Persea Species Restoration in Laurel Wilt Epidemic Areas

Photo: Chip Bates

Photo: LeRoy Rodgers

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Melbourne, Florida
Ambrosia beetles are typically harmless. But, some are causing mass tree mortality.
**Xyleborus glabratus** – redbay ambrosia beetle

**Raffaelea lauricola** - Ophiostomatales

**Clonal symbiosis!**
Lauraceae are dominant canopy species throughout the tropics

- Over 3000 species so taxonomy is poorly understood
- Important essential oils: repel insects, perfumes, spices, fragrant wood and medicine
- Agriculturally important: avocado and spices
Non-native Lauraceae susceptibility to *Raffaelea lauricola*

*Lindera megaphylla* (Asia)
20 days PI
overall tolerant but not resistant

*Cinnamomum pedunculatum* (Japanese cinnamon)
30 days PI
wilt some, then stop

*Persea podadenia* (Mexico)
overall susceptible
30 days PI

~35 more species to test
Known hosts in the USA

*Persea borbonia* - Redbay
*Persea palustris* – Swamp bay
*Persea humilis* - Silkbay
*Persea americana* - Avocado
*Persea indica*
*Cinnamomum camphora* – Camphor tree
*Sassafras albidum* - Sassafras
*Umbellularia californica* – California bay laurel
*Laurus nobilis* – European bay laurel
*Lindera benzoin* - Northern spicebush
*Lindera melissifolia* - Pondberry
*Litsea aestivalis* - Pondspice
*Licaria triandra* - Gulf licaria
*Ocotea coriacea* - Lancewood
*Persea mexicana* – Mexican redbay

*artificial fungal inoculation

* threatened or endangered
Laurel Wilt Disease-Widespread and High Mortality

Percent redbay laurel wilt mortality

Initial detection of *Xyleborus glabratus* 2002

M.A. Hughes et al. (2017) Biological Invasions
Collection and Propagation of Surviving Redbay

• Sampled 2009 – 2013
  After 1st wave of dieback

• 6 sites with high mortality
  ☑ Coastal maritime forests
  ☑ 6-15 genotypes per location

• Chose asymptomatic survivors

• Trees from stem cuttings
  ☑ Resistance screen using artificial fungal inoculation
  ☑ Genotyped with 6 SSR loci- each unique
~60 surviving genotypes tested with 4-6 clonal replicates each

~3000 spores per tree
Disease Parameters Measured for 124 days

1. Days until disease symptoms appear (16-76 days)
2. Rate of disease development
3. Weekly wilt severity, 1 to 10 scale
4. AUDPC: area under disease progress curve show curve
5. Mortality: number of genotype replicates that died
Resistance Screening Reveals Tolerance Not Resistance

7 Tolerant Genotypes
• Slower disease progression
• Lower severity ratings
• No mortality

Remaining Genotypes
• More rapid disease progression
• Higher severity ratings
• High mortality

wilt severity rating = 2 (~15%)

wilt severity rating = 10 (~95%)
Preserving germplasm

Plant Protection Program

View of Black Hills showing trees recently killed by mountain pine beetle (Dendroctonus ponderosae). Photo credit: Chris M Morris, flickr.com, CC BY 2.0

The Plant Protection Program encompasses a variety of activities and resources that engage public gardens in forest health protection and plant conservation. Click on any of the following links to learn more about how your garden can participate!

**Educational Outreach:** Use our interpretive signs and plant labels to enhance the experiential learning opportunity that your garden provides and educate visitors about a wide variety of topics.
3 sites comparing redbay seedlings and cuttings:

- light over each plant
- soil moisture and nutrients
- growth
- damage assessment
Restoration: What to plant

Is tolerance heritable in seedlings?

3 months PI
Susceptible

3 months PI
Tolerant

*Currently inoculating hundreds
Persea species in Florida

Persea borbonia  
redbay

Persea palustris  
Swamp bay

Persea humilis  
silk bay
60 samples, 17 SSR loci

Goethe State Forest

Gold Head Branch State Park

Ocala National Forest

Archbold Biological Station

sandhill habitat
Swamp bay stands out as different

AMOVA: analysis of molecular variance

<table>
<thead>
<tr>
<th>Populations compared</th>
<th>Fst*-Average population differentiation</th>
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</thead>
<tbody>
<tr>
<td>all 3 species</td>
<td>0.19</td>
</tr>
<tr>
<td>swamp bay, silk bay</td>
<td>0.30</td>
</tr>
<tr>
<td>swamp bay, redbay</td>
<td>0.18</td>
</tr>
<tr>
<td>silk bay, redbay</td>
<td>0.05</td>
</tr>
<tr>
<td>Goethe, Ocala (silk bay &amp; redbay)</td>
<td>0.08</td>
</tr>
</tbody>
</table>

*AMOVA using 9999 permutations, all P values are zero (highly significant)
Principle Coordinates (PCoA)
Future Directions

• Go back to 6 original survivor sites
• Florida *Persea* species: more samples/locations
• Continue inoculations non-native Lauraceae
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