Invasive Whitefly Pests of Florida

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Outline

- General Whitefly Introduction
- Other Problems with Whiteflies in Florida
- Bondar's Nesting Whitefly
- Ficus Whitefly
- Rugose Spiraling Whitefly
- Monitoring Whiteflies
- Managing Whiteflies

Overview of Whiteflies

- 1500 species worldwide, at least 60 have been reported from Florida
- Small in size and resemble tiny moths
  - 2 pairs of wings which are covered by a white dust or waxy powder
- Feed on plant juices with a piercing, sucking mouthpart
  - Can be a vector of plant diseases

Image credits:
David Cappaert, Michigan State University, www.bugwood.org, #5351016

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Overview of Whiteflies

- Whiteflies may produce honeydew as a by-product of feeding
- The presence of sooty mold and/or ants may indicate an infestation

Image credits:
Left – Stephanie Stocks, Department of Entomology and Nematology, University of Florida
Right - Joseph O'Brien, USDA Forest Service, www.bugwood.org, #1427010

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Overview of Whiteflies

- Honeydew and sooty mold can cover non-plant surfaces from nearby infested plants

Image credits:
Left – K. Gabel, UF/IFAS Monroe County Extension
Right – H. Glenn, UF/IFAS Tropical Research and Education Center

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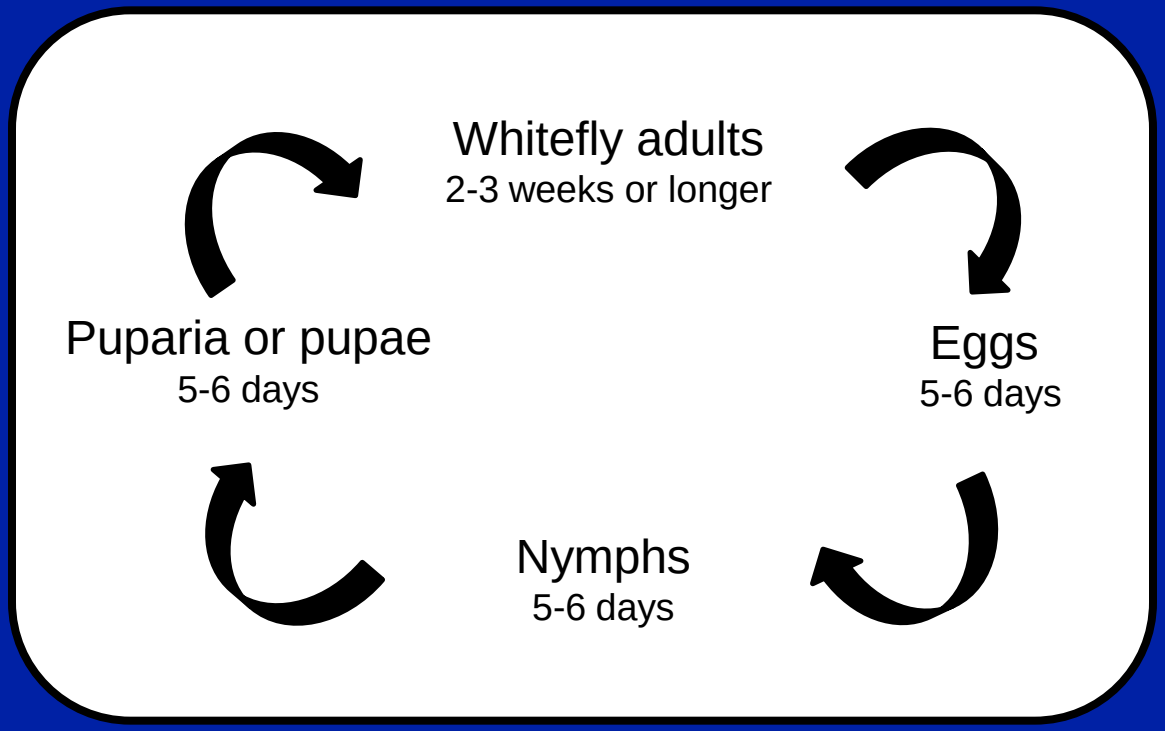
Typical Whitefly Life Cycle



Eggs

Nymph

Image credits:
Whitefly eggs - Florida Department of Agriculture and Consumer Services, Division of Plant Industry
Whitefly nymph - Charles Olsen, USDA APHIS PPQ, www.bugwood.org, #5165041

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Variability in Nymphal Stages

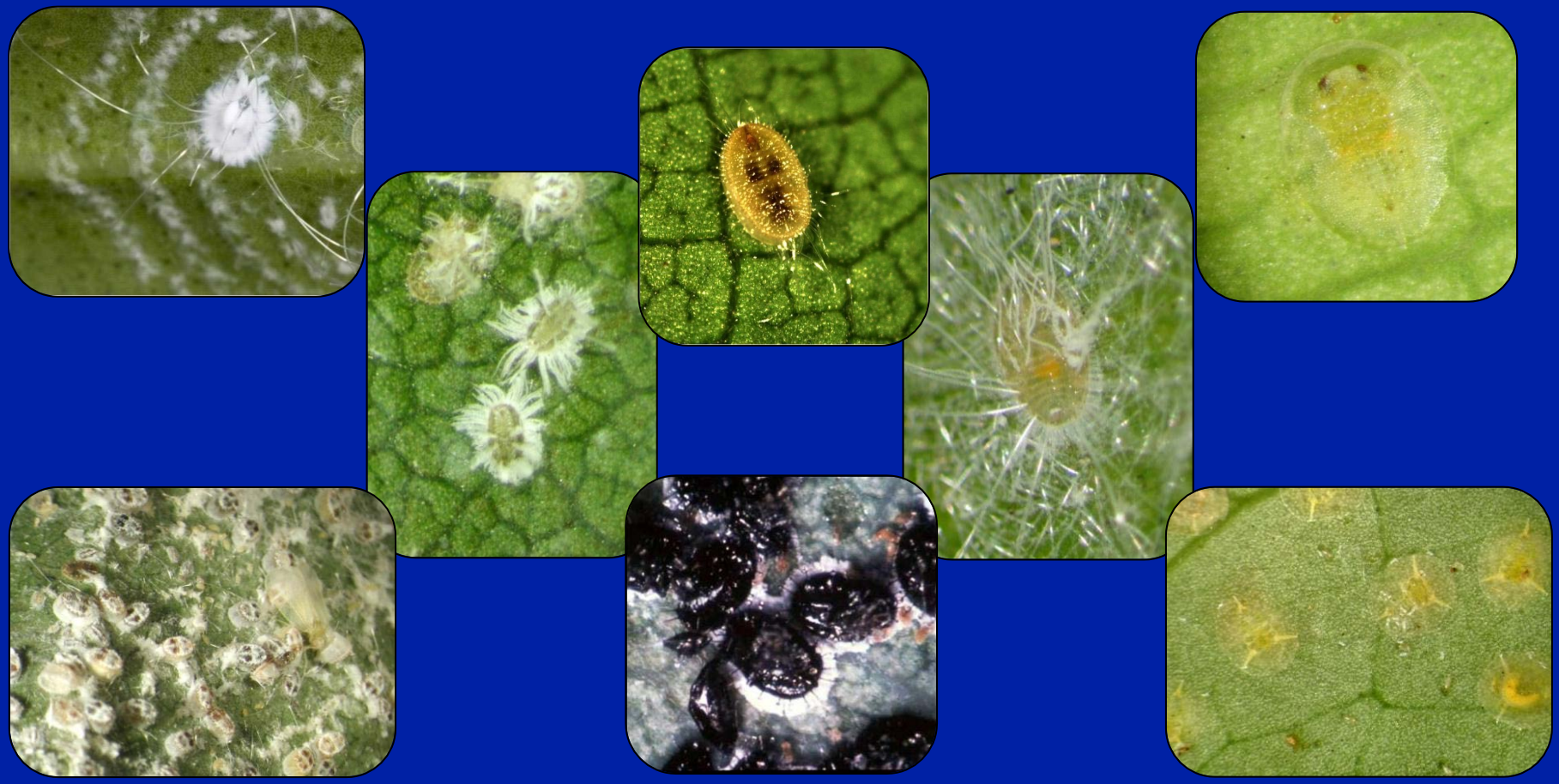

Image credits:
Top left - David Cappaert, Michigan State University, www.bugwood.org, #5389025
Top middle - Nancy Gregory, University of Delaware, www.bugwood.org, #5427652
All others - H. Glenn, UF/IFAS, Tropical Research and Education Center

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Other Problems with Whiteflies in Florida

- Silverleaf Whitefly - *Bemisia tabaci*

Adults

Image credits:
Scott Bauer, USDA Agricultural Research Service, www.bugwood.org. #1316008

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Other Problems with Whiteflies in Florida

- Silverleaf Whitefly - *Bemisia tabaci*

Nymphs

Image credits:
Lance Osborne, UF/IFAS, Mid-Florida Research and Education Center

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Other Problems with Whiteflies in Florida

- Citrus Whitefly - *Dialeurodes citri*

Adult

Image credits:
Lyle Buss, Department of Entomology and Nematology, University of Florida

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Other Problems with Whiteflies in Florida

- Citrus Whitefly - *Dialeurodes citri*

Nymphs

Image credits:
Florida Department of Agriculture and Consumer Services, Division of Plant Industry

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Other Problems with Whiteflies in Florida

- Giant Whitefly - *Aleurodicus dugesii*

Adults

Image credits:
Right – Lyle Buss, Department of Entomology and Nematology, University of Florida
Left- Anne W. Gideon, www.bugwood.org, #1192022

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Other Problems with Whiteflies in Florida

- Giant whitefly - *Aleurodicus dugesii*

Eggs and Nymphs

Image credits:
Lyle Buss, Department of Entomology and Nematology, University of Florida

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Recent Whitefly Issues in South Florida

Bondar's Nesting Whitefly

Ficus Whitefly

Rugose Spiraling Whitefly

Image credits: Bondar's nesting whitefly: nymph – Ian Stocks, Florida Department of Agriculture and Consumer Services, Division of Plant Industry; adult - Lyle Buss, Department of Entomology and Nematology, University of Florida
Ficus whitefly: nymph – Catharine Mannion, UF/IFAS, UF/IFAS, Tropical Research and Education Center; adult – Jeff Lotz, Florida Department of Agriculture and Consumer Services, Division of Plant Industry
Rugose spiraling whitefly: nymph - Lyle Buss, Department of Entomology and Nematology, University of Florida; adult - H. Glenn, UF/IFAS, Tropical Research and Education Center

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Bondar's Nesting Whitefly

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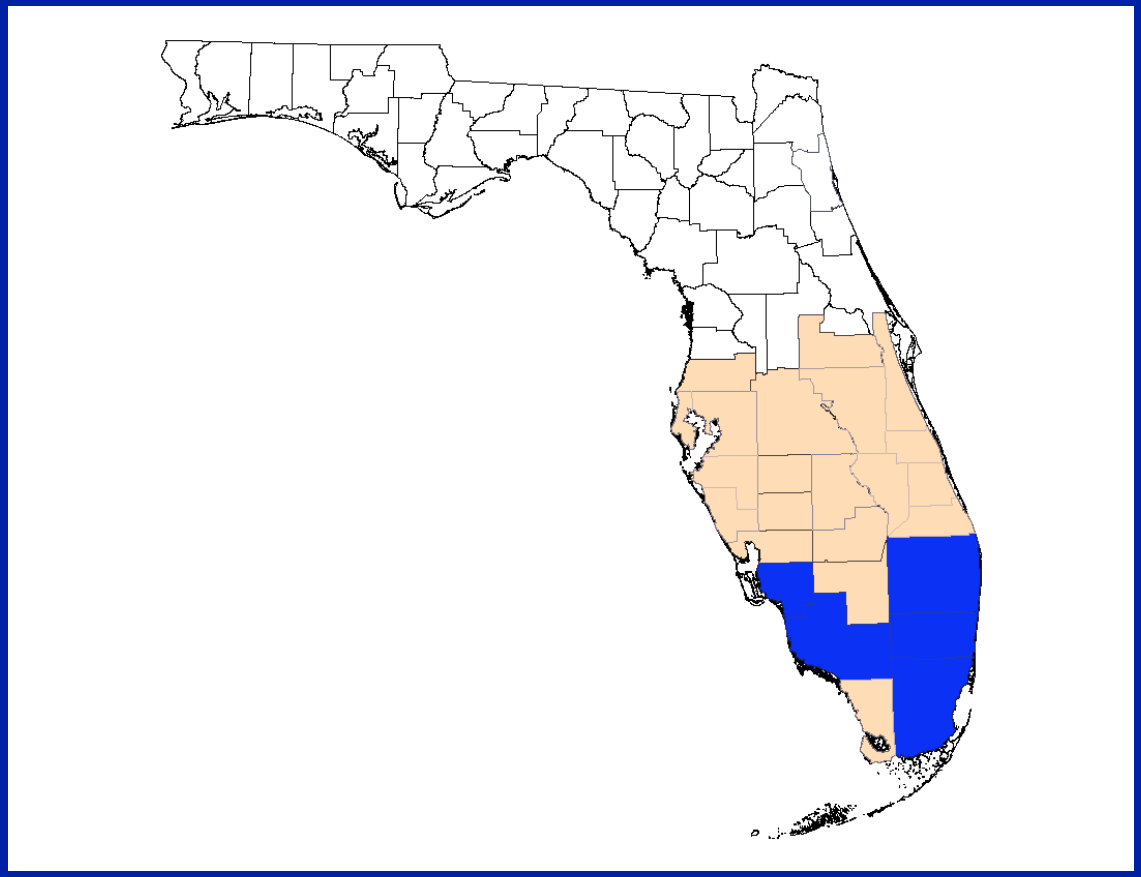
Bondar's Nesting Whitefly

Paraleyrodes bondari

- Native to South America and the Caribbean
- Also detected in Madeira, Comoros, Mauritius, Reunion, Taiwan, Hawaii, Portugal
- Reported in Florida in December 2011
  - Broward
  - Collier
  - Lee
  - Miami-Dade
  - Palm Beach

Distribution Map of Bondar's Nesting Whitefly



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Bondar's Nesting Whitefly

Paraleyrodes bondari

Adult

Image credit:
Lyle Buss, Department of Entomology and Nematology, University of Florida

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Bondar's Nesting Whitefly

Paraleyrodes bondari

Nymph

Image credit:
Ian Stocks, Florida Department of Agriculture and Consumer Services, Division of Plant Industry

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Bondar's Nesting Whitefly

Paraleyrodes bondari

"Nest"

Image credit:
Lyle Buss, Department of Entomology and Nematology, University of Florida

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Bondar's Nesting Whitefly Hosts

- avocado
- banyan tree
- canary laurel or barbusano
- Chinese hibiscus
- coconut palm
- guava
- Indian laurel
- lemon
- navel orange
- mandarin orange
- palms in the genus *Chamaedorea*
- Surinam cherry
- sweetsop
- sapote
- tilo or stinkwood
- weeping fig

Bondar's Nesting Whitefly Damage

Top of the leaves →

Bottom of the leaves →

Image credit:
Stephen Brown, UF/IFAS, Lee County Extension

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Ficus Whitefly

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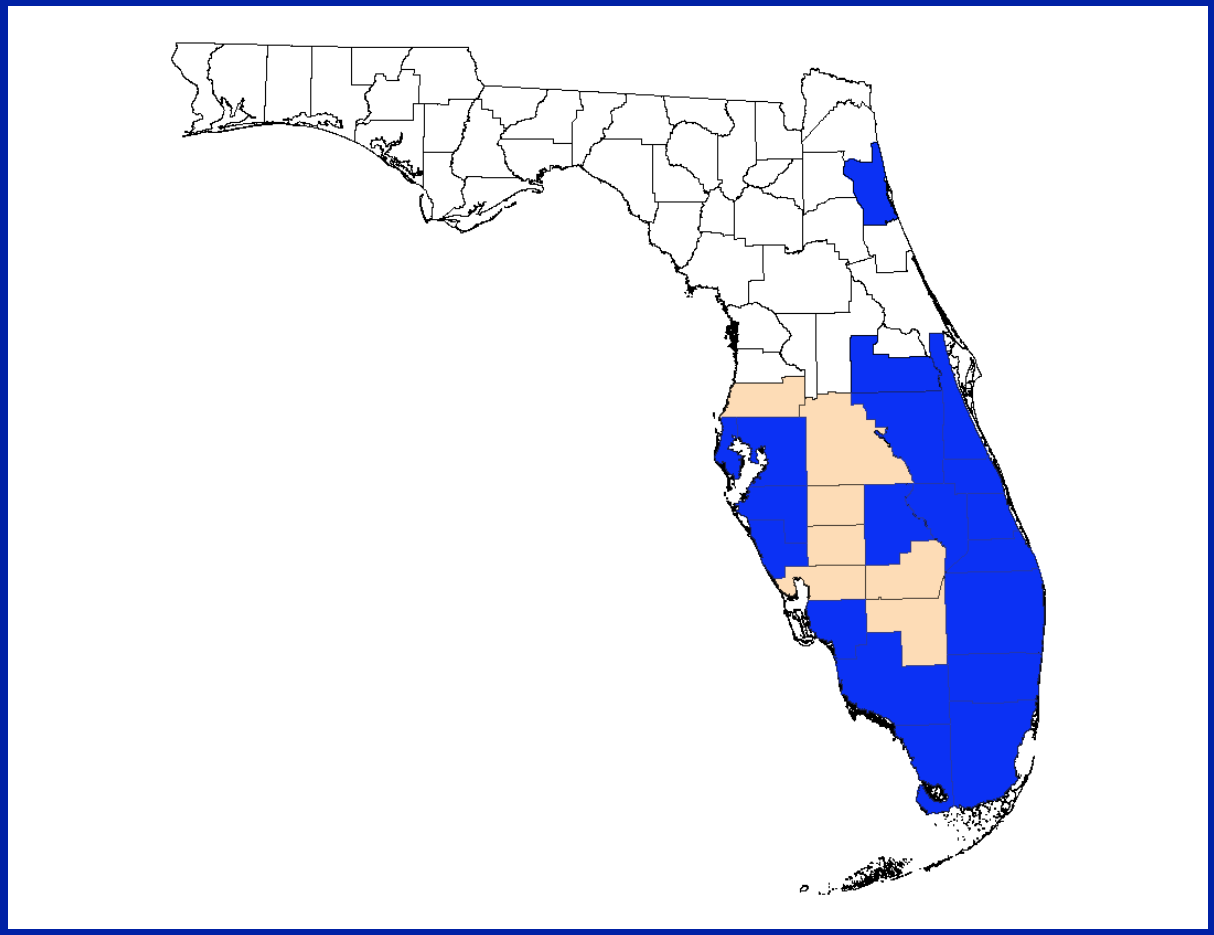
Ficus Whitefly

Singhiella simplex

- Native to India, Burma, and China
  - Where it is a known pest of ficus
- Found in Florida in 2007
  - Detected in 19 counties so far, mostly in southern Florida
  - Particularly problematic for ficus hedges which are planted in abundance in southern Florida

Distribution Map of Ficus Whitefly



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Ficus Whitefly

Singhiella simplex

Adult

Image credits:
Lyle Buss, Department of Entomology and Nematology, University of Florida

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Ficus Whitefly

Singhiella simplex

Eggs

Puparium

Nymphs

Image credits:
Egg - A. Hunsberger, UF/IFAS, Urban Horticulture Agent, Miami-Dade County
Nymph – Lyle Buss, Department of Entomology anfd Nematology. University of Florida
Puparium– Catharine Mannion, UF/IFAS, Tropical Research and Education Center

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Ficus Whitefly Life Cycle

Adult
2-4 days

Eggs
~10 days

Nymphs
~11 days

Puparia
~6 days

Constant temperature (80 ˚ F)

Image credits:
H. Glenn, UF/IFAS, Tropical Research and Education Center

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Ficus Whitefly Damage

Image credits:
Left and top right - A. Hunsberger, UF/IFAS, Miami-Dade County Extension
Bottom right – C. Mannion, UF/IFAS, Tropical Research and Education Center

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Rugose Spiraling Whitefly

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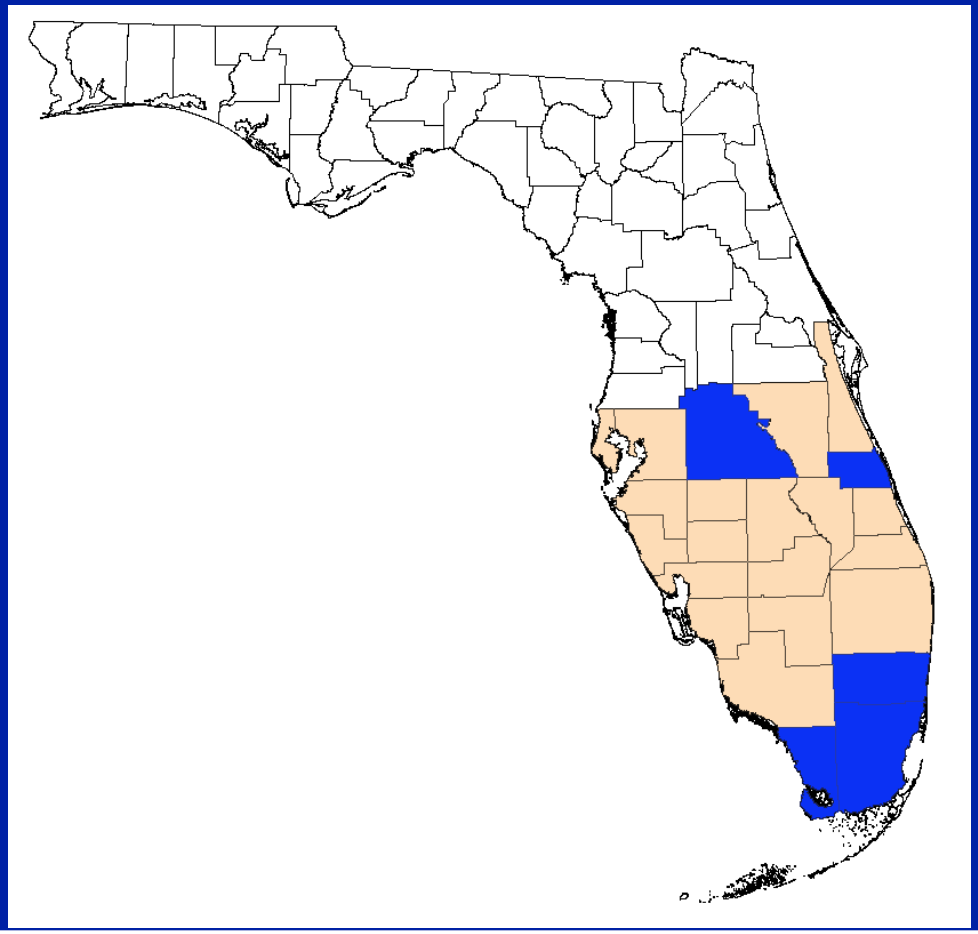
Rugose Spiraling Whitefly

Aleurodicus rugioperculatus

- Native to Central America
- Detected in Florida in 2009 in Miami-Dade County
  - Expanded to include Broward, Monroe, Indian River, and Polk Counties
- Has also been referred to as the gumbo limbo spiraling whitefly.

Distribution Map for Rugose Spiraling Whitefly



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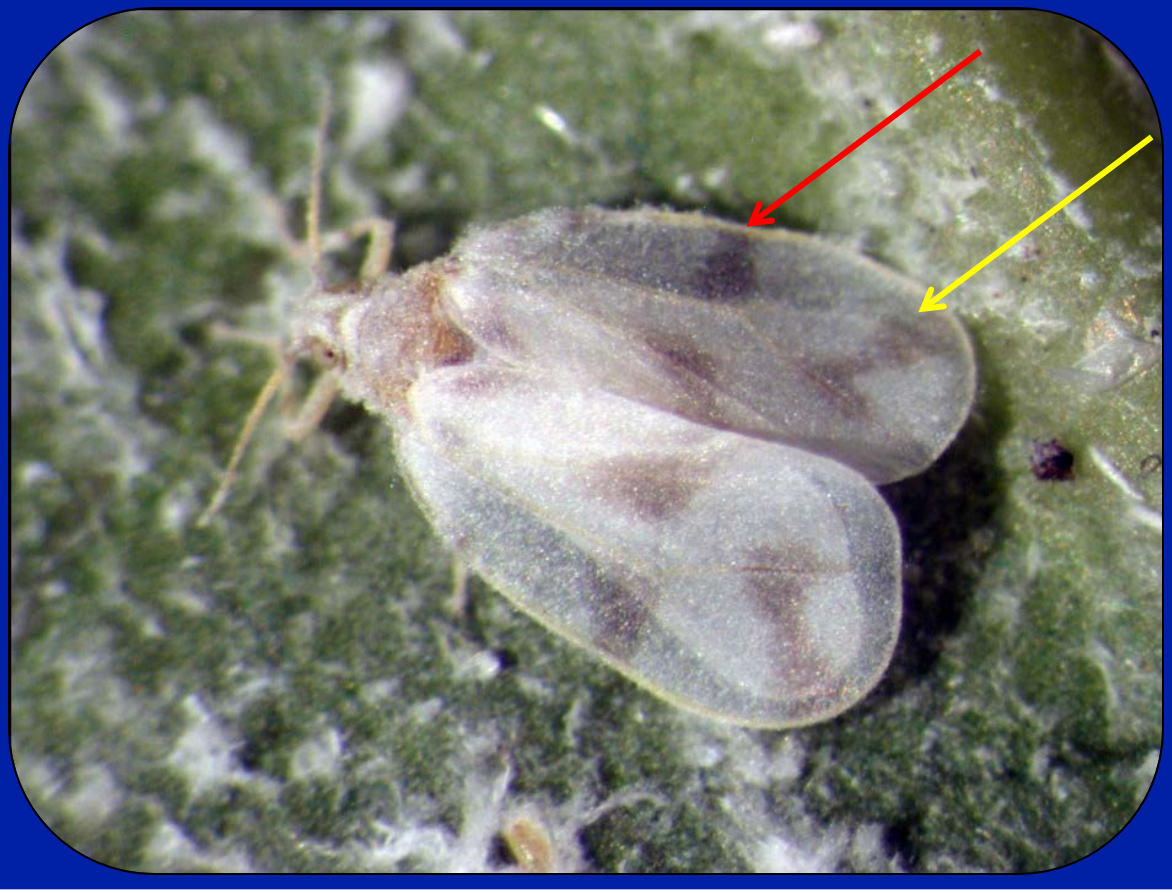
Rugose Spiraling Whitefly

Aleurodicus rugioperculatus



Adult

Image credits:
H. Glenn, UF/IFAS, Tropical Research and Education Center

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Rugose Spiraling Whitefly

Aleurodicus rugioperculatus

Eggs

Image credits:
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Rugose Spiraling Whitefly

Aleurodicus rugioperculatus

Emerging adult

Nymphs

Image credits:
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Rugose Spiraling Whitefly

Aleurodicus rugioperculatus

Adult
~14 days

Eggs
~8 days

Nymph
~14 days

Puparia
~9 days

Development at
80˚F or 27˚C

Image credits:
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Some Rugose Spiraling Whitefly Hosts

- Manila palm
- Florida black olive
- gumbo limbo
- foraha or tamanu
- cocoplum
- satinleaf
- coconut palm
- areca palm
- mango
- avocado
- pigmy palm
- live oak
- white bird of paradise
- tropical almond
- montgomery palm
- washingtonia palm

Rugose Spiraling Whitefly Damage

Image credits:
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Monitoring Whiteflies

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Monitoring Whiteflies

- Scouting- it is very important monitor plants (especially if a known infestation is nearby)
- This allows for early detection which allows for the best management decisions
  - Ficus whitefly – look for live adults and nymphs
  - Rugose spiralling whitefly – look for the spiralling egg patterns
  - Bondar's nesting whitefly – look for the waxy nests on the leaves

Monitoring Whiteflies

- Identifying
  - Take an image to verify identification
  - If needed, submit a sample
    - How to collect a sample
      - 6-12 inches of plant host material with many puparium (or pupae) placed in a sealed plastic bag
      - Keep it cool so that the sample does not degrade
    - How to submit a sample
      - http://edis.ifas.ufl.edu/sr010
    - How to find your local county faculty agent
      - http://solutionsforyourlife.com/map/

Managing Whiteflies

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Managing Whiteflies: Cultural Control

- Use alternative or non-host plants when possible
- If moving infested plant material, bag it or cover it!
- Check your equipment and yourself for infested material that “sticks” and for insects that are “hitchhiking”
- Washing plants with water

Managing Whiteflies: Biological Control

- What are natural enemies or biocontrol agents?
  - Important for long term management of pests
- Predators versus parasites
- Buying and releasing natural enemies

Parasitoids Associated with Ficus Whitefly

Amitus bennetti

Encarsia protransvena

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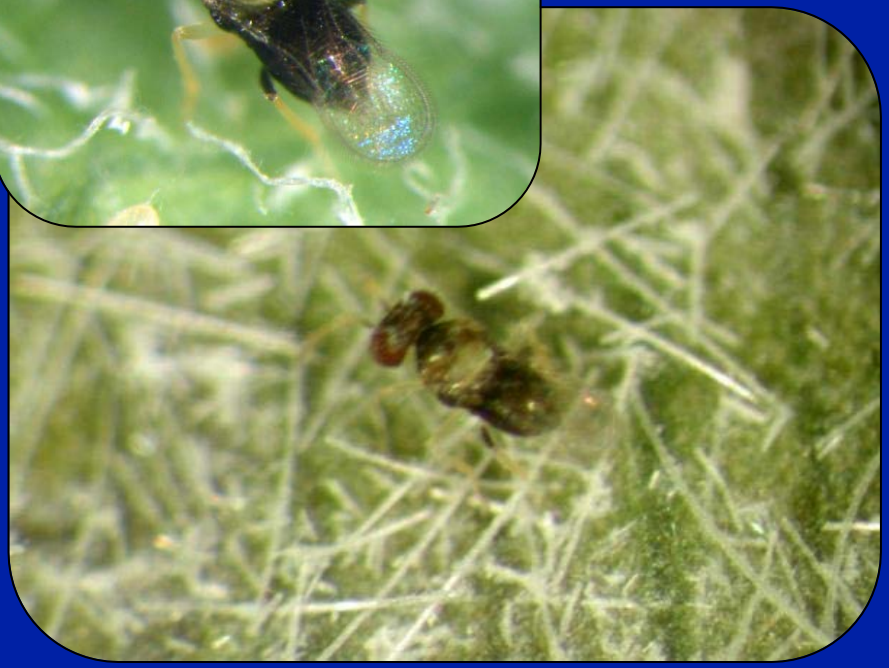
Parasitoids Associated with Rugose Spiraling Whitefly

Encarsia guadalupae



Aleuroctonus sp.

Image credits:
H. Glenn, UF/IFAS, Tropical Research and Education Center

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How to Tell if the Nymphs have been Parasitized

Parasitized nymphs often appear dark in color

Sometimes you can see the parasite in the whitefly nymph ⟷

← Adult whiteflies that have emerged leave a “ripped” hole – NOT PARASITIZED

← Adult parasites that have emerged leave a circular hole

Image credits:
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Predators Associated with Ficus Whitefly

Harmonia axyridis

Olla v-nigrum

Exochomus childreni

Chilocorus nigritis

Curinus coeruleus

Image credits:
Harmonia axyridis - Gyorgy Csoka, Hungary Forest Research Institute, www.bugwood.org, #5410810
Olla v-nigrum - Louis Tedders, USDA Agricultural Research Service, www.bugwood.org, #1223031
Exochomus childreni and Chilocorus nigritis - H. Glenn, UF/IFAS, Tropical Research and Education Center
Curinus coeruleus - Forest & Kim Starr, Starr Environmental, www.bugwood.org, #5219057

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Predators Associated with Rugose Spiraling Whitefly

Nepasphis oculata

Adult

Larva

Image credits:
Lance Osborne, UF/IFAS, Mid-Florida Research and Education Center

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Predators Associated with both Rugose Spiraling Whitefly and Ficus Whitefly

Adult

Eggs

Larva

Image credits:
Lacewing adult – David Cappaert, Michigan State University, www.bugwood.org, #5351009
Lacewing larvae – USDA ARS Photo Unit, USDA Agricultural Research Service, www.bugwood.org, #1323013
Lacewing eggs - Gerald J. Lenhard, Louiana State Univ, www.bugwood.org, #0014149

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Managing Whiteflies: Chemical Control

- Soaps and oils
  - Horticultural oil or insecticidal soap
    - Essentially suffocates the pest
  - Strictly contact so thorough coverage is required
  - Repeated applications are required every 7-10 days
  - Phytotoxicity can occur under high temperatures leading to plant damage

Managing Whiteflies: Chemical Control

- Insecticides
  - Sometimes important in the early management of a pest
  - Appropriate choices of insecticide, formulation, methods of application and frequency of application
  - Effects on natural enemies
  - Misuse or overuse can cause problems such as insecticide resistance, secondary pest problems, environmental contamination, and detrimental effects on non-target organisms
  - Follow label instructions - The site and method of application must be on the label (e.g.. landscape, nursery, etc.)

Managing Whiteflies: Chemical Control

- Foliar application of chemicals
  - Whitefly should be present
  - Foliar insecticides may provide quick control, most will not provide long-term control.
  - Some foliar insecticides (e.g. pyrethroids) may disrupt the natural enemies and should be used selectively.
  - It is not recommended to use the same insecticide on both the foliage and in the soil

Insecticide Selection for Foliar Application

Professional Use (Landscape and Nursery)

- Abamectin (Avid)
- Acetamiprid (TriStar)
- Azadirachtin (Azatin XL)
- Bifenthrin (Talstar)
- Buprofezin (Talus)
- Clothianidin (Arena)
- Flonicamid (Aria)
- Horticultural oils
- Imidacloprid (Merit, Marathon, Discus, Allectus)
- Kontos (Spirotetramat)
- Pymetrozine (Endeavor)
- Pyriproxyfen (Distance)
- Spiromesifen (Judo)
- *Beauveria bassiana* (BotaniGard)
- *Isaria fumosorosea* (PreFeRal)

Managing Whiteflies: Chemical Control

- Systemic applications of chemicals
  - Apply a systemic insecticide to the soil or trunk
    - Trunk application (basal spray, injection)
    - Soil application (drench, granular, pellets)
  - Provides longer term control

Managing Whiteflies: Chemical Control

- Methods of Application for Neonicotinoids
  - There are several ways to apply neonicotinoid insecticides
  - Take advantage of the different methods and formulations
  - Fit the method of application to the site
  - Both the site and method need to be on the label

Systemic insecticides – soil and trunk methods

Drench

Granular

Injection

Trunk spray

Image credits:
Top – H. Glenn, UF/IFAS Tropical Research and Education Center
Bottom left – C. Mannion, UF/IFAS Tropical Research and Education Center
Bottom right - J. Chamberlin, Valent, Inc.

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Neonicotinoid Insecticides

Active Ingredient	Trade Names Professional Use
Acetamiprid	TriStar* # (no soil application)
Clothianadin	Arena, Aloft*
Dinotefuran	Safari#, Zylam#
Imidacloprid	Merit, Marathon, CoreTect, Discus*, Allectus*, several generic labels
Thiamethoxam	Flagship, Meridian

* Contains a neonicotinoid and a pyrethroid
# Allows basal trunk spray

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Conditions that Affect Management of These Pests

- Rugose spiraling whitefly and Bondar's nesting whitefly
  - Less rain makes the infestations appear worse
  - Large host range makes them diffucult to manage
  - Excessive wax can affect contact beetwen the insect and the insecticide
- Ficus whitefly
  - Be patient while the leaves comes back and check the health of your ficus often
  - Try not to prune during recovery

Addressing Damage to Plants Caused by Whiteflies

- Proper fertilization and watering can help plants recover
  - However, over fertilizing will actually help the pests and lead to run-off issues
- Beware: Nothing changes overnight and it sometimes takes time for plant recovery

Removing Honeydew and Sooty Mold

- Control pest problem
- Move property from infested area if possible
  - Particularly for cars
- Pressure washing
- Soaps and oils
  - Be careful of plant damage
- Mold remover products
  - Be especially careful about use on plants
- Remove honeydew as soon possible

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Partnering Agencies

- Florida Department of Agriculture and Consumer Services, Division of Plant Industry
- University of Florida, Department of Entomology and Nematology
- Pest Management University
- IPM Florida
- IFAS Extension – Broward County
- IFAS Extension – Lee County
- IFAS Extension – Miami-Dade County
- IFAS Extension – Palm Beach County
- Southern Plant Diagnostic Network

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