Lebbeck mealybug management updates

Lebbeck Mealybug
Nipaecoccus viridis
(Newstead)

Photo Credit: T.R. Weeks, UF/IFAS CREC

L.M. Diepenbrock, UF/IFAS CREC
2020 Florida Citrus Growers' Institute

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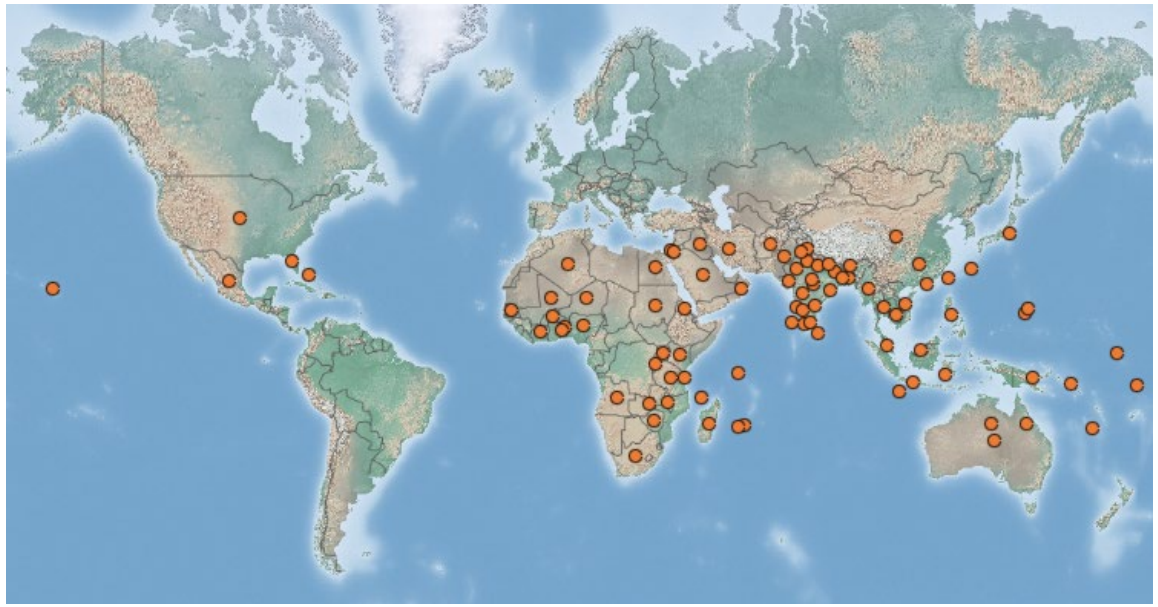
Lebbeck mealybug

- Non-native pest
- Can cause economic damage
  - Fruit distortion make fresh fruit unmarketable
  - Juice fruit ***might*** be okay depending on fruit quality and amount of excess fruit drop
- Serious pest around the world in citrus growing regions



Worldwide reports of Lebbeck mealybug
CABI Invasive Species Compendium

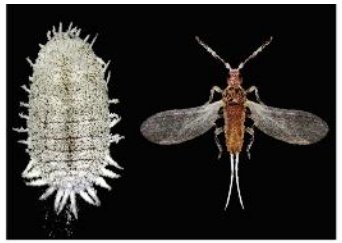
Has been be confused with:

Cottony cushion scale

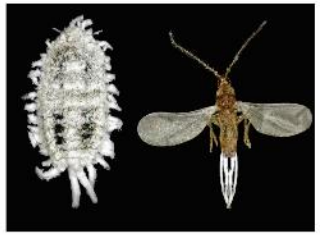
Woolly whitefly

Other mealybugs found in FL citrus

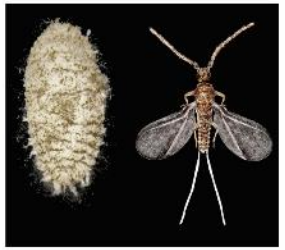
Nipaecoccus viridis, lebbeck mealybug



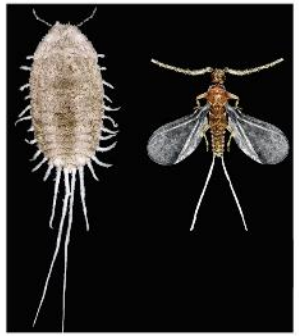
Planococcus citri, citrus mealybug



Phenacoccus solenopsis, cotton mealybug



Paracoccus marginatus, papaya mealybug



Pseudococcus longispinus, longtailed mealybug

Maconellicoccus hirsutus, pink hibiscus mealybug

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Distribution in Florida

- Commercial
  - Highlands
  - Hendry
  - DeSoto
  - Hardee
  - Lee
  - Brevard
  - Indian River
  - Polk
  - Miami Dade
  - Charlotte (6/2/2020)

- Residential
  - Broward

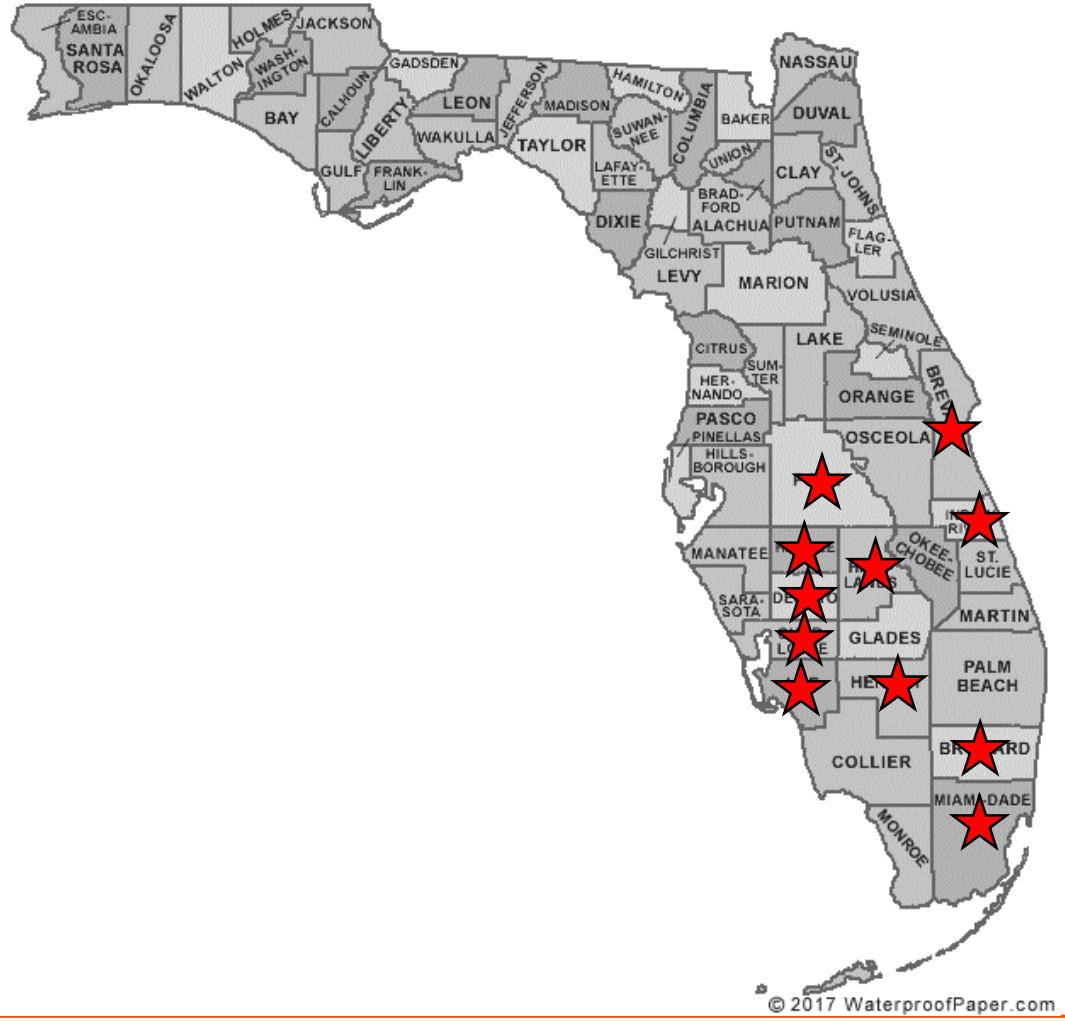

Image Credit: www.waterproofpaper.com/printable-maps/florida.shtml

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Broad range of host plants

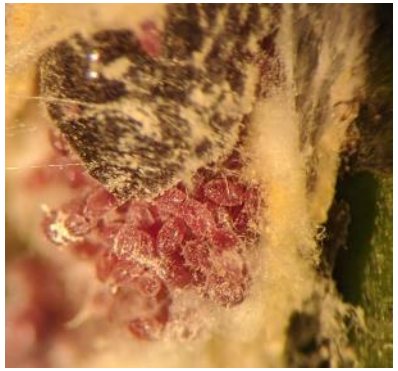
- Has many host plants such as fruit trees and ornamental plants
- Hosts* Lebbeck mealybug has been collected on in Florida:

- Citrus
- Jackfruit
- Pagoda flower
- Cannonball tree
- Tamarind
- Tabog
- Star jasmine
- Laurel fig
- Cape jasmine
- Bottle palm
- Jatropha tree
- Oleander
- Brush cherry
- Succulent sesame
- Night-flowering jasmine
- False ‘ohe
- Common purslane
- Elephant bush
- China doll
- Dwarf umbrella tree

*Hosts recorded from FDACS-DPI identified specimen labels through 5/7/2020

Factors enabling establishment

- Lebbeck mealybug is likely a pest of opportunity
- Multiple interceptions in ports of entry and finding in wild habitat (2009) suggests it may have been here a while
- Persisted due to ideal conditions and lots of food resources
- Why citrus?
  - Most varieties are excellent hosts and used by the pest around the world
  - > decade of psyllid management = reduced predators in system AND psyllid sprays are unlikely to have much impact
  - Easy to not see until populations reach damaging levels



Damage in citrus

- Fruit distortion
- Fruit drop
- Leaf chlorosis
- “Bunchy top”
- Decreased photosynthesis from sooty mold development
- Branch dieback
- Death of young trees

Fruit and leaf distortions from feeding.

Resets killed- previously bagged and infested.
Red ovals indicate tree remnants in closest row.

Basic Biology

- Piercing, sucking mouthparts
- Reproduces sexually or asexually (like aphids)
- Development on citrus 2-3 weeks from egg to reproductive adult
- Continuous reproduction and quick development time leads to overlapping generations in the field

- Their "lifestyle" makes management challenging…

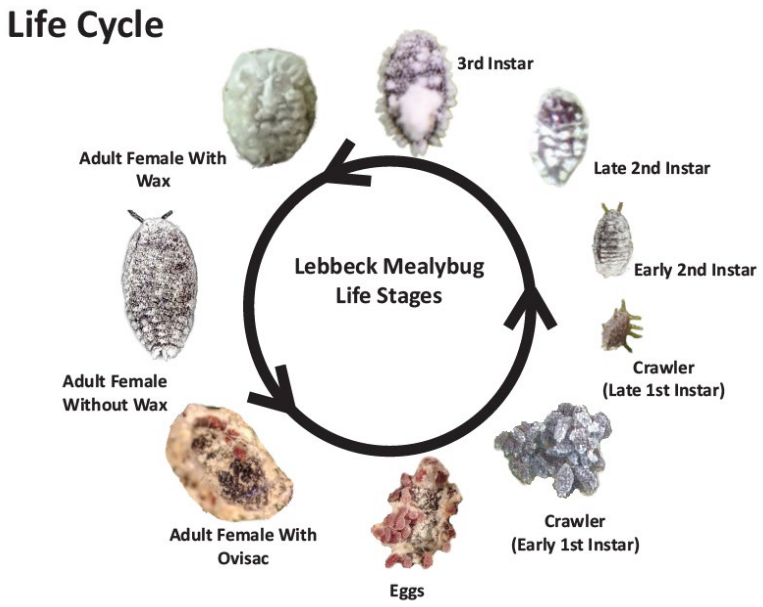


Image from *Field Guide of lebbeck mealybug*

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Lebbeck mealybug "lifestyle" challenges to management: Feeding and movement

Life stage	Does it feed?	Mobile?
Egg	No	No
Crawler	Depends	Highly mobile
2nd-3rd instars	Yes	Yes, but don't generally move far
Adult female	Yes*	No
Adult male	No	Yes, but doesn't cause new infestations

Why feeding biology and movement matter: chemical management options

Life stage	Does it feed?	Mobile?	Contact Insecticide	Systemic Insecticide
Egg	No	No	Material unlikely to be delivered to eggs	
Crawler	Unsure/unlikely	Highly mobile	+	-
2nd-3rd instars	Yes	Yes, but generally not far	+	+
Adult female	Yes*	No	Pre-ovisac: + With ovisac: -	+*

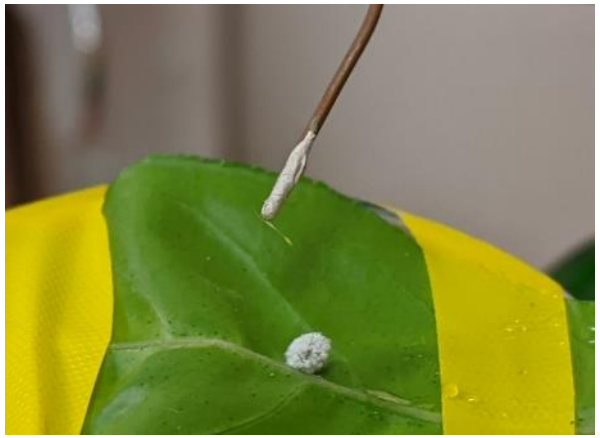
Life stage	Does it feed?	Contact Insecticide	Systemic Insecticide
Adult female	Yes*	Pre-ovisac: + With ovisac: - 	+* 

Previous studies stated that the once the female starts secreting the ovisac and laying eggs, she stops feeding.

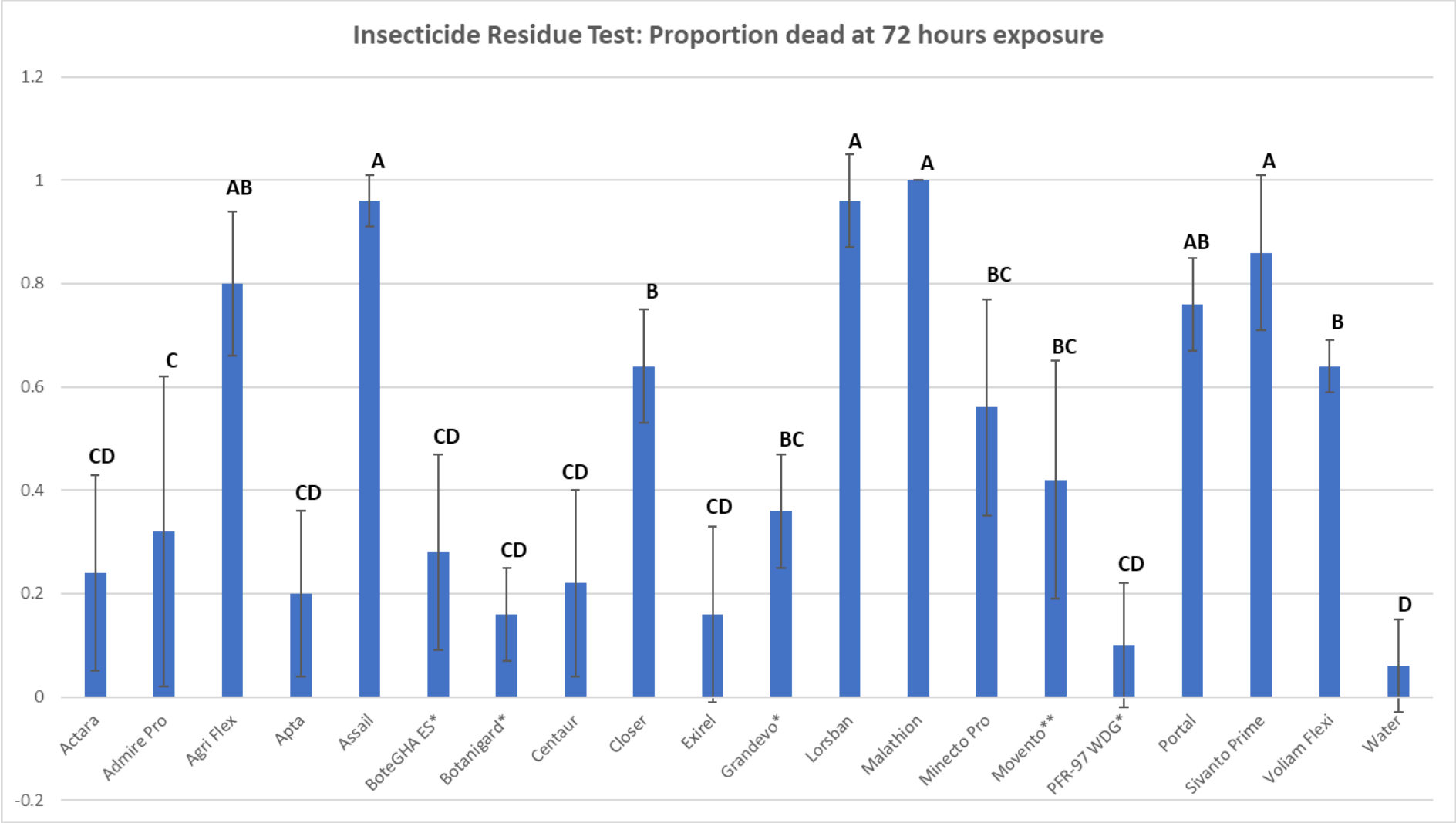
Using electrical penetration graph (EPG) technology, we have found that this is not correct.

Preliminary data show that she feeds intermittently with egg production.

→ Potential for management with systemic insecticide



Chemical management: lab data*



*Additional materials will be tested soon, all materials texted at maximum labelled rate

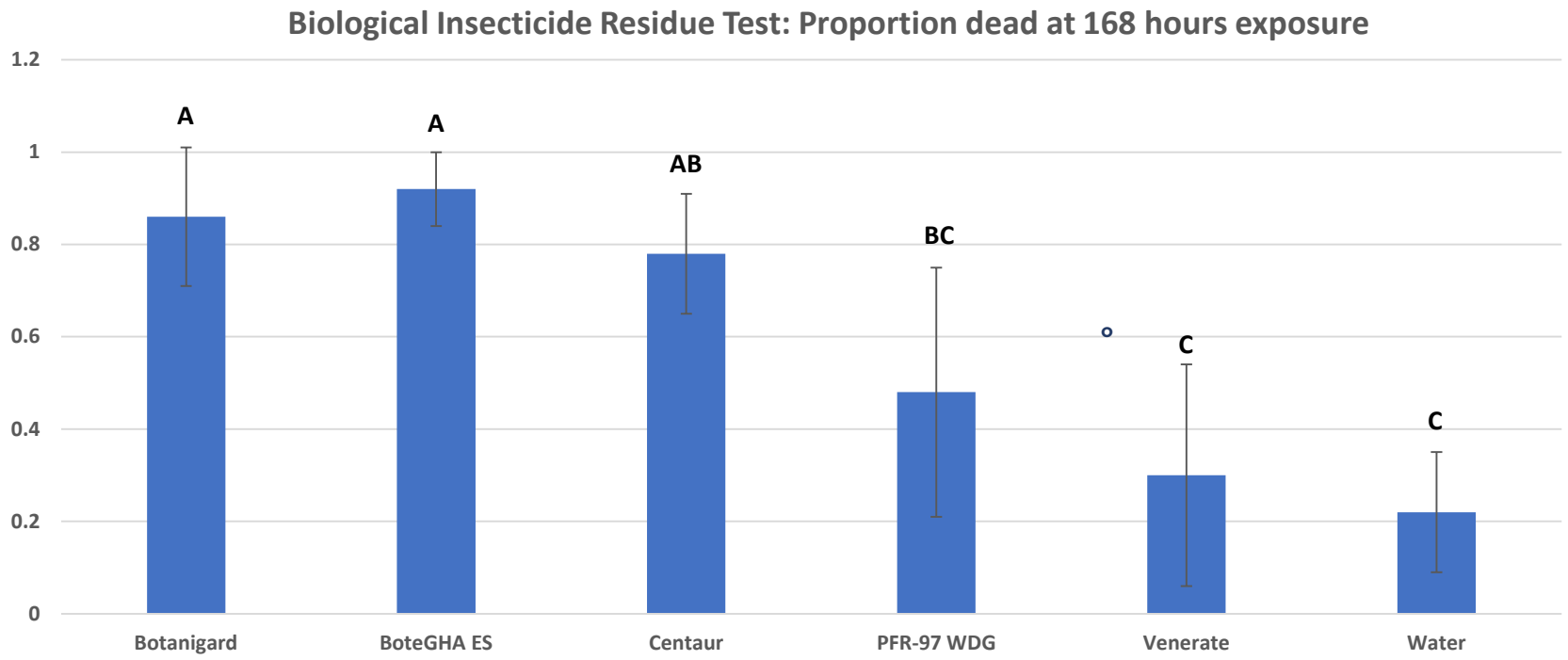
<u>Chemical classes with high efficacy:</u>
1B (organophosphates)
4A (neonics)
4D (butenolides)
21A (fenpyroximate)

Other materials have also been working well in fields. Pyrethroids are LEAST effective for control.

435 oil can enhance efficacy

Field application- COVERAGE IS KEY

Biological insecticide options*



Increases management options:

Entomopathenogenic fungi (EPF) or IGR could be used in rotation with other chemistries, would be ideal for use following a knockdown material.

EPF may be an option for use in bags as a pretreatment

*Botanigard Maxx to be tested in upon resumption of this work

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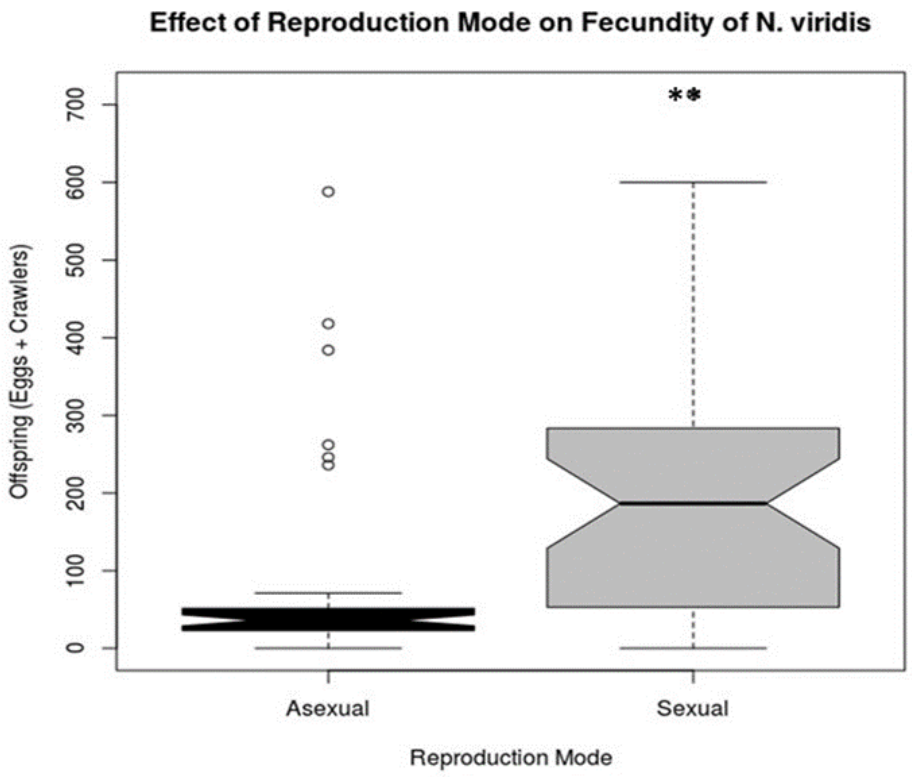
Timing management actions: targeting mobile susceptible stages

- Monitoring
  - Determine when crawlers emerge
  - Time applications to activity- crawlers emerge in batches for 1-2 weeks
- How to monitor
  - Testing in progress
  - Fall 2020: tested inverted white duct tape and clear double-sided tape; neither are optimal
  - 2020: tested inverted duct tape and electrical tape
    - Mealybugs walked over surfaces…

Does mating matter?

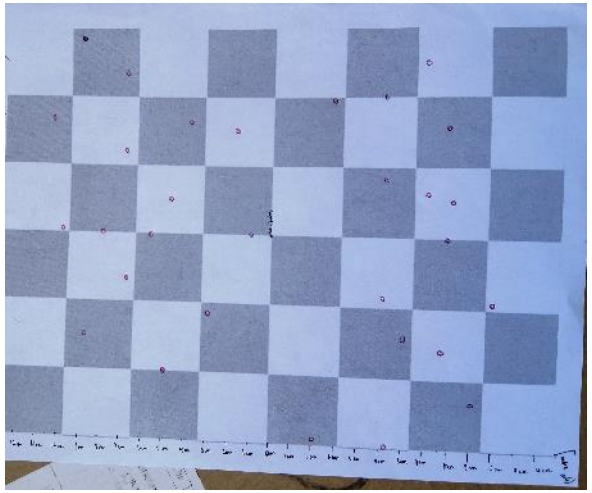
- Mated = more eggs produced
- Why does this matter?
  - Mating disruption could be an option to reduce populations
- Tested pheromone lures in 2019 but unsuccessful, need a better formulation



Ongoing research by PhD student David Olabiyi

How does infestation spread?

- Mealybugs can walk to new locations
  - Walk with no stimulus approximately 0.5 inch per minute
  - Attracted to light
- Wind (?)
  - Research in CA → similar species' crawlers dispersed on wind currents
- Plant debris
- Other organisms
- Equipment being moved between sites



Movement assays- (1) Speed, no stimulus
(2) Light vs. dark

Ongoing research by PhD student David Olabiyi

Movement on equipment

- Research on a different mealybug pest has shown movement on farm equipment- steam sanitizing reduces spread on equipment
- Work in known infested groves AFTER groves without infestations
- Can we reuse tree bags when previous bagged trees were infested?
  - Bags cost ~$10 each plus labor
  - Need to be able to reuse to make profitable
  - How can we clean bags to kill mealybugs that may remain?

Cleaning tree bags for reuse

- Infested leaf material with various life stages, closed ovisacs, and manually opened ovisacs tested
- Temperature & times tested:
  - 130° F 15 min
  - 130 ° F 30 min
  - 150 ° F 30 min

  100% kill rate all life stages
- Need to optimize- more specific temperature & time combination for grower use

Biological control options

MS research,
Kristen Gaines

- Biological controls are key to managing Lebbeck mealybug in other citrus producing regions.
- The good news: there are predators in the system!
- The challenges
  (1) Which ones are important for reducing the pest population?
  (2) How do we promote effective predators?
  (3) How can this work with ACP management?



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Biological control: who's eating Lebbeck mealybugs?

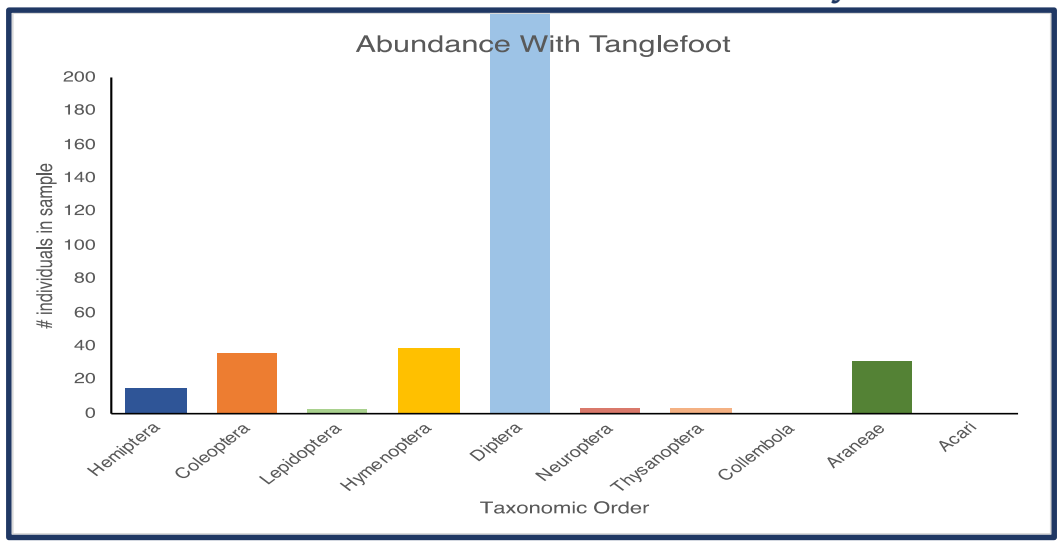
- Field collection
  - Insects, spiders, and mites in canopy sampled using suction sampler
  - Killed on site and preserved to maintain stomach contents
  - Sorted and identified in lab
- Gut content analysis
  - Determine feeding interactions using DNA from the insect's gut PCR and primers specific to the mealybug
    - Primers are currently waiting to be validated

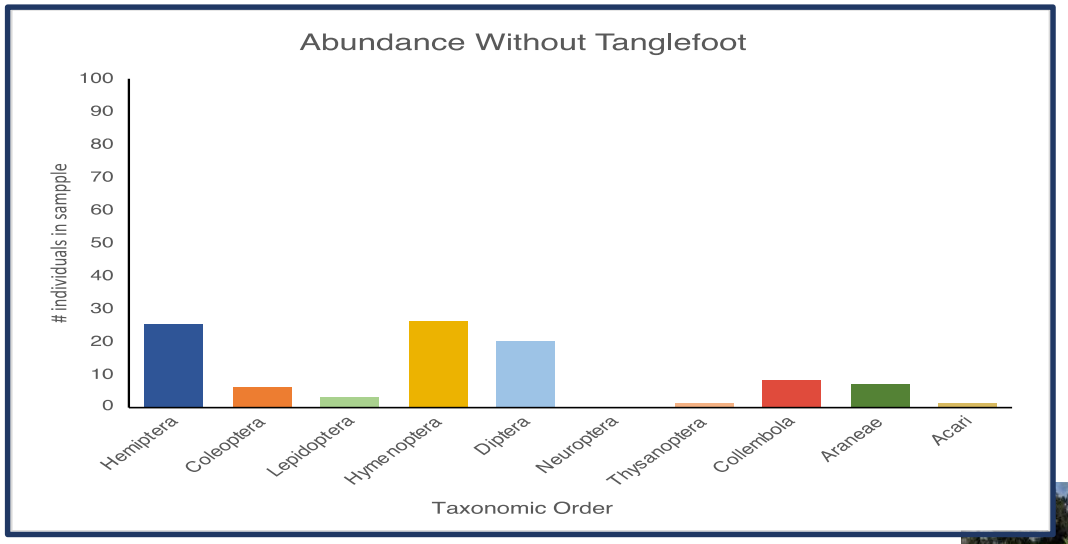
MS research, Kristen Gaines

Biological control: promoting predators

- Enable access
  - Ants farm mealybugs for honeydew and provide protection
  - Preventing ant access can increase ability of predators to feed on mealybugs

Preliminary data from 2019- one site, one date





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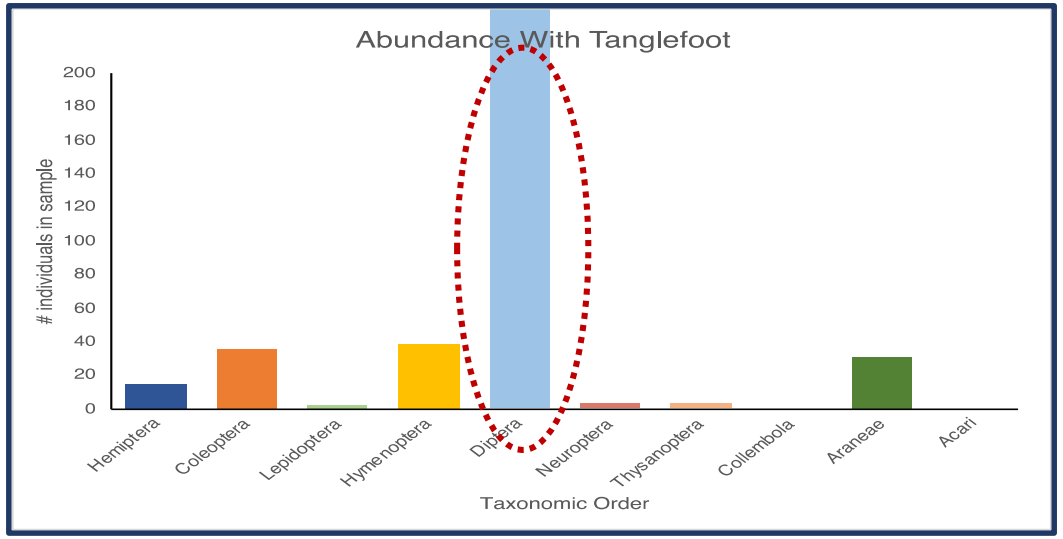
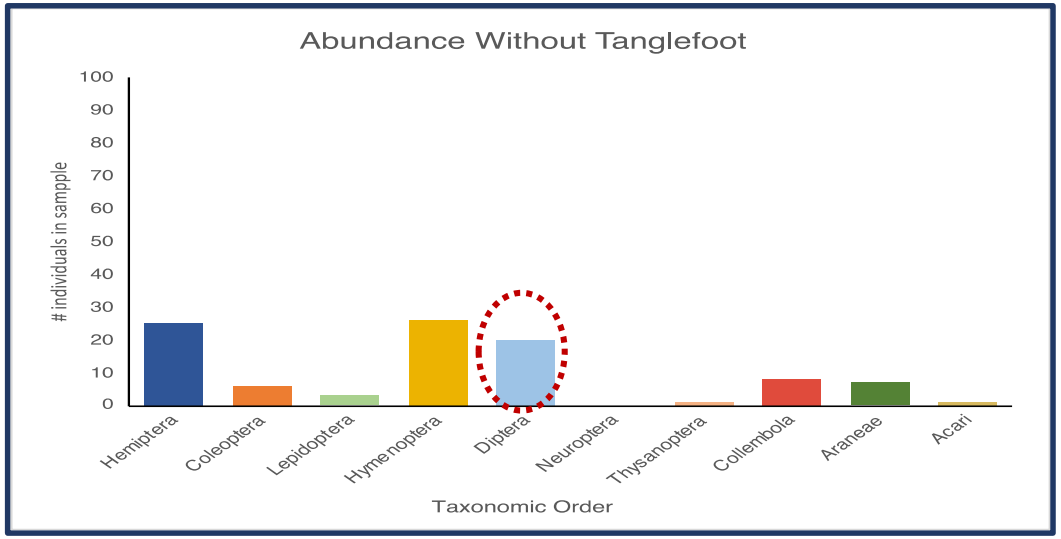
Biological control: promoting predators

- Diptera = flies
  - At least 2 species of known generalist predators, one of which is commonly collected across several groves





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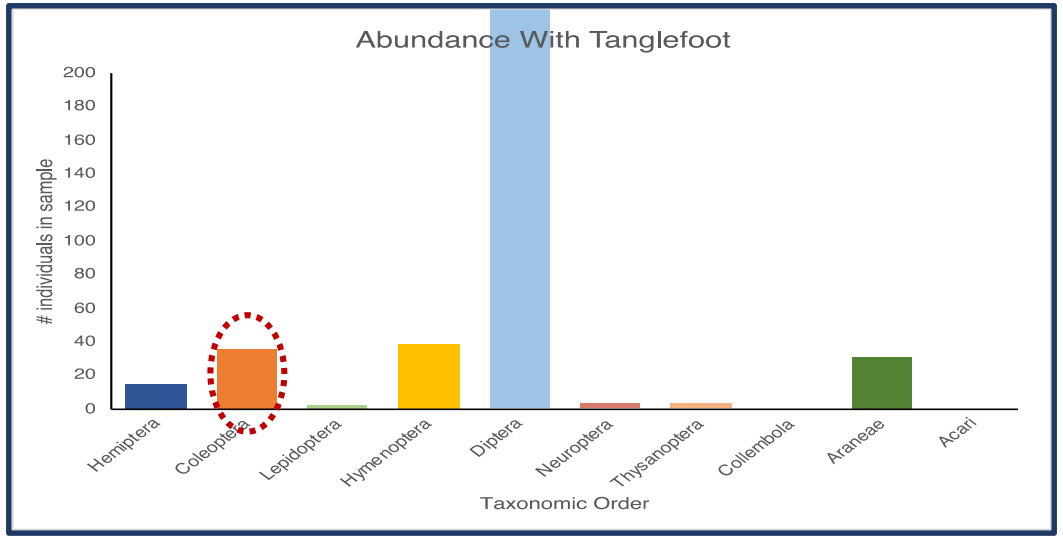
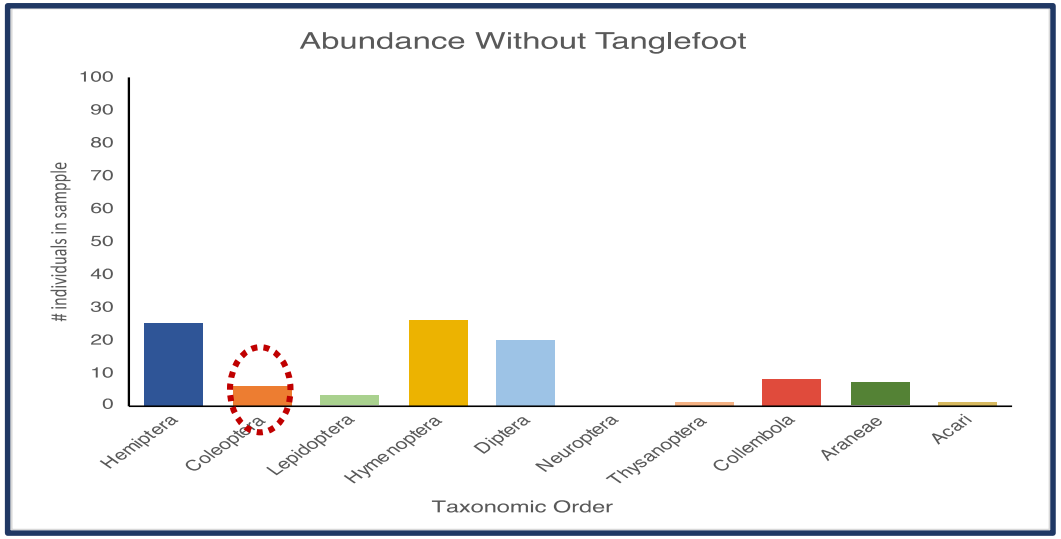
Biological control: promoting predators

- Coleoptera = beetles
  - Large grouping includes mealybug destroyers, weevils, sap beetles
  - Mealybug destroyers common





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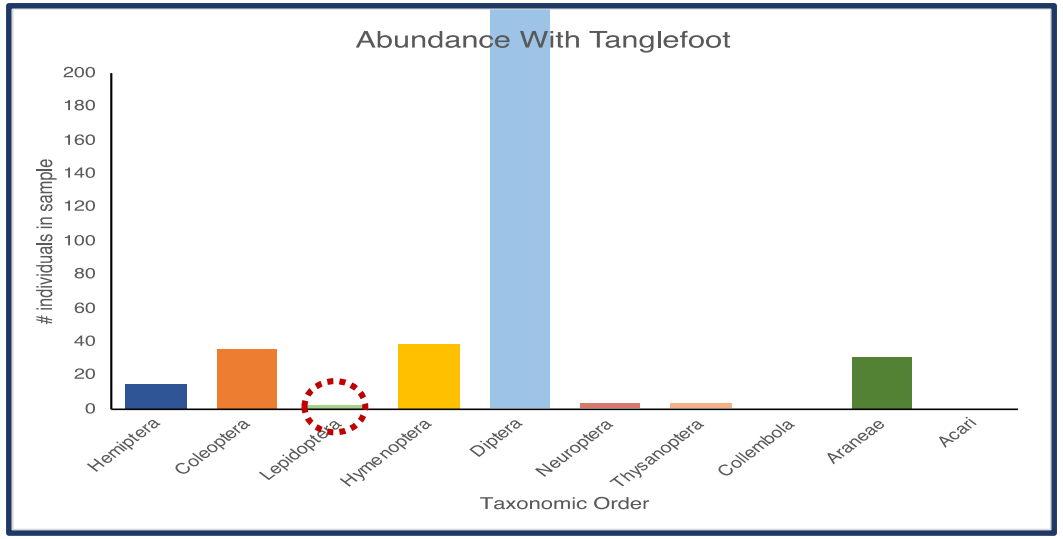
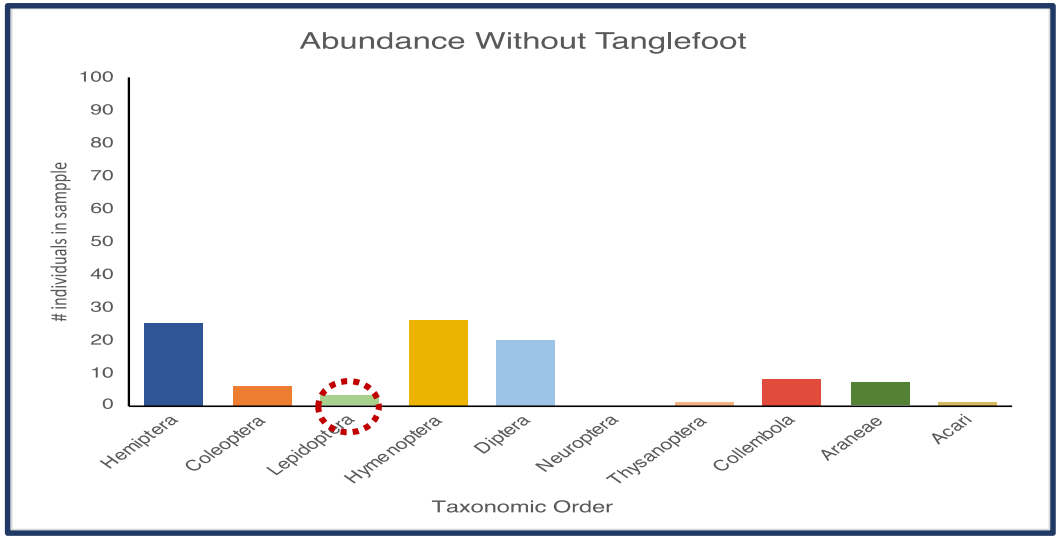
Biological control: promoting predators

- Lepidoptera= butterflies, moths
  - Pest lepidopterans include CLM, armyworm, leafroller
  - Predatory caterpillar is commonly found in groves





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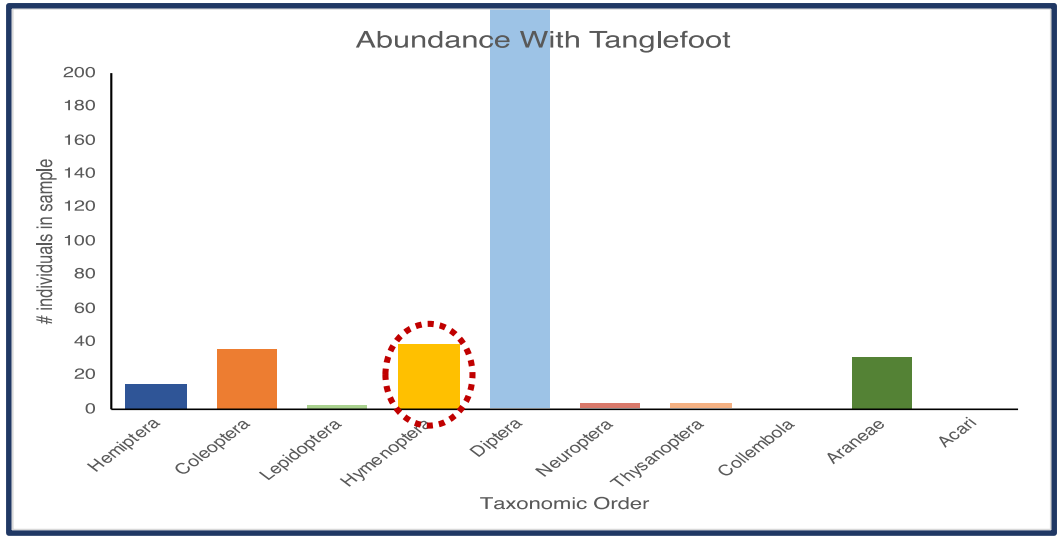
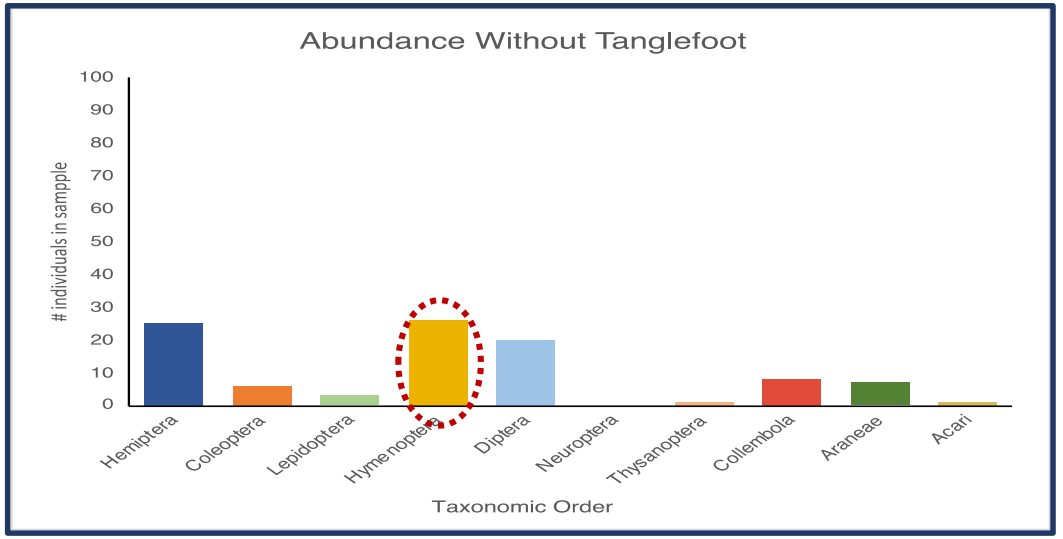
Biological control: promoting predators

- Hymenoptera= ants, wasps, bees
  - Parasitoids are tiny wasps, important for control in other regions
  - Potential parasitoids collected in emergence containers





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Biological control options: working with ACP management

- Will require thoughtful management actions
  - ACP sprays can reduce predators locally, may need to supplement and/or provide alternate habitat to maintain populations nearby
  - Target management only when needed
  - Use materials with less toxicity to beneficials
  - Time application of insecticides to activity



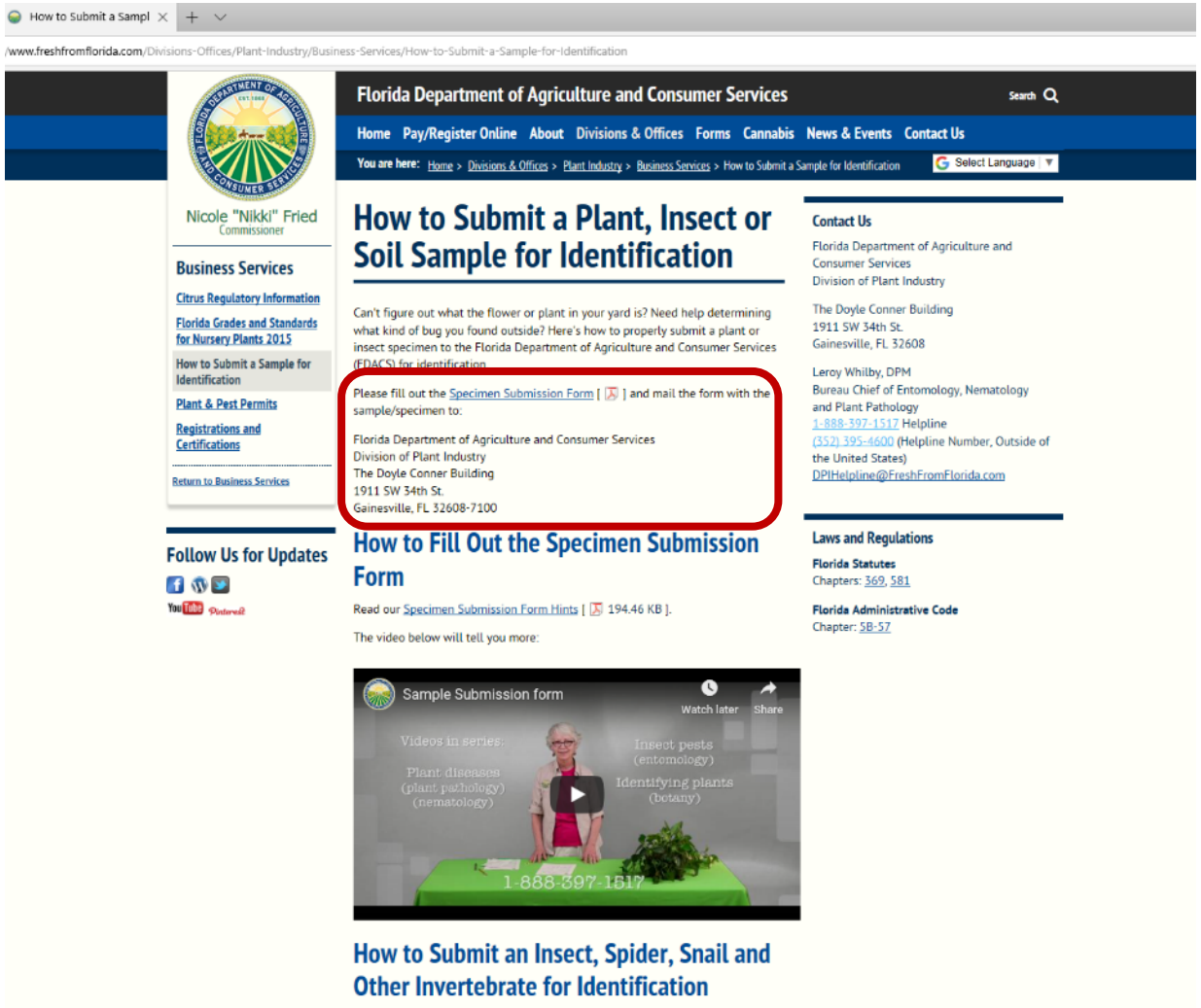



Submit a sample

- www.freshfromflorida.com/Divisions-Offices/Plant-Industry/Business-Services/How-to-Submit-a-Sample-for-Identification

- Follow the instructions on how to package and fill out the Specimen Submission From (must be included with each sample)

- Ship to DPI for confirmation of species



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