Invasive Pests in the Nursery

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Pest Management Concerns

Invasive Pests
- Introduction and establishment of new pests
- Regulatory or quarantine requirements
- Heavy reliance on pesticides

Insecticide Resistance
Insecticide Resistance

- Generally, rely heavily on control with insecticides
- Response to new pests
  - Quick response
  - Insecticides often necessary
- Managing pests with neonicotinoid insecticides
Fig Whitefly
Singhiella simplex (Hemiptera: Aleyrodidae)

- New U.S. continental record;
- Currently in Miami-Dade and Broward Counties
- Attacks ficus species
  - *F. benjamina* (weeping fig)
  - *F. altissima*
  - *F. bengalensis* (“banyan tree”)  
  - *F. aurea* (strangler fig)
  - *F. microcarpa* (Cuban laurel)
  - *F. maclellandii* (banana-leaf fig)
Damage

- Leaves turn yellow
- Rapid defoliation

Photos: H. Glenn and C. Mannion, UF/IFAS
Ficus Whitefly

Photo: H. Glenn, UF/IFAS
Ficus Whitefly
Defoliation Due to Whitefly Infestation

• Clean plants placed in the landscape near infested ficus.

Photos: D. Amalin, UF/IFAS
Predators Collected in Miami on Ficus Infested with Whitefly

Photos: H. Glenn, UF/IFAS

Harmonia axyridis
Olla v-nigrum
Exochomus childreni
Chilocorus nigritis
Curinus coeruleus
Parasitoids Collected in Miami on Ficus Infested with Whitefly

*Encarsia protransvena*  
*Amitus bennetti*

Photos: H. Glenn, UF/IFAS
Fig Whitefly Management in the Nursery

Program developed by Dr. Lance Osborne and others for management of whiteflies with emphasis on insecticide resistance – based on growth stage

- Propagation
  - Mist - on
    - Cuttings – not anchored
  - Mist - off
    - Cuttings – anchored in the soil
      - Roots well established
      - Roots not well developed
        - Plants actively growing
        - Plants showing color or nearing flowering stage

(http://mrec.ifas.ufl.edu/lso/IAWG/FIG/default.asp)
Plants are Actively Growing

<table>
<thead>
<tr>
<th>Suggested Products</th>
<th>IRAC Class</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Neonicotinoid Soil Drench:</strong></td>
<td>4</td>
<td>After drenching, apply foliar sprays as needed if whiteflies are present. Avoid repeated application with a single mode of action (products with the same number in the attached chart).</td>
</tr>
<tr>
<td>Celero (clothianadin)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flagship (thiamethoxam)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marathon (imidacloprid)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safari (dinitrafuran)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Foliar Applications:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aria (flonicamid)</td>
<td>9C</td>
<td></td>
</tr>
<tr>
<td>Avid (abamectin)</td>
<td>6</td>
<td>If plants have received a neonicotinoid drench, DO NOT spray with a neonicotinoid during this phase, if at all possible. If absolutely necessary, make only a single spray prior to shipping.</td>
</tr>
<tr>
<td>Azadirachtin</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Beauveria bassiana</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Celero (clothianadin)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Distance (pyriproxyfen)</td>
<td>7C</td>
<td></td>
</tr>
<tr>
<td>Endeavor (pymetrozine)</td>
<td>9B *</td>
<td>Tank mixes of pyrethroids with abamectin, azadiractin, or acephate may provide a suitable way to manage whiteflies when other pests need to be managed at the same time.</td>
</tr>
<tr>
<td>Endosulfan</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Enstar II (kinoprene)</td>
<td>7A</td>
<td></td>
</tr>
<tr>
<td>Flagship (thiamethoxam)</td>
<td>4</td>
<td>IRAC Class 9B exhibits cross resistance with IRAC Class 4</td>
</tr>
</tbody>
</table>

* IRAC Class 9B exhibits cross resistance with IRAC Class 4
**Plants are Actively Growing (continued)**

<table>
<thead>
<tr>
<th>Suggested Products</th>
<th>IRAC Class</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horticultural Oil</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Insecticidal Soap</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Judo (spiromesifen)</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Marathon (imidacloprid)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>MilStop (potassium bicarbonate)</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Safari (dinotefuran)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Sanmite (pyridaben)</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Talus (buprofezin)</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>TriStar (acetamiprid)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Foggers and other products whose use is not restricted by the label</td>
<td>Many</td>
<td></td>
</tr>
</tbody>
</table>
Plants are Ready for Shipping

**NOTE:** Control of whiteflies during this time is difficult due to the difficulty of achieving effective under leaf spray coverage, lack of labeled products, concerns about phytotoxicity or residue on final product. Therefore, pest management efforts should be concentrated before this phase. Drenches are slower acting and should probably not be within 7 days of shipping.
Weeping Ficus Thrips  
(*Gynaikothrips uzeli*)

- First noted in 2003 due to heavy damage on *Ficus benjamina* in south Florida
- Prefer tender, new foliage
- Feeding causes sunken, reddish spots on leaves. Leaves tend to curl and fold inward.
**Insecticides for Thrips**
(by mode of action)

<table>
<thead>
<tr>
<th>Group 1B – Organophosphates</th>
<th>Group 6 – Avermectin</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Acephate (such as Orthene)</td>
<td>• Abamectin (Avid)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 3 – Pyrethroids</th>
<th>Group 9 – Unknown/nonspecific</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Bifenthrin (Talstar, Onyx)</td>
<td>• Flonicamid (Aria)</td>
</tr>
<tr>
<td>• Cyfluthrin (Tempo, Discus)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 4A – Neonicotinoids</th>
<th>Group 15 – Benzoylureas</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Acetamiprid (TriStar)</td>
<td>• Novaluron (Pedestal)</td>
</tr>
<tr>
<td>• Dinotefuran (Safari)</td>
<td></td>
</tr>
<tr>
<td>• Imidacloprid (Marathon, Discus)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 5 – Spinosyn</th>
<th>Group 18B – Azadirachtin</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Spinosad (Conserve)</td>
<td>• Azadirachtin (Azatin, Ornazin)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 15 – Benzoylureas</th>
<th>Group 18B – Azadirachtin</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Novaluron (Pedestal)</td>
<td>• Azadirachtin (Azatin, Ornazin)</td>
</tr>
</tbody>
</table>
Number of Thrips

Mean Number Thrips

Sample date

Control 1
Control 2
Orthene
Safari
Management of Ficus Thrips

- Thrips peak in late spring and late summer
- The predatory bugs were able to bring the populations back down after these peak periods
- Orthene and Safari (drench treatments) provided control – may only be needed during peak thrips populations
- All insecticides reduced the number of predators
- Overall, the level of damage did not differ much between the insecticide treatments and the control treatments over the long term
Red Palm Mite

(*Raoiella indica*)

- Previously found in India, Philippines, Mauritius, Reunion, Malaysia, Israel and Egypt
- Since 2004 spreading through the Caribbean
- Currently in Palm Beach and Broward Counties.

Photo: J. Pena, UF/IFAS
Hosts Plants

Palms
- Coconut – *Cocos nucifera*
- Manila - *Adonidia merrillii*
- Date – *Phoenix dactylifera*
- Areca (Butterfly) – *Dypsis lutescens*
- Christmas – *Veitchia merrillii*
- Hurricane or Princess – *Dictyosperma album*

Banana, ginger, bird of paradise and other plants within the Musaceae

Note: In Puerto Rico, the effect of mite feeding reduces leaf area and may also reduce coconut yield
**Red Palm Mite Damage**

- Chlorosis and necrosis
- Mites found on the underside of the leaves
• These mites are small (0.01 inches), flat, oval, red.
• Usually feed on the underside of the leaf
• Newly hatched larva has 3 pairs of legs
• Total development: 21 – 33 d
• Oviposition – 20 to 50 eggs over lifetime

Photo: J. Pena, UF/IFAS
THESE ARE NOT MITES

Photo: R. Duncan, UF/IFAS
## Miticides Labeled in Florida

<table>
<thead>
<tr>
<th>Product</th>
<th>Trade name</th>
<th>Label Rate Range (per 100 gal)</th>
<th>Greenhouse and Nursery Ornamentals</th>
<th>Landscape Ornamentals</th>
<th>MOA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spiromesifen</td>
<td>Forbid 480 SC</td>
<td>2-4 fl oz</td>
<td>No</td>
<td>Yes</td>
<td>23</td>
</tr>
<tr>
<td>Judo</td>
<td>2-4 fl oz</td>
<td>Yes</td>
<td>No</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Acequinocyl</td>
<td>Shuttle 15 SC</td>
<td>6.4 – 12.8 fl oz</td>
<td>Yes</td>
<td>No</td>
<td>20</td>
</tr>
<tr>
<td>Bifenazate</td>
<td>Floramite SC</td>
<td>4-8 fl oz</td>
<td>Yes</td>
<td>Yes</td>
<td>2</td>
</tr>
<tr>
<td>Etoxazole</td>
<td>TetraSan 5WG</td>
<td>8-16 oz</td>
<td>Yes</td>
<td>Yes</td>
<td>10B</td>
</tr>
<tr>
<td>Milbemectin</td>
<td>Ultiflora</td>
<td>8-16 fl oz</td>
<td>Yes</td>
<td>No</td>
<td>6</td>
</tr>
</tbody>
</table>
Chili Thrips
(*Scirtothrips dorsalis*)

Found in Florida in 2005 on roses in Palm Beach County; currently found in numerous counties from Key West to Gainesville
• Life cycle - 14-20 days.
• 60 to 200 eggs per female
• Eggs are inserted in plant tissue
• Immatures are pale in color and very small
• Pupation may occur in the soil or on the plant.
• Adults are small, pale yellow to gray in color with incomplete dark stripes on the upper surface of the abdomen.
• **Seasonality:** Expected to be year round in Florida; abundance tends to be low in the rainy season and high during the dry season.

• **Hosts:** Chili thrips feed on more than 100 recorded fruit, vegetable and ornamental host plants from approximately 40 different families.

• **Importance:** It is capable of spreading at least 3 viruses including tomato spotted wilt virus.
Damage
Management

• There are numerous natural enemies including parasitoids and predatory mites, thrips, beetles and bugs (particularly the minute pirate bug).

• Various foliar and drench treatments, alone or combined with oil have achieved some success.

• Pesticides that can be used include abamectin (Avid), acephate (Orthene), acetamiprid (TriStar), azadirachtin (Azatin), cyfluthrin (Decathlon, Discus), dinotefuran (Safari) imidacloprid (Marathon, Discus), novaluron (Pedestal), and spinosad (Conserve).
Pink Hibiscus Mealybug
*Maconellicoccus hirsutus*

- Quarantine pest
  - Specific procedures must be followed if your nursery is infested

- Prevention is the best control
  - Establish a mealybug management program

Photos by UF, Osborne
Biological Control
Pink Hibiscus Mealybug

Parasitoid release program (FDACS and APHIS)

Mealybug destroyer (Cryptolaemus montrouzieri)
Management
Pink Hibiscus Mealybug Preventative Treatments

• Chlorpyrifos (such as DuraGuard ME)
• Acephate (such as Acephate, Orthene)
• Bifenthrin (such as Talstar)
• Buprofezin (such as Talus)
• Pyriproxyfen (such as Distance)
• Neonicotinoids (such as Flagship, Marathon, Discus, Safari)
• Pesticidal oils and insecticidal soaps
Sri Lanka Weevil
*Myllocerus undatus*

- Large host range including fruit and ornamentals
- Eggs, larvae and pupae are in the soil
- Adults feed on the foliage sometimes causing severe damage
Mortality of Adult Weevils Feeding on Foliage Treated 7 Days Previously

Mean No. Dead (x=10)

- Control
- Marathon
- Talstar
- Orthene
- Flagship

Hours of Exposure

24 48 72 96 120
Web Resources

- http://mannion.ifas.ufl.edu
- http://www.mrec.ifas.ufl.edu/lso/
- http://edis.ifas.ufl.edu/
- http://creatures.ifas.ufl.edu/
- Pest Alerts
  - University of Florida (http://extlab7.entnem.ufl.edu/pestalert/)
  - DOACS (http://doacs.state.fl.us/~pi/enpp/pi-pest-alert.html)
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