

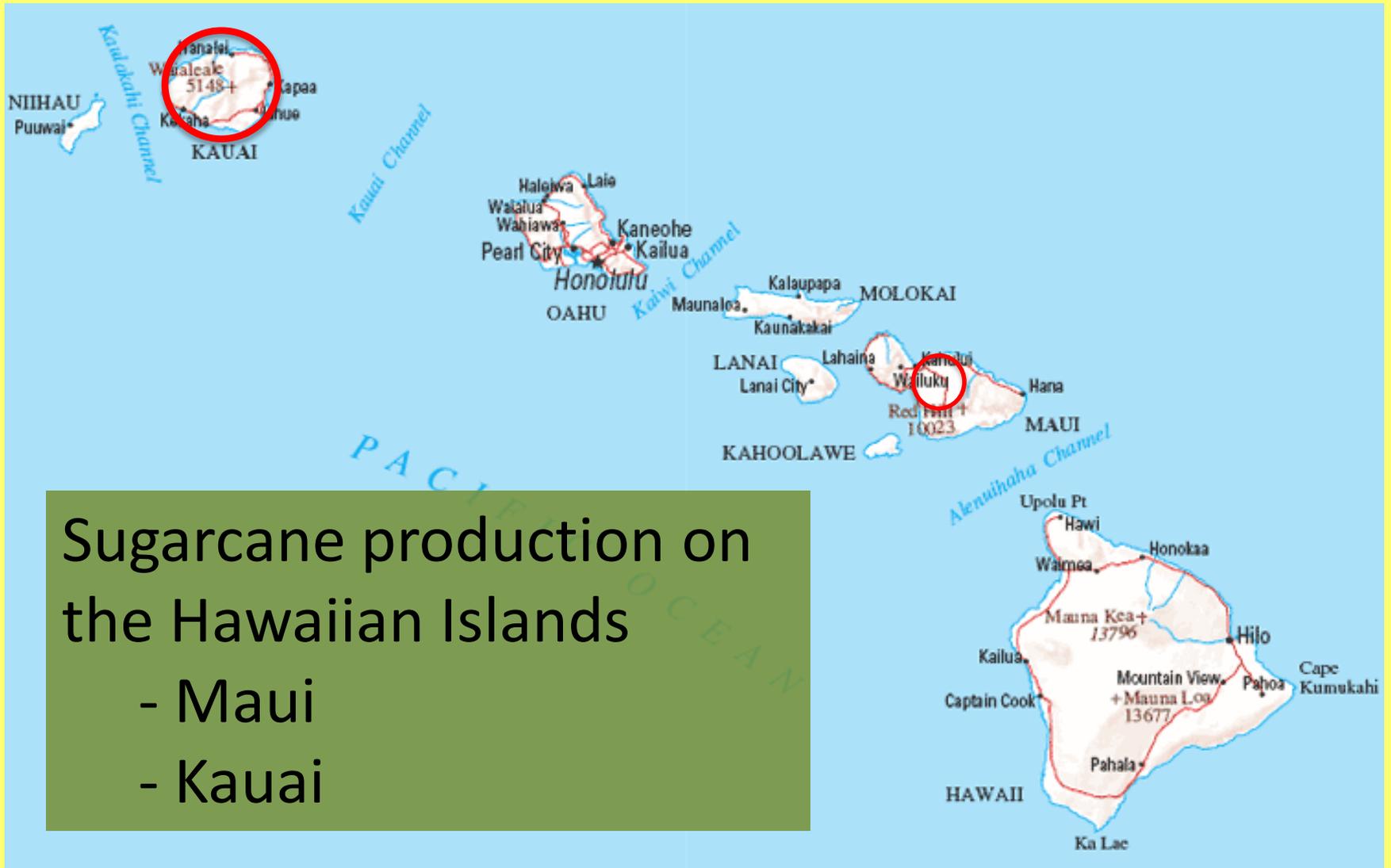
Arthropod Pests of Sugarcane: New Threats to Major Production Areas of North America

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Sugarcane production on the North American mainland

- Florida
- Louisiana
- Texas



Sugarcane production on the Hawaiian Islands

- Maui
- Kauai

2010-11 North American Production

- 280,000 to 324,000 hectares
- Cane for sugar was 26.7 million tons in 2011
- Florida, the top producing state, produced more than 13.1 million tons of sugarcane for sugar in 2011

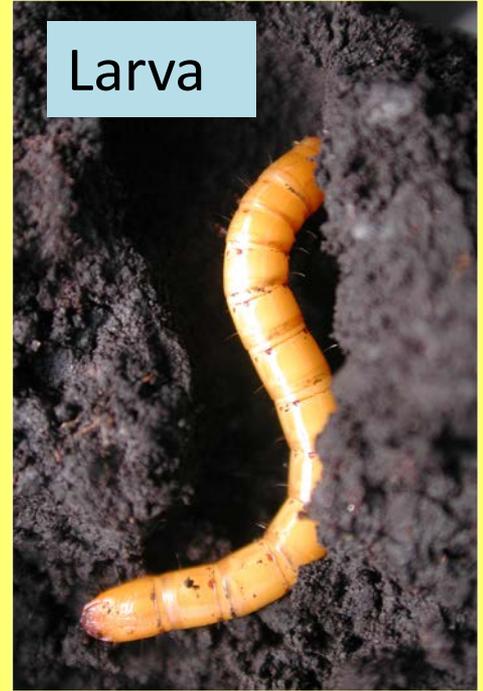
Current Arthropod Pests of North American Sugarcane

Melanotus communis
Corn wireworm

Dead heart
Reduced stand



Larva



Adult



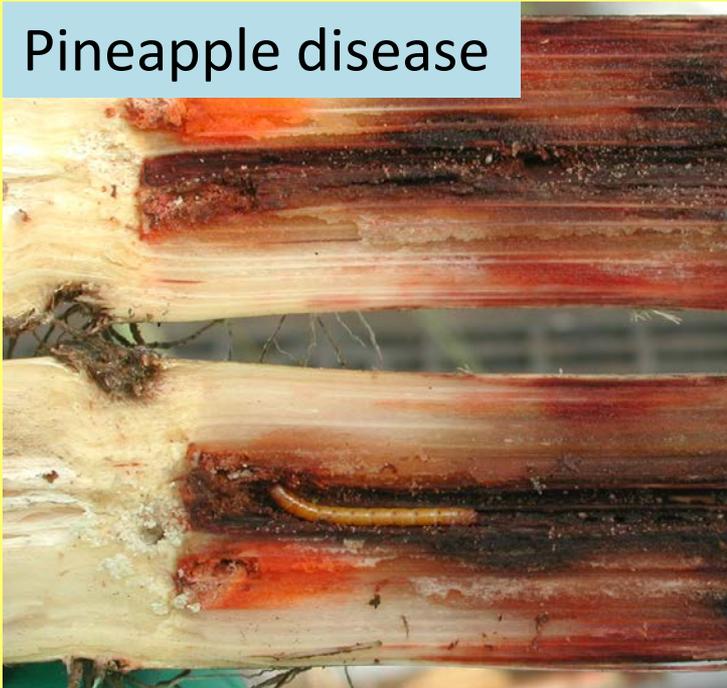
Larvae enter seed pieces



Eat buds and adventitious roots



Pineapple disease



Kill shoots



Elasmopalpus lignosellus

Lesser cornstalk borer, lagartaelasmo

Larvae



Male



Adults

Female



Elasmopalpus lignosellus

Lesser cornstalk borer, lagartaelasmo

Larvae enter
shoots



Dead heart
Reduced stand



Adults
Male



Adults
Female



Tomarus subtropicus
Sugarcane grub

Larva



Adult



Tomarus subtropicus
Sugarcane grub

Larva



Adult



Kills stools and shoots
Reduced stand, lodging, reduced yield

Larva



David Hall, U.S. Sugar Corp.

Diatraea saccharalis Sugarcane borer

Adult



William White, USDA

Larva



David Hall, U.S. Sugar Corp.

Diatraea saccharalis Sugarcane borer



Dead hearts
Reduced stand, lodging,
pineapple
disease, reduced yield

*Metamasius hemipter
ussericeus*
Silky weevil



Larva



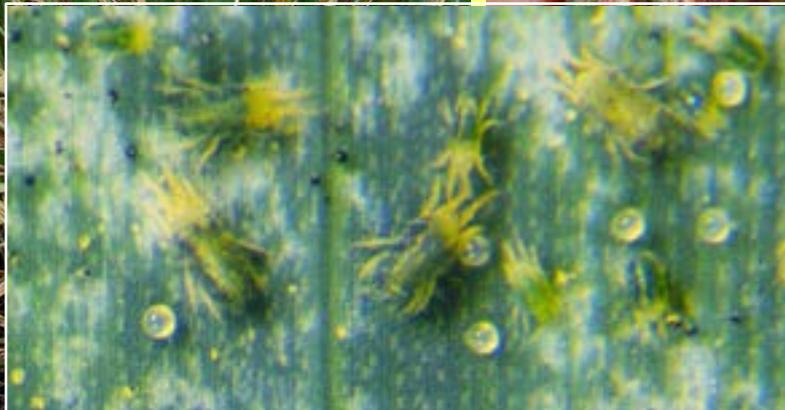
Adult

Broken stalks, pineapple
disease, reduced yield



Oligonychus pratensis
Banks grass mite

Dead leaves, stalks
and stools, reduced
yield

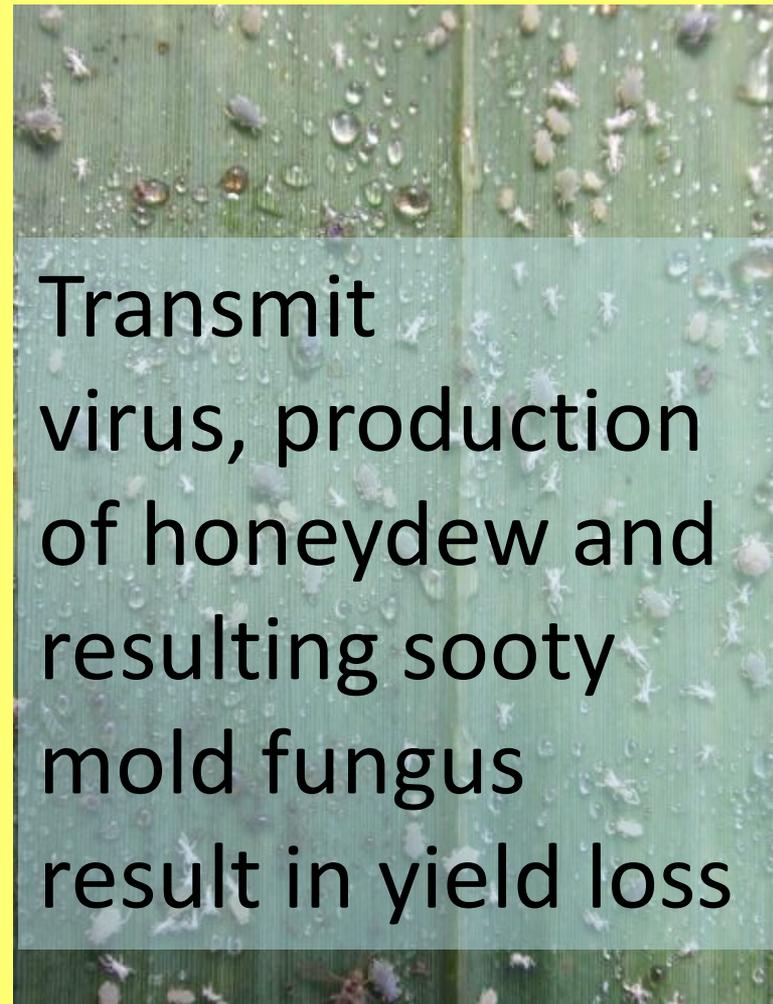
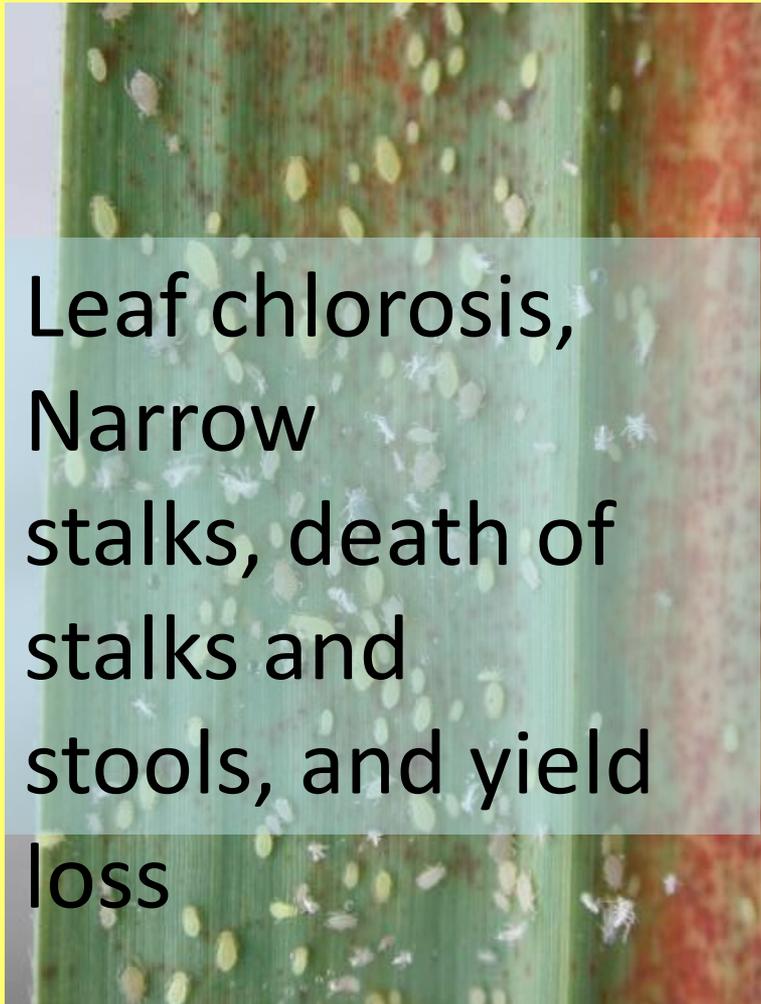


Siphaflava

Yellow sugarcane aphid

Melanaphissacchari

White sugarcane aphid





Leptodictyatabida
Sugarcane lace bug



Adult

Premature leaf death, narrower stalks, reduced photosynthesis

New Threats to Major Production Areas of North America

**2007 First Report of Damage by Sugarcane Rust
Mite, *Abacarussaccharito* Florida Sugarcane**

**2010 First Report of Damage by Mexican Rice
Borer, *Eoreumalofitino* Louisiana Sugarcane**

**2010 First Report of Damage by Sugarcane
Root Weevil *Diaprepesabbreviatusto* Florida
Sugarcane**

Brown rust of sugarcane
Pucciniamelanocephala
1978

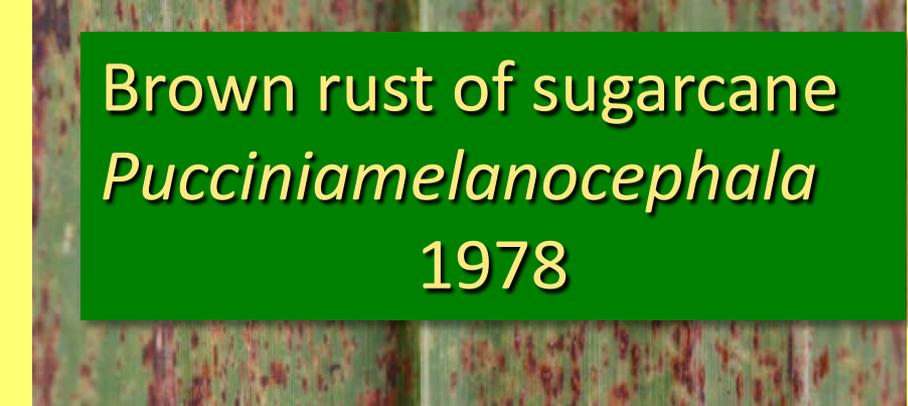


Jeff Hoy, LSU

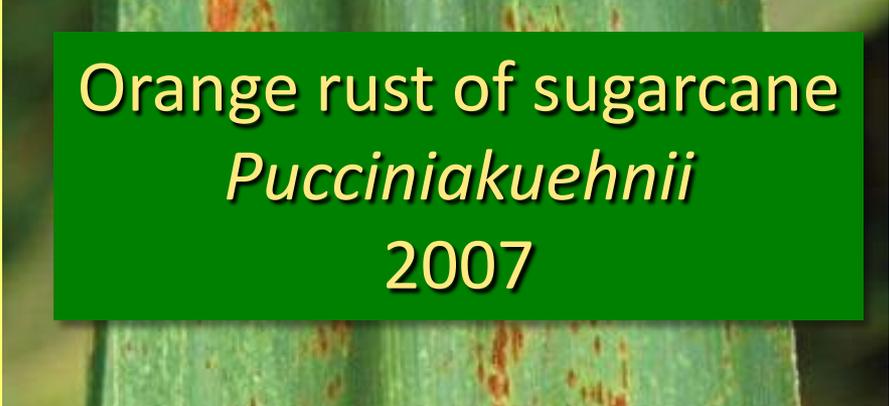
Orange rust of sugarcane
Puccinia kuehnii
2007



Richard Raid, UF



Brown rust of sugarcane
Pucciniamelanocephala
1978



Orange rust of sugarcane
Puccinia kuehnii
2007



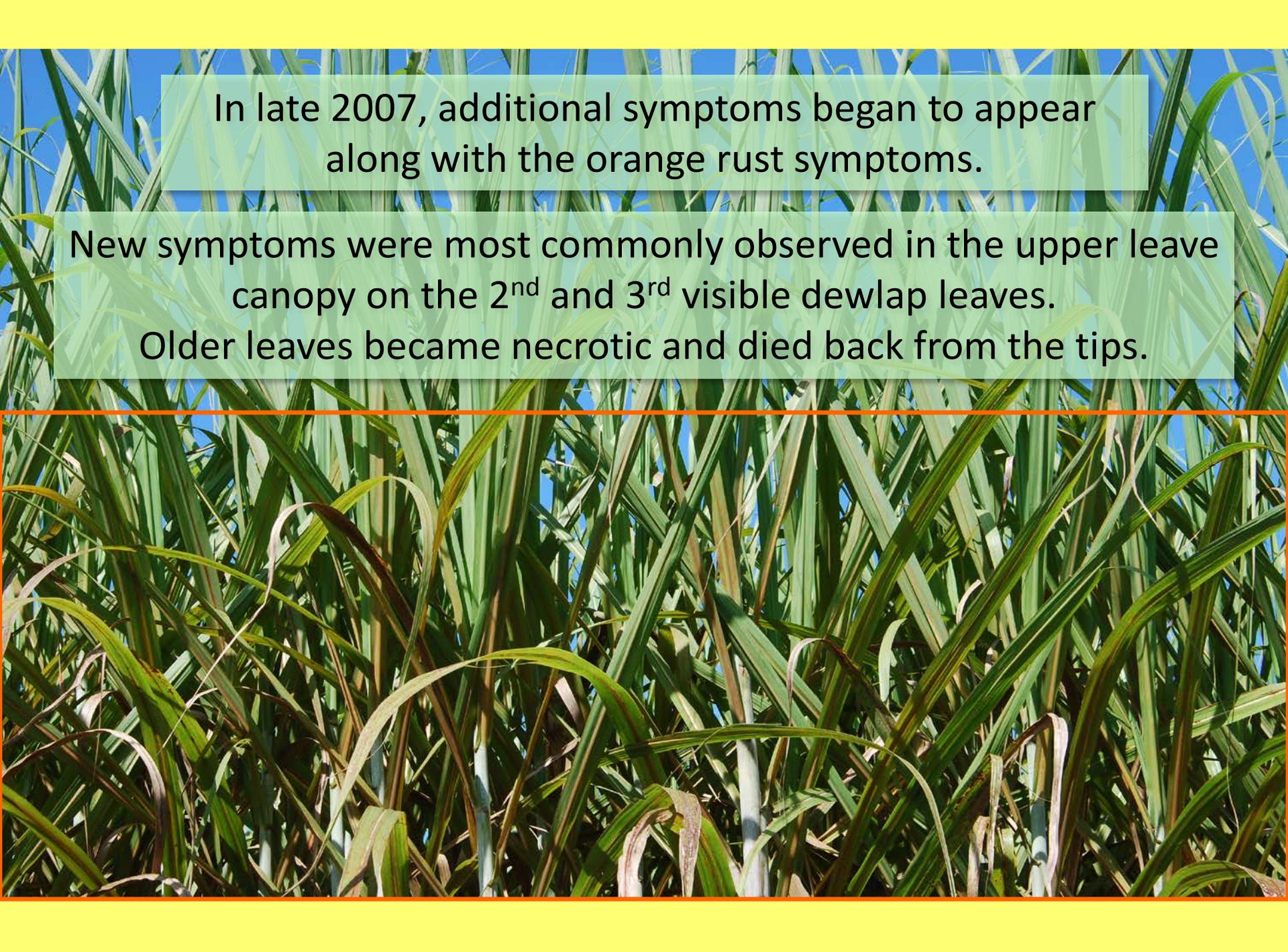
Sugarcane lace bug
Leptodictyatabida
1992



Jeff Hoy, LSU

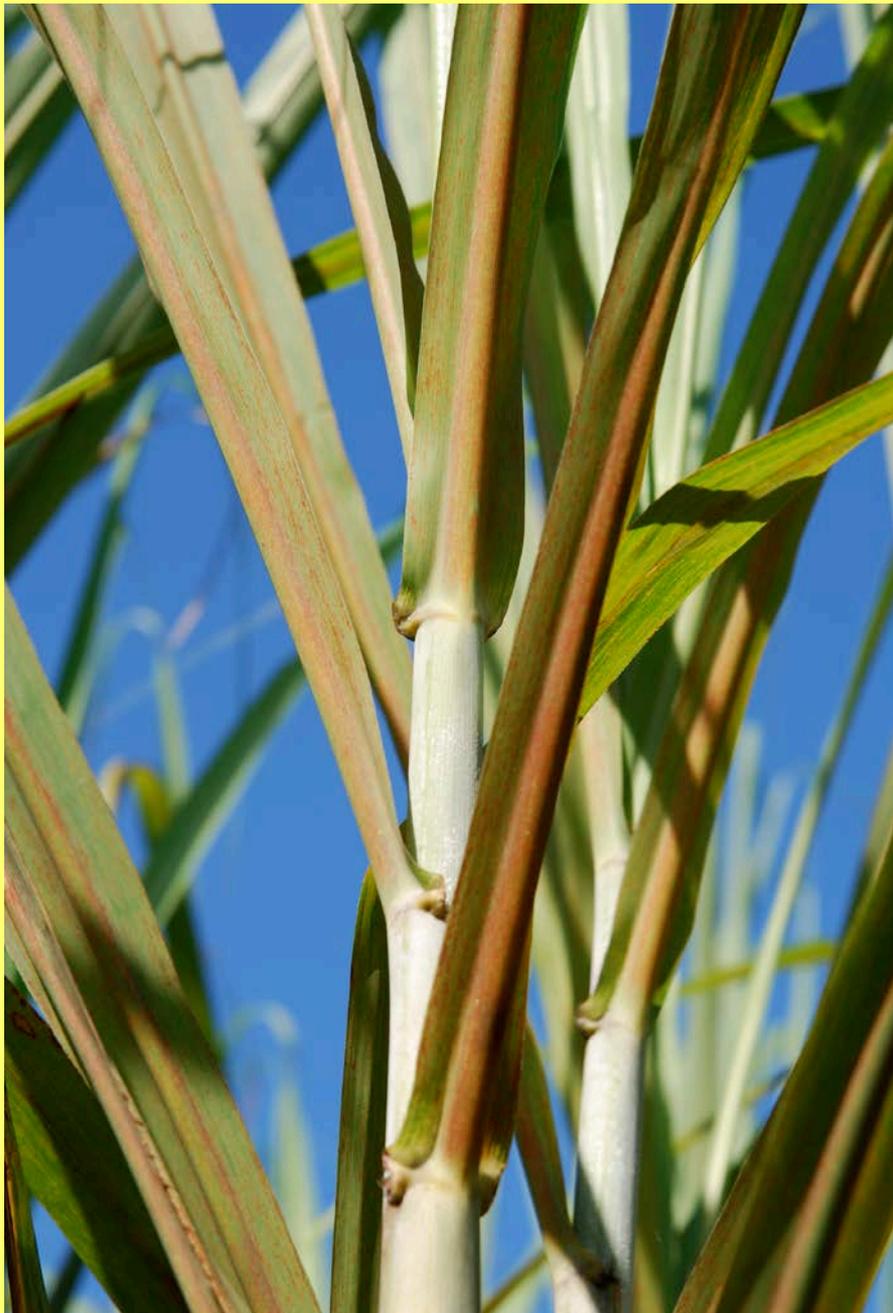


Richard Raid, UF



In late 2007, additional symptoms began to appear along with the orange rust symptoms.

New symptoms were most commonly observed in the upper leaf canopy on the 2nd and 3rd visible dewlap leaves. Older leaves became necrotic and died back from the tips.

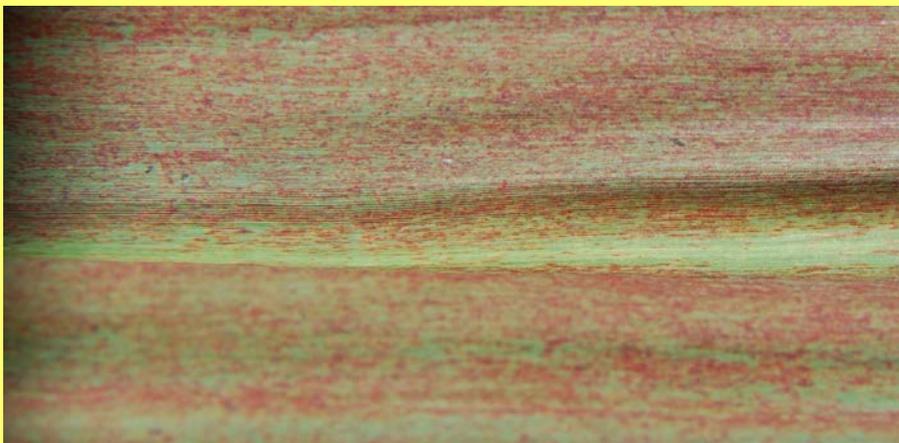


Symptoms :

Light orange to reddish-orange to purple flecking on underside of leaves starting at base and extending outward.

The flecking is so fine that it literally appears to be spray-painted on the leaves with an airbrush.

Mites have become common in late summer since 2007, with damage symptoms visible by mid August in 2008 thru 2012.



Sugarcane rust mite damage symptoms may initially be mistaken for orange rust disease



But discoloration from mite feeding damage is more uniform and DOES NOT produce raised pustules.



Symptoms may appear across the entire leaf, or just on the leaf blades or mid rib.

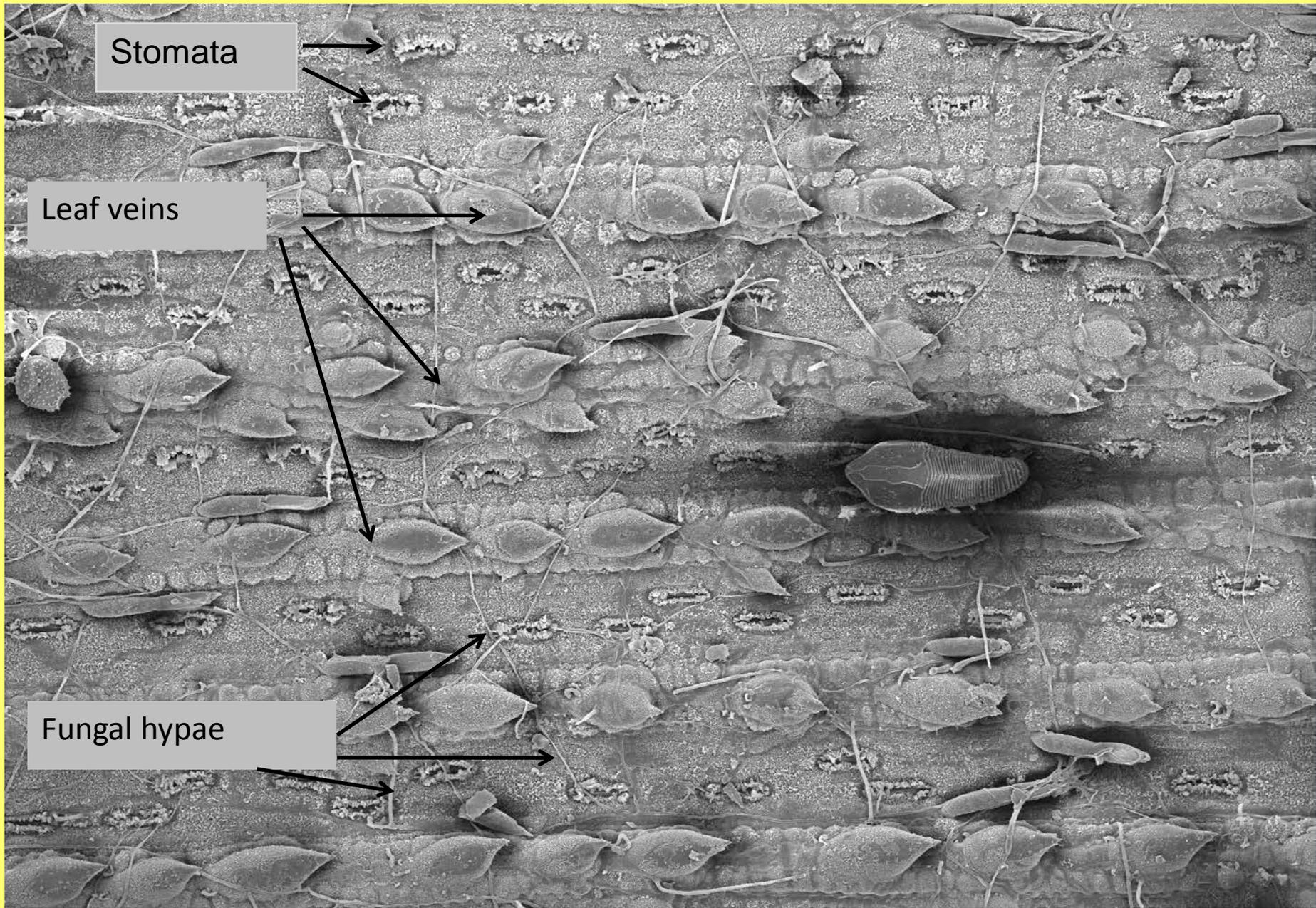
Problem: The biology and damage symptoms of Eriophyoid mites described from sugarcane do not match those observed in Florida for *A. sacchari*.

ChannaBasavanna, the authority of the genus, discussed several species of eriophyiid mites infesting sugarcane in the 1996 book edited by E. E. Lindquist et al., *Eriophyoid Mites – Their Biology, Natural Enemies and Control* (Elsevier Science):

A. sacchari: “all stages of the mite were found on sugarcane on the upper surfaces of tender leaf blades” and that “no apparent symptoms of injury have been noticed”.

A. officinari: “The mites rust the tips of leaf blades of sugarcane”

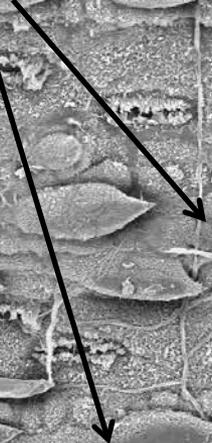
Finally identified by Ron Ochoa using Low Temperature Scanning Electron Microscopy (LTSEM)



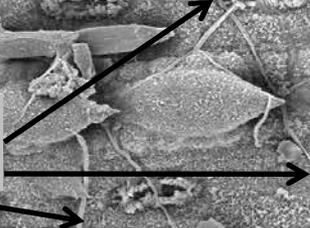
Stomata



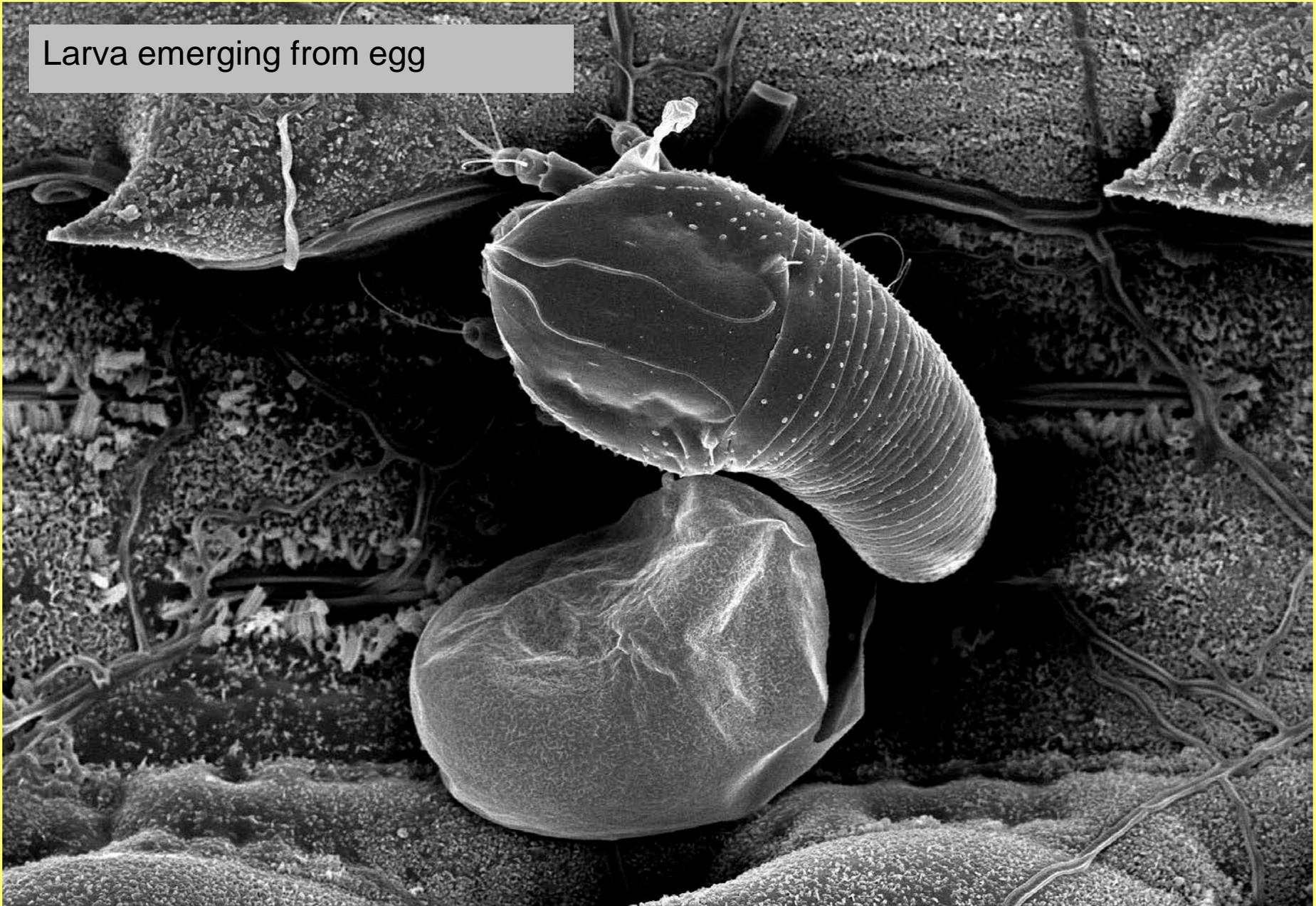
Leaf veins



Fungal hyphae



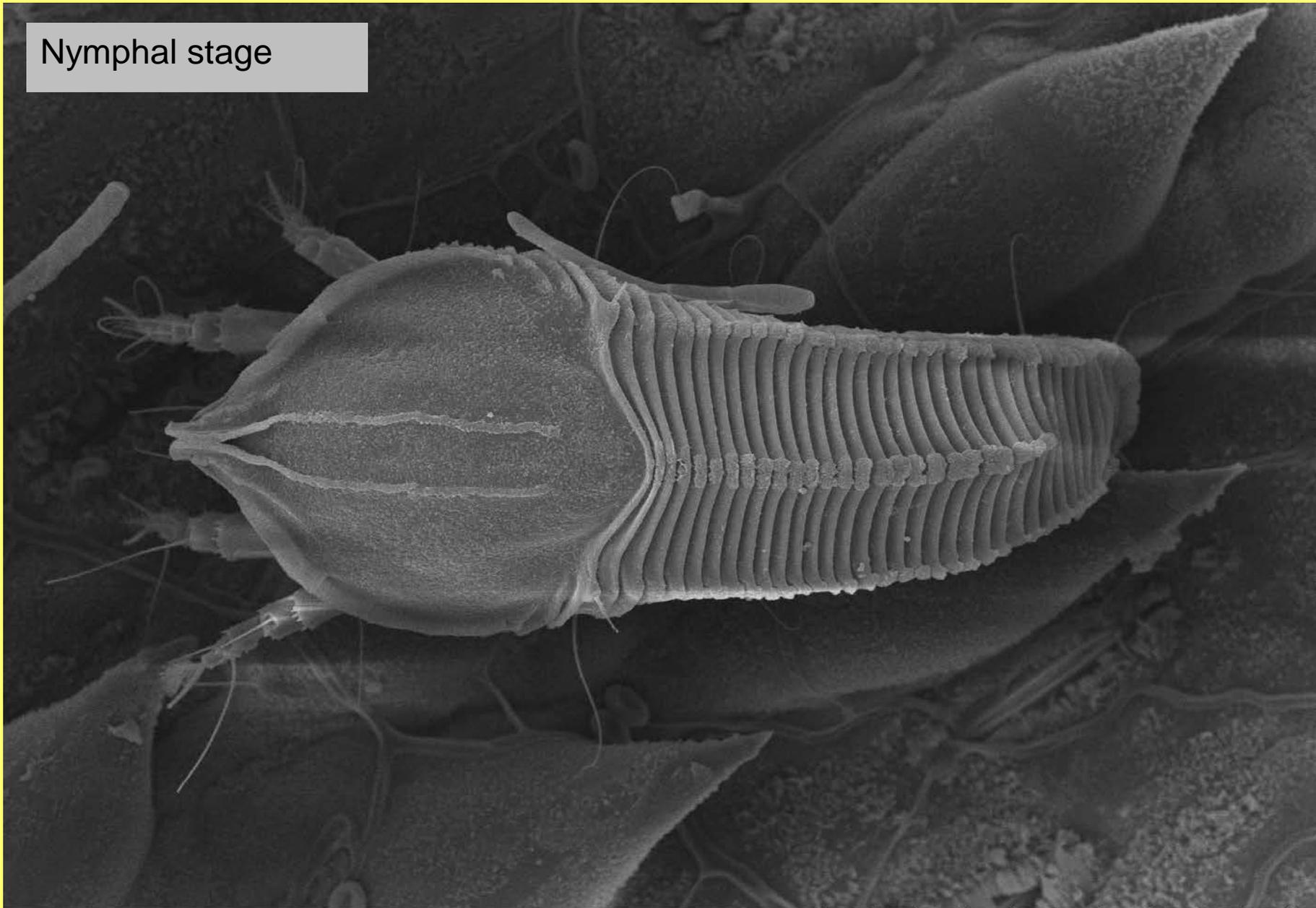
Larva emerging from egg



USDA-03118 10.0kV 8.1mm x1.00k SE(M) 11/23/09 14:21

50.0um

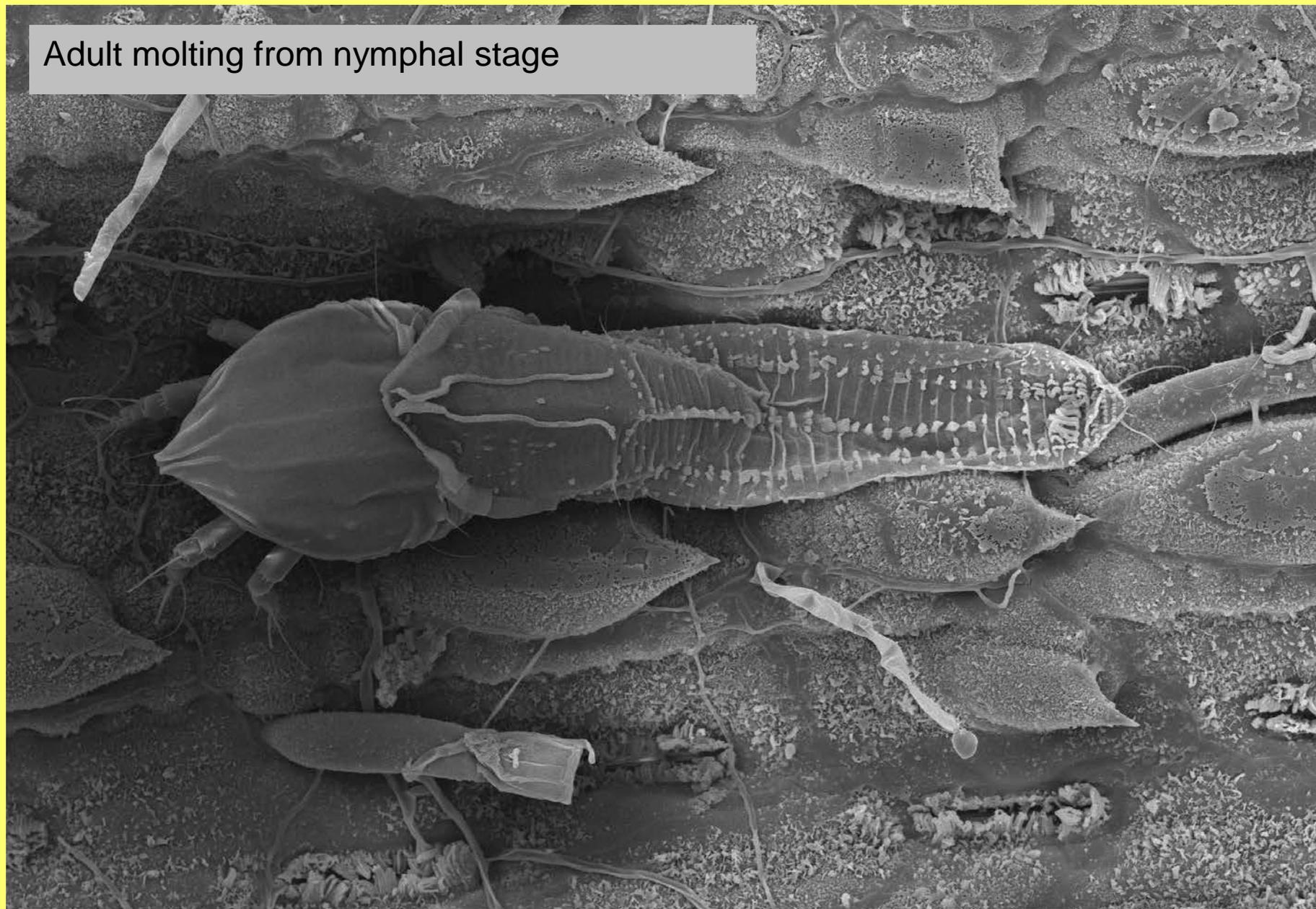
Nymphal stage



USDA-03112 10.0kV 9.2mm x900 SE(M) 11/23/09 13:44

50.0um

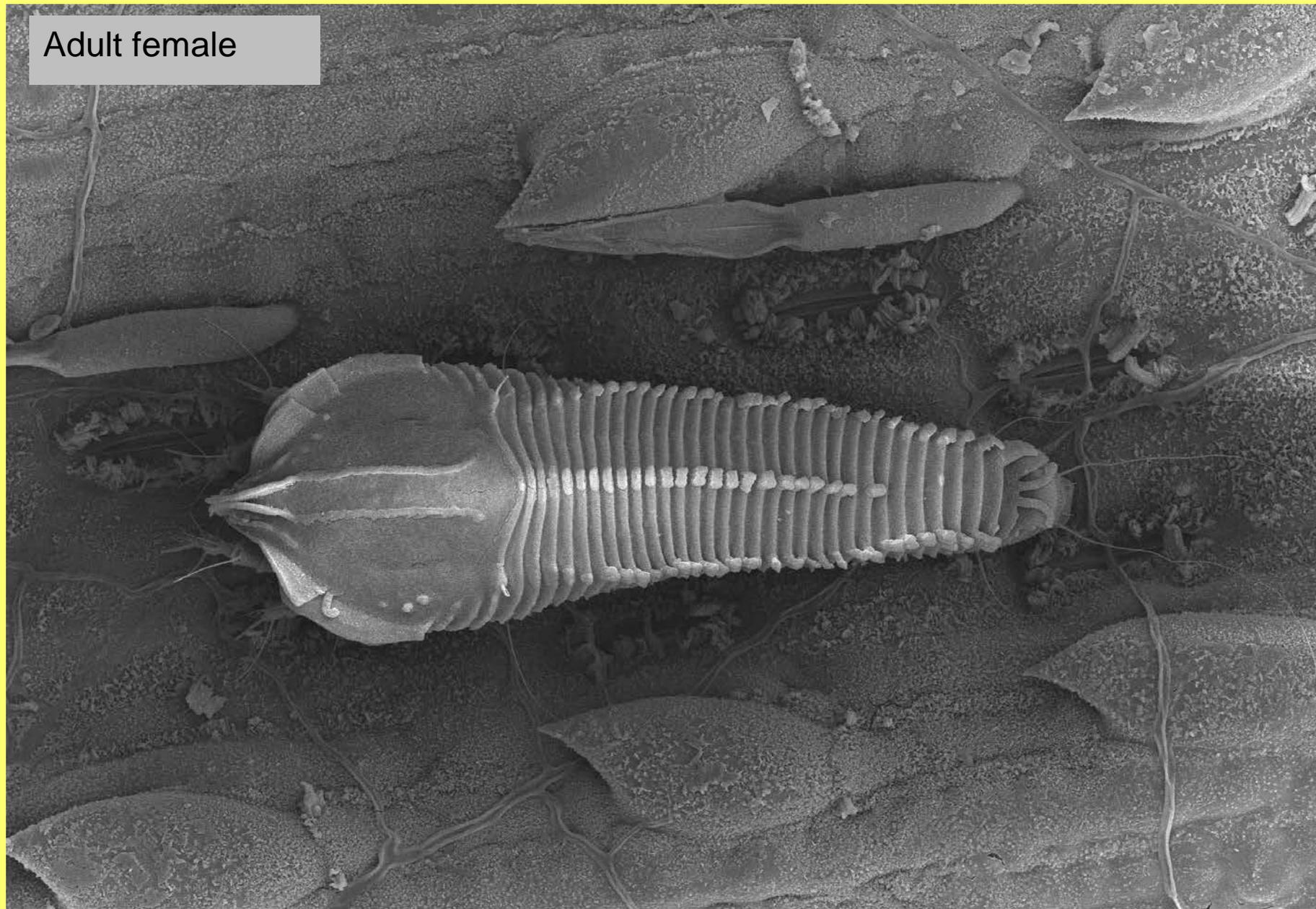
Adult molting from nymphal stage



USDA-03129 10.0kV 15.4mm x600 SE(M) 11/23/09 15:28

50.0um

Adult female



USDA-03105 10.0kV 11.3mm x600 SE(M) 11/23/09 13:13



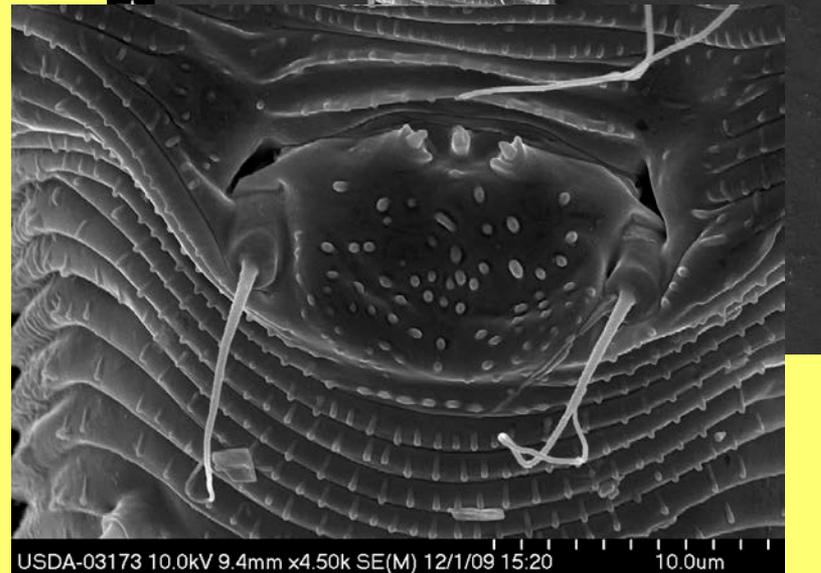
50.0um

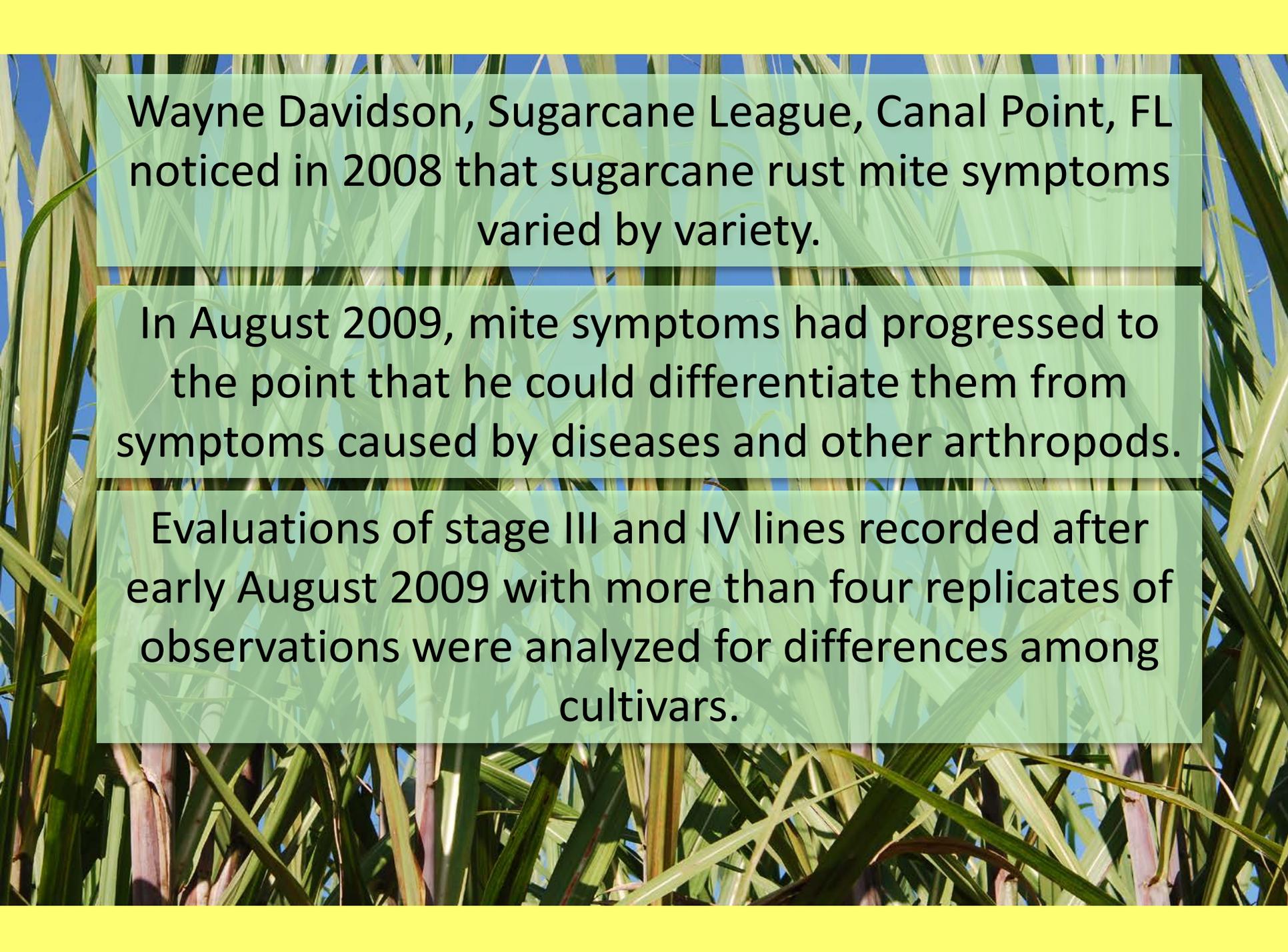
Abacarussacchari

Female



Male





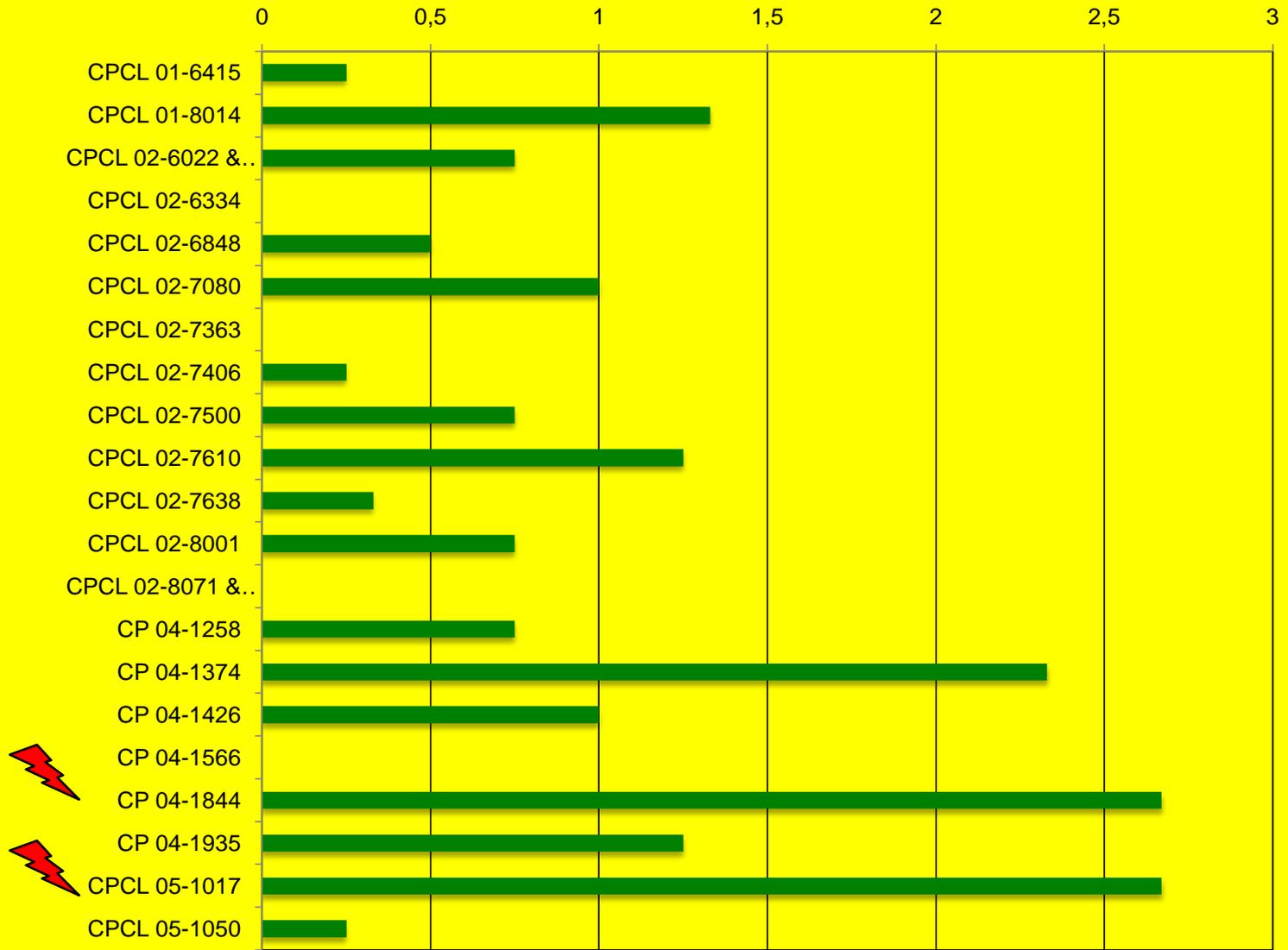
Wayne Davidson, Sugarcane League, Canal Point, FL noticed in 2008 that sugarcane rust mite symptoms varied by variety.

In August 2009, mite symptoms had progressed to the point that he could differentiate them from symptoms caused by diseases and other arthropods.

Evaluations of stage III and IV lines recorded after early August 2009 with more than four replicates of observations were analyzed for differences among cultivars.

Sugarcane Rust Mite Damage

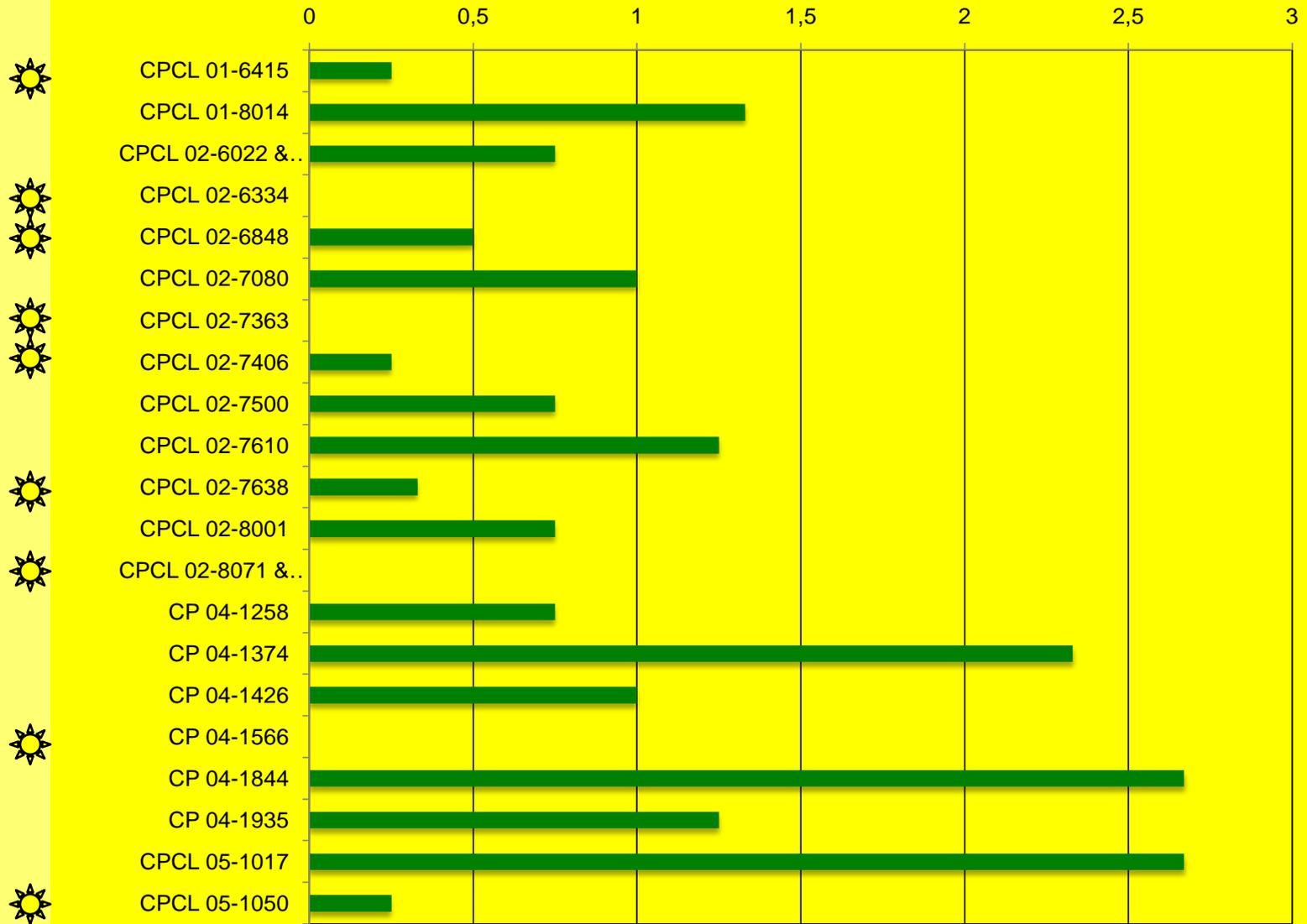
Stage III, 1st stubble



Mite damage symptoms: 0 = none, 1 = light, 2 = moderate, 3 = heavy

Sugarcane Rust Mite Damage

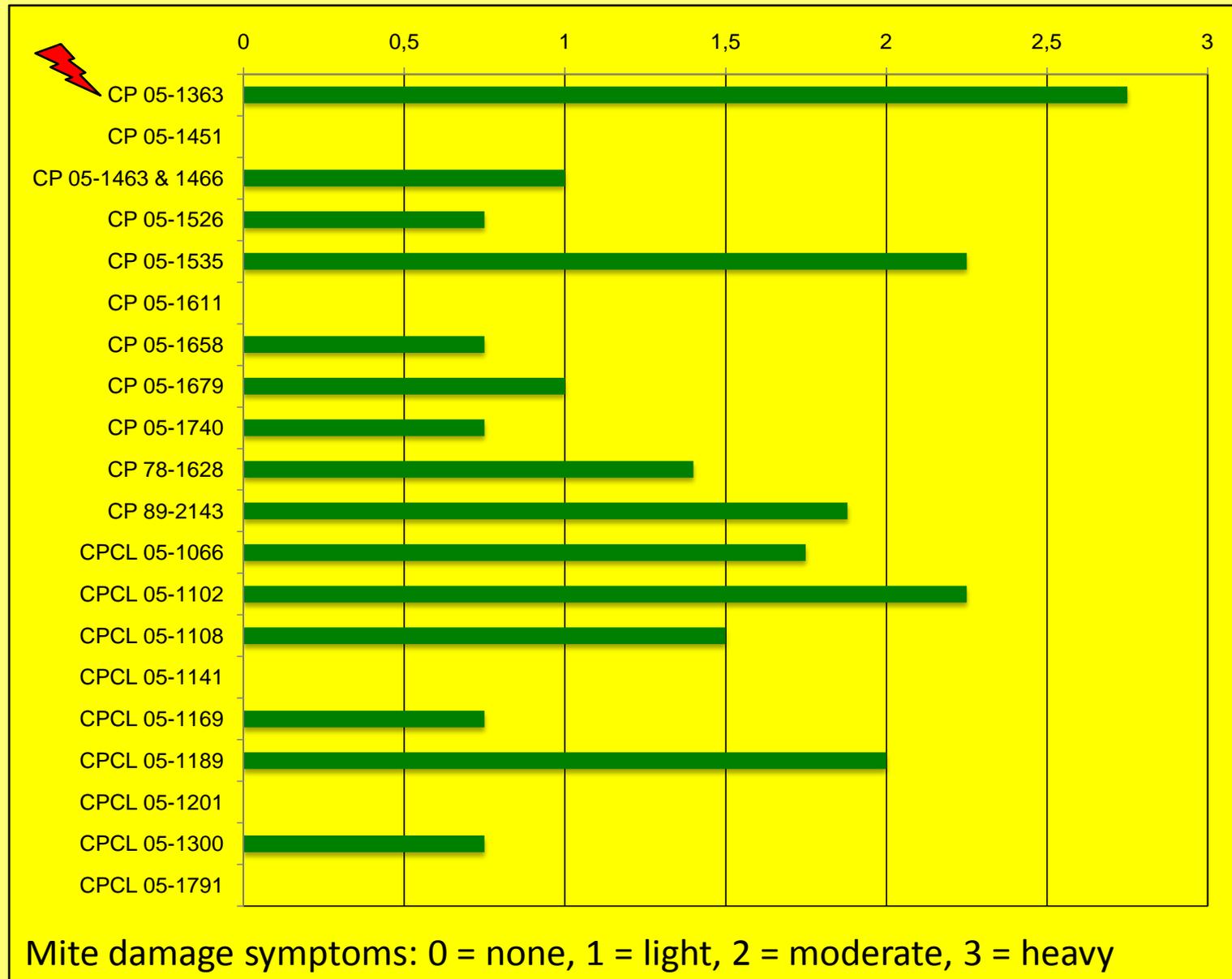
Stage III, 1st stubble



Mite damage symptoms: 0 = none, 1 = light, 2 = moderate, 3 = heavy

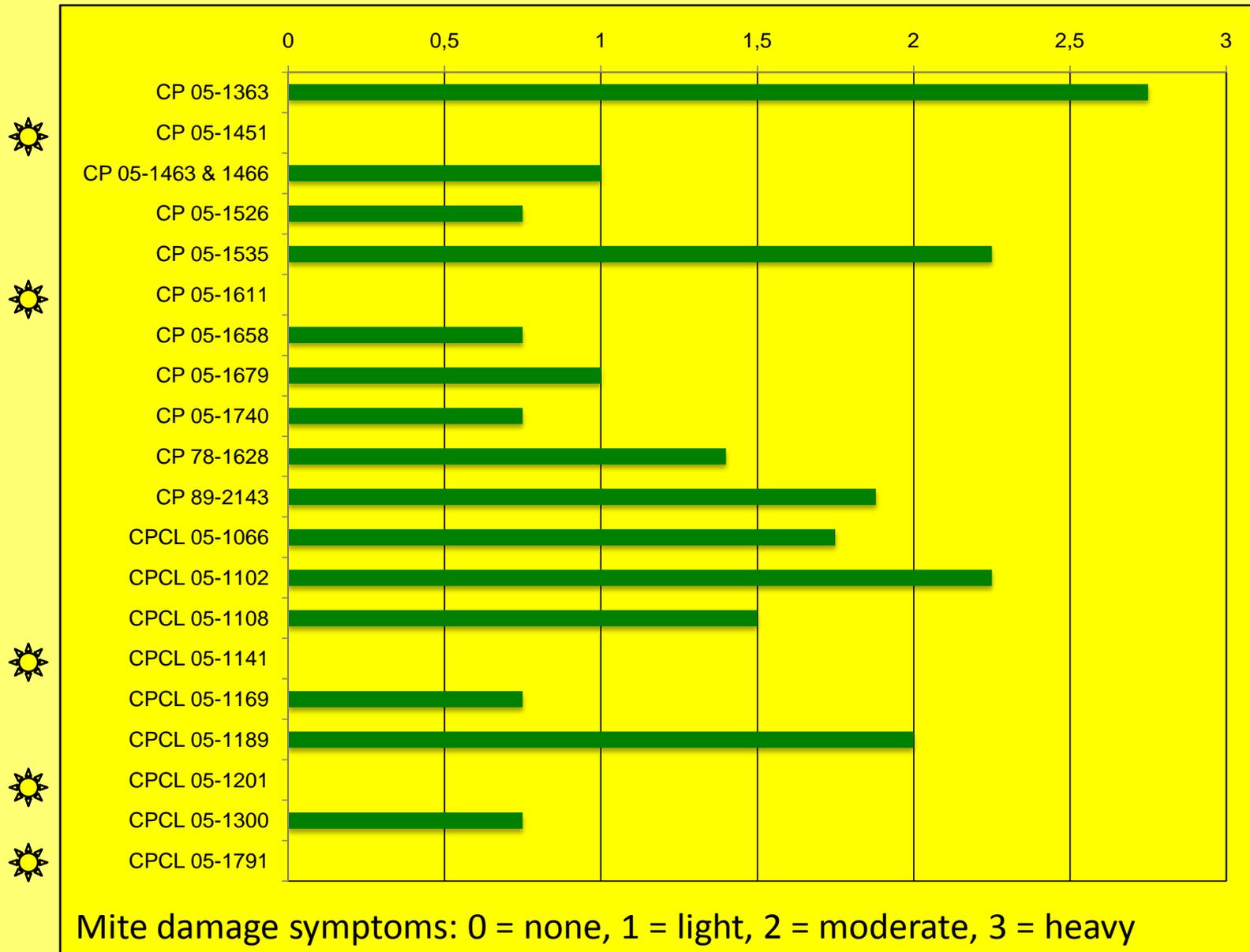
Sugarcane Rust Mite Damage

Stage III, 1st stubble



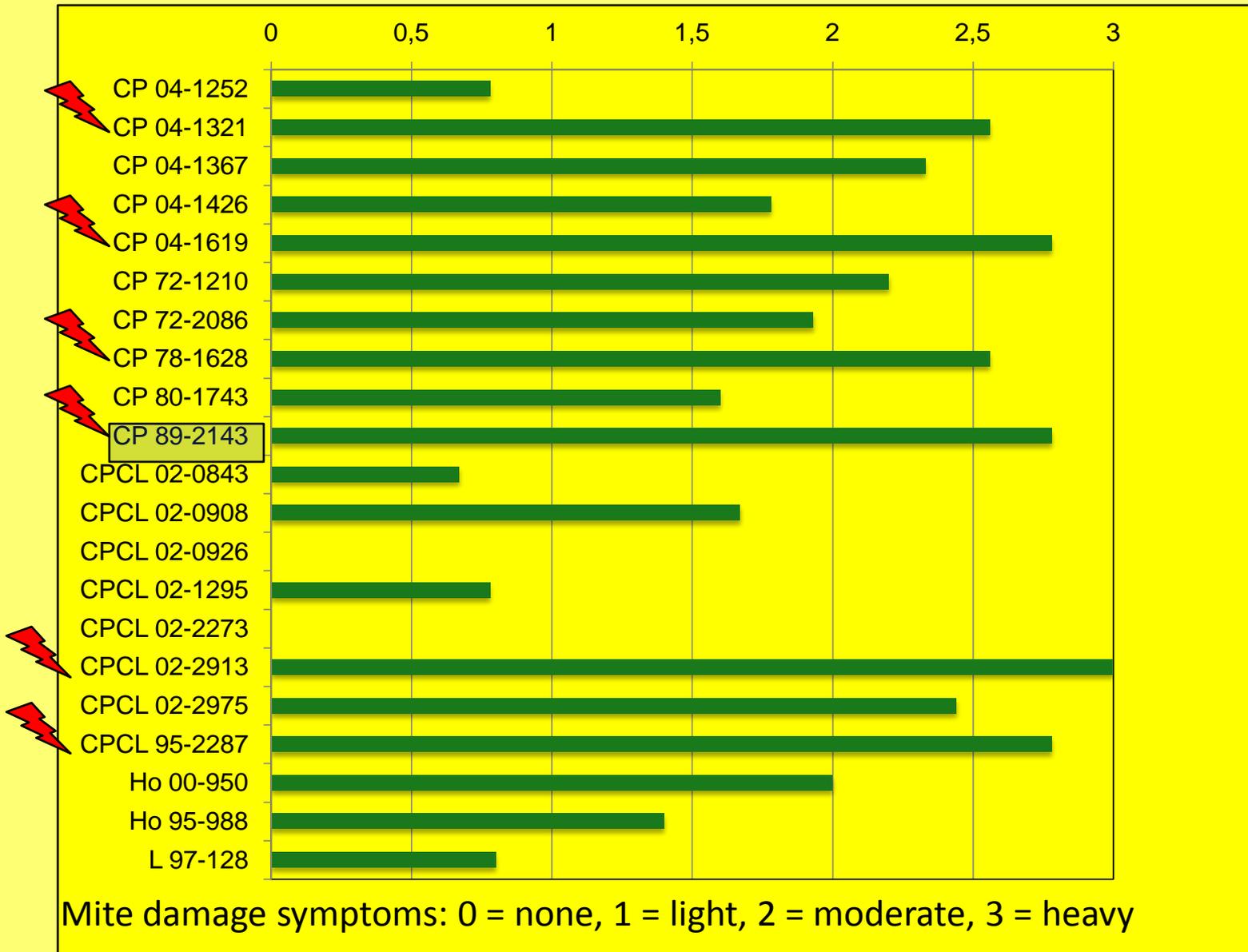
Sugarcane Rust Mite Damage

Stage III, 1st stubble



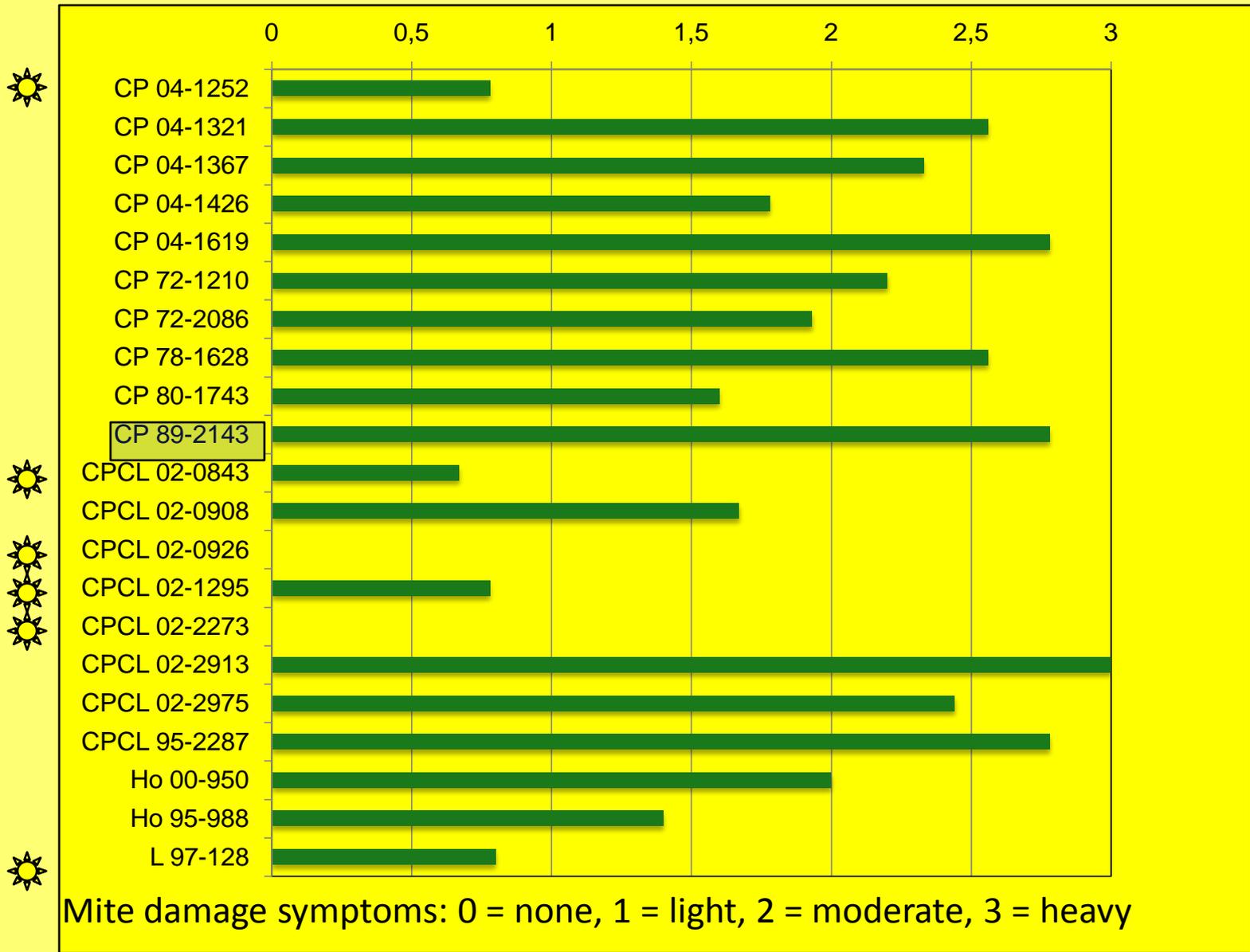
Sugarcane Rust Mite Damage

Stage IV, 1st stubble



Sugarcane Rust Mite Damage

Stage IV, 1st stubble



Mite damage symptoms: 0 = none, 1 = light, 2 = moderate, 3 = heavy

Hand held meters used to compare photosynthetic parameters between plants with and without mite damage symptoms

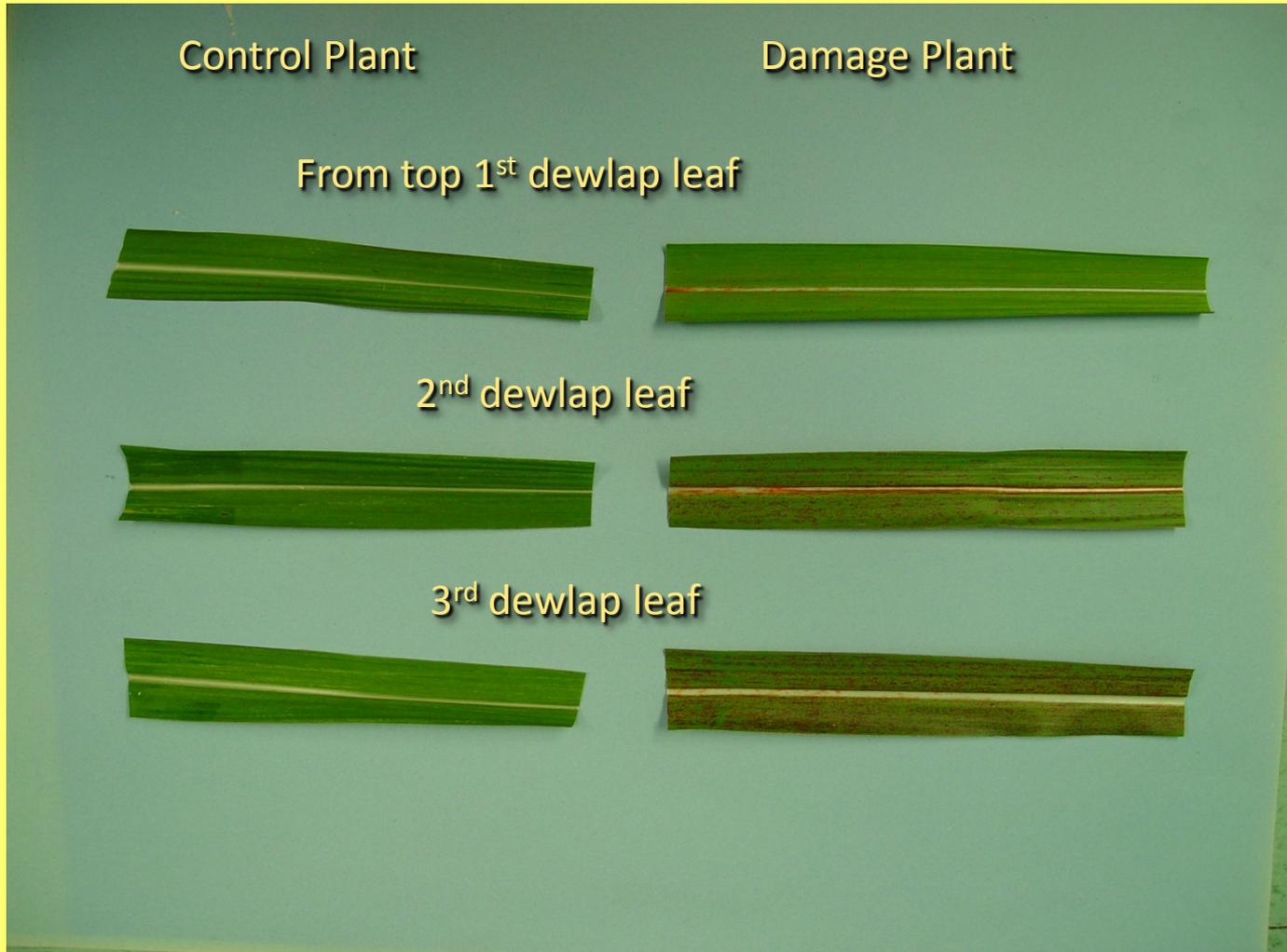
Mite damaged



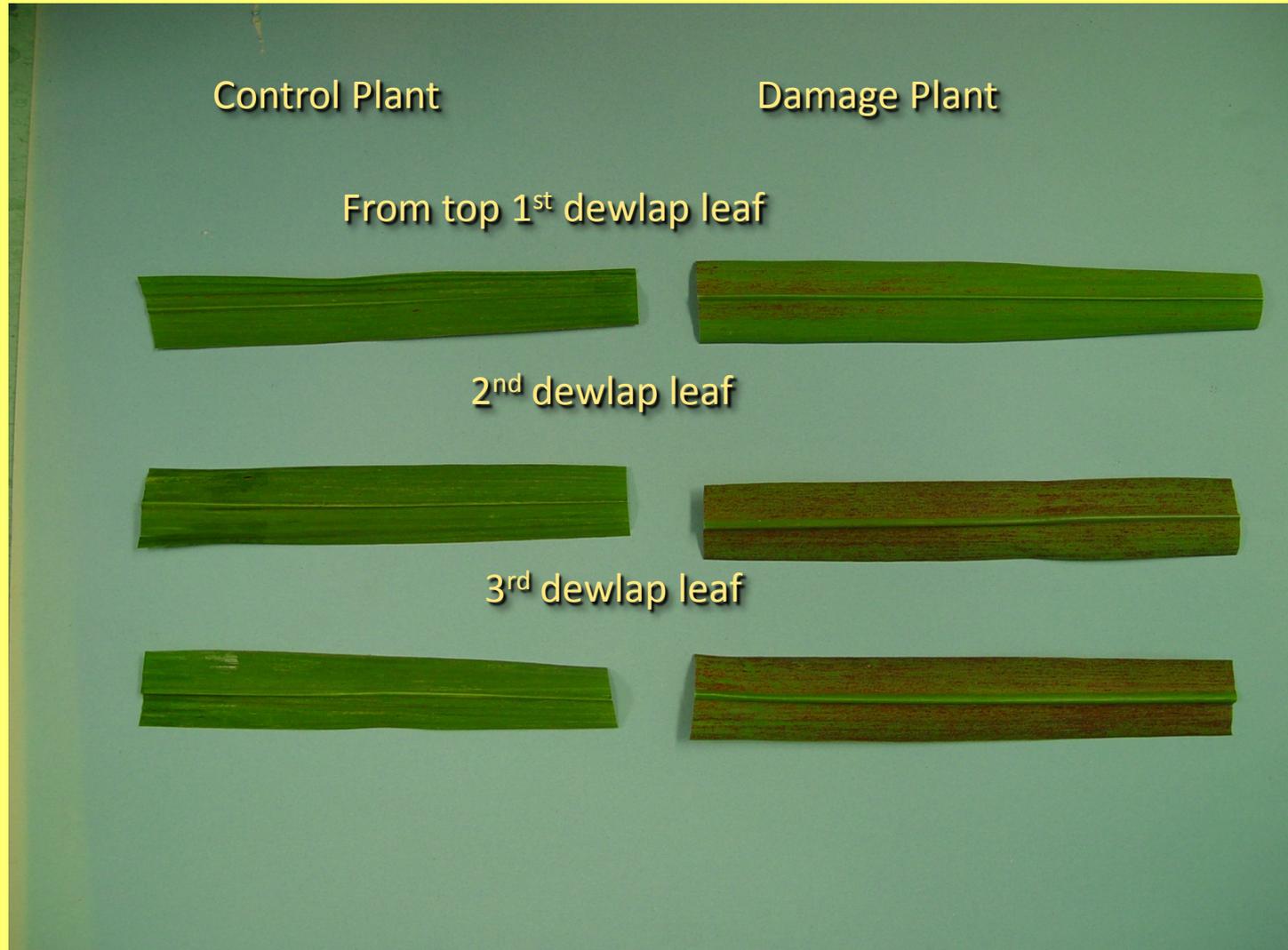
Un-damaged - Control



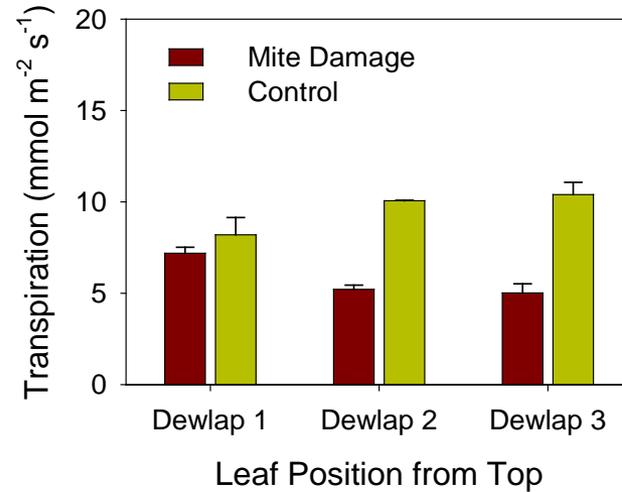
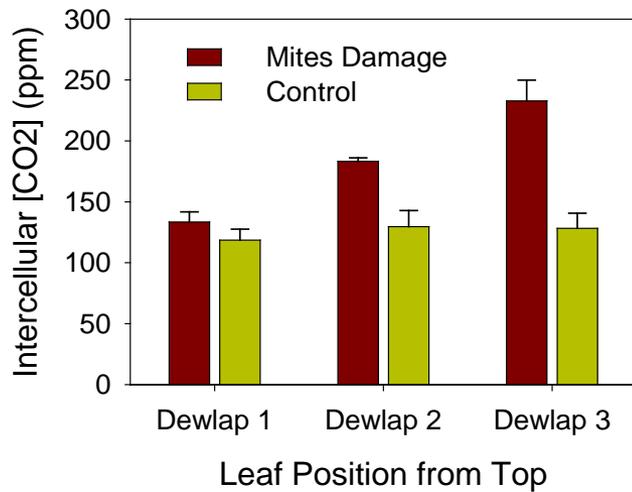
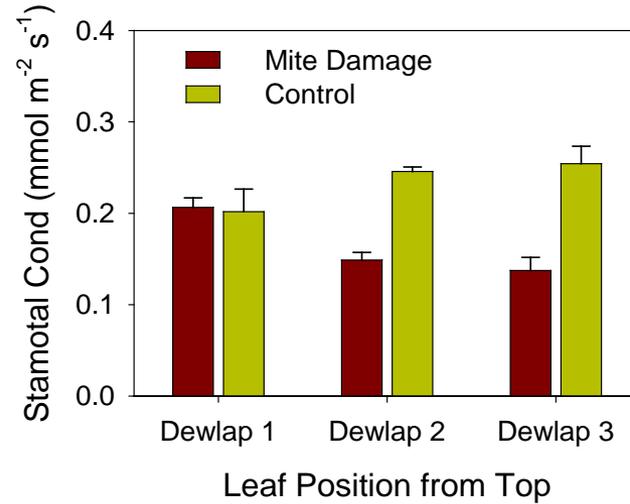
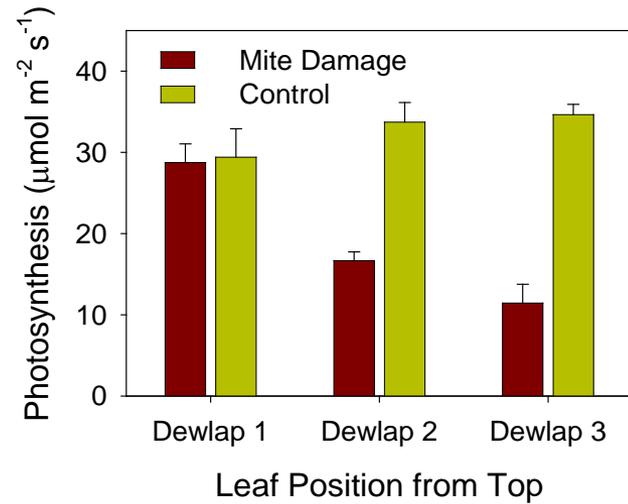
Leaf Sections of Mite Damaged and Un-damaged Plants (upper side)



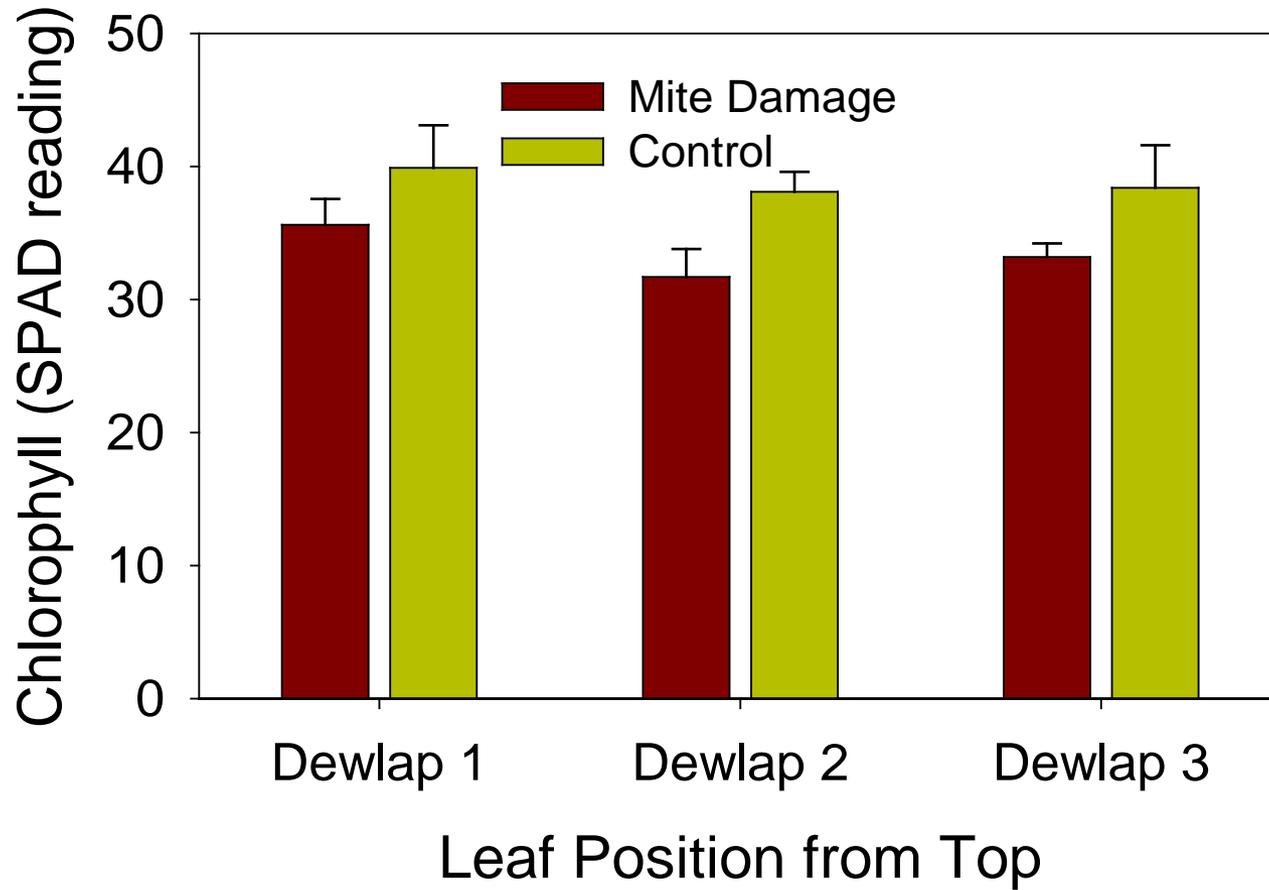
Leaf Sections of Mite Damaged and Un-damaged Plants (lower side)



Leaf Photosynthesis Components



Leaf Chlorophyll





Mixed infections of rust disease and rust mites do occur, but closer examination with a 20x hand lens will find the tiny mites moving and feeding between leaf veins on mite-infested leaves.

2007 Distribution: Africa, Australia, Brazil (?), India, Venezuela, Florida

2008: Found throughout Costa Rican sugarcane industry plantings.

2011: Found throughout El Salvador and Panama sugarcane industry plantings.

Abacarussacchari

Sugarcane Rust Mite

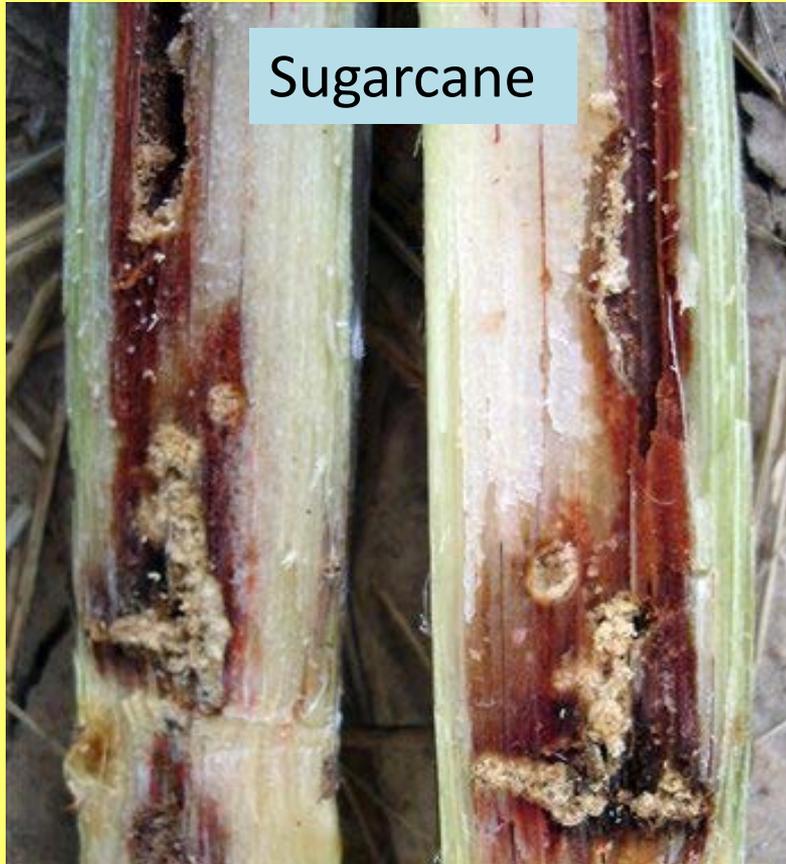
Natural enemies, predacious mites and a parasitic fungus, help with control, but do not prevent damage

Effective mitocides are not labeled for use in sugarcane in the United States

More research needed to prove yield loss from mite feeding

More research needed to evaluate resistant sugarcane cultivars for tolerance to mite feeding

Eoreumaloftini
Mexican Rice Borer



Sugarcane

Dead hearts
reduced stand, lodging,
pineapple disease, reduced yield

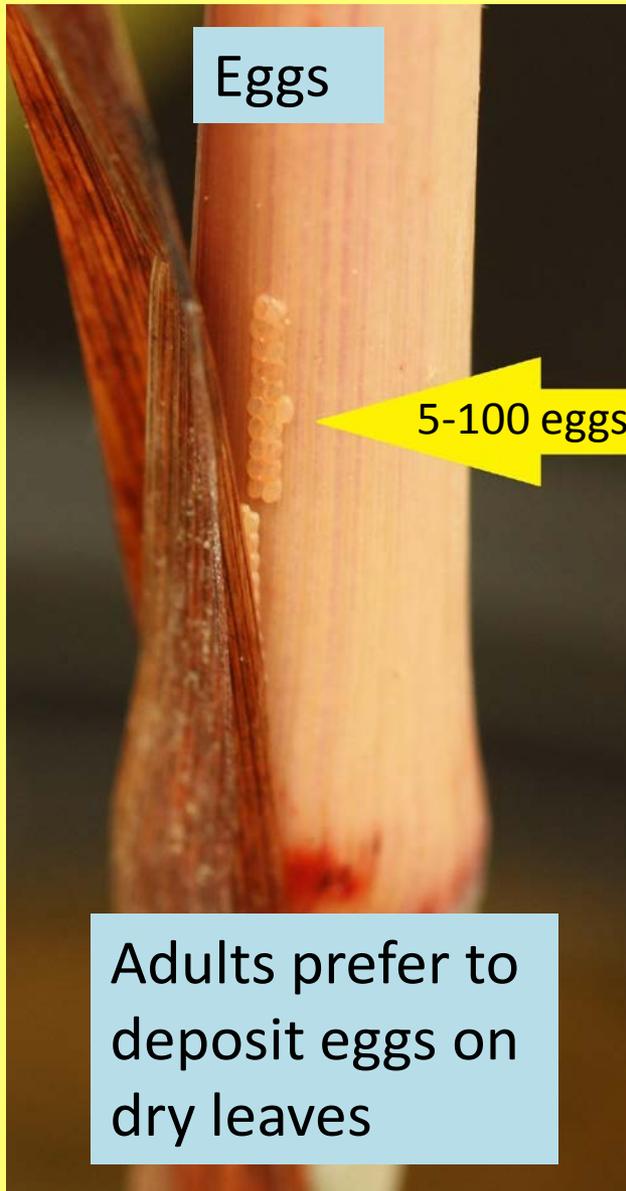


Rice

Dead hearts, lodging,
Sterility (white head)



Eoreumaloftini Mexican Rice Borer



Adult - 12 to 20 mm long,
Small black spot on wing

Eoreumaloftini
Mexican Rice Borer

Reduce spread by eliminating movement of seed pieces from infested areas to areas not infested.

Maintaining healthy plants. Drought stress increases infestation. Maintain irrigation where available to reduce plant stress.

Mow (< 18 cm) and disk down infested rice stubble following harvest to reduce reservoir.

Use pheromone traps to monitor spread to alert growers to presence of moths in their area.

Eoreumaloftini
Mexican Rice Borer

Insecticides have are not completely effective after larvae enters plant. Apply pyrethroid insecticide within 1 wk of larval emergence from eggs before they enter stalks. Apply novaluron, tebufenozide (IGR's) or rynaxypyr within 2 wk of larvae emergence.

HoCP 85-845 and L-08-075 provide best resistance to larvae (>8x less bored internodes).

Preserve natural enemies, in particular the ant *Solenopsisinvicta*, to reduce damage by 50%.

Diaprepes abbreviatus
Sugarcane root weevil

Adults glue leaves together to make a pocket, deposit 25 to 250 eggs in pocket between two leaves.



Adults start to deposit eggs 3 – 7 days after emerging from soil or plants, 5000 eggs per female possible over several months. Larvae emerge from eggs and drop to soil within 7 days.

Diaprepes abbreviatus
Sugarcane root weevil

Larvae feed on roots in soil, then enter seed pieces and stools to feed



Diaprepes abbreviatus
Sugarcane root weevil



Diaprepes abbreviatus
Sugarcane root weevil



0-95 – 1.95 cm long



Cassia obtusifolia - sicklepod

5340095

Adults emerge to feed on >270 plant species

Diaprepes abbreviatus
Sugarcane root weevil



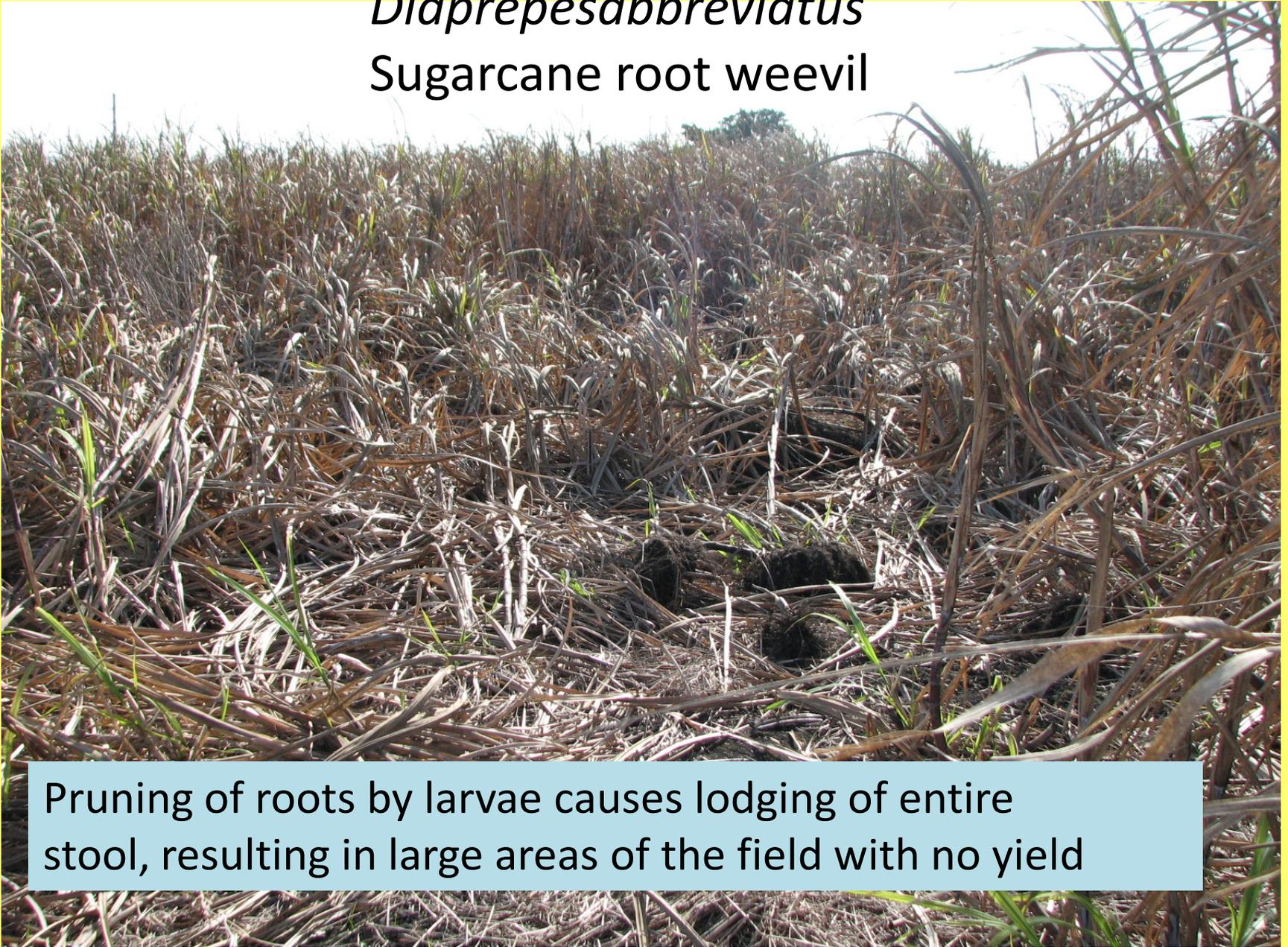
0.95 – 1.95 cm long



Sesbania exaltata - hemp sesbania

Adults emerge to feed on >270 plant species

Diaprepes abbreviatus
Sugarcane root weevil



Pruning of roots by larvae causes lodging of entire stool, resulting in large areas of the field with no yield

Pruning of roots by larvae results in lodging of entire stool



Diaprepes abbreviatus
Sugarcane root weevil

Stand loss from larval feeding and killing stools results in large areas of the field with no plants – reduced yield – for remaining ratoon crops



Diaprepes abbreviatus

Sugarcane root weevil



Pest of sugarcane in Puerto Rico and Barbados for >100 years.

Found in Florida in 1964 and 1968 and became a serious pest of citrus.

November 2010 larvae first discovered feeding on sugarcane stools at Clewiston, Florida (sand).

December 2010 larvae feeding on stools found at Pahokee, Florida (soil with >80% organic matter).

April – June 2012 >1000 adults found on leguminous weeds at Clewiston and Pahokee, Florida.



Diaprepes abbreviatus

Sugarcane root weevil

Current Florida Status: Appears to be slowly spreading in sugarcane fields with legume weeds. Controls not well studied.

Life cycle 6 to 15 months.

Difficult to determine when to treat, but appears to be attracted to leguminous weeds in sugarcane fields.

Control recommendation includes flooding fields, control of host weeds (including *Amaranthus spinosus*) using herbicides.

Imidacloprid-based insecticides used in citrus in Florida not available for sugarcane.

Nematodes may be helpful in some soils.

Acknowledgments

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do Brasil

Usina Ester

UsinaMoreno