Citrus Disease Identification for North Florida

Jamie Burrow, Megan Dewdney, and Michael Rogers
University of Florida, IFAS, CREC

Thursday, January 21, 2016
Citrus Canker

• Citrus canker is caused by a bacterial pathogen *Xanthomonas citri* subsp. *Citri*
• All varieties are susceptible, but early oranges and grapefruit are most susceptible
• Causes lesions on leaves, stems and fruit
• Severe infection can cause general tree decline
  – Defoliation
  – Twig dieback
  – Fruit drop and blemishing
Citrus Canker Spread

• When there is moisture on lesions, bacteria ooze out and can spread to new growth or other trees
• Wind-blown rain is the main means of dispersal
• Wind speeds >18 mph force bacteria through stomata or wounds
Citrus Canker Spread

• Movement of infected or exposed trees, seedlings and propagative material primary means of spreading canker over long distances
• Contaminated clothing, tools, landscaping equipment, ladders or containers are potential sources of infection
• Decontaminate all equipment associated with citrus tree work (70% alcohol solution or 1 ounce of bleach to 1 gallon of water)
Leaf symptoms

- Early symptoms appear as slightly raised, tiny blister-like lesions
- As lesions age, they turn tan to brown and a water soaked margin appears surrounded by a yellow ring or halo
Leaf symptoms

- Center of the lesion becomes raised and corky
- As the leaf tissue dies, it can fall out leaving a hole in leaf
- Lesions are visible on both sides of the leaf
Stem symptoms

- Older lesions become dark brown or black raised corky lesions surrounded by an oily or water-soaked margin
- Mature lesions appear scabby or corky
- Stem symptoms usually indicate the bacteria has been present for a long time period
Fruit symptoms

- Lesions are dark brown to black and raised, often surrounded by yellow halos
- Lesions cause blemishes and early fruit drop
Fact or Fiction

• Huanglongbing
  – HLB
  – Citrus greening
• Spread by an insect
History

• 1919: First reported in China
• 1921: Reported in the Philippines, but thought it was zinc related
• 1937: In South Africa, thought to be mineral toxicity
• 1941-1955: Most extensive work on greening conducted in southern China
History

- 1960: Appeared in Thailand
- 1965: Researchers demonstrated HLB was transmissible by grafting and the citrus psyllid
- 1966: Filipino and Indian researchers recognized the similarities between various named diseases
History

- 1998: Asian citrus psyllid arrived in Florida
- 2004: Disease confirmed in Brazil
- 2005: Disease confirmed in Florida
- 2005 to the present: Disease continues to spread throughout Florida
United States Locations

Greening Spread Through the Years
2005: Florida
2009: Louisiana, Georgia, South Carolina
2012: California and Texas

Importance

- Affects fresh market fruit
- Affects processed fruit
- No cure for the disease
Biology

• Caused by a bacteria
• Found within the phloem of the tree
• Causes damage to the vascular system
Biology

- Affects all citrus varieties
- Affects plants in the *Rutaceae* family
- Affects box orange and orange jasmine

*Murraya paniculata* (orange jasmine)
Biology

• Some plants host the vector only
• Some plants host the vector and are susceptible for greening

http://www.freshfromflorida.com/content/download/24041/486974/hostlist.pdf
Bacterium

- *Candidatus* Liberibacter asiaticus
- Gram negative
  - Defines type of bacteria
- Phloem limited
- Fastidious bacterium
  - Cannot grow in culture
- Reproduces/multiplies in both the psyllid and the tree
Koch’s Postulates

The procedure required to show that *Ca. Liberibacter asiaticus* (LAS) causes Huanglongbing

1. LAS must be present and associated with all diseased plants examined.
2. A sample is taken from the infected plant material. LAS must be isolated from the plant material and grown in pure culture.
3. A sample of the possible disease causing organism from a pure culture is inoculated into healthy plant material of the same species or variety from which it was originally taken.
4. The bacterium must be reisolated in pure culture from the inoculated host and the new culture must have the same characteristics as seen in the original pure culture.
5. A sample needs to be taken from the inoculated host.
6. The healthy tree must produce the same symptoms displayed by the original tree.

Burrow, J.D. and Dewdney, M.M. Revised: April 2013 Original: May 2008
Spread

- Asian citrus psyllid
- Grafting with infected bud wood
- Is not seed transmissible
- **NOT** by contact, tools or equipment
Asian Citrus Psyllid

- Egg to adult in two weeks at 75-80°F
- Eggs are laid on feather stage flush
- 5 nymphal stages
- Nine to ten generations per year
- Life cycle between 15-47 days
- Females may lay more than 800 eggs during their lifetime
Asian Citrus Psyllid

- Psyllids fly or are carried by the wind to new plants
- Psyllids feed on an infected tree and then transmit the bacteria to healthy trees
Asian Citrus Psyllid Adults

Head: light brown

Antennae: black tips with two small light brown spots

Wing: mottled, broadest at tip

Photo Credit: Jeffrey Lotz, FDACS-Division of Plant Industry
Asian Citrus Psyllid Damage

- Nymphs produce a waxy secretion
- Notching on leaves
Transmission of *Candidatus Liberibacter asiaticus* by the Asian Citrus Psyllid
(How Huanglongbing is spread)

**Disease Triangle**
In order for the bacteria to spread, all components of the disease triangle must be present. For the spread of HLB, a citrus tree is the host, the bacteria is the pathogen, and psyllid is the vector.

**Terms Defined**
- *Candidatus Liberibacter asiaticus*: the name of the bacterium that causes the disease Huanglongbing (HLB or citrus greening)
- **Healthy**: does *not* have the HLB bacterium in the plant
- **Infected**: the HLB bacteria is present in the plant

Once the psyllid reaches the phloem, it can acquire the bacterium after an hour or more of feeding. Once the bacterium is in the psyllid, the bacterium replicates and the psyllid is able to transmit the bacteria into other citrus trees.

Psyllids are in need of food; therefore, they feed on citrus trees.

Psyllid feeds on the phloem to acquire the bacteria.

Psyllids can move up to approximately 1.25 miles over 11 days to another citrus tree.

Citrus tree infected with the HLB bacterium.
Leaf Symptoms

• Blotchy mottle patterns
  – Mature leaves
  – Asymmetrical pattern
  – Inside or outer edges of canopy
  – Pattern will appear on both sides of the leaf
Leaf Symptoms

• Blotchy mottle patterns
• Yellow veins
  – Not a definite symptoms of HLB, but one should inspect the tree more closely if found
  – Found on young and mature leaves
Leaf Symptoms

• Blotchy mottle patterns
• Yellow veins
• Vein corking
  – Raised veins with a corky appearance
  – Found on mature leaves
Commonly Mistaken for HLB

• Broken limb
• Foliar symptoms of trees with foot rot (Phytophthora)
Commonly Mistaken for HLB

- Insect damage
- Herbicide/Chemical damage

Don’t forget to look at both sides!
Nutrient Deficiencies vs. HLB

• Zinc
  – Small and narrow leaves with yellow mottle on green background

• Iron
  – Green veins on a light yellow to white colored leaf
Nutrient Deficiencies vs. HLB

- Manganese
  - Dark green veins with a lighter green background

- Magnesium
  - Inverted ‘V’ pattern
Identifying a Leaf Sample

• Circle areas on opposite sides of the midvein. Are they the same on both sides?
  – Nutrient deficiencies are symmetrical and HLB symptoms are asymmetrical

• Look at the other side of the leaf
Fruit Symptoms

• Unmarketable, bitter fruit
• Cannot be used for fresh
• Can be used in processing for juice, but may have a flavor consequence
Internal Fruit Symptoms

• Yellow stain beneath the calyx button
• Curved central core
• Aborted seeds
External Fruit Symptoms

- Lopsided
- Misshapen
- Small
- Does not color properly
Tree Symptoms

- Leaf and fruit drop
- Yellow shoot
- Severely infected trees
  - Stunted
  - Sparse foliation
  - Twig dieback
- Off-season bloom
Common Fungal Diseases on Citrus

Photo Credit: Megan Dewdney, UF/IFAS Citrus Research and Education Center
Citrus Scab

- Fungal disease
- Lesions change from pink to light tan
- Deforms leaves
- Described as wart-like
Citrus Scab

Photo Credit: Megan Dewdney, UF/IFAS Citrus Research and Education Center
Melanose

- Fungal disease
- Red-brown to black
- Feels like sandpaper
- Appears on fruit, leaves and stems
Melanose

Photo Credit: Megan Dewdney, UF/IFAS Citrus Research and Education Center
Greasy spot

- Fungal disease
- Yellow mottle pattern with reddish-brown blisters
- Looks like drops of grease as lesions age
- Affects all citrus, especially grapefruit, Pineapples, Hamlins and tangelos
Greasy spot

Photo Credit: Megan Dewdney, UF/IFAS Citrus Research and Education Center
Alternaria Brown Spot

- Fungal disease
- Fruit lesions protruding or sunken, crater-like
- Leaf lesions are smooth with a chlorotic halo that follow the veins on leaves
- Affects various tangerines and tangelos
  - Honeybell
Alternaria Brown Spot

Photo Credit: Megan Dewdney, UF/IFAS Citrus Research and Education Center
Postbloom Fruit Drop (PFD)

- Peach to orange-colored lesions on petals
- Fruit and petals fall leaving button
  - Can last up to 18 months on tree
  - Diagnostic for disease
- Leaves around infected flowers often twisted and small
  - Can look like a rosette
Postbloom Fruit Drop (PFD)

Photo Credit: Megan Dewdney, UF/IFAS Citrus Research and Education Center
Resources

Any questions?