This text is an integral part of the *EPPO Study on bark and ambrosia beetles associated with imported non-coniferous wood* and should be read in conjunction with the study

Pest information sheet
Ambrosia beetle

XYLEBORUS BISPINATUS (COLEOPTERA: SCOLYTINAE)

EPPO Lists: Not listed. The assessment of potential risks in this information sheet is not based on a full PRA for the EPPO region, but on an assessment of the limited information for that species used to prepare the information sheet.

PEST OVERVIEW

Taxonomy

Xyleborus bispinatus Eichhoff 1868. *X. bispinatus* was long considered a synonym of *Xyleborus ferrugineus*, an invasive species currently found in all tropical and warm temperate areas of the world (Bright 1968; Wood 1982; Wood & Bright 1992). However, *X. bispinatus* was removed recently from synonymy with *X. ferrugineus* (Rabaglia 2005, Kirkendall and Jordal, 2006). Later, Atkinson *et al.* (2013) discussed new characters allowing the definitive separation of these two species, finally confirmed also by Gohli *et al.* (2016). The exact distribution and host range of *X. bispinatus* are therefore not completely known to date.

Associated fungi

The primary symbiont fungus of *X. bispinatus* is not known (Saucedo *et al.*, 2018). *X. bispinatus*, like a number of other ambrosia beetle species, has been shown to acquire *Raffaelea lauricola* (the highly pathogenic symbiont of *Xyleborus glabratus* – see Pest information sheet) when feeding on diseased avocado plants (Menocal *et al.*, 2018a citing others). In Florida, four *Raffaelea* spp. were found associated with *X. bispinatus*: *R. lauricola*, *R. arxii*, *R. subalba* and *R. subfusca*; in feeding experiments *X. bispinatus* was able to reproduce when fed with each of those, indicating that it can produce at least one generation using these fungi (Saucedo *et al.*, 2018). The authors stress however that *R. lauricola* is not the obligate symbiont of *X. bispinatus*, although they note that *X. bispinatus* can carry large amounts of *R. lauricola*, 'more than enough to kill susceptible avocado trees' (*R. lauricola* is highly pathogenic once inoculated into a tree – see Pest information sheet for *X. glabratus*). The association with *R. lauricola* has been qualified as 'frequent' (in experiments, 35% of *X. bispinatus* individuals versus 60% of *X. glabratus* – Saucedo *et al.*, 2018 citing Ploetz *et al.* 2017). Based on the results of feeding experiments, both Menocal *et al.* (2018a) and Saucedo *et al.* (2018) appear to support the recent hypothesis that *X. bispinatus* may be a vector of *R. lauricola* in avocado orchards in Florida (where the main vector *X. glabratus* is rarely associated with diseased avocado trees). However, this has not been fully confirmed to date.

Morphology and biology

Adult females measure ca. 3 mm (2.8–3.2 mm). As in many *Xyleborus* species, a strong sexual dimorphism occurs with females larger than males (1.6–1.9 mm). *X. bispinatus* is an inbreeding species (Kirkendall and Jordal, 2006). Limited information about the life cycle was found. Females lay eggs throughout their whole lifetime (Saucedo *et al.*, 2018). In Sicily, *X. bispinatus* was found in dying or recently killed fig trees, associated with the more aggressive species *Hypocryphalus dilutus* (previously *H. scabricollis*) (Faccoli *et al.*, 2016). No information was found on whether it has been recorded attacking apparently healthy host trees, although trees that were found to be colonized in summer (2014) did not show any signs of stress or infestation in the previous months (spring 2014). No information was reported about size and diameter of the hosts attacked, although their age ranged between 6 to 50 years (Faccoli *et al.*, 2016).

Spread biology
No information was found, but in related *Xyleborus* species, only females fly. In flight studies, *X. bispinatus* was mostly caught in traps located at 0-4 m height in avocado orchards (Menocal *et al.*, 2018b).

Nature of the damage
As a *Xyleborus*, *X. bispinatus* tunnels galleries in the wood of its hosts. In avocado, transmission of *R. lauricola* may cause death of the trees (due to the fungus), but it is not confirmed to date that *X. bispinatus* is a vector (see *Associated fungi*).

Detection and identification

- *Symptoms.* As a *Xyleborus*, and in the absence of pathogenic fungi, symptoms would be the presence of holes on the trees and possibly frass on or at the base of trees.
- *Trapping*. Some captures of *X. bispinatus* have been made in traps with the following attractants: ethanol, ethanol + sulcatol, alpha pinene + ethanol, exotic *Ips* lure (Atkinson, 2018).
- *Identification.* Descriptions and photos of *X. bispinatus* are given in Kirkendall and Jordal (2006) and Atkinson *et al.* (2013). The latter details morphological differences between three species, *X. bispinatus*, *X. impressus* and *X. ferrugineus*, previously all under *X. ferrugineus* and whose distributions overlap in the Americas. Gomez *et al*. (2018) provides a key to *Xyleborinus* species (for the USA). Faccoli *et al.* (2016) gives characters differentiating *X. bispinatus* from European *Xyleborus* species.

Distribution (Table 1)
The exact distribution of *X. bispinatus* is not known (Kirkendall and Jordal, 2006). *X. bispinatus* is native to tropical and subtropical regions of the Americas. *X. bispinatus* and *X. ferrugineus* are sympatric in the Americas, and some records of *X. ferrugineus* (prior to 2006) may refer to *X. bispinatus* (Atkinson, 2018). *X. bispinatus* is known to occur from the northern part of South America through to Central America, north to Mexico and the Eastern coast of the USA. Faccoli *et al.* (2016) mentions that *X. bispinatus* has been introduced into some Eastern USA states, and it is present north to New York State, according to collection data. Known records are listed in Table 1.

In the EPPO region, large infestations of *X. bispinatus* were found in 2014 and 2015 in 8 localities of Sicily (Italy) on fig (*Ficus carica*). In addition, in France, *X. bispinatus* has been trapped in Nice (GEFF, 2017) and is considered established (L-M Nageleisen and T. Noblecourt, pers. comm. 2018-05).

Host plants
There is little data on the hosts of *X. bispinatus* as it was previously considered as a synonym of *X. ferrugineus*. In Florida, *X. bispinatus* was found on *Persea palustris*, *Persea americana* (Lauraceae), *Wodyetia bifurcata* (Aracaceae) (Atkinson *et al.*, 2013). Records also exist for *Quercus* (Fagaceae), *Swietenia macrophylla* (Meliaceae) (Perez *et al.*, 2015), *Hevea brasiliensis* (Euphorbiaceae), *Eschweilera biflava* (Lecythidaceae), *Lonchocarpus macrophyllus* (Fabaceae) (Atkinson, 2018). In Italy, it was found only on fig trees (*Ficus carica,* Moraceae) (Faccoli *et al.*, 2016). The host range is probably wider. *X. ferrugineus* is reported to be highly polyphagous, with ca. 200 non-coniferous hosts (Faccoli *et al.*, 2016).

Known impacts and control in current distribution
There is no information about the specific impact of *X. bispinatus* in its native areas. Menocal *et al.* (2018a, citing others) mention that there are no supporting data for the statement made in the literature that *X. ferrugineus* (under which *X. bispinatus* was previously classified) caused economic damage in lowland areas of the neotropics. Atkinson (2018) lists a new unpublished record (dated 2017) for *X. bispinatus* in Argentina on *Persea americana*. *X. bispinatus* on avocado is a cause of concern in Florida because of *R. lauricola* (see *Associated fungi*) and a similar concern may exist in other countries (neither *R. lauricola* nor its vector *X. glabratus* are reported from Argentina). No information was found on the impact on the wood value. However, *X. bispinatus* is mentioned by Faccoli *et al.* (2016) as being associated with tropical timber trade. As for other ambrosia beetles, the galleries and possibly fungal staining would presumably cause defects in the wood.

In the USA, no impact by *X. bispinatus* has been reported. Concerns relate to its possible role, not confirmed to date, as a vector of *R. lauricola* in avocado orchards (see *Associated fungi*).

In Italy, the large infestations of *X. bispinatus* and *H. dilutus* observed in 2014 and 2015 on *F. carica* caused the rapid death and desiccation of many fig trees of various ages growing individually, in small groups or in large plantations for fruit production, as well as wild figs. The authors consider that *X. bispinatus* was secondary in these attacks, and *H. dilutus* was the primary pest (Faccoli *et al.*, 2016).

Control: No mention of control was found where *X. bispinatus* is well established. In Italy when a mixed infestation with *H. dilutus* was found, infested trees were destroyed (Faccoli *et al.*, 2016).

POTENTIAL RISKS FOR THE EPPO REGION

Pathways

Entry

Life stages are associated with the wood of host trees. Faccoli *et al.* (2016) note that *X. bispinatus* has been introduced to other regions by the trade of tropical timber. Of the known hosts, at least *Swietenia macrophylla* (mahogany) and *Quercus* spp. are major traded woods. *X. bispinatus* is likely to be associated with wood commodities. Processes applied to produce wood commodities would destroy some individuals. The likelihood of entry on wood chips, hogwood and processing wood residues would be lower than on round wood, as individuals would have to survive processing and transport, and transfer to a suitable host is less likely. The wood would also degrade and not be able to sustain development of the pest. Bark on its own is an unlikely pathway.

Entry on plants for planting or cut branches may be possible if *X. bispinatus* can be associated with small diameter material (no data was available on this). Data from the EU Project Isefor (Increasing sustainability of European forests: Modelling for security against invasive pests and pathogens under climate change) for the period 2001-2010 reports imports of plants for planting of known hosts from some countries where *X. bispinatus* is known to occur (especially *Ficus*, but also *Persea*, *Quercus* and *Woodyetia*). Plants for planting are normally subject to controls during production, and attacked plants may be detected and discarded. Cut branches are a less likely pathway, as they are used indoors, and the pest is unlikely to be able to transfer to a suitable host. No data was sought on whether cut branches of hosts are used and traded.

One additional concern would be if *X. bispinatus* carrying *R. lauricola* entered into the EPPO region. To date, entry with *R. lauricola* would be more likely on plants for planting of *P. americana* from Florida. The association with the fungus has been found only in avocado orchards in Florida, and exports of wood of other species from Florida to the EPPO region are probably minimal or non-existent.

Finally, inbreeding is favourable to entry and establishment. *Summary of pathways (uncertain pathways are marked with '?'):*

- *wood (round or sawn, with or without bark, incl. firewood) of hosts*
- *wood packaging material if not treated according to ISPM 15*
- *non-coniferous wood chips, hogwood, processing wood residues (except sawdust and shavings)*
- *plants for planting (except seeds) of hosts?*
- *cut branches of hosts?*

Spread (following introduction, i.e. within EPPO region)

X. bispinatus could spread naturally and through human-assisted pathways. Of the hosts currently known, *Quercus* is widely present and traded in the EPPO region, and *F. carica* and *P. americana* are present mostly in the southern part of the region (see below).

Establishment
X. bispinatus is native to tropical and subtropical areas but has extended its distribution. Based on the classification of Köppen-Geiger (see Annex 6 of the study), at least the climate type Cfa[1] occurs in its North American distribution and also in the EPPO region. In the EPPO region, *X. bispinatus* has been found in the Mediterranean climate type Csa[1]. Together, these climate types occur around the Mediterranean and in Portugal, and to the Black Sea.
Regarding hosts, *F. carica* grows in the wild and in commercial cultivation in the southern part of the EPPO region, and is also cultivated in gardens in more temperate climates. *P. americana* is cultivated in the South of the EPPO region; if *X. bispinatus* carrying *R. lauricola* were introduced, they may contribute to the establishment of the fungus in the EPPO region, even if the vector *X. glabratus* was appropriately regulated to prevent its introduction. *Quercus* spp. are widespread in the EPPO region (although the species that are hosts of *X. bispinatus* are not known). Some other hosts are used as ornamental (e.g. *Woodyetia bifurcata*). The host range of *X. bispinatus* is not fully known.
As potential host plants are present in areas of suitable climate in the EPPO region, the pests could establish.

Potential impact (including consideration of host plants)
X. bispinatus could have a secondary role in attacks by other beetles on *F. carica*, as was observed in Italy with *H. dilutus*. No direct impact has been reported in areas of introduction to date, but data is lacking from its native distribution in South and Central America. Impact would depend on whether *X. bispinatus* would find a more susceptible host in the EPPO region. One major concern would be any impact linked to the transmission of *R. lauricola* in avocado orchards (however it is not confirmed to date that *X. bispinatus* is a vector - see *Associated fungi*).

Table 1. Distribution

	Reference	**Comments**
EPPO region		
Italy	Faccoli *et al.*, 2016	Sicily
France (trapped)	GEFF, 2017	Nice (trapped)
North America		
Mexico	Perez *et al.*, 2015	
USA - Florida - Georgia, Louisiana, North Carolina, Texas - *Uncertain records*: Indiana, Maryland, New York	 - Atkinson *et al.*, 2013 - Gomez *et al.*, 2018 - Atkinson, 2018	 - considered uncertain as unpublished
Central America		
Belize	Kirkendall and Jordal (2006)	
Costa Rica	Kirkendall and Jordal (2006)	including Cocos Island

[1] **Cfa**: warm temperate climate, fully humid, hot summer; **Csa**: warm temperate climate, summer dry, hot summer.

	Reference	Comments
Guatemala	Gomez *et al*., 2018	
Honduras	Gomez *et al*., 2018	
Panama	Gomez *et al*., 2018	
South America		
Argentina	Gomez *et al*., 2018	
Bolivia	Kirkendall and Jordal (2006)	
Brazil	Kirkendall and Jordal (2006)	
Colombia	Gomez *et al*., 2018	
Ecuador	Kirkendall and Jordal (2006)	
Peru	Gomez *et al*., 2018	
Venezuela	Gomez *et al*., 2018	
Oceania		
Uncertain records: Papua New Guinea	Atkinson, 2018	Considered uncertain here as unpublished

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