Scouting Citrus for Pests and Beneficials

Phil Stansly
UF-IFAS, Immokalee: http://www.imok.ufl.edu/entlab/

- Mites
- CLM
- Thrips
- Psyllids
- Scales
- Predators
- Parasitoids
- Pathogens
Pesticide Use in Florida Citrus Before HLB

- Most pests under biological control
- Most process fruit received 1 or 2 oil sprays, primarily for greasy spot
- Copper 2nd most used pesticide
- Acaracides used primarily on fresh fruit
## Insecticide Use in SW Florida Citrus: 2011

Average applications per year: 7.3

<table>
<thead>
<tr>
<th>MOA</th>
<th>MOA</th>
<th>% Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbamates</td>
<td>1A</td>
<td>7.4</td>
</tr>
<tr>
<td>Organophosphates</td>
<td>1B</td>
<td>35</td>
</tr>
<tr>
<td>Pyrethroids</td>
<td>3A</td>
<td>26</td>
</tr>
<tr>
<td>Neonicotinoid</td>
<td>4A</td>
<td>7.4</td>
</tr>
<tr>
<td>Abamectin</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>Micromite</td>
<td>15</td>
<td>8.4</td>
</tr>
<tr>
<td>Movento</td>
<td>23</td>
<td>3.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4%</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

[MOA](www.irac-online.org)
Grower Survey: Increase of Secondary Pests:

% Responding

- Scales
- Leafminers
- Mites
- None
- Snails

2009 vs 2010
Key Florida Citrus Pests and Their Biological Control Agents

- **Mites**: spider (true & false), broad, spider
  - *Hirsutella*, mites, ladybeetles

- **Thrips**
  - Minute pirate bugs, mites

- **Leafminer**
  - Ants, Spiders, *Ageniaspis*

- **Root weevils**
  - Nematodes

- **Scales**: armored, soft

- **Asian Citrus Psyllid**
  - Ladybeetles, *Tamarixia*
Predators: Ladybeetles – Lacewings, Spiders

Funnelweb
Jumping
Spitting
Velox
Widow
Predaceous mites: Phytoseiids
Parasitoids: Parasitic wasps

- *Encarsia spp*
- *Tamarixia*
- *Ageniaspis*
Pathogens: Fungi

Beauveria

Hirsutella

Aschersonia

Nematodes
## Citrus Pests: Sucking Insects

<table>
<thead>
<tr>
<th>Pest Type</th>
<th>Nymphs</th>
<th>Adults</th>
<th>Honey-Dew?</th>
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<tbody>
<tr>
<td>Psyllids</td>
<td>Wingpads only</td>
<td>Males and females alike</td>
<td>Yes, waxy secretion (nymphs)</td>
</tr>
<tr>
<td></td>
<td>Stay on flush</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aphids</td>
<td>Like adults</td>
<td>Usually no males. Some winged</td>
<td>Yes</td>
</tr>
<tr>
<td>Whiteflies</td>
<td>Immobile after crawler- scalelike</td>
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<td>Only crawler mobil</td>
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<td>Like adults except for wings</td>
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Asian citrus psyllid, *Diaphorina citri* (ACP) first detected SE Florida June 1998. Presently found throughout FL and TX, Mexico, and S. America.
Adult Feeding, Longevity

• Adults can feed on both new and mature leaf flushes

• Adults primary over-wintering stage

• Mean longevity of females increases with decreasing temperature within the range 59-86°F (15-30°C)
- Adults need to feed on young flush to mature eggs. Feeding of both adults and nymphs causes leaf distortion.
- Eggs are laid **ONLY** in young flush, are about 0.3 mm long and almond shaped.
- Eggs are pale when laid, turn yellow then orange as they mature. Often difficult to see.
Nymphs and nymphal feeding

- Nymphs feed ONLY on new developing flush, flower stems and shoots
- There are 5 nymphal stages ("instars"), recognized by size and development of wing buds.
- Nymphs can be readily identified by their yellow to orange coloration, large lateral wing pads in later stages and red eyes.
Nymphs secrete honeydew packaged in wax tubes normally removed by wind and/or ants.
Huanglongbing (Yellow Shoot Disease) HLB, or Greening Disease caused by *Candidatus liberibacter asiaticus*.
First Appearance
Recognizing HLB

Micronutrient deficiency (symmetric)

HLB ("blotchy" mottle)
Disease Progression
Evolution of Symptoms
Small, asymmetrical, green fruit, aborted seeds, fruit drop.
Coccinellid Predators of D. citri in Florida

*Harmonia axyridis*

*Curinus coeruleus*

*Cycloneda sanguinea*

*Olla V-nigrum*
Psyllid Predators
Lacewings

Chysoperla  Ceraeochrysa
Parasitoid: *Tamarixia radiata*

- **Adult**
- **Egg**
- **Larva**
- **Prepupa**
- **Mummies**

*Alberto Urbaneja*
Scouting Principles

- “Random” Sample
- Representative Sample
- Deliberate Method
- Uniform & Thorough Reporting
Monitoring Commercial Groves for Psyllids

- **Tap Sample**
  - Do first
  - 10 per stop

- **Visual inspection**
  - Do next
  - 10 flush per stop
Equipment

Clipboard: For catching adults and recording data

Piece of PVC (optional) For hitting branch

Hand lens: For seeing small eggs and nymphs
Sample location

- 1 Block
- 10 Stops
  - 5 border
  - 5 inside
- 10 trees
Tap Sampling

- 3 taps per sample
- 1 tap sample per tree
- 10 trees per stop
- 10 stops per block (5 in the borders + 5 inside)
Visual inspection

- Look for young flush (shoots)
- Observe 10 flush per stop
  - If 10 not available record number found in 20 trees
- Record
  - # of infested flush (any psyllid stage)
  - # of observed flush
  - # of trees needed to find 10 flush (Max 20)
### Datasheet

Visit the [Datasheet](http://swfrec.ifas.ufl.edu/entlab/programs/index.htm)

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**Instructions:**
1. Hold clipboard 1 foot below branch, strike branch 3 times and note number of psyllid adults falling on clipboard in box. Mark a vertical line in the appropriate box for any beneficials seen.
2. Continue for 10 trees and note total number of adult psyllids, greening trees and beneficials seen.
3. Observe 10 young shoots (flush) and note how many are infested with any stage of ACP. If 10 shoots cannot be found in 20 trees, note how many found.
4. Note how many trees were searched to find flush you observed.
5. Note other pests or other observations.
6. For more information see the “Sampling for Asian Citrus Psyllid (ACP)” Field sheet.

<table>
<thead>
<tr>
<th>Number of ACP per Tree</th>
<th>Trees with Greening</th>
<th>Beneficials</th>
<th>Notes and other pest observations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lady beetles</td>
<td>Trabebugs</td>
</tr>
<tr>
<td>Stop 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stop 2</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Stop 3</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Stop 4</td>
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<td></td>
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<tr>
<td>Stop 5</td>
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<td></td>
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<tr>
<td>Stop 6</td>
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<td></td>
<td></td>
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<tr>
<td>Stop 7</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Stop 8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stop 9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stop 10</td>
<td></td>
<td></td>
<td></td>
</tr>
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Scouting for Psyllids: Summary

• Adults first priority
  – Responsible for spread of HLB
  – Target of most sprays
  – Can scout whether or not there is flush
  – Tap test rapid and effective
  – 10 trees per location, 10 locations per block

• Flush evaluation
  – Percentage infested any stage
  – 10 flush per location if possible
  – Note number of trees searched.
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Green citrus aphid: *Aphis spireacola*

Brown citrus aphid: *Toxoptera citricida*

Citrus Tristeza Virus
Citrus Whitefly and Cloudywing Whitefly

Dialeurodes spp.

Parasitized

“Friendly” Fungus

Parasitic wasp
Wooly Whitefly

*Aleurothrixus floccosus*

Nesting Whitefly

*Paraleyrodes minei*
Citrus Blackfly

*Aleurocanthus woglumi*

Eggs

*Mummy*

*Amitus hesperidum*
Armored Scales

Purple

Glover

Lepidosaphes

Florida red

Chrysomphalus aonidum

Purple Scale

(L. beckii)

Chaff scale

Green spots on fruit

Parlatoria pergandii

Causes die back
Armored scale predator twice-stabbed ladybeetle
*Chilocorus stigma*

Florida Red Scale Parasitoid
*Aphytis holoxanxthus*
Other Armored Scales

**Snow**

*Unaspis citri*

Trunk, main scaffold limbs

♀

**Fern**

*Pinnaspis aspidistrae*

Outer Canopy

♀

**Lesser Snow**

*Pinnaspis strachani*

Mid Canopy
Lesser Snow Scale Havoc

Controlled by *Chilocorus circumdatus*
Soft Scales: Black Scale  \textit{Saissetia} \textit{spp} 

- “H” pattern
- Nymphs on leaves, twigs
- Adults on larger limbs
- Copious honeydew
- Ash ladybeetle

\[ \text{Azya orbigera} \]
Citrus Mealybug
*Planococcus citri*

**Cryptolaemus montrouzieri**

Mealybug destroyer
Stink Bugs and Leaffootted Bugs

- Thin skinned varieties most susceptible (Hamlin)
- Perforate fruit, introduce pathogens
- Build up on weeds
Mite Pests of Citrus

- **Rust mites**
  - Citrus rust mite *Phyllocoptruta oleivora*
  - Pink rust mite *Aculops pelekassi*

- **Spider mites**
  - Citrus red mite *Panonychus citri*
  - Texas spidermite *Eutetranychus banksi*

- **False Spider Mites**
  - *Brevipalpus spp*

- **Broad mites**
  - *Polyphagotarsonemus latus*
**Rust Mites**
- Primarily problems in fresh fruit
- Flared by copper and broad spectrum insecticides, especially pyrethroids

**Pink Rust Mite**
*Aculops pelekassi*

**Citrus Rust Mite**
*Phyllocoptruta oleivora*
Citrus Rust Mite
*Phyllocoptruta oleivora*

- Biological control by mites, ladybeetles and *Hirsutella*
- Disrupted by insecticides and copper.
Early damage: Sharkskin

Late damage: Bronzing
Standarize the Lensfield

Lensfield size depends on:

- Magnification
- Distance between eye and eyepiece
Scout and Note

Middles and Swales

Middle (m)

Swale (s) (water furrow)
Florida Pest Management Guide*:

• Process: Every 2-3 Weeks
• Fresh: every 10-14 days
• 80 Lensfields /block (10-40 acres)
  ✓ Stops/ per block = 10
  ✓ Trees per stop = 4
  ✓ Fruit/tree = 2
  ✓ Lens fields per fruit = 1
    Sun-shade transition
  ✓ Location of Fruit: all 4 quadrants, midway in canopy
• Record Mites/lens field
• Provides < 25% variation if CRM > 10/cm²
• Thresholds process: 6 CRM/ LF - Caution
  10 CRM/LF - Spray
• Threshold fresh: 2 CRM/LF - Spray

*2011 Florida Citrus Pest Management Guide, Publication SP-43, UF Gainesville
http://edis.ifas.ufl.edu/cg002
What the Heck is the H-B Rating System?

- Developed by Horsfall & Barratt (1945) to measure disease incidence.
- Based on density recognition rather than individual counts.
Spider Mites:
- Dry weather
- Upper surfaces of young hardened leaves
- Stippling, Firing
Scouting for Spider Mites

- Follow CRM sample pattern
- 4 leaves per tree
- Threshold 5-10/leaf, depending on:
  - Population trends
  - Predominantly males
  - Nymphs and females
- Weather
- Tree Condition
False spider mite *Brevipalpus* spp: Vector of Leprosis (not yet in US)
Broad mite
*Polyphagotarsonemus latus*

Mostly a pest of lemons and limes
Other Citrus Pests

- Citrus leafminer
- Thrips
- Fruit flies
- Grasshoppers and the like
- Root weevils
Citrus Leafminer, *Phyllocnistis citrella*

Indigenous ectoparasitoids

Predators
- Ants
- Spiders
- Lacewings

Canker – Leafminer Interaction

Ageniaspis
Orchid thrips

Ring spot

Grapefruit

Minute pirate bug

Flower Thrips

Mite Predator
Fruit Flies

**Caribfly**
*Anastrepha suspensa*
Present in Florida

**Medfly**
*Ceratitis capitata*
Not presently known to be in Florida
Caribfly Lifecycle

A. suspensa

Female lays eggs in fruit

Eggs

Larvae

Larvae emerge from fruit

Pupate in soil

Adult emerges

Caribfly Lifecycle (21 days total)
**Medfly C. capitata**

- Many hosts
- Few effective natural enemies
- Control with toxic baits, Mass trapping, sterile male release
- Baits disruptive to biological control
Grasshoppers, Katydid, Crickets

- Build up on weeds.
- Large nymphs most damaging
- Foliar damage irregular (like orange dog)
- Occurrence usually localized in grove

Stink Bugs and Leaffooted Bugs

- Thin skinned varieties most susceptible (Hamlin)
- Perforate fruit, introduce pathogens
- Build up on weeds
Root Weevils:

- **Diaprepes**
- Blue-green weevil
- Little leaf notcher
- Sri Lanka Weevil
Generalized Lifecycle of Citrus Root Weevils

1. Adults Feeding on Leaves
2. Egg Masses on Leaves
3. Neonate Larvae on Leaves
4. Neonate Larvae on Soil Surface
5. Larvae Feeding on Roots
6. Pupae in Soil
Diaprepes: Life cycle and damage to citrus roots

- Adult
- Leaf Damage (adults)
- Root damage (larvae)
- Eggs
- Larvae
Sri-Lanka Weevil: *Myllocerus undatus*
Similar to Little Leaf Notcher (Artipus) but...

Myllocerus undatus

Artipus floridanus
Acknowledgements

- Citrus Research and Development Foundation ($$)
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Questions?
¿Preguntas?