

# Whiteflies, Scales, and Mealybugs



**FLORIDA FIRST DETECTOR**



# Whiteflies, Scales, and Mealybugs



- Adults usually have 4 white wings and usually are detected by this feature when the host plant is disturbed.



- Divided into categories of soft or armored scales. (Horticulture and Home Pest News, 2022).
- The nymphs have legs to allow for crawling to select host plant.
  - As nymph grows, the legs and antennae are often lost.



- Unlike female scales, there is often a presence of legs in adult mealybugs.
  - This allows nymphs and adults to slowly move while on the host plant or to other host plants.
- Eggs usually laid in cottony egg sacs that can be found on leaves, bark, the fruit, or twigs of host plant (Flint, 2016).

# Honeydew Feeding

- The production of honeydew is caused by feeding by whiteflies, some mealybugs, and some species of scales, particularly the soft scales.
  - Armored scales do not create honeydew
  - Presence of ants and wasps feeding on honeydew may indicate the presence of these feeders mentioned.
- This honeydew later causes the presence of **sooty mold**, a fungus that blocks plant's access to light and turn the surface black (Buss, 2016).



Honeydew from feeding on a pecan leaf.



# Whiteflies (Family: Aleyrodidae)

- Common pest with more than 1,500 species.
  - o Develop quickly in warmer temperatures, with higher populations in spring and summer (Flint, 2015)
- Feed on more than 500 host plants (Osborne, 2016).
  - 1990 - Extreme outbreaks in southern US caused damage from whiteflies that “exceeded \$500 million in one year” (Osborne, 2016).
- Some are vectors of plant-pathogenic viruses
- Common species in FL that can have economic impact:
  - Greenhouse whitefly: *Trialeurodes vaporariorum*
  - Citrus whitefly: *Dialeurodes citri*
  - Sweetpotato whitefly: *Bemisia tabaci*
    - “Biotype Q” resistant to insecticide
      - First detected in poinsettias in Arizona retail outlet in December 2004 in the USA (Agricultural Research magazine, 2008).



Photo: W. Billen, Pflanzenbeschaustelle, Weil am Rhein, Bugwood.org #UGA1263013

# Hosts



Tomato



Potato



Watermelon



Soybean



Poinsettia



Hibiscus

Photo: (Top row) - UF/IFAS Photo by Tyler Jones; Nikolai Sokolov, [www.Bugwood.org](http://www.Bugwood.org) # 5444203; UF/IFAS Photo by Camila Guillen # 5359959. (Bottom Row)- UF/IFAS Photo by Robert Annis; Jonathan D. Eisenback, Virginia Polytechnic Institute and State University, [Bugwood.org](http://Bugwood.org) #5440518; Tony Pernas, USDI National Park Service, [Bugwood.org](http://Bugwood.org) #UGA1499030



# Damage



Sooty mold on soybean



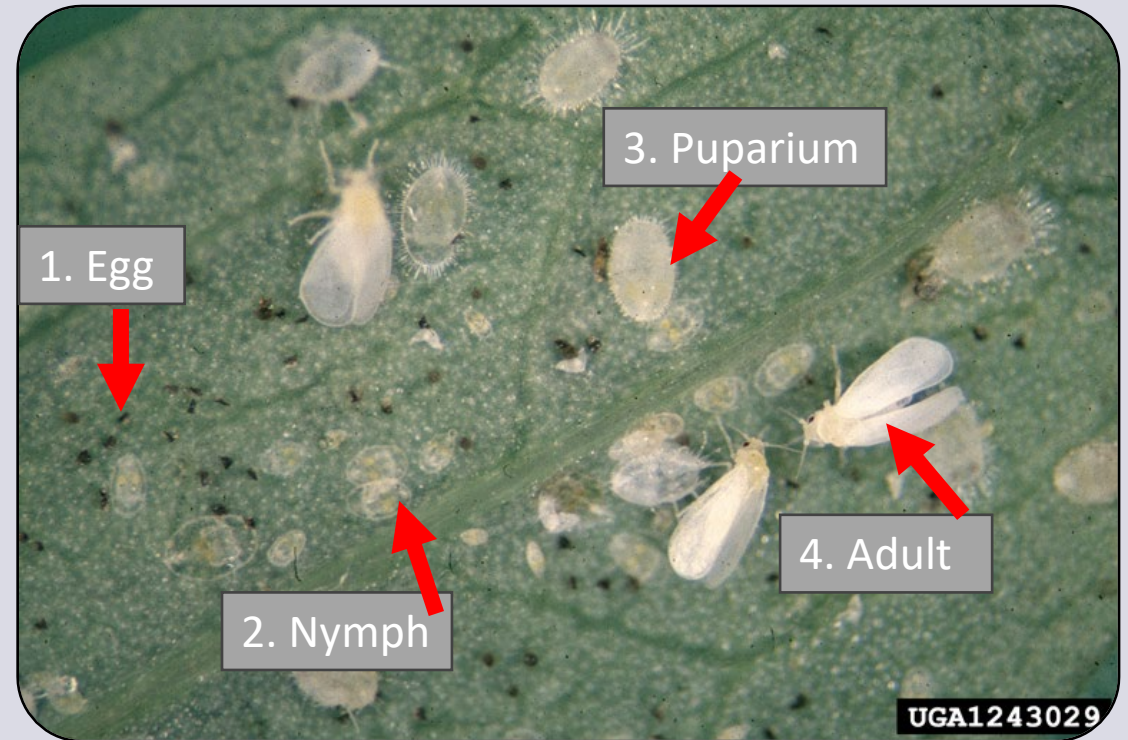
Chlorosis of foliage



Tomato infected with Tomato yellow leaf curl virus

# General Life Cycle

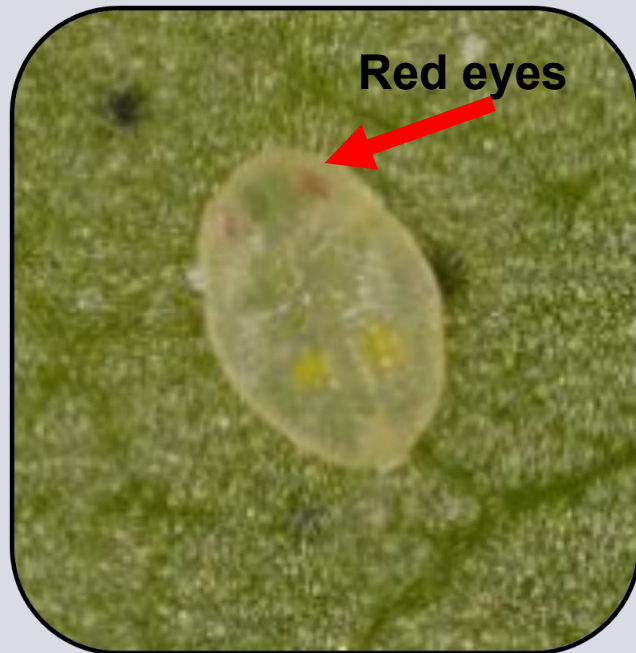
- Females lay eggs on undersides of leaves
- Nymphs go through 4 instars, and molt 3 times.
  - Pupaarium – last nymphal stage that the adult emerges from.
- 4-6 weeks total developmental time



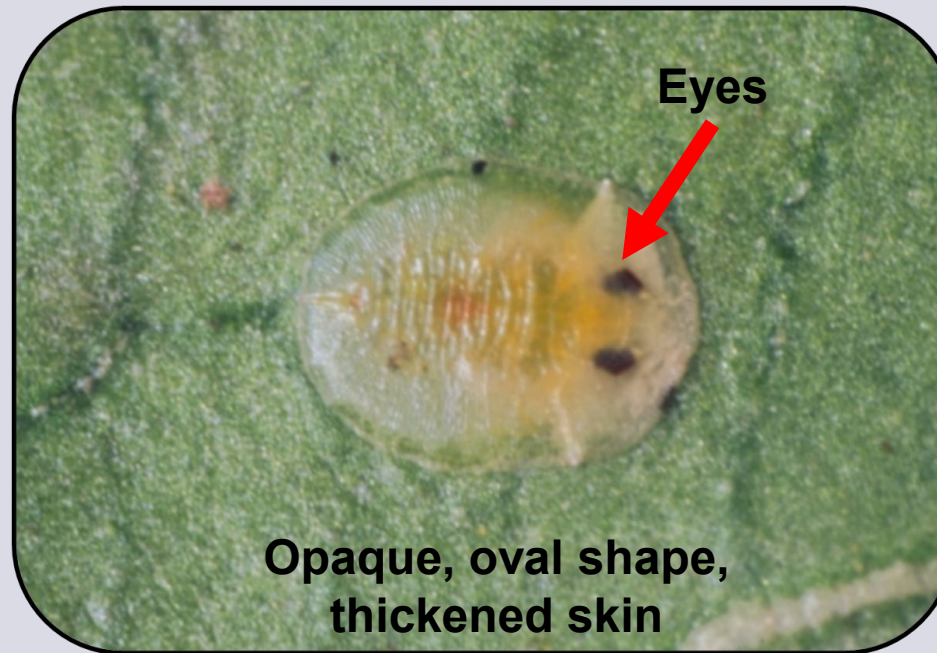
Greenhouse Whitefly Multiple Life Stages



# Identification: Nymphs

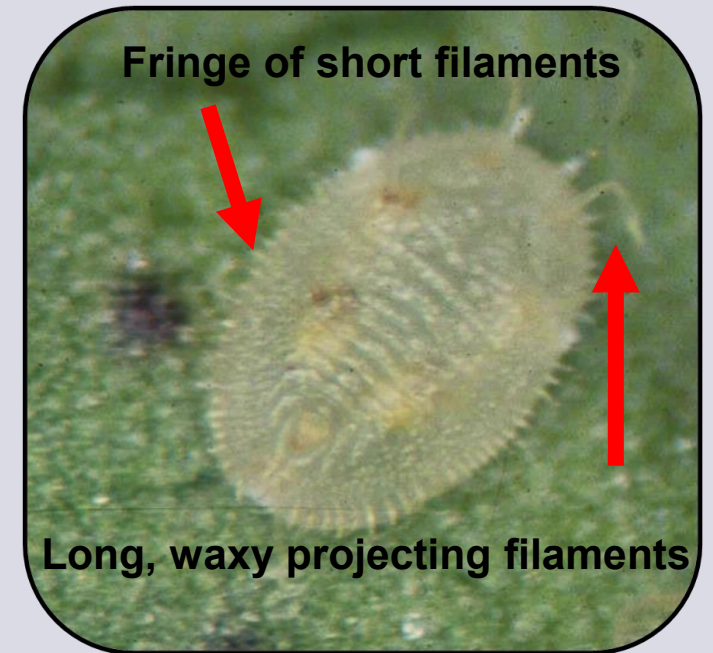


Sweet potato whitefly  
*Bemisia tabaci*



Opaque, oval shape,  
thickened skin

Citrus whitefly  
*Dialeurodes citri*



Long, waxy projecting filaments

Greenhouse whitefly  
*Trialeurodes vaporariorum*



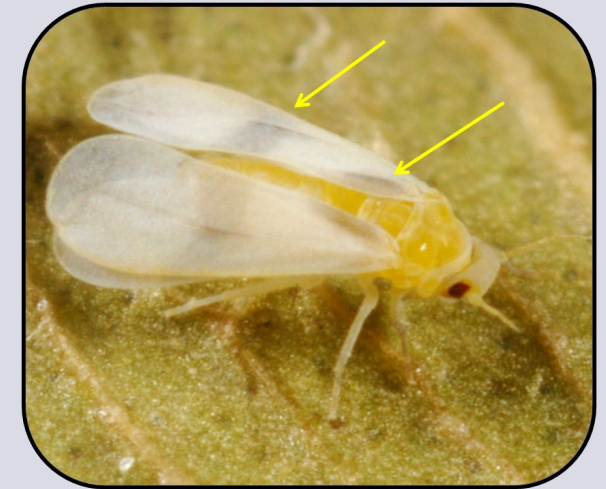
# Identification: Adult



Sweet potato whitefly  
*Bemisia tabaci*



Greenhouse whitefly  
*Trialeurodes*  
*vaporariorum*



Ficus Whitefly  
*Singhiella simplex*

# Management: Biological

- Biological control agents
  - Parasitoid wasps, lacewing larvae, minute pirate bugs, big-eyed bugs and ladybird beetles (McAuslane, 2000; Gardening Solutions, 2022).
  - Entomopathogenic fungi (hot, humid conditions necessary)



Parasitoid wasp (*Eretmocerus*) parasitizing a *Bemisia* nymph



# Management: Cultural

- Virus-resistant cultivars
- Remove virus-infected plants
- Remove crop residues
- Reflective mulch
- Exclusion from greenhouses
- Non-planting months during summer when temperatures are hot.
  - South and Central FL



Reflective mulch

# Management: Chemical

- Homeowners:
  - Allow for biological control efforts first, to allow natural enemies to control the population.
    - Some chemical controls can injure and decrease natural enemy populations.
  - Can also spray a mixture of insecticidal soap or horticultural oil in water before populations reach outbreak levels (follow the label!)
    - Cover the lower surface of the leaves





# Management: Chemical

- Commercial:
  - Contact your county extension agent and follow the label of the instructions for application for your specific plants.
  - The label is law!



# Scale Insects (Superfamily Coccoidea)

- Order: Hemiptera
  - About 8,000 species in Superfamily Coccoidea
    - Mealybugs are included too!
- May be found on any plant surface (depends on species)
- Common on ornamental landscape plants
- Secrete various wax coverings
- Two main families:
  - Armored scales (i.e.: Diaspididae)
  - Soft scales (i.e.: Coccidae)
  - Some common species aren't in the armored and soft scales
    - Cotton Cusion Scale: *Icerya purchasi*



Tulip tree scale  
*Toumeyella liriodendri*



White peach scale  
*Pseudaulacaspis pentagona* (Targioni)



# Identification: Armored vs Soft

- Armored scale (Diaspididae)
  - Waxy covering is not attached to body
  - Do not secrete honeydew (Williamson, 2012)
  - Females are generally flat, slightly convex against the plant surface



Cycad aulacaspis scale  
*Aulacaspis yasumatsui*

- Soft Scale (Coccidae)
  - Waxy covering is attached to body
  - They secrete honeydew and leads to sooty mold
  - Females are more dome-shaped (Mahr, 2024)
  - They have two triangular anal plates (Lambdin, 2004)



Cottony maple scale  
*Neopulvinaria innumerabilis*

# Life Cycle: Scales

- 2. Crawler stage
- 3. Two molts of insect.
- 4. Puparium



Adult male



Adult female

Photo: John .A. Davidson, Univ. Md, College Pk, Bugwood.org, #1635048; John .A. Davidson, Univ. Md, College Pk, Bugwood.org, #1635043; John .A. Davidson, Univ. Md, College Pk, Bugwood.org, #1635045



# Symptoms

- Yellowing leaves, branch dieback, defoliation, and eventually plant death
- Sooty mold (soft scale) caused by feeding of Nymphs and adults on the cell contents and vascular fluid.
- Reduced photosynthesis from sooty mold



Yellowing leaves from Cycad scale infestation



Sooty mold growth from honeydew excretion

# General Management

- Monitoring
  - Observe the underside of chlorotic areas (yellow areas on leaves) – an indication of armored scale
  - Determine if alive by removing the cover or crushing them to see if liquid comes out (Pundt, 2020)
  - Scout for sooty mold and honeydew
  - If ants are near, that means there are honeydew secretions
- Cultural Control
  - Plant stress is often associated with scale outbreaks
  - Washing plant with moderate pressure water for removal of scales in early stage of detection.



Odorous House Ants tending to scale insects



Chlorosis of underside of leaves on *Camellia japonica* host plant by Tea scale (*Fiorinia theae*)



# Management: Biological

- Most scales can be controlled by natural enemies
  - Parasitoid wasps
  - Lady beetles
  - Predacious mites
  - Lacewings

Have diversity in the landscape to provide habitat for biological control!



Parasitoid wasp  
*Encarsia perniciosi*



Multicolored Asian lady beetle  
*Harmonia axyridis*



Predatory mites  
(Family Phytoseiidae)



Green Lacewing  
*Mallada signata*

Photo: Left - INRA-HYPPZ , Institut National de la Recherche Agronomique, Bugwood.org, #5449520; Middle Left - A.G. Dale; Middle Right - Whitney Cranshaw, Colorado State University, Bugwood.org, #UGA5303071; Right - Sonya Broughton, Department of Agriculture & Food Western Australia, Bugwood.org, #UGA5186096

# Chemical Management: Homeowners

- THE LABEL IS THE LAW!
- Some home-use insecticides can be applied but ask extension agent about recommendations.
- Remove infested areas of plant.
- Target crawler stage - Horticultural oils can help penetrate scale covers
  - Period of late winter to early summer
  - During dormant season



Scale infestation on  
cabbage palm



# Chemical Management: Commercial

- THE LABEL IS THE LAW!
- Avoid broad-spectrum pesticides to conserve natural enemies
- Systemic insecticides:
  - Be careful of plant's flowering life stages
  - Be aware of effect on beneficial insects and natural enemies
  - Secondary pest increases may be caused by some insecticides.



Infestation on cycad by scales  
(Genus Aulacaspis)

# Mealybugs (Family: Pseudococcidae)

- Common pest with around 2,000 species worldwide
  - About 70-80 species known throughout FL.
- Although mealybugs are often known to be found on the foliage, they can also be seen in the vegetative shoot apex or for some smaller species in the soil (Osborne, 2015).
- Worldwide greenhouse pest
- Adult females generally used for species-level identification





# Identification

- Number of wax filaments on the side of the body
- Presence/length of wax filaments at the end of the body (i.e., terminal wax filaments)
- Presence of an ovisac (a waxy mass covering the eggs)
- Body shape, size, and color
- Color of eggs (if present)
- Color of fluids when crushed
- Host plant!



Longtailed mealybugs, *Pseudococcus longispinus*.

# Differences Amongst Common Species

Citrus Mealybug  
*Planococcus citri*

"Stripes" across the body      Wax filaments



Wax filaments at end of body (tail)

- Clear body fluid when crushed
- Cottony ovisac egg masses on host plant (Gill, 2012)

Pink Hibiscus Mealybug  
*Maconellicoccus hirsutus*



- No "stripes" on back
- Body fluid dark red
- Ovisac beneath the body (Osborne, 2015)

*Hypogeococcus pungens*



- No lateral, short filaments around body
- Pink to reddish body fluids when crushed
- Adult females like to be concealed in cottony egg masses (Osborne, 2015)



# Biology

- Some Mealybug females reproduce using parthenogenesis or sexually
  - Parthenogenesis – female reproduces asexually, meaning does not need male present to create eggs.
- Most female mealybugs have an ovisac, which is an egg mass that is kept beneath them.
  - A few species give live birth although it is rare.
  - Some species just lay eggs
- Mealybug males have 2 wings that are generally gnat-like



Mealybugs on leaf of plant



Pink Hibiscus Male Mealybug

# General Life Cycle of Mealybug

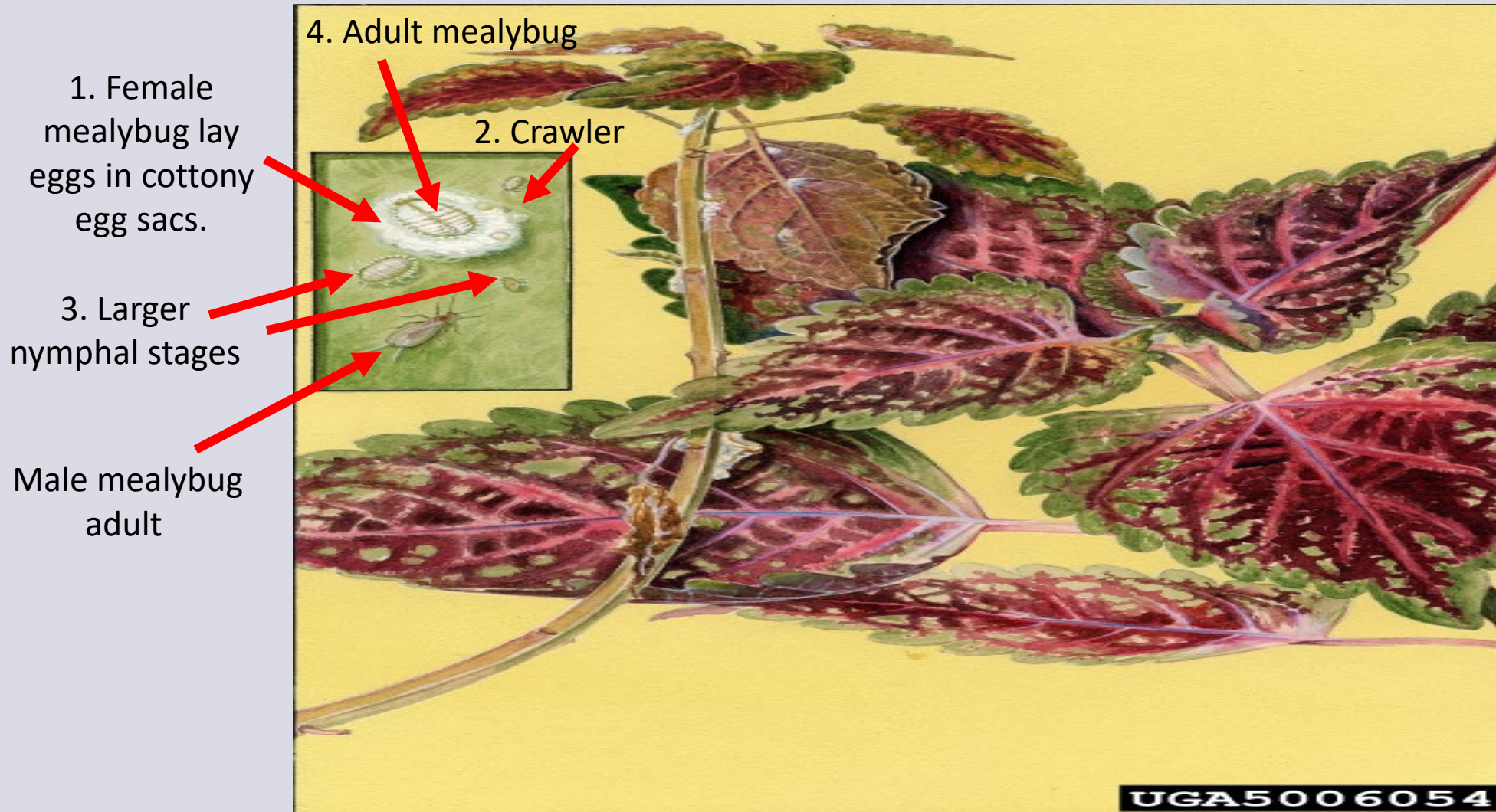


Photo: Art Cushman, USDA Systematics Entomology Laboratory, Bugwood.org, #UGA5006054



# Symptoms

- Sooty mold
- White fluffy masses
- Chlorosis
- Defoliation
- Wilting, stunted growth
- Premature leaf fall
- Mealybugs on plant roots
- Leaf and flower bunching
  - Specific for Pink Hibiscus mealybug, *Maconellicoccus hirsutus*



Ornamental shrub displaying bunching of leaves.



Blind Mealybug  
*Rhizoecus dianthi*

# Management

- Biological control
  - Parasitoid wasp
    - *Leptomastix dactylopii*
  - Mealybug destroyer, *Cryptolaemus montrouzieri*
  - Lady beetles
  - Lacewings
  - Syrphid flies, *Episyrphus balteatus* – Marmalade Hover flies (predatory larvae)
  - Check to see if there are ants farming the mealybugs!
    - Ants will defend mealybugs from predators and parasitoids
- Outdoor plants
  - Cultural and biological control should be sufficient
  - Make decisions based on the species and host



Mealybug destroyer  
(ladybug larvae)



Syrphid or flower flies  
(Family Syrphidae)



# Management: Homeowners

- Indoor plants
  - Spot treat by swabbing insects with 70% isopropyl alcohol
  - Can be sprayed with diluted isopropyl, 10-25%



Mealybugs feeding on leaf

# Monitoring

- Monitoring:
  - Some mealybug species are attracted to pheromone sticky traps that capture males or tape traps, so that they will not reproduce and monitor population within area.
  - Observe trees, ornamentals, and other plants for sooty mold on leaves as well as clusters of mealybugs.
  - If defoliation occurs, check leaves for white cottony masses or wax.
  - Check roots for cottony egg masses or wax.
  - Check new buds of plants for survivors of winter.



Tape Trap



# Reporting to UF/IFAS Faculty in Florida

- Local county extension office

<https://sfyl.ifas.ufl.edu/find-your-local-office/>

- Insect ID Lab - Dr. Lyle Buss

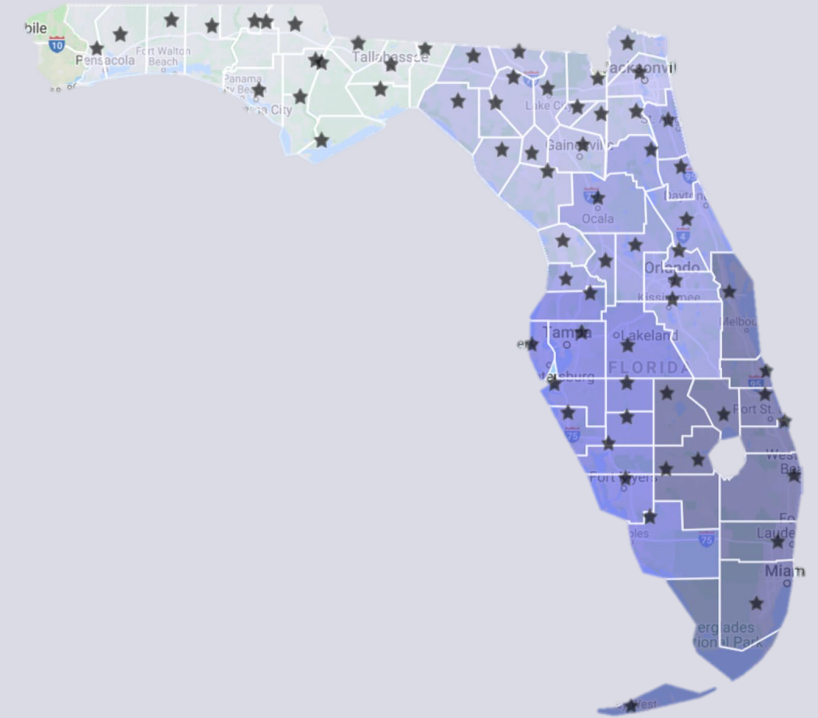
<http://entnemdept.ufl.edu/insectid/>

- Nematode Diagnostic Lab - Dr. Billy Crow

<http://nematology.ifas.ufl.edu/assaylab/index.html>

- Plant Diagnostic Center - Dr. Carrie Harmon

<https://plantpath.ifas.ufl.edu/extension/plant-diagnostic-center/>



# Reporting to FDACS-DPI in Florida

Florida Department of Agriculture and Consumer Services (FDACS)  
- Division of Plant Industry (DPI)

- FDACS, DPI Responsibility

- Announcing detection or establishment of new invasive species.
- Reporting is a legal obligation under Florida Statute 581.091.

- Submission Form

- <http://forms.freshfromflorida.com/08400.pdf>
- <https://www.fdacs.gov/Agriculture-Industry/Pests-and-Diseases/How-to-Submit-a-Sample-for-Identification>



# FDACS, DPI Contact

- Dr. Leroy Whilby, Bureau Chief-Entomology, Nematology and Plant Pathology
  - 352-395-4661
  - [Leroy.whilby@freshfromflorida.com](mailto:Leroy.whilby@freshfromflorida.com)
- Dr. Paul Skelley, Assistant Chief-Entomology, Nematology and Plant Pathology
  - 352-395-4678
  - [Paul.skelley@freshfromflorida.com](mailto:Paul.skelley@freshfromflorida.com)
- Division of Plant Industry Hotline
  - 1-888-397-1517
  - [DPIHelpline@FDACS.gov](mailto:DPIHelpline@FDACS.gov)

# Reporting using DDIS in Florida

## Digital Diagnostic and Identification System (DDIS)

- Digital Diagnostic Collaboration
  - Extension agents
  - Laboratories
  - Clinics
  - Specialists
- <https://ddis.ifas.ufl.edu/>



The screenshot displays the DDIS website interface. At the top, there is a blue header with the UF IFAS Extension logo on the left and the DDIS logo on the right. Below the header is a navigation menu with links for Home, Media Library, Diagnostic Labs, Equipment, Training, and Contact Us. A login section includes links for 'Become a User' and 'Forgot Your Password', along with input fields for 'user name' and 'password', and a 'Sign In' button. The main content area features a photograph of a yellow and black striped caterpillar on a green leaf. To the right of the image, the following sample information is displayed:

- Sample Type:** Insect (Plant)
- Common Name:** Snowbush spanworm
- Scientific Name:** *Melanchroia chephise*
- Family:** Geometridae
- Sample Submitter:** Joe Sowards
- Sample ID:** 15-2335



# Find More Information At:

<https://entnemdept.ufl.edu/ffd/>



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- U.S. Department of Agriculture Animal and Plant Health Inspection Service (USDA-APHIS)
- Cooperative Agricultural Pest Survey Program (CAPS)
- Florida Department of Agriculture and Consumer Services (FDACS)
- National Plant Diagnostic Network (NPDN)
- Sentinel Plant Network (SPN)
- University of Florida Institute of Food and Agricultural Sciences (UF-IFAS)
- Protect U.S.



# Educational Disclaimer and Citation

- This presentation can be used for educational purposes for NON-PROFIT workshops, trainings, etc.
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