

BIOLOGICAL CONTROL OF THE CYCAD AULACASPIS SCALE



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INDIAN RIVER RESEARCH
& EDUCATION CENTER

1947



CITRUS: SCION AND ROOTSTOCK TRIALS

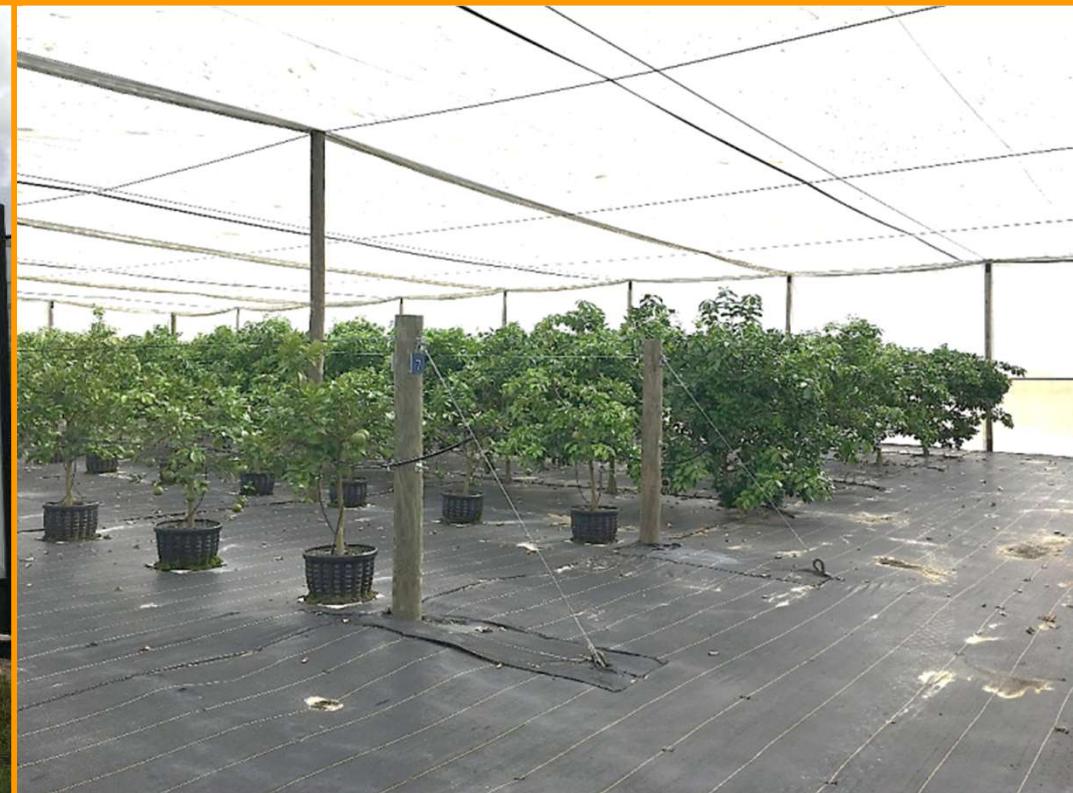


- Nutritional therapies
- Fertilization guidelines
- Bactericides
- Genomics of fungal pathogens
- Early detection system for CLas
- Oak mulch
- Smart irrigation
- Phosphorus management
- Tolerant grapefruit varieties

RHIZOTRONS: BELOWGROUND IMAGERY OF Roots



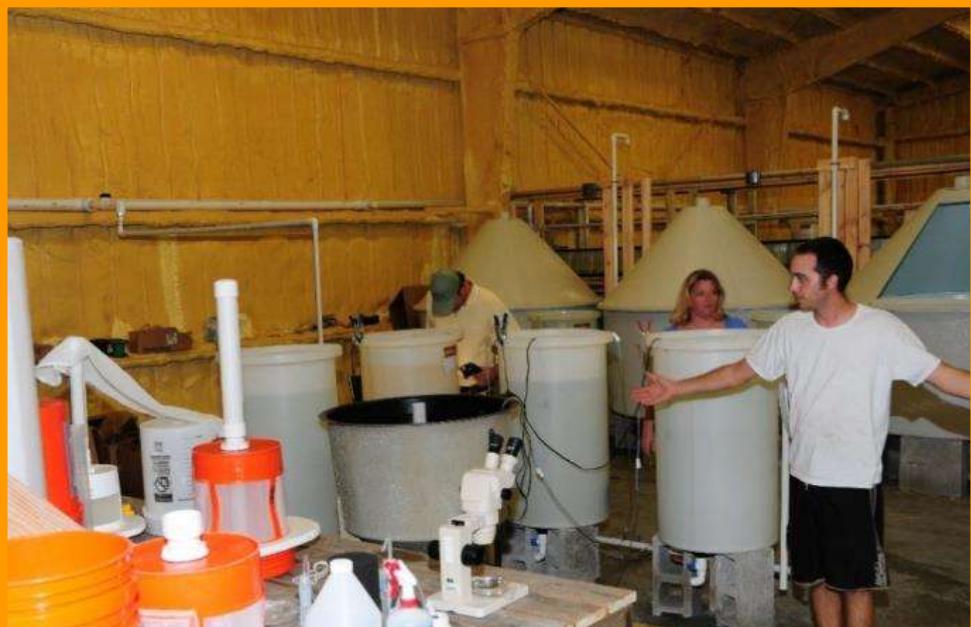
CITRUS UNDER PROTECTIVE COVER



POSTHARVEST FACILITY



AQUACULTURE RESEARCH AND DEMONSTRATION FACILITY



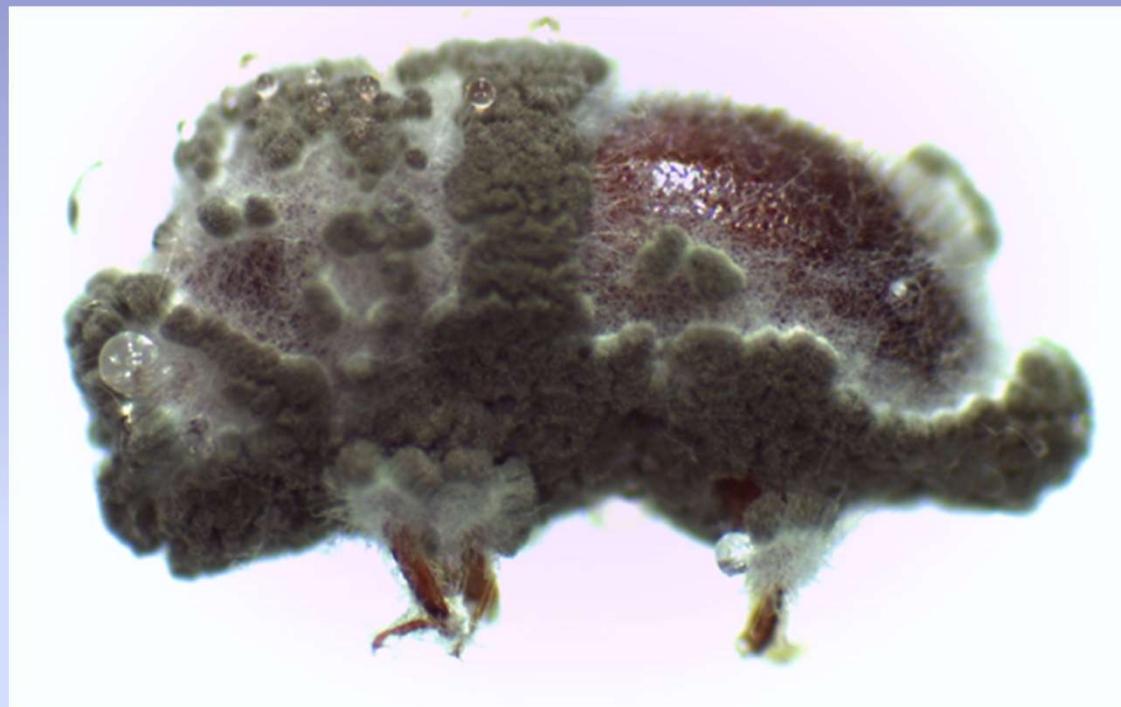
HAYSLIP BIOLOGICAL CONTROL RESEARCH & CONTAINMENT LABORATORY



BIOCONTROL OF WEEDS

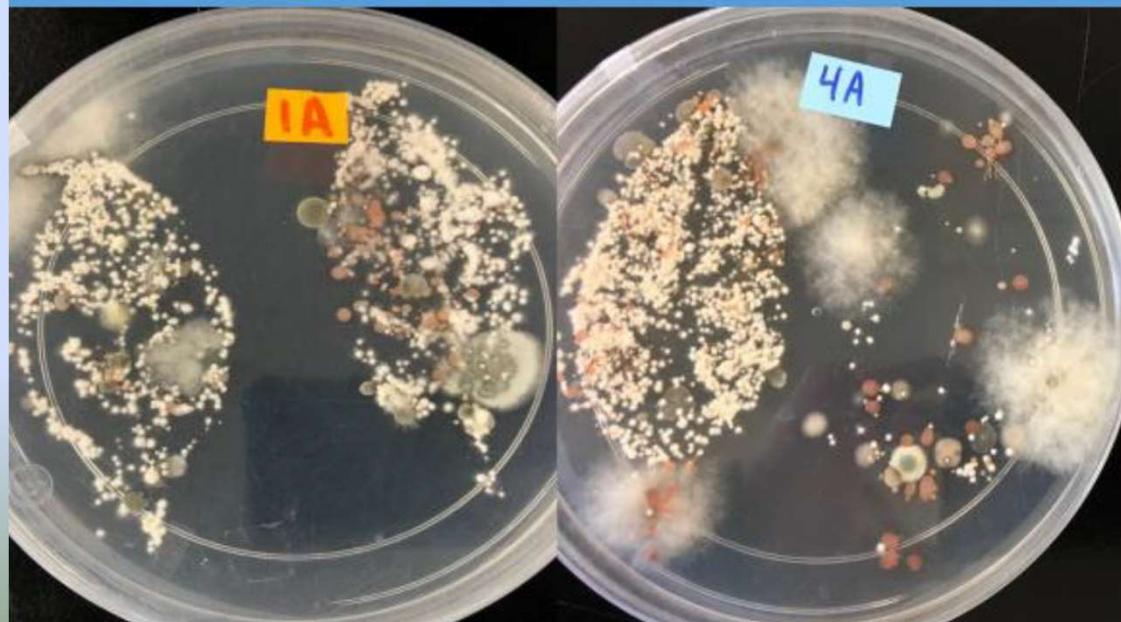


ENTOMOPATHOGENIC FUNGUS RESEARCH LABORATORY



Air Blast Sprayer

Proptec (ULV) Sprayer



BIOCONTROL OF INSECTS

Mexican bromeliad weevil



Yellowmargined leaf beetle



Cycad aulacaspis scale









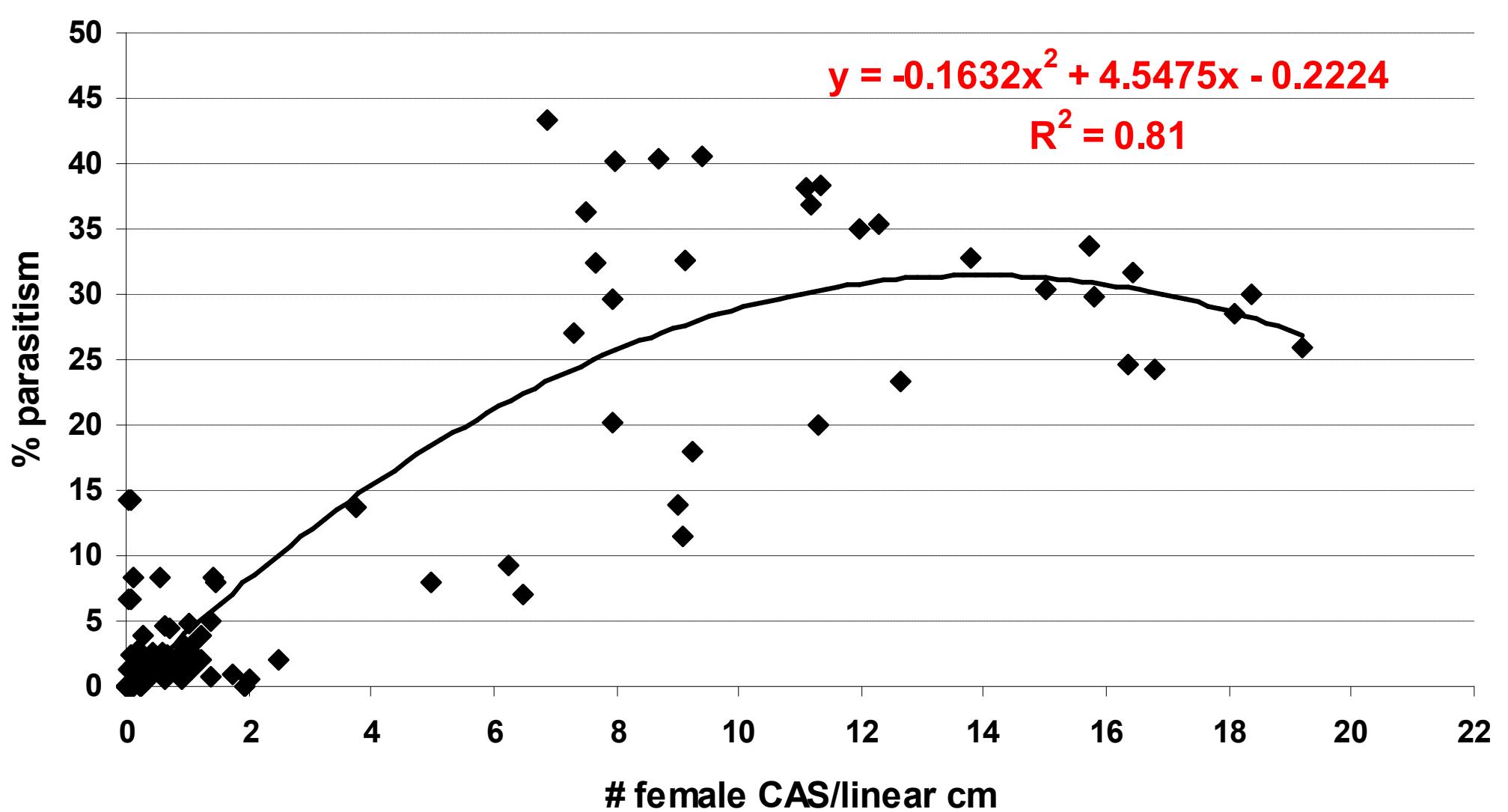
Coccobius fulvus

Native to Southeast Asia

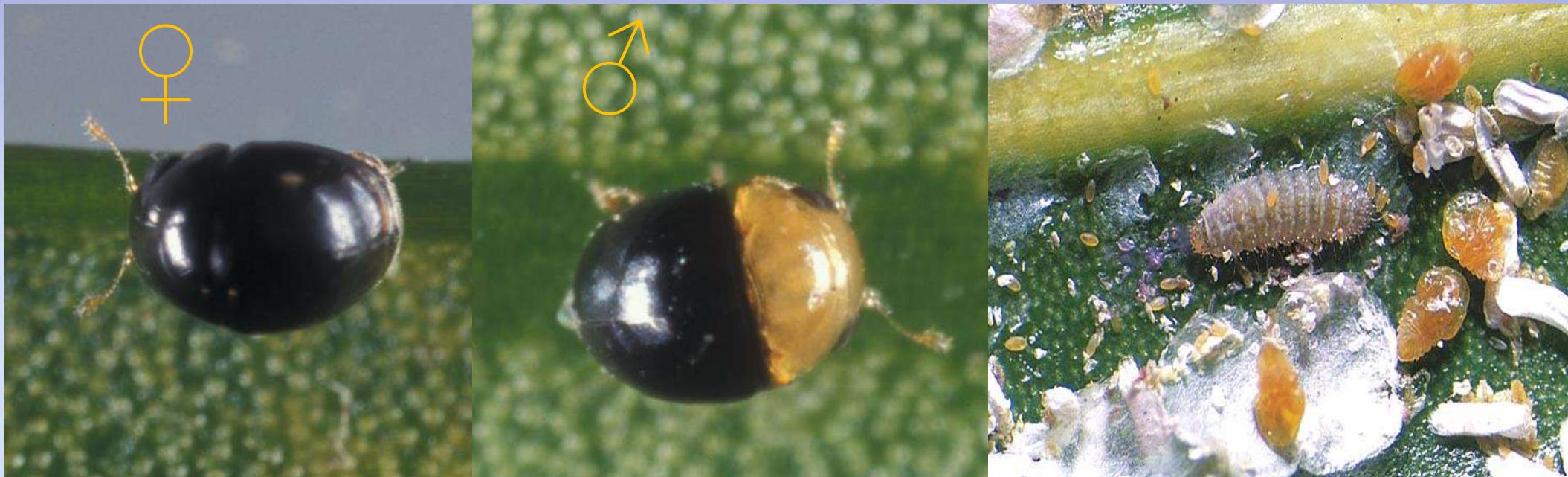
Introduced into FL in 1998



Rates of parasitism on leaflets in Florida



Cybocephalus nipponicus

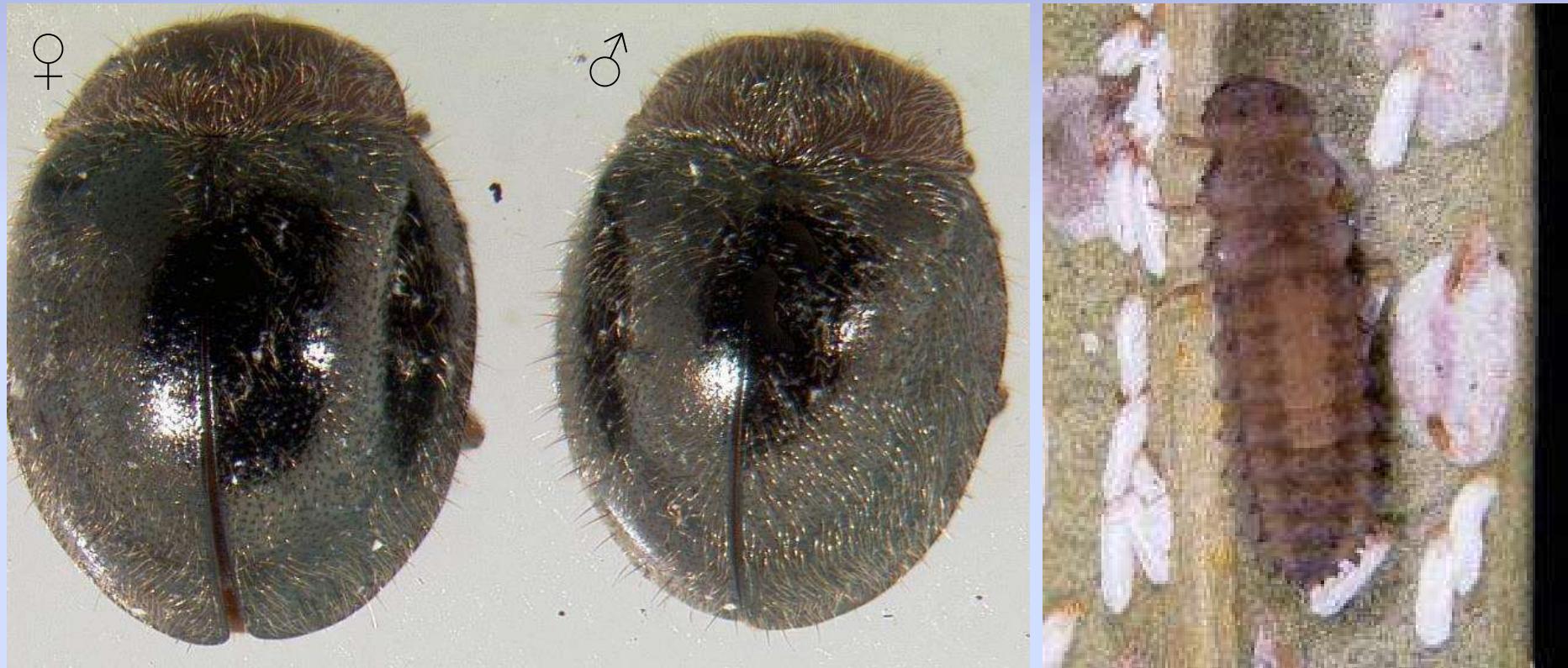


Larvae and adults are predaceous on many species of armored scales

Larval-pupal parasitoid
Aphanogmus albicoxalis



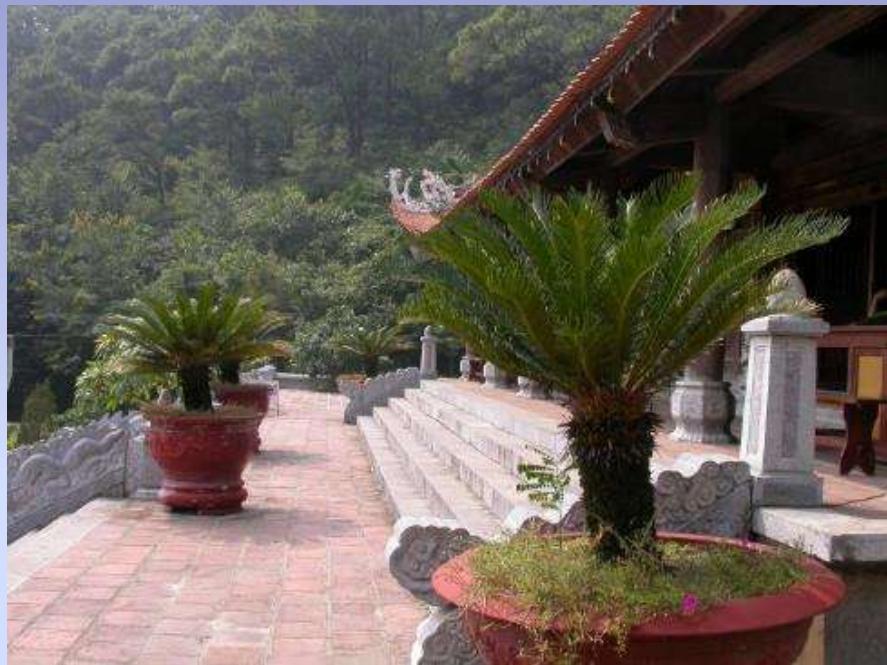
Rhyzobius lophantheae



Why is it not abundant in Florida?

FOREIGN EXPLORATION

VIETNAM – 2006, 2007



FOREIGN EXPLORATION

CHINA – 2006, 2009



FOREIGN EXPLORATION

THAILAND – 2007, 2009



FOREIGN EXPLORATION

Aprostocetus purpureus

- generalist that attacks females scales
- widespread, not too common in Asia



Arrhenophagus chionaspidis

- specialist on male armored scales only
- widespread and abundant in Asia



Aphytis lingnanensis? *Aphytis lepidosaphes?*

**cryptic species?
biotypes?**



- generalists that attack females scales
- widespread for biocontrol in citrus

FOREIGN EXPLORATION

Phaenochilus kashaya

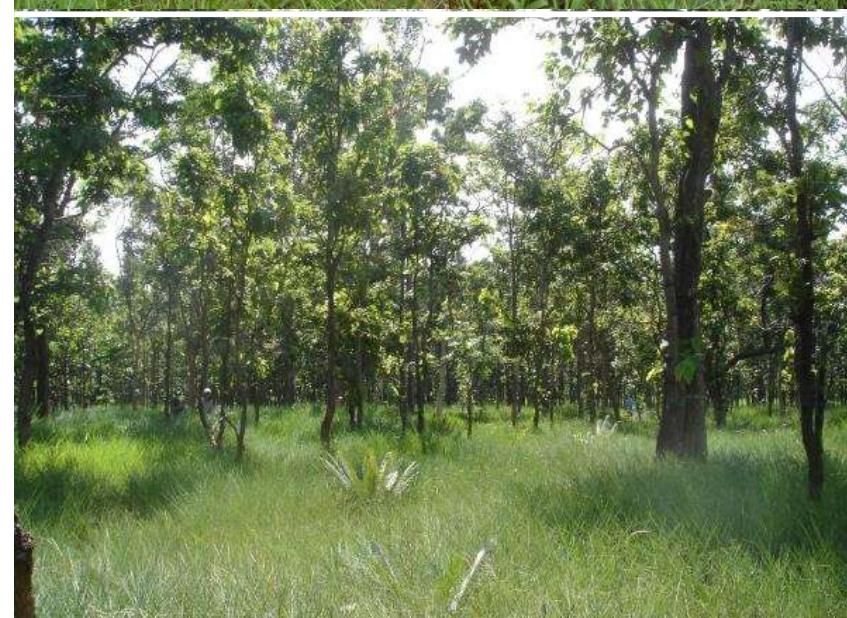


Voracious predator of armored scales

HABITAT OF *P. kashaya* IN THAILAND

Sub Tao

**Sakaerat Environmental
Research Station**



COMPARATIVE DEVELOPMENTAL TIMES

egg hatch-adult at 25° C

Aulacaspis yasumatsui **23 days**

Coccobius fulvus **27 days**

Cybocephalus nipponicus **32 days**

Rhyzobius lophantheae **28 days**

Phaenochilus kashaya **39 days**

COMPARATIVE FECUNDITY

Aulacaspis yasumatsui

?? “1-10 daily, 50-150 total”

Coccobius fulvus

61 eggs at 25° C

Cybocephalus nipponicus

288 eggs at 22° C

Rhyzobius lophantheae

50 eggs at 24° C

Phaenochilus kashaya

339 eggs at 20° C

COMPARATIVE CONSUMPTION RATES

at 25° C

Coccobius fulvus

61/adult female

Cybocephalus nipponicus

20/larval period

Rhyzobius lophantheae

75/larval period
2-3/adult day

Phaenochilus kashaya

380/larval period |
29 / 5 adult days |
adult ♀♀ live 158 days ■

ENTOMOPATHOGENIC FUNGI

Cordyceps javanica



- **73-84% infection rate;
reduced molting rate by 72%**
- **Capable of infecting scales on
leaves, trunk, crown, and in soil?**
- **Field trials needed**

ENTOMOPATHOGENIC NEMATODES, maybe?

Steinernema carpocapsae

Heterorhabditis bacteriophora

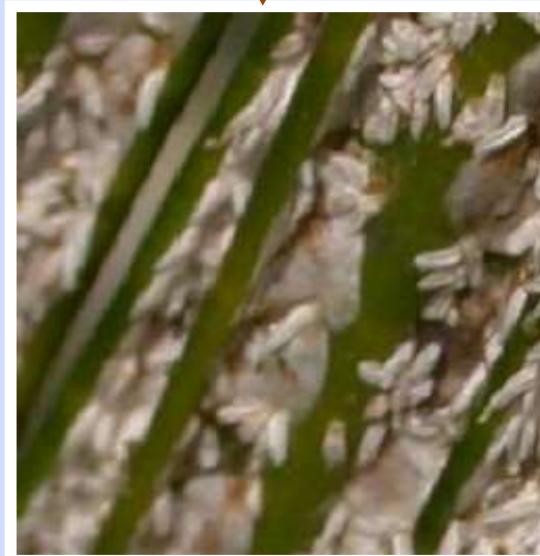
Heterorhabditis marelatus

Heterorhabditis indica

- Parasitism by all 4 species, but low
- Capable of killing scales on trunk, crown, soil?
- Need to do lab and field trials again

FIVE AGAINST ONE

Jeffrey W. Lotz, FDACS, Bugwood.org



SIX AGAINST ONE?







Scymnine lady beetle



SEVEN AGAINST ONE?

