Xyleborus glabratus **System:** Terrestrial

Kingdom	Phylum	Class	Order	Family
Animalia	Arthropoda	Insecta	Coleoptera	Curculionidae

Common name Xyleboro (Italian), Holzborher (German), redbay ambrosia beetle (English), Asian ambrosia beetle (English), xylébore (French), Ambrosiakäfer (German)

Synonym

Similar species

Summary *Xyleborus glabratus* is an ambrosia beetle native to Asia which is the only known vector of a newly discovered fungus *Raffaelea lauricola* that causes laurel wilt in members of the Lauraceae family, most notably redbay trees (*Persea borbonia*) and avocado (*P. americana*). The recent introduction, rapid spread, and high mortality rates associated with *X. glabratus* and *R. luaricola* implicate the complex as a serious threat to the survival of redbay trees in southeastern United States. Furthermore, its invasive potential to the avocado industry in Florida and elsewhere could be devastating.

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Species Description
Xyleborus glabratus is a small, slender, cylindrical beetle about 2 mm long and brown or black in color. Its punctures are relatively large, larger and deeper than on the elytral disc, and the surface is shinny. The posterio-lateral portion of the declivity has a distinct raised, almost carinate margin. The first interstriae have a distinct tubercle at the middle of the declivity, and interstria 3 has a much smaller tubercle at about the same position. Its blackish coloration, nearly glabrous upper surface, and abrupt apical declivity helps to distinguish it from other members of its genus. Positive identification typically requires examination by a specialist. Males of are dwarfed, haploid, and flightless (Rabaglia, 2008; Cameron *et al*, 2008; Hodges & Eickwort, 2009).

Notes

Indications of trees infested by the ambrosia beetle and laurel wilt include beetle entrance holes, cylinders of frass emanating from the trunk, black discoloration of sapwood that start as streaks and becomes extensive cross sections, wilting of branch tips and leaves, dieback of individual branches, and red and brown-to-purple coloration of dying leaves that persist over a year after its death (Fraedrich *et al*, 2008; Hoddle, 2009).

The association of a wilt-causing fungus with an ambrosia beetle is unprecedented. The only previously documented case of extensive mortality of forest trees caused by an ambrosia beetle and a fungal symbiant appears to be the death of oaks *Quercus crispula* and *Q. serrata* in Japan associated with *Raffaelea quercivora*, a fungal associate of the ambrosia beetle *Platypus quercivorus*. This ambrosia beetle is thought to be indigenous to Asia and the decline of oaks in Japan has been documented since the 1930s. The attacked trees appear to be weakened by drought or other agents, and mass attacks by *P. quercivorus* are necessary for the oak trees to die. R. quercivora is thought to facilitate tree death through localized colonization of the tree in the vicinity of the ambrosia beetle galleries, but the fungus does not colonize the host systemically. In contrast, the *Raffaelea lauricola* that causes laurel wilt is a very aggressive vascular wilt pathogen that is capable of colonizing the entire tree from a single introduction into small branches or stems by egg-laying attacks of *X. glabratus* (Fraedrich *et al*, 2008; Cameron *et al*, 2008).

Recent research has isolated six *Raffaelea* species from *X. glabratus*; their roles in the biology of *X. glabratus* are uncertain at present (Harrington *et al*., 2010).

Lifecycle Stages

Larvae of *Xyleborus glabratus* are white legless grubs with an amber colored head capsule. They reside in galleries of infested trees where they feed on fungus (*Raffaelea lauricola*). Brood development seems to take 50-60 days. Females seek out new hosts and typically out number dwarfed, flightless, haploid males 15:1 (Hoddle, 2009; Hanuala *et al*, 2008; Rabaglia, 2008).

Habitat Description

Xylebrous glabratus is known to inhabit tropical to temperate temperatures in forests that bear suitable hosts of the Lauraceae family. Little is known about the biology and habitat range of *X. glabratus*. One climate matching study based on host tree distributions in Asia found its native range climates to possess an extreme minimum temperature of -26-15°C and a 30-year mean growing season of 61% moisture (Koch & Smith, 2008).

Reproduction

Xyleborus glabratus reproduces sexually and lays its eggs within host trees of the family Lauraceae. The developmental time of the *X. glabratus* inside the galleries of the host tree from egg to adult is 7 to 8 weeks depending upon temperatures. The fungus *Raffaelea lauricola* is carried in the paired mandibular mycangia of females. They inoculate host trees with the fungus to serve as a food source for larvae (Fraedrich *et al*, 2008 Crane, 2009).

Nutrition

Larvae feed on fungus (*Raffaelea lauricola*) within host trees (Hanula *et al*, 2008). Adults may rely on stored nutrition.

General Impacts

Xyleborus glabratus is the only known vector for the exotic fungus *Raffaelea lauricola* which causes laurel wilt in members of the Lauraceae family, most notably redbay trees (*Persea borbonia*). *X. glabratus*, or the redbay ambrosia beetle, inoculates trees with this fungus which spreads through the vascular system of trees, blocking water transport, causing trees to wilt and die within months of infection. The wood of dying and recently dead trees serves as host material for *X. glabratus*, which multiply rapidly, resulting in large numbers of beetles capable of spreading to new locations. It has a rapid rate of natural spread that has been estimated at 34 miles/year and may advance by anthropogenic dispersal of infested wood products. Currently, *X. glabratus* is the only confirmed vector of *R. lauricola*. The ambrosia beetle and its accompanying laurel wilt have spread through forests of coastal southeastern United States killing almost all redbays over 2.5 cm in diameter in its path. A survey of redbays in counties near Savannah, the point of introduction of *X. glabratus* in Georgia (USA), found mortalities of redbays as high as 70% and 90% in most heavily infested locations. Other known, susceptible hosts based on laboratory inoculations include: sassafras (*Sassafras albidum*), camphor (*Cinnamomum camphora*), silkbay (*Persea borbonia humilis*, California bay (*Umbellularia californica*), avocado (*Persea americana*), pondspice (*Litsea aestivalis*), which is endangered in Florida and threatened in Georgia, and pondberry (*Lindera melissifolia*), which is federally endangered. Mortality of forest or yard trees of sassafras and avocado as a result of laurel wilt has already been observed. Laurel wilt has essentially eliminated mature redbay trees from a large portion of the South Atlantic Coastal Plain and maritime forests leaving only seedlings and saplings. *X. glabratus* and laurel wilt may continue to expand throughout coastal plain forests from Virginia to Texas. This invasive complex is considered “very high risk” having invasive potential equal to that of Dutch elm disease or chestnut blight. *X. glabratus* and its associated fungus are also a major threat to the avocado industry in south Florida, Mexico, and elsewhere. All three varieties of avocado were found to be infected under experimental conditions. The invasion of Florida’s avocado groves, valued at $13 annually, by *X. glabratus* could be devastating. Redbay is a very common tree in maritime forests of southeastern United States. In addition to the direct effects on redbay stands, dramatic losses of redbays causes a cascade of ecological impacts that have yet to be discovered (Cameron *et al*, 2008; Fraedrich *et al*, 2008; Hess, 2007; Kendra *et al*, 2009; Hodges & Eickwort, 2009; Mayfield *et al*, 2008; NAPPO, 2008).

Redbay is important to wildlife as its fruit, seed and or foliage are eaten by several species of songbirds, wild turkeys, quail, deer, and black bear, particularly in winter foraging. Two butterflies, the spicebush swallowtail (*Papilio troilus*) and the Palamedes swallowtail (*P. palamedes*) use Lauraceae species as hosts. Although *P. palamedes* larvae may feed on redbay or sassafras, adult females strongly prefer to oviposit on redbay. Reduction in redbay densities may have significant negative impacts on *P. palamedes* populations in their current range (Mayfield & Thomas, 2006; Koch & Smith, 2008).

X. glabratus and laurel wilt are thought capable of spreading throughout the entire range of redbays in the U.S. in under 40 years. It may eventually become even more widely distributed if it continues to spread in sassafras, which is found in much of the eastern half of the U. S (Cameron *et al*, 2008; Koch & Smith, 2008).

Management Info
Preventative measures: The Laurel Wilt Working Group public education and outreach campaigns recommended the emphasises of the potential destructive consequences of moving firewood and raw materials infested with *Xyleborus glabratus* to uninfested areas and should target those groups of people most likely to transport infested host material (Cameron *et al*, 2008).
Researchers have proposed that redbays be removed from a 4 to 5 km thick band surrounding the known populations of *X. glabratus*. Such wide areas devoid of redbay hosts may deter the spread of *X. glabratus* and laurel wilt (Cameron *et al*, 2008; Hess, 2007; Hanula *et al*, 2008).
Avocado farmers are advised to be extremely vigilant regarding *X. glabratus* and laurel wilt. They are encouraged to report signs of wilt and dieback in the United States to the Department of Plant Industry. They are also advised to avoid stress on trees as it might make them more vulnerable and to not move infested wood from orchards but burn it in the grove (Crane, 2009).
Manuka oil, the essential oil extracted from *Leptosperum scoparium* was found to be equally attractive to *X. glabratus* as redbay wood. Phoebe oil, an extract of Brazilian walnut (*Phoebe porosa*) was also found to attract *X. glabratus*. They are both readily available and act as good alternatives to redbay wood as trap bait for monitoring *X. glabratus* distribution and population trends (Hanula & Sullivan, 2008).
Chemical control: The fungicide propiconazole may be a useful method of preventing laurel wilt in redbay trees. Research results found that root-flare injections of propiconazole completely inhibited mycelial growth of *Raffaelea* spp. in vitro at concentrations 0.1 parts per million (ppm) or greater and was fungitoxic at 1 ppm or greater. Ten mature redbay trees received root-flare injections of propiconazole and none developed crown wilt symptoms for at least 30 weeks after being inoculated with *Raffaelea* spp., whereas nine of ten untreated control trees wilted in more than one-third of their crowns. Propiconazole was retained in the stem xylem for at least 7.5 months after injection but was more frequently detected in samples from trees injected 4.5 months earlier. This method may not be used on avocado crops as there are no fungicides registered for use on avocado. Control of the redbay ambrosia beetle is complicated by the fact that adult beetles must be in the immediate area of aerial sprays to be controlled. Detection of adult beetles involves monitoring traps and/or scouting groves. Once adult beetles bore into the trees contact insecticides are ineffective. The current recommendation is to periodically apply permethrin to the trunk and major limbs of uninfested, potential host trees up to about 10 ft above the ground beginning in early March. If an infestation is taking place, an application of permethrin is recommended to knock down the population as soon as possible (Mayfield *et al*, 2008a; Crane, 2009).

Principal source:
Cameron, R. Scott; Chip Bates and James Johnson., 2008. Distribution and Spread of Laurel Wilt Disease in Georgia: 2006-08 Survey and Field Observations. Georgia Forestry Commission September 2008 Funded partially by the USDA Forest Service Forest Health Protection Region 8\"
10cm) initially. Similarly, over time stems < 2.5 cm in diameter were significantly less likely to exhibit the disease. A die-back of the primary stem due to Laurel Wilt Disease was found to correlate with a doubling in the average number of resprouts growing from the base of the stem. Overall initial observations suggest that Laurel Wilt Disease preferentially affects large stems, exhibits a high mortality rate, and spreads through the stem rapidly, but may not invade the root system.

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