

An Ecological Disaster Coming our Way



6 months from infection to collapse

Laurel Wilt Disease

Raffaelea lauricola fungus

spread by

Redbay Ambrosia Beetle

Xyleborus glabratus



Pest-Disease Complex

Ambrosia Beetles (>34,000 species world-wide)
order: coleoptera

Usually bore into dead trees

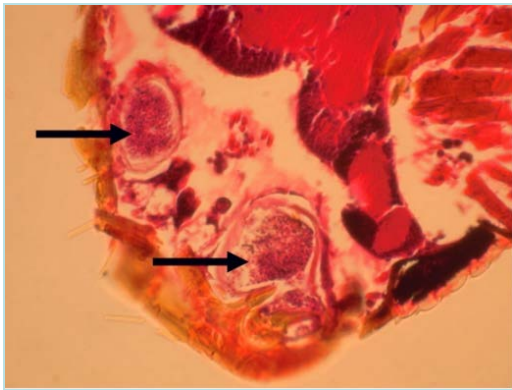
Characterized by boring into trees and forming galleries in the sapwood.

Beetle carries the fungus which digests the wood disrupting the flow of water and nutrients

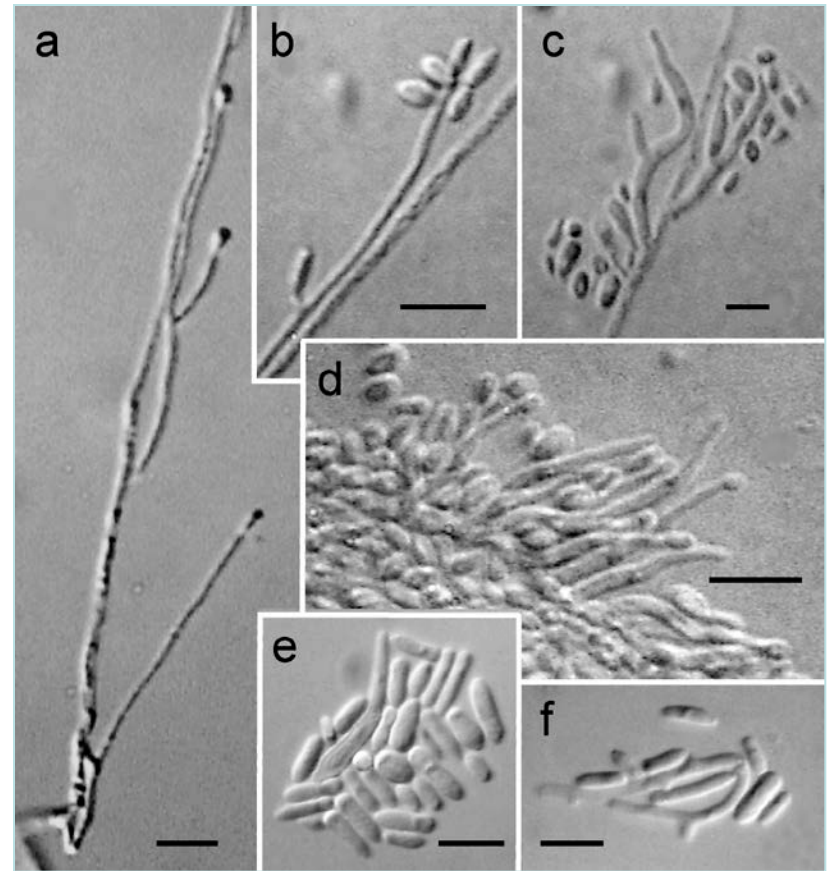
The adult and larvae feed on the mycelium and spore clusters of the fungus

Typically attack trees under stress (e.g. drought)

It only takes one beetle to cause the infection



Mouth pouches on the beetle with LW spores



LW pathogen
Similar to pathogen causing Dutch elm disease

Hosts of RAB in the New World Laurel Family

Redbay

SilkBay

Swampbay

Sassafrass

Pondberry

Pondspice

Camphor - street tree

California Bay Laurel

Avocado



All small trees and
shrubs along the
east coast







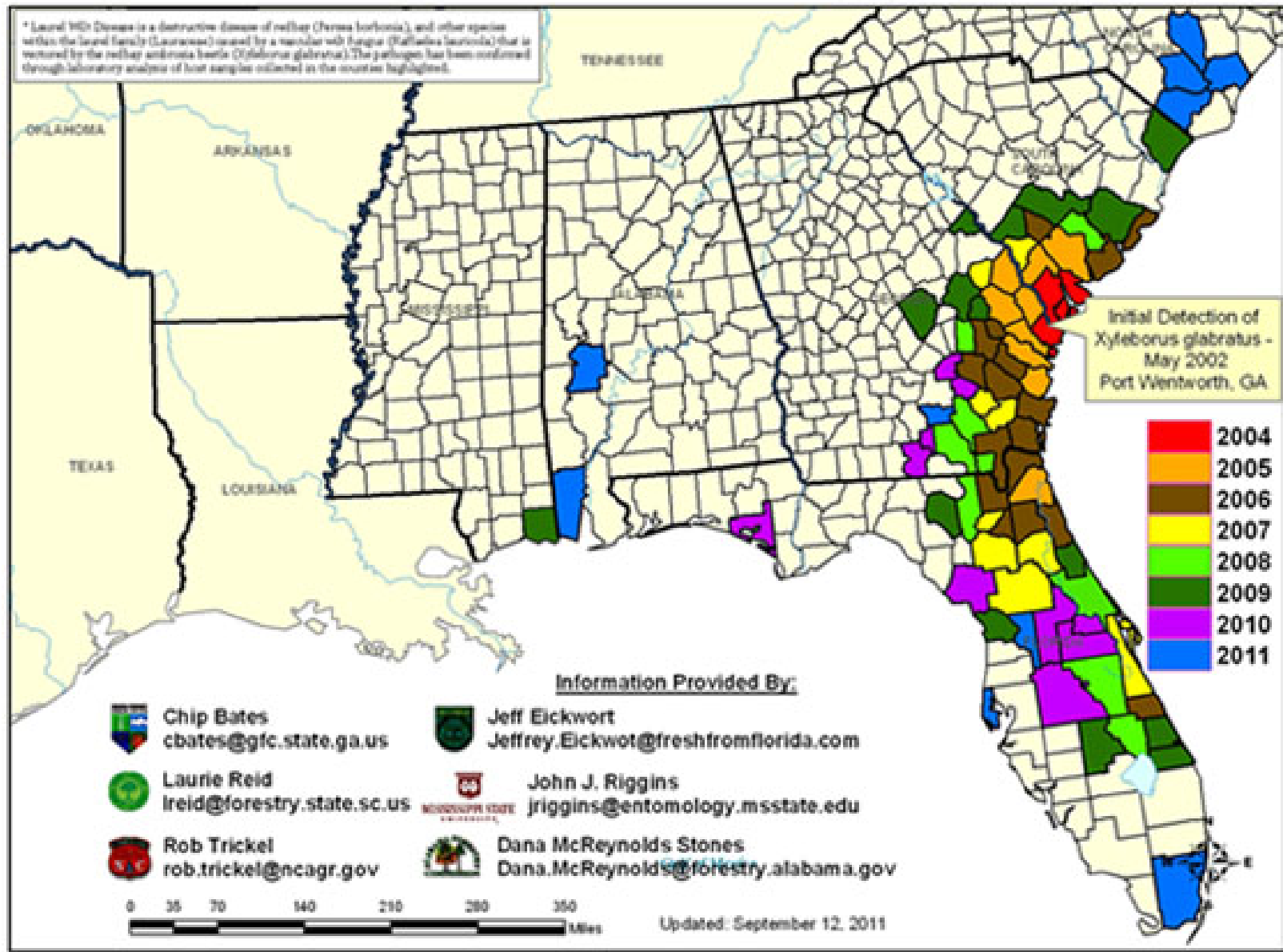
Strings of compacted ambrosia
beetle sawdust



Just under bark is stained sapwood.

Distribution of Counties with Laurel Wilt Disease* by year of Initial Detection

* Laurel Wilt Disease is a destructive disease of redbay (*Persea borbonia*), and other species within the laurel family (Lauraceae) caused by a vascular wilt fungus (*Raffaelia lauricola*) that is vectored by the redbay ambrosia beetle (*Xyleborus glabratus*). The pathogen has been confirmed through laboratory analysis of host samples collected in the counties highlighted.



Spread of RAB-LW

Natural spread through flight ~ 10-20 mpy

Spread through redbay and other hosts

Spread through backyard avocados

Manmade through firewood, wood-turnings and wood chips

Potential spread through: landscape services, right of way services, illegal dumping, landfills



Results so far

RAB appears to be attracted to volatiles given off by lauraceae

RAB produce few males

Peak flights in Sept (Florida)

RAB attacks all avocado cultivars tested so far

LW appears to kill all avo varieties

Large avocado trees appear to be more susceptible than young trees

RAB is more attracted to damaged trees (pruned)

Propiconazole (Banner, Honor Guard) work but is expensive and requires trunk injection

Manuka and phoebe oil are attractants

A general RAB-LW infestation scenario:

- A few RAB locate a host tree and bore into it, inoculating the tree with LW.
- The LW colonizes (grows) the water (xylem) and nutrient (phloem) conducting tissues inside the tree.
- The tree undergoes drought stress due to blockage of the xylem (water conducting tissue).
- The infested and stressed tree now becomes an attractive host for brood rearing and is attacked in mass.
- The tree dies or is severely damaged.
- The beetle reproduces inside the tree and new beetles emerge to infest more trees.

March 2012 – South Gate, Downey,
Pico Rivera – LA County





Fusarium growing in galleries



Shothole Borer

Shot hole borer – *Euwallacea fornicatus*

ambrosia beetle

pest of black locust, lychee, tea, box elder, castor bean, sycamore, alder, willow, native oak, English oak

Has been found in 207 species of perennials

With these hosts there has been no reported fungal damage by *Fusarium*

In this case, there is dieback thought to be caused by *Fusarium*. This has been a problem in Israel for three years now.

The fungus affects 104 species at this point.

The biology of this pest/disease complex is little known

The sudden emergence of pathogenicity in insect–
fungus symbioses threatens naive forest ecosystems
Jiri Hulcr^{1,2,*} and Robert R. Dunn¹

<http://rspsb.royalsocietypublishing.org/content/early/2011/07/07/rspsb.2011.1130.full>

Asian Citrus Psyllid, Huanglongbing and Biocontrol Efforts in California



Host Plants for ACP

- Citrus and plants in the Rutaceae (Sapindales) are highly preferred. Especially

- *Citropsis* spp.
- *Citrus* spp.
- *Berberis* (*Murraya*) *koenigii*
- *Murraya*

Native

to the

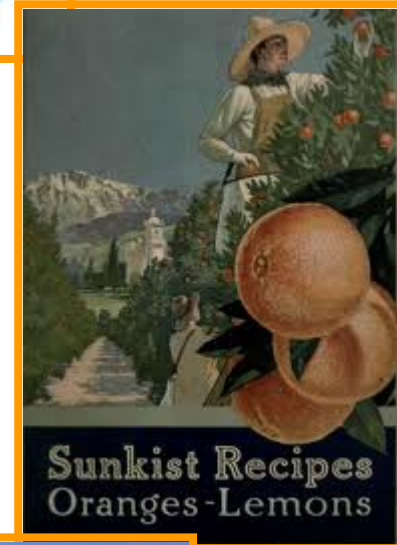


The Florida Citrus Industry

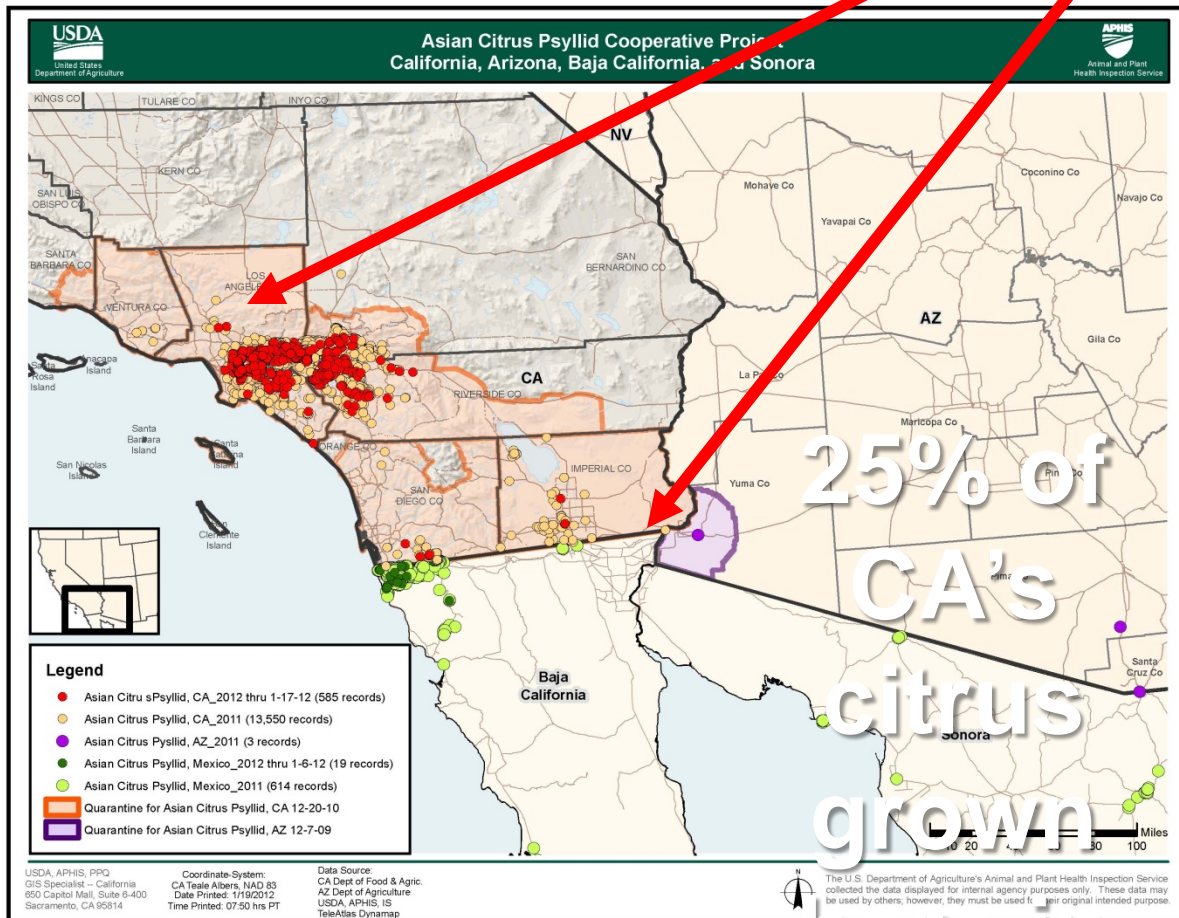
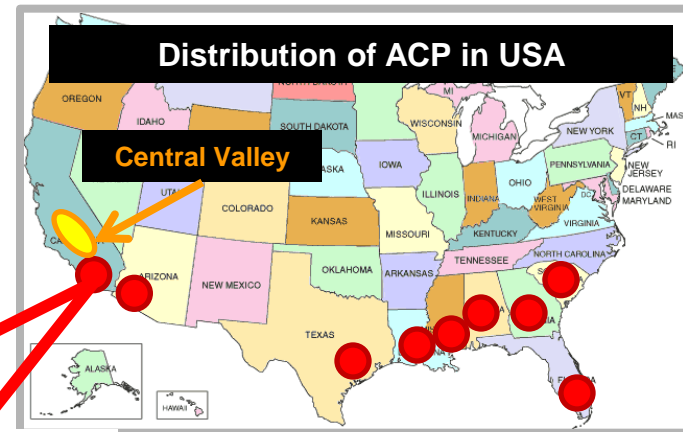
- **Florida's citrus industry valued at US\$9.3 billion**
- **ACP first found in 1998**
- **HLB detected in 2005**
 - **Now infects all 32 citrus producing counties in FL**
- **~621,000 acres of citrus in Florida**
 - **>60,000 acres of trees destroyed by 2009**
- **Three pronged management approach**
 - **Produce new plants in screened facilities**
 - **Area wide insecticide management of ACP**
 - **Removal of infected trees**

The California Citrus Industry

- **CA second largest citrus producer in USA after FL**
 - **66% of crop = oranges**
 - 75% are navels & 25% valencias
 - 80% are for fresh consumption; 30% exported
 - Worth \$580 million/yr
 - **lemons = 25% of crop**
 - CA grows 87% of US lemons
 - 66% for fresh market
 - Worth \$295 million/yr
 - **grapefruit = 6%; tangerines = 3%**
 - **3.2 million tons of fruit harvested per season from ~250,000 acres**
 - **All CA citrus is worth ~\$1.2 billion/yr**



Distribution of ACP in California



ACP &
HLB Found
in:

- 1) CA (+ HLB)
- 2) FL (+ HLB)

Is HLB in California?

- **HLB was detected in Hacienda Heights, LA County in April 2012**
 - **Backyard pummelo with a lemon graft that may have originated from Asia & shared by a group of citrus grafting enthusiasts**
- **It is highly likely other HLB infestations are in CA**
 - **Plants smuggled into CA from Asia have been intercepted at airports**
 - **Some plants have been contaminated with ACP and infested with HLB**
 - **How many infected plants are in people's gardens waiting for ACP to arrive?**

Management Options

- **Biological Control**

- **Use of natural enemies, in particular parasitoids of great interest for suppressing ACP populations**

- **First work on ACP parasitoids conducted by Husain & Nath (1927) in the Punjab of Pakistan**
 - **Study sites: Sargodha, Lyallpur, and Gujranwala**
 - **Trees dry up, fruit is insipid, leaves fall to ground (HLB symptoms)**
- **Nine species of parasitoid associated with ACP nymphs**
 - **No adult or egg parasitoids recorded**
 - **Hyperparasitoids exist**
 - **1 species named from this project, [Tamarixia radiata](#)**

Adult Female and Male *Tamarixia*



**Female *Tamarixia*
have clubbed**



**Male *Tamarixia*
have setose or**

Summary

- **Spray program for ACP likely unsustainable in southern CA**
- **ACP continuing to spread despite monitoring and pesticide treatments**
- **Natural enemies may help reduce ACP densities in urban and public areas where sprays are hard to make**
- **Reduction of ACP in urban areas may lessen pressure on commercial citrus**







3 15 '94

Serious erosion



Sediment (inches) collected from covers and mulch

Month	Rain		Fescue	Barley	Mulch	Bare
Nov.	2.6		tr	tr	tr	0.7
Dec.	5.3		1	0.1	0.2	3.3
Jan.	3.4		0.1	tr	tr	2.6
Feb.	17		4.9	3.3	tr	15
Mar.	3.9		0.8	tr	tr	2.9
Totals	33		6.8	4.4	0.2	25



Stay tuned

Keep pests out
of California

