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FOR289

Assessing the Survival of the Redbay Ambrosia Beetle and Laurel Wilt Pathogen in Wood Chips[1]

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Laurel wilt (LW) is a vascular disease of the Lauraceae plant family. The disease is caused by a fungus (*Raffaelea lauricola* T. C. Harrin., Aghayeva, & Fraedrich) that is vectored by a non-native beetle, the redbay ambrosia beetle (RAB), *Xyleborus glabratus* Eichhoff (Coleoptera: Curculionidae) (Hanula 2008). To date, it is likely that millions of *Persea* species have died from the disease, which currently ranges from North Carolina to south Florida and west to Mississippi. In this study we examined the survivability of the RAB and the laurel wilt fungus in wood chips made from infested trees and chipped using a standard tree chipper. With large volumes of wood from dead *Persea* species, the potential for intact infested logs to be moved from state to state is significant. This disease also affects avocado (*Persea americana*) and has the potential to harm both the Florida and California avocado industry. Results suggest that chipping wood can be used to minimize the spread of both RAB and the laurel wilt fungus.

Introduction

The laurel wilt vector and pathogen were introduced into Georgia before 2002. Since then, laurel wilt has killed plants in the Lauraceae, including: redbay (*P. borbonia*), swampbay (*P. palustris*), silkbay (*P. humilis*), sassafras (*Sassafras albidum*), northern spicebush (*Lindera benzoin*), pondberry (*Lindera melissifolia*), and pondspice (*Litsea aestivalis*) (Fraedrich et al. 2008). The disease also affects planted avocado (*P. americana*) and camphor (*Cinnamomum camphora*) (Mayfield et al. 2008, Smith et al. 2009). In the eight years since laurel wilt has been recognized in the U.S., it has spread faster to the South than it has to the North or West (Figure 1). From the site of first detection, the disease has traveled some 200 miles north, reaching North Carolina in 2011. To the south, the disease has moved almost twice as far, reaching Miami-Dade County, Florida, in 2011 (DPI 2010). Laurel wilt was confirmed in Bay County, Florida, and Mississippi in 2009 and in Alabama in 2011; however, it is suspected that these movements were due to the anthropogenic movement of firewood (Riggins et al.2010) (Figure 1).

In its native Asian range, RAB is not known to be a pest. The RAB is a true ambrosia beetle and attacks both living and dead trees. And, like other ambrosia beetles, it bores into a tree and deposits spores of its symbiotic fungi on which it feeds (Harrington 2008). When living host trees are attacked, the laurel wilt pathogen (*R. lauricola*) spreads inside the tree through the water-conducting xylem tissue. Although the exact mechanism of mortality is not known, tree death likely occurs due to dysfunction of the water conducting cells. Once a susceptible host is inoculated with the fungus, death can occur in a few weeks or up to

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several months. Once trees die, they continue to serve as breeding sites for more RAB. New RAB populations can be established by a single female through a unique reproductive strategy. A female RAB can produce flightless male offspring without mating, and upon mating with those offspring males, she can produce additional females that can fly to new trees. Thus, a single female beetle emerging from a tree has the potential to start a new population.

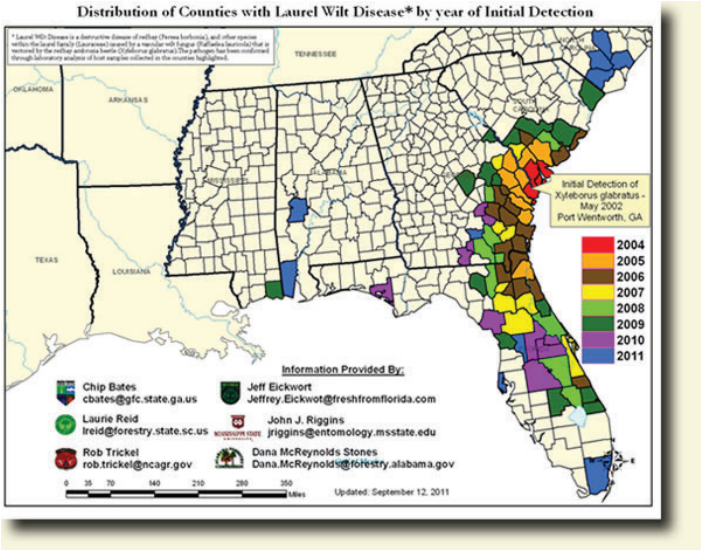

Figure 1. Counties where Laurel Wilt has been identified. Credits: USDA Forest Service, Forest Health Protection, http://www.fs.fed.us/r8/foresthealth/laurelwilt/dist_map.shtml to view full sized map.

Dead trees in urban landscapes are commonly taken in large sections or chipped into wood pieces and taken to local landfills. On occasion, when large volumes of trees are collected from urban or rural areas they could be taken to a wood processing plant for conversion into wood chips that can be used as mulch or burned for electricity generation (Asikainen and Pulkkinen. 1998). Due to the concern about transmission of LW in chipped wood, we explored the potential elimination and neutralization of the RAB and laurel wilt fungus through the conversion of infested trees into small wood chips.

Study

Several dozen diseased redbay trees were collected and chipped into small wood pieces, ranging from 6.3 to 40 cm^3. A Bandit model 1890 tree chipper was used to chip the trees into 1 m^3 mulch bins; the bins were either exposed to full sun or kept in constant shade. In each bin we placed small mesh bags containing woodchips from the infested redbay trees (Figure 2). The bags were extracted every two weeks and tested for the presence of the laurel wilt fungus by plating small pieces of wood on artificial growth media (Figure 3).

Figure 2. 1 m^3 mulch bin with mesh bags on the surface.

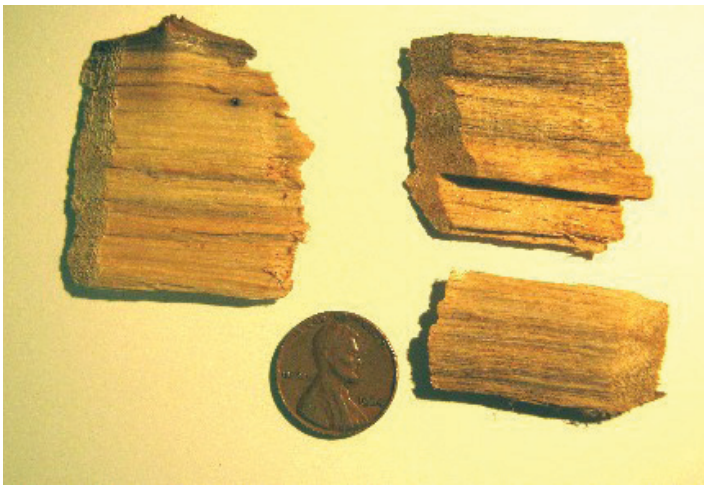

Figure 3. Wood chips with black staining from laurel wilt.

The remaining wood chips from each mesh bag were placed into small insect rearing chambers and monitored for 10 weeks for beetle emergence (Figure 4). The rearing chambers were kept at room temperature and exposed to light daily.

Figure 4. The rearing chambers were kept at room temperature and exposed to light daily.

To further test RAB survival in chipped wood, we placed ten piles of infested redbay wood chips from the pre-chipped wood pile under mesh netting in a garage to evaluate RAB emergence without being exposed to rainfall or high temperatures from direct exposure to sunlight (Figure 5). We also placed ten 50 cm logs from the pre-chipped wood pile (infested with RAB) under mesh netting in the same garage to collect any beetles that emerged from intact pieces of wood (Figure 6).

Figure 5. Wood chips under a mesh net.

Figure 6. 50 cm log infested with RAB under a mesh net.

Over the course of the study, temperature was recorded in the wood chip bins for each treatment. A temperature probe was placed in the center of each bin and data logged every hour from the beginning of the study in July until its termination in late October.

Results

Raffaelea lauricola was not recovered from any of the 1400 samples of plated wood chips from the mesh bags. No RAB emerged from any of the 400 insect rearing chambers, regardless of whether the wood chips were in the sun or shade. Five RAB emerged from the ten netted wood chip piles (Figure 5). This is in contrast to 856 RAB that emerged from 10 netted redbay logs (Figure 6) that were monitored over the same period.

Recommendations

- For those who wish to dispose of their dead redbay trees that were killed by laurel wilt, chipping the trees and covering them with a tarp for at least one week is a very good disease management strategy. Since some RAB did survive the chipping, tarping the wood chips for at least a week is an important component to reducing the potential spread of the beetle. This type of sanitation strategy could help to reduce the local impact of the disease.
- Since the laurel wilt fungus was not recovered from wood chips, the use of wood chips as mulch (after the chips have been tarped for a week) does not pose a threat to living trees in the Lauraceae, nor does it provide a mechanism for the movement of the laurel wilt disease.

Conclusion

Chipping trees that died from laurel wilt is a useful tool to minimize the potential spread of laurel wilt. This study provides evidence that: 1) owners of dead redbay trees have a simple technique to dispose of dead trees; 2) chipping dead trees can contain the disease within a small area; and 3) there is a low probability of long-distance movement of LW via wood chips. More research is planned to assess the environmental limits of *X. glabratus* and *R. lauricola.*

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USDA Forest Service, Forest Health Protection http://www.fs.fed.us/foresthealth/