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Laurel Wilt: A Threat to Redbay, Avocado and Related Trees in Urban and Rural Landscapes[1]

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Introduction

Laurel wilt is a disease of redbay (*Persea borbonia*), avocado (*Persea americana*), and other trees in the laurel family (Lauraceae). It is caused by a fungus (*Raffaelea* sp.) that stops the flow of water in host trees, causing the leaves to wilt. The fungus is carried into host trees by a non-native insect, the redbay ambrosia beetle (*Xyleborus glabratus*), which was first detected in the United States in 2002 and Florida in 2005.Laurel wilt has caused high levels of redbay tree death in Florida, Georgia, and South Carolina, and avocado has succumbed to this disease in both residential and experimental settings. At this time, the geographic distribution of the redbay ambrosia beetle and laurel wilt disease continues to expand in Florida.

Descriptions

Ambrosia Beetles

In general, ambrosia beetles are very small, wood-boring insects that typically attack trees and shrubs that are already stressed, dying, or dead. There are at least 30 species of ambrosia beetles in Florida, several of which are non-native. Ambrosia beetles transport spores of fungi with which they have a mutually beneficial relationship. When an ambrosia beetle bores into a host tree, it creates tunnels (galleries) in the sapwood and inoculates the gallery walls with fungal spores that are carried on its body. The fungus grows in the galleries and serves as food for the beetles and their larvae. Thus, ambrosia beetles can be considered "fungus farmers." The fungus obtains nutrition from the tree and is dispersed to new trees by the beetles when they emerge from the wood. It is important to note that the redbay ambrosia beetle is unlikely to kill trees unless the fungus is present.

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Redbay Ambrosia Beetle and Laurel Wilt Fungus

Unlike most other ambrosia beetles in Florida, the redbay ambrosia beetle attacks healthy trees of certain species in the laurel family, particularly redbay. More importantly, the laurel wilt fungus that accompanies this beetle causes disease in several host species. The fungus does not produce readily visible fruiting structures. Rather, it produces very small spores (called conidia) that are carried in specialized sacs located in the beetle's mouthparts. So far, this appears to be the only way the laurel wilt fungus is transported into trees. After being introduced into the wood by the beetle, the fungus moves through the water and nutrient transport system of the tree, plugging the flow of water and causing the tree to wilt.

The redbay ambrosia beetle is very small (about 2 mm long), dark brown to black, and cylinder-shaped. To the unaided eye it is similar in appearance to other ambrosia beetles found in Florida (Fig. 1). Female beetles fly and are much more numerous than the smaller, flightless males. It is important to note that the redbay ambrosia beetle would not likely kill trees nor be a pest without the disease-causing fungus it carries.

Figure 1. Redbay ambrosia beetles (Xyleborus glabratus): a) comparison of beetle to a penny; b) top view and c) side view of a single adult. Credits: Michael C. Thomas, Florida Department of Agriculture and Consumer Services.

Origin, Detection and Spread

The redbay ambrosia beetle is native to India, Japan, Myanmar, and Taiwan. The origin of the laurel wilt fungus is not known with certainty, but it is presumed to have been introduced with the beetle. Neither the beetle nor the fungus is known to be pests in their native range. The redbay ambrosia beetle was first detected in a survey trap in Port Wentworth, Georgia in 2002 and probably arrived in infested solid wood packing materials (such as crates and pallets) used to ship commercial goods. By 2003, laurel wilt had caused substantial levels of mortality in native redbay populations in Georgia and South Carolina, and by the spring of 2005, it was detected on redbay in Duval County, Florida. Since that time, laurel wilt has spread southward into peninsular Florida and along the east coast as far south as Indian River County (Fig. 2). The natural range of redbay largely coincides with the southeastern Coastal Plain region, extending from coastal Virginia to eastern Texas and including all of Florida. Experts fear that the redbay beetle and laurel wilt will spread through the range of redbay trees into south Florida and attack avocado trees grown in home landscapes and in commercial groves in Miami-Dade County.

Plant Hosts in the U.S.

To date in the U.S., only woody plants in the laurel family (Lauraceae) have been reported as hosts of the redbay ambrosia beetle and the laurel wilt fungus. Certain species in at least four plant families (Lauraceae, Fabaceae, Fagaceae, and Dipterocarpaceae) have been reported as hosts of the beetle in Asia, but whether the beetle will colonize other plant families in the U.S. remains to be seen. There are at least 13 species in the laurel family in Florida, including forest species, ornamental and landscape plants, and one major commercial fruit crop tree (avocado). Reported hosts of the both the redbay ambrosia beetle and the laurel wilt fungus include redbay (*P. borbonia*), swampbay (*P. palustris*), avocado (*P. americana*), and sassafras (*Sassafras albidum*). The laurel wilt fungus has also been recovered from diseased plants of pondberry (*Lindera melissifolia*), camphor tree (*Cinnamomum camphora*), and pondspice (*Litsea aestivalis*). Recent research suggests that some avocado varieties may be more susceptible to laurel wilt than others.

Impact

Laurel wilt is devastating to mature redbay trees. At one site in Duval County, Florida, percent mortality among monitored redbays greater than 1 inch diameter increased from 10% to 92% in just 15 months. Most small redbay seedlings and sprouts,

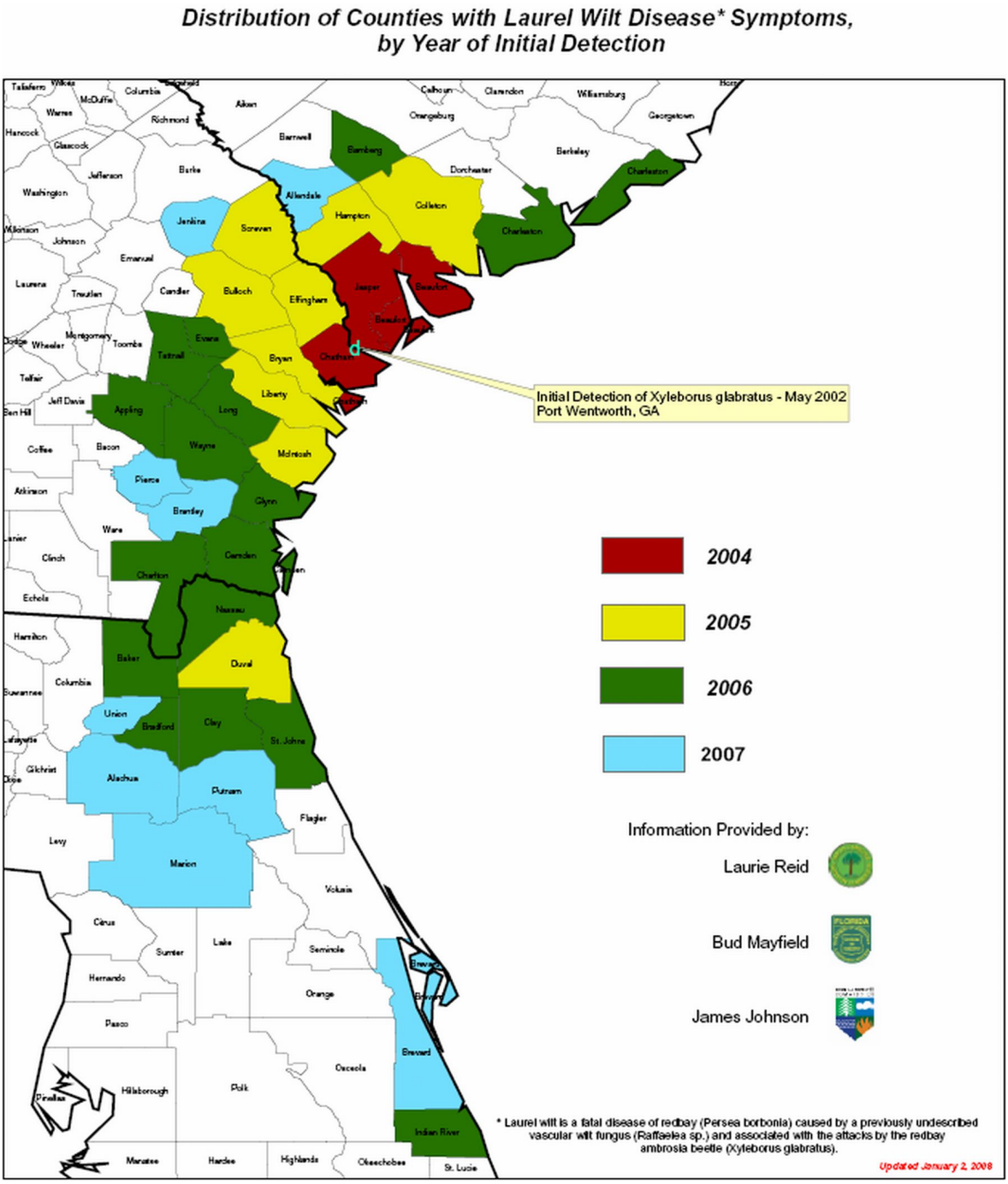

Figure 2. Map showing the spread of the laurel wilt in the southeastern U.S. and Florida in particular. Note that several counties above Indian River County do not have laurel wilt at this time, indicating that the disease was moved to Indian River County in contaminated wood products (most likely firewood).[http://www.fs.fed.us/r8/foresthealth/laurelwilt/dist_map.shtml] Credits: Laurie Reid, South Carolina Forestry Commission; Albert Mayfield, Florida Department of Agriculture and Consumer Services, and James Johnson, Georgia Forestry Commission.

however, do not appear to be affected by the disease, but are likely to become infected as they grow larger. Redbay is important to wildlife because its fruit, seed and/or foliage are eaten by several species of songbirds, wild turkeys, quail, deer, and black bear.

Larvae of the Palamedes swallowtail, also called laurel swallowtail (*Papilio palamedes* (Drury)), feed primarily on species of *Persea*; thus this butterfly species may be negatively impacted by laurel wilt. Endangered tree species such as pondberry and

pondspice are confirmed hosts of the laurel wilt fungus and may be in danger of additional negative pressure on their populations. Laurel wilt has also caused substantial negative economic and aesthetic impacts in residential neighborhoods and parks where large redbay trees have been killed.

Host Symptoms

- Laurel wilt causes the leaves of affected trees to droop and take on a reddish or purplish discoloration (Fig. 3a). Wilted foliage may occur in only part of the crown at first, but typically the entire crown eventually wilts and reddens (Fig. 3b). In redbay, the leaves eventually turn brown and remain on the tree for up to a year or more (Fig. 3c). Limited experience with laurel wilt in avocado suggests that this host may drop its leaves relatively soon after wilting (Figs. 3d, 4). Crown damage by laurel wilt is typically more extensive than that caused by the black twig borer (*Xylosandrus compactus*), which kills small-diameter outer branches and twigs of a variety of tree species.

- Removal of bark from wilted trees reveals a black to brown discoloration in the sapwood (Fig. 5). This is the best diagnostic feature of laurel wilt in the field. The extent of this discoloration, which runs in streaks parallel to the grain of the wood, will vary depending on how long the tree has been infected.

- Initial attacks by the redbay ambrosia beetle on stems or branches are often difficult to detect. However, after the tree is inoculated and has wilted as described above, ambrosia beetles will attack the dying tree in larger numbers and small strings of compacted sawdust (ejected wood fiber) may protrude from bore holes along the tree trunk and limbs (Fig. 6.). These sawdust tubes may not always be present because they disintegrate easily, and may be produced by other ambrosia beetle species in addition to the redbay ambrosia beetle.

Figure 3. Whole redbay trees killed by laurel wilt. Credits: Albert Mayfield, Florida Department of Agriculture and Consumer Services.

Figure 4. a) A bore-hole from a redbay ambrosia beetle surrounded by dried sap (white-crystal-like) from an avocado stem and b) wilted leaves of laurel-wilt-infected avocado tree. Credits: Jason Smith, IFAS, Department of Forestry and Conservation, Gainesville, Florida.

Figure 5. Symptoms of laurel wilt in 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 fungus that has colonized the sapwood blocks water and nutrient movement in the tree. Credits: Albert Mayfield, Florida Department of Agriculture and Consumer Services.

Figure 6. Small strings of compacted sawdust protrude from the small bore holes along the trunk of a tree. Credits: Albert Mayfield, Florida Department of Agriculture and Consumer Services.

Management Strategies and What You Can Do

The following strategies may help reduce the spread and impact of laurel wilt:

- Avoid the movement of firewood, tree trimmings, or mulch from redbays (and other laurel family host species) out of counties in which laurel wilt is known to occur. Avoid long distance transport of firewood in general. A county-level distribution map is periodically updated on the following website: http://www.fs.fed.us/r8/foresthealth/laurelwilt/dist_map.shtml

- Whenever possible, leave dead and dying redbay wood (and wood from other laurel family hosts) on site instead of transporting it. If the wood must be transported, dispose of it as close to the source as possible.

- Use of landfills or covering, burning, or chipping infested host tree material, either at its original site or a disposal site, is preferable to leaving infested wood intact in the open environment. Check with your local county before burning: a burning permit may be required. Chipping wood from an infested tree might not destroy all of the ambrosia beetles (due to their extremely small size), but should reduce the suitability of the wood as breeding material and hinder beetle colonization and dispersal.

- Although the pathogen has not yet been documented to spread by any means other than the beetle vector, consider cleaning/sterilizing saws and pruning blades after cutting an infected tree and before using them on uninfected host tree species.

- Urban and rural residents and commercial growers should be on the look-out for redbay and other host trees (including avocado) showing signs of rapid wilting and dark sapwood discoloration. Report new finds to the Florida Division of Plant Industry (http://www.doacs.state.fl.us/pi/) or Division of Forestry (http://www.fl-dof.com/). This will help regulatory agencies and scientists track the movement of this pest.

- Extreme caution should be used in moving any plant species in the laurel family (this includes avocado trees) and wood products into Miami-Dade County from other counties. Only insect- and disease-free containerized avocado trees should be purchased from reputable nurseries. Nursery stock in the laurel family showing signs of wilt or sapwood discoloration should be carefully inspected, tested for evidence of the laurel wilt pathogen, and destroyed if necessary.

- By participating in the Redbay Seed Collection Program, you can help conserve genetic material from *Persea* bay species, should populations become threatened by laurel wilt. See "Seed Collection" at http://www.fs.fed.us/r8/foresthealth/laurelwilt/.

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, Division of Forestry laurel wilt page:

http://www.fl-dof.com/forest_management/fh_insects_redbay_ambrosiabeetle.html

Florida Department of Agriculture and Consumer Services, Division of Plant Industry pest alert:

http://www.doacs.state.fl.us/pi/enpp/ento/x.glabratus.html

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