

The Asian Citrus Psyllid & Huanglongbing



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Huanglongbing (HLB)



“Yellow dragon” or
“yellow shoot” disease



Dramatic “greening” on fruit

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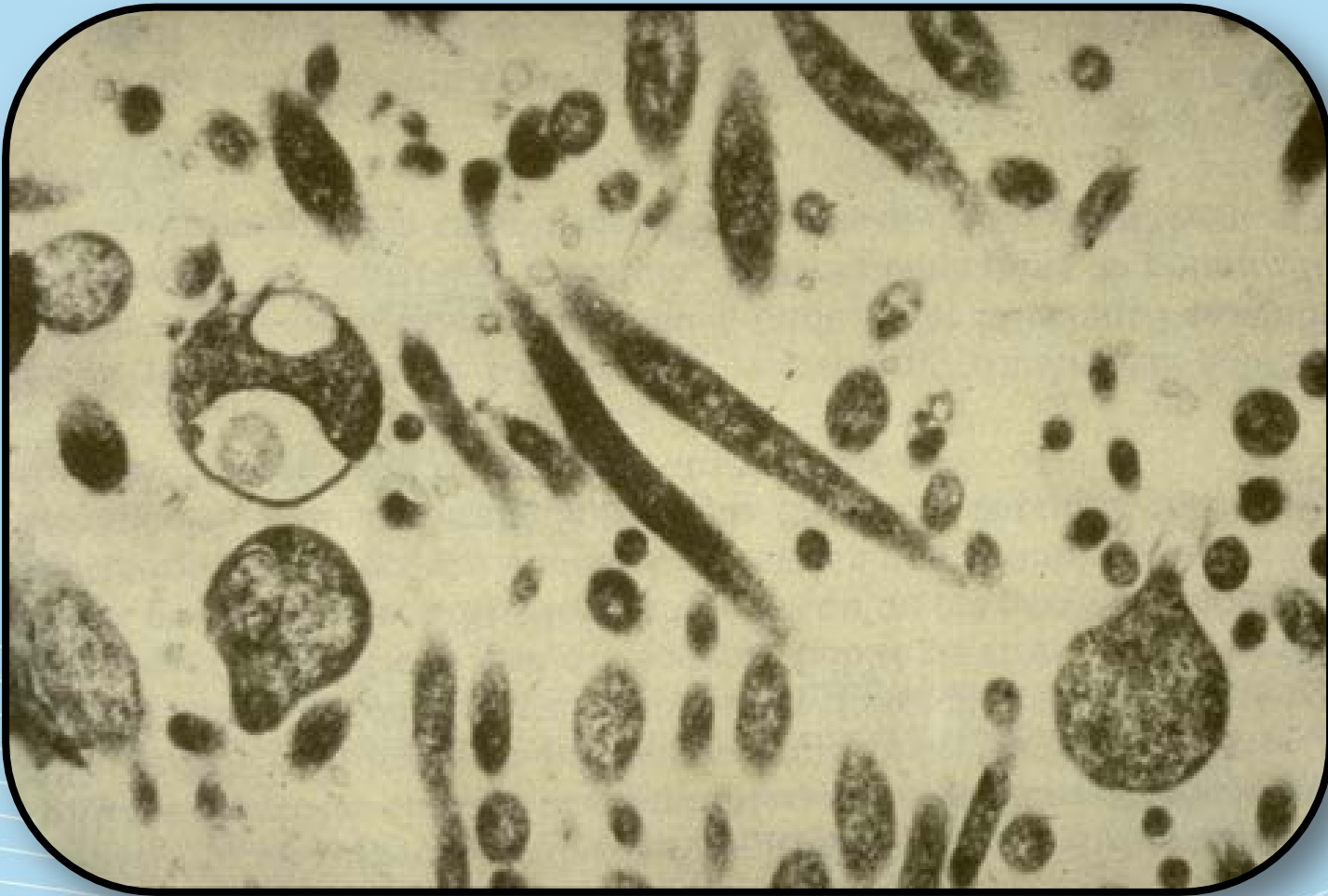
Tree: APS Compendium of Citrus Diseases 2nd edition, used with permission

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)



Image credits:

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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



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Left: Gottwald et al., used with
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Comparison of HLB and Nutrient Deficiency



nutrient deficiency



Citrus greening

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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

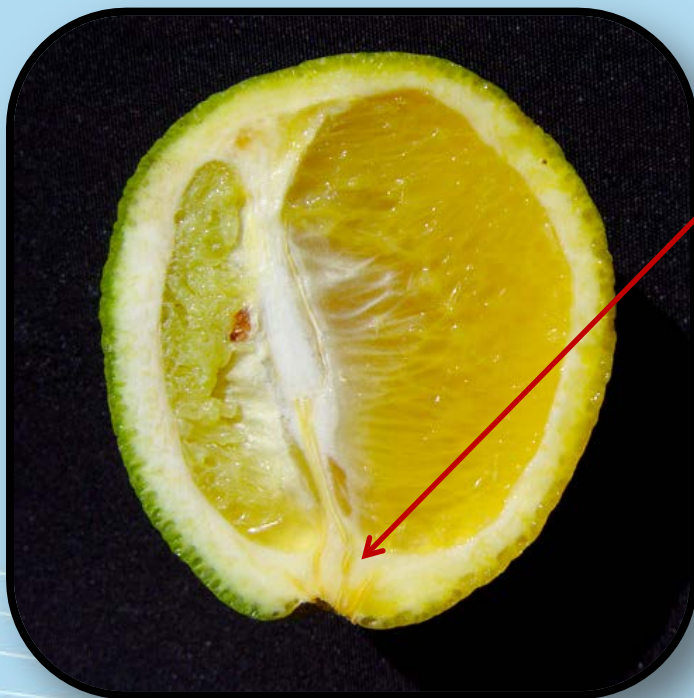
Right: Florida Department of Agriculture and Consumer Services, Division of Plant Industry - <http://www.freshfromflorida.com/pi/chrp/greening/cgphotos.html>



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Lopsided sections



Orange-brown staining of columella



Death of seeds

Image credit:
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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.



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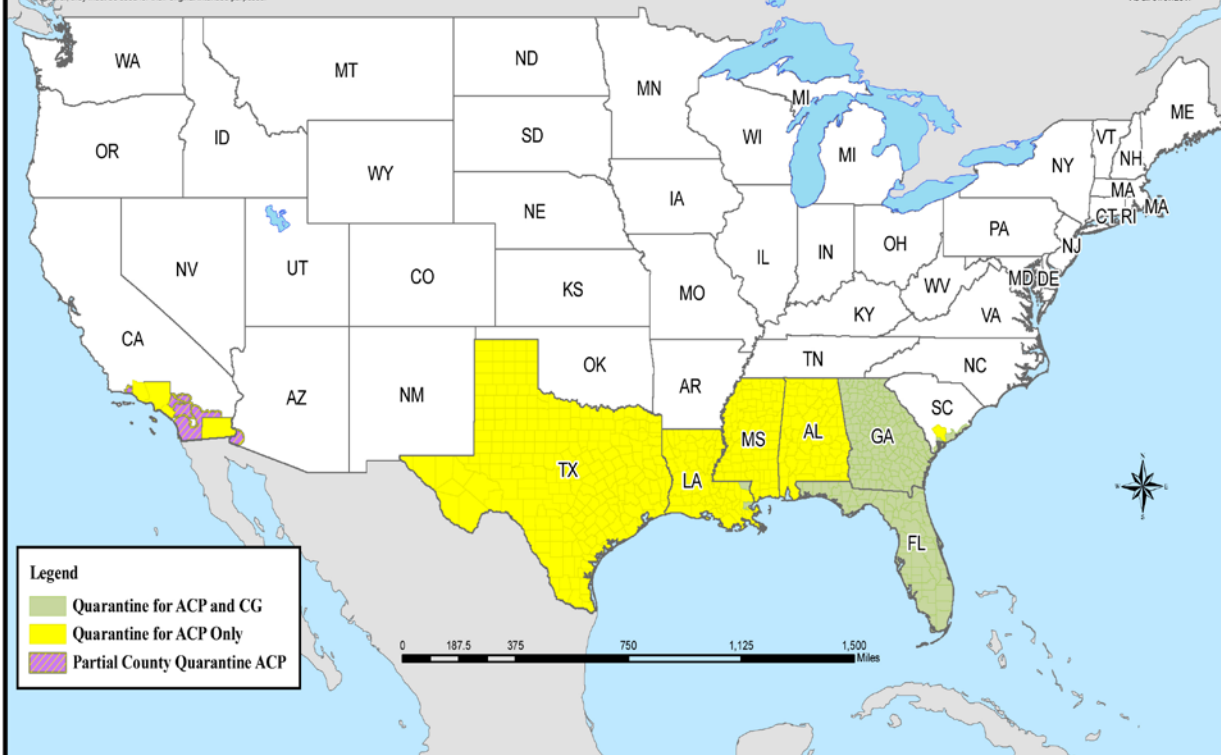
National Quarantine Citrus Greening And Asian Citrus Psyllid



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

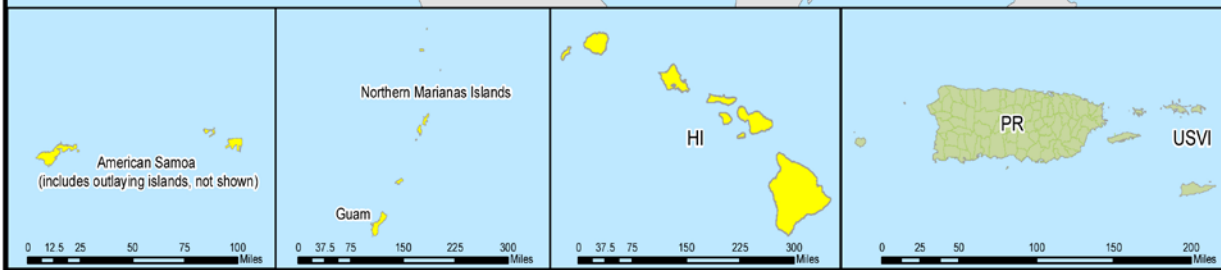
As Of: 01/07/2011

Author: Jamie Peattie
Title: GIS Specialist
Data Source: PPQ ESRI
As of: 01/07/2011



Legend

- Quarantine for ACP and CG
- Quarantine for ACP Only
- Partial County Quarantine ACP



Map:
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

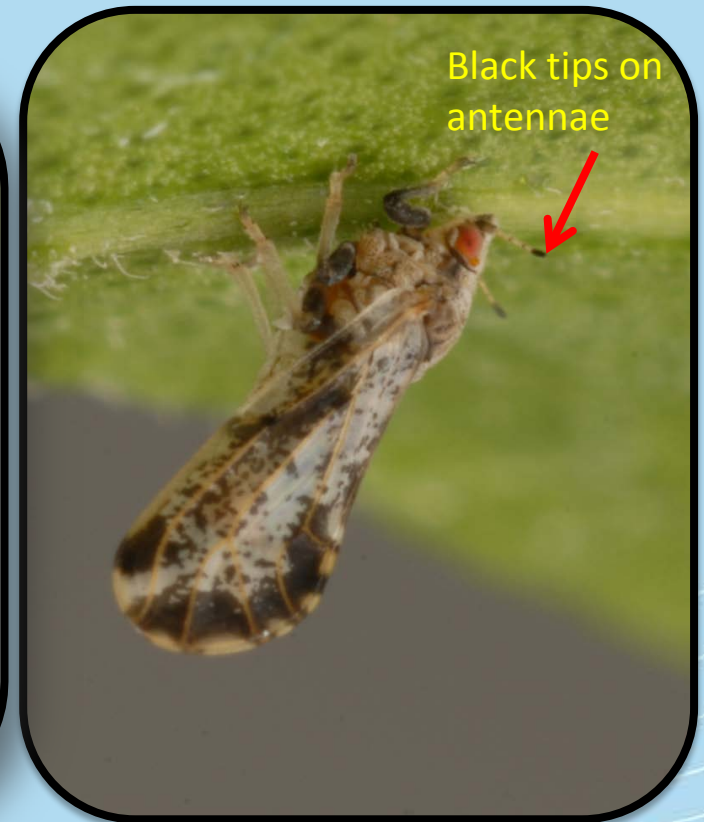
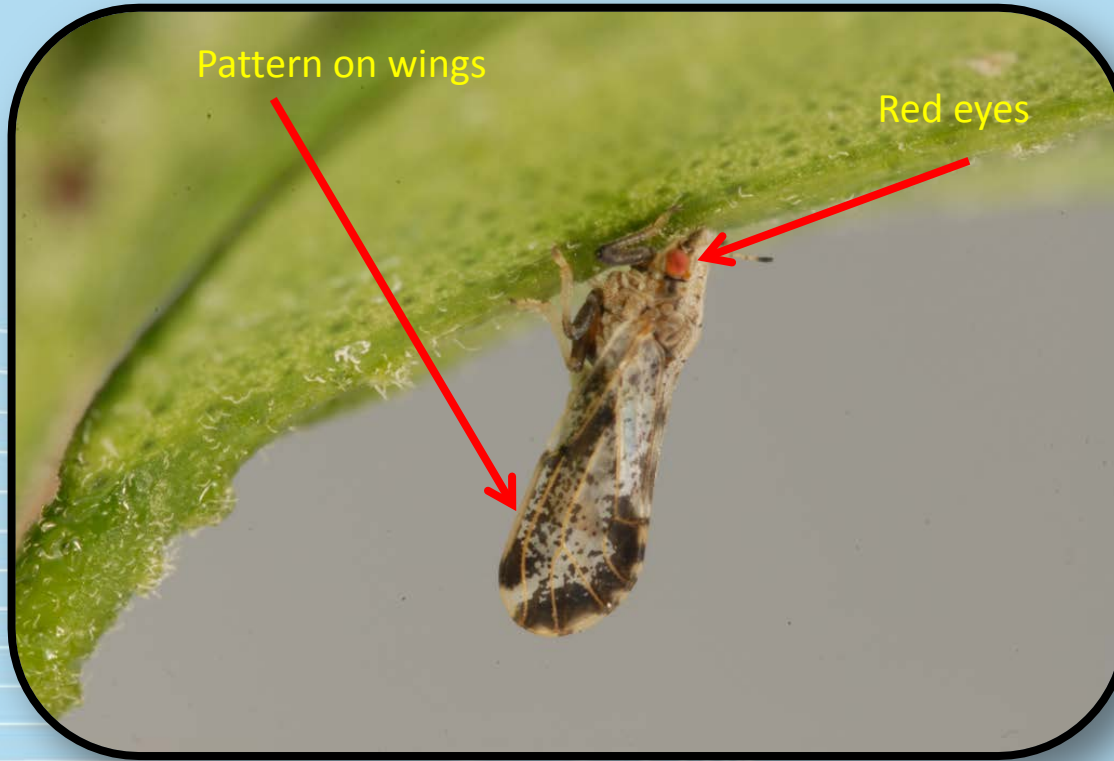


Image credits:
Lyle Buss, University of Florida



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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:
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Mature nymphs are almost 2mm
in length



Image credit: Eric A. White, USDA-APHIS



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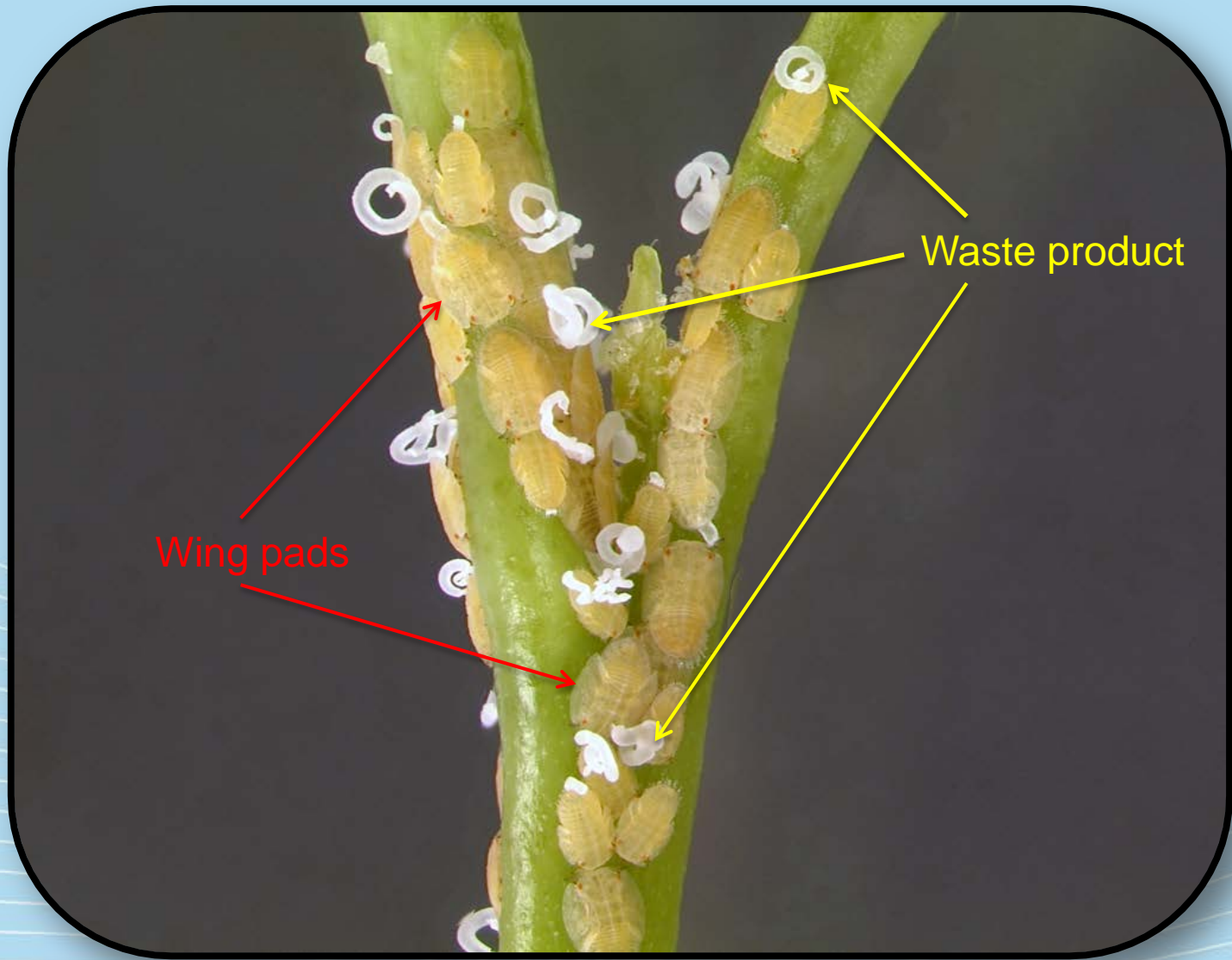


Image credit: Lyle Buss, University of Florida



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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

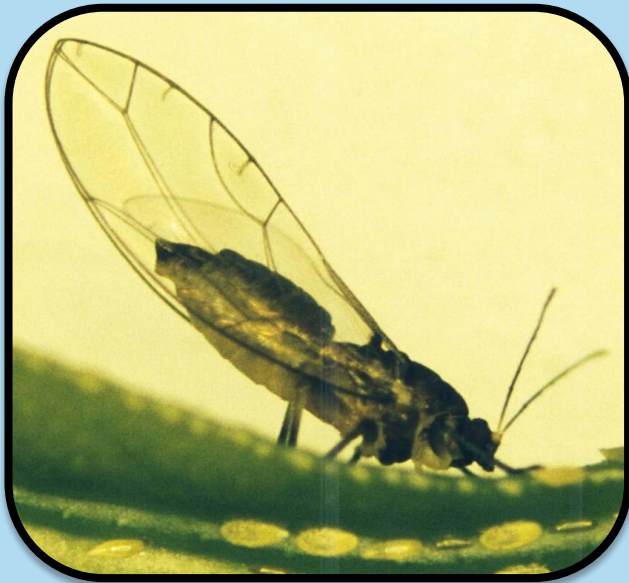


Can complete a
new generation
with every flush,
(16-49 d) up
to 30 /yr

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, #5137023

Trioza erytreae nymph: Peter Stephen, Citrus Research International, www.bugwood.org, #5137030

Dodder: Chales T. Bryson, USDA Agricultural Research Service, 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, #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, #5385208
citrus whitefly nymph and citrus blackfly nymph
- Florida Division of Plant Industry Archive,
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, #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, #0908098

Larvae: Gerald J. Lenhard, Louisiana State University, 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, #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, #5370388

Hentzia palmarum: David Cappaert, Michigan State University, www.bugwood.org, #2146029

Oxyopes sp.: Joseph Berger, www.bugwood.org, #5386064



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Biological control generalists: hoverfly



Image credits:

Allograpta obliqua adult: Susan Ellis, 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)



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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
- 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
- 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/
 - Texas
 - 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://swfrec.ifas.ufl.edu/entomology/extension/hlb/>



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Questions?

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



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[U.S. Forest Service](#)



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



References

- Garnier, M., and Bové, J.M. 2000. Huanglongbing (Greening). Pages 46-48 in: Compendium of Citrus Diseases , 2nd ed. L.W. Timmer, S.M. Garnesy and J.H. Graham, eds. APS Press, St. Paul, MN.
- Gottwald, T. R., da Graça, J. V., and Bassanezi, R. B. 2007. Citrus Huanglongbing: The pathogen and its impact. Online. Plant Health Progress doi:10.1094/PHP-2007-0906-01-RV.
- Husain, M.A. and Dina Nath. 1927. “The Citrus Psylla (*Diaphorina citri*, Kuw.) [Psyllidae: Homoptera]”. Memoirs of the Department of Agriculture in India. Volume X, No. 2, July.
- Lin, K.H. 1956. “Observations on yellow shoot on citrus. Etiological studies of yellow shoot on citrus”. Acta Phytopathologica Sinica 2, 1-42.
- Jove, BM. 2006. Huanglongbing: A destructive, newly-emerging, century-old disease of citrus. Journal of Plant Pathology [J. Plant Pathol.]. Vol. 88, no. 1, pp. 7-37.
 - online access - <http://www.sipav.org/main/jpp/volumes/0106/010602.pdf>
- http://www.cdfa.ca.gov/phpps/acp/docs/usda/faq_citrus_greening.pdf
- Halbert, Susan and Keremane L. Manjunath. 2004. “Asian Citrus Psyllids (Sternorrhyncha: Psyllidae) and Greening Disease of Citrus: A Literature Review and Assessment of Risk in Florida”. Florida Entomologist, Volume 87, No.3



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References

- Hummel N.A. and Don Ferrin. “Pest Alert: Get the facts about citrus greening (or Huanglongbing)”. Louisiana State University Agricultural Center. Publication 3079. July 2008
- <http://www.doacs.state.fl.us/pi/enpp/ento/dcitri.htm>
- Pelz-Stelinski, K.S., R.H. Brlansky, T.A. Ebert, and M.E. Rogers. 2010. “Transmission Parameters for *Candidatus Liberibacter asiaticus* by Asian Citrus Psyllid (Hemiptera: Psyllidae)”. Journal of Economic Entomology, Volume 103, No. 5.
- Inoue, H., J. Ohnishi, T. Ito, K. Tomimura, S. Miyata, T. Iwanami, and W. Ashihara. 2009. Enhance Proliferation and Efficient Transmission of *Candidatus Liberibacter asiaticus* by adult *Diaphorina citri* after Acquisition Feeding in Nymphal Stage”. Annals of Applied Biology, 155, pp. 29-36.
- <http://entnemdept.ufl.edu/creatures/citrus/acpsyllid.htm>
- <http://ccpp.ucr.edu/news/PsyllidbrochureAug05.pdf>
- Tsai, James H. and Ying Hong Liu. 2000. “Biology of *Diaphorina citri* (Homoptera: Psyllidae) on Four Host Plants”. Journal of Economic Entomology, Volume 93, No. 6.
- http://entnemdept.ufl.edu/creatures/beneficial/multicolored_asian_lady_beetle.htm
- <http://www.ajol.info/index.php/ajb/article/viewFile/62112/50151>
- Gordon, R.D. 1985. The Coccinellidae (Coleoptera) of America north of Mexico. Journal of the New York Entomological Society 93: 1-912



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References

- http://www.aphis.usda.gov/plant_health/plant_pest_info/citrus_greening/index.shtml
- http://www.aphis.usda.gov/publications/plant_health/content/printable_version/faq_citrus_greening.pdf
- http://www.tradejunction.apeda.com/MarketReport/jul_aug_2010/Mexico%208-19-2010.pdf
- Halbert, Susan E., Keremane L. Manjunath, Chandrika Ramadugu, Matthew W. Brodie, Susan E. Webb, and Richard F. Lee. 2010. "Trailers Transporting Oranges to Processing Plants Move Asian Citrus Psyllids". Florida Entomologist, Volume 93, No.1.
- Michaud, J.P. 2002. "Biological Control of Asian Citrus Psyllid, *Diaphorina citri* (Hemiptera: Psyllidae) in Florida: A Preliminary Report". Entomological news 113(3):216-222, May and June 2002.
 - web access - <http://swfrec.ifas.ufl.edu/hlb/database/pdf/00000239.pdf>
- Garnier, Monique and Joseph M. Bové. 1983. "Transmission of the Organism Associated with Citrus Greening Disease from Sweet Orange to Periwinkle by Dodder". Phytopathology 73: 1358-1363.
- Zhou, L.J., D.W. Gabriel, Y.P. Duan, S.E. Halbert, and W.N. Dixon. "Disease Notes: First Report of Dodder Transmission of Huanglongbing from Naturally Infected *Murraya paniculata* to Citrus". Plant Disease, Volume 91, No. 2.



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References

- http://entnemdept.ufl.edu/creatures/citrus/bc_aphid.htm
- <http://edis.ifas.ufl.edu/ch055>
- <http://edis.ifas.ufl.edu/ch058>
- http://entnemdept.ufl.edu/creatures/citrus/citrus_blackfly.htm
- <http://www.entomology.umn.edu/cues/inter/inmine/Whitefe.html>
- <http://edis.ifas.ufl.edu/in241>
- <http://insects.tamu.edu/fieldguide/aimg96.html>
- <http://ucanr.org/freepubs/docs/8205.pdf>
- Wenninger, Erik. J. and David G. Hall. 2007. “Daily Timing of Mating and Age at Reproductive Maturity in *Diaphorina citri* (Hemiptera: Psyllidae)”. Florida Entomologist Volume 90, No.4.
- <http://edis.ifas.ufl.edu/in436>
- Damsteegt, V.D., E.N. Postnikova, and A.L. Stone. 2010. “*Murraya paniculata* and Related Species as Potential Hosts and Inoculum Reservoirs of *Candidatus Liberibacter asiaticus*, Causal Agent of Huanglongbing”. Plant Disease, Volume 94, No. 5.
- Arevalo, H.A., J.A. Qureshi, and P.A. Stansly, 2010. “Sampling for the Asian citrus psyllid (ACP) in Florida citrus groves”. University of Florida – IFAS – EDIS publication.
 - <http://edis.ifas.ufl.edu/in867>
- http://www.texascitrusgreening.org/files/CG_Action_Plan.pdf



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References

- Michaud, J.P. and L.E. Olsen. 2004. "Suitability of Asian citrus psyllid, *Diaphorina citri*, as prey for ladybeetles". Biocontrol, Volume 49, pp. 417-431.
- <http://ipm.ifas.ufl.edu/agriculture/citrus/asian.shtml>
- <http://edis.ifas.ufl.edu/in858>
- <http://edis.ifas.ufl.edu/in668>
- <http://edis.ifas.ufl.edu/in686>
- Gottwald, Tim R. 2010. "Current Epidemiological Understanding of Citrus Huanglongbing". Annual Review of Phytopathology Volume 48, No. 6.
- <http://www.freshfromflorida.com/onestop/plt/budwood.html>
- http://www.aphis.usda.gov/plant_health/plant_pest_info/citrus_greening/downloads/pdf_files/twg/Psyllid%20Area%20Wide%20Control2.09.09.pdf
- Halbert, Susan E. and Carmelo A. Nunez. 2004. "Distribution of the Asian Citrus Psyllid, Kuwayama (Rhynchota: Psyllidae) in the Caribbean Basin". Florida Entomologist, Volume 87, No. 3.
- http://www.eppo.org/QUARANTINE/insects/Aleurocanthus_woglumi/ALECWO_ds.pdf



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References

- Stotzel, Manya B. 1994. “ Aphids (Homoptera: Aphididae) of Potential Importance on *Citrus* in the United States with Illustrated Keys to Species.” Proceedings of the Entomological Society of Washington, Volume 96, No. 1, pp. 74-90
- Ben-Dov, Yair. 1993. A Systematic Catalogue of the Soft Scale Insects of the World. Flora and Fauna Handbook No. 9, Sandhill Crane Press, Inc.
- http://entnemdept.ufl.edu/creatures/citrus/citrus_whitefly.htm
- Qureshi, Jawwad A. and Philip A. Stansly. 2007. “Integrated Approaches for Managing the Asian Citrus Psyllid *Diaphorina citri* (Homoptera: Psyllidae) in Florida”. Proceedings of the Florida State Horticultural Society, 120, pp. 110-115.
- Qureshi, Jawwad A. and Philip A. Stansly. 2010. “Dormant season foliar sprays of broad-spectrum insecticides: An effective component of integrated management for *Diaphorina citri* (Hemiptera:Psyllidae) in citrus orchards”. Crop Protection, 29, pp. 860-866.
- http://www.epa.gov/oppsrrd1/REDs/aldicarb_red.pdf
- Catharine Mannion, University of Florida, IFAS, Tropical Research and Education Center, ppt presentation titled - Neonicotinoid Insecticides for Ornamentals: The Good, Bad and Ugly



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References

- <http://bugguide.net/node/view/8744>
- <http://bugguide.net/node/view/8874>
- <http://www.pestvictoria.com/Spider%20Guide-Wegner-BASF.pdf>
- Richman, David B. 1989. "A Revision of the Genus *Hentzia* (Araneae, Salticidae)". Journal of Arachnology 17:285-344.
- <http://kaston.transy.edu/spiderlist/anyphen.htm>
- Edwards, R. J. 1958. The spider subfamily Clubionidae of the United States, Canada and Alaska (Araneae: Clubionidae). Bulletin of the Museum of Comparative Zoology 118: 365-436.
- Ubick, D., P. Paquin, P.E. Cushing, and V. Roth. 2005. Spiders of North America: An Identification Manual. Published by the American Arachnological Society.
- <http://npic.orst.edu/factsheets/imidagen.pdf>
- Susan Halbert – Florida Department of Agriculture and Consumer Services, Division of Plant Industry, personal communication
- Sétamou M., D. Rodriguez, R.R. Saldana, G. Schwarloze, D. Palrang, and S. Nelson. 2010. "Efficacy and uptake of soil-Applied imidacloprid in the control of Asian citrus psyllid and a citrus leafminer, two foliar-feeding citrus pests". Journal of Economic Entomology 103 (5): 1711-1719 .



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