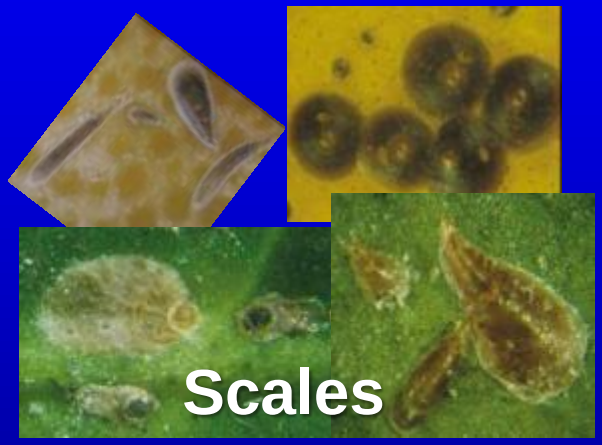
Scouting Citrus for Pests and Beneficials

Phil Stansly

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

Predators

Psyllids



Scales

Parasitoids

CLM

Mites

Pathogens

Thrips

Pesticide Use in Florida Citrus Before HLB

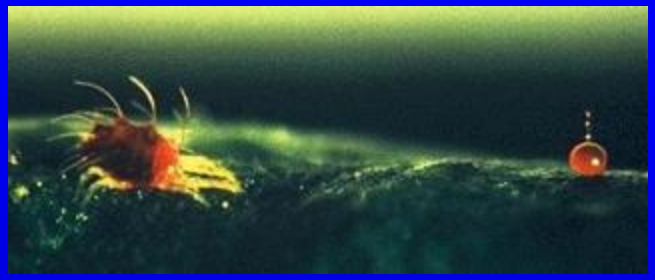
- Most pests under biological control
- Most process fruit received 1 or 2 oil sprays, primarily for greasy spot
- Copper 2nd most used pesticide
- Acaracides used primarily on fresh fruit

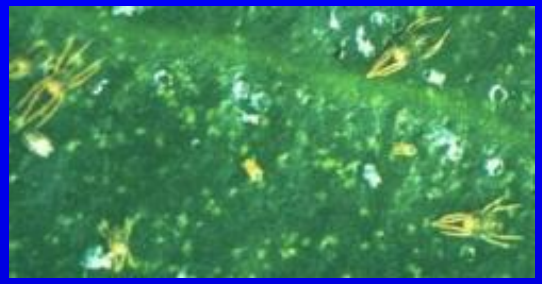
Insecticide Use in SW Florida Citrus: 2011

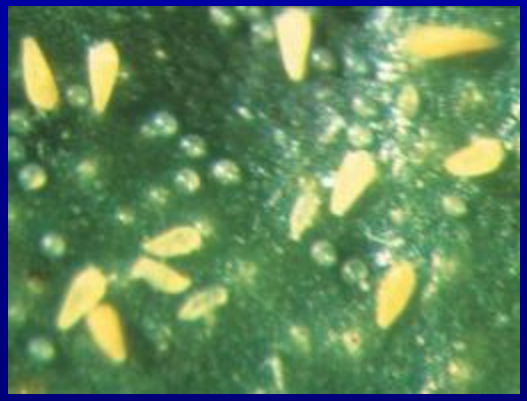
Average applications per year: 7.3

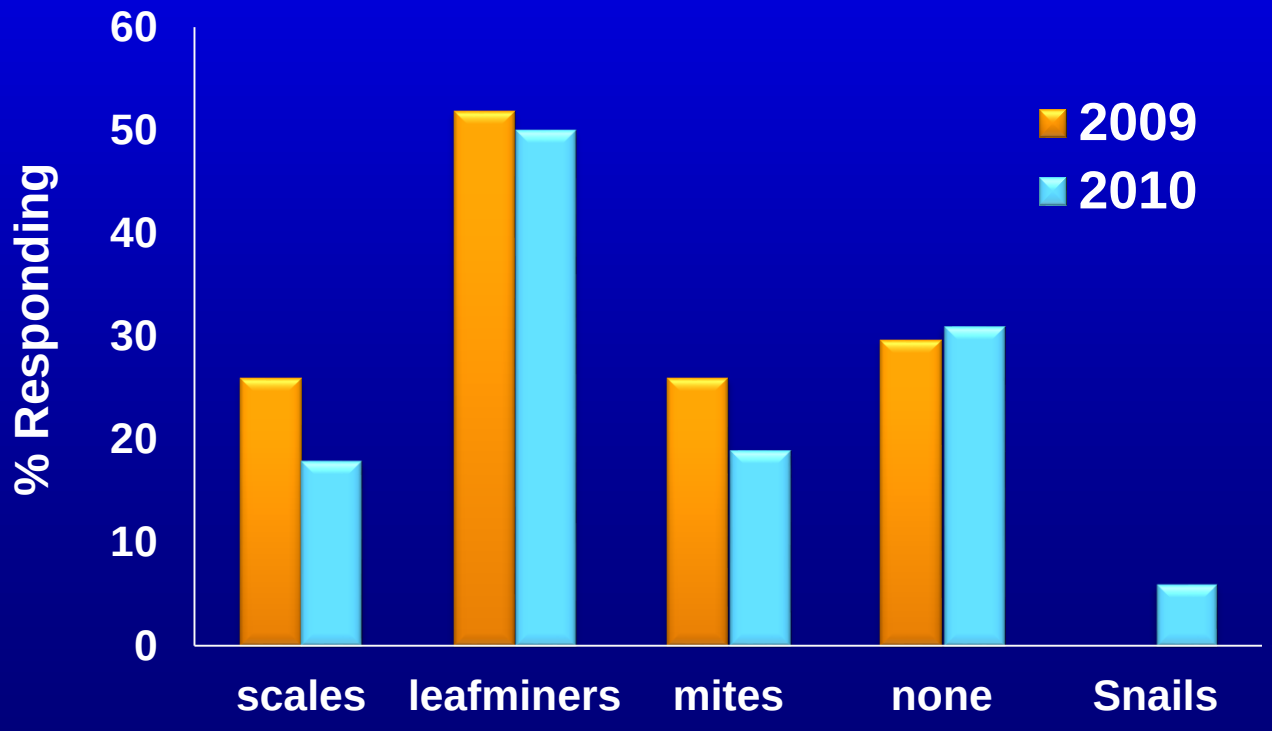
MOA www.irac-online.org	MOA	% Total
Carbamates	1A	7.4
Organophosphates	1B	35
Pyrethroids	3A	26
Neonicotinoid	4A	7.4
Abamectin	6	13
Micromite	15	8.4
Movento	23	3.2
Total	4%	100%

Grower Survey: Increase of Secondary Pests:



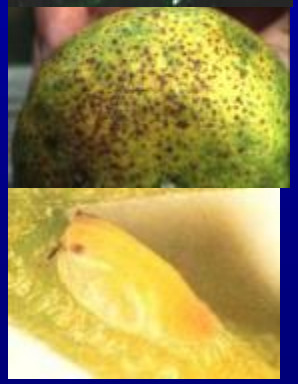






Key Florida Citrus Pests and Their Biological Control Agents



- **Mites: spider (true & false), broad, spider**
  - ***Hirsutella*, mites, ladybeetles**
- **Thrips**
  - **Minute pirate bugs, mites**
- **Leafminer**
  - **Ants, Spiders, *Ageniaspis***
- **Root weevils**
  - **Nematodes**
- **Scales: armored, soft**
  - **Ladybeetles, *Aphytis* spp.**
- **Asian Citrus Psyllid**
  - **Ladybeetles, *Tamarixia***

Predators: Ladybeetles – Lacewings, Spiders

Funnelweb

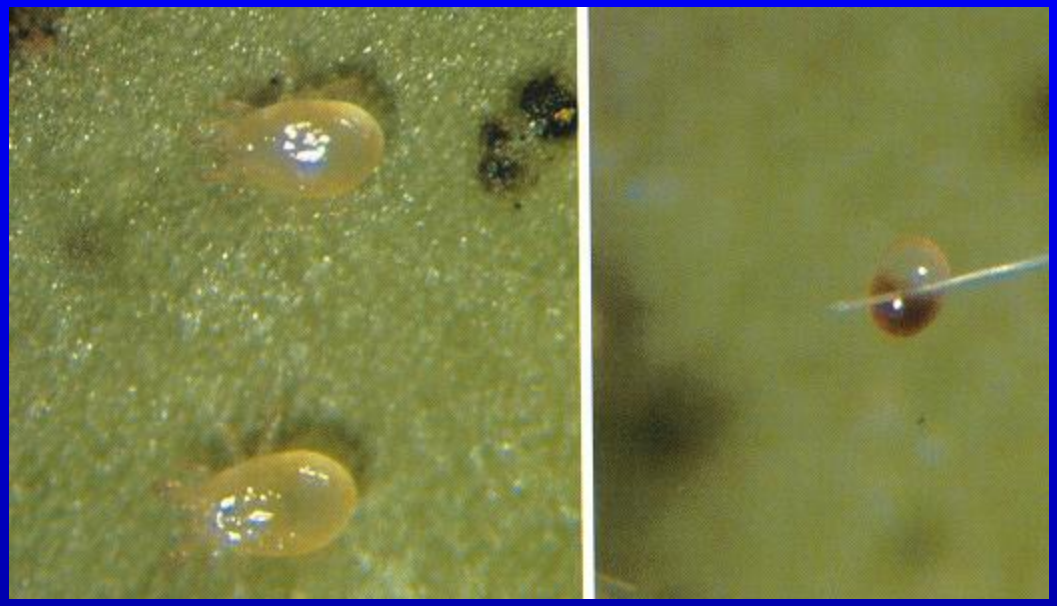
Jumping

Spitting

Velox

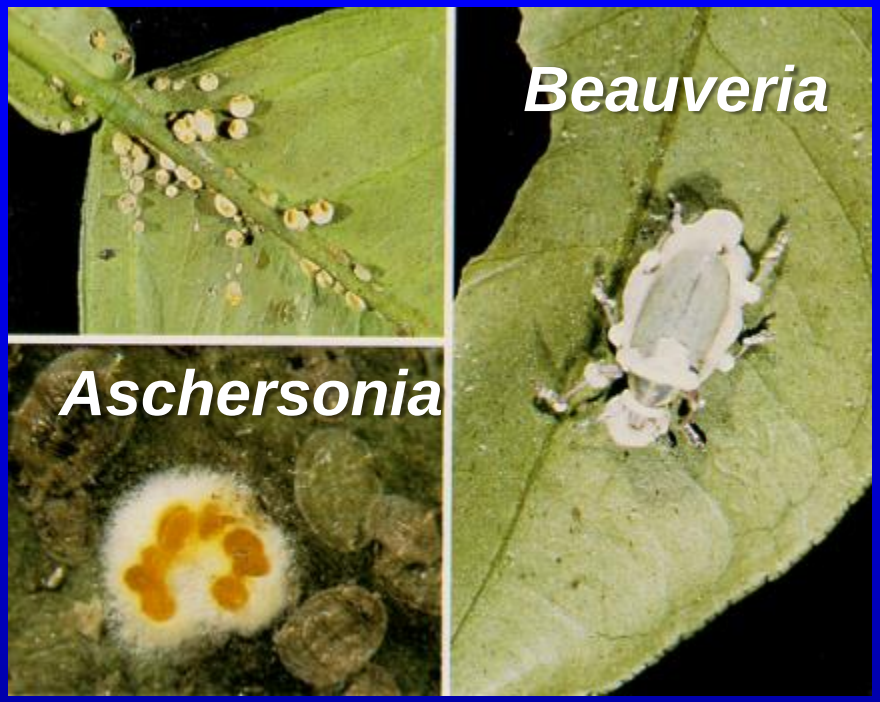
Widow

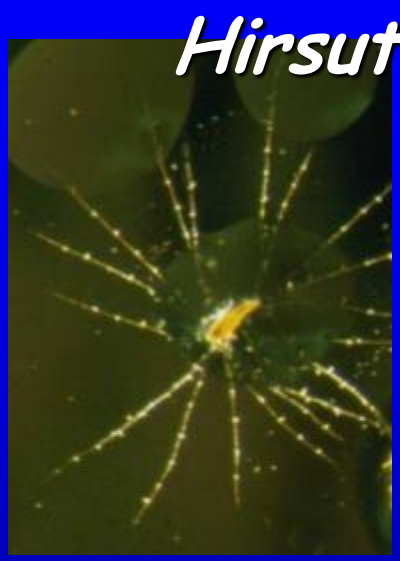
Predaceous mites: Phytoseiids



Parasitoids: Parasitic wasps

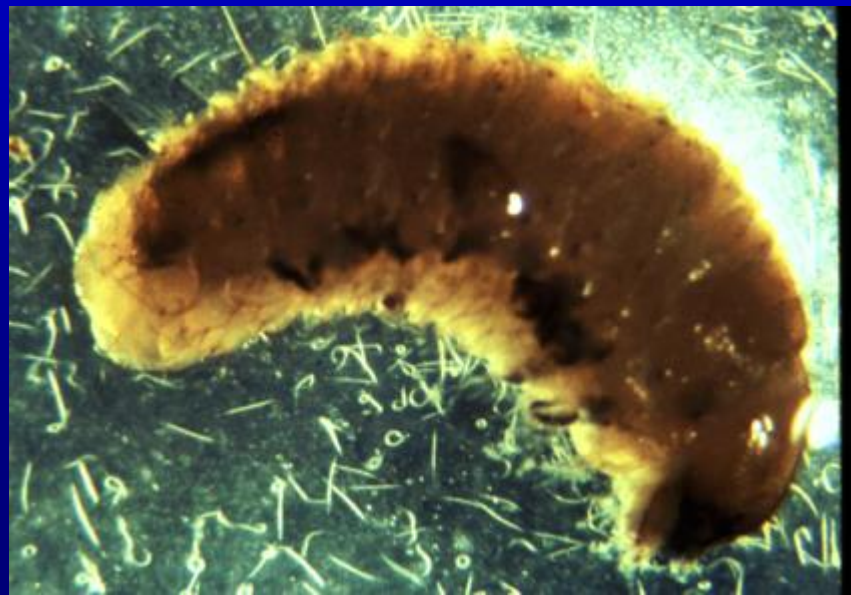
Pathogens: Fungi





Hirsutella

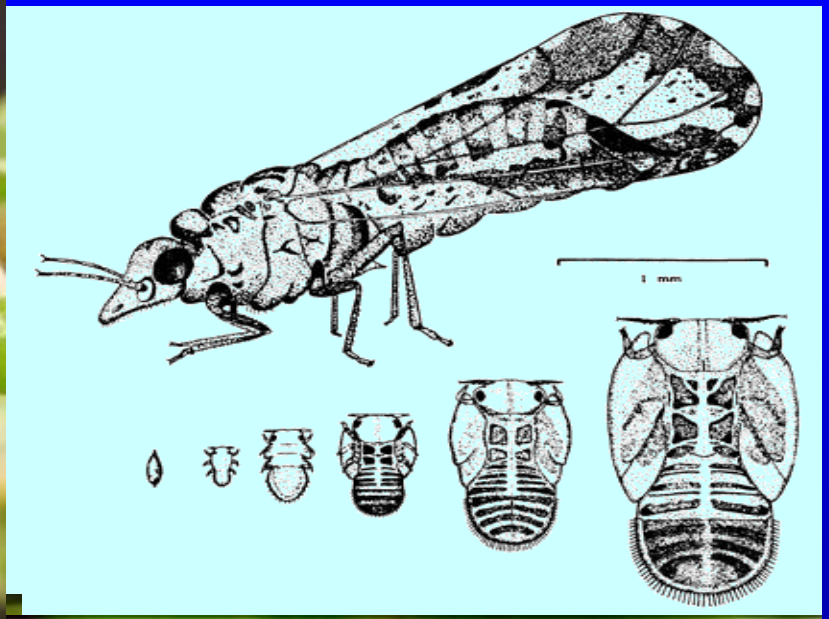
Nematodes



Citrus Pests: Sucking Insects

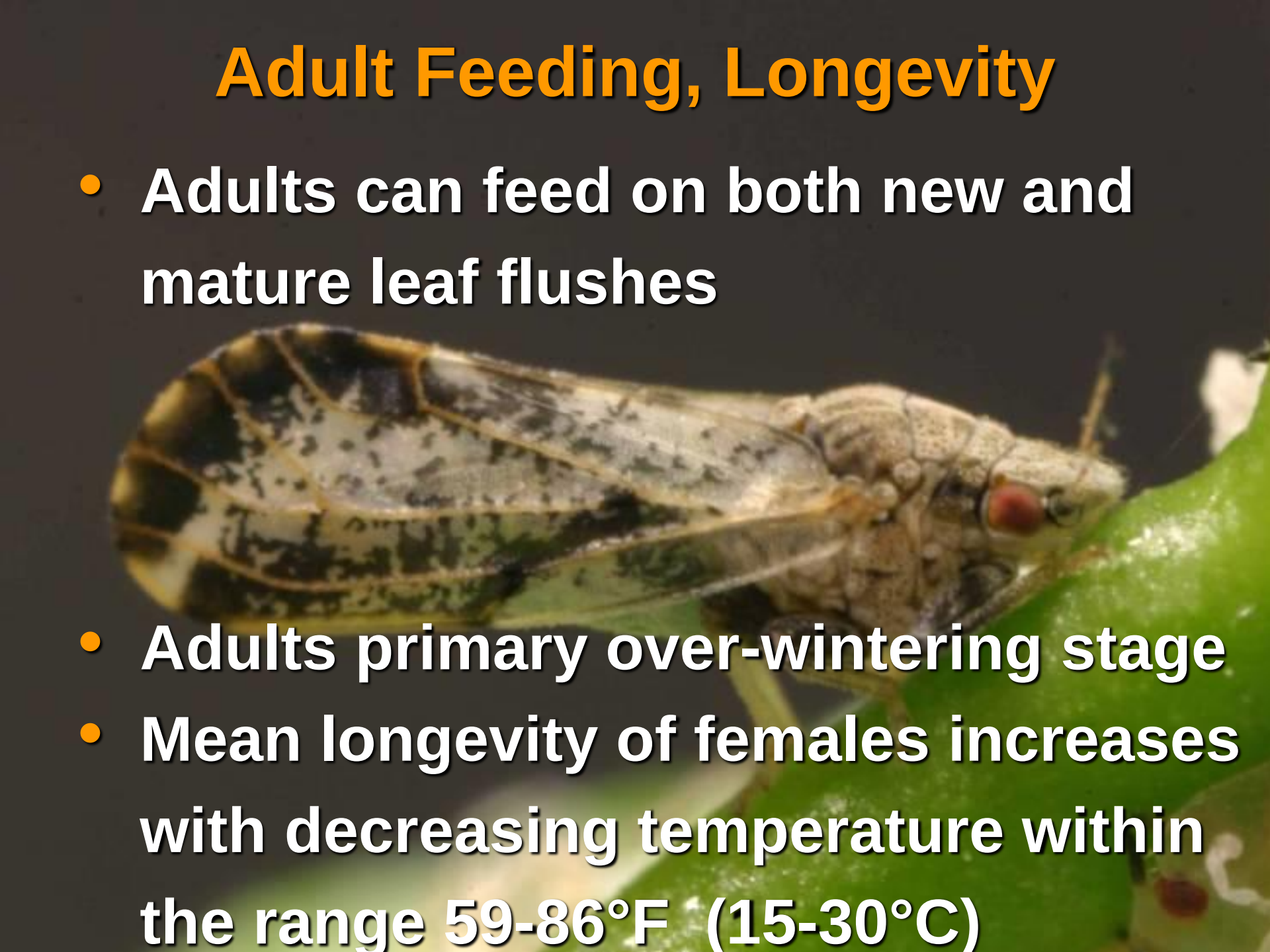
	Nymphs	Adults	Honey-Dew?
Psyllids	Wingpads only Stay on flush	Males and females alike	Yes, waxy secretion (nymphs)
Aphids	Like adults	Usually no males. Some winged	Yes
Whiteflies	Immobile after crawler- scalelike	Males and females winged	Yes
Armored Scales	Only crawler mobil	Cover separates, Males winged	No
Soft Scales	Can move when disturbed and at molts	Cover attached, Males winged	Yes
Mealy bugs	Retain mobility	Waxy filaments. Males winged	Yes
Stinkbugs	Like adults except for wings	Males and females alike	No

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)

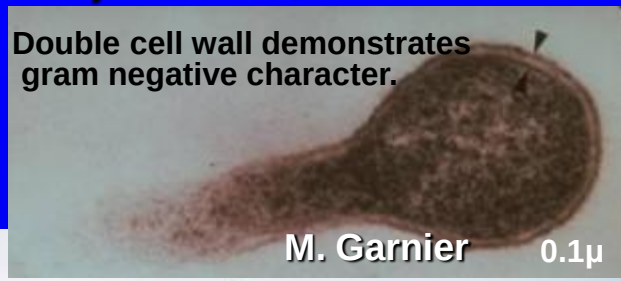
- Adults need to feed on young flush to mature eggs. Feeding of both adults and nymphs causes leaf distortion.
- Eggs are laid ONLY in young flush, are about 0.3 mm long and almond shaped.
- Eggs are pale when laid, turn yellow then orange as they mature. Often difficult to see.

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.

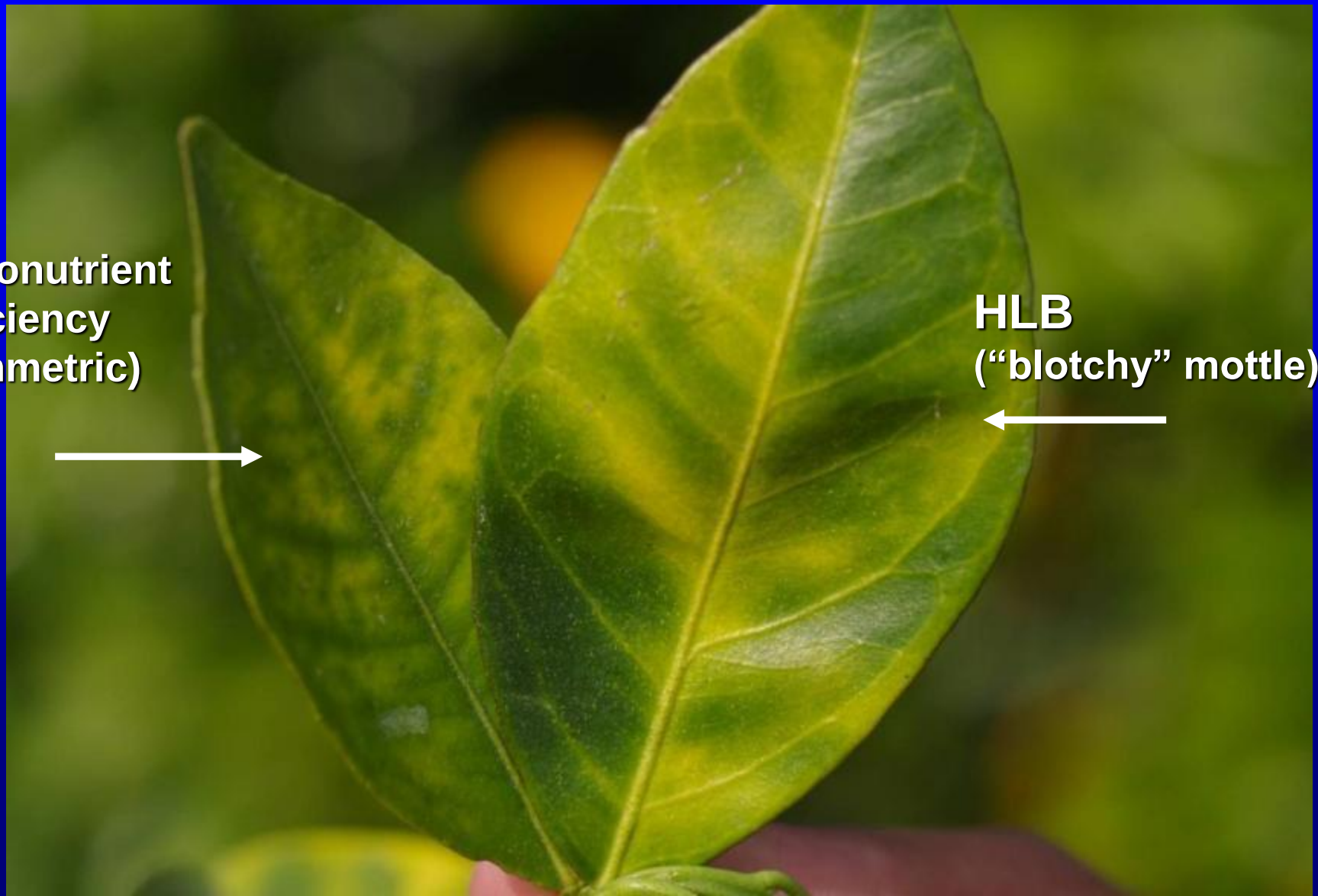
Nymphs secrete honeydew packaged in wax tubes normally removed by wind and/or ants.

Huanglongbing (Yellow Shoot Disease) HLB, or Greening Disease caused by *Candidatus* liberibacter asiaticus



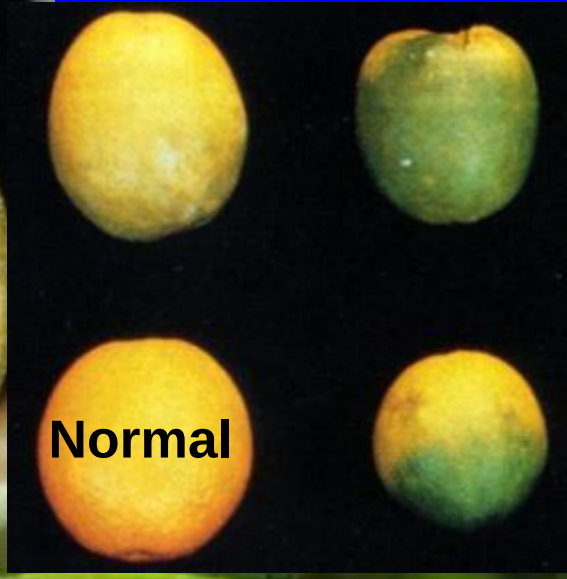
First Appearance

Recognizing HLB



Disease Progression

Evolution of Symptoms



Small, asymmetrical, green fruit, aborted seeds, fruit drop.

Fruit Drop

Coccinellid Predators of D. citri in Florida

Harmonia axyridis

Curinus coeruleus

Cycloneda sanguinea

Olla V-nigrum

Psyllid Predators
Lacewings

Parasitoid: *Tamarixia radiata*

Scouting Principles

- “Random” Sample
- Representative Sample
- Deliberate Method
- Uniform & Thorough Reporting

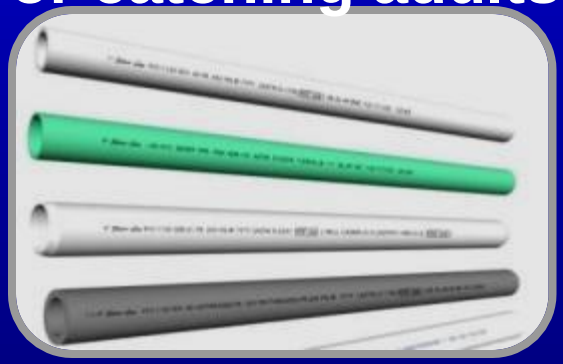
Monitoring Commercial Groves for Psyllids

- Tap Sample
  - Do first
  - 10 per stop
- Visual inspection
  - Do next
  - 10 flush per stop

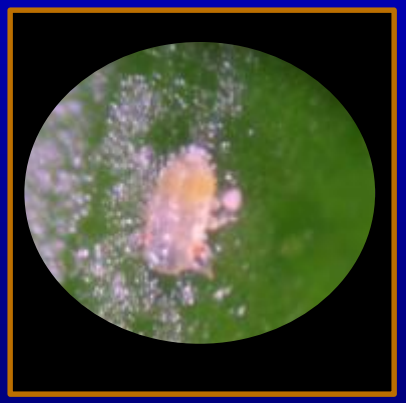
http://swfrec.ifas.ufl.edu/entlab/programs/index.htm

Equipment

Clipboard:
For catching adults and recording data



Piece of PVC (optional)
For hitting branch

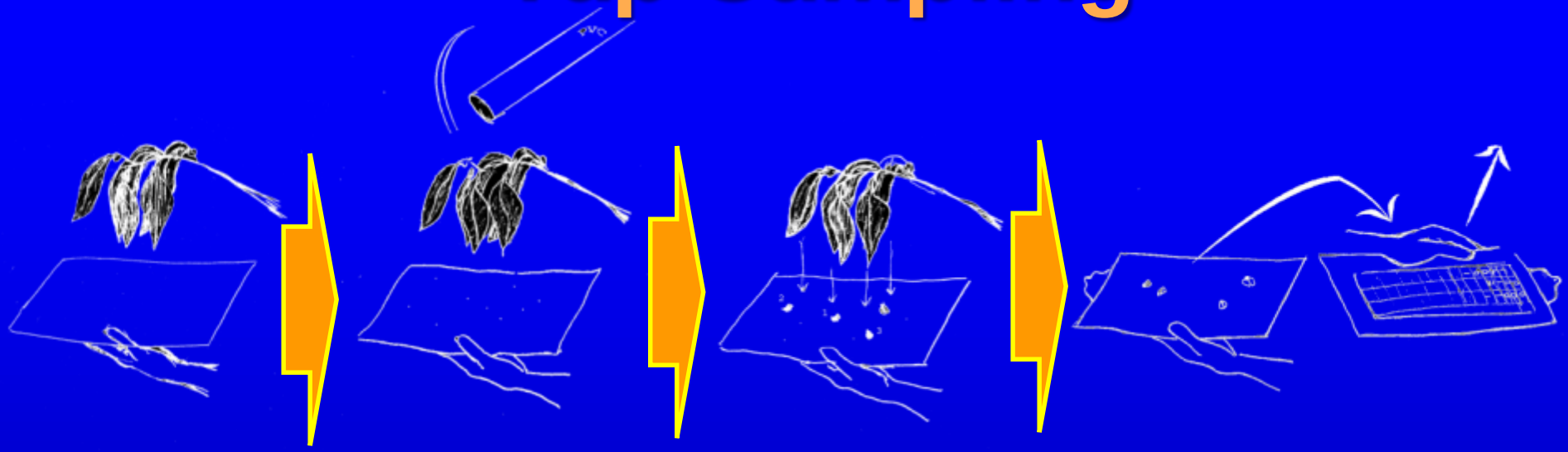


Hand lens:
For seeing small eggs and nym

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

http://swfrec.ifas.ufl.edu/entlab/programs/index.htm

UF UNIVERSITY of FLORIDA
IFAS Extension

Scouted by: _____ Variety: _____
Grove: _____ Tree size : _____
Date: _____ Block: _____ Lat: _____N Long: _____W

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 beneficial 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.

	Number of ACP per Tree										ACP TOTAL	Trees with Greening										Greening total	# infested flushes	# Flushes observed	# of trees to find	Beneficials				Notes and other pest observations
←Stop	1	2	3	4	5	6	7	8	9	10		1	2	3	4	5	6	7	8	9	10					Lady beetles	Trashbugs	Spiders	Other	
1																													
2																													
3																													
4																													
5																													
6																													
7																													
8																													
9																													
10																													

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.

Other Sucking Insects

	Nymphs	Adults	Honey-Dew?
Aphids	Like adults	Usually no males. Some winged	Yes
Whiteflies	Immobile after crawler-scalelike	Males and females winged	Yes
Armored Scales	Only crawler mobil	Cover separates, Males winged	No
Soft Scales	Can move when disturbed and at molts	Cover attached, Males winged	Yes
Mealy bugs	Retain mobility	Waxy filaments. Males winged	Yes
Stinkbugs	Like adults except for wings	Males and females alike	No

Citrus Aphids

Green citrus aphid: Aphis spireacola

Brown citrus aphid: Toxoptera citricida

Citrus Tristeza Virus

Citrus Whitefly and Cloudywing Whitefly

Dialeurodes spp.

Parasitic wasp

Parasitized

“Friendly” Fungus

Wooly Whitefly

Aleurothrixus floccosus

Nesting Whitefly

Paraleyrodes minei

Citrus Blackfly

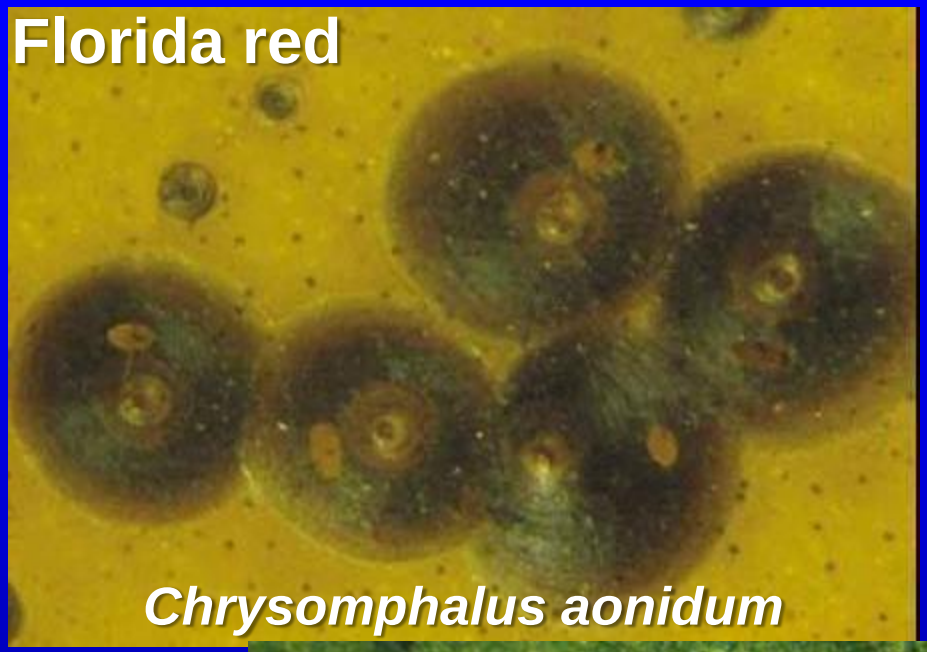
Aleurocanthus woglumi

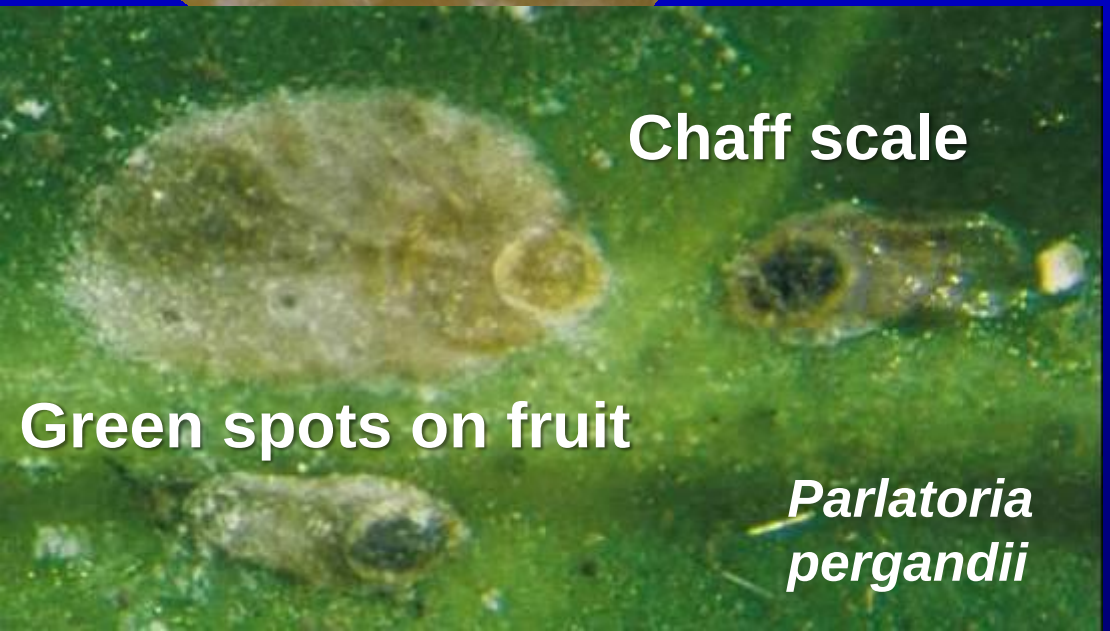
Eggs

Amitus hesperidum

Mummy

Armored Scales





Armored scale predator
twice-stabbed ladybeetle
Chilocorus stigma

Florida Red Scale Parasitoid
Aphytis holoxanthus

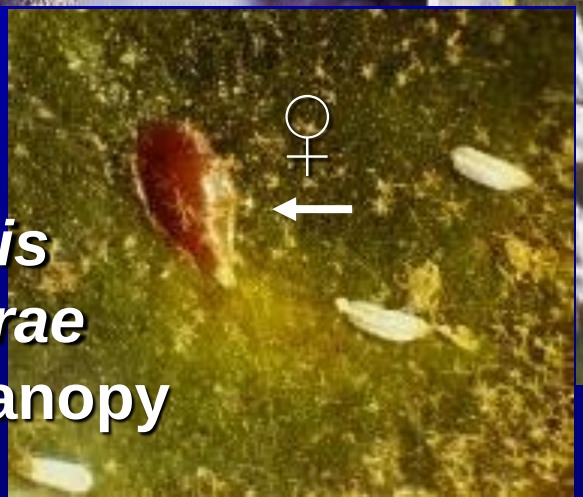
Other Armored Scales

Snow

Unaspis citri

Trunk, main scaffold limbs

♀



Fern

Pinnaspis aspidistrae

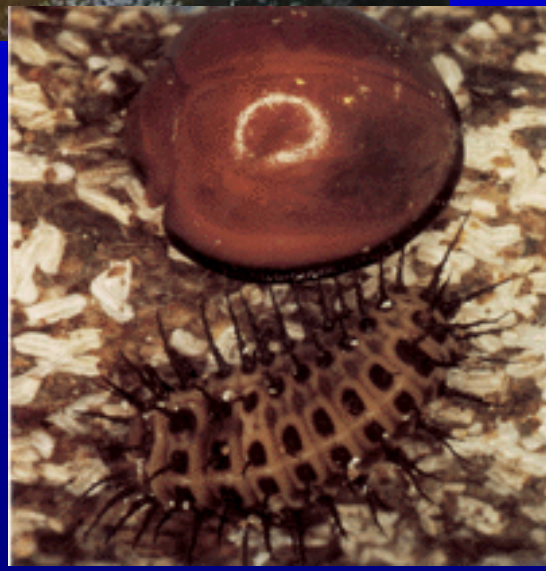
Outer Canopy

Mid Canopy

Lesser Snow

Pinnaspis strachani

Lesser Snow Scale Havoc



Controlled by *Chilocorus circumdatus*

Soft Scales: Black Scale *Saissetia spp*

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

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**
  - *Polyphagotarsonems latus*

Pink Rust Mite
Aculops pelekassi

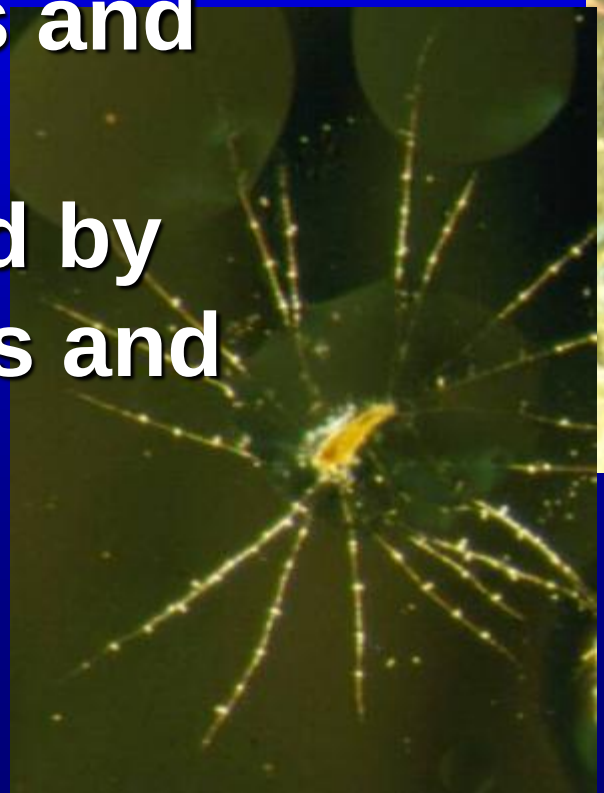
Rust Mites

- Primarily problems in fresh fruit
- Flared by copper and broad spectrum insecticides, especially pyrethroids

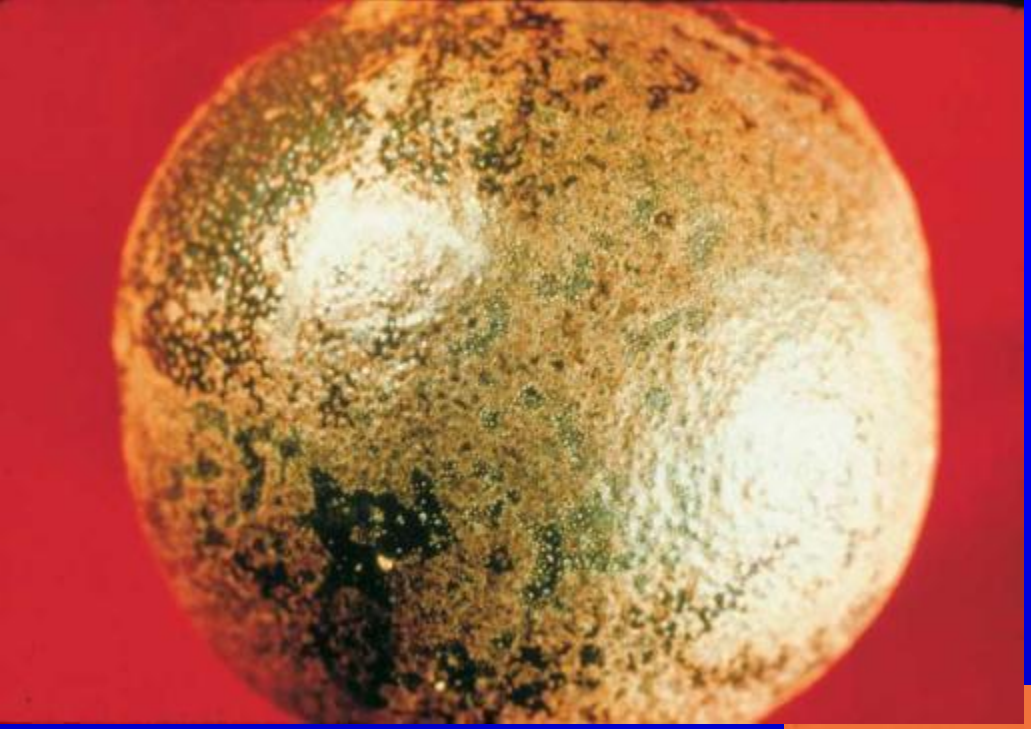
Citrus Rust Mite
Phyllocoptruta oleivora

Citrus Rust Mite *Phyllocoptruta oleivora*

- Biological control by mites, ladybeetles and *Hirsutella*
- Disrupted by insecticides and copper.

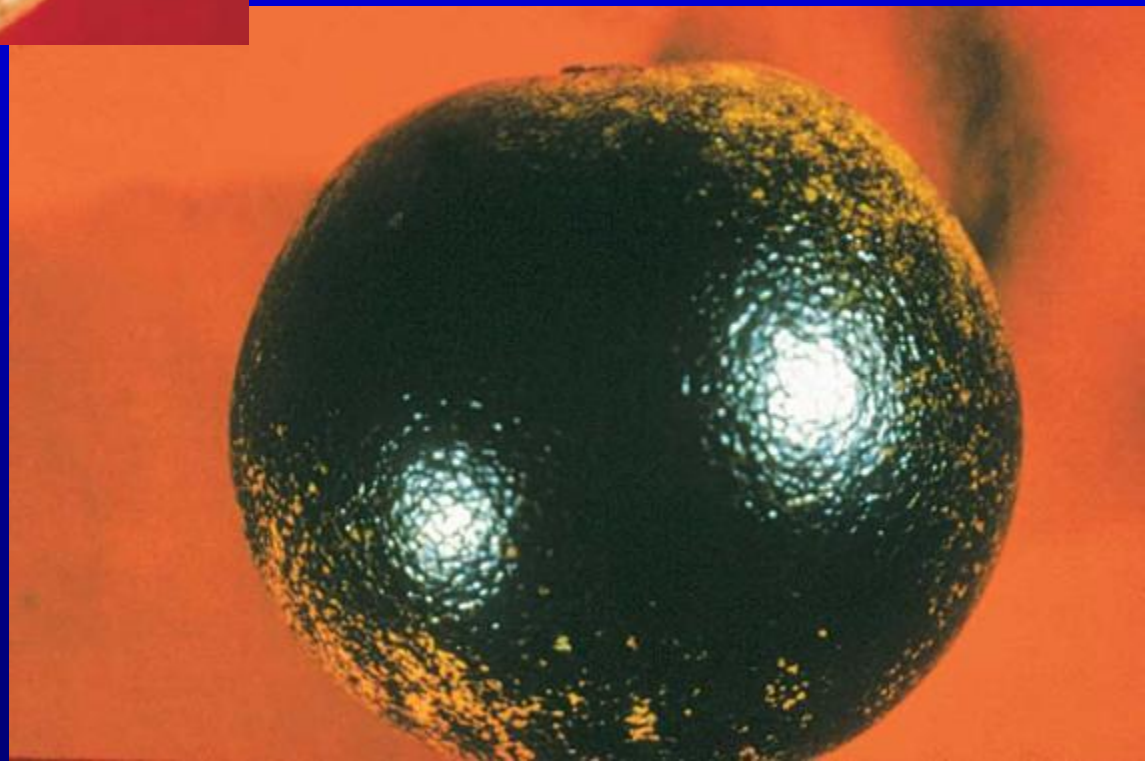


Stethorus



Early damage: Sharkskin

Late damage: Bronzing



Standarize the Lensfield

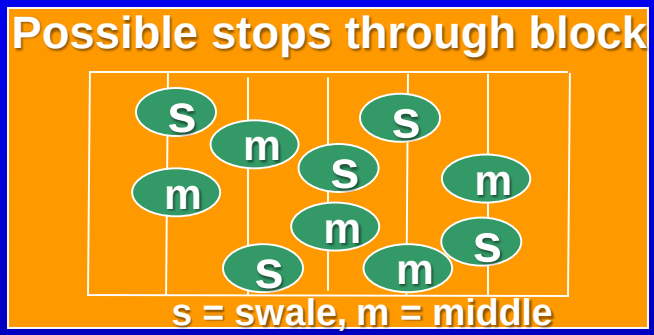
Lensfield size depends on:

- **Magnification**
- **Distance between eye and eyepiece**

Scout and Note Middles and Swales

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

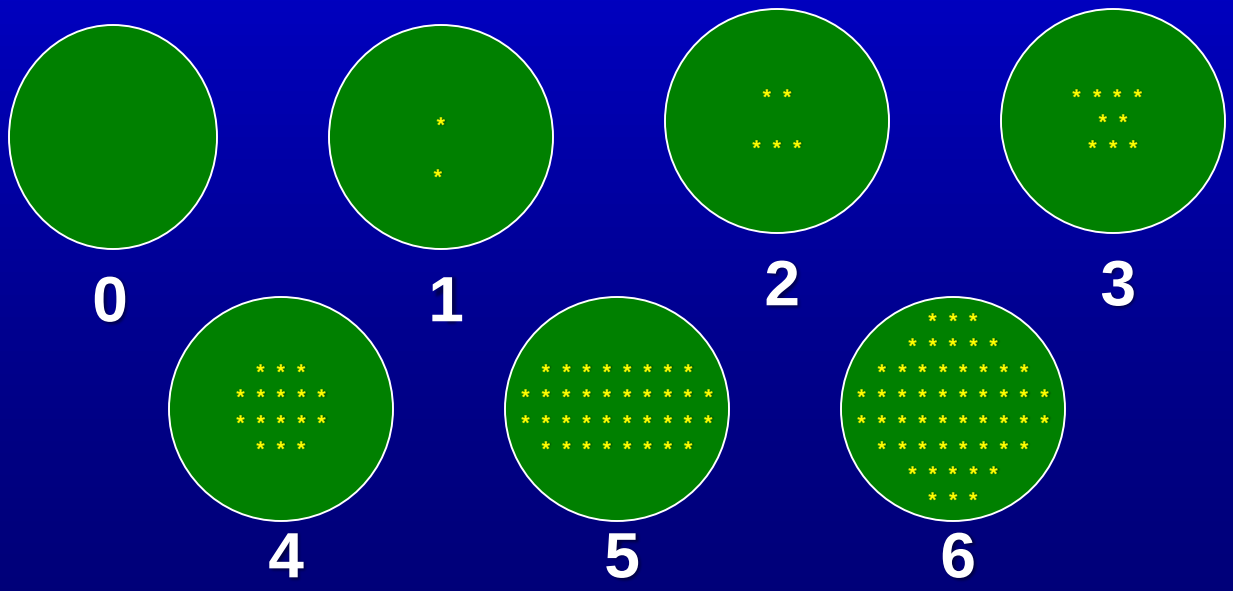


- Record Mites/lens field
- Provides < 25% variation if CRM > 10/cm^2
- Thresholds process: 6 CRM/ LF - Caution
  10 CRM/LF - Spray
- Threshold fresh: 2 CRM/LF - Spray

*2011 Florida Citrus Pest Management Guide, Publication SP-43, UF Gainesville
http://edis.ifas.ufl.edu/cg002

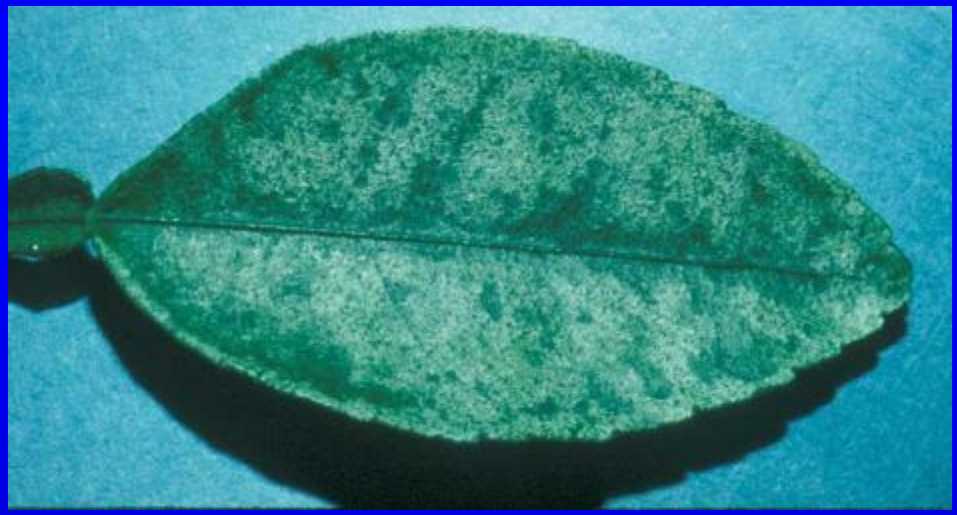
What the Heck is the H-B Rating System?

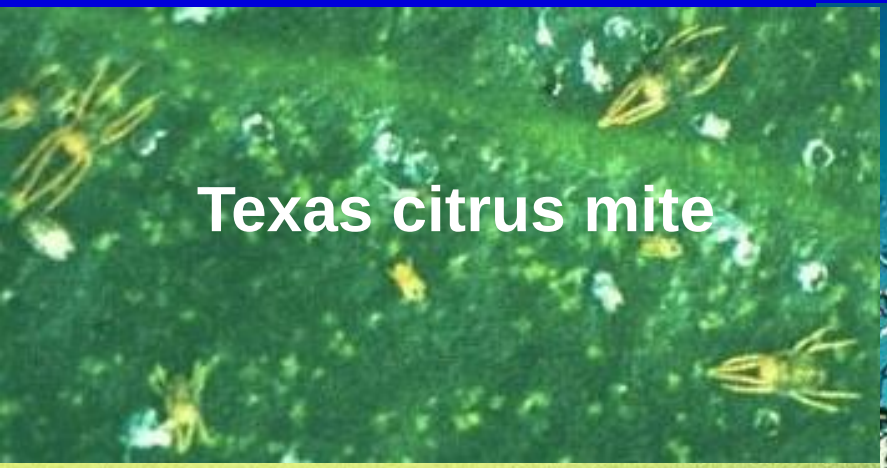
- Developed by Horsfall & Barratt (1945) to measure disease incidence.
- Based on density recognition rather than individual counts.

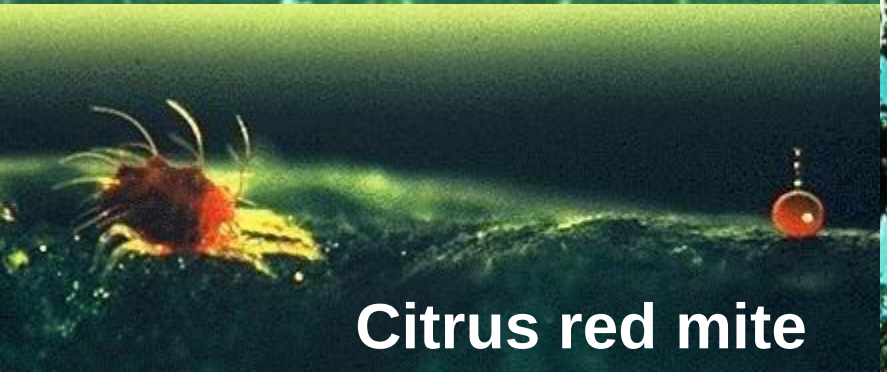


Spider Mites:

- Dry weather
- Upper surfaces of young hardened leaves
- Stippling, Firing



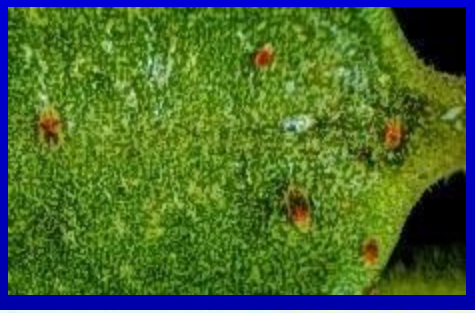


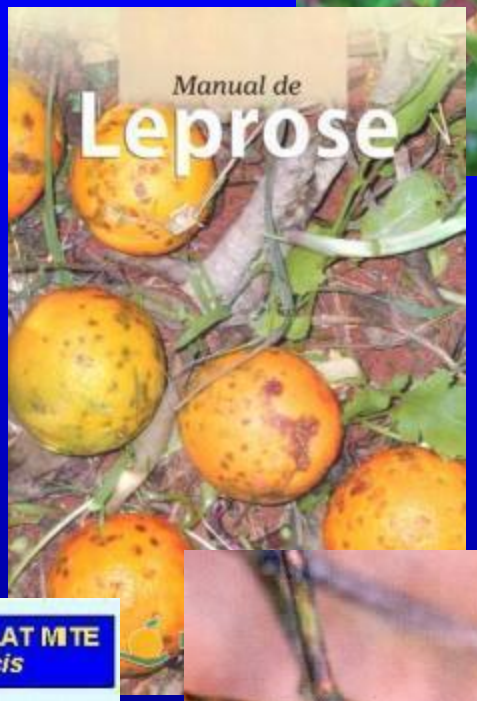


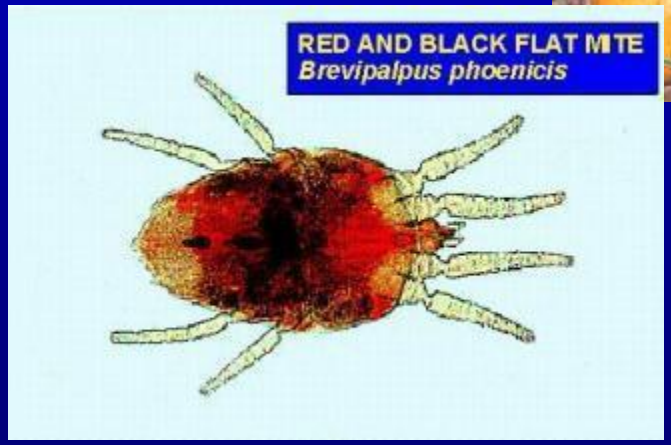
Scouting for Spider Mites

- Follow CRM sample pattern
- 4 leaves per tree
- Threshold 5-10/leaf, depending on :
- Population trends
  - ↓ Predominantly males
  - ↑ Nymphs and females
- Weather
- Tree Condition

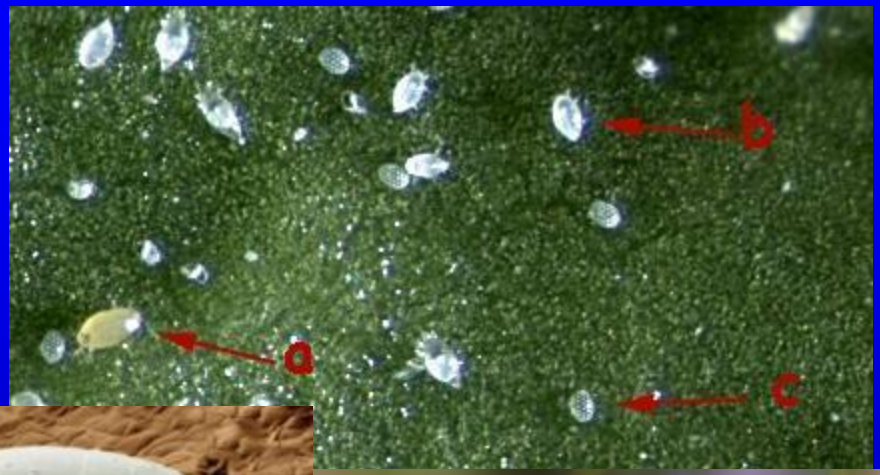
False spider mite *Brevipalpus* spp: Vector of Leprosis (not yet in US







Broad mite
Polyphagotarsonemus latus



Other Citrus Pests

- Citrus leafminer
- Thrips
- Fruit flies
- Grasshoppers and the like
- Root weevils

Citrus Leafminer, *Phyllocnistis citrella*

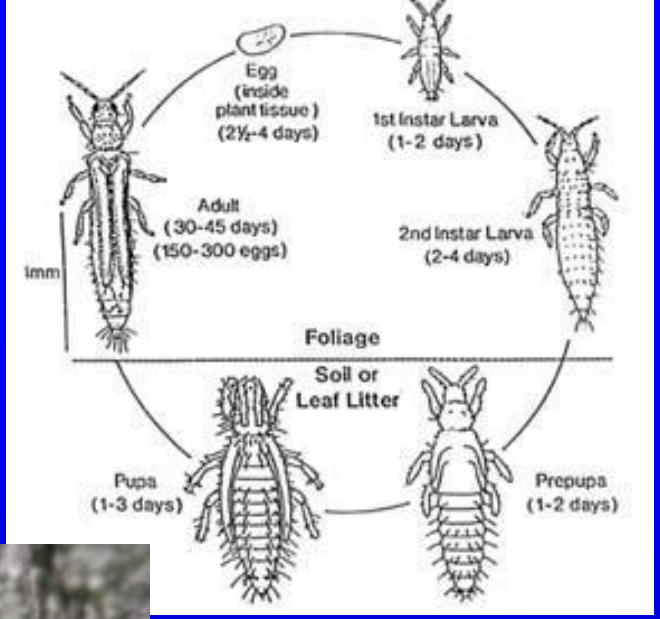
Canker – Leafminer Interaction

Predators
Ants
Spiders
Lacewings

Ageniaspis

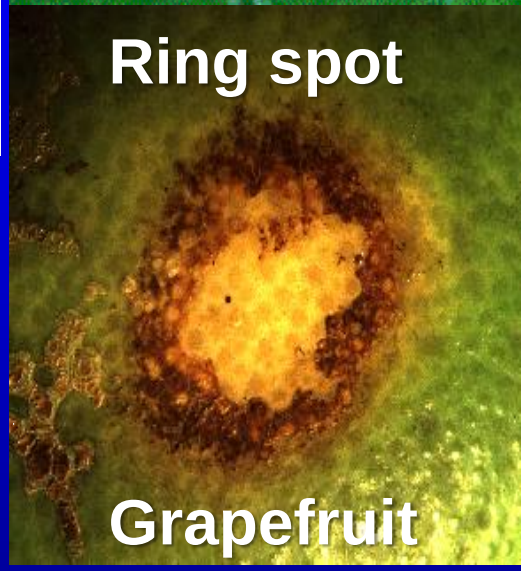
Indigenous ectoparasitoids


Flower Thrips


Egg
(inside
plant tissue)
(2½-4 days)
1st Instar Larva
(1-2 days)
Adult
(30-45 days)
(150-300 eggs)
2nd Instar Larva
(2-4 days)
Foliage
Soil or
Leaf Litter
Pupa
(1-3 days)
Prepupa
(1-2 days)


Orchid thrips


Mite
Predator


Ring spot
Grapefruit


Minute pirate bug

Fruit Flies

Caribfly

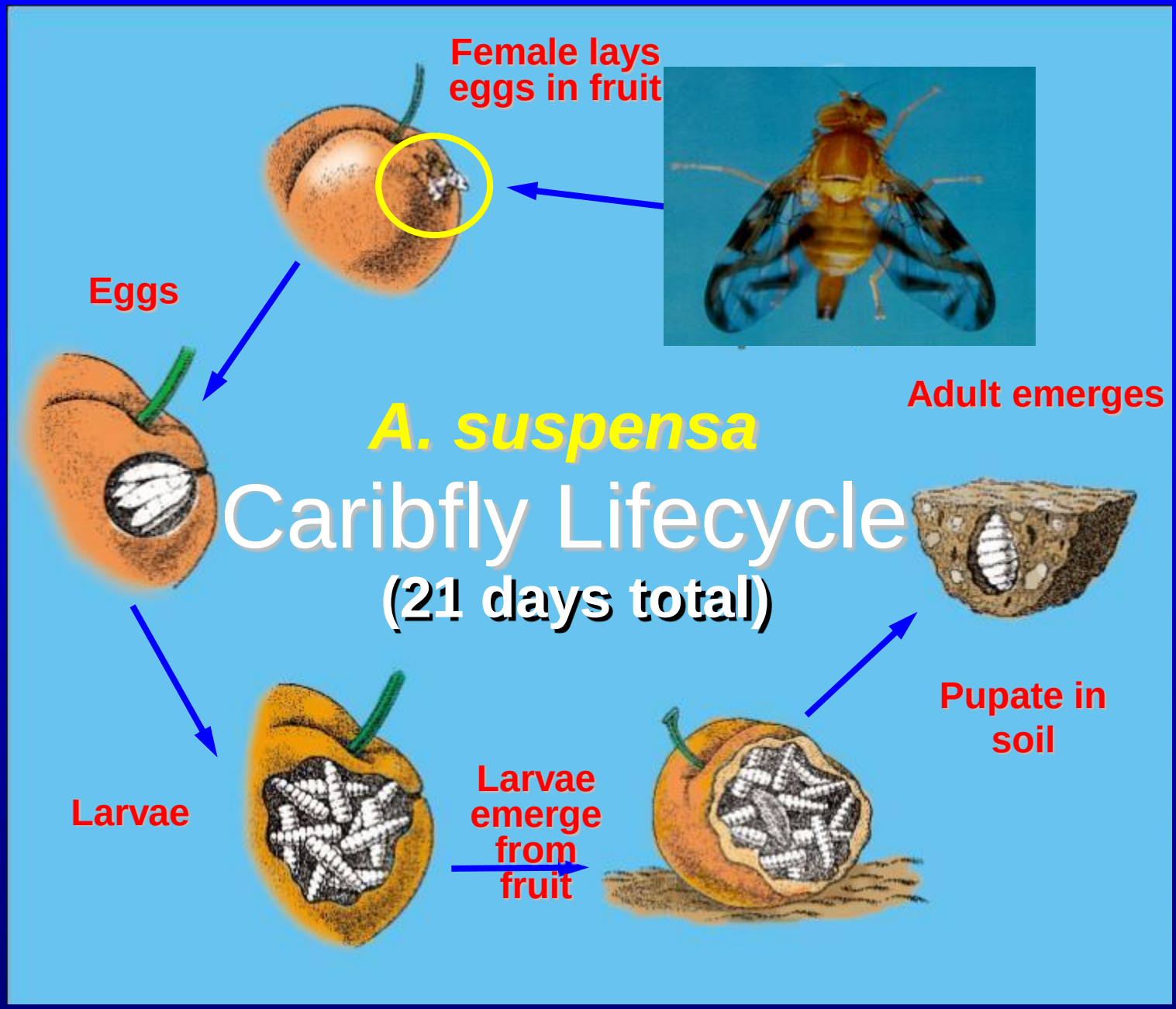
Anastrepha supsensa

Present in Florida

Medfly

Ceratitus capitata

Not presently known to be in Florida

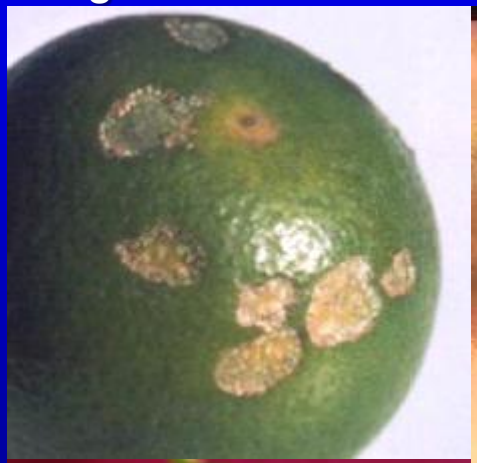

Female lays eggs in fruit
Eggs
Adult emerges
A. suspensa
Caribfly Lifecycle
(21 days total)
Pupate in soil
Larvae
Larvae emerge from fruit

Medfly *C. capitata*

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

Grasshoppers, Katydids, Crickets

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

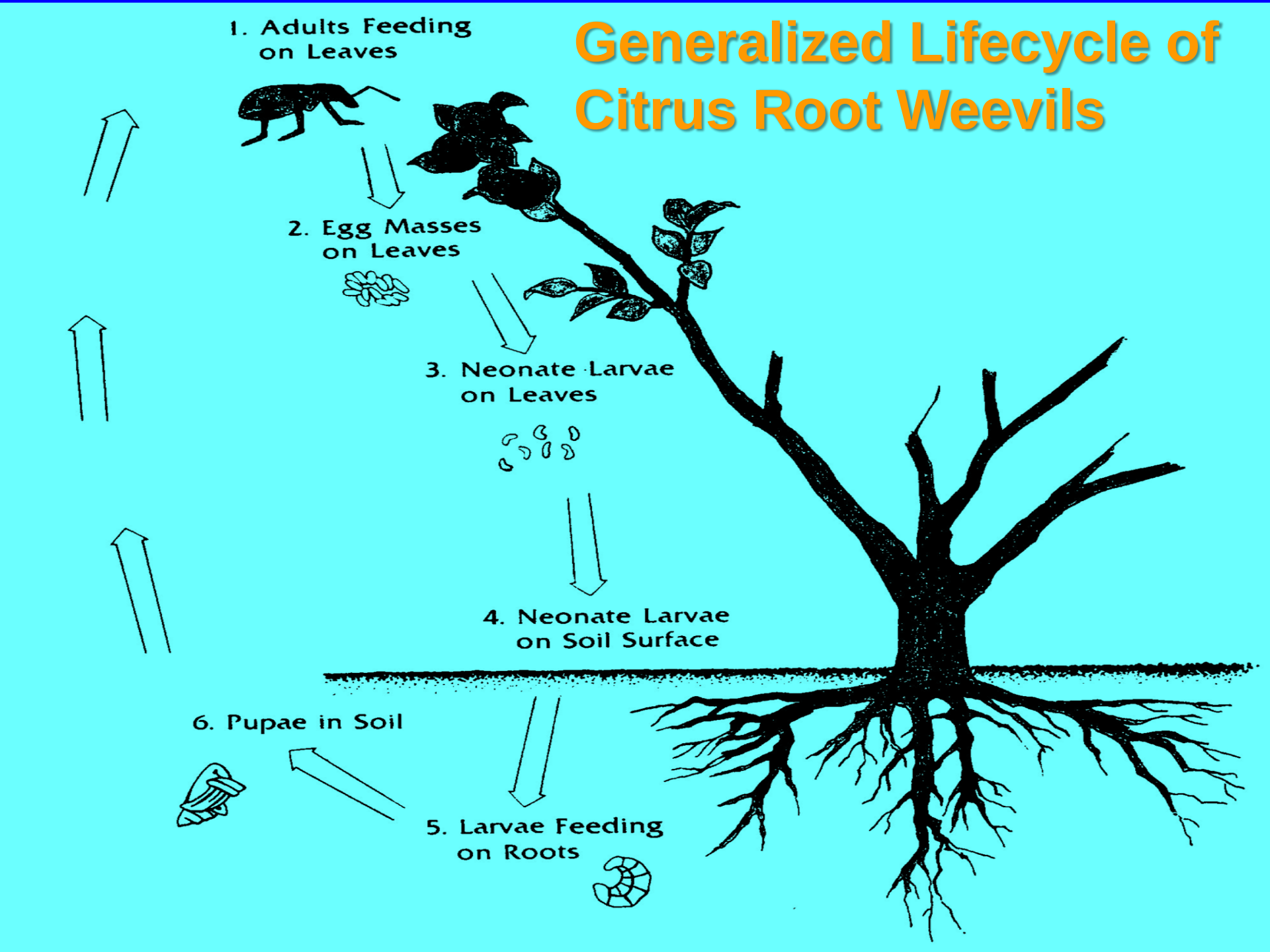


Stink Bugs and Leaffootted Bugs

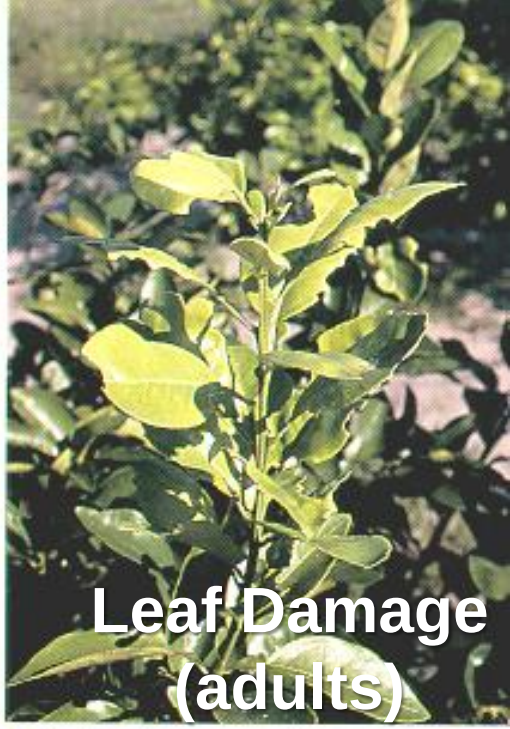
- Thin skinned varieties most susceptible (Hamlin)
- Perforate fruit, introduce pathogens
- Build up on weeds

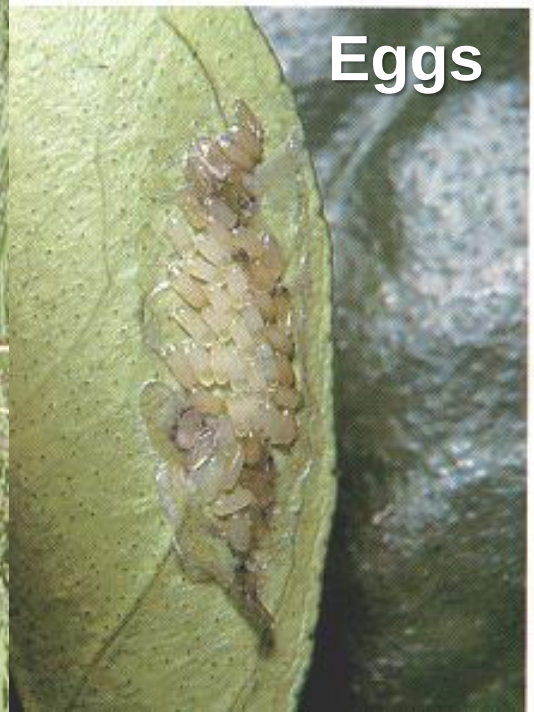
Root Weevils:

Generalized Lifecycle of Citrus Root Weevils



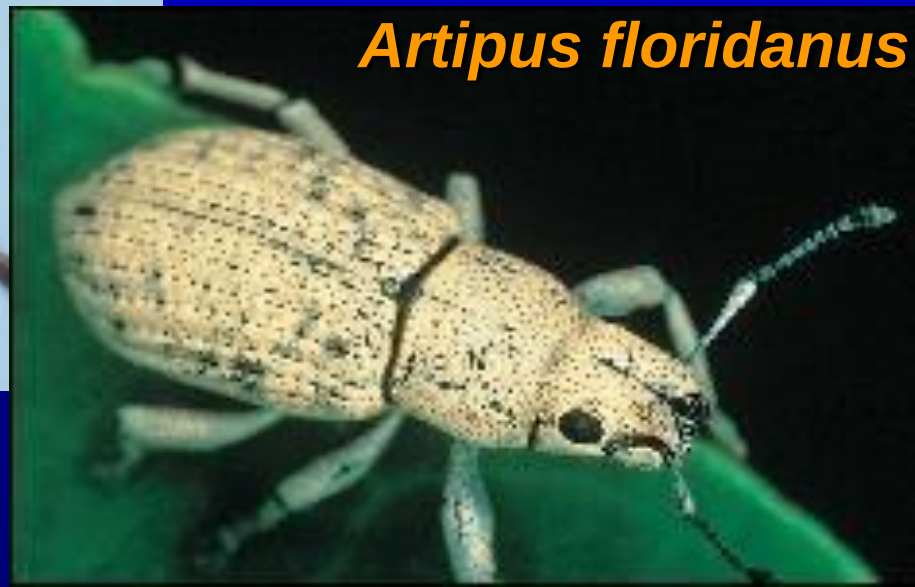
Diaprepes: Life cycle and damage to citrus roots





Sri-Lanka Weevil: *Myllocerus undatus*

Similar to Little Leaf Notcher (Artipus) but...

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Questions?
¿Preguntas?