Xyleborus glabratus (Eichhoff)

Coleoptera: Curculionidae (Subfamily Scolytinae)
Redbay ambrosia beetle
Vector of laurel wilt disease

Host(s)	CAPS-Approved Survey Method
Cinnamomum camphora (Camphor), *Leucaena glauca* (White leadtree), *Lindera latifolia* (Asian spicebush), *Lindera melissifolia* (Pondberry), *Lithocarpus edulis* (Matebashi), *Litsea aestivalis* (Pondspice), *Litsea elongata* (Yellow litsea), *Persea americana* (Avocado), *Persea borbonia* (Redbay), *Persea palustris* (Swampbay), *Phoebe lanceolata* (Medang Rungku), *Sassafras albidum* (Common sassafras), *Shorea robusta* (Sal Tree) (Rabaglia et al., 2006; Mayfield and Thomas, 2009)	Manuka oil in multi-funnel traps.

Reason for Inclusion in Manual

Xyleborus glabratus was added to the manual in 2010. *Xyleborus glabratus* is a CAPS Additional Pests of Concern for Fiscal Year 2011 (New Pest Advisory Group recommendation).

Pest Description

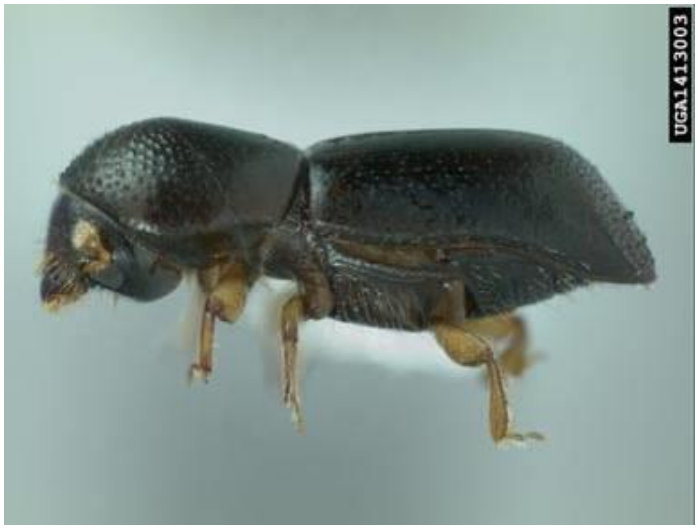
From "Exotic Forest Pest Information System for North America: *Xyleborus glabratus*" (Rabaglia, 2008):

Larvae:
"Larvae are typical Scolytidae, white colored c-shaped, legless grubs with an amber colored head capsule. These ambrosia beetles culture a fungus on the walls of their galleries, and larvae feed on the fungus within the parental galleries."

Adults:
"Adults: small beetles, 2.0 mm [approx. $^{1}/_{16}$ in] long, slender, and brown-black in color. They can be distinguished from other species of *Xyleborus* found in North America by the following characters found on the declivity: The declivity is steep and convex, especially on the posterior portion; the 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. Males are dwarfed, haploid and flightless. Only the females seek a new host and establish galleries."

X. glabratus adult, dorsal view (Michael C. Thomas, Florida Department of Agriculture and Consumer Services,



X. glabratus adult, lateral view (Michael C. Thomas, Florida Department of Agriculture and Consumer Services, Bugwood.org)

Biology and Ecology

In its introduced range in the United States, adults are active throughout the year, with peak activity occurring in early September. Because there is no indication of distinct generations this species most likely multiple overlapping generations. This species is not known to produce an aggregation pheromone (Hanula et al., 2008). In the United States, this species seems to be attracted to both diseased and healthy trees, although wounded trees appear to increase attraction (Hanula et al., 2007).

When building the gallery, extensive frass is produced. The frass forms "toothpick-like" tubes of compacted boring dust that can jut and fall from the trunk (Hanula et al., 2007). Brood development occurs in about 50-60 days. Adults and larvae do not eat the wood, but instead eat the ambrosia fungi associated with the species (Hanula et al., 2008). The fungi are moved to different host plants through movement of the adult females (Mayfield and Thomas, 2009) in specialized structures found at the base of each mandible (Fraedrich et al., 2008).

Adult males are dwarfed, haploid, and flightless (Rabaglia, 2008).

Countries of Origin
This species is native to India, Japan, Myanmar and Taiwan (Rabaglia, 2008).

Current Distribution
This species is present in: Bangladesh, Bonin Islands, India, Japan, Myanmar, and Taiwan (Rabaglia et al., 2006; Rabaglia, 2008).

Distribution in United States
X. glabratus was first detected in May 2002, near crating material close to a warehouse in Port Wentworth, Georgia (Bulluck and Colpetzer, 2007). It has since been found in numerous counties in Florida, South Carolina, and in one county in Mississippi (Hanula, 2010).

Florida reported positive NAPIS data from 2005 to 2009 (K. Handy, personal communication, 2009).

Georgia reported positive NAPIS data in 2002 and 2005 to 2006 (K. Handy, personal communication, 2009). Georgia reported negative data in 2003, 2004 and 2008 (K. Handy, personal communication, 2009).

South Carolina reported positive NAPIS data in 2004 and 2005 (K. Handy, personal communication, 2009).

Pathway
The species *X. glabratus* has not been intercepted in the United States; however, unidentified *Xyleborus* species have. *Xyleborus* species have been intercepted on cut flowers, cuttings, plant parts (like leaves, seeds and fruit), and also on wood products and cargo (AQAS, accessed October 8, 2009). Most beetles were intercepted on general and permit cargo but have also been intercepted in baggage and mail (AQAS, accessed October 8, 2009).

X. glabratus has been reported to move in imported tropical logs (Bulluck and Colpetzer, 2007) and solid wood packing materials such as crates and pallets (Haack, 2002). Local spread may be caused by the transport of fuel wood, tree trimmings, and other infested wood products (Rabaglia, 2008).

In the United States, *X. glabratus* has spread by natural spread in Florida. *X. glabratus* has moved by human spread into two new, isolated areas: in one county in Mississippi and in Northern South Carolina (Hanula, 2010).

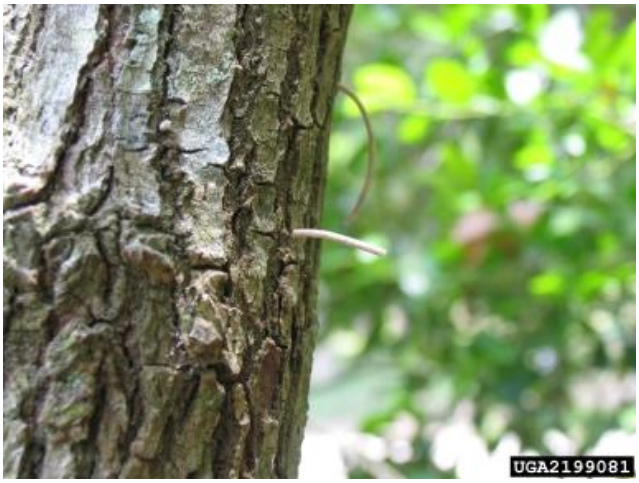
Pathogens Vectored
X. glabratus vectors *Raffaelea* sp., its fungal symbiont (Hanula et al., 2008). The fungus causes mortality in redbay due to a vascular wilt disease called laurel wilt disease (Hanula et al., 2008).

From Bulluck and Colpetzer (2007):

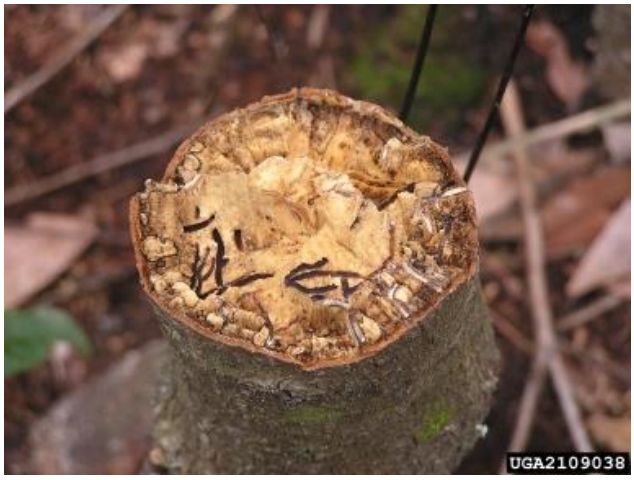
> *X. glabratus* "cultivates a symbiotic fungus in the inner heartwood and sapwood of host trees (Hanula, 2007). The cultivated fungi may, in addition to providing the beetles with food, condition the substrate for oviposition, assist in host colonization, help produce aggregation pheromones, or protect the beetles from entomopathogenic organisms (Kiristis, 2004; Krokene and Solheim, 1998)…. Female *X. glabratus* have paired mycangia at the bases of their mandibles that carry symbiotic fungal spores to new hosts (Fraedrich et al., In Press)."

From "A Fungal Symbiont of the Redbay Ambrosia Beetle Causes a Lethal Wilt in Redbay and Other Lauraceae in the Southeastern United States" (Fraedrich et al.; 2008):

> "Extensive mortality of redbay has been observed in the coastal plain counties of Georgia and southeastern South Carolina since 2003 and northeastern Florida since 2005. We show that the redbay mortality is due to a vascular wilt disease caused by an undescribed *Raffaelea* sp. that is a fungal symbiont of *Xyleborus glabratus*. Trees affected by the disease exhibit wilt symptoms that include a black discoloration of the sapwood. Female adults of *X. glabratus* have paired mycangia near the mandibles, and the *Raffaelea* sp. is routinely isolated from the heads of beetles. The fungus is apparently introduced into healthy redbay during beetle attacks on stems and branches."



Sawdust tube produced by an ambrosia beetle on a dead redbay. (Albert (Bud) Mayfield, Florida Department of Agriculture and Consumer Services, Bugwood.org)



X. glabratus galleries (James Johnson, Georgia Forestry Commission, Bugwood.org)

Damage

Damage caused by the insect:

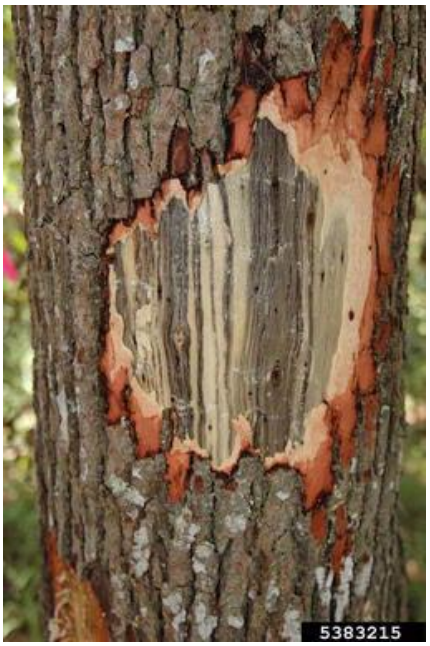
From "Pest Alert: The Redbay Ambrosia Beetle, *Xyleborus glabratus* Eichhoff (Scolytinae: Curculionidae)" (Mayfield and Thomas, 2006):

"Trees freshly attacked by *Xyleborus glabratus* exhibit few external symptoms initially. Small strings of compacted sawdust may protrude from the bark at the point of attack, but these strings disintegrate easily and are not always readily apparent. Removal of bark at the point of attack reveals shotholes from which a dark stain extends into the surrounding xylem."

Redbay trees dying from laurel wilt disease; center tree responding with epicormic sprouting. (Ronald F. Billings, Texas Forest Service, Bugwood.org)

Damage caused by the pathogen:
From "Pest Alert: The Redbay Ambrosia Beetle, *Xyleborus glabratus* Eichhoff (Scolytinae: Curculionidae)" (Mayfield and Thomas, 2006):

"The stain is the tree's response to infection by the *Ophiostoma* sp. [*Raffaelea* sp.] fungus, which gradually spreads through much of the outer sapwood. Attacked trees eventually exhibit wilted foliage with a reddish or purplish discoloration. Foliar discoloration may occur first within a section of the crown (e.g., major branch) or simultaneously throughout the entire crown. The foliage eventually turns brown and tends to remain



Redbay trunk with bark removed exposing sapwood with typical black staining caused by laurel wilt disease. (Ronald F. Billings, Texas Forest Service, Bugwood.org)

Partial canopy wilt due to a vascular infection by a fungus introduced by *Xyleborus glabratus*. (Albert (Bud) Mayfield, Florida Department of Agriculture and Consumer Services, Bugwood.org)

on the branches. This wilt scenario is more extensive than the isolated branch "flagging" caused by the black twig borer (*Xylosandrus compactus* (Eichoff)), which commonly kills twigs and outer portions of small-diameter branches of redbay (Dixon and Woodruff 1982)."

From "Forest and Shade Tree Pests: Laurel Wilt" (Mayfield, 2008):

"Redbay trees with laurel wilt initially exhibit drooping foliage with a reddish or purplish discoloration. Wilted leaves may remain on redbay trees for up to a year or more. Removal of bark reveals a black discoloration in the outer sapwood."

Survey

1.1 Survey Site Selection

Identify known or prospective hosts of *X. glabratus* and follow the general instructions on **General Site Considerations for Trap Placement** in the manual section **Planning a Survey**.

1.2 Trap and Lure

The recommended survey method for *X. glabratus* is manuka oil in a multi-funnel trap (Hanula, 2010; Hanula, personal communication, 2009; Hanula and Sullivan, 2008). Manuka oil is an essential oil extracted from wild manuka (*Leptospermum scoparium* Forst. and Forst.) that contains high proportions of two redbay odor components (Hanula and Sullivan, 2008).

It is not known if manuka oil inhibits attraction of other EWB/BBs if it were to be placed in the same traps with other lures (ethanol, alpha-pinene, etc.) (Hanula, personal communication, 2009). The current recommendation is to place manuka oil in a separate trap.

The manuka oil lure is effective for 8 weeks.

IPHIS Survey Supply Ordering System Product Names:

1) Manuka Oil Lure
2) Multi-funnel Trap, 12 Funnel, Wet or
3) Multi-funnel Trap, 8 Funnel, Wet

1.3 Trap Placement

Follow the general instructions on **Trap Placement** and **Trap Setup** for multi-funnel traps in the manual section **Conducting a Survey**. For *X. glabratus* survey, traps should be placed approximately 1.5 meters (5 feet) above the ground (Hanula, 2010).

1.4 Time of year to survey

It is not known how many generations *X. glabratus* goes through in the United States (Hanula et al., 2008). From research in South Carolina, Hanula et al. (2008) suggest that "beetles go through either a single generation per year or, more likely, multiple overlapping generations."

In South Carolina, peak adult activity of *X. glabratus* has been reported to occur in early September (Hanula, 2010; Hanula et al., 2008). In South Carolina, beetles are active year round; however, trap catches were highest from mid-June through mid-November and trap catches were very low in the winter (Hanula et al., 2008).

Identification

CAPS-Approved Method

Morphological. Examine specimens under a good quality, high powered (preferably with up to 90X) dissecting microscope, with the help of screening aids and a reference collection. Use screening aid for relevant geographical area. Positive identification will depend on examination by a specialist.

Mistaken Identities

This species may be confused with other families of small beetles as well as other Scolytinae. It is very similar in appearance to other members of this genus that are present in the United States.

Resources and High Resolution Images

Images of insect:
http://www.invasive.org/browse/subimages.cfm?sub=10998

Images of damage caused by pathogen:
http://www.forestryimages.org/browse/subimages.cfm?sub=20929

References

AQAS. 2009. Interception data for *Xyleborus glabratus*. Accessed October 8, 2009 from: https://mokcs14.aphis.usda.gov/aqas/HomePageInit.do

Bulluck, R. and K. Colpetzer. 2007. Amended NPAG et Report: *Xyleborus glabratus* Eichhoff, Ambrosia Beetle. USDA-APHIS-PPQ-CPHST-New Pest Advisory Group. 8 pp.

Fraedrich, S.W., T.C. Harrington, R.J., Rabaglia, M.D. Ulyshen, A.E. Mayfield, III, J.L. Hanula, J.M. Eickwort, and D.R. Miller. 2008. A fungal symbiont of the redbay ambrosia beetle causes a lethal wilt in redbay and other Lauraceae in the southeastern United States. Plant Disease. 92:215-224.

Haack, R.A. 2002. Intercepted Bark and Wood-Boring Insects in the United States: 1985-2000. Newsltr. Mich. Entom. Soc. V. 47(3&4).

Handy, K. J. 2009. NAPIS data for EWB/BB target species. Personal communication (email) to L. Jackson on 23 March 2009, from KJ Handy (USDA-APHIS-PPQ-EDP).

Hanula, J. 2010. Invasive beetle highlights: Redbay ambrosia beetle and laurel wilt. Presentation given at the Southern Forest Insect Work Conference. Wilmington, NC. June 20-23, 2010.

Hanula, J.L. 2009. Survey recommendations for *Xyleborus glabratus*. Personal communication with L.D. Jackson on April 15, 2009, from J. Hanula (USDA-Forest Service).

Hanula, J.L, A.E. Mayfield, III, S.W. Fraedrich, and R.J. Rabaglia. 2008. Biology and host associations of redbay ambrosia beetle (Coleoptera: Curculionidae: Scolytinae), exotic

vector of laurel wilt killing redbay trees in Southeastern United States. Journal of Economic Entomology. 101: 1276-1286.

Hanula, J., B. Rabaglia, and S. Fraedrich. 2007. Redbay Ambrosia Beetle Biology and Host Attraction [powerpoint]. USDA Forest Service. January 18, 2007.

Hanula, J.L. and B. Sullivan. 2008. Manuka oil and phoebe oil are attractive baits for *Xyleborus glabratus* (Coleoptera: Scolytinae), the vector of laurel wilt. Chemical Ecology 37: 1403-1409.

Mayfield, III., A.E. 2008. Forest and shade tree pests: Laurel Wilt. April 2008. Leaflet Number 13. Florida Department of Agriculture and Consumer Services, Division of Forestry.

Mayfield, A. E. and M. C. Thomas. 2009. Pest Alert. The Redbay Ambrosia Beetle, *Xyleborus glabratus* Eichhoff (Scolytinae: Curculionidae). Florida Department of Agriculture and Consumer Services, Division of Plant Industry.

Rabaglia, R. 2008. Exotic Forest Pest Information System for North America: *Trypodendron domesticum*. North American Forest Commission.

Rabaglia, R. J., S. A. Dole, and A. I. Cognato. 2006. Review of American Xyleborina (Coleoptera: Curculionidae: Scolytinae) occurring north of Mexico with an illustrated key. Annals of the Entomolotical Society of America, 1034-1056.