Avocado Problem Diagnosis
Common Pests and Diseases

University of California
Agriculture and Natural Resources

Text from the UC California Master Gardener Handbook Pub. 3382 Pages 609-613

Supplemental text by Dr. Gary Bender

Pictures from ipm.ucdavis.edu, Dr. Joe Morse and Dr. Mark Hoddle (UC Riverside), and Dr. Gary Bender (UC Cooperative Extension San Diego County)

The Most Common Avocado Diseases

- Avocado Root Rot (*Phytophthora cinnamomi)*
- Avocado Trunk Canker *(Phytophthora citricola)*
- Oak Root Fungus (*Armillaria mellea)*
- Sun Blotch Viroid
- Black Streak
- Dothierella Canker

Small pale green, wilted leaves. Sparse foliage. New growth absent. Small branches die back at the top of tree allowing other branches to become sunburned. Small fibrous feeder roots absent or, if present, blackened, brittle, dead

- Diagnosis: Avocado root rot (*Phytophthora cinnamomi)*


UC Statewide IPM Program
© 2004 Regents, University of California


UC Statewide IPM Program
© 2004 Regents, University of California


UC Statewide IPM Program
© 2004 Regents, University of California

This is a fungus with more than 1000 hosts

- Attacks small feeder roots. The most serious avocado disease in California. Fungus thrives in excess soil moisture (over-irrigation and poor drainage).
- Attacks trees of any size or age. Absence of feeder roots prevents moisture uptake so the soil under diseased trees stays wet even though tree appears wilted.

IPM treatment plan

- Fungus can spread on contaminated nursery stock, water in contact with infested soil, shoes and cultivation equipment. Fungus can spread on anything that moves soil, including horses hooves, ladders and bins.
- Use only clean nursery stock and replant with only resistant clonal rootstocks. The most effective rootstock currently is ‘Dusa’.

Chemical Treatment

- For mature trees that are diseased, the best treatment appears to be trunk injection with a registered fungicidal buffered phosphorous acid.
- For areas that could be threatened by the fungus, soil treatments with registered fertilizer-type buffered or non-buffered phosphorous acids appears to be beneficial.

Mulch Treatment

- Mulch heavily with wood chip-based greenwaste mulch. Keep it 8 inches away from trunk. Mulch can be up to 4 inches deep under the tree. Manures are ineffective at control of the fungus.
- Apply gypsum under the mulch, 25 lbs per large mature tree. This supplies calcium with reduces the ability of the fungus to form spores.

Replanting

- The easiest method is to replant with a crop that is immune to the disease, such as citrus, cherimoya, all types of vegetables, most annual flowers, and many deciduous fruit trees and berries.
- If the grower wants to replant with avocado, use only resistant clonal rootstocks. This is a dynamic areas of research…the most effective rootstock now in 'Dusa'.

Where is Avocado Root Rot found in San Diego County?

- Found in all commercial growing areas.
- Found in almost all of the older avocado areas of Fallbrook, Escondido, Vista, Carlsbad, Encinitas, Lemon Grove, La Mesa, El Cajon (formerly commercial groves)
- The nurseries appear to be clean at this time.

Review: Avocado Root Rot - Diagnosis

- Small, pale green, wilted leaves
- Sparse foliage, usually leaf drop starts at the top of the tree
- New growth absent
- Branches become sunburned
- Small fibrous feeder roots absent, or if present are blackened and brittle

Review: Avocado Root Rot - Treatment

- Easiest – Replace with a non-host, like citrus or cherimoya
- Injection of trunk with registered pesticide phosphorous acid twice a year for life,
- Mulch heavily with greenwaste mulch, must be a wood-based mulch Apply gypsum to soil.
- Replace with a better rootstock

Symptom: Poor growth, loss of tree vigor. Small yellowing leaves; premature leaf drop, wilting, collapse. Mushrooms at base in winter. White fan shaped mycellium growing under bark of large roots and below the soil line on trunk.

- Diagnosis: Armillaria root rot, also known as Oak Root Fungus
- Attacks roots. Visible symptoms may not appear until fungus is well established in the roots. Can destroy the entire root system and kill tree. Once symptoms appear it is very difficult to save a tree.


UC Statewide IPM Project
© 2001 Regents, University of California


UC Statewide IPM Project
© 2000 Regents, University of California

- After aerial parts of infected trees are dead the fungus remains alive in the roots to infect any replanted susceptible trees, such as citrus, peach or avocado.
- Let soil dry out between irrigations.
- Removing soil from the crown of the tree seems to have been beneficial in citrus and grapes, but has not been researched in avocado

Review: Armillaria (Oak Root Fungus)

- Fungus invades crown of tree, colonizes the cambium layer below the bark, and uses the stump as a food base for rhizomorphs that grow through the soil to attack other woody plants.
- Possible Control: hosing soil away from lower crown, exposing scaffold roots, remove stump to prevent spread..

Symptom: Poor growth, loss of tree vigor. Chlorotic. Poor fruit production. Cankers on trunk and branches. Leaf blotching, wilting. Rapid death of some new growth. Tree eventually dies.

- Diagnosis: Avocado Black Streak (ABS)
- Causal organism unknown.
- Attacks trunk and branches. Present in California for more than 60 years but observed only on Guatemalan varieties such as Hass and Reed, and only after prolonged stress.

- Cankers vary in size and have a dry **powdery water-soluble sugar** that exudes through tiny cracks in the bark.
- **Shallow red-brown lesions** under cankers are revealed when bark is removed.
- Management: maintain tree health with good fertilizer and irrigation practices. Remove unhealthy trees as the disease seems to move through the grove by possible root grafting.

Avocado Black Streak

Symptoms: Leaves suddenly wilt on one part of tree or on the entire tree and then turn brown and die, but do not drop off for months. Brown to gray-brown streaks are visible in wood ao branches or roots (plugged xylem tissue)

- Diagnosis: Verticillium wilt (*Verticillium albo-atrum)*
- Fungus attacks xylem tissue. Enters roots and moves upward. May kill all or part of tree, with the remainder having complete recovery

Verticillium Wilt

Management of Verticillium

- Mexican rootstocks are more resistant than Guatemalan
- Do not plant on soil that has been used by other crops that are susceptible to Verticilium such as tomato, eggplant, pepper, many berries, apricot, potato and several flower crops. Do not plant these near an avocado tree.

Symptoms: Bark cankers exude white powder. Outer bark cracks and sheds easily. Diseased trees die back and may look unthrifty but rarely die.

- Diagnosis: Dothiorella canker (*Dothiorella gregaria)*

- Attacks trunks and branches. A minor fungal problem favored by moisture. Keep irrigation water off tree base. Guatemalan rootstocks or scion tops are much more susceptible than Mexican.

Dothiorella Canker

Control of Dothiorella

- Control not usually needed. Scraping off outer bark removes some infection and encourages regeneration of vigorous bark.
- This is an area of active research by Dr. Akif Eskalen at UC Riverside. Control strategies will probably be updated in the near future.

Symptoms: Trunk cankers at base of older trees, originating at or below ground level. Canker appears as a dark region with a red, resinous exudate that dries to a white crystalline deposit.

- Diagnosis: Phytophthora canker or Collar Rot (*Phytophthora citricola)*
- Underneath the superficial canker is an orange-tan to brown lesion instead of the normal white or cream-colored tissue. Lesion has a fruity odor when exposed. Gradual decline, or sudden death, of tree.

Phytophthora Canker

Collar rot is second only to avocado root rot is severity as a disease.

- Attacks phloem tissue in lower tree trunk. Disease is favored by excess soil moisture such as over-irrigation or poor drainage.
- Spreads by contaminated nursery stock, irrigation water and cultivation equipment. Use sanitation measures noted for other Phytophthora species.

Management of *P. citricola*

- Seedling rootstocks are generally more sensitive than clonal stocks such as Duke 7 and Toro Canyon.

  P. citricola is found increasingly together with *P. cinnamomi*

Keep drip emitters away from lower trunks.

Aim minisprinklers away from trunks

Avoid wounding trunks

Control of *P. citricola*

- If cankers are detected at an early stage, they can sometimes be controlled by cutting out the selected tissue.
- Phosphorous acid based fungicides, sprayed on the canker, are sometimes effective in controlling this disease. The treatment is done several times, 60 days apart. See ipm.ucdavis.edu for amount and timing.

Symptoms: Fruit hanging near the ground has a distinct, rounded black area, usually at the end toward the soil

- Diagnosis: Phytophthora fruit rot (*P. citricola)*

- Limited to prolonged wet weather in a dry climate like California.

Phytophthora Fruit Rot

Symptoms: Fruit rot, but unlike Phytophthora fruit rot symptoms develop after picking. Purple-brown spots appear on fruit surface. Fruit flesh becomes discolored and has an unpleasant odor.

- Diagnosis: Dothiorella fruit rot
- Fungal spores develop on dead branches, leaves and dead leaf margins. Spores are present on fruit and rot develops as fruit starts to soften

Management of Dothiorella fruit rot

- Do not let dead debris accumulate in the grove. Keep salt damage to leaves at a minimum by irrigation properly and leaching the salts out of the rootzone.
- After picking, move fruit to a minimum of 41F as soon as possible. Ripen under 60F to minimize rot.

Dothiorella Fruit Rot

Symptoms: Active lesions on bark are dark, slightly sunken areas with watery , necrotic pockets under the surface. Bark splits and watery fluid oozes out and dries, leaving a white powdery residue at the lesion

- Diagnosis: Bacterial canker (*Xanthomonas campestris)*
- Most groves have a few of these trees, but most infections are mild and seem to have little effect on yield.
- If the disease is severe, remove the tree

Bacterial Canker

Symptoms: Twigs and fruit have narrow yellow, red or necrotic shallow indentations the occur lengthwise.

- Diagnosis: Sunblotch (avocado sunblotch viroid, ASBVD)

- Fruit are rectangular with white, yellow or reddish blotches or streaks that may be depressed. Cracking of bark on trunk is known as “alligator bark”. Tree is stunted.

Sunblotch


UC Statewide IPM Program
© 2003 Regents, University of California


University of California

Sunblotch

- Sunblotch is caused by a small circular strand of RNA without a protein coat (a “naked” virus)
- Tree removal is recommended because it can spread by root grafting and pollen (to the seed in the fruit of a neighboring tree).
- Sterilize pruning tools and harvesting clippers between trees.

The Most Common Avocado Pests

- Avocado Brown Mite
- Persea Mites
- Avocado Thrips
- Avocado Worms (amorbia and loopers)
- Whiteflies
- Avocado Lace Bugs

Symptom: Light green or yellow areas on upper leaf which later turn brown or bronze if severe, leaves may drop

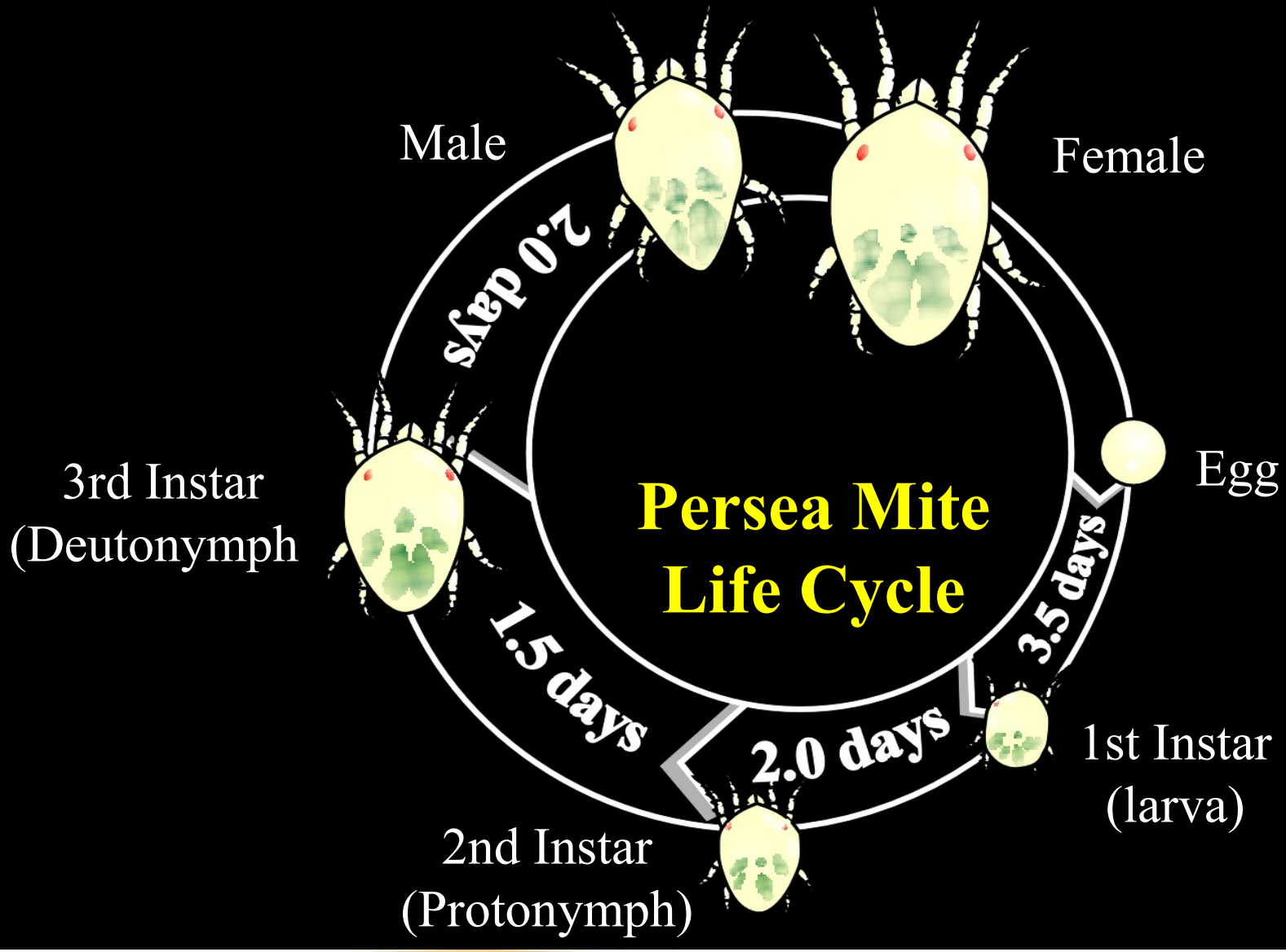
- Diagnosis: Avocado Brown Mites
- Tiny mites about the size of a period in a sentence. On top side of leaves.
- Usually good biological control by Stethorus beetles

Persea Mite, *Oligonychus perseae* (Acari: Tetranychidae)

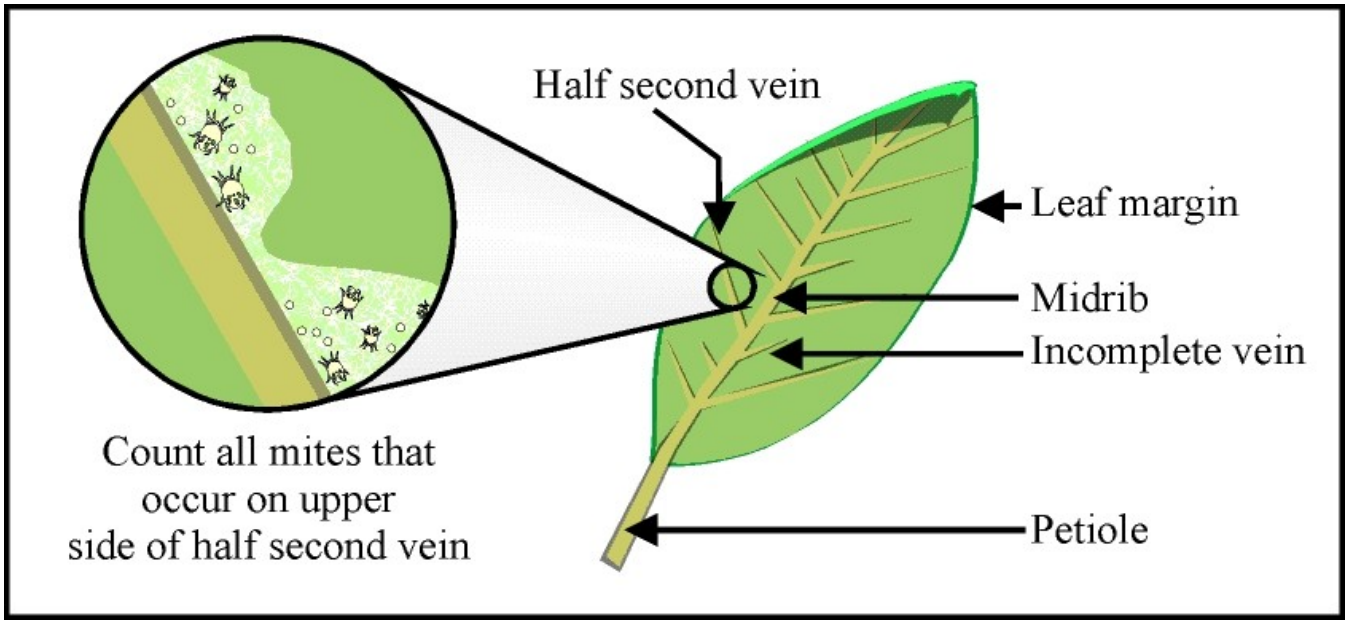
- Native to Mexico. Described in 1976 from specimens found on smuggled avocados intercepted in Texas
- First discovered in CA in 1991 near the Port of San Diego
- Feeding damage causes partial or total defoliation
- Broad host range: thistles, eucalyptus, carob, bamboo, grapes, peaches

Persea Mite Feeding Damage

When mite feeding damages ~ 10% of the leaf surface the probability of leaf drop increases significantly


Persea Mite
Life Cycle
Male
Female
Egg
1st Instar
(larva)
2nd Instar
(Protonymph)
3rd Instar
(Deutonymph
2.0 days
3.5 days
2.0 days
1.5 days

Quick Sampling Method for Persea Mite



1) Choose 10 leaves at random.

2) Average the number of persea mites counted on the top side of the second half vein of the 10 selected leaves.

3) Multiply this 10 leaf average by 12 (a correlation factor) to get the average number of persea mites per leaf in the orchard.

See: Dave Machlitt. 1998. Persea mite on avocados: quick field counting method. Subtropical Fruit News 6: 1-4.

Selecting Natural Enemies for Persea Mite Control

Galendromus annectens

✓ *Galendromus helveolus*

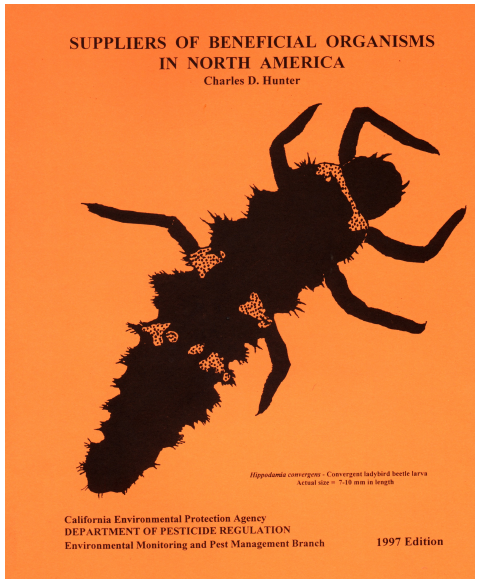
Galendromus occidentalis

Galendromus pilosus

✓ *Neoseiulus californicus*

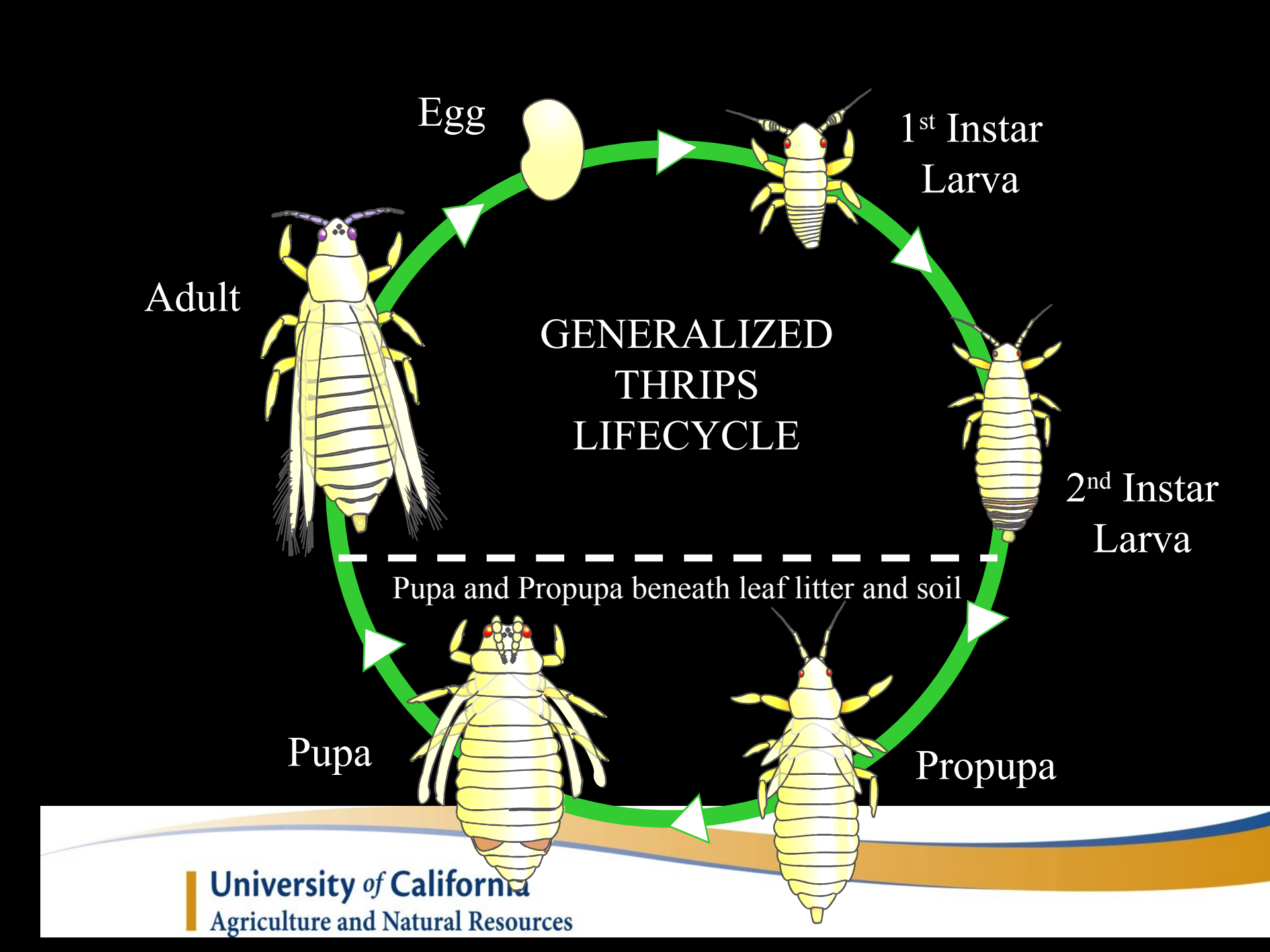
Neoseiulus fallacis

Typhlodromus rickeri



Avocado Thrips *Scirtothrips perseae* Nakahara (Thysanoptera: Thripidae)

- First discovered in CA in 1996 near Port Hueneme in Ventura Co.
- Similar to a specimen found on smuggled avocados from Oaxaca at the Port of San Diego in 1971
- Undescribed species when first discovered. Officially named in 1997
- Appears to be monophagous in CA and native to Latin America

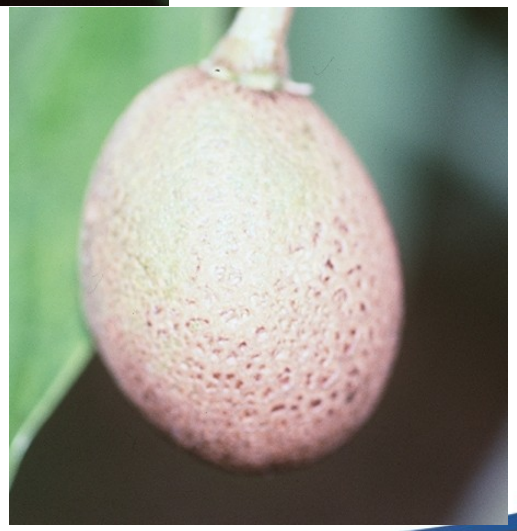

Egg
1st Instar Larva
Adult
GENERALIZED THRIPS LIFECYCLE
2nd Instar Larva
Pupa and Propupa beneath leaf litter and soil
Pupa
Propupa

Avocado Thrips Feeding Damage

Elongate scarring on maturing fruit

Leaf scarring

"Alligator Skin" on small fruit



Natural Enemies Associated with Avocado Thrips

Black Hunter

***Franklinothrips* (adult)**

Lacewing Larva

***Franklinothrips* (larva)**

Using Insecticides

- Three insecticides have been used successfully to control avocado thrips in CA
  - **Sabadilla (Veratran-D) with sugar**
  - **Abamectin (Agri-Mek) with 1% NR 415 oil**
  - **Spinosad (Success) with 1% NR 415 oil**
- Spray decisions should be based on monitoring results, fruit size, and consultation with a PCA

Insecticides and Natural Enemies

- Spinosad and abamectin caused declines in natural enemy populations
- Natural enemy populations recovered after 14-17 days
- Suffocation with oil or consumption of poisoned thrips may kill natural enemies
- Labels limit use of insecticides while bees are working flowers in orchards

Resistance Management

- Avocado thrips tolerance to sabadilla has increased
- Rotating use of sabadilla, spinosad, and abamectin may delay the onset of insecticide resistance to these compounds
- Applications should be made based on label recommendations and after consultation with a local PCA familiar with avocado pest management in the local area

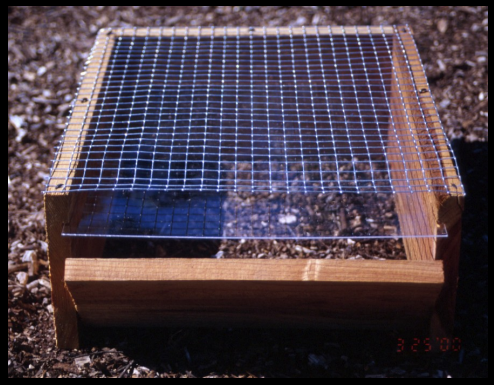
Mulches for Avocado Thrips Control

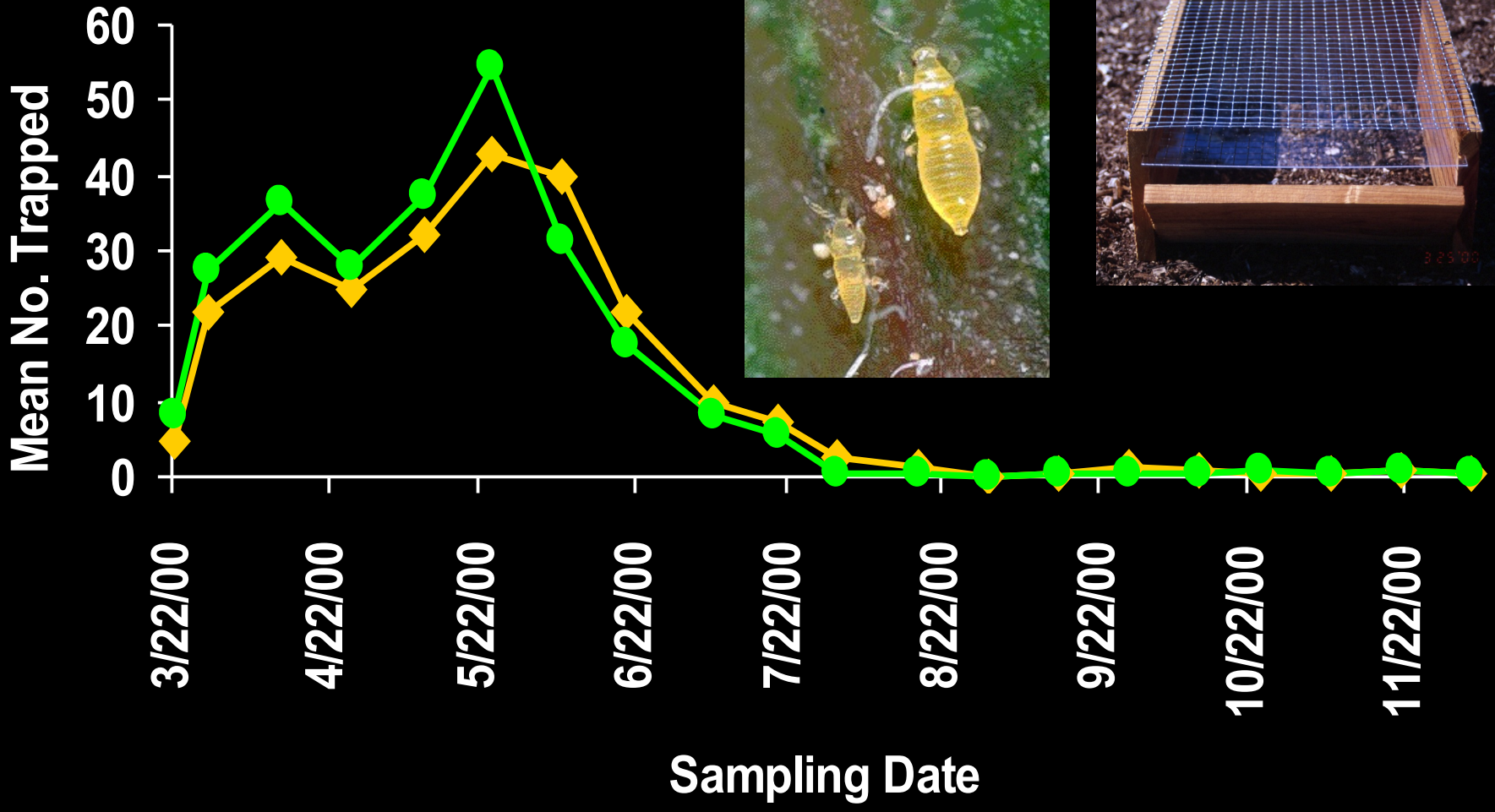
- Composted organic yard waste
  - Root rot control
  - Water retention
  - Improved soil fertility
  - Weed suppression
  - Improved plant growth
  - **Thrips control????**

Mulched Plot

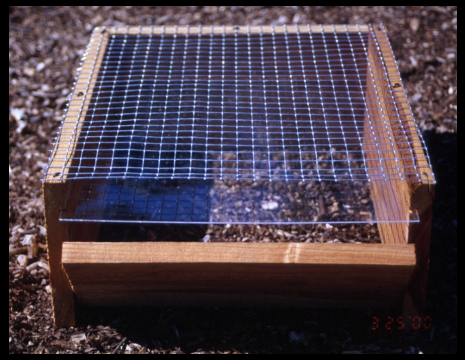
Unmulched Plot

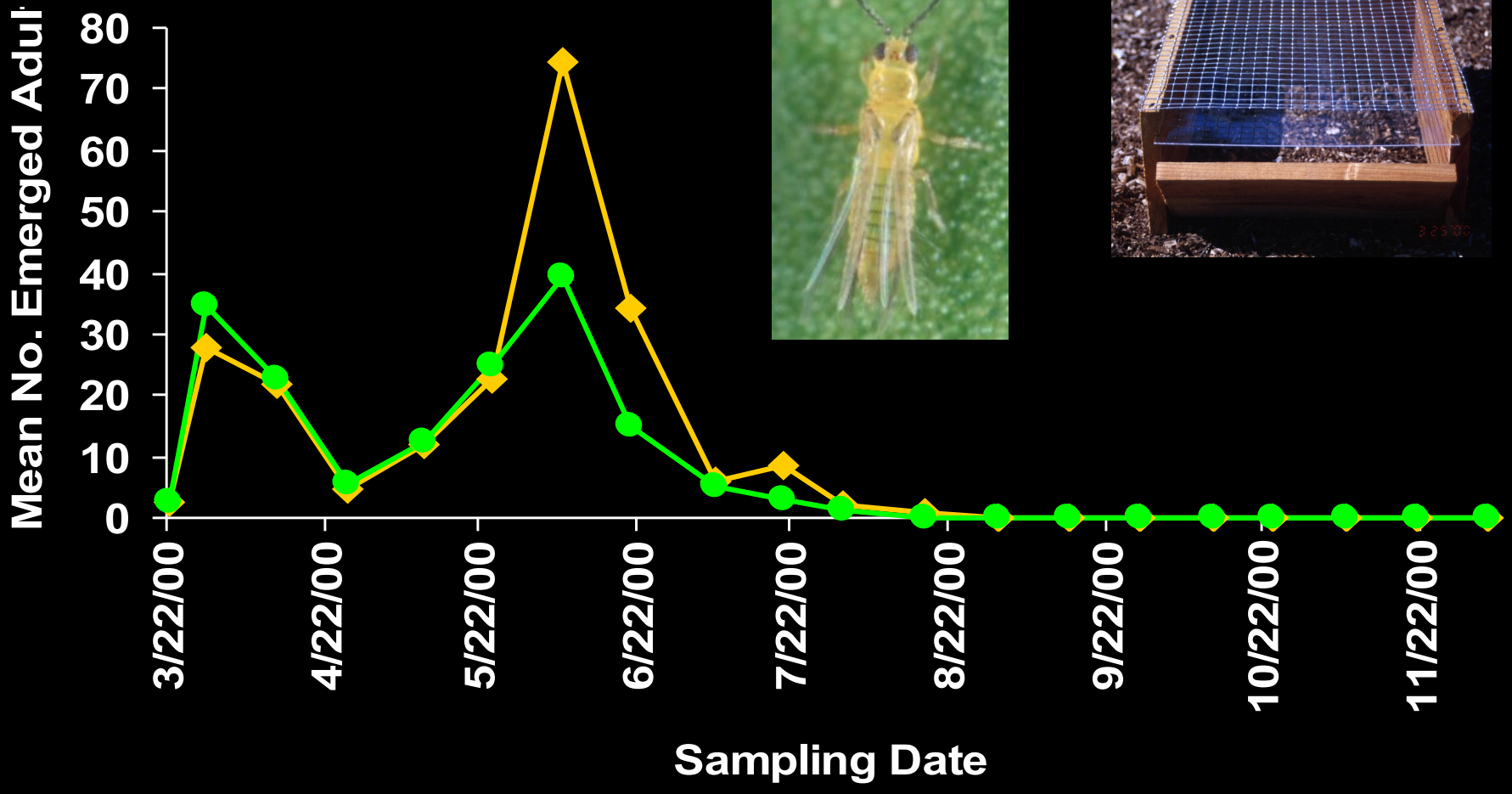
Avocado Thrips Larvae Trapped on Tops of Traps





Adult Avocado Thrips Trapped on Bottom of Traps





Red Banded Whitefly - *Tetraleurodes perseae* Nakahara

- First discovered in San Diego in 1982
- Undescribed species at time of discovery
- Native to Latin America
- Controlled by *Cales noacki* - a whitefly parasitoid

Adult

Eggs

Pupa

Nymph

University of California
Agriculture and Natural Resources

Resistance Management

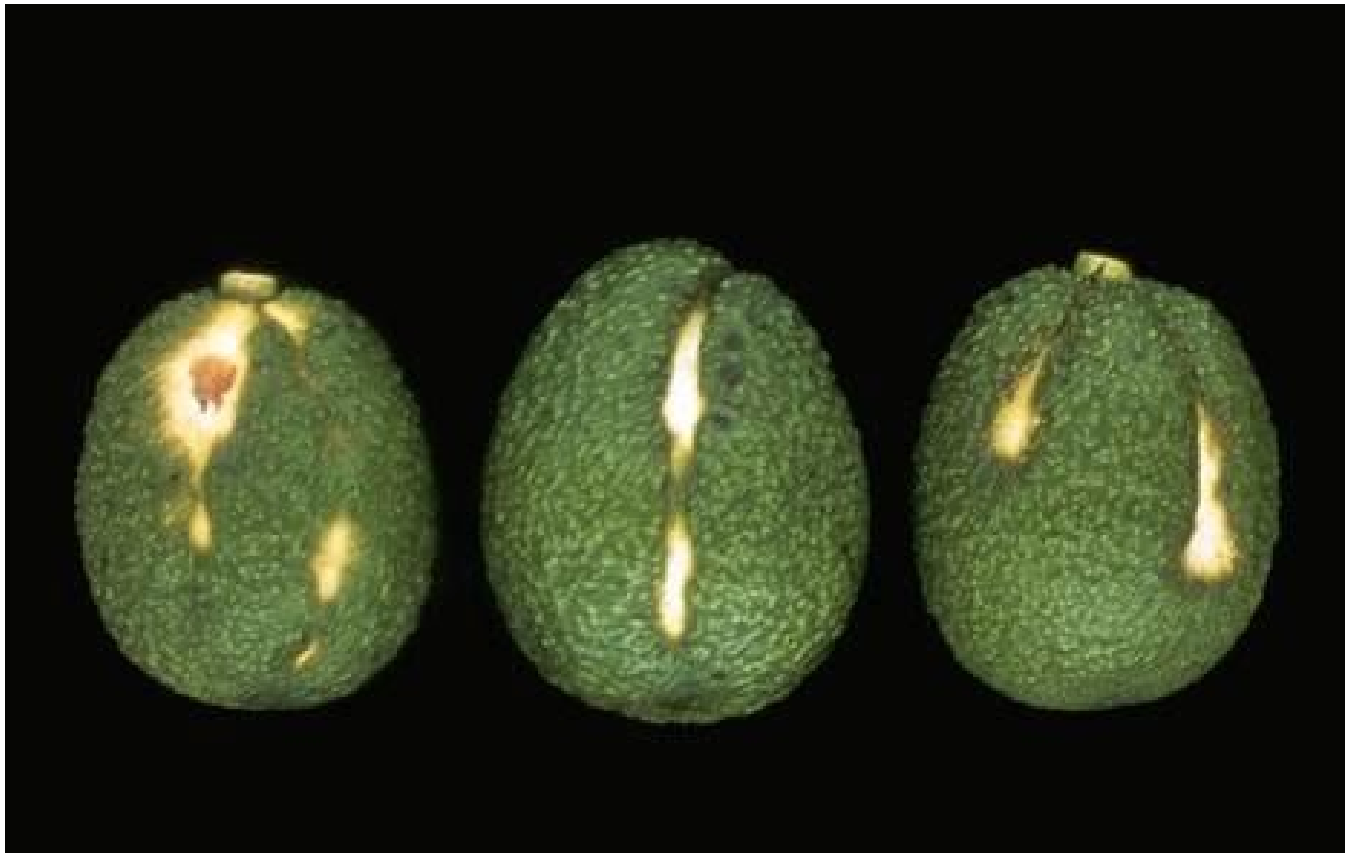
- Avocado thrips tolerance to sabadilla has increased
- Rotating use of sabadilla, spinosad, and abamectin may delay the onset of insecticide resistance to these compounds
- Applications should be made based on label recommendations and after consultation with a local PCA familiar with avocado pest management in the local area

What Did This?

What Did This?

What did this?

What did this?



What did this?

What is she doing?

What is causing this?

What caused this?