



Asian citrus psyllid management and current findings of recent surveys

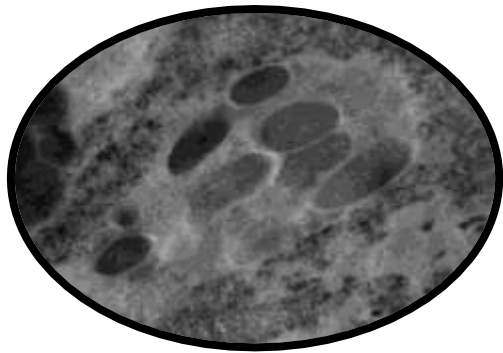
Xavier Martini



The Asian citrus psyllid



- *Diaphorina citri*, the Asian citrus psyllid. First found in Florida June 1998
- Vector of *Candidatus Liberibacter asiaticus* (CLas) pathogen responsible for Huanglongbing (HLB)



Candidatus Liberibacter asiaticus

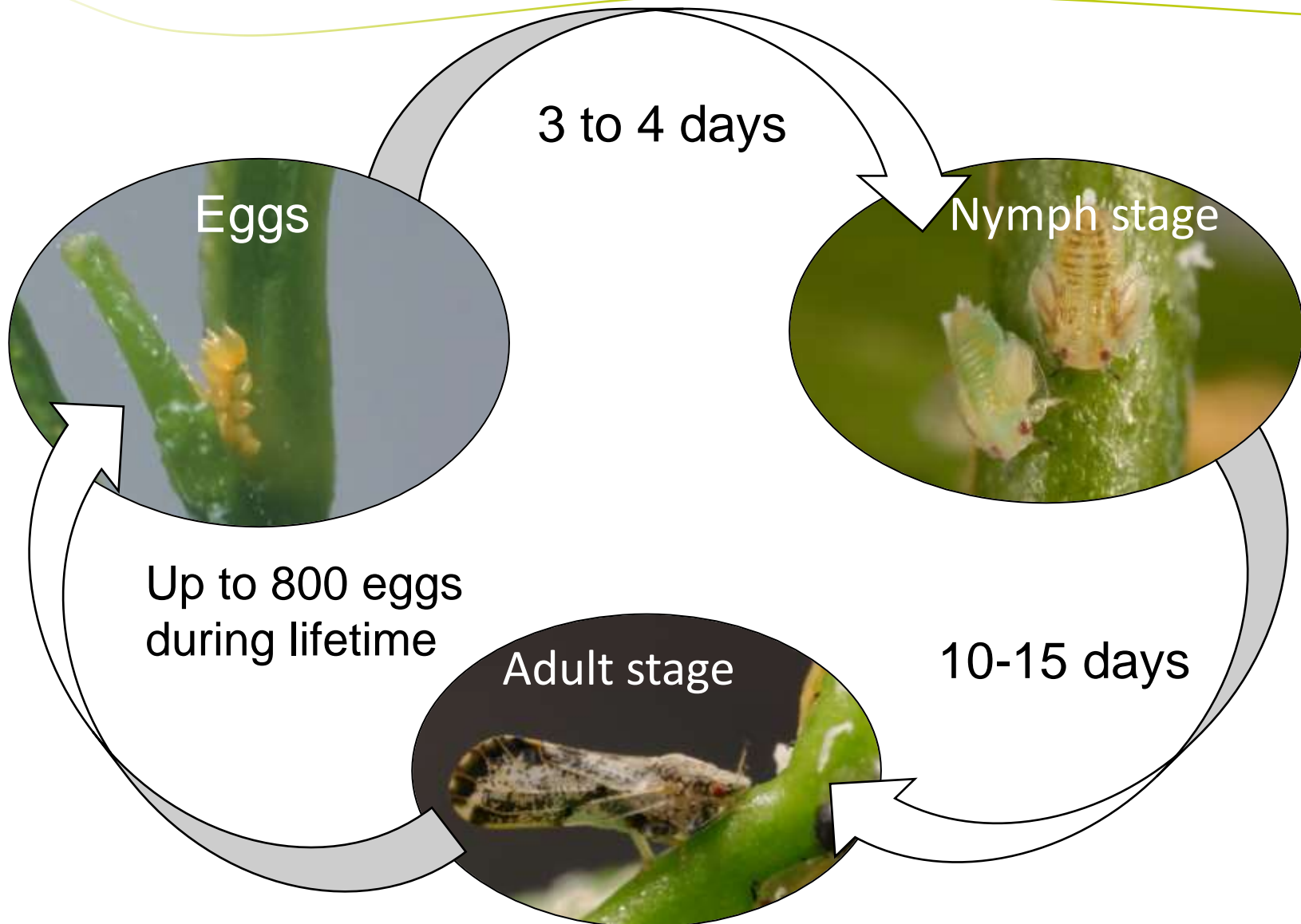


HLB infected

Uninfected



The Asian citrus psyllid: Life Cycle

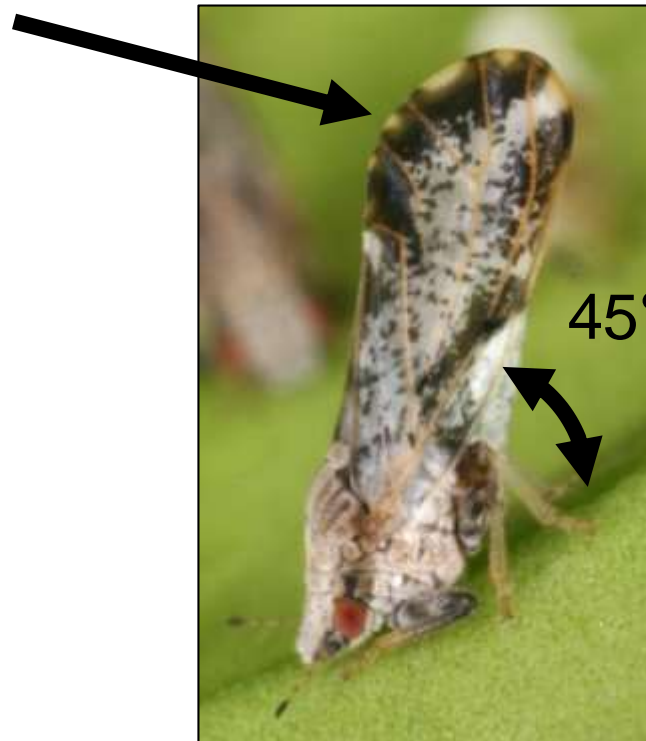


The Asian citrus psyllid



- Adults jump when approached
- They sit in a vertical position with abdomen up in the air

Black
coloration at
the end of the
wings



45°

1/10 to 1/6
inches

- Nymphs are always found on new emerging leaves.
- Can be confused with scale insects, but scale insects do not move and do not produce white honeydew.



Finding in Franklin Co, FL



UF

Lovestrand E.
2016

Citrus plant in Carabelle, FL. Note the asymmetrical chlorosis on the leaves.

Citrus tree
in Carabelle,
FL. Note
the leaf
mottle and
shape and
color of the
fruit.



UF
IFAS

Lovestrand E.
2016

SYMPTOMS

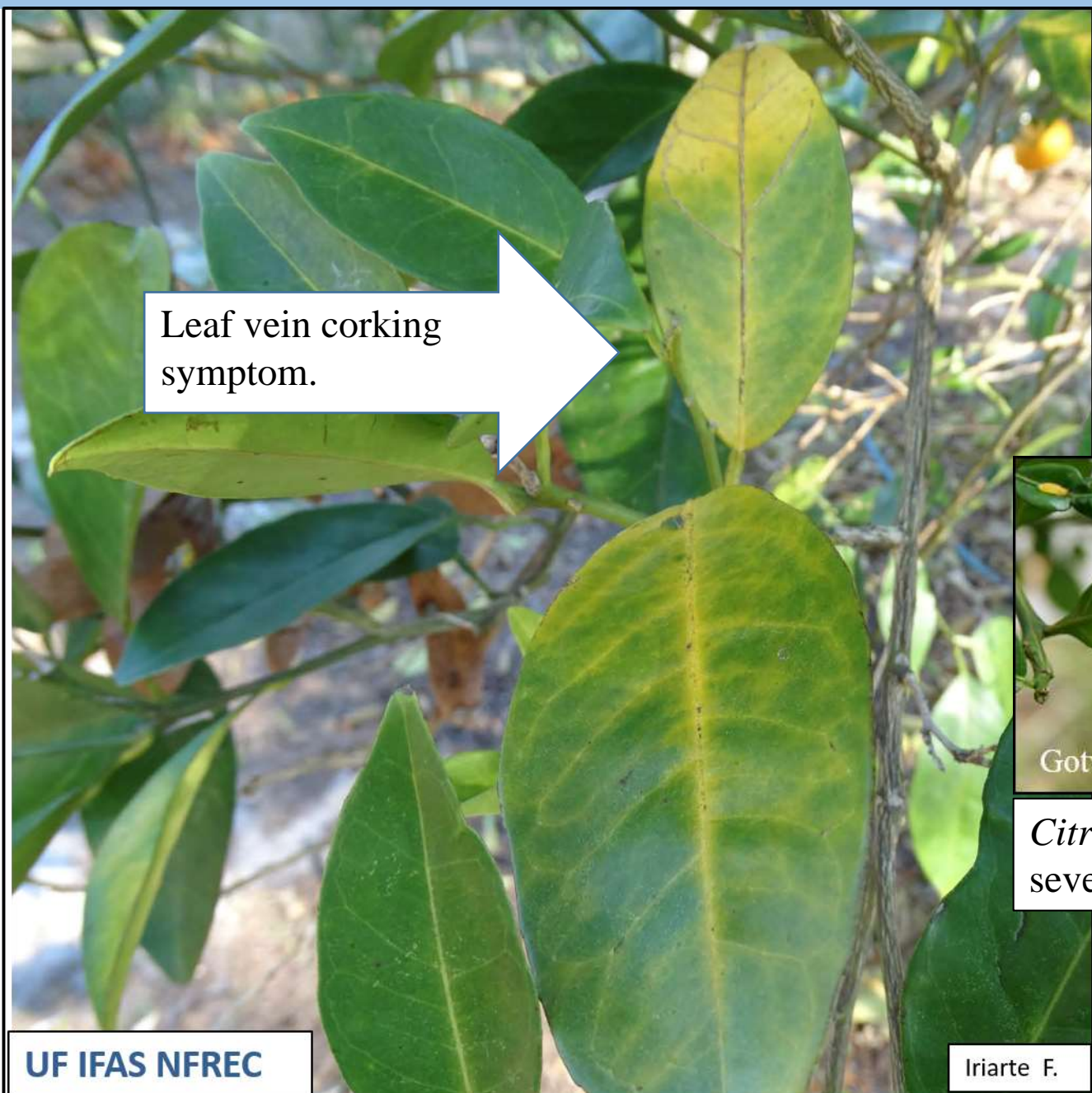
Affected leaves develop a pattern of yellow and green areas giving a “blotchy mottle” appearance. The patterns are asymmetrical on the two halves of the leaf



Pummelo foliage from south Florida displaying “blotchy-mottle” symptoms.

Backyard citrus in Franklin county showing symptoms of Citrus greening.

SYMPTOMS



Leaf vein corking symptom.

Leaves can become thicker, with veins enlarged and corky in appearance



Gotwald T. R.

Citrus hystrix tree showing severe vein corking symptom.

SYMPTOMS

Fruit is usually small, poorly colored, lopsided and may have lack of coloration at the stylar end



Infected fruits have stylar end “lack of coloration” .



Fruit taste may be bitter, medicinal and sour.

Infected trees may not show symptoms for several years (1 to 5 years or more).

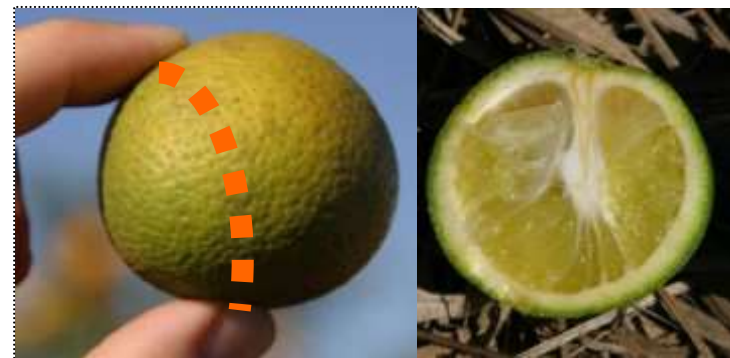


Asymmetrical “lopsided” sweet orange fruit from São Paulo, Brazil.

Economic impact of HLB in Florida

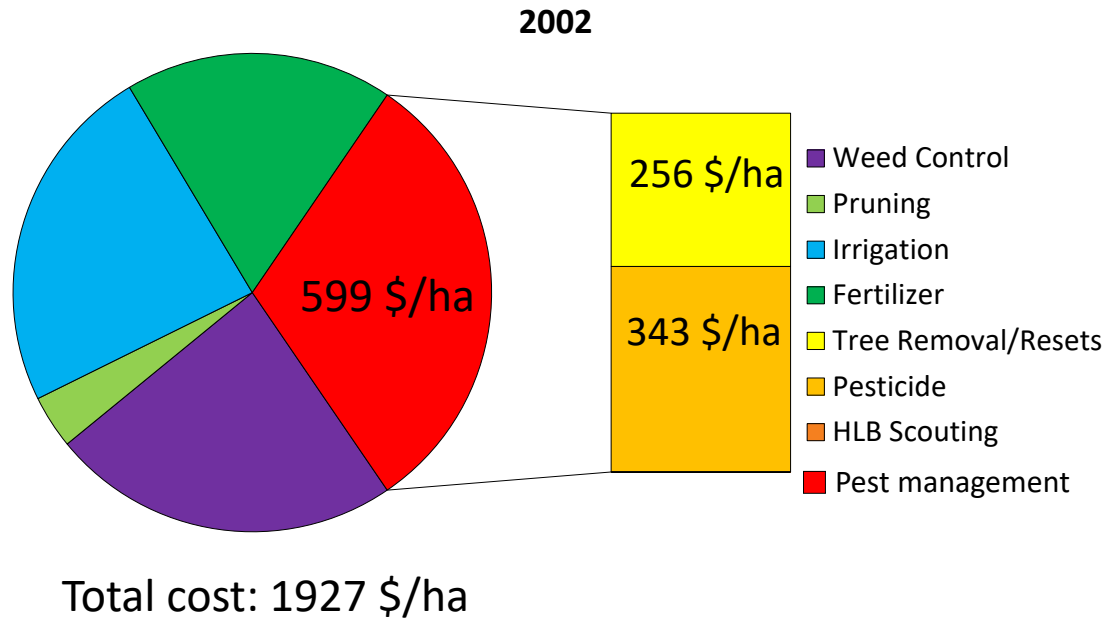


- Death of citrus trees only a few years after infection
- Undesirable organoleptic properties
- All known commercial citrus species are susceptible to HLB infection
- Citrus yield decreased from 133.6 millions of boxes in 2012-2013 to 81.4 millions of boxes in 2015-2016
- HLB infection rate in Florida is approximately 80%

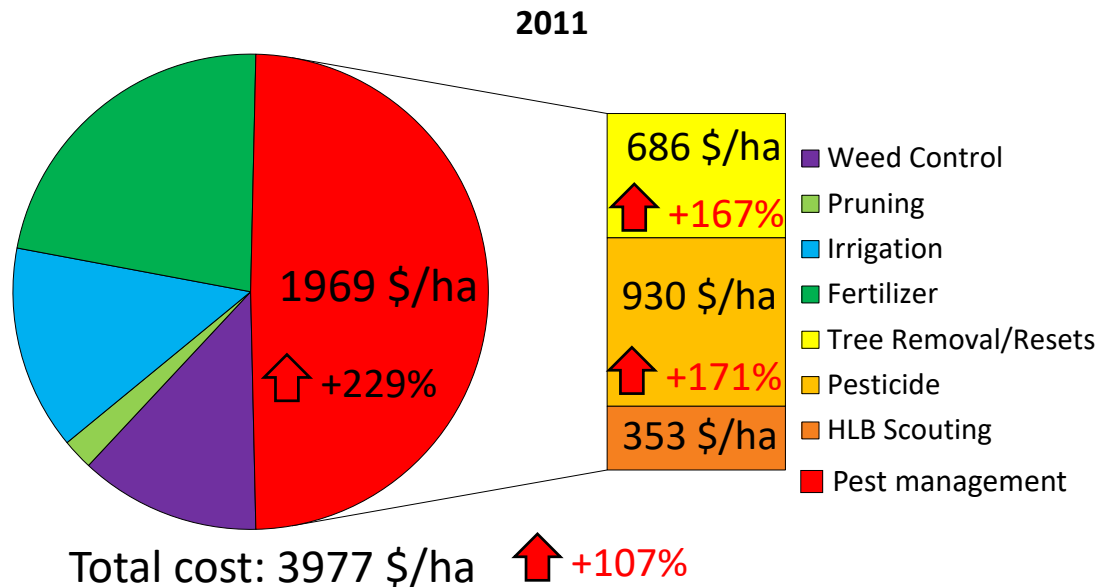


Economic impact of the HLB in Florida

Cost of citrus production increased about 107% over the past 10 years



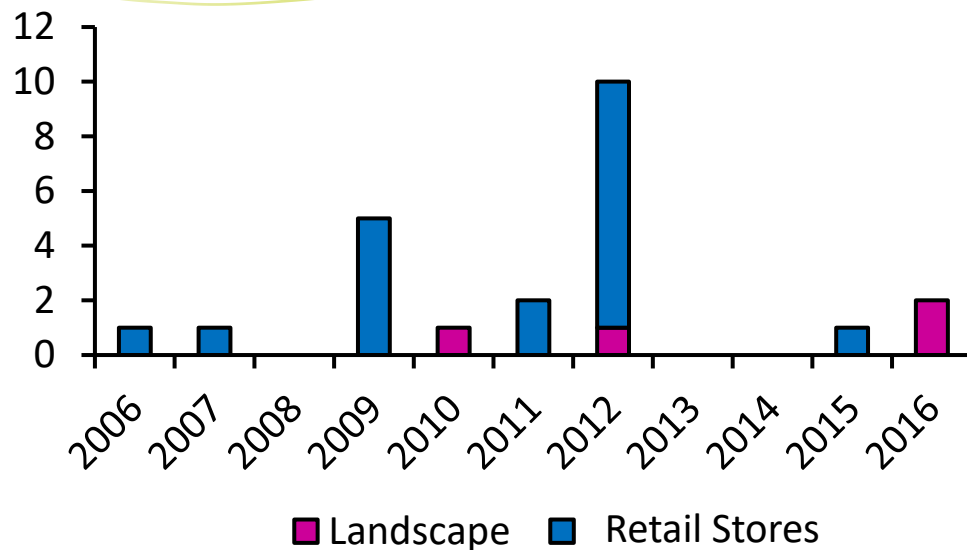
The amount of abandoned citrus groves account for 20% of the citrus land in Florida



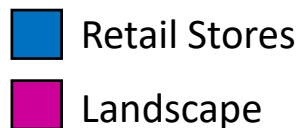
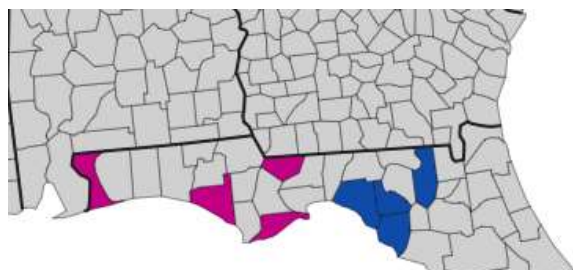
Distribution of HLB in Florida



Records of Asian Citrus psyllid in the Northwest district



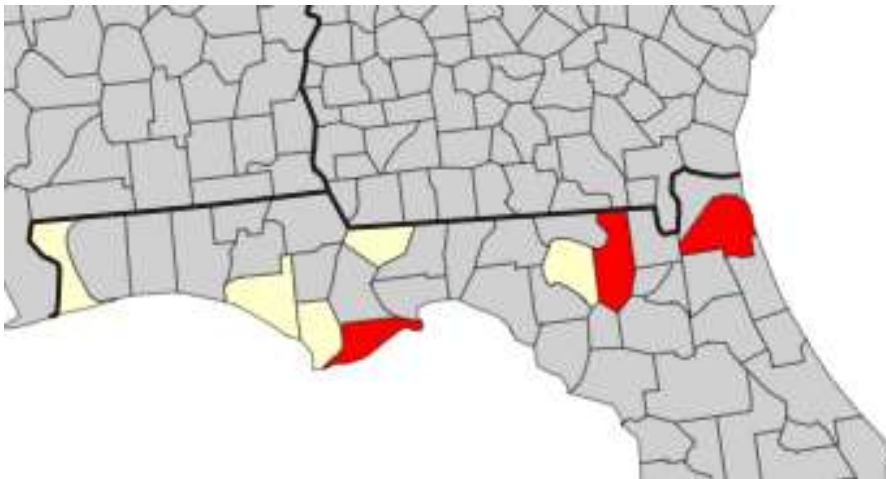
First case of HLB in Franklin County



Records of Asian Citrus psyllid in the Northwest district



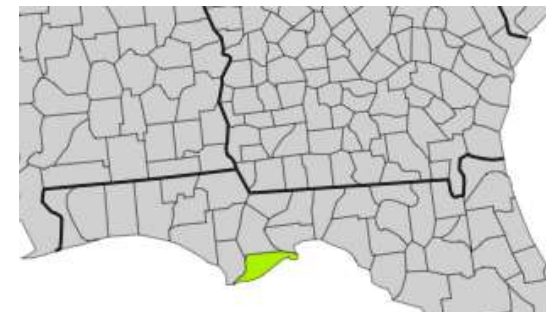
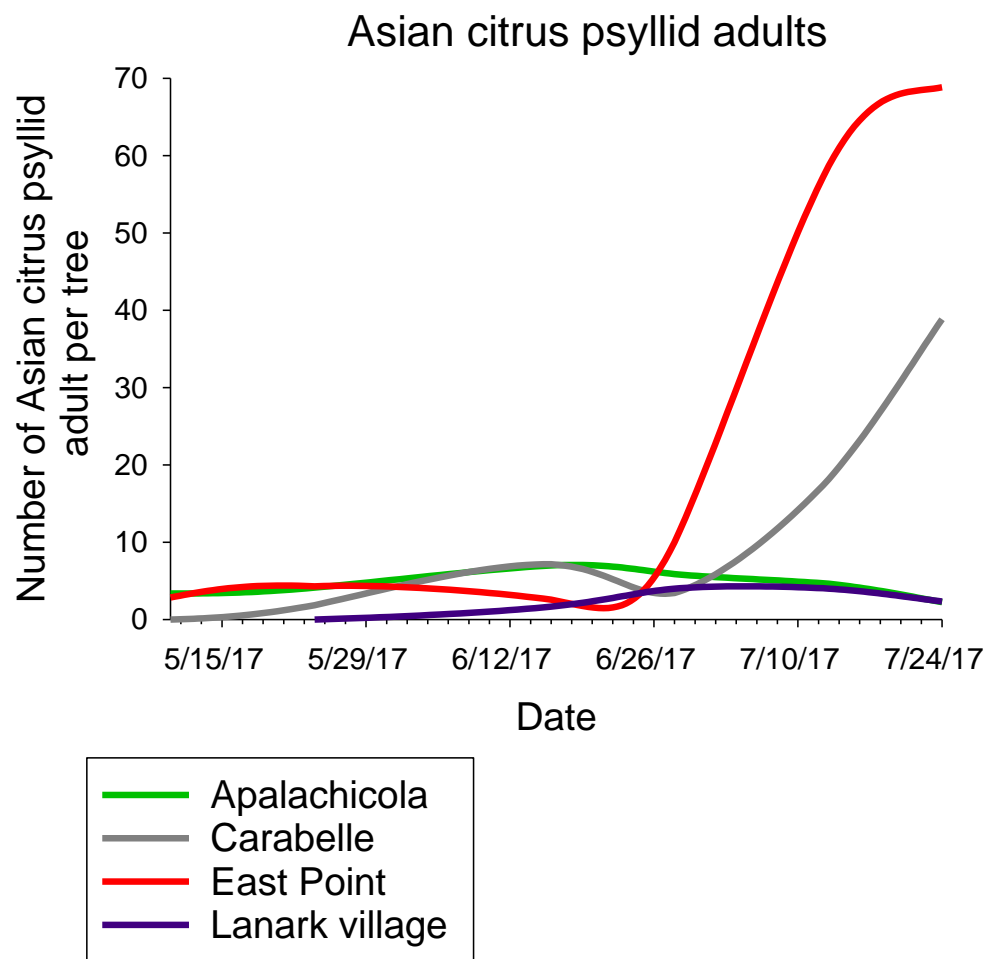
2016-2017 survey



 Psyllids found

 Confirmed HLB
cases 2017

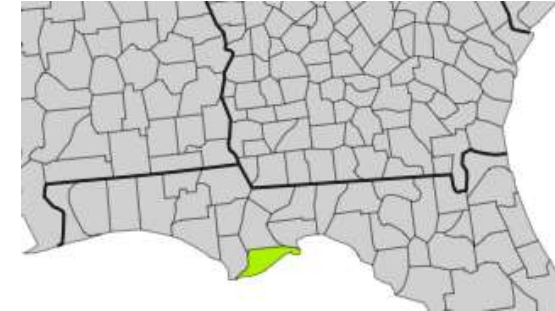
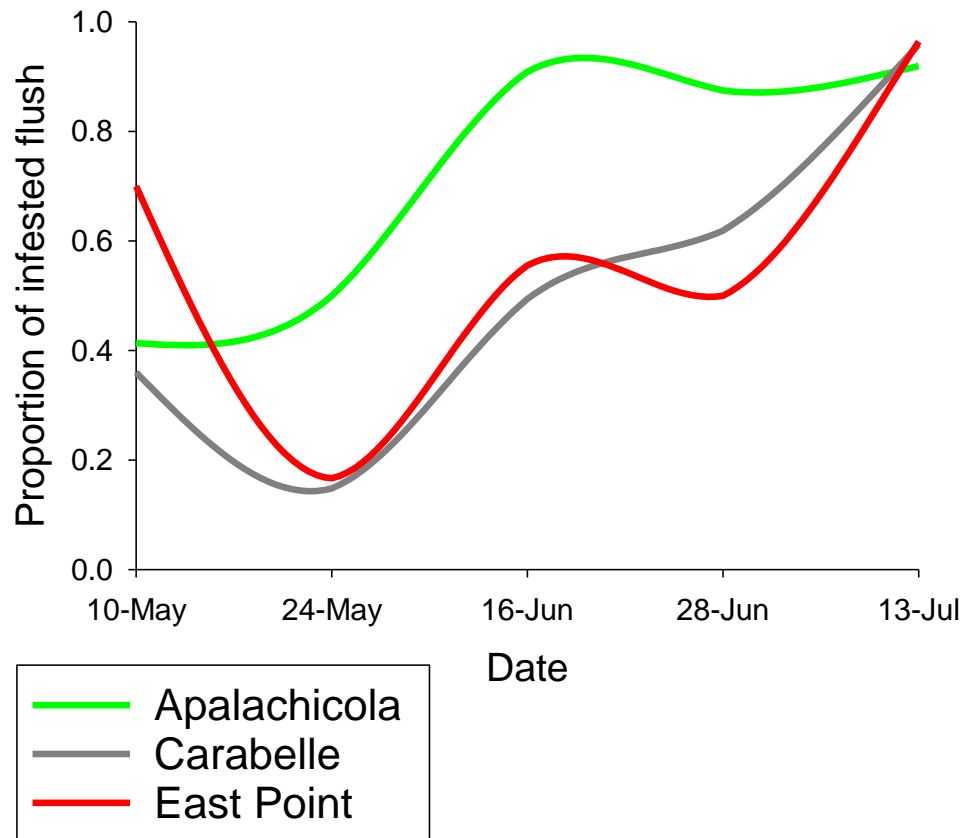
Population dynamic of the Asian citrus psyllid in Franklin county



Population dynamic of the Asian citrus psyllid in Franklin county



Proportion of infested flush



In summer all the potential breeding sites (flush) are occupied.



Overwintering capabilities



50% mortality 0°C (32°F) for 2 days

95% mortality for 7 hours at -4.5°C (23.9°F) to 2 hours at -9.2°C (15.4°F)

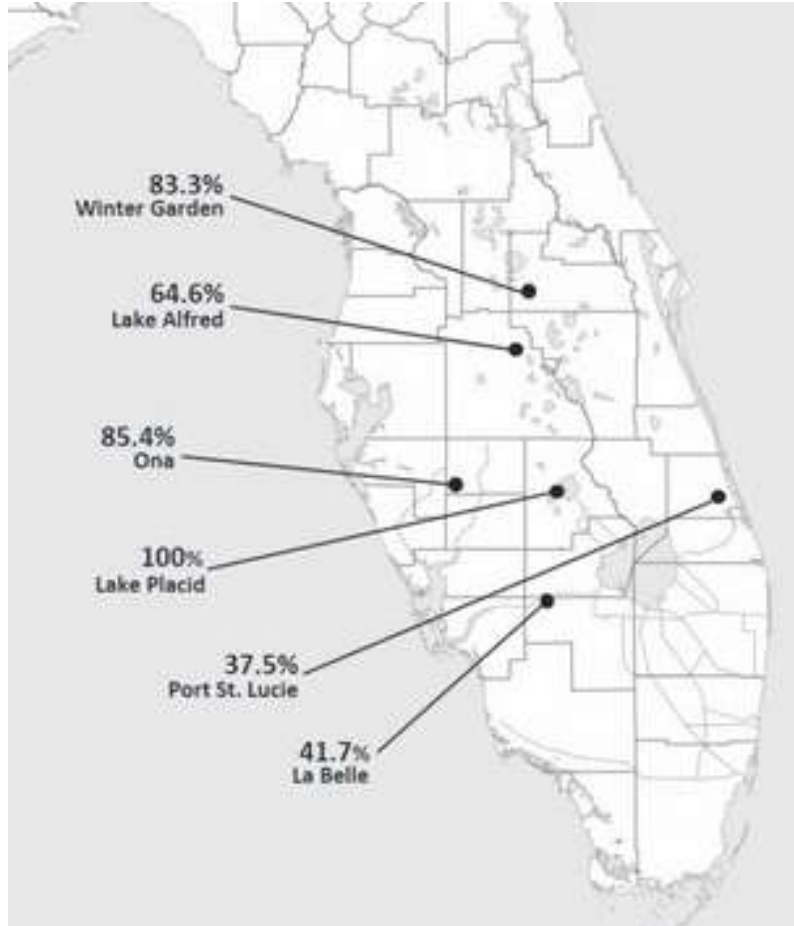
In Tallahassee, the temperature falls below -6.7°C (20°F) in about half of the years.

In Monticello, the temperature falls below -6.7°C (20°F) about one year in three.

In Panama City Temperatures below -6.7°C (20°F) occurred about one year in ten

Local adaptations? Climate change?

Percentage of Psyllids carrying HLB pathogen



All psyllids found in Gadsden county this year were negative to HLB pathogen.

If not in contact with HLB trees, most psyllids lost HLB pathogen after 3 weeks.

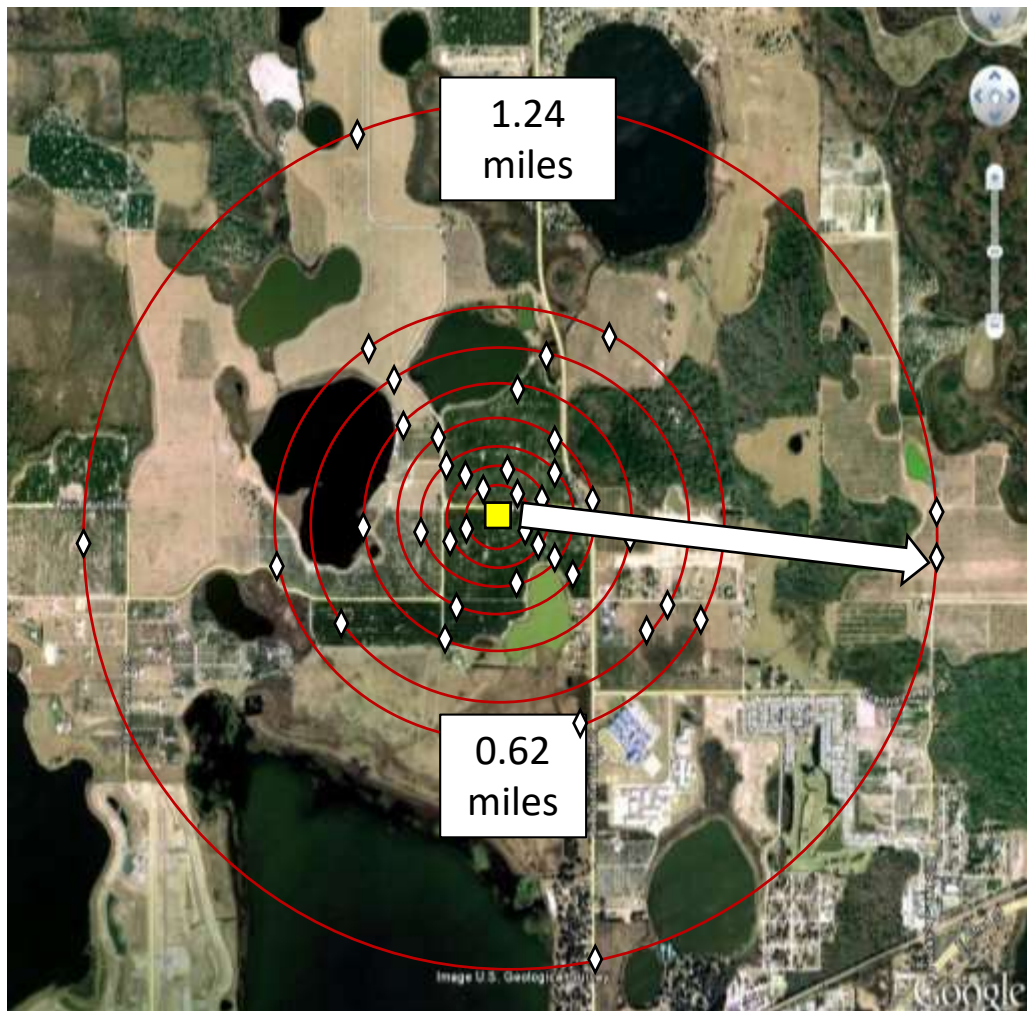
Dispersion potential of *D. citri*



Collection site

Abandoned grove

Dispersion potential of *D. citri*



Citrus trees sprayed with
milk protein

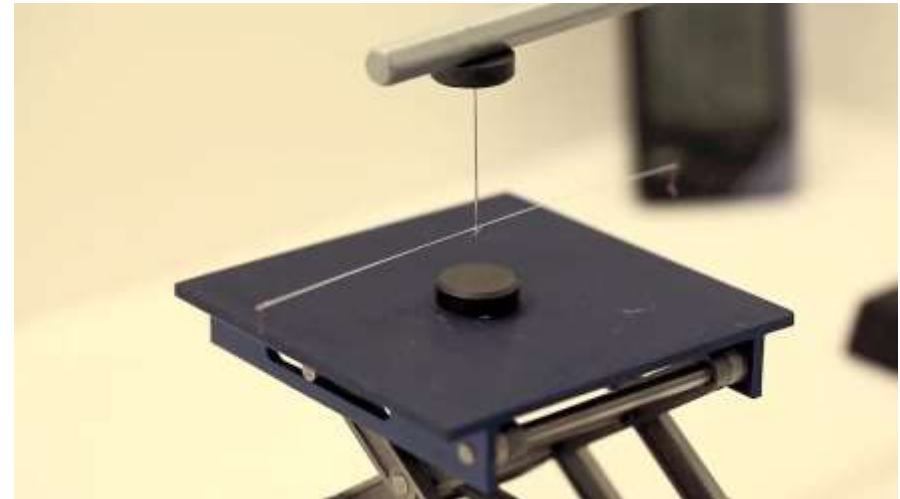
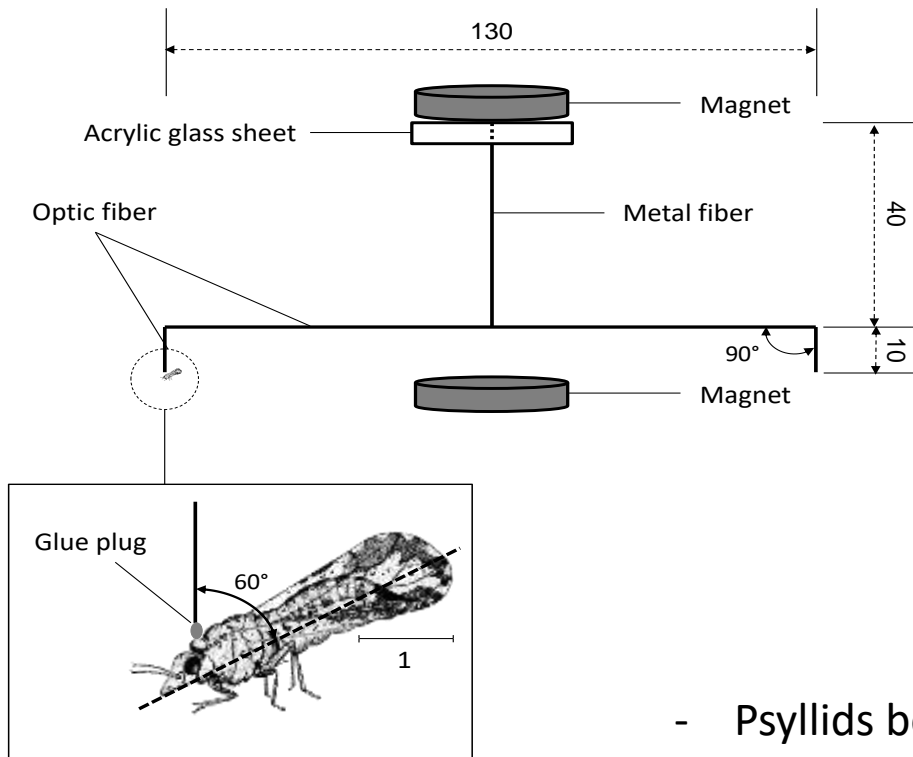


Sticky trap placed on 8
concentric circles

ELISA performed on psyllids
captured after one week

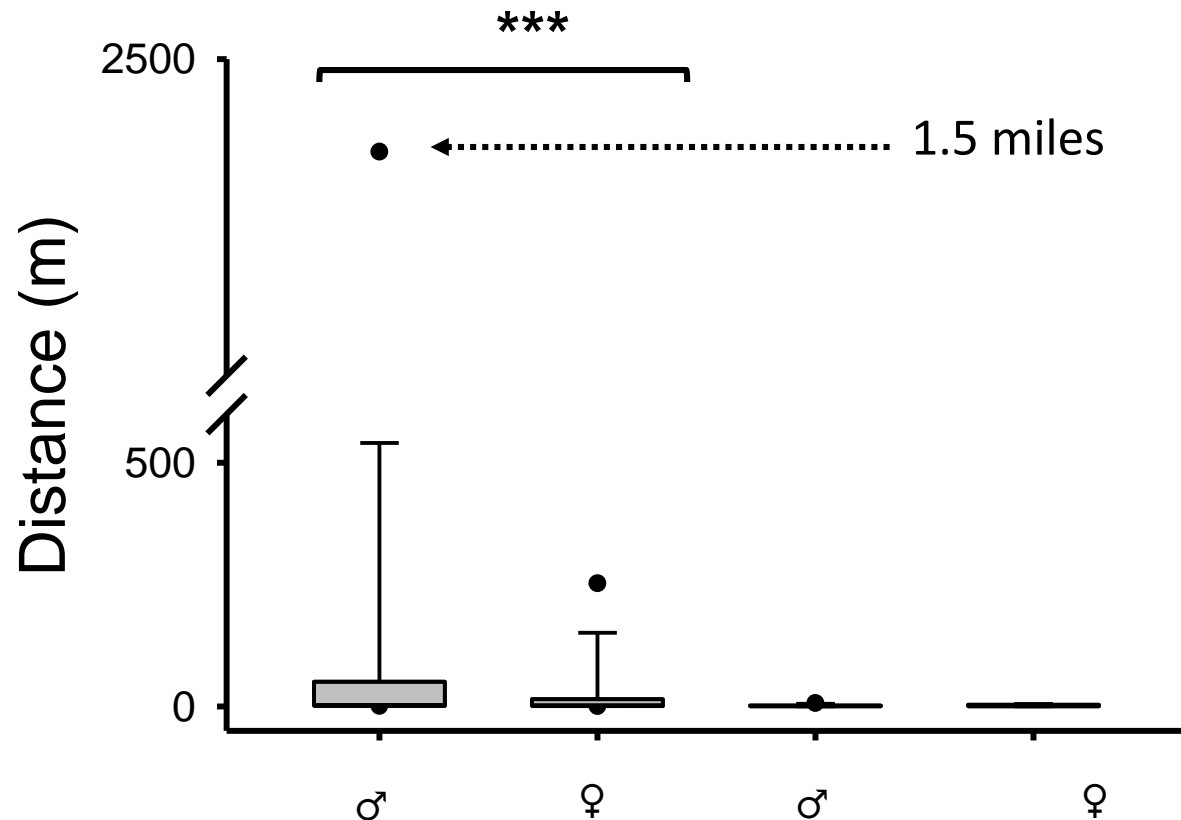
Marked psyllids were captured
on traps placed in the outer
circle (1.24 miles)

Flight mill apparatus

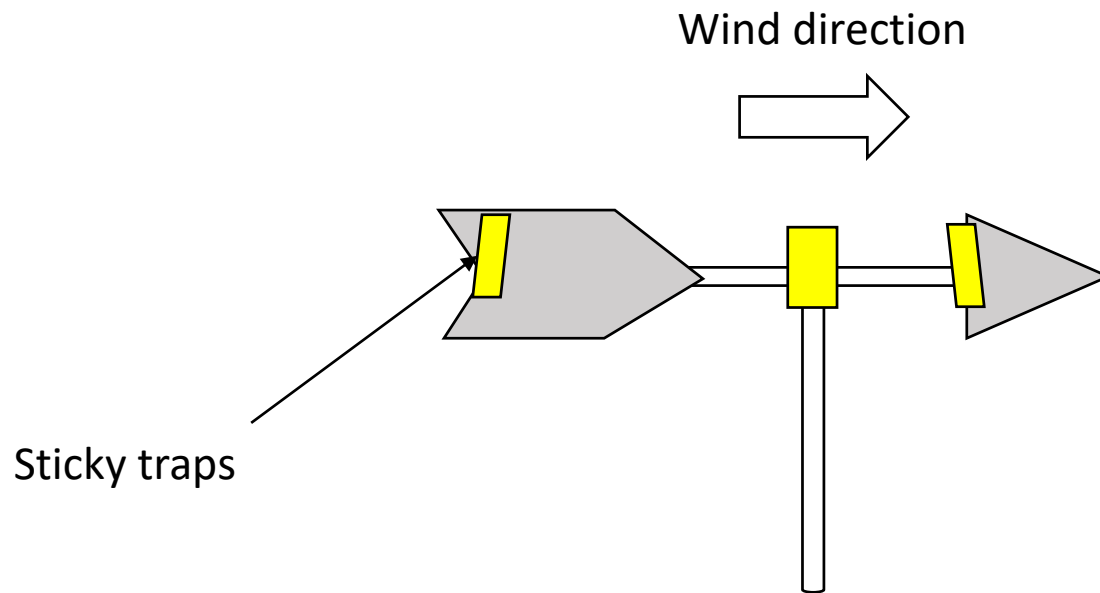


- Psyllids between 4 to 15 days old
- Allowed 10 min to fly
- Flight recorded until psyllid stopped to fly for > 5min

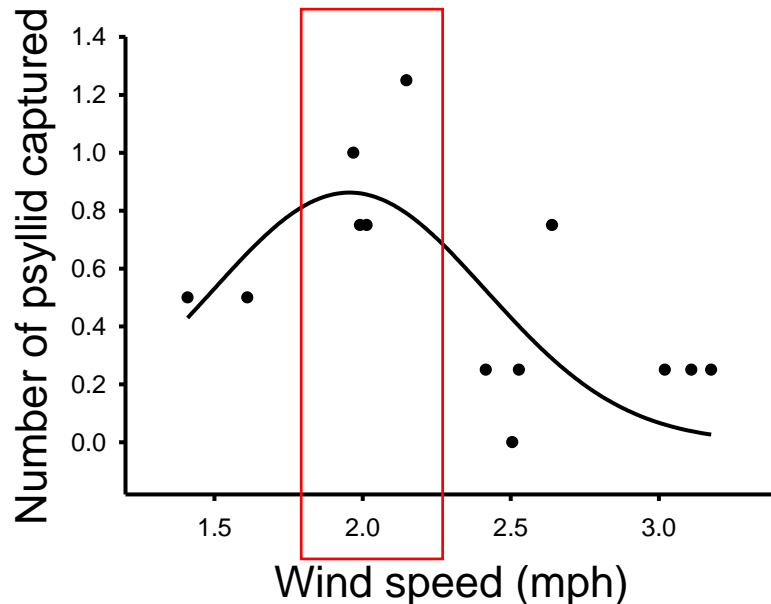
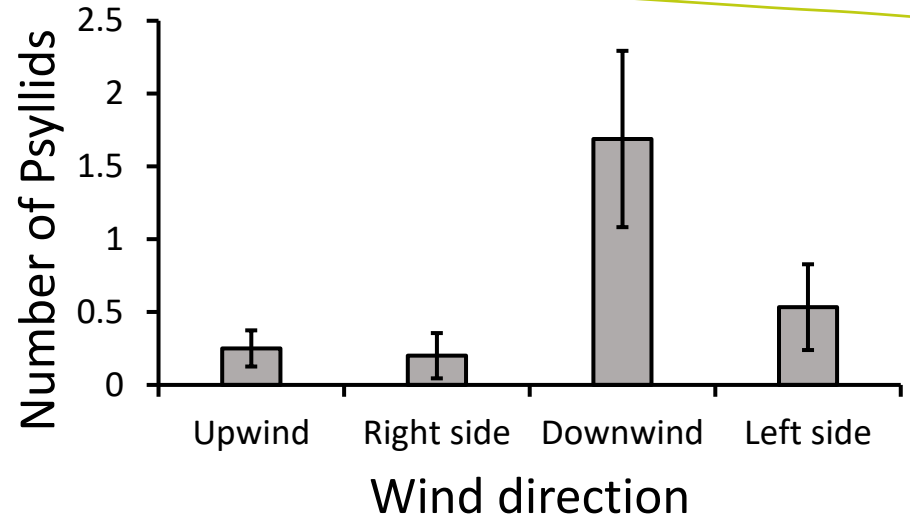
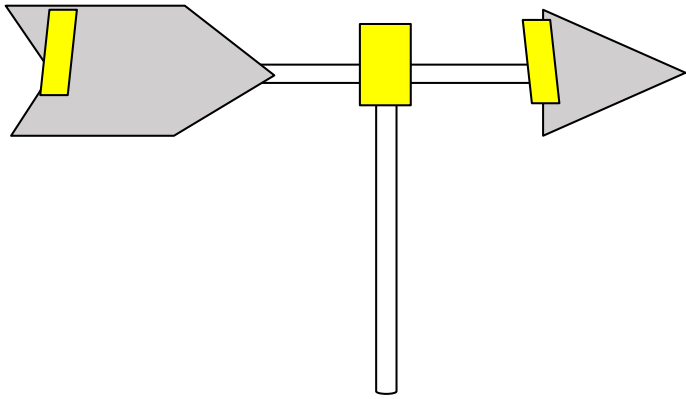
Color morph influence flight capability of *D. citri*



Assessment of wind direction in the field



Assessment of wind direction in the field



Asian citrus psyllid tend to move upwind

Optimal wind speed for dispersal around 2 mph

Presence of windbreaks



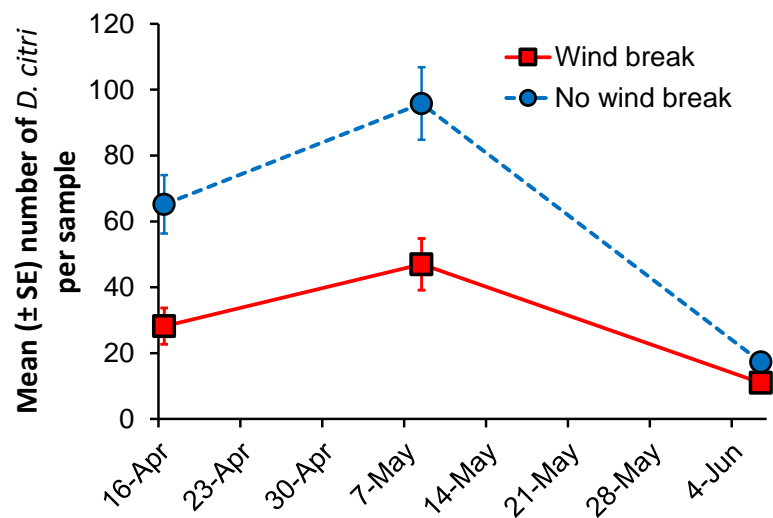
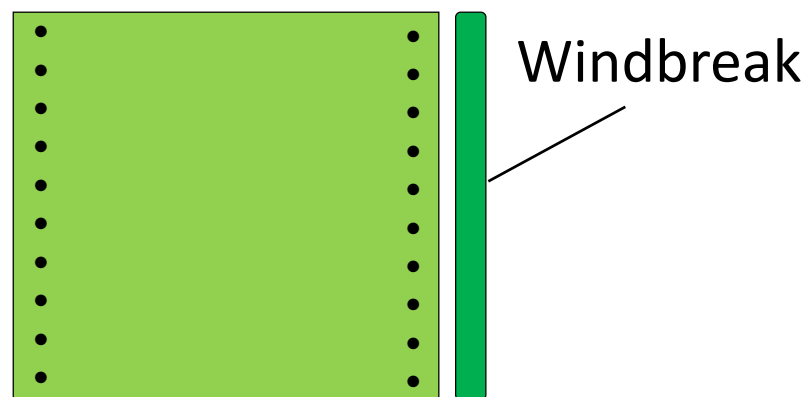
Windbreaks are erected to protect orchards from extreme weather to manage citrus canker

Effect on *D. citri* populations?

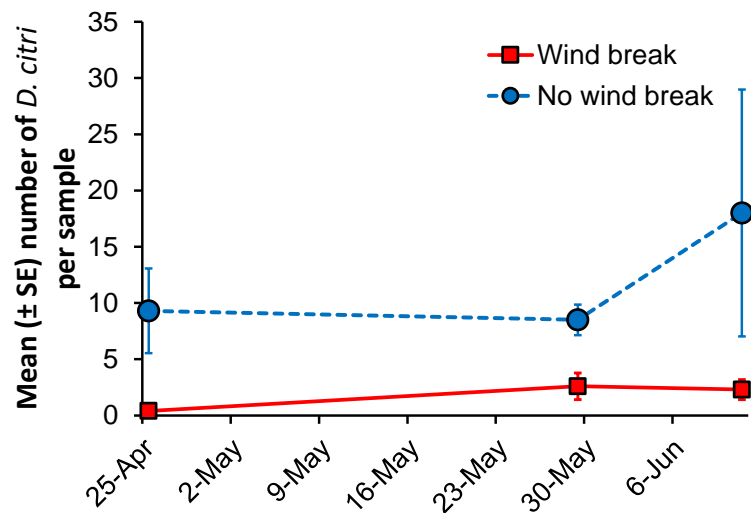


Presence of windbreak

5 Groves
2 months of sampling
Use a vacuum insect sampler



GLMM on pooled data:
 $\chi = 1141.9$, $P < 0.001$



Grove architecture



Resets in mature orchards

4 fields; 4 varieties

2 months of sampling

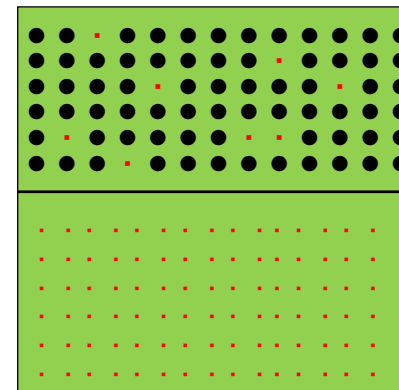
2 seasons

14 trees per field

Use a vacuum insect sampler

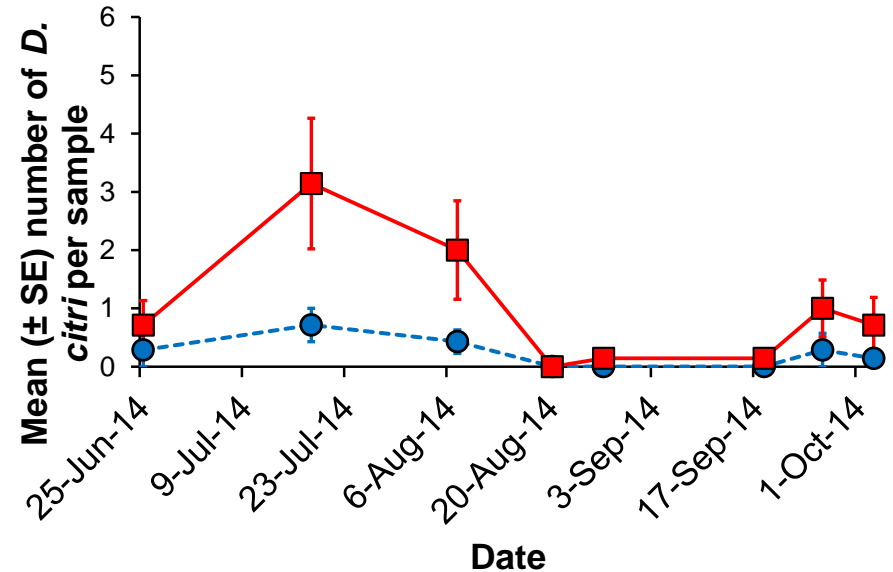
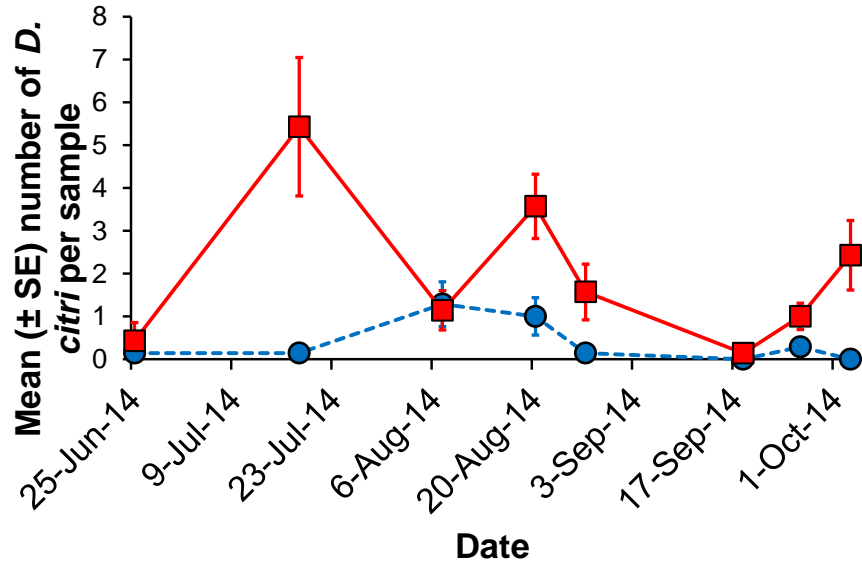


Solid set planting



- Reset
- Mature trees

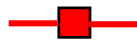
Grove architecture



Resets



Solid set planting



GLMM on pooled data:
 $\chi = 19.446$, $P < 0.001$

Psyllid sampling methods



Flush examination: observing and counting during approximately 40 s psyllid adults found in tree canopy

Sticky traps

www.alphascents.com

www.iscatech.com



Tapping: Tap a randomly selected branch three times with a stick (PVC pipe). Psyllid adults are counted as they fell on a clipboard above.

Natural enemies of psyllids



Tamarixia radiata – parasitoid



Ladybeetles



Lacewings



Spiders

Soil-applied systemic insecticides



Current Products

- Admire Pro (imidacloprid)
- Platinum 75 SG (thiamethoxam)
- Belay 50 WDG (clothianidin)
 - Non-bearing use only (Belay)

Soil-applied systemic insecticides



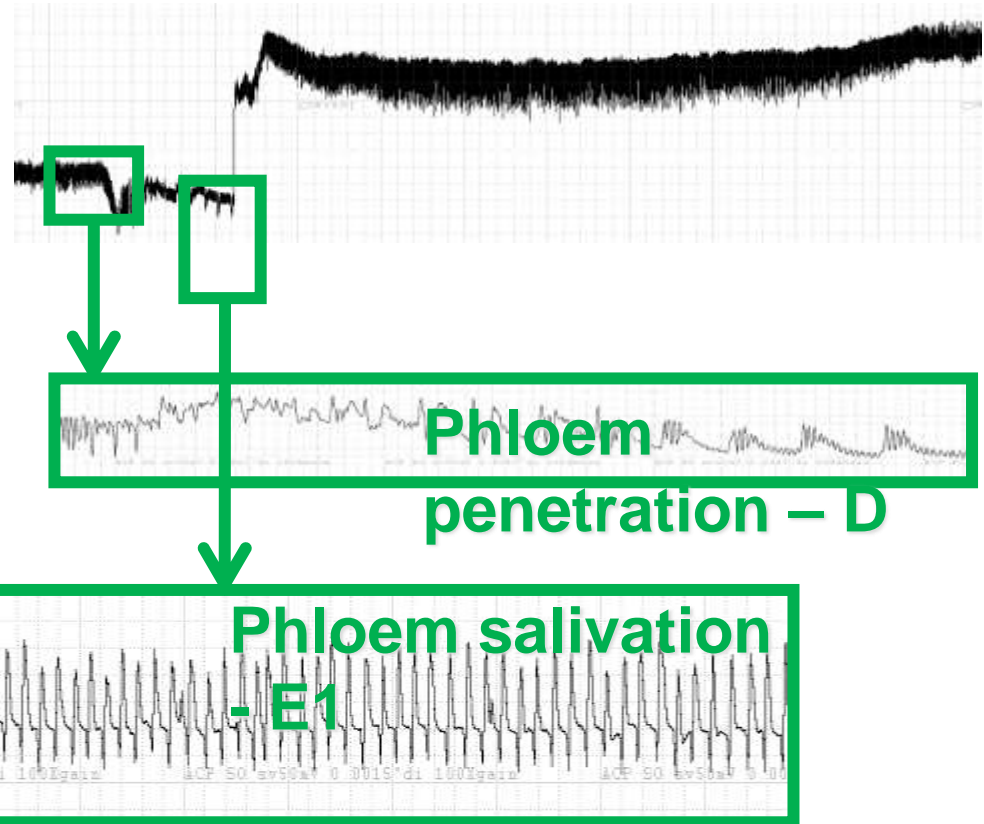
Important Benefits

- Long-lasting systemic (whole tree) protection
- Control both psyllid and leafminer
- **Disrupt psyllid feeding greatly reducing HLB pathogen transmission**

Soil-applied systemic insecticides



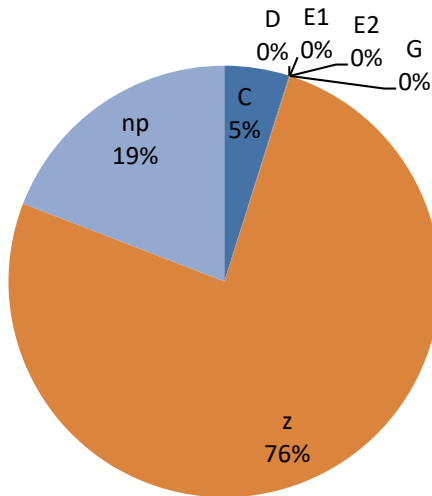
Soil-applied insecticides can protect citrus trees from becoming HLB infected!



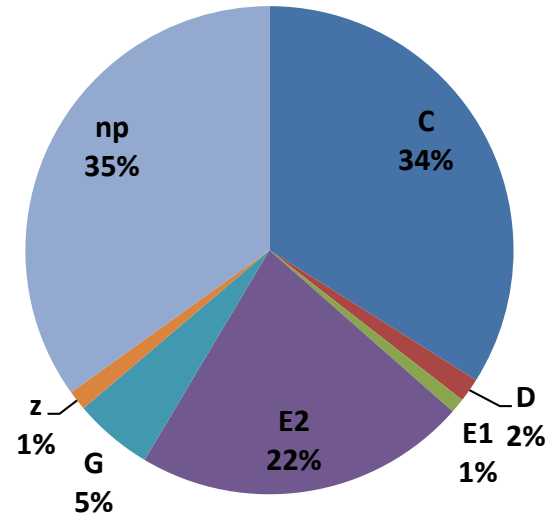
Psyllid Feeding Behavior

Admire Pro (Imidacloprid)

Duration of time performing
each behavior
(Imidacloprid)



Duration of time performing
each behavior
(control)



- phloem salivation (pathogen inoculation) was disrupted as a result of imidacloprid application

Foliar-applied insecticides



- Current Products

- Typically not systemic
- Rely on the residue on leaf surface to control psyllids
- Much shorter lived than soil-applied systemic insecticides

Foliar-applied insecticides



- Provado (imidacloprid – 4A – Neonicotinoid)
- Danitol (fenpropathrin – 3A – Pyrethroid)
- Lorsban (chlorpyrifos – 1B – Organophosphate)
- Delegate (spinetoram – 5 – Spinosyns)
- Movero (spirotetramat – 23 – Tetrone acid derivative)

Final thoughts



- Psyllids move—long distances
- ACP is intimately associated with the HLB pathogen
- ACP likely had been spreading disease for many years before HLB was first detected in Florida and before we began controlling it
- Psyllids have not been found in a any citrus grove in Florida panhandle so far.
- If trees are treated in due time, chances that the disease will be transmitted are reduced.