Insects That Impact Fruit Appearance & New Pest Management Challenges

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Insects that Impact Fruit Appearance

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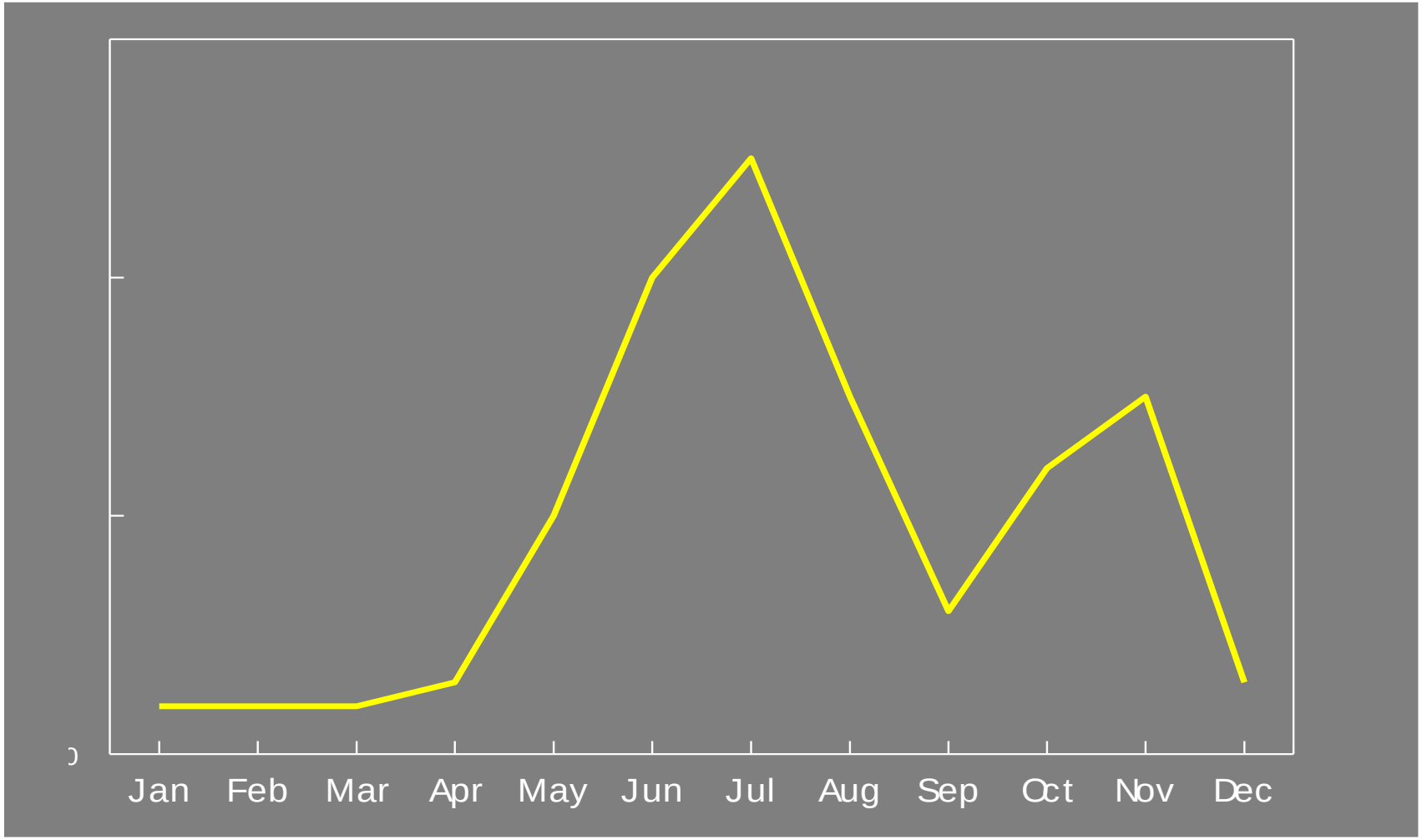
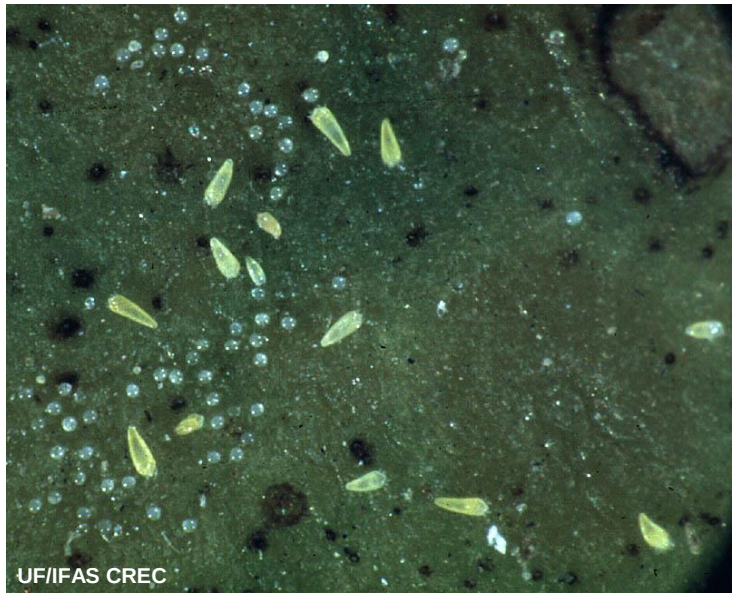
Citrus Rust Mite (CRM; *Phyllocoptruta oleivora*)





CRM populations peak in early summer in central FL, then again at a smaller scale in mid-late fall depending on weather.

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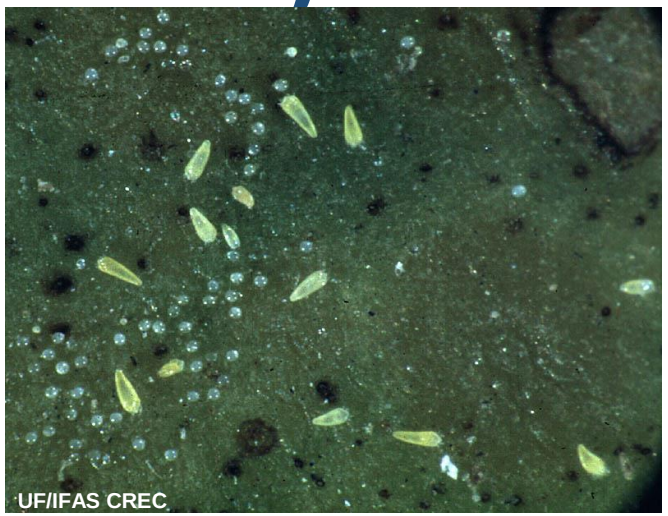
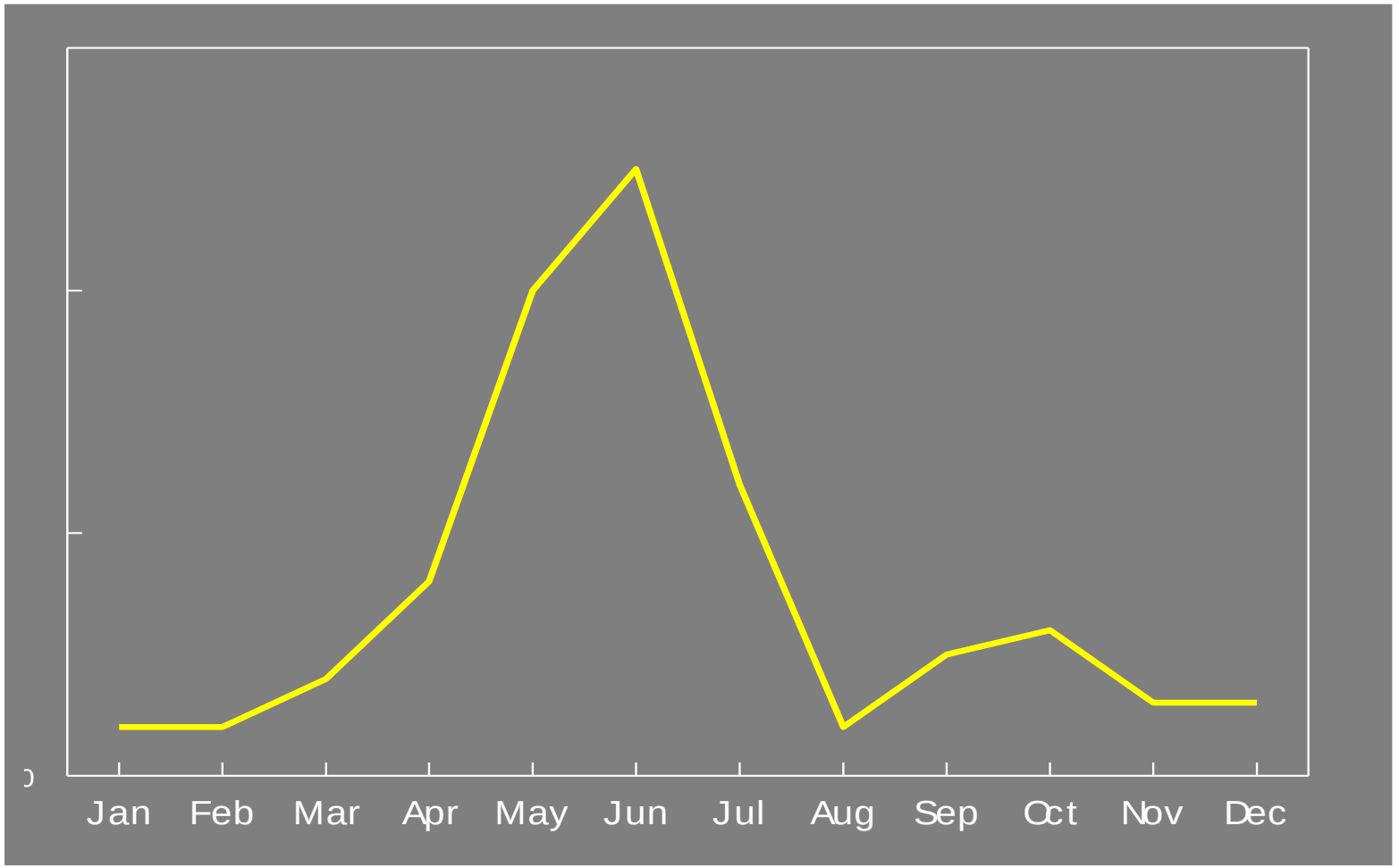
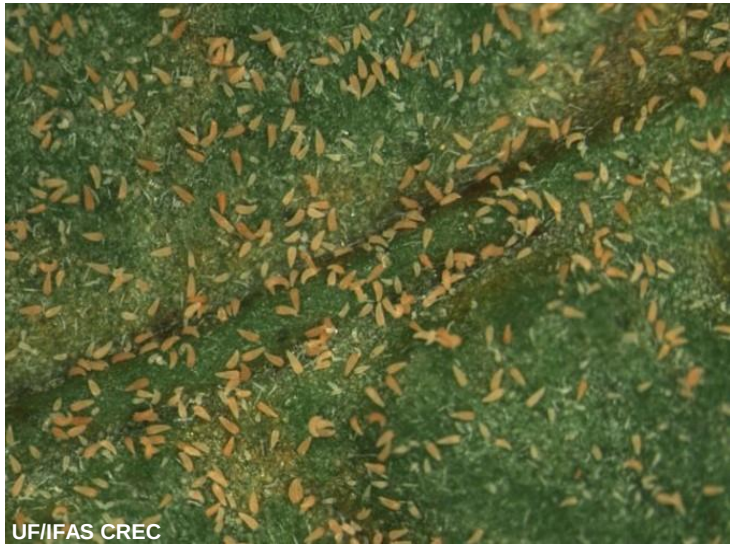
Citrus Rust Mite (*Phyllocoptruta oleivora*)

- Damage
  - Feeding injury
    - Russeting of fruit & leaves
    - “sharkskin” = damage EARLY in fruit maturity
    - “bronzing” = damage LATER in fruit maturity
  - Distortion of new leaf growth
  - Lesions on lower surfaces & along midribs of mature leaves
- Quick ID
  - Tiny cone shape
  - Translucent to light yellow
  - Eggs look like water droplets



Pink Citrus Rust Mite (PCRM; *Aculops pelekassi*)





PCRM populations peak in mid spring/early summer in central Florida.
Populations build up on flowers & leaves prior to feeding on fruit.

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Pink Citrus Rust Mite (PCRM; *Aculops pelekassi*)

- Damage
  - Leaf loss with high pressure
  - PCRM start feeding on leaves & flowers before moving to fruit
  - Feeding injury on young fruit- leads to discoloration/"sharkskin" as fruit mature

- Quick ID
  - Tiny cone shape
  - Light pink color
  - Egg flat and opaque

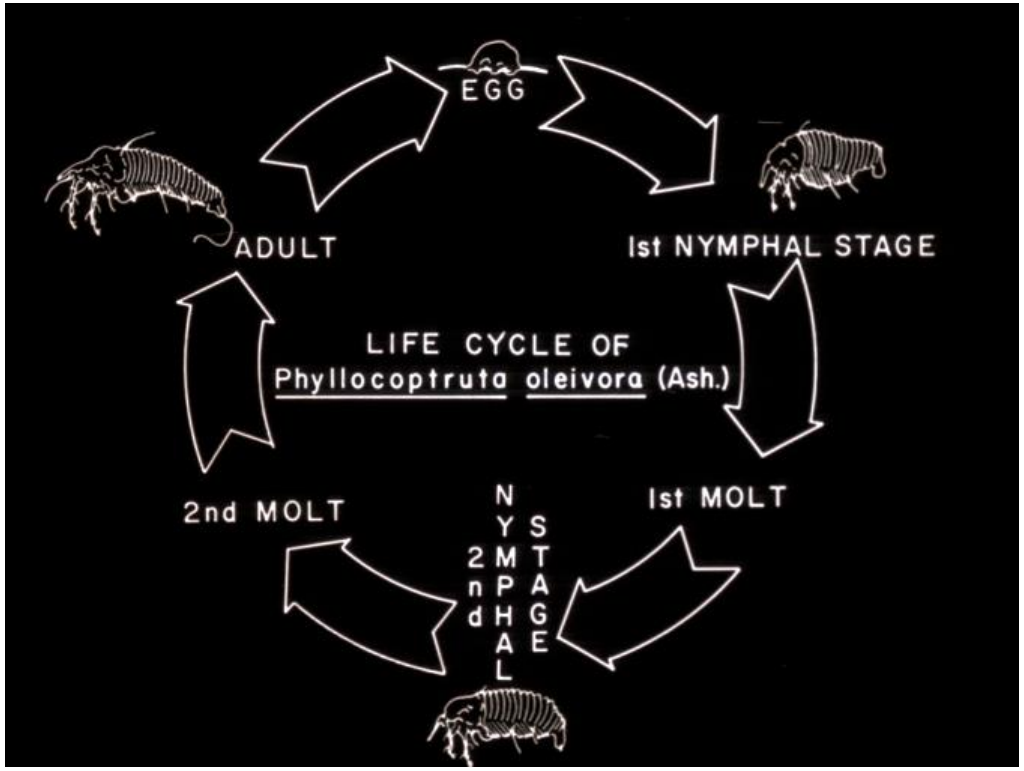
Leaf distortion on new growth

Bronzing over entire fruit because damage was done early in fruit's development

Citrus Rust Mite Life Cycle

- Females lay 2 eggs/day
  - ~30 eggs in a lifetime
- Egg → adult in 6 days
- Adult male longevity approx. 6 days
- Adult female longevity approx. 14 days

- Populations can increase rapidly under ideal conditions



Citrus Rust Mite Control

- *Hirsutella thompsonii* fungus
- Predatory Arthropods

  -predatory mites, lady beetles, ants, spiders, lacewing larvae
- Insecticides

  Action thresholds

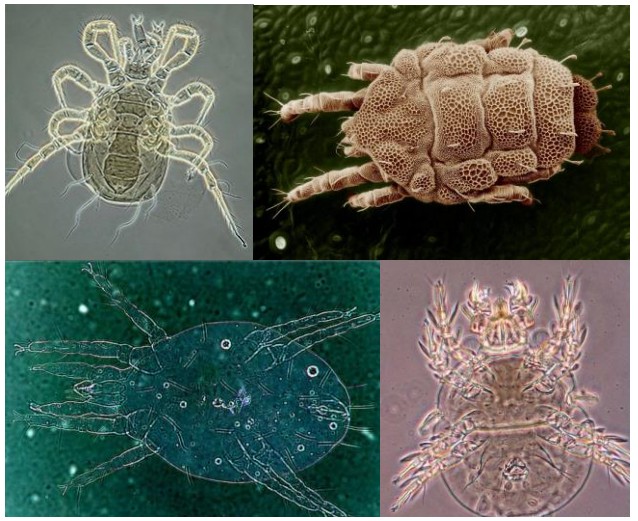
  -Processed fruit = 10 rust mites/ 2 cm^2

  1-3 oil or miticide applications/season

  -Fresh fruit = 2 rust mites/ 2 cm^2

  3-5 miticide applications/season

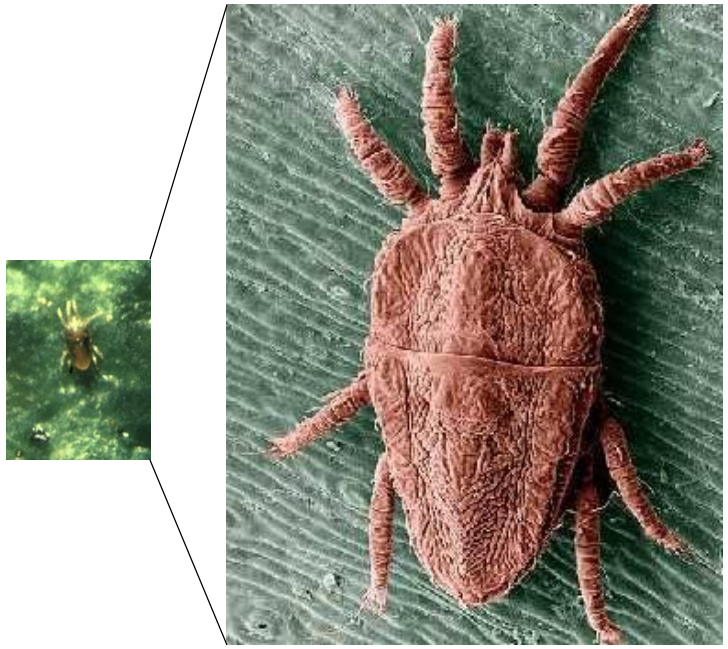
Hirsutella fungus consuming rust mite



Predatory mites

Brevipalpus mites

- Over 622 species in 26 genera worldwide
- False spider mites, flat mites
- Primarily found in tropical/subtropical areas
- Genus *Brevipalpus* most important economic group
- Toxic saliva causes feeding lesions
- Vectors of Citrus Leprosis



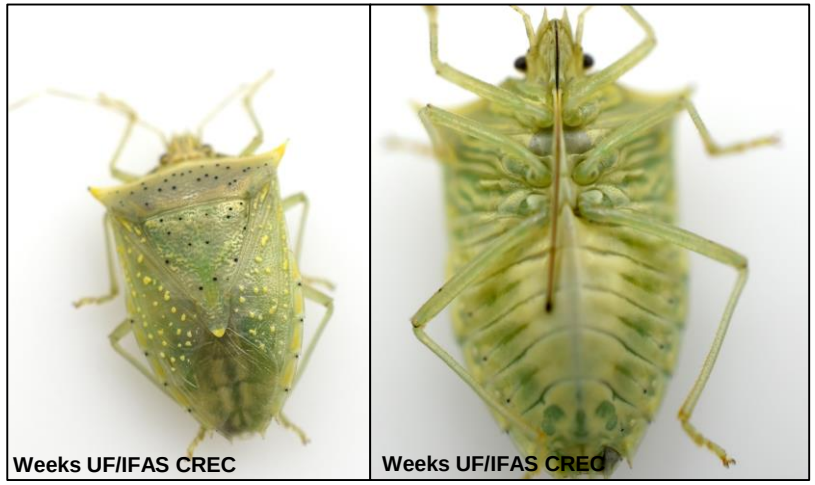
Brevipalpus **mite and zoomed in micrograph of a *Brevipalpus* mite**

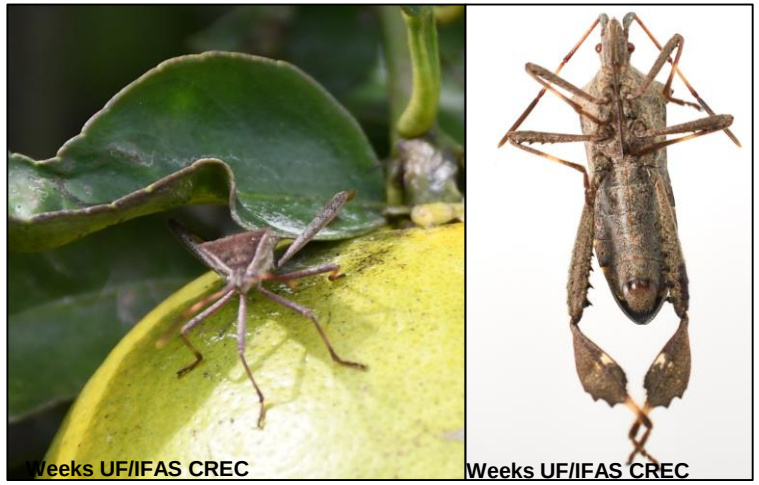
Brevipalpus **mite feeding damage**

Brevipalpus mites & Leprosis

- Problem on sweet orange varieties
- Caused by virus that is not systemic in plant
- *B. phoenicis* is the only confirmed vector
- Miticide costs on Brazilian citrus exceed 90 million US dollars per year (Omoto 2000)
- Currently not in Florida (is present in Mexico)
- Symptoms:
  - Chlorotic leaf lesions becoming brown with or without necrotic centers
  - Flat or slightly raised necrotic areas on twigs and leaves
  - Flat or depressed lesions on fruit with concentric patterns and gumming

Piercing-Sucking Pests: Leaf-footed Bugs and Stinkbugs





Use piercing-sucking mouthpart to puncture fruit & feed.
Feeding holes create openings for secondary pests/pathogens to enter including bacteria, fungi, and other insects.

Piercing-Sucking Pests: Leaf-footed bugs and Stinkbugs

- Management
  - Remove habitat
    - Weed control
    - IF using cover crops, avoid preferred hosts like peas
  - Insecticides if necessary- prophylactic treatment with Malathion*
    - Advisable prior to harvest of neighboring crops IF neighboring crop harbors these bugs (examples: tomato, peppers)

*Malathion is the primary material recommended for control of piercing-sucking plant bugs (FCPG)

Scales

- Several species of ARMORED SCALES can be problematic to fruit appearance
  - Red scale, purple scale, Chaff scale
- Scale insects in Florida have historically been under biological control by natural enemies
- Not currently considered key pests in the development of pest management programs

“Secrets to success” for biological control of scale insects

- Adult scales are sessile- either *VERY* slow moving or not moving at all
- High number of offspring to support natural enemy population growth
- Populations tend to be concentrated → easy for natural enemies to find

- IF biological control is unsuccessful, chemical treatment may be warranted. Insecticidal management should be targeted towards crawler stage.

Aggregation of red scale on green fruit

Florida red scale
Chrysomphalus aonidum

- Damage
  - Feeding occurs on leaves, green twigs, and fruit
  - Feeding causes discoloration at the feeding site

Florida Red Scale (*Chrysomphalus aonidum*)

- Red scale largely under biological control by parasitic wasps released in Florida (*Aphytis* wasps)

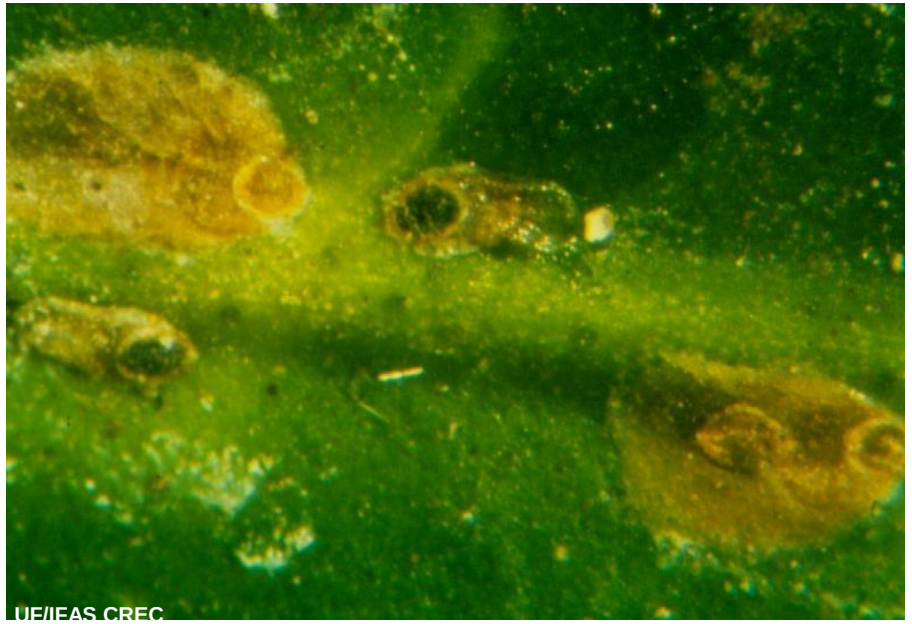
- Good example of successful classical biological control

Purple scale
Lepidosaphes beckii

- Once major pest of fruit, leaves, and twigs
- Populations are highest in late spring/early summer
- Parasitoid (*Aphytis lepidosaphes*) introduced in 1950s to manage

Chaff scale
Parlatoria pergandii

- Often found on trunk and inner canopy
- Fruit feeding causes spotting
- Slow rate of reproduction + parasitoid *Aphytis hispanicus* historically kept populations low



Thrips

- Flower thrips
  - *Frankliniella bispinosa*
  - *Frankliniella kelliae*
- Orchid thrips
  - *Chaetanaphothrips orchidii*
  - *Danothrips trifasciatus*

- Greenhouse thrips
  - *Heliothrips haemorrhoidalis*
- Chili thrips
  - *Scirtothrips dorsalis*

Orchid and Greenhouse Thrips

- Cause rind blemishes on developing fruit, in particular “ring spotting”
- Develop in protected areas (under calyx, between touching fruit)
- Primarily a problem on red grapefruit varieties but can occur on white grapefruit varieties as well

Ring scarring where fruit in clusters were touching

Monitoring Orchid and Greenhouse Thrips

- Examine interior clusters of red grapefruit when fruit are beginning to touch
- Use 10x hand lens to search for thrips (larvae and adults) on fruit where touching
- If most clusters sampled contain thrips, then insecticide application may be justified
- This damage is cosmetic in nature and does not affect internal fruit quality
  - Your market will determine management needs for fresh fruit

New Pest Management Challenges

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New pest in Florida citrus: Lebbeck mealybug (*Nipaecoccus viridis)*

- Can cause economic damage
- Export pest concern (EPPO)
- Serious pest around the world in citrus growing regions
- Known to cause significant damage, fruit drop
- First identified in 1894

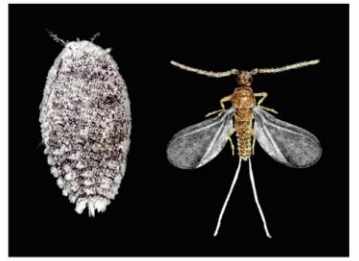
Similar looking pests

Cottony cushion scale

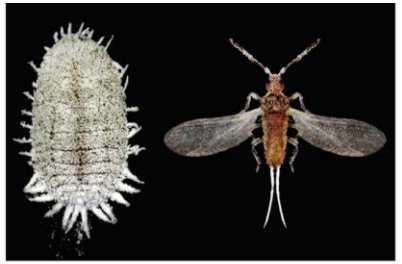
Jan 2020 *Citrus industry*

Wooly whitefly

February 2020, L. Diepenbrock



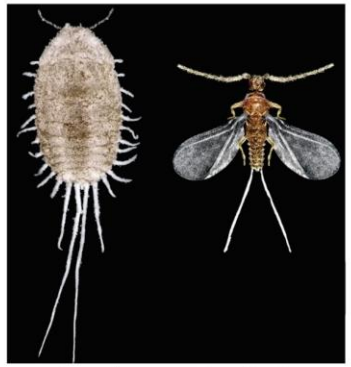
Nipaecoccus viridis, lebbeck mealybug



Planococcus citri, citrus mealybug

Phenacoccus solenopsis, cotton mealybug

Paracoccus marginatus, papaya mealybug



Pseudococcus longispinus,
longtailed mealybug

Maconellicoccus hirsutus,
pink hibiscus mealybug

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Distribution in Florida

40,000+ acres surveyed since first find

- Commercial
  - Highlands
  - Hendry
  - DeSoto
  - Hendry
  - Polk
  - St. Lucie
- Residential
  - Broward

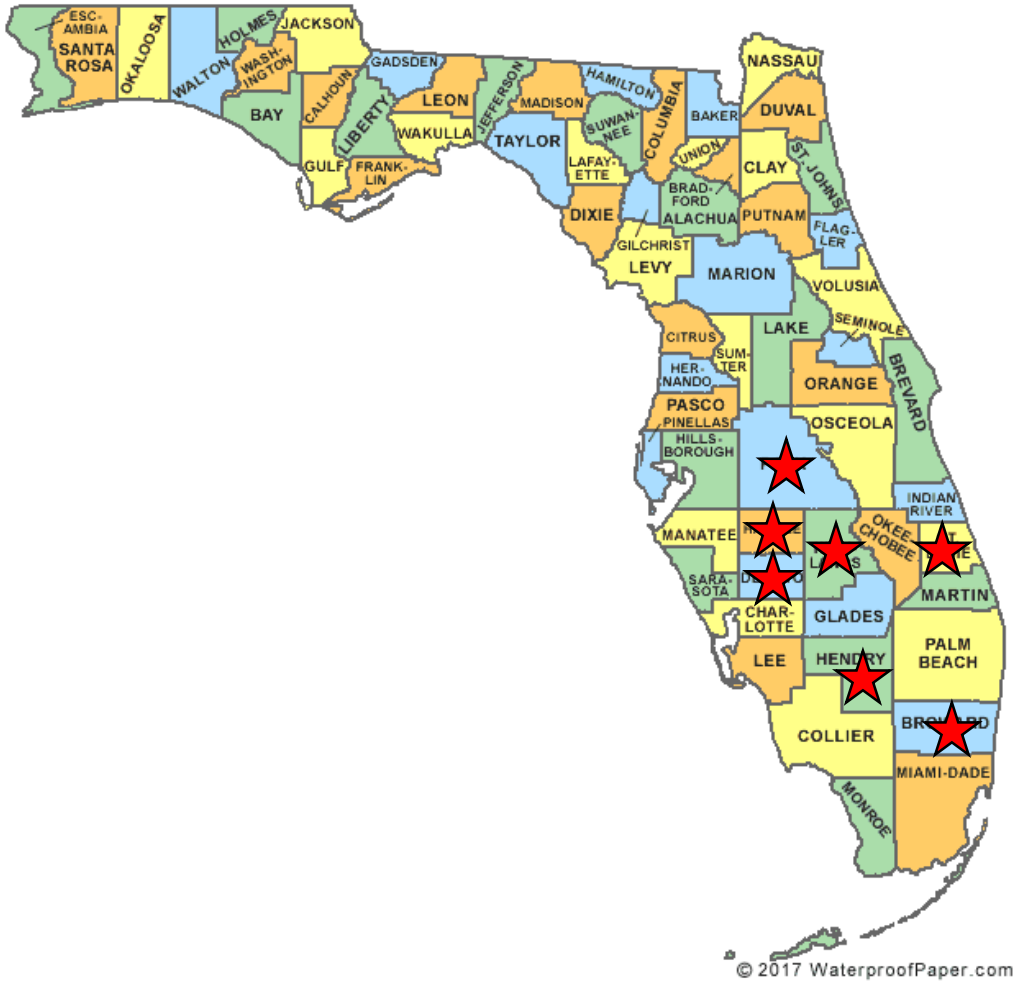

Image Credit: www.waterproofpaper.com/printable-maps/florida.shtml

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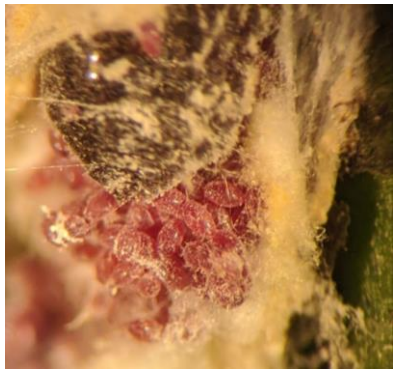
Why is this becoming a problem now?

- Lebbeck mealybug is likely a pest of opportunity
- Interceptions in ports of entry and finding in wild habitat (2009) suggests it may have been here a while
- Persisted due to ideal conditions and lots of food resources
- Why citrus?
  - Most varieties are excellent hosts and used by the pest around the world
  - > decade of psyllid management = reduced predators in system AND psyllid sprays are unlikely to have much impact
  - Challenging to scout for until at high levels



Favored Environmental Factors

- A pest in tropical and subtropical environments
- Survives well in plant hardiness zones 9-11
  - BUT can overwinter in cold regions
- Thrives in high humidity (60%) and high temperatures (86°F)
- Feeds on fruit, vegetables, field crops, and ornamentals

Image Credit: https://planthardiness.ars.usda.gov/PHZMWeb/#

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Host Plants

- Has many host plants such as fruit trees and ornamental plants
- This list contains common plants, but is not all-inclusive

- Jackfruit
- Asparagus
- Citrus
- Loquat
- Common fig
- Gardenia
- Soybean
- Cotton
- Hibiscus
- Mango
- Mulberry
- Avocado
- Pomegranate
- Potato
- Guava

Damage

- Not known to spread a disease
- Feeding damage from toxin mealybugs inject when they feed, causes fruit to “bubble”
- Fruit drop is the biggest damage assessed in other regions

Photo Credit: T.R. Weeks, UF/IFAS CREC

Damage

- Fruit damage
  - Damaged fruit will not be marketable (fresh)
  - Juice quality?
- Leaves exhibit feeding damage
- Excessive sooty mold build up
- May stunt growth on young trees
- Can cause tree death in new plantings

Any questions?

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