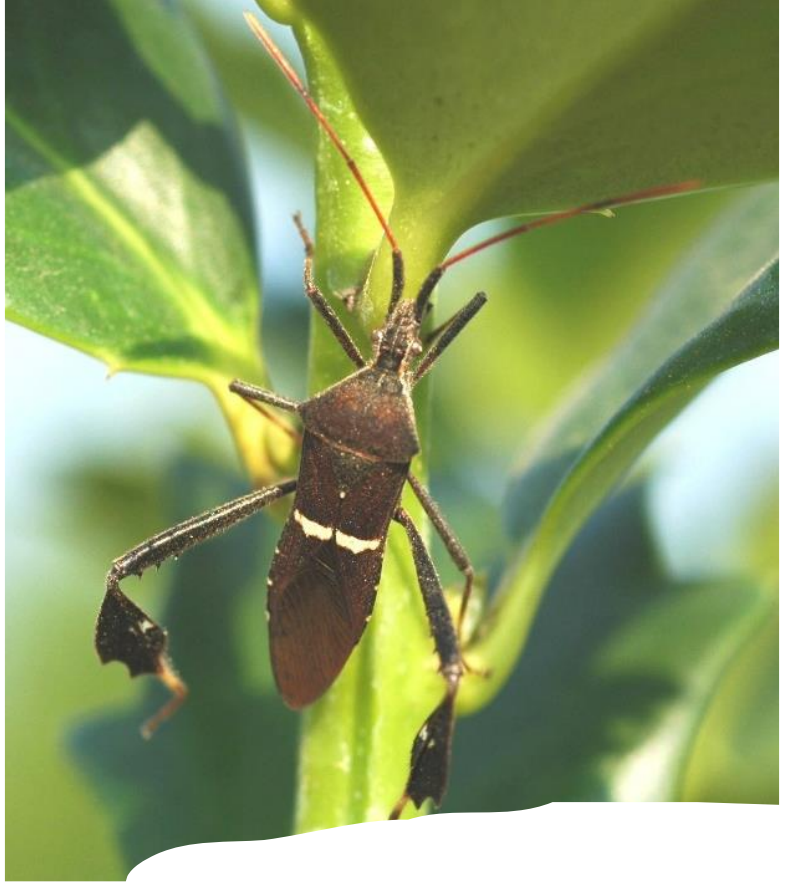


General Guidelines for Pest Control in a Fruit Orchard

Xavier Martini

University of Florida, Entomology department

North Florida Research and Extension Center

UF UNIVERSITY of FLORIDA
IFAS
Entomology and Nematology

Generalist pests

Fire ants

Peanut snails

Ambrosia beetles

Citrus root weevil

Orthopter pests

Red Imported Fire ants

Can kill young trees if nest is too close from the trunk

Can disrupt biological control of scale, psyllid or aphids

Can not be eradicated from a grove

Remove/ destroy nests too close to trees

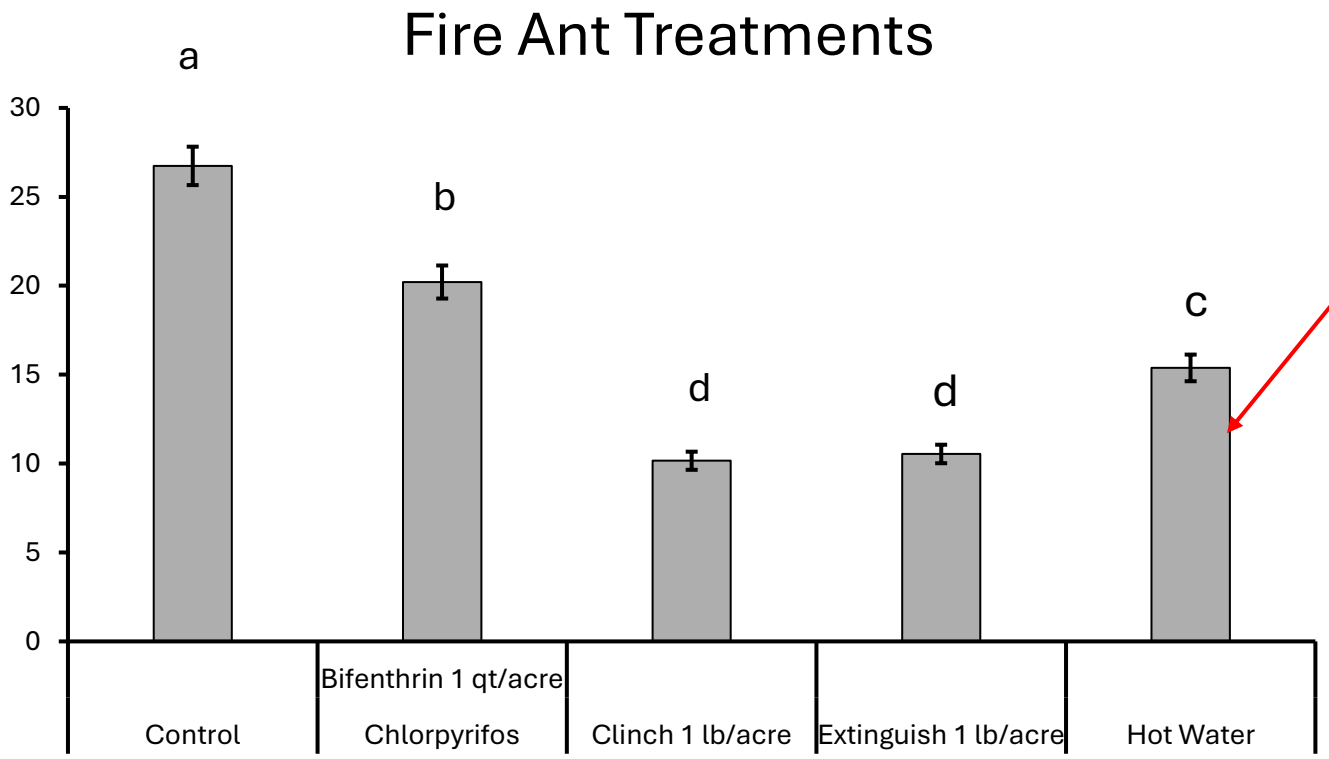
Food baits might be efficient, but ants need to be active (temperature > 12 °C)

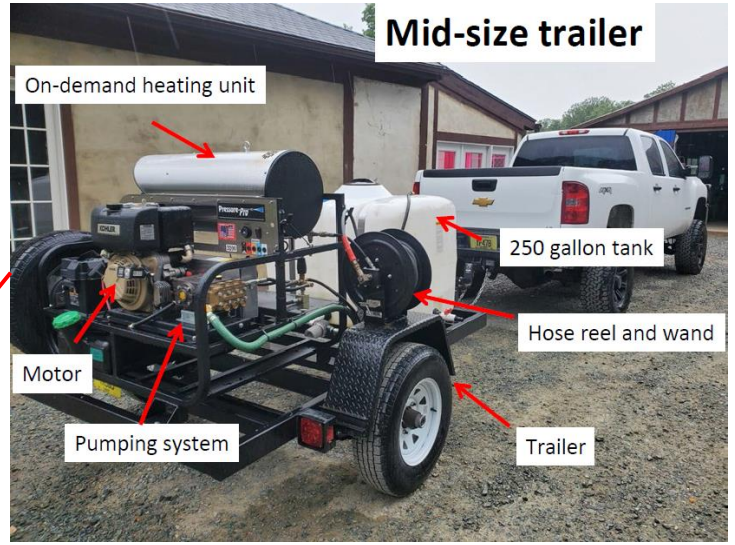
Red Imported Fire ants

Figure 1. (A) Wilting leaves on a declining Satsuma tree, (B) leaf drop and (C) remnants of a fire ant mound around the base of a tree.

Diepenbrock 2021

Red Imported Fire ants





An alternative to food baits is injecting boiling
Water into ant nest at high pressure.

Dr. Joshua King UCF

Joshua.King@ucf.edu

Peanut Snail

- *Bulimulus bonariensis* is an invasive snail native to south American
- Shows potential to negatively impact numerous crops
- Citrus: blocks water and frost irrigation lines. Causes defoliation of younger trees.
- Also a pest in blueberry, pecan…

Snail infestations

- The snail *Bulimulus sporadicus* was introduced in Florida in 2009. It is an invasive species that originate from west India.
- Gregarious.
- Does not damage plant.
- Tend to aggregate on irrigation emitters and clog them, causing them to stop-up and reduce irrigation efficiency.
- Snails rely on humidity and moisture to complete their life cycle.
- Mostly a problem during dry seasons

Snail infestations

- Keeping the ground around irrigation emitter free of weeds may help reduce their habitat.
- Molluscicide available:
  - Metaldehyde (Deadline M-P)
  - Iron Phosphate + Spinosad (Bug-N-Suggo)
  - Sodium Ferric (Ferroxx)
- Molluscicides need to be applied after irrigation or rain and scattered in small amount.

Snail infestations

- Trapping with
  - Snailer traps® (A)
  - Pyramid style trap - takes advantage of climbing behavior (B)
  - Fermented bread dough is an attractant to snails

Ambrosia Beetles

- Specialized bark beetles - wood-boring insect
- Play a central role in the nutrient cycling of forest ecosystems
- Evolved with symbiont fungi to invade the nutrient poor xylem
- Adults and larvae feed on this symbiotic “ ambrosia” fungus
- Dependent on the presence of this fungus
- Fungus can cause disease in the tree

Ambrosia Beetles

Mature Ambrosia beetle females emerge after mating:

- Seek a susceptible tree as a new host
- Female creates new gallery in tree xylem to cultivate fungus and oviposit

Most Ambrosia Beetles attack weak trees

- Extreme freezes or over pruning can stress trees

Declining & dying trees encourage more attacks

- Attracted by ethanol release

Ambrosia Beetles

- Several ambrosia beetles are a treat for nursery and landscape.
- This include the Asian ambrosia beetle *Xylosandrus crassiusculus*
- Transmission of fungal symbiont spores to their host
- Insecticides are of limited activity as beetles spend most or their life in wood.
- Repellents and attractants can be used to manage ambrosia beetles in your operation

Xylosandrus crassiusculus

Xyleborus bispinatus

Euwallacea fornicatus

Xyleborus volvulus

Avocados killed by laurel wilt

Ambrosia Beetles

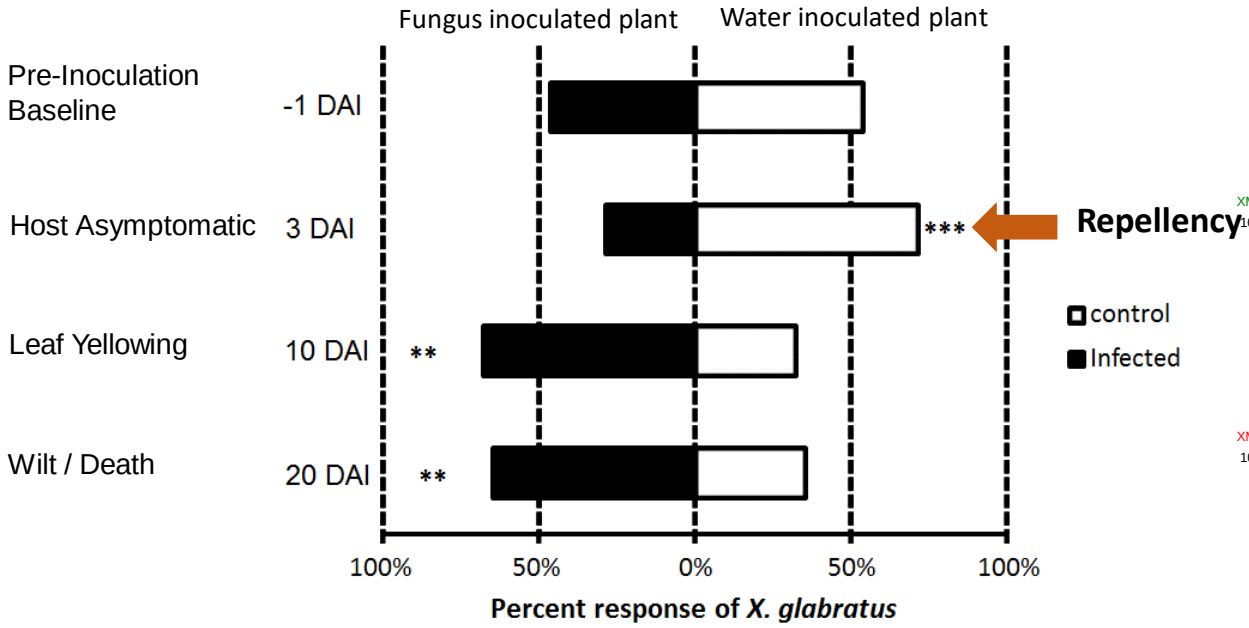
- Methyl Salicylate is a natural repellent

J Chem Ecol
DOI 10.1007/s10886-017-0843-y

The Fungus *Raffaelea lauricola* Modifies Behavior of Its Symbiont and Vector, the Redbay Ambrosia Beetle (*Xyleborus Glabratus*), by Altering Host Plant Volatile Production

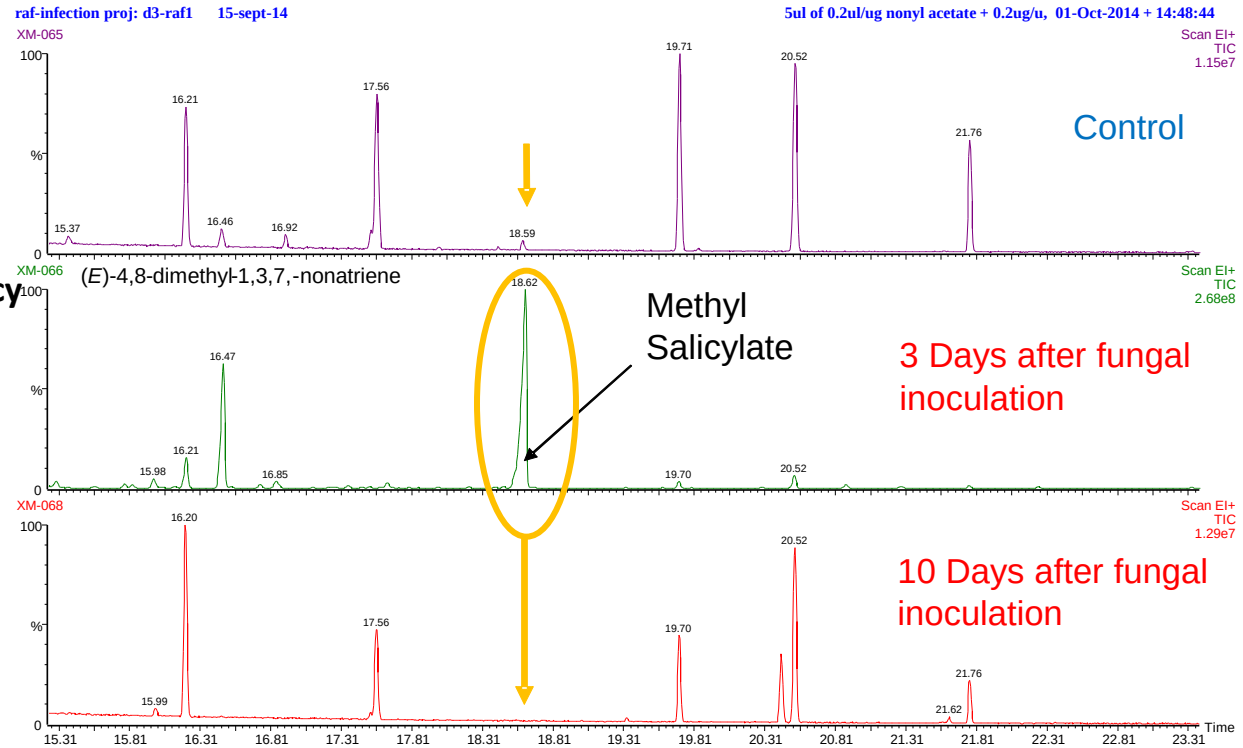
Xavier Martini[1,2] · Marc A. Hughes[3] · Nabil Killiny[4] · Justin George[5] · Stephen L. Lapointe[5] · Jason A. Smith[3] · Lukasz L. Stelinski[2]

Stages of laurel wilt disease

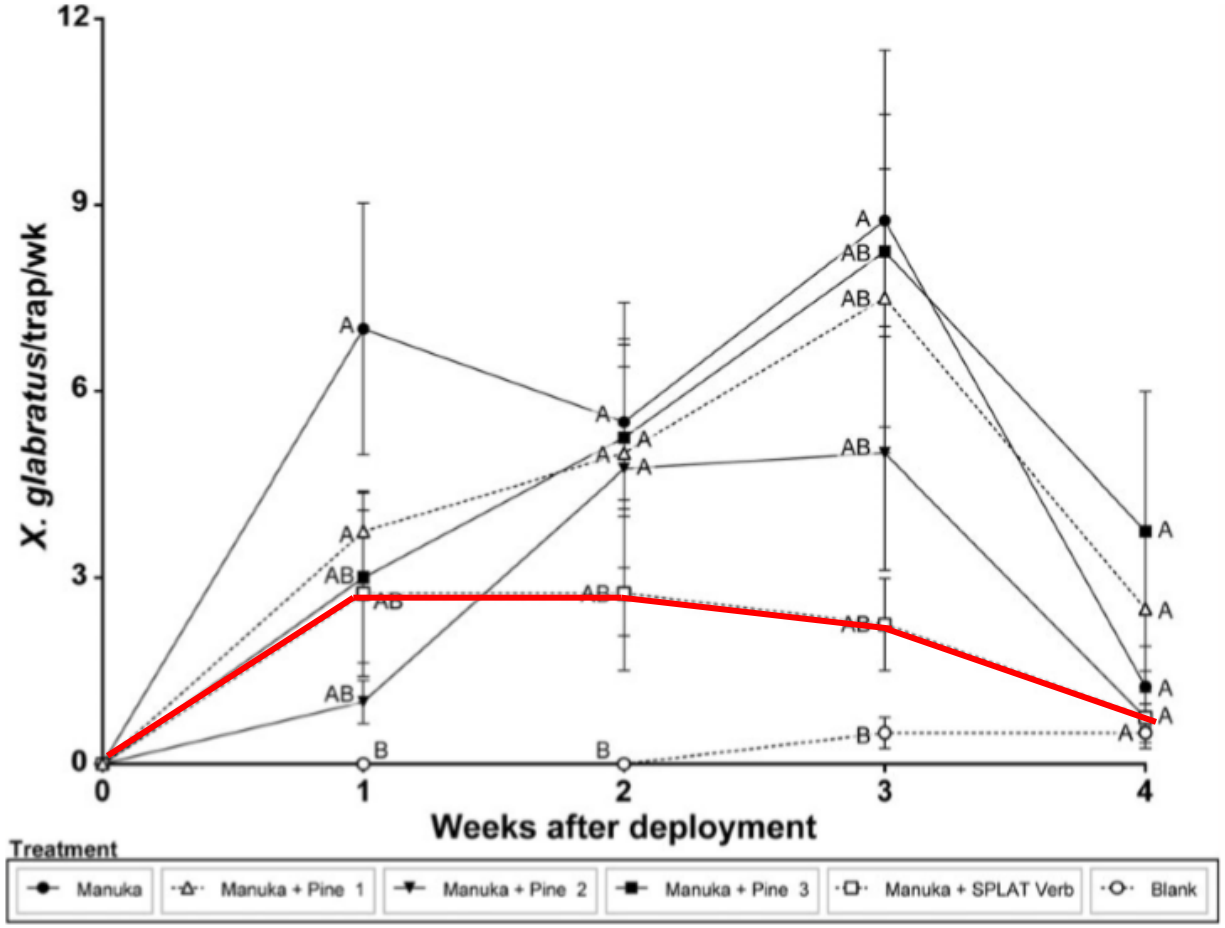


DAI = **D**ays **A**fter **I**noculation with *R. lauricola* fungus

Swamp bay leaf GC -MS profile 3 DAI

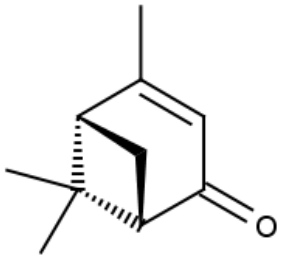


Ambrosia Beetles



Verbenone showed potential efficacy in repelling *X. glabratus* in preliminary tests

Fig. 1 Trapping experiment at Wekiwa Springs State Park (WSSP) in Florida. Mean *Xyleborus glabratus* captures ± SE over four weeks. Traps consisted of sticky panels (46 × 32 cm) affixed to wooden posts baited with manuka oil. Putative repellent synthetic blends were labelled as pine 1–3 (see table 1) and SPLAT Verb. Traps baited with only manuka oil were positive controls, and negative controls were unbaited traps. Separations of means are listed at weekly intervals. Columns denoted with different letters are statistically different at $\alpha = 0.05$ according to Tukey's multiple comparisons procedure of treatment least squares means. n = 24.



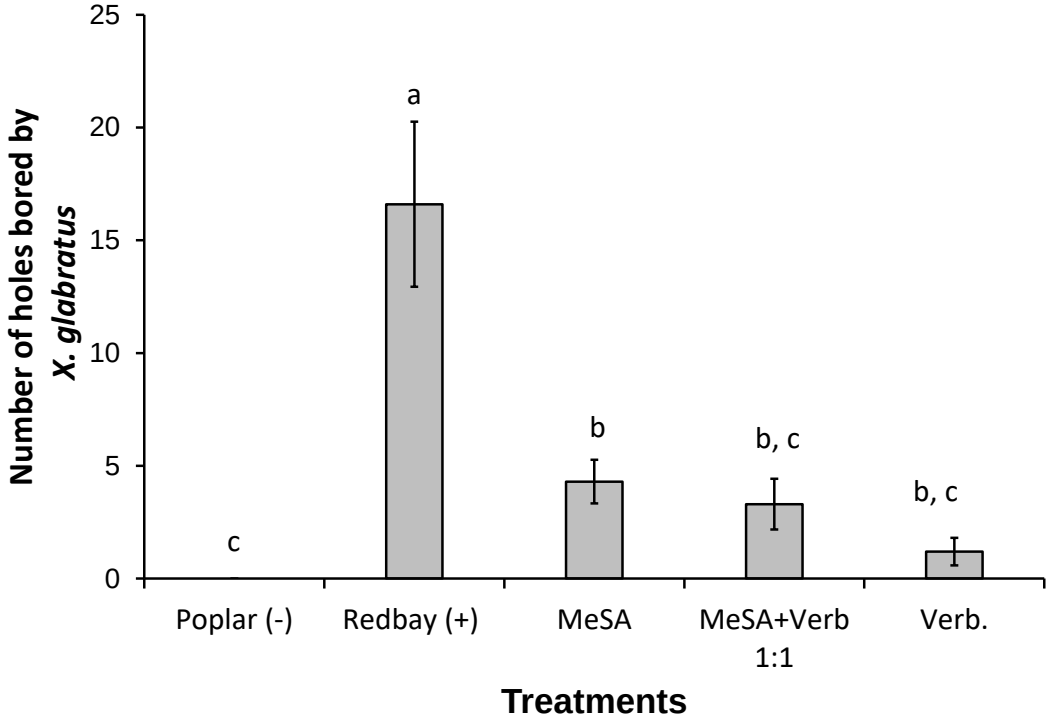
Verbenone

Hughes, M. A., Martini, X. et al. 2017
Journal of Applied Entomology, *141*(8), 653-664.

Ambrosia Beetles

ISCA TECHNOLOGIES
Pest Management Tools & Solutions

SPLAT® with high concentration of Methyl salicylate and verbenone to apply directly on the trunk of redbay trees



J. Appl. Entomol.

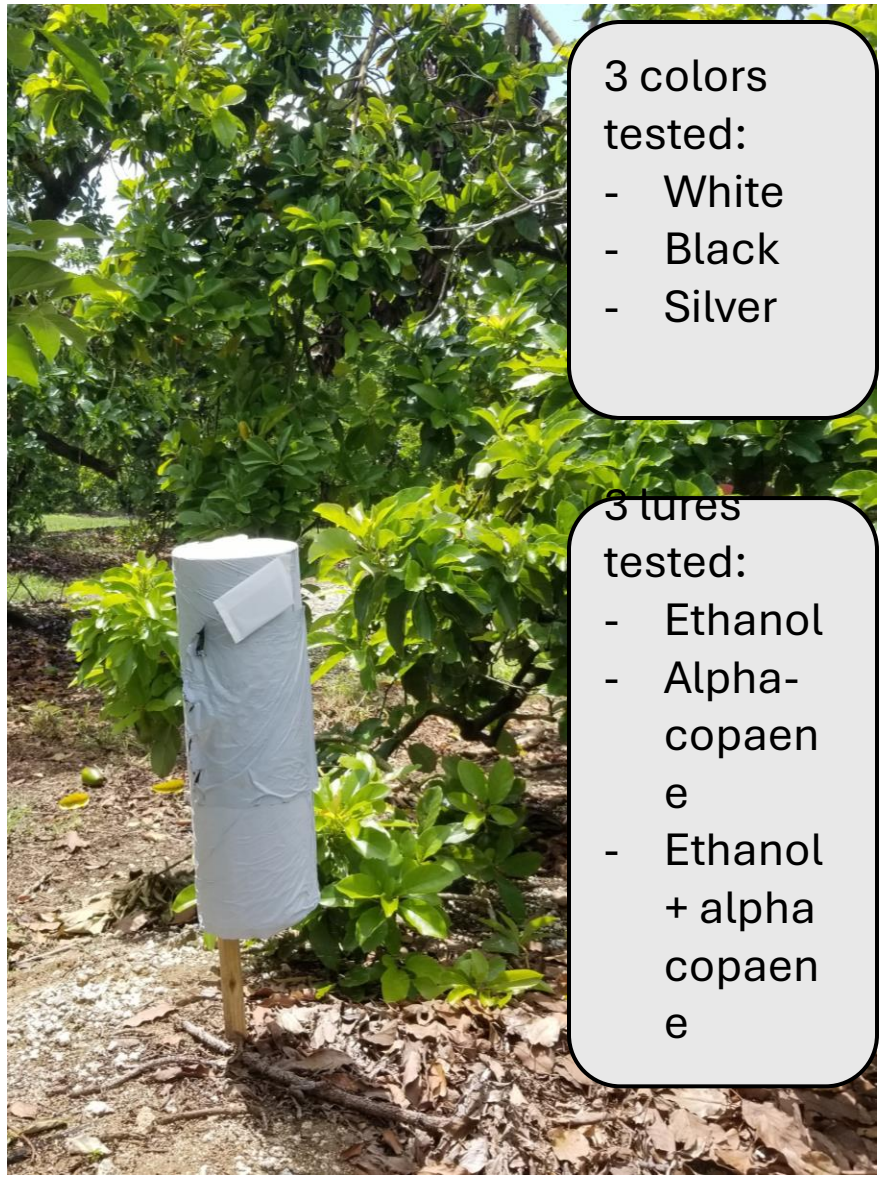
ORIGINAL CONTRIBUTION

Evaluation of repellents for the redbay ambrosia beetle, *Xyleborus glabratus*, vector of the laurel wilt pathogen

M. A. Hughes[1,a], X. Martini[2,3,a], E. Kuhns[2,*], J. Colee[4], A. Mafra-Neto[5], L. L. Stelinski[2] & J. A. Smith[1]

1 School of Forest Resources and Conservation, University of Florida, Gainesville, FL, USA
2 Department of Entomology and Nematology, Citrus Research and Education Center, University of Florida, Lake Alfred, FL, USA
3 Department of Entomology and Nematology, North Florida Research and Education Center, University of Florida, Quincy, FL, USA
4 IFAS Statistical Consulting Unit, University of Florida, Gainesville, FL, USA
5 ISCA Technologies, Inc., Riverside, CA, USA

Ambrosia Beetles



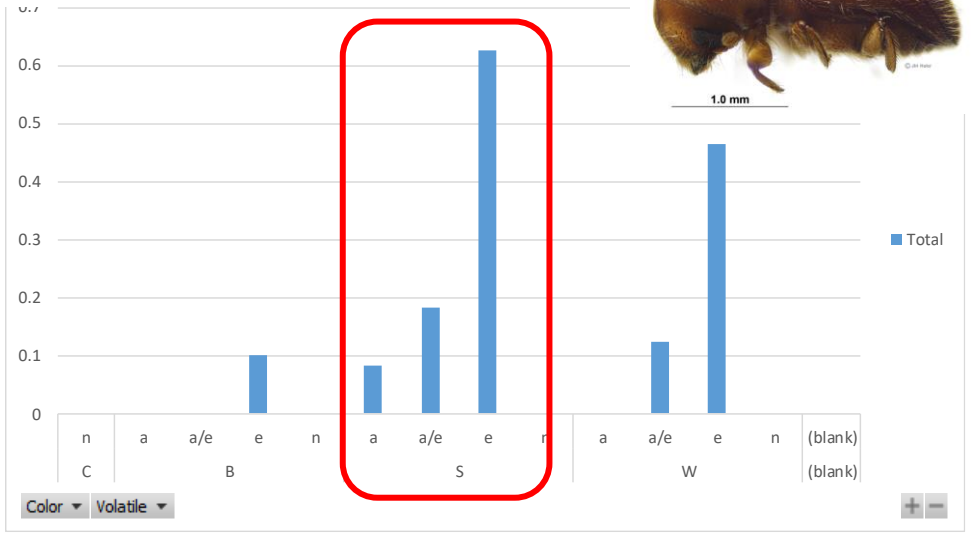
3 colors tested:
- White
- Black
- Silver

3 lures tested:
- Ethanol
- Alpha-copaene
- Ethanol + alpha copaene

Trap color:
C= control
B= Black
S= Silver
W= White

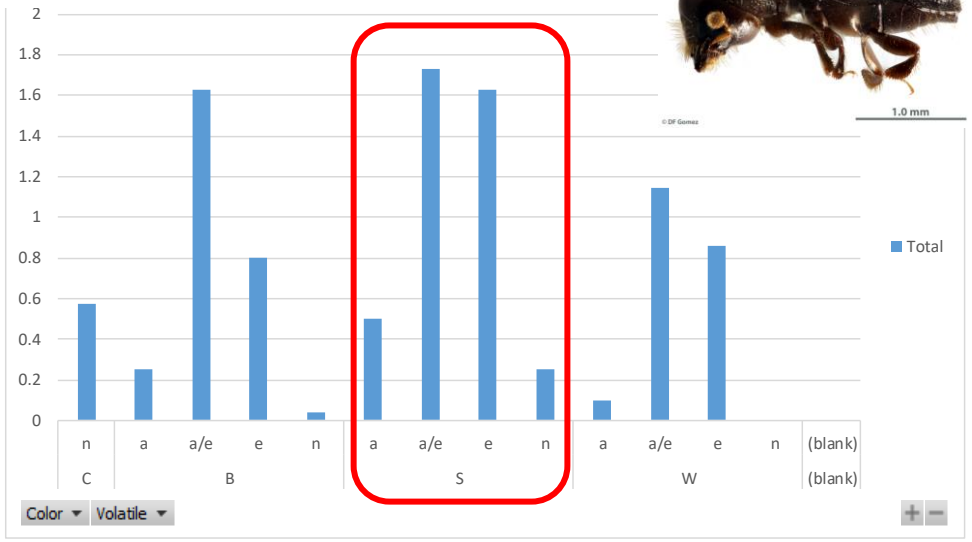
Odor:
a= α-copaene
n= no lure
e= ethanol
a/e= ethanol + α copaene

Xylosandrus crassisculus

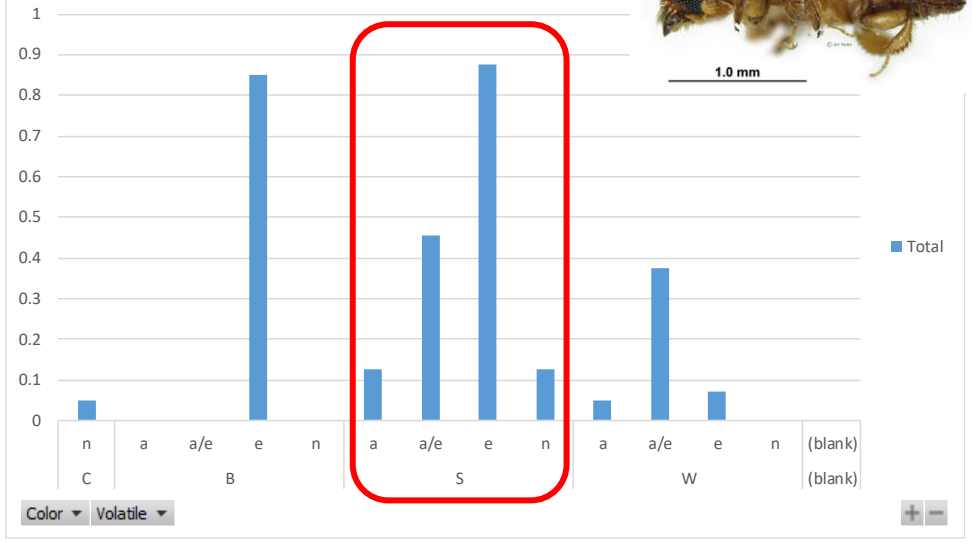


Xyleborus bispinatus

Euwallacea fornicatus



Xyleborus volvulus

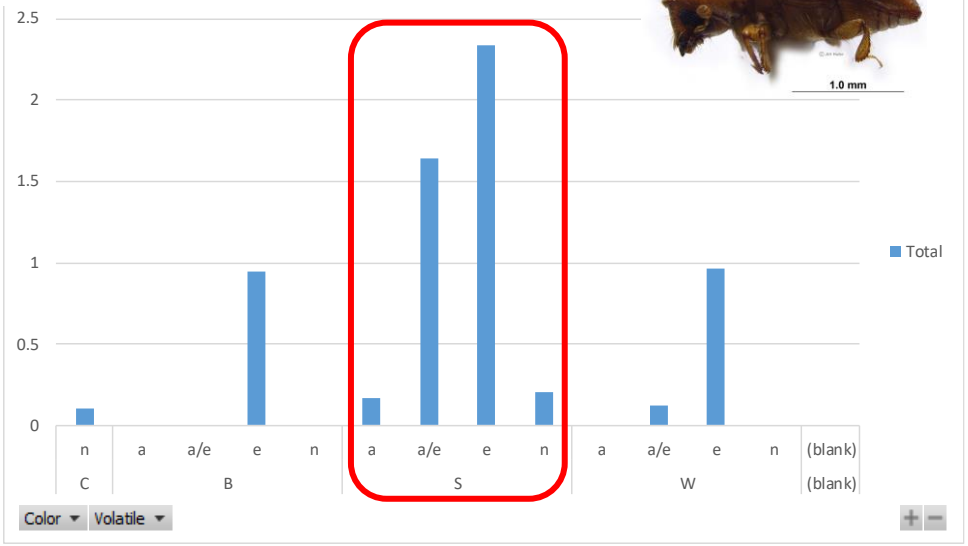


Pictures from Jiri Hulcr

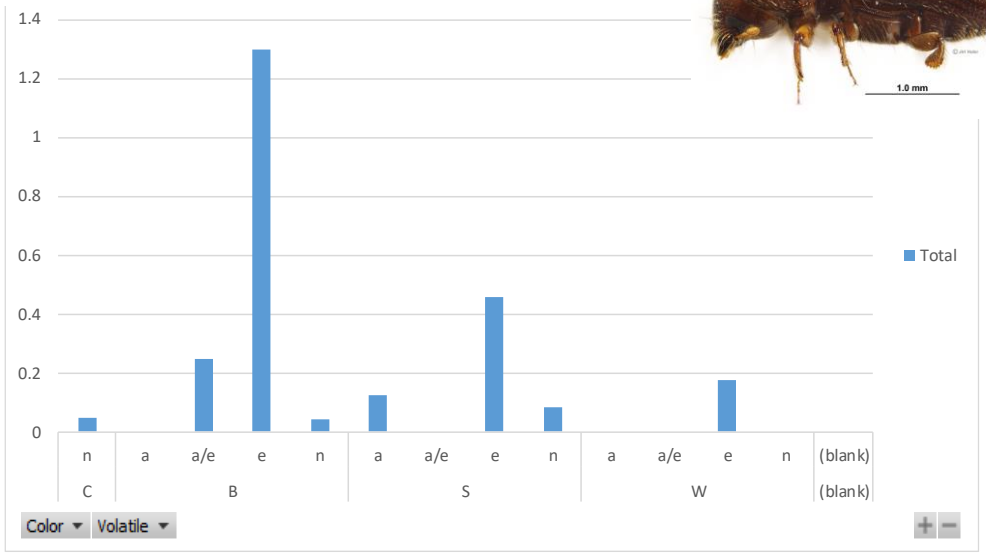
Trap color:
C= control
B= Black
S= Silver
W= White

Odor:
a= α-copaene
n= no lure
e= ethanol
a/e= ethanol + α copaene

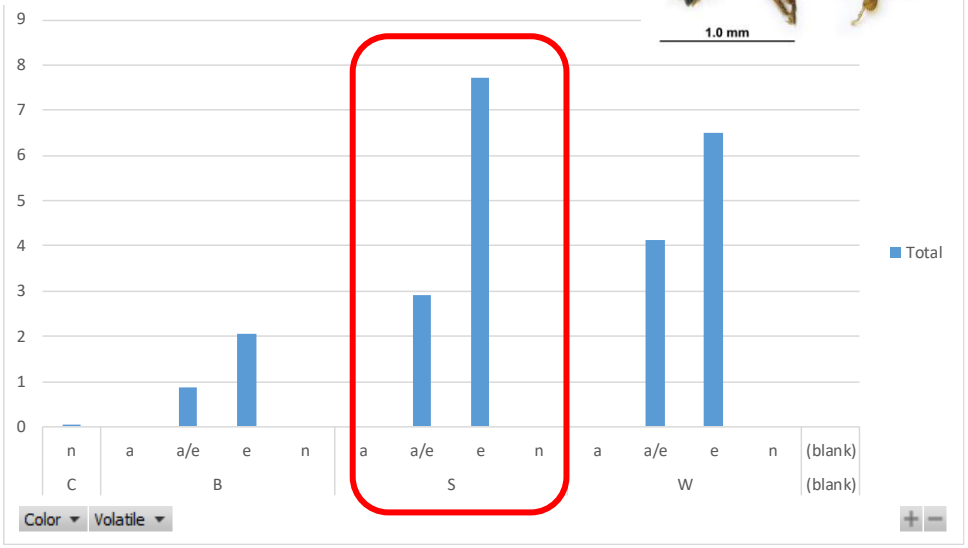
Xyleborus affinis



Xyleborus ferrugineus



Xyleborinus saxesenii



Xylosandrus compactus

Pictures from Jiri Hulcr

Ambrosia Beetles

- For most ambrosia beetle species, the combination silver cover/ Ethanol lures attracted the greatest number of beetle

Case study: ambrosia beetle infestation in a tung oil orchard

Ambrosia Beetles

First case of dead trees (12) in June 2023, and spreading

Ambrosia Beetles

Collection and identification of ambrosia beetles

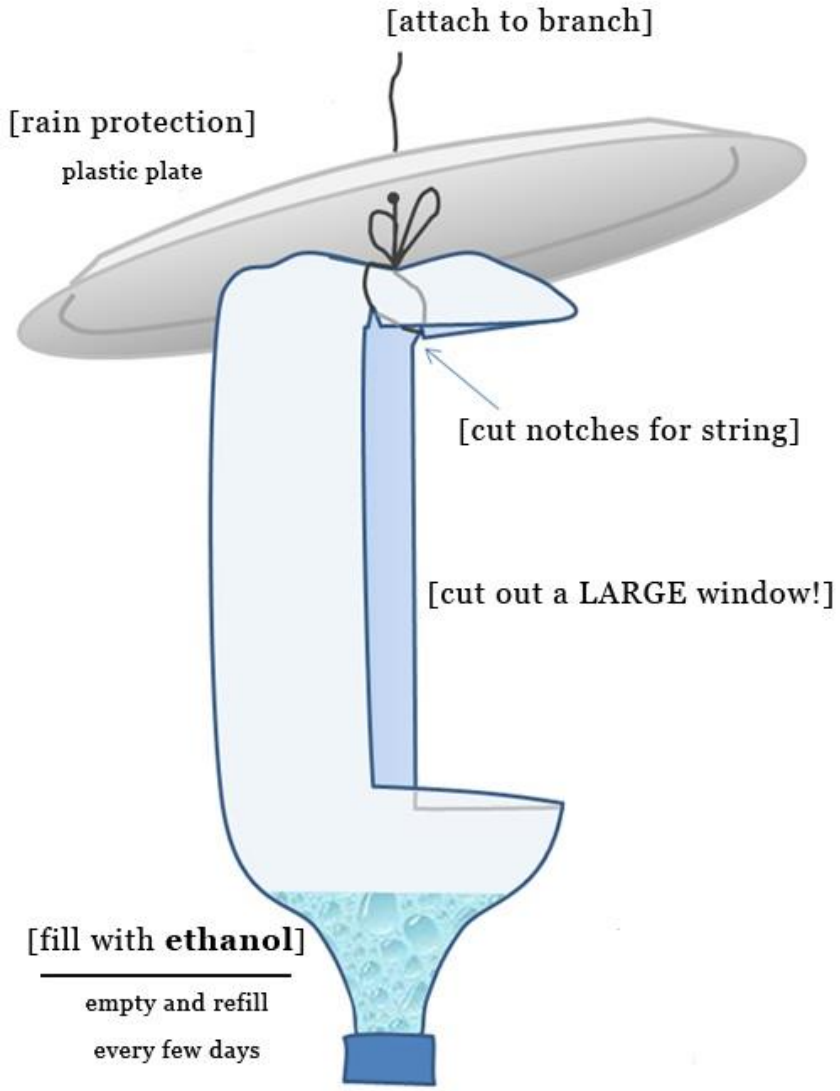
Recommendations:

- Removal and disposal of all dead trees

- Treatment with pyrethroid of the stump

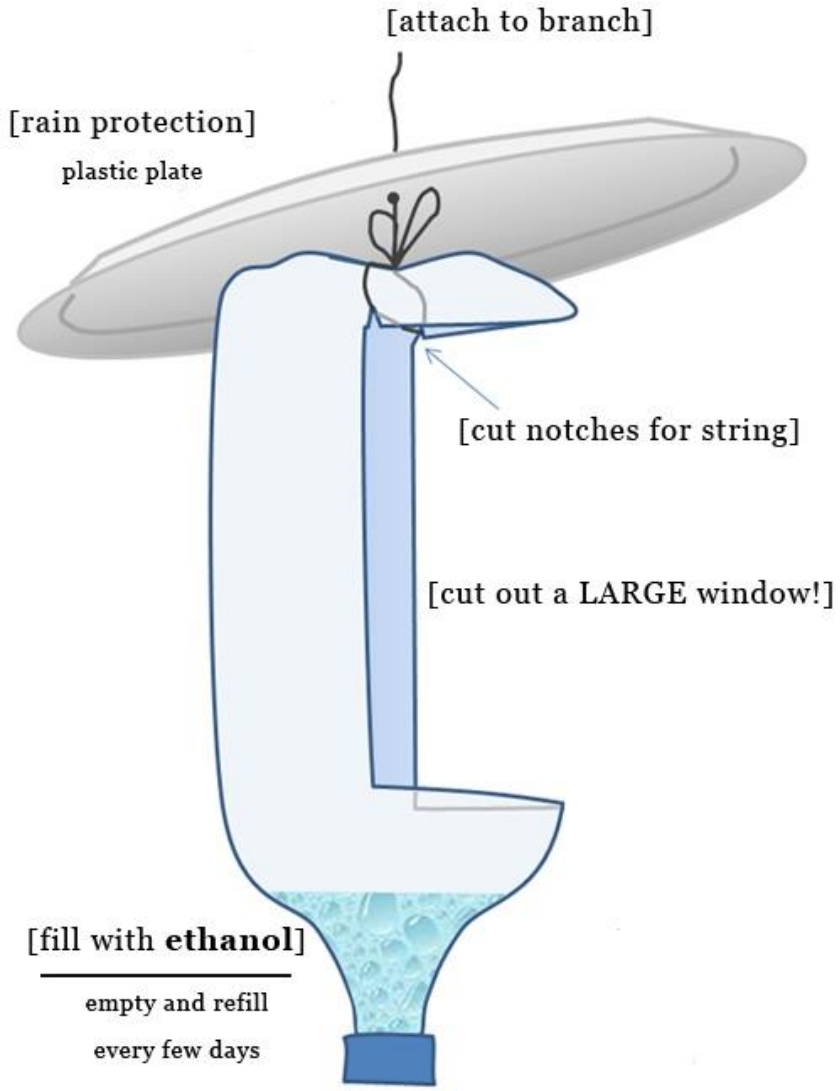
- Treatment of the two rows nearby the infected trees with verbenone pouch or pyrethroid sprays.

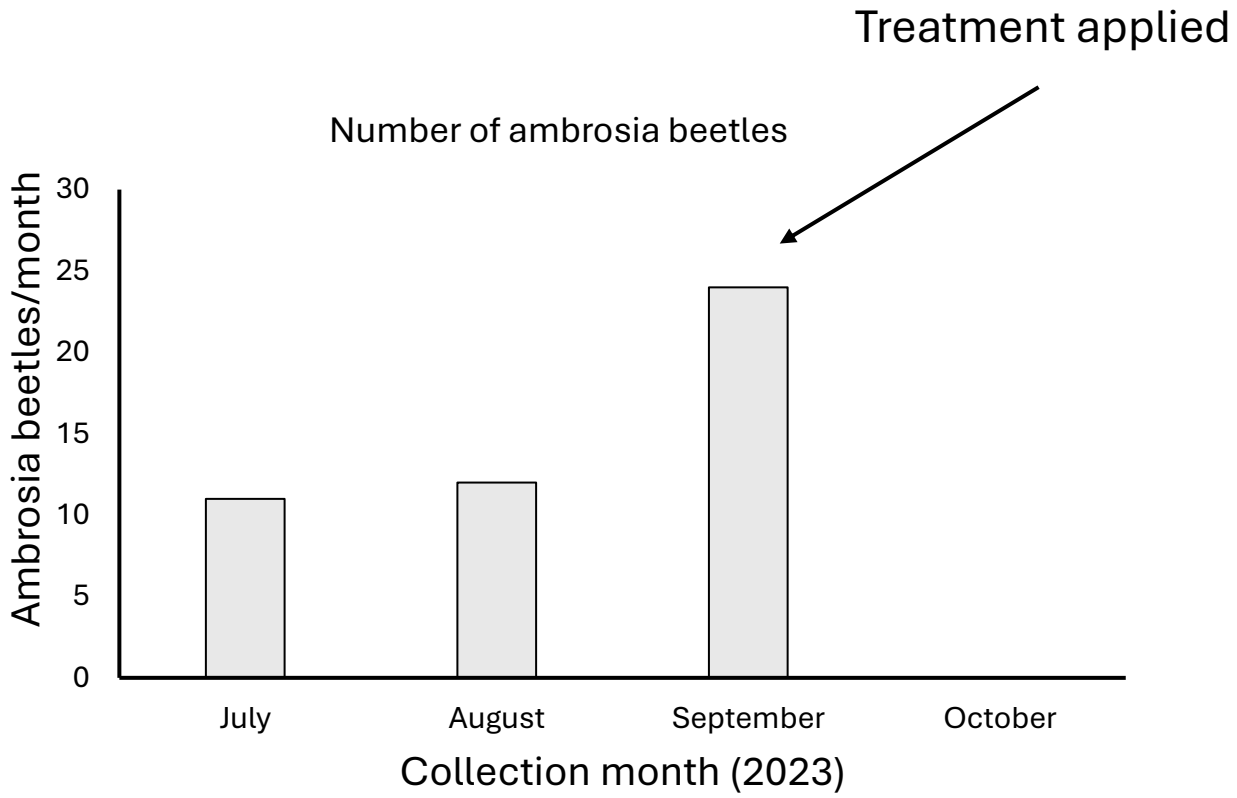
Ambrosia Beetles



https://ambrosiasymbiosis.org/

Ambrosia Beetles





https://ambrosiasymbiosis.org/

Citrus root weevil

Diaprepes abbreviatus

- Native of Caribbean Islands
- First reported in Florida, in 1964 (in a nursery in central Florida)
- **Recently detected in North Florida (in Jefferson County)**
- Major pest of citrus, ornamental plants, root crops, and sugarcane

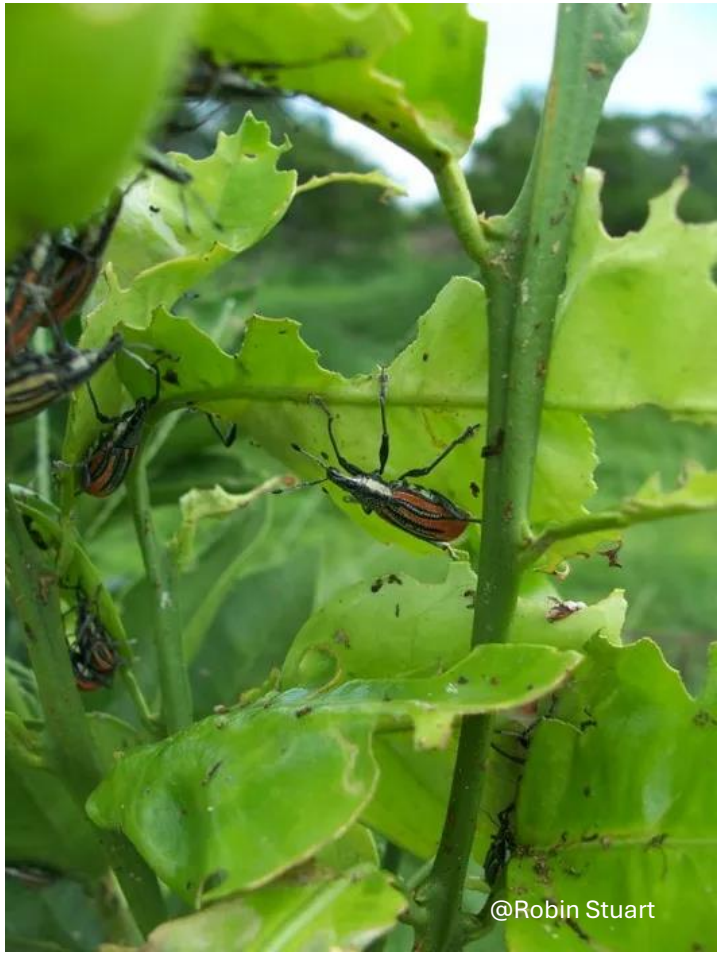
Citrus Root Weevil

Adult weevil colors range from gray to yellow to orange to black

Diaprepes root weevil egg mass on citrus leaf (3—264/mass)

The larvae are white and legless. The head capsule has variable light and dark areas

Citrus Root Weevil



- Adult feeds on leaves causing notching along leaf margins

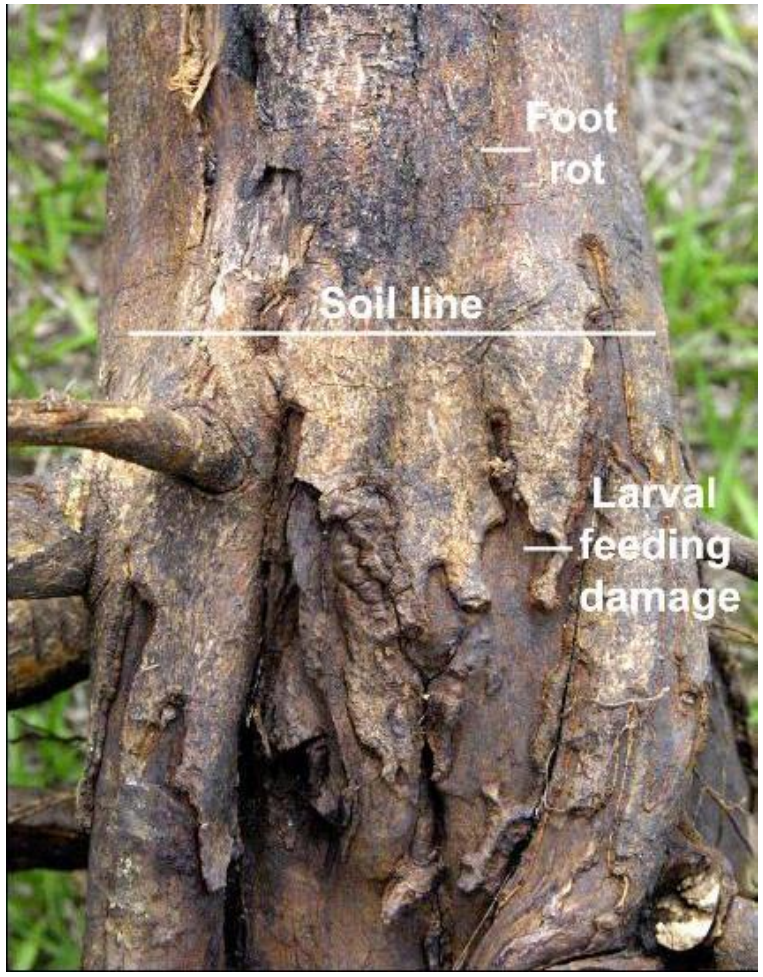
Citrus Root Weevil

vs

- Larvae feed on the roots, impeding the uptake of nutrients and water
- Severe infestations can result in plant stunting and death
- Root damage can lead to root rot infections caused by pathogens (*Phytophthora sp.)*

Larvae

Citrus Root Weevil



Channeling of roots caused by weevil larvae

Citrus Root Weevil

Tedders trap

How?

Adults can be monitored visually, by scouting the trees or using ground traps

When?

Early in the morning (Spring and early summer)

Citrus Root Weevil

Prevent citrus root weevils!

- Prune dead, discolored, or damaged plant leaves, stems, and branches

- Control of shade and moisture in the soil

  - Adjust watering to once a week in the early morning
  - Remove overgrown plant leaves and branches
  - Rake fallen leaves, branches, and fruit

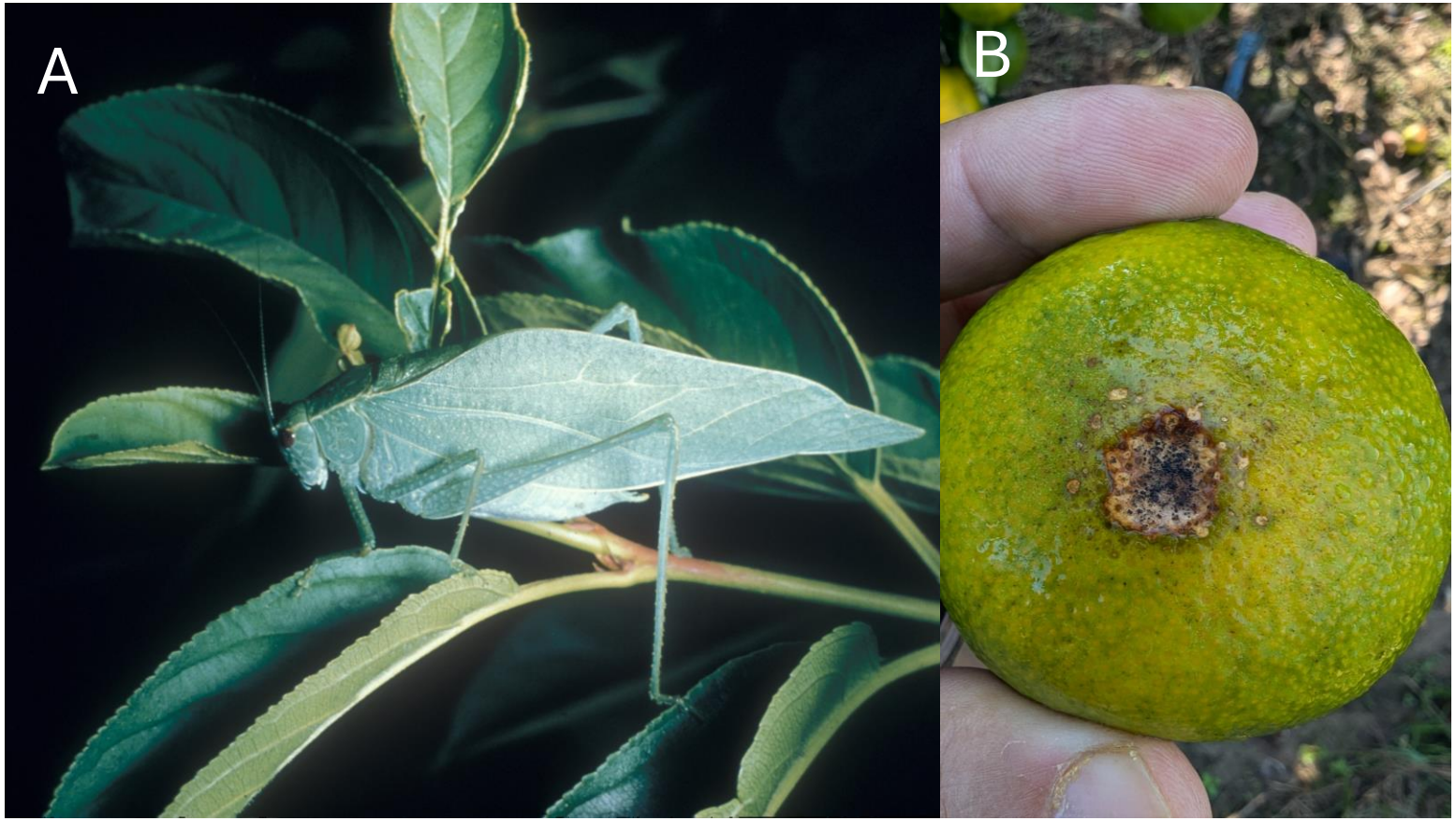
Citrus Root Weevil

- Foliar sprays for egg and adult suppression
  - Ex. Bifenthrin, Carbaryl, Fenpropathrin

- Biological control of all subterranean stages
  - Two parasitic nematodes, *Heterorhabditis indica and Steinernema riobravis*, can attack and kill Diaprepes larvae

(Apply nematodes one or more times from mid-July to September)

Orthopter pests



(A) Broad-winged katydid (*Microcentum rhombifolium*) and (B) damage on a satsuma fruit

Eastern Lubber Grasshopper

Orthopter pests

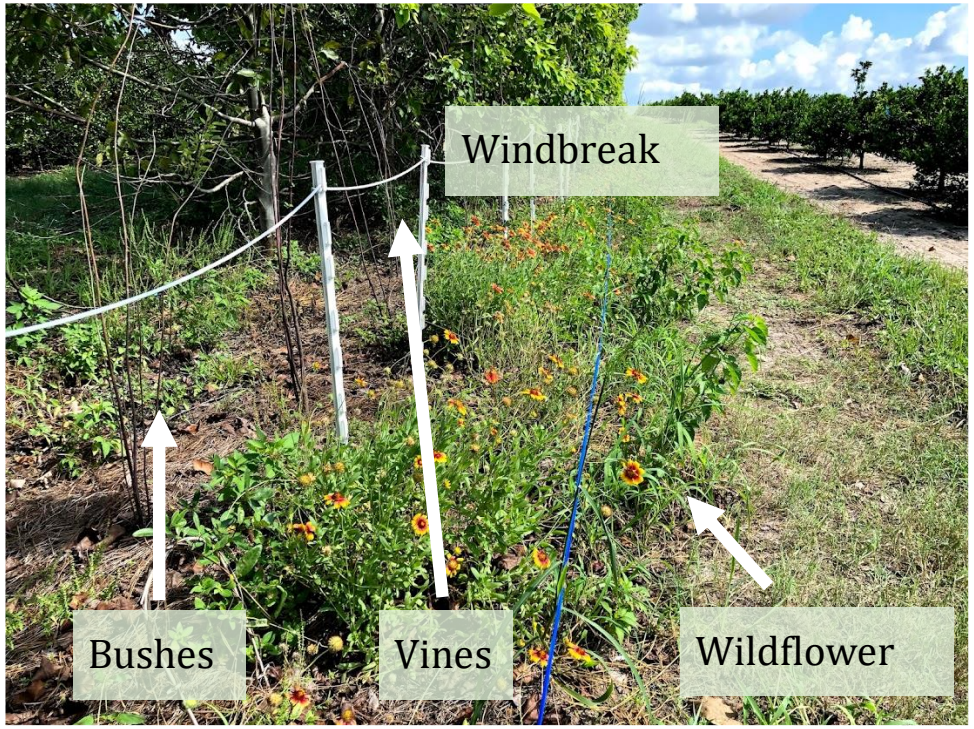
- Keep your orchards clean from weeds

- Adjacent pastures, hay fields, and fallow lands can be significant sources of orthopterans pests

- In case of high-density treatments with Carbaryl-based insecticides or Diamide can be warranted.

Enhancing windbreak habitat attractiveness to pollinators and predators via insectary plantings

Enhancing windbreak habitat attractiveness to pollinators and predators via insectary plantings



Lake Alfred:

Treatment Grove = 5 groups:

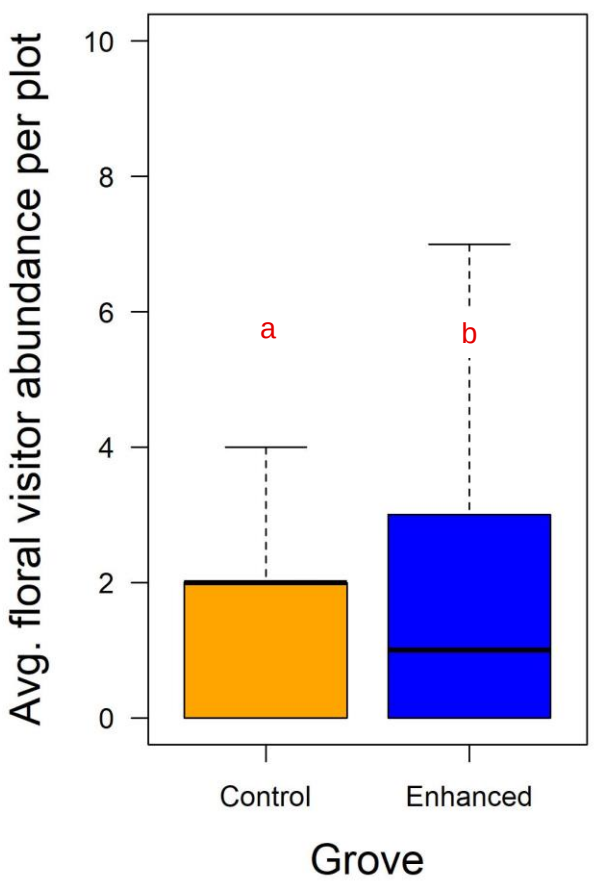
- Windbreak only (Control)
- Windbreak + Wildflowers (blanket flower)
- Windbreak + Vines (Florida honeysuckle)
- Windbreak + Bushes (buttonbush)
- Windbreak + All flowers (Wildflowers + Vines + Bushes)

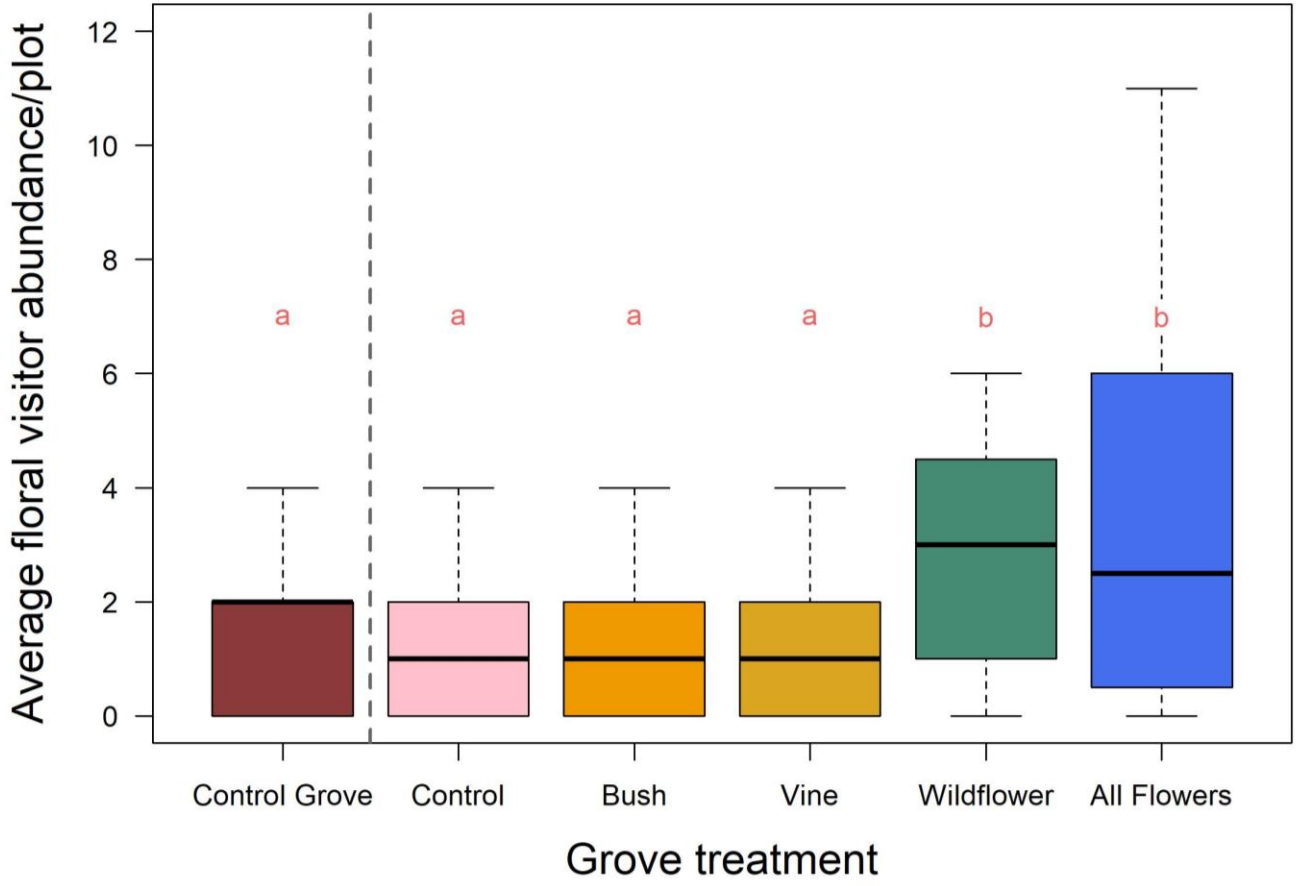
Monticello:

Treatment Grove = 4 groups:

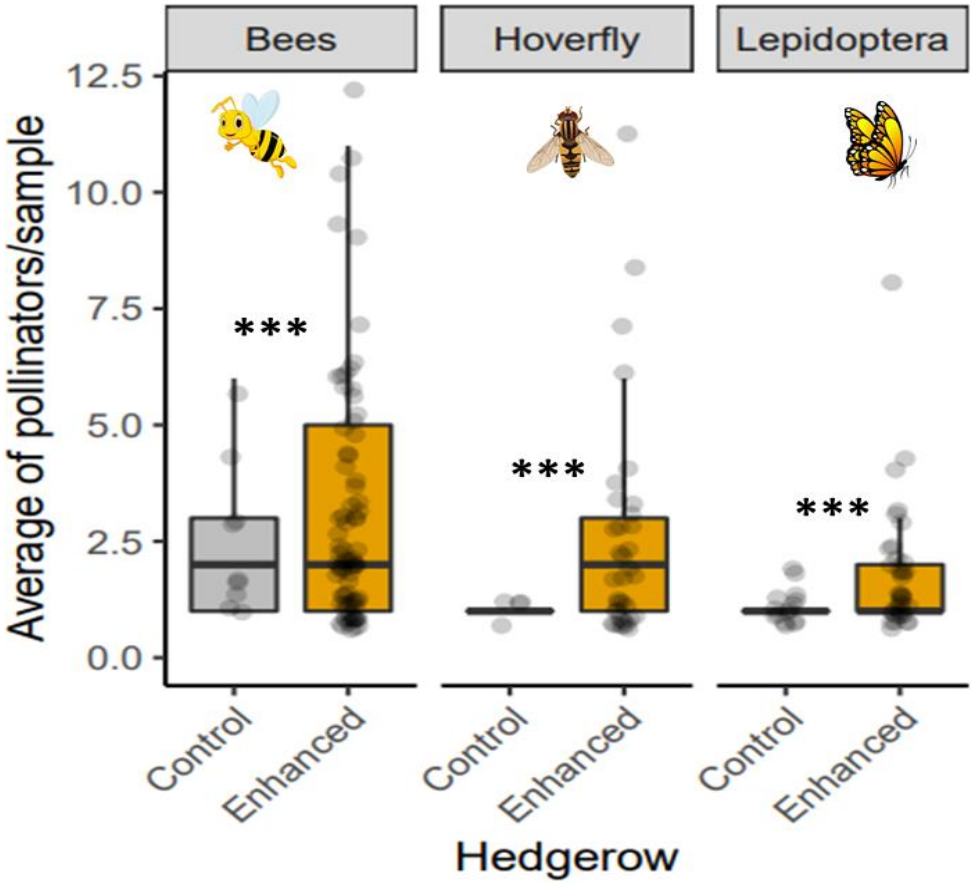
- Windbreak only (Control)
- Windbreak + Wildflowers (blanket flower)
- Windbreak + Vines (Florida honeysuckle)
- Windbreak + Wildflowers + Vines

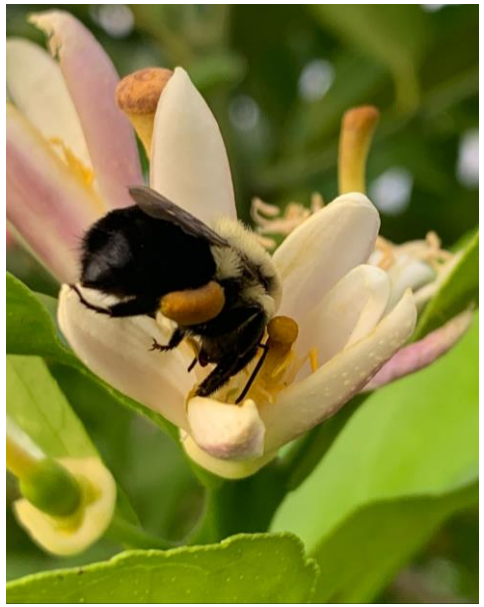
Enhancing windbreak habitat attractiveness to pollinators and predators via insectary plantings



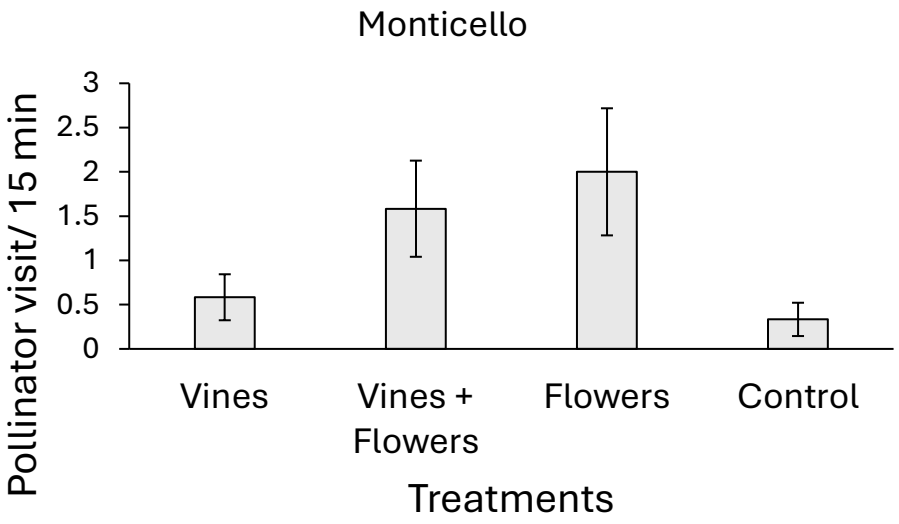


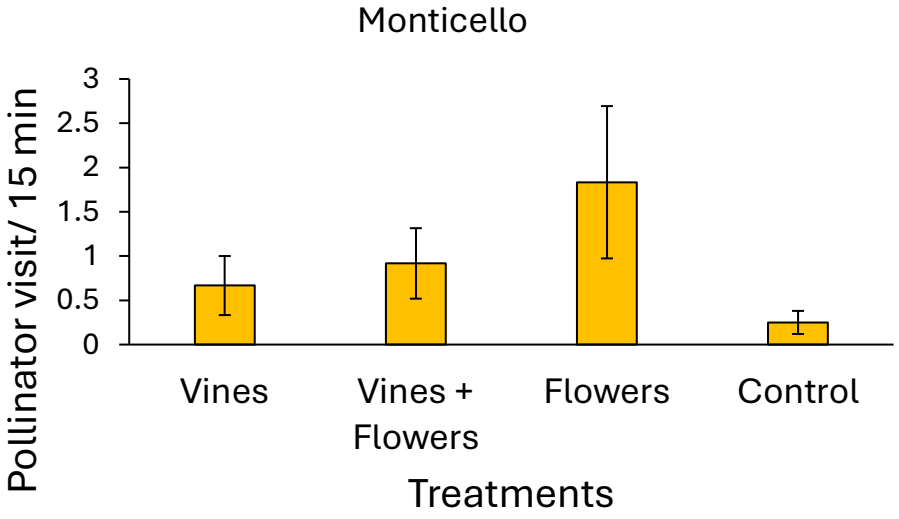
Enhancing windbreak habitat attractiveness to pollinators and predators via insectary plantings

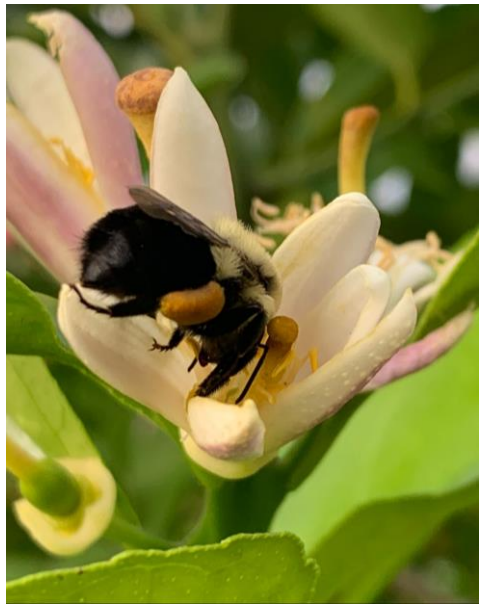




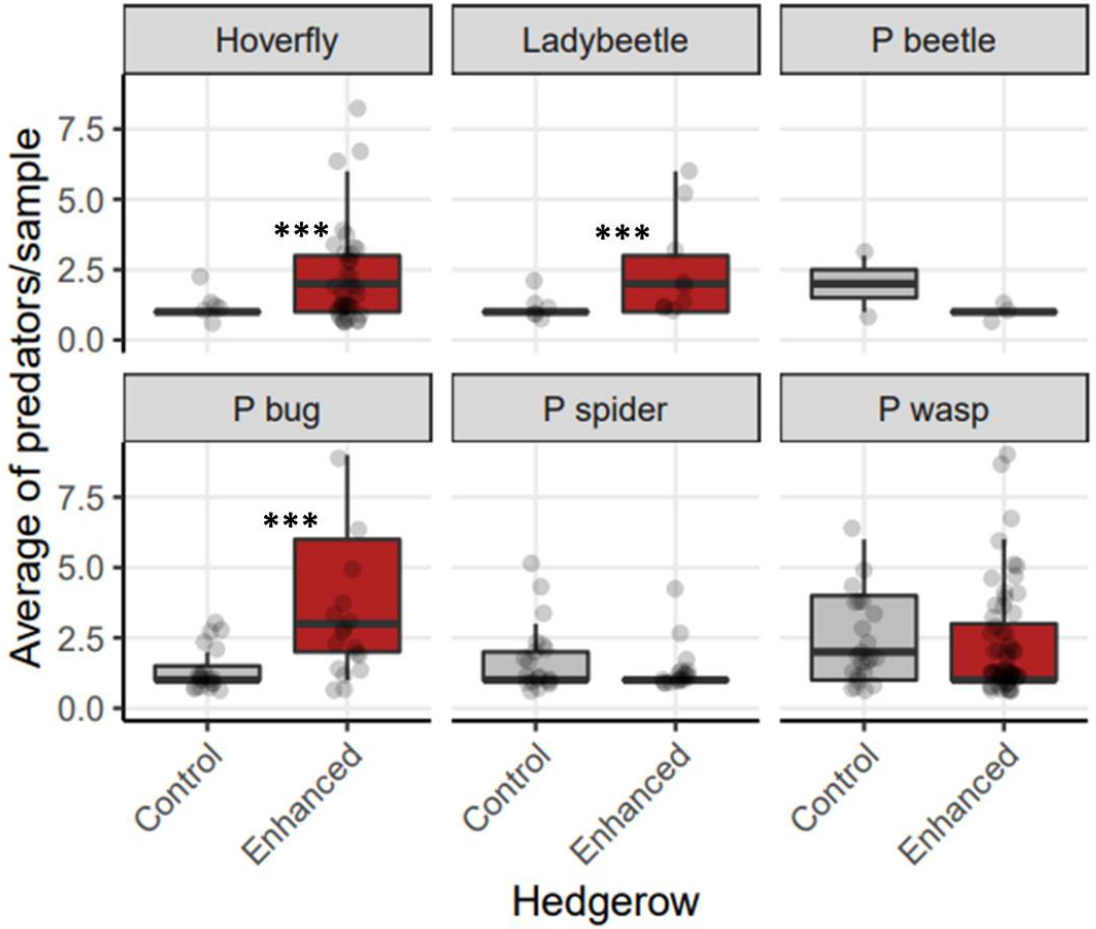
Enhancing windbreak habitat attractiveness to pollinators and predators via insectary plantings

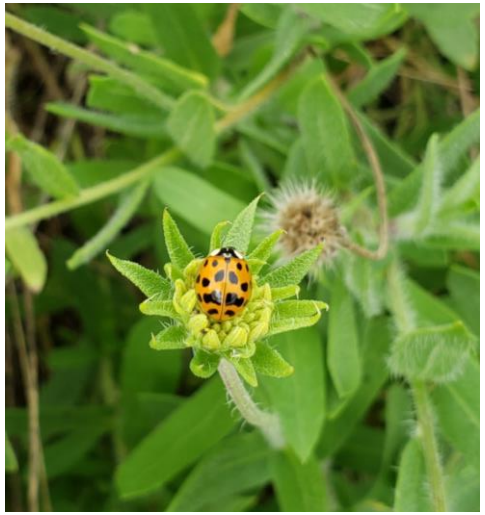




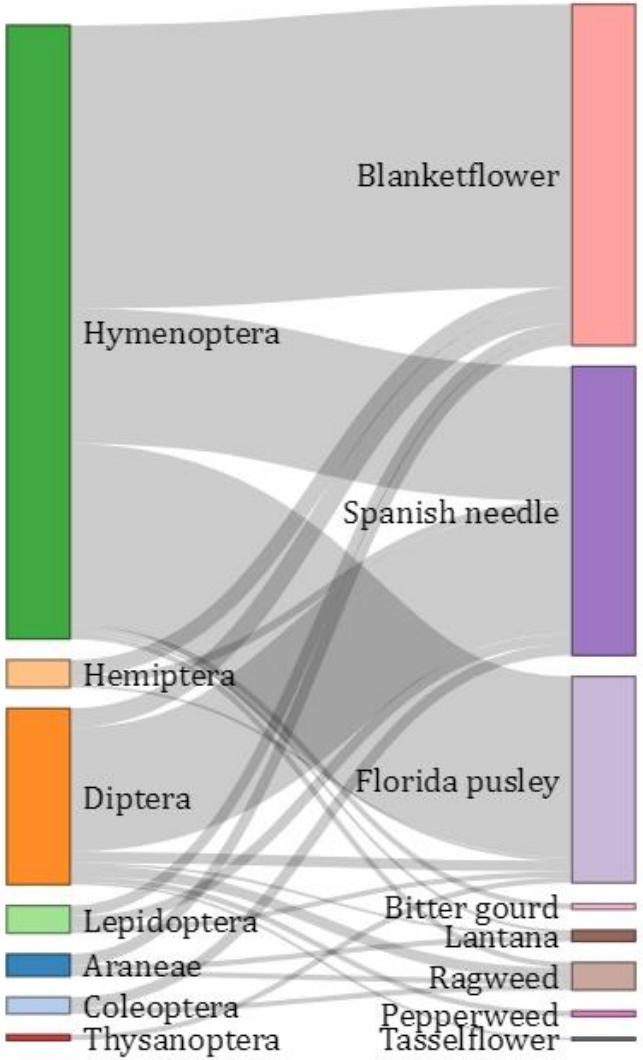


Enhancing windbreak habitat attractiveness to pollinators and predators via insectary plantings

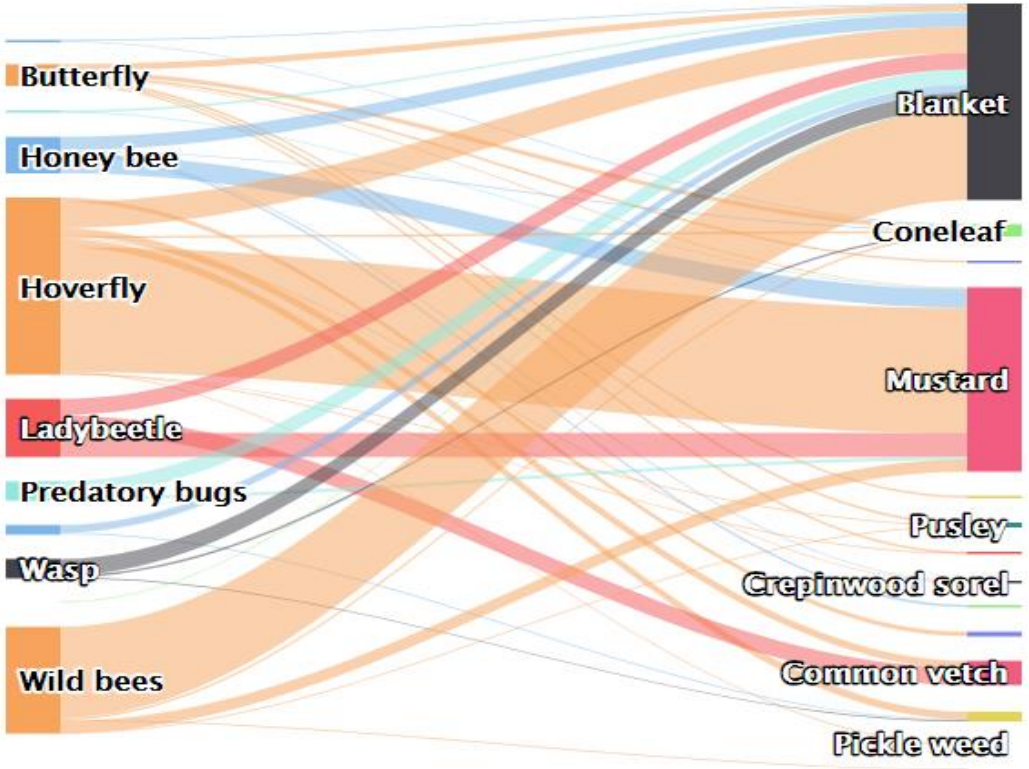




Enhancing windbreak habitat attractiveness to pollinators and predators via insectary plantings



Enhancing windbreak habitat attractiveness to pollinators and predators via insectary plantings



Acknowledgments

Derrick Conover, Kathi Malfa, Romain Exilien, Thomson Paris, Jessica Griesheimer…

Xavier_martini_florida

@xaviermartini

FLORIDA DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES
EST. 1868

SOUTHERN SARE
Sustainable Agriculture Research & Education

UF IFAS
UNIVERSITY of FLORIDA

USDA NIFA