

# Forest Diseases

## Old and New Tree Ailments

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## Forest Pathology Lab and Pine Health

- ▶ Tree disease advanced diagnostics service
  - ▶ DNA-based identification of pathogens
  - ▶ Rapid turn-around for FBRC members
- ▶ Lab specialties
  - ▶ Laurel wilt
  - ▶ Pitch canker epidemiology work
  - ▶ Fusiform rust biology
  - ▶ Diplodia tip blight
- ▶ UF Plant Diagnostic Center (agriculture and ornamental)

## Emerging Threats to Forests Research Group



Forest entomology, pathology, bioeconomics and law.  
<http://sfrc.ufl.edu/emergingthreats/>

## Old, New and Future

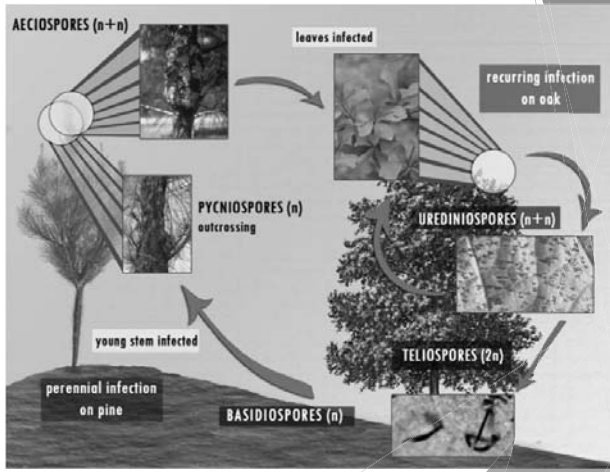
- | <u>Current Diseases</u>   | <u>Emerging Diseases</u>  | <u>Exotic Diseases</u>   |
|---|---|--|
| <ul style="list-style-type: none"> <li>• Fusiform rust</li> <li>• Pitch canker</li> <li>• Laurel wilt</li> <li>• Armillaria root rot</li> </ul> | <ul style="list-style-type: none"> <li>• Diplodia tip blight</li> <li>• Bot Canker</li> </ul> | <ul style="list-style-type: none"> <li>• Daño Foliar del Pino (DFP)</li> <li>• Sudden Oak Death</li> </ul> |

## Fusiform Rust

- ▶ *Cronartium quercuum* f.sp. fusiforme
- ▶ Native; mostly found in southern U.S.
- ▶ Macrocytic/Heteroecious
- ▶ Very dependent on temperature and moisture conditions
- ▶ Telial hosts are oaks (*Quercus* spp.)
- ▶ 2-needled pines are aecial hosts
  - ▶ Most susceptible: slash pine (*P. elliotii*) and loblolly pine (*P. taeda*), longleaf pine (*P. palustris*)
  - ▶ Immune or resistant: shortleaf pine (*P. echinata*)



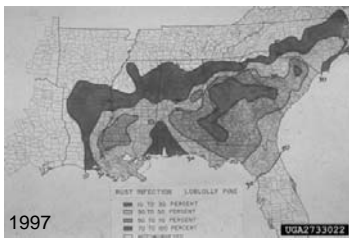
# Fusiform Rust Disease Cycle



## Resistance is Key



## Fusiform rust "hazard zones" may shift due to Climate Change



• Will environmental changes affect distribution and virulence?

Randolph et al 2015.

• Rust hazard remains high



Figure 6. Estimated fusiform rust hazard for loblolly pine based on rust incidence assessments on FIA plots from the 2010s (A) and on the average of assessments from the 1990s and 2010s (B).

Loblolly Pine

Slash Pine

## Longleaf and Rust



- Planting sites should be carefully considered
- Resistant families are needed

## Clonal pines and rust



- Clonal loblolly pines are experiencing rust in some cases.
- How should resistant clones be developed?

## Pitch Canker

- ▶ Caused by the fungus *Fusarium circinatum*
- ▶ Host range mostly conifers such as pines
- ▶ The pathogen can be latent and cause disease outbreaks when host stress occurs
  - ▶ Drought stress is common factor for outbreaks
  - ▶ Outbreaks occur after wounding events caused by storms (hail, wind etc.)
- ▶ Wave years are common - could they become more frequent?
- ▶ Excessive nitrogen predisposes trees (especially slash pine)

EDIS Publication #FOR236



- Pitch canker, caused by *Fusarium circinatum* is a common disease on pines in Florida. Note terminal shoot dieback.

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UCA1361164

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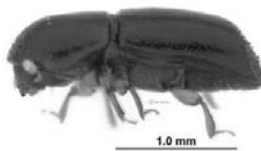
## Longleaf and pitch canker



- Longleaf planted on old “ag” sites experiencing severe pitch canker in some cases
- Excessive nitrogen? Stress?? Rapid, succulent growth?

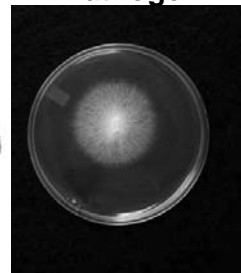
## Laurel Wilt

### Vector



**Redbay Ambrosia Beetle**  
*Xyleborus glabratus*  
(exotic)

### Pathogen



**Raffaelea lauricola**  
(exotic)

### Host



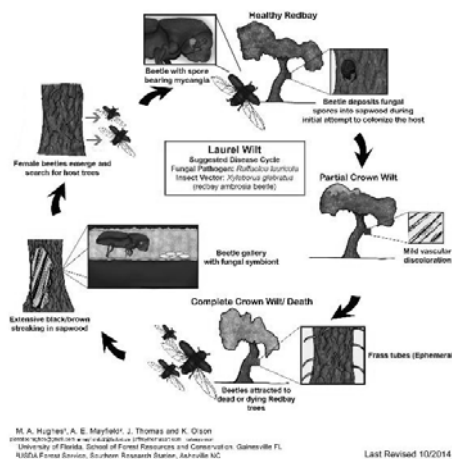
**Lauraceae**  
Swamp bay, redbay, silkbay, avocado, sassafras, pondspice, pondberry, spicebush, camphor, bay laurel, gulf licaria,.....

EDIS Publication #HS1136



**Redbay (*Persea borbonia*) trees with laurel wilt symptoms; wilted canopy with attached brown leaves**

Daytona Beach, FL Photo: Don Spence



EDIS Publication #HS1136

## Current Laurel Wilt Management

- ▶ Eradication: Jekyll Island (2007)
- ▶ Physical Barriers: Screen enclosures
- ▶ Biological Control: Entomopathogens
- ▶ Insecticides: Contact killers
- ▶ Fungicides: Alamo® macroinfusion
- ▶ Resistant Hosts: UF Resistance Screening
- ▶ Repellents: ?



Screen-enclosed redbay  
Maner et al. 2013

## Armillaria Root Rot

- ▶ In Florida, the fungus *Armillaria tabescens*
- ▶ Wide host range (global pathogen)
- ▶ In FL, primarily hardwoods (oaks & hickories)
- ▶ Infects trunk and roots
- ▶ Opportunistic pathogen (often attacks and kills weak trees)
- ▶ Once symptomatic, little can be done

EDIS Publication #HS1136

EDIS Publication #ENH1217

## Armillaria: Symptoms

- Overall decline
- Wilted foliage and/or thin crown
- Stunted growth
- Dead
- Trunk and/or branch failure



EDIS Publication #ENH1217



Photos: Jason Smith

## Armillaria: Signs

- ▶ Fungal Structures
- ▶ Mushroom clusters
  - ▶ Cool wet conditions
- ▶ Mycelial Fans
- ▶ Rhizomorphs
  - ▶ Rare in Florida



USDA0364052



USGA4922097

## Diplodia outbreak on slash pine

- ▶ Slash pines were observed exhibiting dieback along many major highways in Orange, Lake and Osceola Counties in Florida
- ▶ The loss of the trees reduces function of buffers, limits aesthetic value and results in significant economic impact (removal and replacement costs)
- ▶ *Diplodia* complex identified as cause
- ▶ Over-planting and Over-fertilization

## Recognizing *Diplodia* tip blight

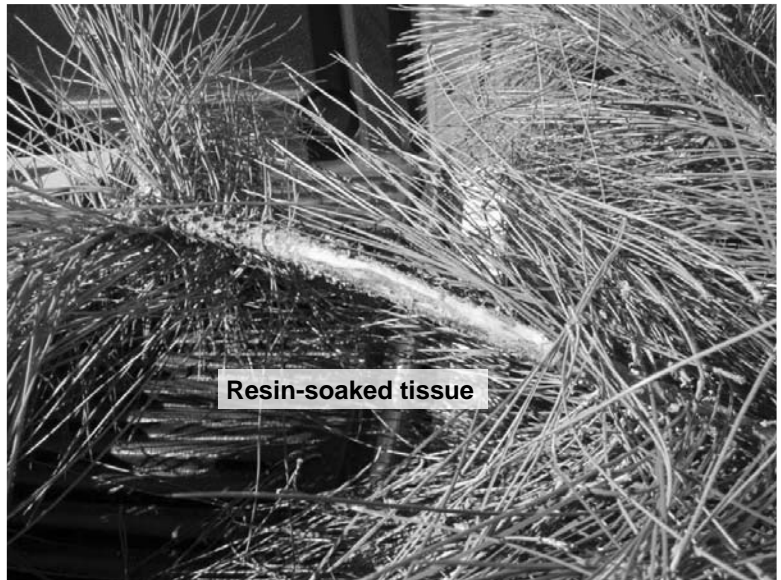
- ▶ Begins as dieback of shoots & branches
- ▶ Can spread to main stem & kill trees
- ▶ Dead needles often persist







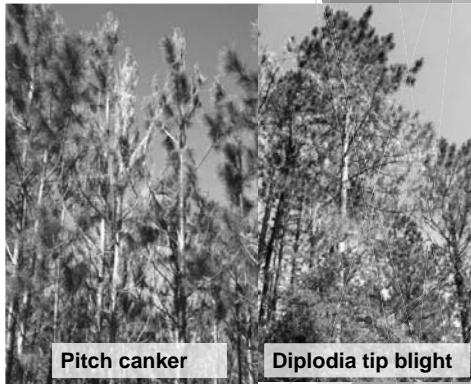
Resin weeping from lesions



Resin-soaked tissue

Clues to distinguish *Diplodia* from Pitch Canker Disease

- ▶ **Pitch canker:** typically newest growth and tops of trees affected first ("tips and tops")
- ▶ ***Diplodia*:** more often starts lower on the crown, towards interior of tree



Pitch canker

Diplodia tip blight



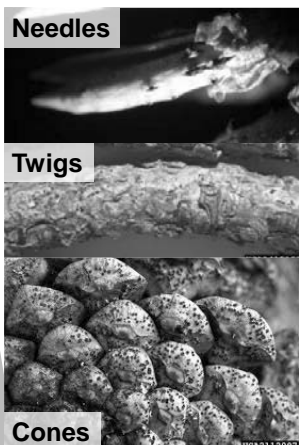
Diplodia: newest growth often remains alive longer



Pitch canker: newest growth almost always killed early

Spore-producing Structures

***Diplodia*: black pycnidia**

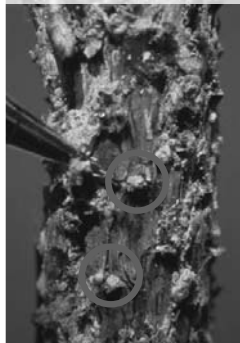


Needles

Twigs

Cones

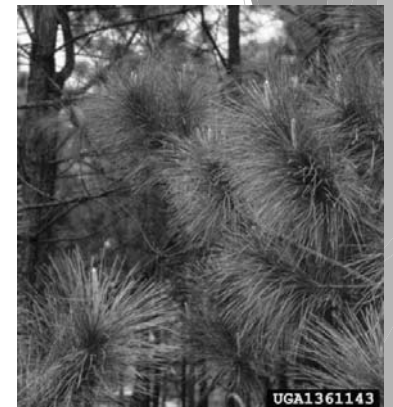
**Pitch canker: salmon-colored sporodochia, not as commonly seen**



Often in fascicle scars of dead/dying shoots

Not to be confused with: pine needlecast

- ▶ Previous season's needles look "scorched" and brown, eventually dropped
- ▶ No symptoms on new spring growth
- ▶ No cankering or shoot death
- ▶ Usually seen in winter through spring, from infections that started the previous spring.



UGA1361143

## USDA-FS/FHM-EM Project

- ▶ Goal is to determine extent of problem.
- ▶ Secondary goal is to evaluate stand age, structure and climate on disease parameters.
- ▶ Please help us find stands!



<http://sfrc.ufl.edu/forestpathology/projects/pinedisease/#survey>

## Bot Canker of Oaks

- ▶ Two fungal species:
  - ▶ *Diplodia corticola* and *Diplodia quercivora*
  - ▶ family Botryosphaeriaceae: generalist pathogens
- ▶ In Florida, planted live oaks in urban settings
- ▶ Branch cankers
- ▶ Twig and crown dieback (randomly distributed)
- ▶ Urban stresses (pesticide, drought, compaction) and previous wounds may play a role

EDIS Publication #FOR318

## Symptoms and Signs



Branch Dieback



Cankers



Pycnidia

Avoidance of stress and wounds is best management option so far...

EDIS Publication #FOR318

Photos: Jason Smith, Tyler Dreaden

## Exotic Diseases and Future Threats??



## Daño Foliar del Pino (DFP) on *Pinus radiata* in Chile



## *Phytophthora pinifolia*

- ▶ *P. pinifolia* is devastating pine (*Radiata* pine) forests in Chile
- ▶ Infections begin in needles and then extend to stems
- ▶ Trees of all ages are killed
- ▶ Cool, moist weather favors disease
- ▶ We are very concerned about the potential impact of this disease on southeastern pines

## Symptoms

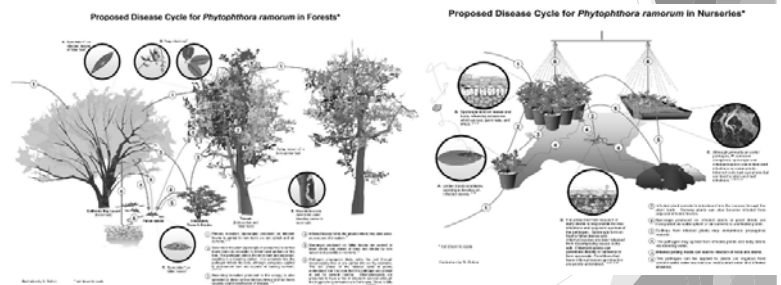
- ▶ In Chile, autumn to spring (rainy season)
- ▶ Needle infection (not trunk)
- ▶ Resin at needle base
- ▶ Rapid death of needles
- ▶ Phloem lesions
- ▶ Defoliation of trees
- ▶ Needles can remain attached too
- ▶ Tree death



## Sudden Oak Death/Ramorum Blight

- ▶ *Phytophthora ramorum*
- ▶ Two Diseases:
  - ▶ Oaks and tanoak - trunk canker (SOD)
  - ▶ Ornamental scrubs - foliar blight (Ramorum blight)
- ▶ Over 100 plant species affected
- ▶ In 2002 reported in California and Oregon
- ▶ Major issue on western coast of USA (not in FL)
- ▶ Complex life cycle

## Different Disease Cycles



Sudden oak death - Forests

Ramorum blight - Nursery



## Ramorum Blight - Symptoms

- ▶ Water-soaked lesions
- ▶ Tip blight
- ▶ Leaf drop
  
- ▶ Symptoms can differ by species
- ▶ Camellia, Rhododendron and Azalia

Pacific rhododendron

Camellia

Mountain Laurel



Photos: Plant Management Network, Parke and Lucas 2008

## Sudden Oak Death- Symptoms

- ▶ Bleeding cankers
- ▶ Brown stain under bark
- ▶ Discolored cankers in phloem and outer sapwood
- ▶ Crown decline and death

Coast live oak

Tanoak

Tanoak



Photos: Plant Management Network, Parke and Lucas 2008

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