

Redbay Ambrosia Beetle-Laurel Wilt Fungus: A Potential Major Problem for Florida Avocados¹

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Descriptions

Ambrosia Beetles

Ambrosia beetles are members of the insect tribe Xyleborini and are known for attacking various woody plants, causing some limb and stem dieback and sometimes plant death. There are at least 30 species of ambrosia beetles in Florida, several of which are non-native. Typically ambrosia beetles have a symbiotic relationship with a fungus and the beetles carry fungal spores on their bodies. When the beetles bore into the sapwood of the host tree, the galleries formed from the beetle boring are inoculated with the fungal spores which then germinate. The fungus grows in the galleries and adjacent sapwood, disrupting the flow of water and nutrients in the tree. The fungus grows on the living wood of the tree, and the redbay ambrosia beetle adults and larvae feed on the fungus. Of the many ambrosia species in Florida, several *Xylosandrus* species attack avocado trees, but their boring and their associated fungi do not generally cause the entire tree to die. In contrast, the redbay ambrosia beetle and its associated fungus (the laurel wilt fungus; *Raffaelea laurelensis*) can cause whole tree death.

Most ambrosia beetles attack trees and shrubs that are stressed, dying, or dead. Plant stress may be the result of drought, flooding, freezing temperature damage, wind damage, or very poor cultural practices. In contrast, some ambrosia beetles, the redbay ambrosia beetle included, attack healthy trees. More importantly, the laurel wilt fungus that accompanies this beetle often causes tree death.

Redbay Ambrosia Beetle

The redbay ambrosia beetle (*Xyleborus glabratus*) is a very small (about 2 mm in length), dark brown to black, cylinder-shaped beetle similar to other ambrosia beetles found in Florida (Fig. 1). The male beetles are smaller than the females and cannot fly. In contrast, the females are strong flyers. Like other ambrosia beetles, redbay ambrosia beetles bore into the wood just below the bark, form galleries in the sapwood, and inoculate these galleries with spores of the fungus they carry (*Raffaelea laurelensis*). The fungus feeds on the sapwood and then the adult and larval redbay ambrosia beetles feed on the fungus.

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Fig.1. Redbay ambrosia beetles (*Xyleborus glabratus*): a) top view and b) side view of a single adult. Credits: Photographs courtesy of Michael C. Thomas, Florida Department of Agriculture and Consumer Services

Laurel Wilt Fungus

The adult female redbay ambrosia beetle carries the spores of the laurel wilt fungus (*Raffaelea laurelensis*) in a special pouch in its mouth called a mycangia. As the beetle bores into the wood, forming galleries, the spores carried in its mycangia and on its body inoculate the tree, germinate and grow, colonizing the outer wood (sapwood) of the host plant (Fig. 2). The fungal hyphae and colonized sapwood block water and nutrient movement in the tree.



Fig.2. Symptoms of laurel wilt fungal (*Raffaelea laurelensis*) colonization of redbay trees: a) removing the bark reveals dark staining of the sapwood, and b) the dark color of the outer ring of sapwood below the bark indicates the tree has been infested by the redbay ambrosia beetle and the wood colonized by the laurel wilt fungus. The fungal hyphae which have colonized sapwood block water and nutrient movement in the tree. Credits: Photographs courtesy of Albert Mayfield, Florida Department of Agriculture and Consumer Services

Origin, Detection, and Spread of the Pest

The redbay ambrosia beetle is native to India, Japan, Myanmar, and Taiwan. However, the origin of the laurel wilt fungus that accompanies the beetle is not known. The fungus is presumed to have been introduced with the beetle. The beetle and fungus are not known to be major pests in their native range. The beetle is believed to have been introduced into Georgia by infested packing materials, such as wooden crates and pallets. This insect-fungal pest attacks a number of forest tree species in Asia, including Asian spicebush (*Lindera latifolia*), yellow litsea (*Litsea elongate*), and sal (*Shorea robusta*). However, we are not aware of any reports in Asia of this pest attacking avocado (*Persea americana*).

The redbay ambrosia beetle was first detected in a survey trap in Port Wentworth, Georgia in 2002, and by 2003 this beetle and its associated fungus had caused substantial destruction to the native redbay (*Persea borbonia*) in Georgia and South Carolina (Fig. 3). During the spring of 2005, this pest was detected on redbay in Duval County, Florida. Since that time the pest has spread southward from northeast Florida (Duval County) along the east coast to as far south as Indian River County. The range of redbay trees is from coastal Virginia to eastern Texas and includes coastal areas of North and South Carolina, Georgia, southern Alabama Mississippi, parts of Louisiana, and all of Florida. There is a danger that this continuous range will facilitate the natural spread of the redbay ambrosia beetle and laurel wilt fungus to the commercial avocado production area in Miami-Dade County.

Plant Hosts in the U.S.

The redbay ambrosia beetle appears to be most attracted to woody plants in the Lauraceae (laurel) family, although there are reports in Asia of the beetle attacking some plant species in Fabaceae, Fagaceae, and Dipterocarpaceae. There are numerous species in Lauraceae in Florida; some of these are forest species, some of ornamental value, and one, avocado, a major commercial fruit crop species. Whether the redbay ambrosia beetle-laurel wilt fungus attacks plants in other plant families is not

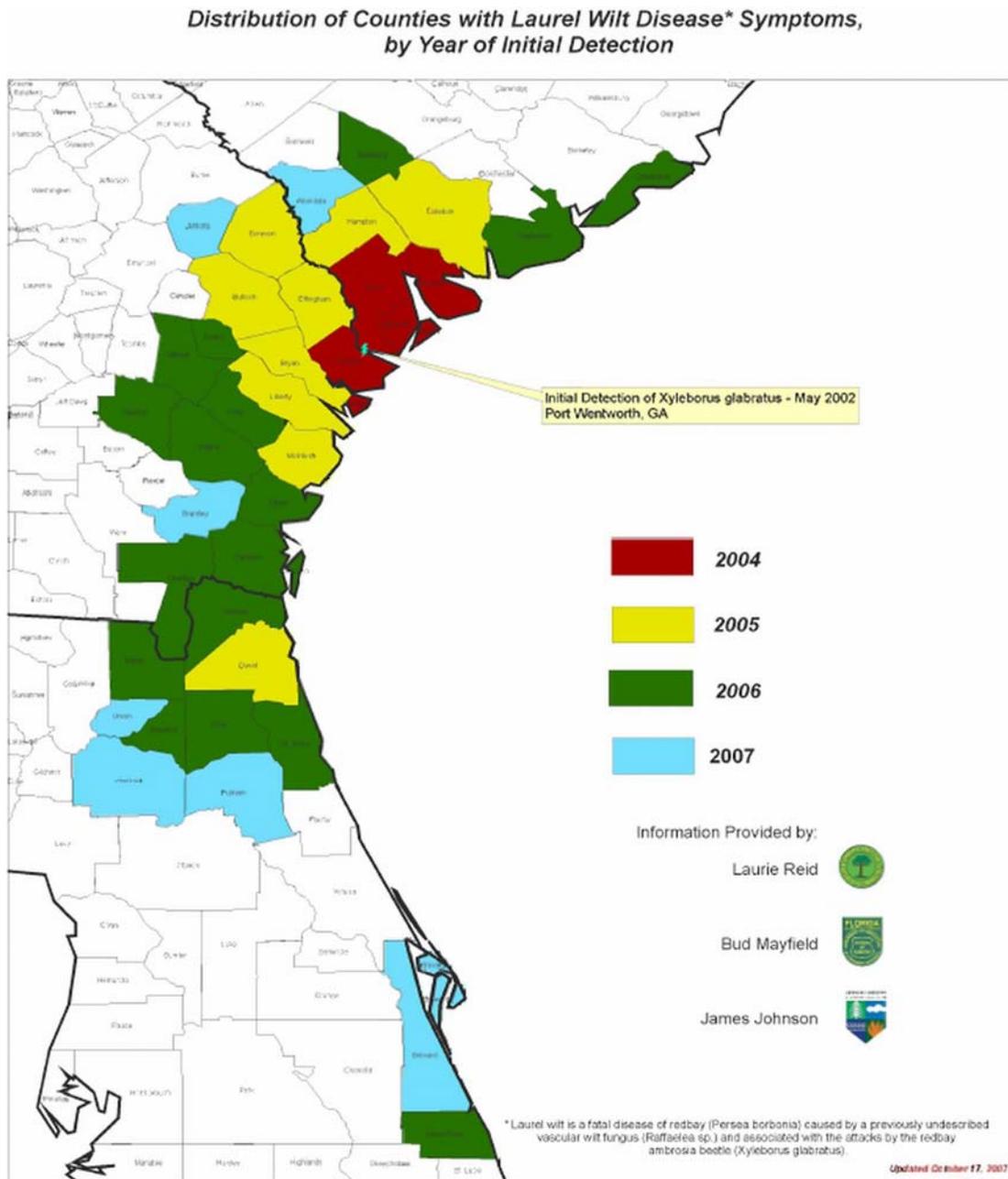


Fig.3. Map showing the spread of the redbay ambrosia beetle in the southeastern U.S. and Florida in particular. Note that several counties above Indian River County do not have the beetle at this time, indicating that the beetle was moved to Indian River County in contaminated wood products (most likely firewood). Credits: Map courtesy of Laurie Reid, South Carolina Forestry Commission; Albert Mayfield, Florida Department of Agriculture and Consumer Services, and James Johnson, Georgia Forestry Commission http://www.fs.fed.us/r8/foresthealth/laurelwilt/dist_map.shtml

known at this time. Currently, the reported hosts of the redbay ambrosia beetle-laurel wilt fungus have included the redbay (*P. borbonia*), swampbay (*P. palustris*), sassafras (*Sassafras albidum*), and avocado (*P. americana*). The laurel wilt fungus has been recovered from diseased plants of pondberry (*Lindera melissifolia*), camphor tree (*Cinnamomum camphora*), and pondspice (*Litsea aestivalis*).

Recently research has shown that avocado cultivars appear to vary in their susceptibility to the laurel wilt fungus (Table 1). Preliminary results to date suggest 'Donnie', 'Simmonds' and 'Monroe' avocado varieties are susceptible to attack by the redbay ambrosia beetle and that 'Brogdon' is highly, 'Simmonds' moderately, and 'Reed' avocado slightly susceptible to the laurel wilt fungus.

Plant Host Symptoms and Damage

1. Small strings of compacted sawdust (ejected wood fiber) protrude from small bore holes along the tree trunk and limbs (Fig. 4). However, these may not always be present because they disintegrate easily.

2. Removing the tree bark reveals bore holes in the wood at the point of attack from the beetle and dark staining caused by the fungus as it extends into the surrounding water-conducting tissues (xylem) (Fig. 4).

3. Leaf and young stem wilting in sections of the tree show signs of attack (sometimes the whole tree if the trunk is infested) (Fig. 5). Subsequently leaves in part of the tree canopy or the whole canopy may drop or desiccate and remain attached to the stems.

4. Leaf, stem, and limb dieback; eventual tree death (Fig. 6).



Fig.4. Small strings of compacted sawdust protrude from the small bore holes along the trunk of a tree. Credits: Photographs courtesy of Albert Mayfield, Florida Department of Agriculture and Consumer Services



Fig.5. Bore holes are seen when the bark is removed from an infested limb or trunk. Note the dark staining of the sapwood caused by the feeding of the laurel wilt fungus on the sapwood. Credits: Photographs courtesy of Albert Mayfield, Florida Department of Agriculture and Consumer Services



Fig.6. Wilted leaves and young stems of laurel-wilt-infected avocado trees. Credits: Photograph courtesy of Jason Smith, IFAS, Department of Forestry and Conservation, Gainesville, Florida

Management Strategies Recommended and What You Can Do

1. The USDA-APHIS-PPQ (United States Department of Agriculture Animal and Plant Health Inspection Service Plant Protection and Quarantine) requires imported crates, pallets, and other wood-based packing material to be quarantine-treated prior to arrival in the U.S.

2. Redbay and other host forest wood species should not be moved or sold as firewood, tree trimmings, BBQ smoke-wood or mulch.

3. Rural residents and commercial growers should be on the look-out for redbay and other host trees (including avocado) showing signs of rapid wilting, dieback, and insect boring, and should report this to the Department of Plant Industry (<http://www.doacs.state.fl.us/pi/index.html>) and Division of Forestry (<http://www.fl-dof.com/>). This will help regulatory agencies and scientists track the movement of this pest. Preliminarily, redbay ambrosia beetle finds appear to be highest from July through September.

4. Extreme caution should be used in moving avocado trees and wood products into Miami-Dade



Fig.7. Whole redbay trees killed by redbay ambrosia beetle-laurel wilt fungus attack. Credits: Photographs courtesy of Albert Mayfield, Florida Department of Agriculture and Consumer Services

County from other counties. Insect- and disease-free containerized avocado trees should only be purchased from reputable nurseries, and trees showing any signs of wilt or dieback should be destroyed immediately.

5. Usually, ambrosia beetles attack trees suffering from some type of environmental or cultural stress (e.g., drought, flooding, freezing, nutrient deficiencies, etc.). Thus it is highly recommended to keep your trees as healthy as possible, especially optimizing nutrition and water management strategies to preclude nutrient deficiencies and drought stress.

6. Once the beetle and fungus is detected in the avocado production area:

a. Consider burning infested tree parts or trees in the grove to destroy redbay larvae and adults inside the wood (permits may be required from the county). Chipping the infested wood will eliminate the wood from being used for breeding more beetles but may not destroy the beetles or larvae due to their very small size.

b. Consider requiring disinfection of mechanical and hand pruning equipment prior to pruning a new grove.

Agencies and Institutions Working on the Redbay Ambrosia Beetle-Laurel Wilt Fungus

1. United States Department of Agriculture (USDA), Forest Research Service
2. Florida Department of Agriculture and Consumer Services (FDACS), Division of Forestry and Department of Plant Industry
3. University of Florida (UF), School of Forest Resources and Conservation
4. UF Institute of Food and Agricultural Sciences (IFAS), Tropical Research and Education Center
5. USDA, Animal Plant Health Inspection Service (APHIS) and Plant Protection and Quarantine (PPQ)

Research and Extension Efforts on Avocado

Research is continuing to evaluate the degree of avocado variety susceptibility to attack by the redbay ambrosia beetle and the extent of damage or death from the laurel wilt fungus. Work with containerized avocado plants and avocado plants in the field in infested locations in north Florida is in progress; more is planned. The avocado and fruit-tree nursery industries have been supporting the research effort along with the USDA-Forest Service, Florida Department of Agriculture and Consumer Services, Division of Forestry, and the University of Florida, IFAS.

The commercial avocado industry has been kept abreast of the movement of the beetle, and the early results from research on avocado susceptibility to the beetle and fungus. A workshop on the redbay ambrosia beetle-laurel wilt fungus pest problem has been presented to the Avocado Administrative Committee and to local growers. As new information is generated it will be provided to the industry. The Florida Department of Agriculture and Consumer Services Department of Plant Industry (<http://www.doacs.state.fl.us/pi/index.html>) has

issued several Pest Alerts to the public concerning this pest problem.

What We Do Not Know

1. How attracted redbay ambrosia beetles are to mature (large) avocado trees and whether there are differences among avocado varieties.
2. The susceptibility of different avocado varieties to the laurel wilt fungus.
3. Whether any beetle repellents have the potential to keep the redbay ambrosia beetle from attacking avocado trees.
4. Whether any fungicides will control the laurel wilt fungus and whether any pesticides will kill the beetle.
5. Whether a trap and kill system could be used to control the redbay ambrosia beetle.
6. Some of the basic biology of the beetle and fungus.
7. Whether the laurel wilt fungus can be transmitted mechanically by pruning equipment.

More Information and Links

- Website of the Laurel Wilt Working Group, hosted by USDA Forest Service, Forest Health Protection, Southern Region:
<http://www.fs.fed.us/r8/foresthealth/laurelwilt/>
- Florida Department of Agriculture and Consumer Services, Department of Plant Industry:
- University of Florida, IFAS, Extension Data Information Source (EDIS):
<http://edis.ifas.ufl.edu>
- Tropical Research and Education Center, University of Florida, IFAS:
<http://trec.ifas.ufl.edu>

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