Citrus Greening Disease and Asian Citrus Psyllid: What you should know

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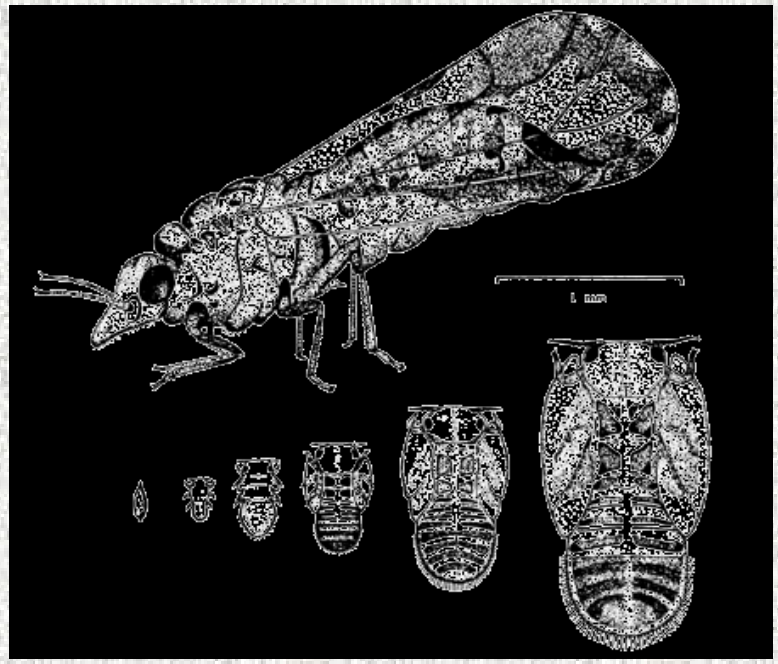
Asian Citrus Psyllid (ACP)

Adult psyllids are about the same size as a winged aphid (1/4th to 3/8th of an inch long). This is a characteristic feeding position, head down and abdomen up.

Asian Citrus Psyllid Life Cycle

Photo by E. Grafton-Cardwell

Eggs are found in the flush or new growth on a citrus branch. They hatch in about 4 days.



Adult survival – 30 days or longer at cooler temperatures

Nymphs complete 5 instars in about 11 days

Complete life cycle from egg to adult can take from 14 – 49 days depending upon temperature.

Host Range

- Includes 25 genera in the family Rutaceae, but not all of the genera are good hosts
- Most preferred hosts include the genera *Citrus, …*

Citrus sp. – Limes, lemons, oranges, grapefruit, mandarins, etc.

Host Range

… *Citropsis, Murraya,* and *Bergera*

Murraya exotica or *Murraya paniculata*
Orange jasmine

Bergera koenigii,
Curry leaf

Direct Feeding Damage

Leaf distortion caused by the adults feeding on leaves. The adults inject a salivary toxin as they feed. This damage is fairly characteristic of adult feeding, but feeding by thrips can also give similar damage.

If presented with a leaf sample with this sort of damage, the Agricultural Commissioner or CDFA Pest Hotline should be notified.

Direct Feeding Damage

Distorted flush growth

Honey dew and wax exudate

Leaf distortion and fouling by feeding activity of the nymphs and adults

ACP As A Vector of HLB

Huanglongbing (HLB) or
Citrus Greening (CG)

HLB or Citrus Greening

- This disease is thought to be caused by one of three bacteria, *Candidatus* Liberibacter asiaticus (CLas), *Candidatus* Liberibacter africanus (CLaf), and *Candidatus* Liberibacter americanus (CLam).
- *Candidatus* Liberibacter asiaticus is the most widespread throughout the world.
- Two psyllids, the Asian citrus psyllid (ACP) and the African citrus psyllid (*Trioza erytreae*) can vector these Liberibacter pathogens. Asian citrus psyllid is the most widespread vector of the pathogen.
- These pathogens can infect most citrus cultivars, species, hybrids, and some citrus relatives. Symptom severity varies with cultivar and species.
- In the United States, HLB is thought to be caused by CLas and vectored by ACP.

Transmission of HLB

It is vectored by ACP

Graft transmission

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Only use certified disease-free budwood for grafting to limit spread of HLB

Acquisition of CLas by ACP

- Nymphs and adults can acquire CLas from symptomatic and asymptomatic HLB plants while feeding on the phloem of an infected plant
- Once a psyllid acquires CLas, it is infected for life.
- ACP can acquire CLas about 1.5 - 2 months after initial infection. It takes from 4-6 months after infection to detect CLas in a plant using PCR (polymerase chain reaction) method.

Notice the sectoring of the symptoms of the disease. This tree is early in the infection cycle.

Early symptoms of the disease

Symptoms may not appear for 6 months up to 5 years after infection.

Symptoms of HLB

Mottling from HLB

Zinc deficiency

Mottling of leaves that are not the same on each side of the leaf. Leaves with nutrient deficiencies have the same yellow pattern on both sides of the leaf.

Symptoms of HLB

Small, hard fruit that do not color properly. The lower half of the fruit may remain green, hence the alternate name “Citrus Greening” for this disease.

Symptoms of HLB

HLB diseased grapefruit on the left and a healthy grapefruit on the right.

The fruit is small and misshapen. The seeds are aborted or malformed. The juice is bitter and off-flavored.

Symptoms of HLB

Premature fruit drop

Stunted, sparsely foliated trees

In a few years the infected tree will no longer produce fruit and may be dead about 5 years after infection. **There is no therapy or cure for this disease.**

Citrus Stubborn Disease looks like HLB

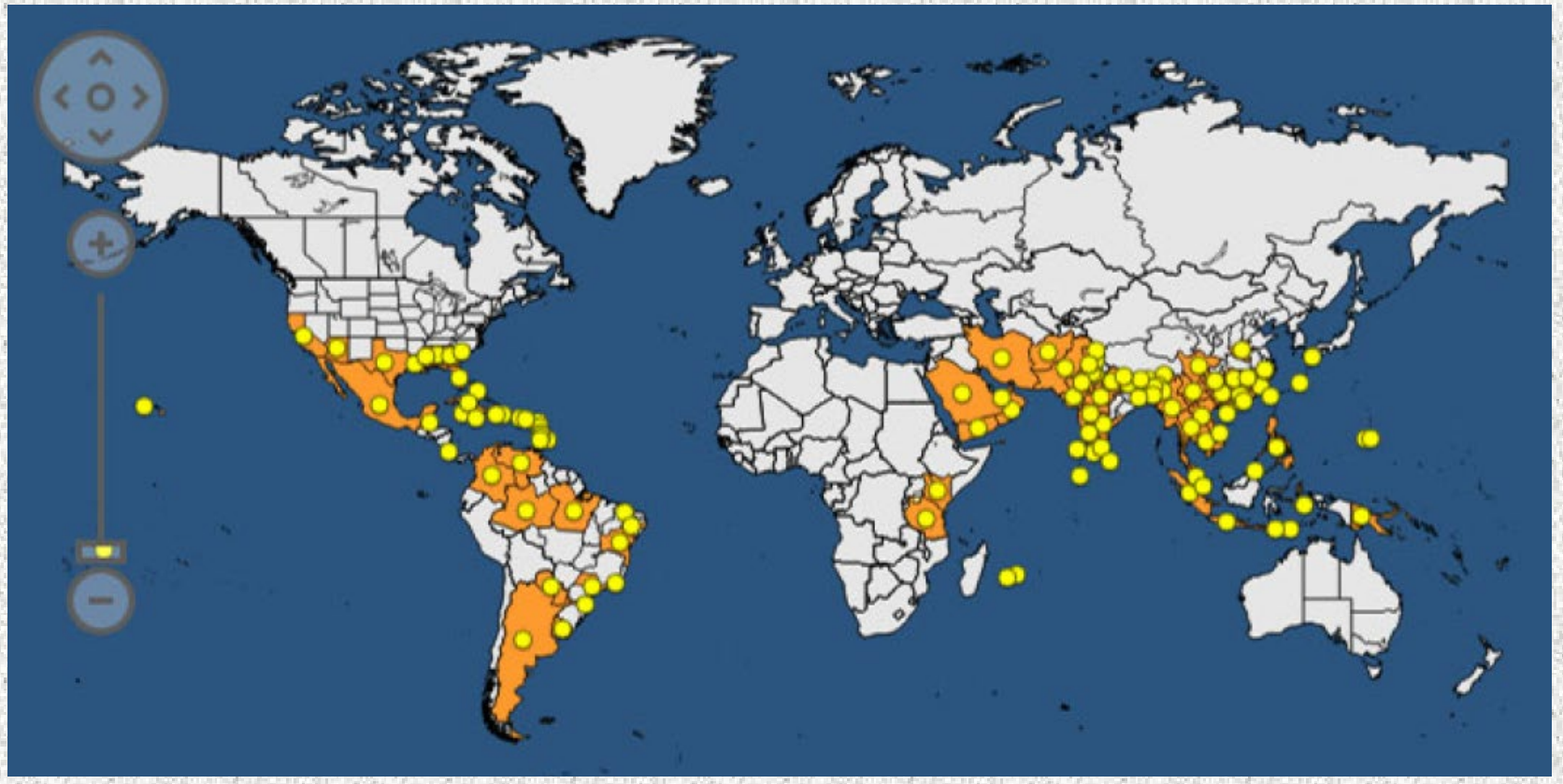
Citrus stubborn disease is caused by *Spiroplasma citri* and is endemic to California. Leaf mottling, misshaped and poorly colored fruit, and trees with sparse leaves and stunting are typical symptoms. This disease can be easily separated from HLB using qPCR. **If you see symptoms like this, submit a sample to your Agricultural Commissioner's office or CDFA. Do not assume the symptoms are from citrus stubborn disease.**

Two ways CLas can spread

ACP acquiring CLas as a nymph or adult, and then feeding on other healthy citrus trees. ACP can acquire CLas from symptomatic and asymptomatic trees.

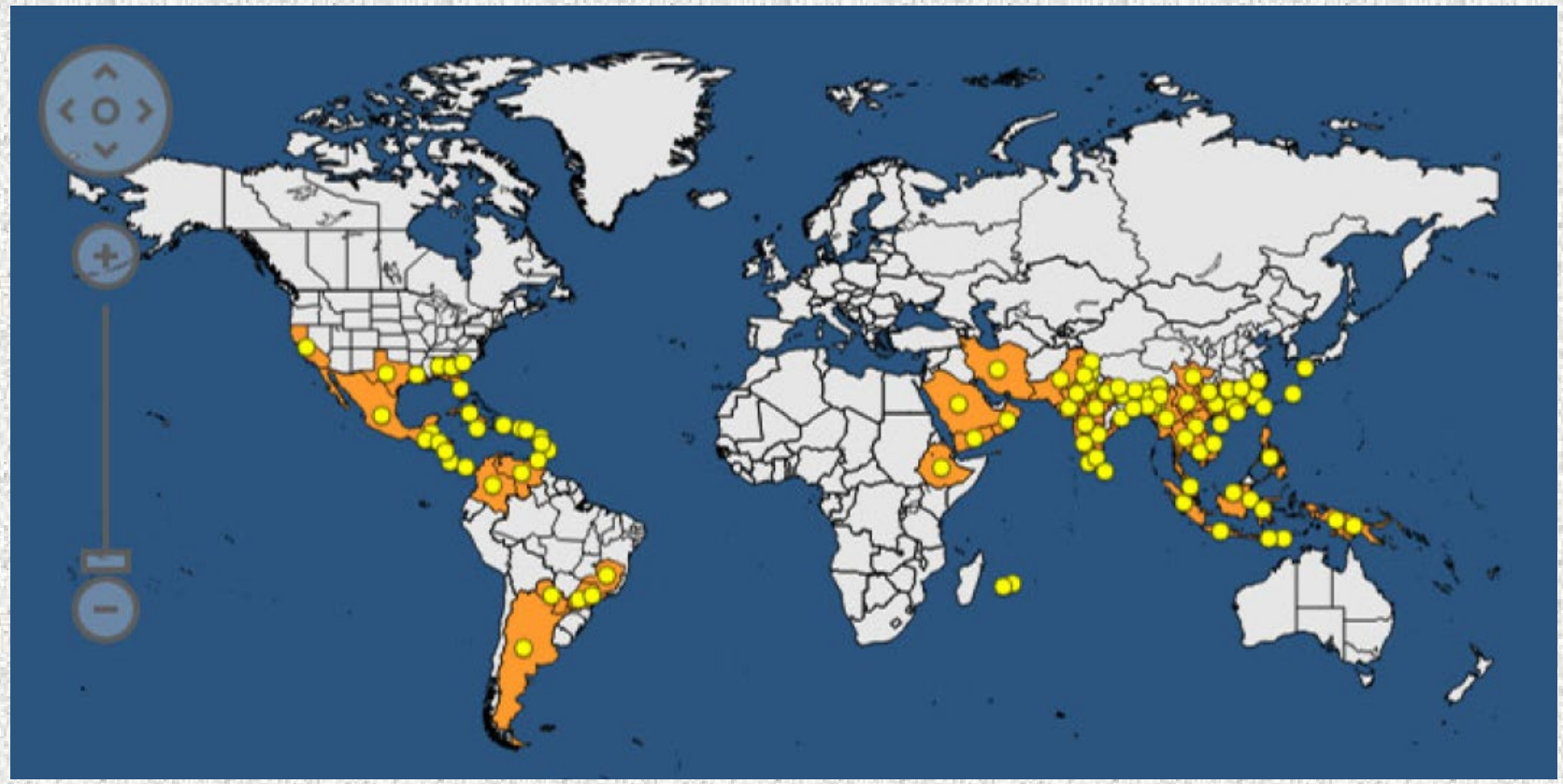
Grafting infected budwood into healthy trees

World Distribution of ACP



From EPPO 2019

World Distribution of HLB Caused by CLas



From EPPO 2019

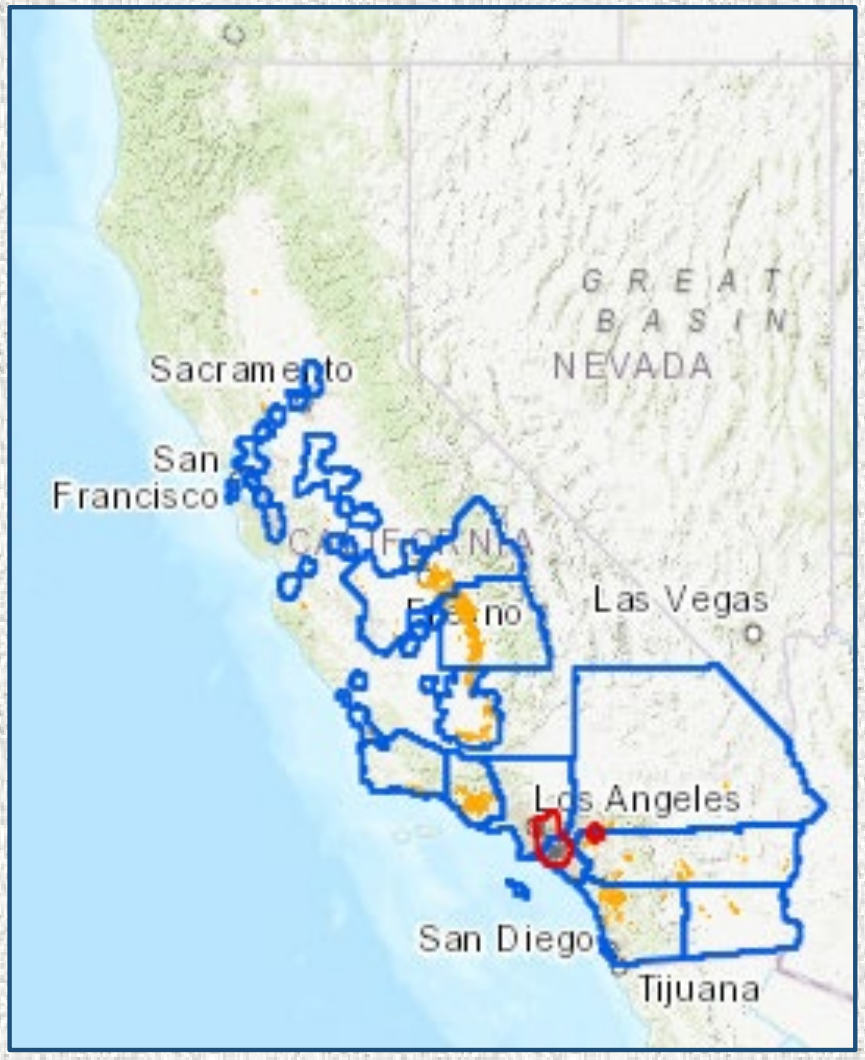
Movement of ACP and HLB

- ACP adults may fly short distances from an infested orchard to other citrus orchards, or from infested urban areas to commercial citrus
- ACP adults and nymphs may hide in foliage in bouquets or in boxes of various sorts of leaves used for culinary purposes
- Movement of unprocessed fruit out of an infested area
- Movement of rutaceous nursery trees out of an infested area by private individuals
- ACP was first found in landscape plantings of orange jasmine in Palm Beach County, Florida in June 1998. HLB was first found infecting an urban tree in South Florida in September 2005. In about 3 years, ACP and HLB had spread throughout Florida.
- Currently, ACP is found in parts of 8 states and HLB is found in parts of 6 states.

ACP and HLB in California

- ACP was first found in San Diego County in 2008. USDA and CDFA put regulations in place to slow the spread of this insect.
- HLB was first found in one dooryard tree in an urban area of Los Angeles in March 2012. The tree was removed.

Current Distribution of ACP in California



The blue polygons outline ACP quarantine boundaries. The red polygons are the boundaries of the HLB quarantine.

Current Situation with HLB in California

- From the first find of HLB in 2012 until October 30, 2020, HLB has been found at a total of 1,536 sites comprised of 2,124 trees at urban sites in Southern California.
- In Los Angeles County, there are 399 sites with a total of 487 positive trees.
- In Orange County, there are 1,094 sites with a total of 1,591 positive trees
- In Riverside County, there are 29 sites with a total of 31 positive trees. Also, at one commercial citrus orchard in August, a single ACP adult was found that was positive for CLas, but no trees in the orchard have tested positive for CLas yet.
- In San Bernardino County, there are 14 sites with a total of 15 positive trees.

How can I help slow the spread of ACP and HLB?

Know how close you are to an ACP or HLB quarantine. Information on quarantine boundaries can be found at your local county Agricultural Commissioner's Office or at http://cdfa.ca.gov/plant/ACP

Keep citrus plants and budwood local

- **Buy citrus plants from a reputable, local nursery.**
- **Do not share budwood, and only graft with certified clean budwood.**

If you don't know where the plants were produced, don't buy them or move them. Respect quarantine boundaries and regulations.

Moving fruit out of quarantine

Technically, fruit can move out of quarantine if it is washed thoroughly, and all twigs and leaves are removed. However, it would better if you just enjoyed the fruit where it was grown and not move it.

Green waste in an ACP quarantine area

Green waste from citrus trees, such as plant material from pruning, can facilitate the spread of ACP. To avoid spreading ACP do one of the following:

- Dry our the clippings for 2 weeks before putting them in the composting cart.
- Double bag the clippings before putting it in the trash.
- Chip or shred the material to dry it out before disposal.

Identifying ACP in plants

Look at the leaves on a plant for white waxy substances on leaves and look for adults and nymphs on new flush tips.

White waxy exudate from ACP feeding – look at leaves above the fouled leaves

Flush tip or the new growth found on a citrus tree – adults and nymphs may be on this plant tissue

Identifying ACP in plants

You can see the larger nymphs with a hand lens, but the white waxy tubules can be see without magnification.

If you find what may be ACP adults or nymphs, call you local county agricultural commissioner or the CDFA – hotline. The goal is to report the possible find of ACP as quickly as possible.

Identifying HLB in plants

Look for yellow blotchy leaves and small, misshapen fruit
If you suspect it may be HLB, contact your local county agricultural commissioner's office of the CDFA Pest Hotline as quickly as possible.

CDFA treatment program for urban areas

When CDFA finds ACP in a backyard, all ACP host plants within 400 meters of the yard with the ACP are treated with a foliar and systemic insecticide by professional pesticide applicators. The foliar insecticide is cyfluthrin (Tempo), a pyrethroid, and the systemic insecticide is imidacloprid (Merit), a neonicotinoid.

Insecticides homeowners can use if CDFA does not treat a property

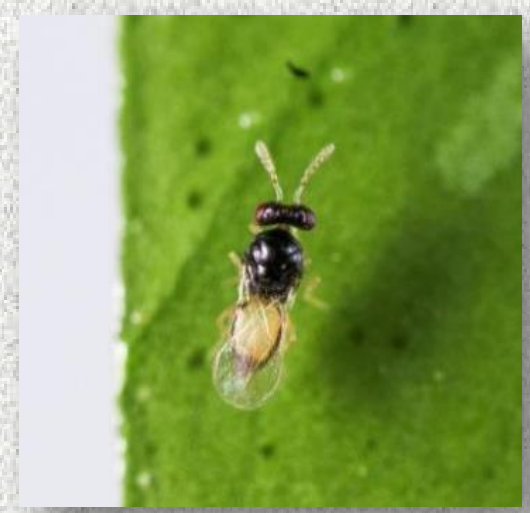
Type of treatment	Pesticide Name	Effectiveness against ACP	Duration of control	Application timing
Professional treatment	Tempo & Merit	High	Months	Foliar: when psyllids are present Systemic: summer or fall
Homeowner-applied broad-spectrum foliars	Sevin, Malathion	Moderate	Weeks	When psyllids are observed
Homeowner-applied soil drench	Bayer Advanced Fruit, Citrus & Vegetable	Moderate	Months	When psyllids are observed in summer or fall
Homeowner-applied soft foliars	Insecticidal soaps, oils and pyrethrins	Low to moderate	Days	Every 7-10 days especially during *leaf flushing

*Flushing: when new leaves are first developing until they expand and harden

Biological Control of ACP

There is a tiny parasitic wasp that lays its egg inside the psyllid nymph. The wasp develops and kills the nymph.

Tamarixia radiata



Exit hole left by a parasite that emerged from a psyllid nymph

The wasps are specific to the Asian citrus psyllid and pose no risk to people

It is critical to **control ants**, because they feed on the honeydew that the nymphs produce in the white tubules, and they aggressively prevent natural enemies from attacking the nymphs.

Your Role in Managing ACP and HLB to Slow the Spread

- Keep up-to-date on how close you are to an ACP or HLB quarantine
- Buy citrus plants from a reputable nursery that is local to your area. Do NOT obtain citrus plant material from internet sellers.
- Do NOT trade budwood or plants.
- Do NOT move fruit out of the quarantine area.
- Call the CDFA hotline if you think one of your trees has ACP or HLB
- If HLB is found near your house, consider removing your tree, so that it doesn't serve as a reservoir for HLB. Remember, HLB is very difficult to detect early in infection, but the psylllids can still acquire and transmit CLas from the tree.

More Information

- http://ucanr.edu/sites/ACP
- https://www.cdfa.ca.gov/plant/ACP
- http://citrusinsider.org
- http://ipm.ucdavis.edu
- To report possible ACP infestations or suspected HLB infections, contact either the California Department of Food and Agriculture Pest Hotline – 1-800-491-1899 or your local County Agricultural Commissioner's Office