Asian Citrus Psyllid and the Citrus Disease Huanglongbing

Huanglongbing

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Adult psyllids can feed on either young or mature leaves. This allows adults to survive year-round.

When feeding, the adult leans forward on its elbows and tips its rear end up in a very characteristic 45° angle.

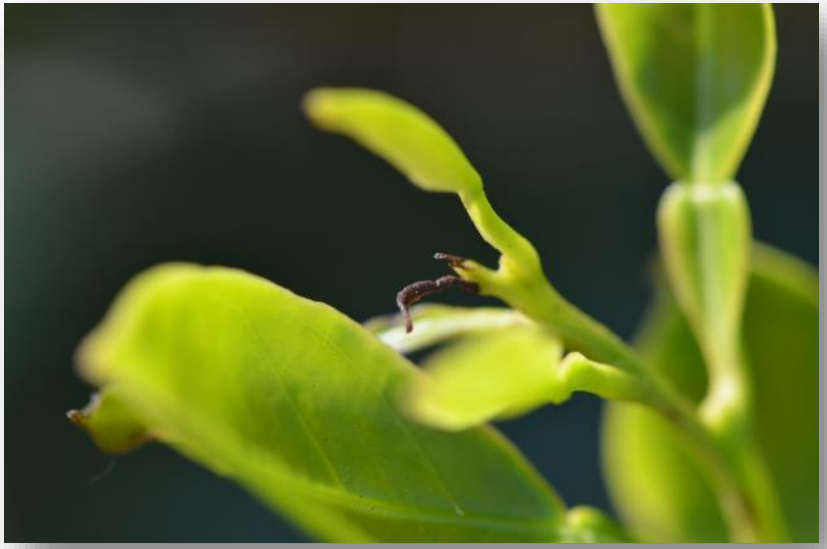
The eggs are yellow-orange, tucked into the tips of tiny new leaves. They are difficult to see because they are so small

The nymphs produce waxy tubules that direct the honeydew away from their bodies. These tubules are unique and easy to recognize.

Nymphs can only survive by living on young, tender leaves and stems.

Thus, nymphs are found only when the plant is producing new leaves.

As the psyllid feeds, it injects a salivary toxin that causes the tips of new leaves to easily break off.
If the leaf survives, then it twists as it grows.



Twisted, notched leaves can be a sign that the psyllid has been there.

What plants can the psyllid attack?
All types of citrus and related plants in the Rutaceae family

- *Citrus* (limes, lemons, oranges, grapefruit, mandarins…)
- *Fortunella* (kumquats)
- *Citropsis* (cherry orange)
- *Murraya paniculata* (orange jasmine)
- *Bergera koenigii* (Indian curry leaf)
- *Severinia buxifolia* (Chinese box orange)
- *Triphasia trifolia* (limeberry)
- *Clausena indica* (wampei)
- *Microcitrus papuana* (desert-lime)
- Others…..

Calamondin

Asian citrus psyllid feeds and reproduces on plants that we don't think of as citrus: such as the ornamental orange jasmine

This orange jasmine plant, *Murraya paniculata*, is grown throughout Florida as a bush, tree or hedge. It is a preferred host for the psyllid because it produces new leaves continuously. It is not a common plant in California or Arizona.

How did the psyllid spread through Florida?

The psyllid was first detected in backyard citrus trees in southern Florida in 1998. The psyllid spread very rapidly both by flying (green areas) as well as riding on nursery plants (blue areas), such as orange jasmine, that were moved between retail nurseries throughout the state.

Asian citrus psyllid feeds and reproduces on Indian Curry Leaf

This Indian curry leaf, *Bergera koenigii*, is grown in Hawaii and the leaves are shipped to California for use in restaurants.
It is a favorite host of the psyllid.

Shipments of ACP-infested leaves have been intercepted at airports.

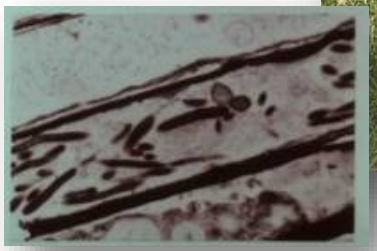
Why are we so worried about this psyllid?

The Asian citrus psyllid can pick up the bacterium that causes Huanglongbing (HLB) disease and move the disease from citrus tree to citrus tree as it feeds. The bacterium blocks nutrient flow in the tree.

Huanglongbing means "yellow shoot disease" in Chinese.

It causes the leaves on some of the branches of citrus to turn yellow.

***Candidatus* Liberibacter asiaticus**



An early sign of the disease is yellowing of the leaves

Leaves with HLB disease have a blotchy yellow pattern that is not the same on both sides of the leaf.

Leaves with nutrient deficiencies (Zinc is an example) have the same yellow pattern on both sides of the leaf.

HLB leaf symptoms can range from slight to nearly completely yellow

In addition to yellow mottling, the veins of the leaf may be thickened

HLB disease prevents the fruit from developing the proper color

The lower half of the fruit may remain green, which is why this disease is also sometimes called citrus greening.

Even more devastating, HLB causes the fruit to be small, oddly shaped, with aborted seeds and bitter juice

The fruit is small, grows crookedly, forming uneven segments and the seeds are aborted

In as little as 5 years after HLB infection, the tree stops bearing fruit and eventually dies

There is no cure for the disease!

This citrus tree in a backyard in Florida is obviously very sick, with few leaves and no fruit.

The HLB leaf and fruit symptoms can look very similar to another disease called citrus stubborn

Don't panic if you see yellowed leaves or off-colored fruit –

but do get them checked out!

How does the bacterium spread? – Two ways

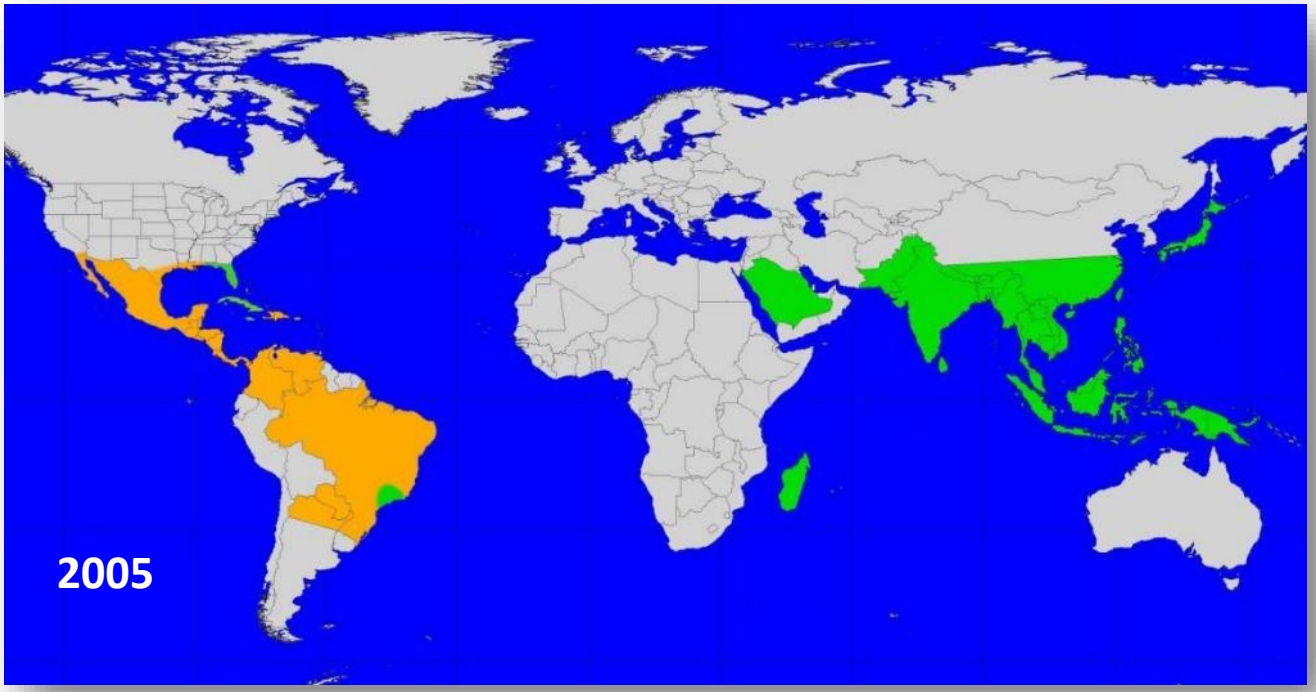
The bacteria can be spread by grafting infected plant material

When the insect feeds it takes up the bacteria and passes it on when it feeds on the next citrus tree or 'citrus-like' plant

The psyllid can pick up the bacteria as a nymph or adult and then it carries the bacteria in its body for the rest of its life (weeks to months).

Where did Asian citrus psyllid and the HLB disease come from?

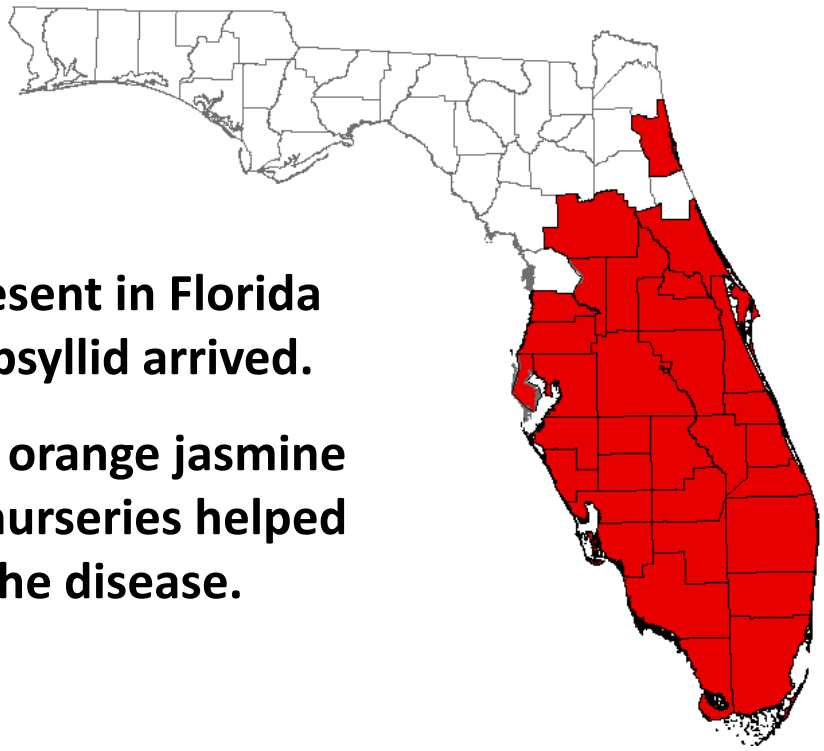
Most likely ACP and HLB came from India or Asiariding in and /or on citrus or closely related plants. The disease first showed up in the Americas in 2005.



Asian citrus psyllid, but not the disease
Both the psyllid and HLB disease

How fast did the disease spread in Florida?

It took less than 3 years for HLB to spread through most of the citrus growing regions of the state.



Citrus production in FL has been reduced by nearly 50% due to two diseases: Canker and HLB

HLB was present in Florida before the psyllid arrived.

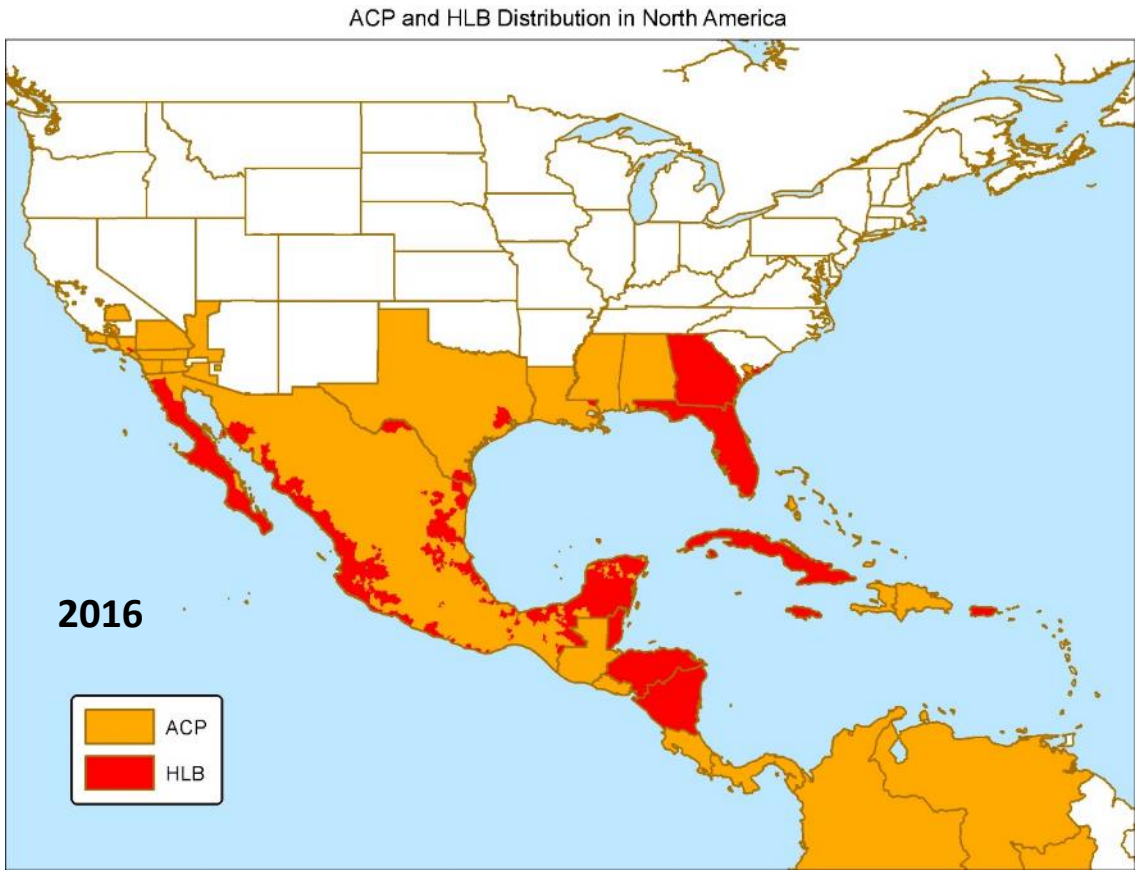
ACP-infested orange jasmine in the retail nurseries helped spread the disease.

How did the psyllid get to California and where is the disease?

The psyllid was first found in California in 2008

The psyllid most likely arrived in Calfiornia from Mexico.

The disease is rapidly spreading in Mexico and will likely spread to California in illegal plant material or in the bodies of psyllids.



In March 2012, HLB was found in a residential tree in Southern California. How did it get there?

Illegally imported citrus trees or budwood:

Most likely an HLB-infected tree or infected budwood was brought illegally into California and planted or grafted onto a residential tree. The disease just sits inside the plant, until a psyllid arrives and picks it up and moves it.

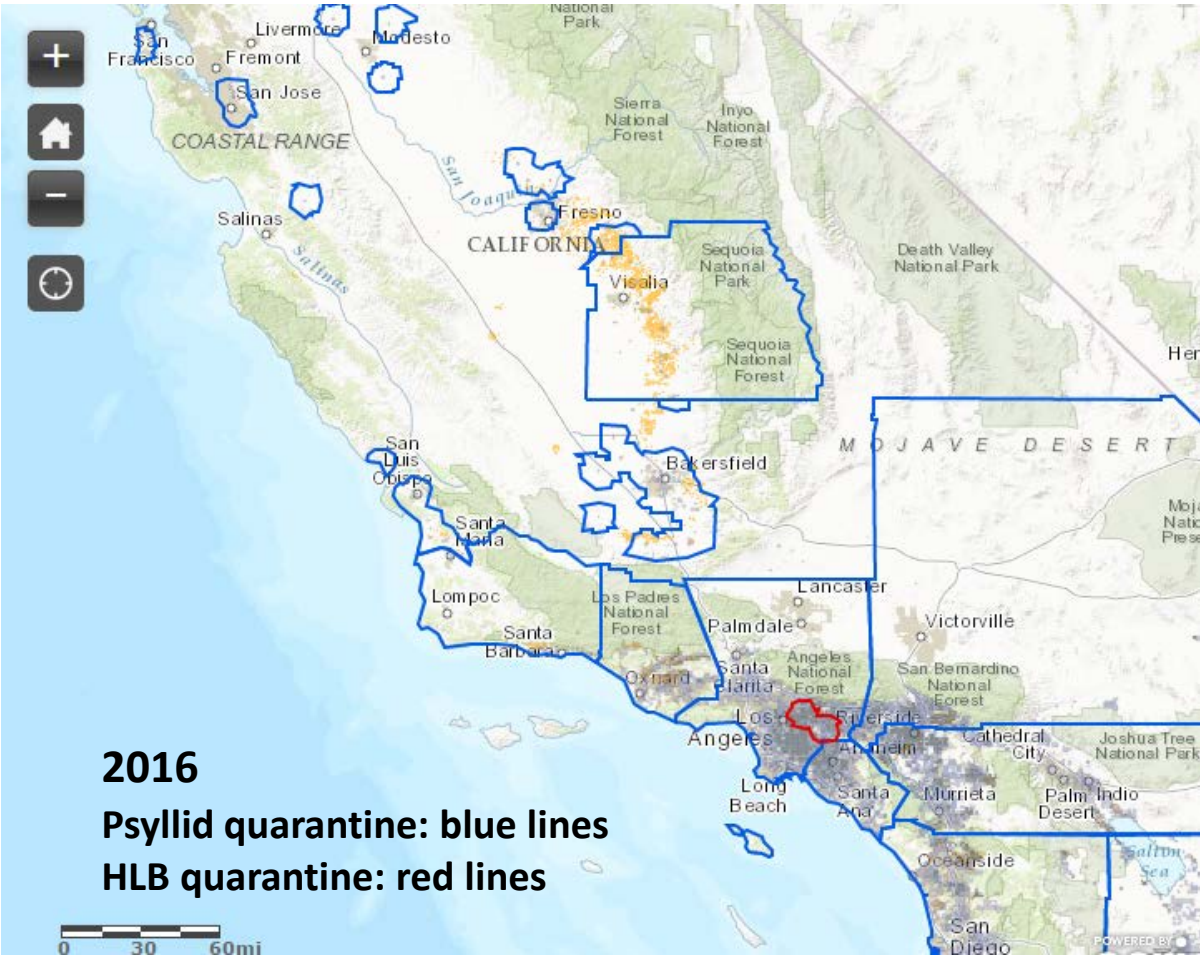
It is very important to obtain disease-free trees and budwood from reputable nurseries, rather than trading plant material of unknown origin

How can I help prevent the spread of the pest and disease?

Know where your home is in relation to the pest and disease.

If you are inside a psyllid-infested quarantine area, don't move host plants to or through uninfested areas of the state.

Keep citrus plants local!



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Citrus trees in nurseries in the quarantine areas will have a tag on them

The tag explains that the tree should not be moved out of the quarantine area.

Be sure to buy citrus trees only from a reputable nursery

If you don't know where the plants came from, then don't buy them!

They may be full of pests and diseases.

If I am in the quarantine area, is it ok to pick the fruit and give it to my friends?

The psyllids can't live on citrus fruit. So as long as you brush or wash the fruit and make sure it is free of leaves and twigs before transporting it, it is ok to move it.

If I am in an area known to have ACP, what should I do about green waste?

To avoid spreading Asian citrus psyllid, when your citrus trees are pruned, make sure the green waste:

- **Dries out for two weeks before putting it in the recycling can**
- **Or double bag it before putting in trash cans**
- **Or chip and shred it to dry it out before disposing of it**

Why does this disease spread so fast?

The eggs are laid on new flush next to the where the psyllid injects the bacterium.

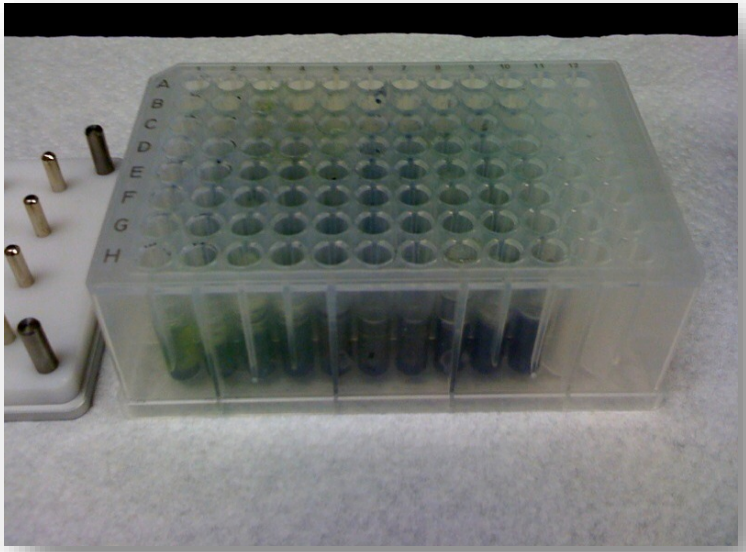
The nymphs hatch and immediately pick up the bacterium and move it when they molt and fly away 4-6 weeks later.

Monitoring for HLB with PCR: the regulatory standard

Plant tissue (leaves and petioles): takes > 9 months for the bacterium to multiply and distribute itself throughout the tree so that we can detect it.

Psyllids (adults or nymphs): early warning system

PCR (polymerase chain reaction) is used to determine if the bacterium is present



What happens when Asian citrus psyllids are found in a California backyard and CDFA treats in my area?

If a psyllid is found, all of the host plants in that yard and 400 meters around the yard, are treated with a foliar and a systemic insecticide.

A professional applicator treats the backyard citrus trees and closely related plants with insecticides

-cyfluthrin (Tempo) a foliar pyrethroid

-imidacloprid (Merit) a systemic neonicotinoid

Insecticide treatments available to homeowners – treatments to apply when CDFA does not treat

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

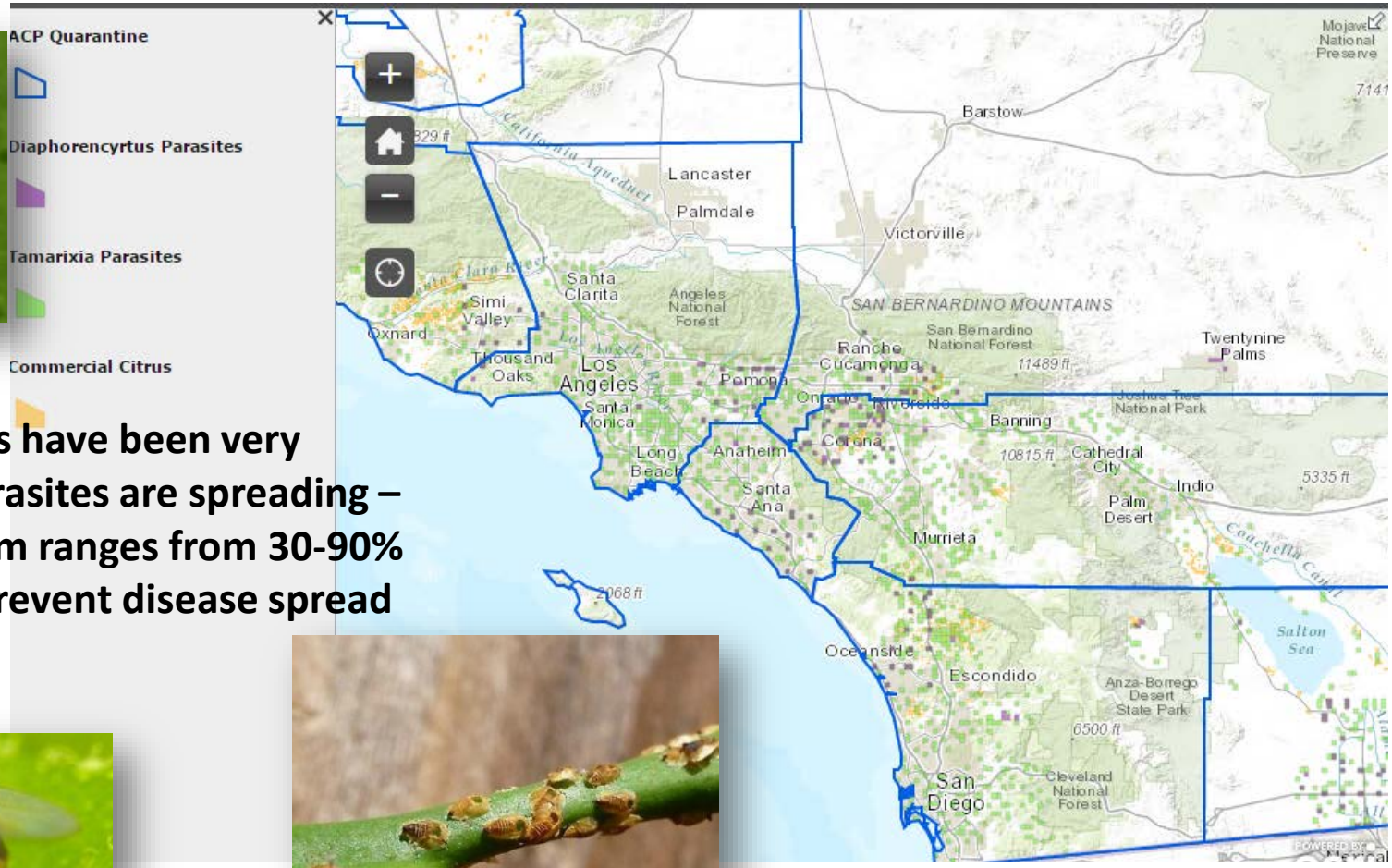
*Flushing: when new leaves are first developing until they expand and harden

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Flowering

Treat for psyllids with Tempo and Merit –	Partial treatments of Tempo and Merit	Use oils, soaps, do nothing, parasite releases
Local eradication, no psyllids or treatments for months to years	Psyllids may reinvade, more treatments may be necessary	Psyllids will re-appear, frequent treatments are needed
Low risk of HLB spread		High risk of HLB spread

Tamarixia and *Diaphorencyrtis* parasite releases



USDA/UC Releases have been very successful, the parasites are spreading – however parasitism ranges from 30-90% = not enough to prevent disease spread

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Master Gardeners can help with messaging about how homeowners can protect their citrus

- Plant only disease-free citrus plants (or graft budwood) obtained from a reputable nursery.
- Do not move plant material around the state
- Learn to recognize the pest and disease.
- Call the Department of Food and Agriculture hotline if you think you might have the psyllid or the disease.
- Allow treatments by CDFA and if CDFA does not treat psyllids in your area, and you see psyllids, then treat the plants yourself.

All of these steps will protect your citrus tree and buy time for the scientists to find a cure for the disease!

How do I look for the psyllid?

Look at new leaves for adult and nymphal psyllids and the waxy tubules they produce.

If you find it, you can call your county ag commissioner
Or the CDFA hotline – either way act fast to contact the authorities

If You Find it: Act Fast, Time is Critical

Call
800/491-1899

Think you found the Asian citrus psyllid or HLB symptoms on your tree.

- Time is critical.
- Secure psyllids and leaf samples in a clear, locked sandwich bag, jar or plastic container.
- Contact your local Agricultural Commissioner's office or call the California Department of Food and Agriculture hotline immediately.

How do I look for the disease?

Look for blotchy yellowed leaves and small oddly shaped fruit.

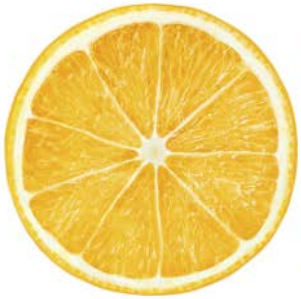
E. Grafton-Cardwell

www.CaliforniaCitrusThreat.org
www.PeligranCitricosenCalifornia.com

This web site, funded by the citrus industry provides users with basic information about the psyllid and disease and how to respond.

Citrus Pest & Disease Prevention Program

PEST & DISEASE | PROTECT YOUR CITRUS | CALIFORNIA CITRUS | NEWS | RESOURCES | CONTACT



A Threat to California Citrus

A plant disease that kills citrus trees has been found in California. The disease, called Huanglongbing or citrus greening disease, isn't harmful to humans, but it is fatal for citrus trees and has no cure. The disease is spread by a pest called the Asian citrus psyllid as it feeds on citrus tree leaves. Until researchers find a solution, California homeowners who enjoy growing fresh citrus fruit in their yards, and California farmers tending to $2.5 billion worth of citrus fruit trees must work together to protect their trees. Learn more about how to detect the pest and disease and protect California's beloved citrus heritage.

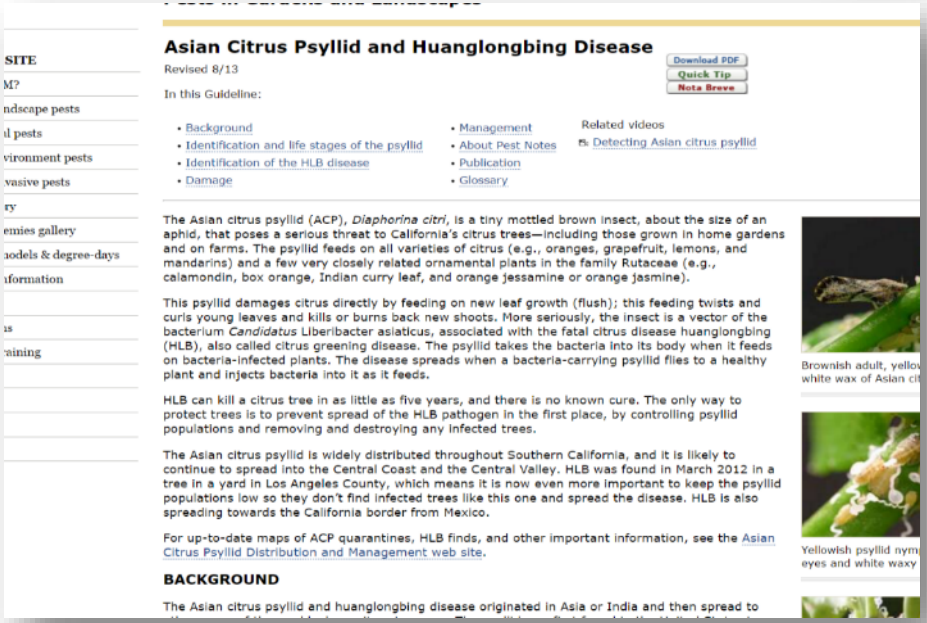
Protect Your Citrus Trees

The Citrus Pest & Disease Prevention Program recommends these tips to protect citrus trees.

- Inspect trees for the Asian citrus psyllid and Huanglongbing
- Don't move citrus into or out of your area
- Buy citrus trees from licensed, local nurseries
- Only use registered budwood
- Cooperate with agriculture crews
- Apply products that protect your tree
- Dry or double bag plant clippings

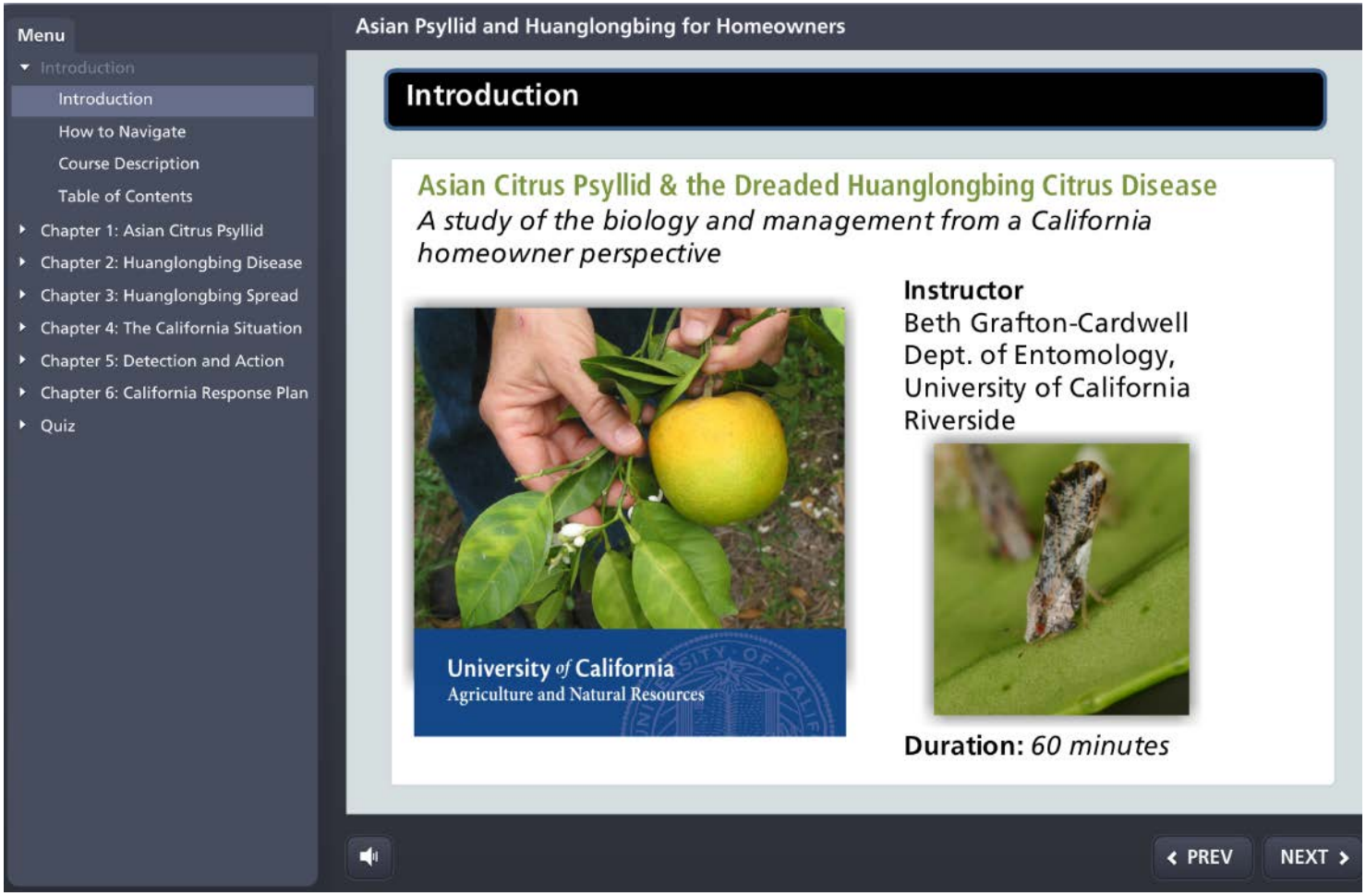
Where can I get more University of California information?

- **ACP HLB Website:** www.ucanr.edu/sites/ACP
- **UC IPM Pest note for homeowners** http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74155.html
- **UCIPM Quick tip for homeowners** http://www.ipm.ucdavis.edu/QT/asiancitruscard.html



For an in-depth study of the psyllid and ACP in English, take the

ANR Online Class on ACP for Master Gardeners http://class.ucanr.edu



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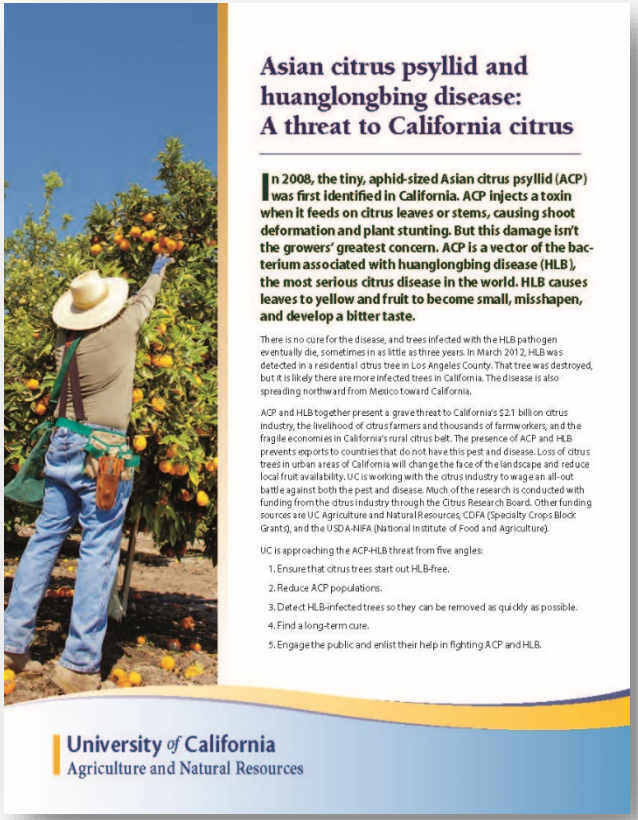
Scientists are studying every conceivable way to stop this disease:

- **Early detection techniques** to find and destroy diseased trees
  - Sick trees produce different volatiles and proteins that can be measured (VOC sniffer or dogs)
  - The bacteria produce proteins that can be measured
  - The micro-organisms associated with sick trees are different than healthy trees
- **Psyllid traps** – attract and kill
- **Antibiotic** treatments
- **Resistant** rootstocks and scions (traditional breeding and gene editing)
- Utilize an **altered citrus tristeza virus to introduce anti-HLB genes into plants** (GE)
- Altering the psyllid so it can't vector the disease and releasing the '**nupsyllid**' to replace the wild ones (GE)



Asian citrus psyllid and huanglongbing disease: A threat to California citrus

In 2008, the tiny, aphid-sized Asian citrus psyllid (ACP) was first identified in California. ACP injects a toxin when it feeds on citrus leaves or stems, causing shoot deformation and plant stunting. But this damage isn't the growers' greatest concern. ACP is a vector of the bacterium associated with huanglongbing disease (HLB), the most serious citrus disease in the world. HLB causes leaves to yellow and fruit to become small, misshapen, and develop a bitter taste.

There is no cure for the disease, and trees infected with the HLB pathogen eventually die, sometimes in as little as three years. In March 2012, HLB was detected in a residential citrus tree in Los Angeles County. That tree was destroyed, but it is likely there are more infected trees in California. The disease is also spreading northward from Mexico toward California.

ACP and HLB together present a grave threat to California's $2.1 billion citrus industry, the livelihood of citrus farmers and thousands of farmworkers, and the fragile economies in California's rural citrus belt. The presence of ACP and HLB prevents exports to countries that do not have this pest and disease. Loss of citrus trees in urban areas of California will change the face of the landscape and reduce local fruit availability. UC is working with the citrus industry to wage an all-out battle against both the pest and disease. Much of the research is conducted with funding from the citrus industry through the Citrus Research Board. Other funding sources are UC Agriculture and Natural Resources, CDFA (Specialty Crops Block Grants), and the USDA-NIFA (National Institute of Food and Agriculture).

UC is approaching the ACP-HLB threat from five angles:

1. Ensure that citrus trees start out HLB-free.
2. Reduce ACP populations.
3. Detect HLB-infected trees so they can be removed as quickly as possible.
4. Find a long-term cure.
5. Engage the public and enlist their help in fighting ACP and HLB.

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http://ucanr.edu/repositoryfiles/ACP_Fact_Sheet-101755.pdf