *Populus* L., originating in the American continent.

(debarked round wood option) **may not be sufficient** to prevent the entry of *Euwallacea* spp. (Directive 200/29/EC Annex IV/AI/(7.1.1)).

c) According to Commission decision of 19 September 2002 on provisional emergency phytosanitary measures to prevent the introduction into and the spread within the Community of ***Phytophthora ramorum* (**Commission decision 2002/757/EC):

-Wood of *Quercus* spp. L. and *Acer macrophyllum* originating in the USA.

The special requirements (Pest Free Area from *P.ramorum*; and squared debarked options) **may not be sufficient** to prevent the entry of *Euwallacea* spp. [Annex I. 2].

d) According to Commission implementing decision of 9 June 2015 as regards emergency measures to prevent the introduction into and the spread within the Union of ***Anoplophora glabripennis*:**

-Wood of *Acer* spp., *Alnus* spp., *Koelreuteria* spp., *Platanus* spp., *Populus* spp., *Salix* spp. and *Ulmus* spp. originating in countries were *A.glabripennis* is present (e.g: USA, China, Korea)

Specific import requirements (PFA option) applied for *Anoplophora glabripennis* in wood **may not be sufficient** to prevent the entry of *Euwallacea* sp. [Annex I.B].

Annex 6. Data on trade

Plants for planting

Notice that there have been selected general groups that may contain woody plants from Asia (Non-hosts can not be excluded from the statistic). It is not possible to obtain data by species which are hosts for *Euwallacea* sp.:

TARIC CODE	DESCRIPTION
06022090	Trees, shrubs and bushes, grafted or not, of kinds which bear edible fruit or nuts (excl. vine slips)
06029041	Live forest trees
06029045	Outdoor rooted cuttings and young plants of trees, shrubs and bushes (excl. fruit, nut and forest trees)
06029049	Outdoor trees, shrubs and bushes, incl. their roots (excl. cuttings, slips and young plants, and fruit, nut and forest trees)
06029050	Live outdoor plants, incl. their roots (excl. bulbs, tubers, tuberous roots, corms, crowns and rhizomes, incl. chicory plants and roots, unrooted cuttings, slips, rhododendrons, azaleas, roses, mushroom spawn, pineapple plants, vegetable and strawberry pl
06029070	Indoor rooted cuttings and young plants (excl. cacti)
06029099	Live indoor plants and cacti (excl. rooted cuttings, young plants and flowering plants with buds or flowers)

Uncertainty: It is not clear which species are whithin these codes, and if they are hosts of Euwallacea sp. or not.

A6-1: Imports of commodities that may include trees, shrubs or woody plants for planting into Europe.

Elemento	400 Estados Unidos					436 Costa Rica				
	Año 2010	Año 2011	Año 2012	Año 2013	Año2014	Año 2010	Año 2011	Año 2012	Año 2013	Año2014
06022090 Árboles, arbust., matas de frutas, inc. injert.	85,80	61,00	68,70	63,40	105,40			19,00		
06029041 Árboles y matas de tallo leñoso, forestales	36,40	0,20	0,10		0,50	11,20				
06029045 Esquejes enraiz. y plantas jóvenes, de árboles	29,60	29,30	30,40	53,50	36,30	1,20	6,40	1,50	2,60	1,80
06029049 Árboles y matas de tallo leñoso, de exterior	70,50	149,40	98,50	59,30	58,10	175,90	90,50	214,60	187,10	45,30
06029050 ---- Las demás plantas de exterior:	213,00	165,30	64,30	331,50	231,50	288,40	464,80	321,60	274,30	256,00
06029070 Esquejes enraiz. y plantas jóvenes, de interior	291,90	219,50	203,20	169,70	70,50	22.560,20	21.253,90	18.319,80	17.018,30	13.402,60
06029099 ----- Las demás:	384,90	519,30	294,10	300,40	307,50	3.231,00	3.480,50	4.813,40	5.780,70	7.874,40
Total seleccionado	1.112,10	1.144,00	759,30	977,80	809,80	26.267,90	25.296,10	23.689,90	23.263,00	21.580,10

Elemento	480 Colombia					624 Israel				
	Año 2010	Año 2011	Año 2012	Año 2013	Año2014	Año 2010	Año 2011	Año 2012	Año 2013	Año2014
06022090 Árboles, arbust., matas de frutas, inc. injert.		0,00		0,00	0,00	10,10	8,80	0,60	15,20	4,40
06029041 Árboles y matas de tallo leñoso, forestales										
06029045 Esquejes enraiz. y plantas jóvenes, de árboles			0,10	2,10	0,20	83,60	83,10	58,50	42,70	73,80
06029049 Árboles y matas de tallo leñoso, de exterior	0,10	0,10				1.421,00	1.163,20	784,90	466,60	368,50
06029050 ---- Las demás plantas de exterior:				0,20	0,20	430,80	218,50	45,80	160,60	237,10
06029070 Esquejes enraiz. y plantas jóvenes, de interior	8,00	7,20	12,50	15,10	18,60	543,80	548,90	1.185,30	599,20	549,60
06029099 ----- Las demás:	0,80	0,50	0,20	0,20	0,40	376,20	270,70	70,10	121,60	68,40
Total seleccionado	8,90	7,80	12,80	17,60	19,40	2.865,50	2.293,20	2.145,20	1.405,90	1.301,80

Elemento	AS - Asia				
	Año 2010	Año 2011	Año 2012	Año 2013	Año2014
06022090 Árboles, arbust., matas de frutas, inc. injert.	32,50	26,70	28,30	54,20	48,20
06029041 Árboles y matas de tallo leñoso, forestales	12,00	17,80	15,00	2,90	23,00
06029045 Esquejes enraiz. y plantas jóvenes, de árboles	521,20	531,00	160,00	88,00	131,40
06029049 Árboles y matas de tallo leñoso, de exterior	3.239,80	2.542,50	1.517,20	1.005,30	664,30
06029050 ---- Las demás plantas de exterior:	2.284,80	1.553,10	1.681,80	1.212,50	1.078,70
06029070 Esquejes enraiz. y plantas jóvenes, de interior	4.351,00	3.202,90	3.572,50	2.505,10	2.152,30
06029099 ----- Las demás:	17.422,70	15.429,90	14.273,20	12.420,80	12.422,00
Total seleccionado	27.864,00	23.303,90	21.248,00	17.288,80	16.519,90

Importación a '436 Costa Rica, 442 Panamá, 400 Estados Unidos, 480 Colombia, 484 Venezuela, -AS - Asia, 624 Israel' realizado por los siguientes miembros de la Unión Europea: 'Toda la UE' referente al grupo de productos: '06022090 Árboles, arbust., matas de frutas, inc. injert., 06029041 Árboles y matas de tallo leñoso, forestales, 06029045 Esquejes enraiz. y plantas jóvenes, de árboles, 06029049 Árboles y matas de tallo leñoso, de exterior, 06029050 ---- Las demás plantas de exterior:, 06029070 Esquejes enraiz. y plantas jóvenes, de interior, 06029099 ----- Las demás:' en el periodo: 'Año2014, Año 2013, Año 2012, Año 2011, Año 2010'. Unidades: 'Toneladas'. El tipo de comercio: 'Todos los tipos'.

Source: Eurostat, 2015 (from http://datacomex.comercio.es/principal_comex_ue.aspx)
There are no imports from Panama or Venezuela where *Euwallacea* sp. has also been reported.

Cut branches:

TARIC CODE	DESCRIPTION
06042090	Foliage, branches and other parts of plants, without flowers or flower buds, and grasses, <u>fresh</u>, suitable for bouquets or ornamental purposes (excl. Christmas trees and conifer branches)

Uncertainty: It is not clear which species are within this code, and if they are hosts of Euwallacea sp. or not.

A6-2: Imports of cut branches into Europe.

Elemento	400 Estados Unidos			436 Costa Rica			442 Panamá			480 Colombia			484 Venezuela			624 Israel			AS - Asia		
	Año 2012	Año 2013	Año2014	Año 2012	Año 2013	Año2014	Año 2012	Año 2013	Año2014	Año 2012	Año 2013	Año2014	Año 2012	Año 2013	Año2014	Año 2012	Año 2013	Año2014	Año 2012	Año 2013	Año2014
06042090 --Los demás	24.328,90	22.692,40	21.382,00	17.327,50	16.641,10	15.482,40		1,10	19,00	4,60	5,70	25,30		0,00		6.308,90	4.899,30	3.970,20	7.338,20	5.998,40	5.129,00

Importación a '436 Costa Rica, 442 Panamá, 400 Estados Unidos, 480 Colombia, 484 Venezuela, -AS - Asia, 624 Israel' realizado por los siguientes miembros de la Unión Europea: 'Toda la UE' referente al grupo de productos: '06042090 --Los demás' en el periodo: 'Año2014, Año 2013, Año 2012, Año 2011, Año 2010'. Unidades: 'Toneladas'. El tipo de comercio: 'Todos los tipos'.

Source: Eurostat, 2015 (from http://datacomex.comercio.es/principal_comex_ue.aspx)

There are no imports from Venezuela, where *Euwallacea* sp. has also been reported.