

# The Asian Citrus Psyllid & Huanglongbing



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# Huanglongbing (HLB)



“Yellow dragon” or  
“yellow shoot” disease



Dramatic “greening” on fruit

Image credits:

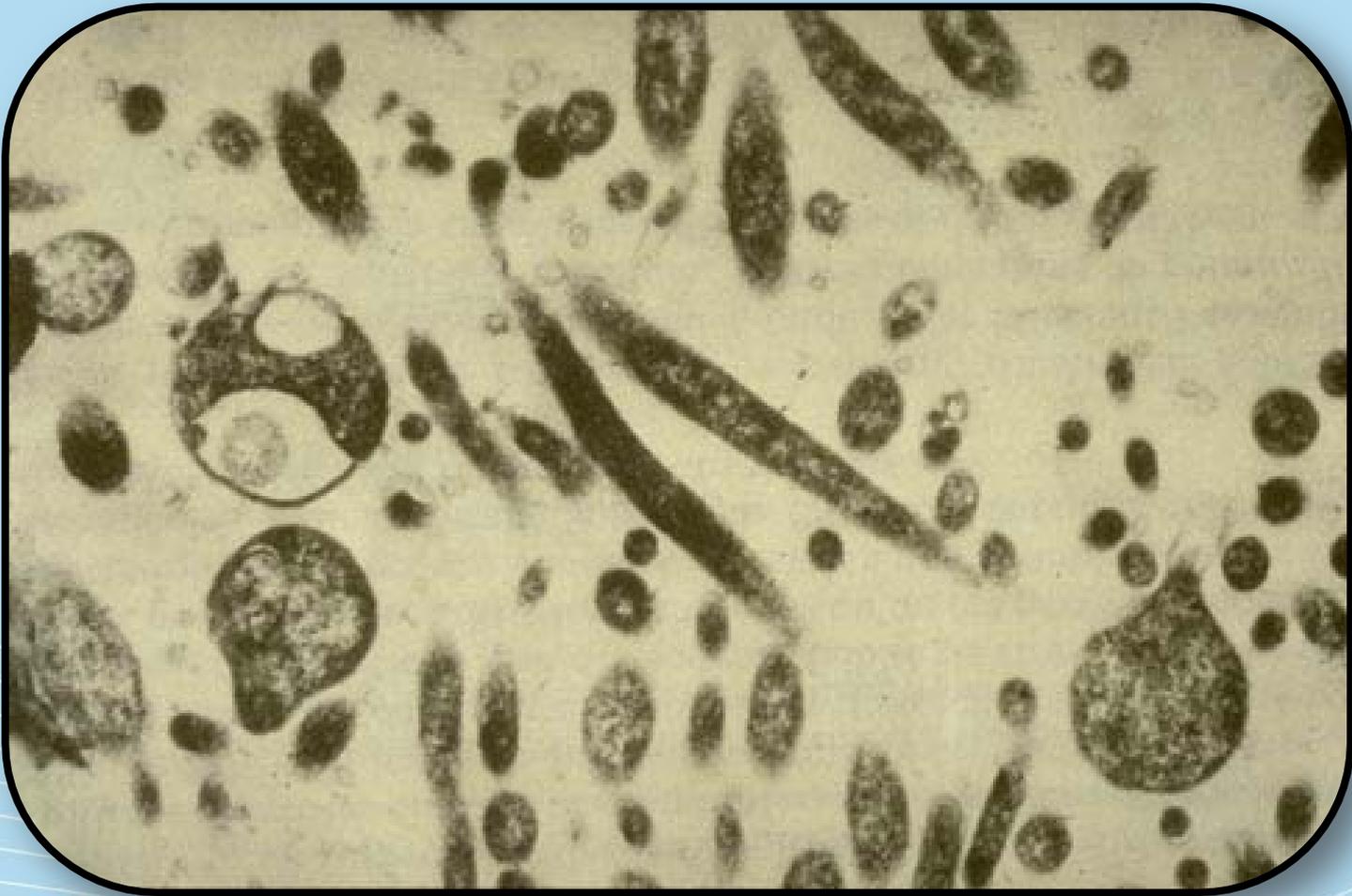
Tree: APS Compendium of Citrus Diseases 2<sup>nd</sup> edition, used with permission

Fruit: Gottwald et al., used with permission



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*Candidatus* Liberibacter africanus (68-75 ° F)

*Candidatus* Liberibacter americanus (68-75 ° F)

*Candidatus* Liberibacter asiaticus (68-90 ° F)

Image credit:  
Gottwald et al., used with permission



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# Yellow shoots

(individual branches or sectors of the tree)

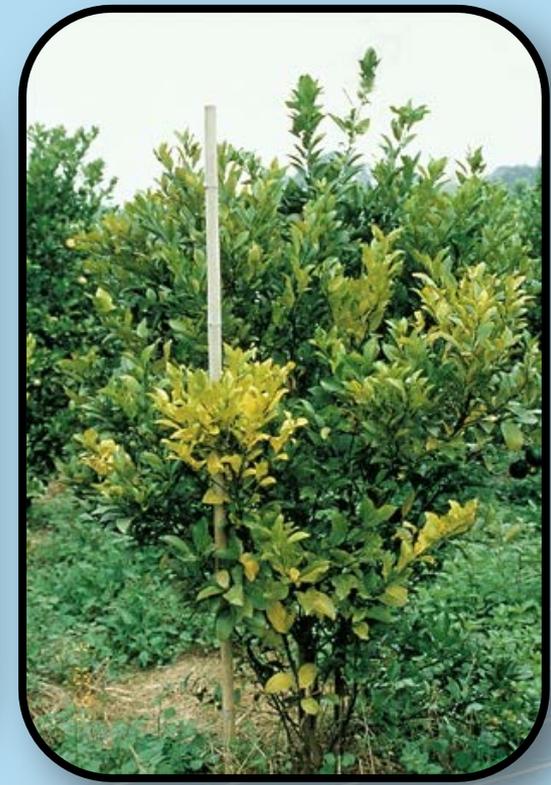


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Right: APS Compendium of Citrus Diseases 2<sup>nd</sup> edition, used with permission

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Blotchy mottling that extends across veins

Leaf halves are not mirror images of each other



Image credits:  
Top: Florida Department of Agriculture and Consumer Services, Division of Plant Industry - <http://www.freshfromflorida.com/pi/chrp/greening/cgphotos.html>  
Right: Gottwald et al., used with permission



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# Zinc deficiency



Image credits:  
Left: Gottwald et al., used with permission  
Right: Don Ferrin, LSU AgCenter



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# Comparison of HLB and Nutrient Deficiency



nutrient deficiency



Citrus greening

Image credits:

Right: Gottwald et al., used with permission

Left: Don Ferrin, LSU AgCenter



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Thickening of  
veins

Image credit:  
Beth Grafton-Cardwell, Kearney Agricultural Research and  
Extension Center, University of California



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# “Greening” of fruit



Reduction in fruit size, fruit are bitter, green color may be pale or dramatic

Image credit:

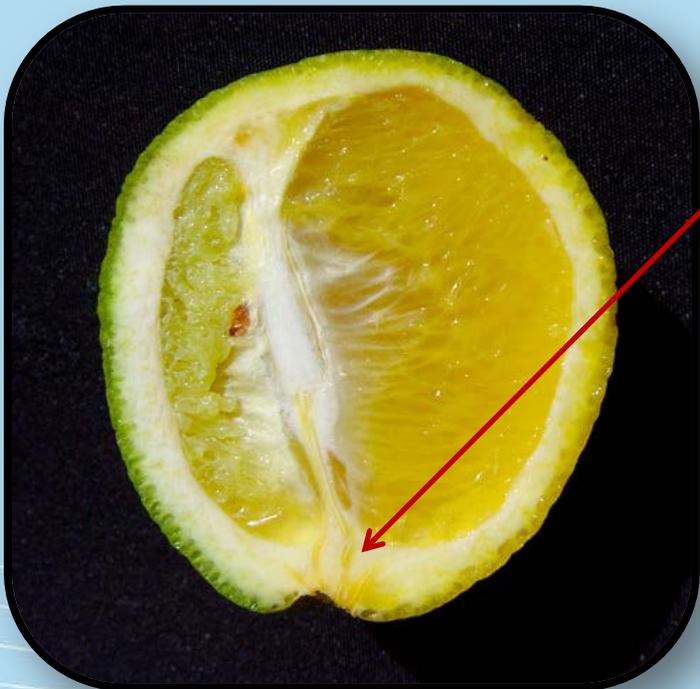
Left images: Gottwald et al., used with permission  
Right: Florida Department of Agriculture and Consumer Services, Division of Plant Industry - <http://www.freshfromflorida.com/pi/chrp/greening/cgphotos.html>



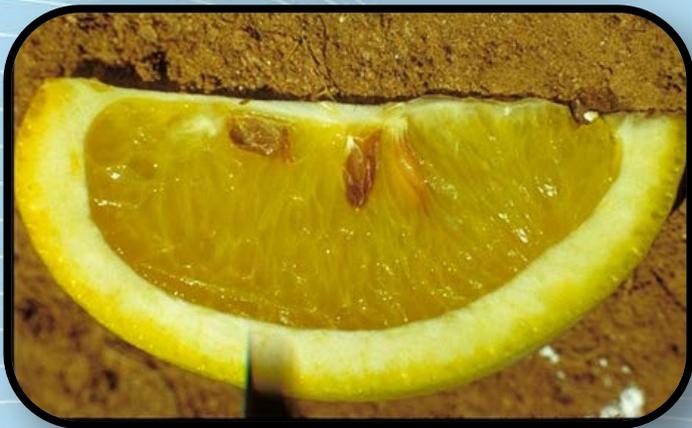
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Lopsided sections



Orange-brown staining of columella



Death of seeds

Image credit:  
Gottwald et al., used with permission



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# Defoliation, fruit drop, twig dieback and reduction in the health and vigor of the tree



Click [here](#) for a video that reviews citrus greening symptoms.

Image credit:  
Gottwald et al., used with permission



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# Management of HLB

- There is no known cure for an infected tree.
- Because this disease resides in the vascular tissue of the tree, there is a high risk of disease transfer by certain insects such as the Asian citrus psyllid.
- These particular insects go from tree to tree consuming the plant sugars contained in the phloem tissue. In the process, they can and do transmit the disease from one plant to another.
- In managing the disease, the monitoring and control of this vector is extremely important in preventing the spread of the disease to new areas.





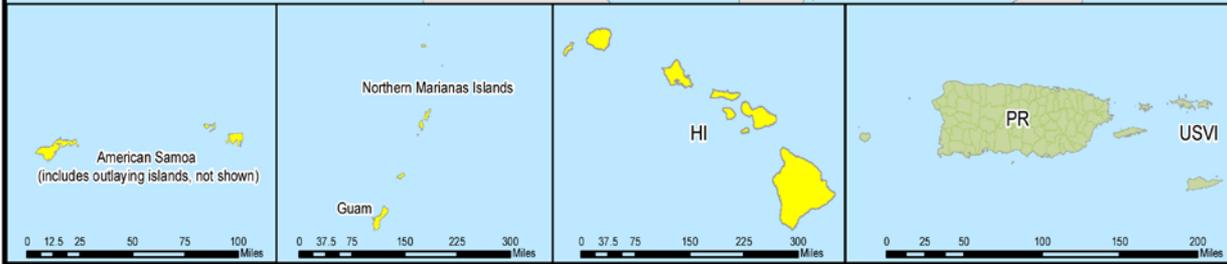
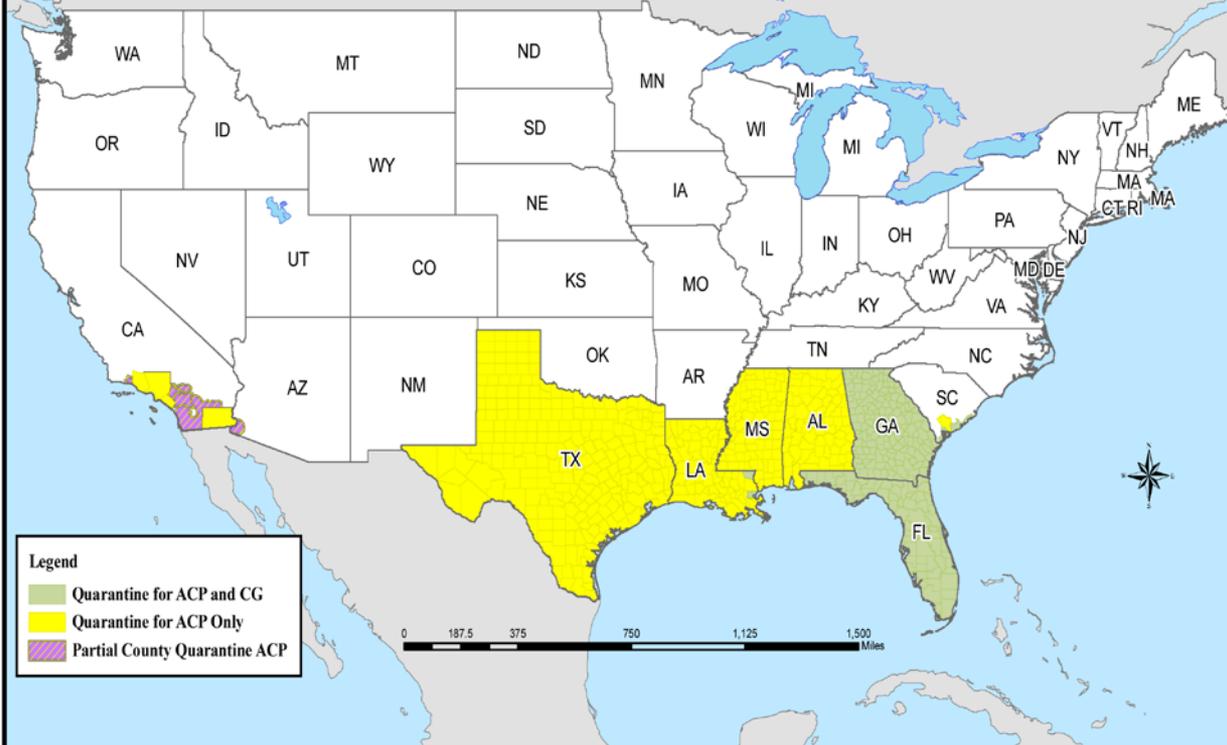
# National Quarantine Citrus Greening And Asian Citrus Psyllid



DISCLAIMER: The U.S. Department of Agriculture's Animal and Plant Health Inspection Service collected the data displayed for internal agency purposes only. This data may be used by others however, they must be used for their original intended purposes.

As Of: 01/07/2011

Author: Jamie Peerie  
Title: GIS Specialist  
Data Source: PPO ESRI  
As of: 01/07/2011



Map:  
[http://www.aphis.usda.gov/plant\\_health/plant\\_pest\\_info/citrus\\_greening/downloads/pdf\\_files/nationalquarantinemap.pdf](http://www.aphis.usda.gov/plant_health/plant_pest_info/citrus_greening/downloads/pdf_files/nationalquarantinemap.pdf)



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# Asian Citrus Psyllid

## *Diaphorina citri*

Wings held at 45° angle to leaf/stem

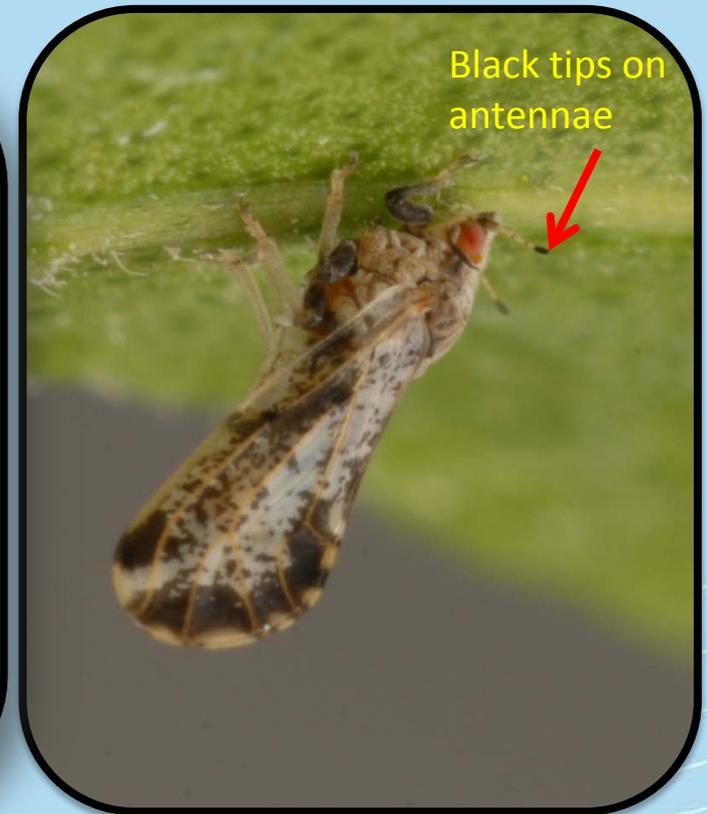
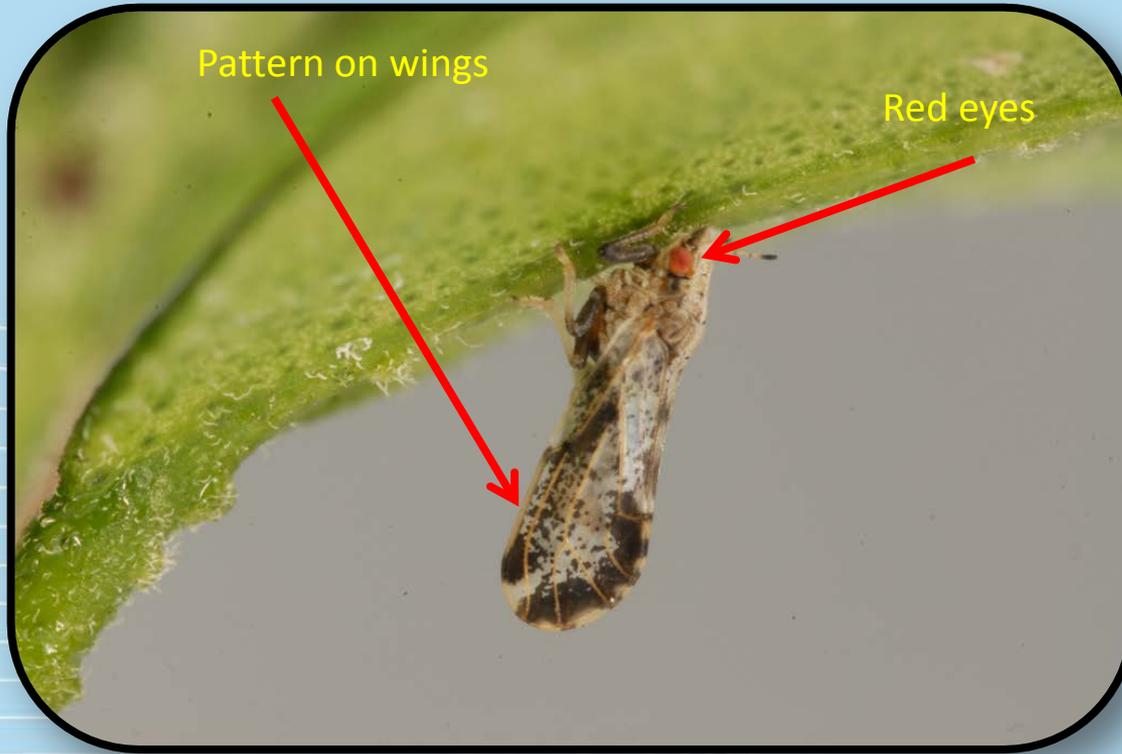


Image credits:  
Lyle Buss, University of Florida



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Adults are 2-3mm in length



Image credit: Natalie Hummel, LSU AgCenter



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# Asian citrus psyllid nymphs



Image credits:  
Lyle Buss, University of Florida



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Mature nymphs are almost 2mm  
in length



Image credit: Eric A. White, USDA-APHIS



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Image credit: Lyle Buss, University of Florida



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Image credit: Lyle Buss, University of Florida



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# Eggs laid by the Asian Citrus Psyllid



Image credit: Lyle Buss, University of Florida



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# Life Cycle

Nymphs  
mature into  
adults



Adults live 1-2  
mo.

ACP lay eggs  
on new flush

Can complete a  
new generation  
with every flush,  
(16-49 d) up  
to 30 /yr

Eggs hatch  
into nymphs



# Other transmitters of Huanglongbing



*Trioza erytreae* adult  
(above) and nymph (below)



Dodder

Image credits:

*Trioza erytreae* adult: S.P. van Vuuren, Citrus Research International, [www.bugwood.org](http://www.bugwood.org), #5137023

*Trioza erytreae* nymph: Peter Stephen, Citrus Research International, [www.bugwood.org](http://www.bugwood.org), #5137030

Dodder: Chalres T. Bryson, USDA Agricultural Research Service, [www.bugwood.org](http://www.bugwood.org), #1116055



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# There are other insects that attack citrus

Brown citrus aphid



Black citrus aphid



Citrus white fly



Asian citrus psyllid



Citrus black fly



Image credits:  
Brown citrus aphid: Louisiana Department of Agriculture and Forestry  
Citrus black fly: Division of Plant Industry (Florida), [www.bugwood.org](http://www.bugwood.org), #5194005  
Citrus white fly, black citrus aphid and Asian citrus psyllid images: Lyle Buss, University of Florida



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# There are other insects that attack citrus



Green scale nymph



citrus black fly nymph



Asian citrus psyllid nymph

citrus white fly nymph



Image credits:

Asian citrus psyllid nymph - Lyle Buss, University of Florida

Green scale nymph - Jeffrey W. Lotz, Florida Department of Agriculture and Consumer Services, [www.bugwood.org](http://www.bugwood.org), #5385208

citrus whitefly nymph and citrus blackfly nymph - Florida Division of Plant Industry Archive, [www.bugwood.org](http://www.bugwood.org), #5194033 and #5194011



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Orange  
Jessamine  
*Murraya*  
*paniculata*



Image credits:

Right: Stephanie Stocks, University of Florida

Left: Forest & Kim Starr, U.S. Geological Survey, [www.bugwood.org](http://www.bugwood.org), #5420227



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# Scouting flush for Asian citrus psyllid nymphs



Click [here](#) and [here](#) for videos of how to scout for Asian citrus psyllids.

Image credits: Stephanie Stocks, University of Florida



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# Scouting for Asian citrus psyllid adults



Click [here](#) to view the stem tap technique and click [here](#) to view the results of the stem tap technique.

Image credits: Stephanie Stocks, University of Florida



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# Management of Asian citrus psyllid

- IPM options
  - Chemical control
    - control adults before and between flushes, before they lay their eggs
      - Requires constant monitoring during growing season
      - Also done during the winter, at least once (at the end of the season or more importantly before the first leaf flush in the spring)
    - Rotation of insecticide classes is essential to avoid resistance
  - Cultural control
    - Scouting and cutting infected trees
    - Removing overwintering hosts
    - Clean budwood
    - [Click here to find out about upcoming micronutrient research](#)
  - Biological control
    - Specialists
    - Generalists



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# Biological control specialist: *Tamarixia radiata*



*Tamarixia radiata* in an Asian citrus psyllid nymph and exit holes.

Image credits: M.E. Rogers and P.A. Stansly, IFAS, UFL



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# Biological control generalists: beetles



*Cycloneda sanguinea*  
Spotless lady

*Olla v-nigrum*  
Ashy gray ladybird beetle

Image credits:

*Cycloneda sanguinea* and *Olla v-nigrum* adult (top, right): Lyle Buss, University of Florida

*Olla v-nigrum* adult and larvae (bottom right): Peter J. Bryant



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# Biological control generalists: beetles



*Harmonia axyridis*

Multicolored Asian lady beetle adult showing variation in pattern and larvae

Click [here](#) and [here](#) for a video that discusses the importance of lady beetles as a control of ACP populations.

Image credits:

Adults: Louis Tedders, USDA Agricultural Research Service, [www.bugwood.org](http://www.bugwood.org), #0908098

Larvae: Gerald J. Lenhard, Louisiana State University, [www.bugwood.org](http://www.bugwood.org), #0014068



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# Biological control generalists: beetles



*Curinus coeruleus*  
Metallic blue lady beetle



*Exochomus childreni*

Image credits:

Left Forest & Kim Starr, Starr Environmental, [www.bugwood.org](http://www.bugwood.org), #5219057

Right: Lyle Buss, University of Florida



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# Biological control generalists: spiders



*Hibana velox*



*Cheiracanthium inclusum*  
Black footed yellow sac  
spider



*Oxyopes* sp.  
lynx spider



*Hentzia palmarum*

Image credits:

*Hibana velox*: Lyle Buss, University of Florida

*Cheiracanthium inclusum*: Joseph Berger, [www.bugwood.org](http://www.bugwood.org), #5370388

*Hentzia palmarum*: David Cappaert, Michigan State University, [www.bugwood.org](http://www.bugwood.org), #2146029

*Oxyopes* sp.: Joseph Berger, [www.bugwood.org](http://www.bugwood.org), #5386064



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# Biological control generalists: hoverfly



Image credits:

*Allograpta obliqua* adult: Susan Ellis, [www.bugwood.org](http://www.bugwood.org), #1366030

*Allograpta obliqua* larvae: James Price, University of Florida



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# Management of Asian citrus psyllid in organic production

- Oils, kaolin clay, and pyrethrin based products
  - Different treatments target different life stages
  - In Florida they spray on a weekly basis
- Treatment needs to coincide with other citrus groves in the area (even if they are not organic)



# Review



Click [here](#) for a video that reviews ACP and the symptoms of greening disease.



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# If you suspect citrus greening...

- Or if you think you have an infestation of Asian citrus psyllids, you should contact your local county extension agent.
  - <http://www.csrees.usda.gov/Extension/>
- They can contact the appropriate agencies (such as the National Plant Diagnostic Network) to help identify the disease or the insect in question and make recommendations as to what to do next.
  - [www.npdn.org](http://www.npdn.org)
- Homeowners, we need your help, too!



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# Future work



Click [here](#) for a video on some of the future work planned to manage citrus greening.



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# Additional information resources

- USDA
  - [http://www.aphis.usda.gov/plant\\_health/plant\\_pest\\_info/citrus\\_greening/index.shtml](http://www.aphis.usda.gov/plant_health/plant_pest_info/citrus_greening/index.shtml)
- For various states and territories of the U.S. that grow citrus:
  - Arizona
    - <http://www.azda.gov/psd/acp.htm>
  - California
    - <http://www.cdfa.ca.gov/phpps/acp/>
    - <http://www.californiacitrusthreat.org>
  - Florida
    - <http://www.doacs.state.fl.us/pi/chrp/greening/citrusgreening.html>
    - <http://www.citrusgreeningtraining.org/>
  - Hawaii
    - <http://hawaii.gov/hdoa/pi/ppc/npa-1/npa06-01-ACP.pdf>



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# Additional information resources

- For states and territories of the U.S. that grow citrus (cont'd):
  - Louisiana
    - [http://www.lsuagcenter.com/en/crops\\_livestock/crops/citrus/asian\\_citrus\\_psyllid\\_and\\_greening\\_disease/](http://www.lsuagcenter.com/en/crops_livestock/crops/citrus/asian_citrus_psyllid_and_greening_disease/)
  - Texas
    - [http://www.agr.state.tx.us/agr/main\\_render/0,1968,1848\\_28009\\_0\\_0,00.html?channelId=28009](http://www.agr.state.tx.us/agr/main_render/0,1968,1848_28009_0_0,00.html?channelId=28009)
    - <http://www.texascitrusgreening.org/>
- Other sources of information:
  - <http://saveourcitrus.org/>
  - <http://www.citrusgreening.org/>
  - [http://cizr.ucr.edu/citrus\\_greening.html](http://cizr.ucr.edu/citrus_greening.html)
  - <http://swfrec.ifas.ufl.edu/entomology/extension/hlb/>



# Questions?

- For more information, check out [www.protectingusnow.org](http://www.protectingusnow.org)
- You can also contact:
  - Stephanie D. Stocks, University of Florida, [sstocks@ufl.edu](mailto:sstocks@ufl.edu)
  - Amanda Hodges, SPDN, University of Florida, [achodges@ufl.edu](mailto:achodges@ufl.edu)



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[National Plant Board \(NPB\) and State Departments of Agriculture](#)



[Center for Invasive Species and Ecosystem Health \(i.e. the Bugwood Network\)](#)



[U.S. Department of Homeland Security \(DHS\)](#)



[U.S. Forest Service](#)



[National Plant Diagnostic Network \(NPDN\)](#)



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- [http://entnemdept.ufl.edu/creatures/citrus/citrus\\_blackfly.htm](http://entnemdept.ufl.edu/creatures/citrus/citrus_blackfly.htm)
- <http://www.entomology.umn.edu/cues/inter/inmine/Whitefe.html>
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