AgriLIFE EXTENSION
Texas A&M System

E-597
5/12

Identification and Management of the Asian Citrus Psyllid and Citrus Greening Disease in Texas Nurseries

Carlos E. Bográn,
Raul T. Villanueva,
and Mamoudou Setamou

Citrus greening, also known as Huanglongbing (HLB) or yellow dragon disease, is the most important threat to citrus production worldwide. The disease devastates citrus plants, reducing fruit yield and quality, and killing the plants in as little as 2 years.

Citrus greening diseases is caused by bacteria that can live and multiply in the plant's vascular system (phloem). The bacteria are carried by the Asian citrus psyllid, *Diaphorina citri,* and may be transmitted when insects feed on healthy plants. The bacteria can also spread during grafting plants with infected plant material.

Once restricted to China and South Africa, HLB has spread rapidly in recent years and now occurs in:

- **The United States:** Florida, South Carolina, Georgia, Louisiana, Texas, California
- **Mexico:** Nayarit, Colima, Jalisco, the Yucatan peninsula
- **Jamaica**
- **Puerto Rico**
- **Virgin Islands**
- **Brazil.**

As of January 13th, 2012 the first known case of HLB was confirmed in Texas on a Rio Grande Valley orange tree in Hidalgo County.

Currently there is no cure for citrus greening disease; the best control strategy is to keep healthy plants from being infected. One of the most effective ways to prevent the disease is to avoid moving plants and plant materials from areas under regulatory quarantine or where the insect or disease is present.

To avoid or minimize the impact of the disease, use an integrated approach: use only certified-clean plant stock; monitor plants regularly to detect and control any population of Asian citrus psyllid; if you suspect HLB, send a sample of the foliage to the appropriate diagnostic laboratory; and remove and destroy trees that are confirmed infected with HLB.

* *Associate Professor and Extension Specialist–Entomology/Plant Pathology and Microbiology, Assistant Professor and Extension Entomologist, Texas AgriLife Extension; Research Scientist, Texas Agrilife Research, The Texas A&M System*

Asian citrus psyllid

The Asian citrus psyllid feeds on all varieties of citrus and citrus relatives, including ornamentals such as orange jasmine and other members of the family Rutaceae. The insect inserts its mouthparts into the plant phloem and sucks the liquid sap. When a plant is already infected with citrus greening, the insects acquire the bacteria and then can transmit the disease to healthy plants.

Figure 1. Adult Asian citrus psyllids.

Description: Adults are mottled brown and about ⅛ inch (3–4 mm) long. They hold their wings in a roof-like position over their body.

The outer wings (forewings) have a brown band that extends around most of the wing-margin; the antennae are brown with black tips.

Figure 2. Adults gathered on a citrus stem.

Adults characteristically sit at a 45 degree angle (Fig. 1) when they feed on citrus twigs or leaves. They are found most often gathered on stems and are typically covered with a white waxy secretion that makes them look dusty (Fig. 2).

When disturbed, adult psyllids jump away or hide on the the underside of a leaf.

Citrus psyllid eggs are bright yellow or orange and are attached to young plant tissue including new leaves, tender stems, axillary buds, and feather flush (Fig. 3).

Figure 3. Asian citrus psyllid eggs.

Figure 4. Asian citrus psyllid nymphs.

Nymphs (immature psyllids) are yellow or orange, have a flattened scale-like shape, and have large wing pads (Fig. 4). Though nymphs can be difficult to see, they can be detected by the sugary white waxy substance they produce. This substance attracts ants and flies and becomes more noticeable in dry weather because it curls up at the edges.

Life cycle: The Asian citrus psyllid progresses from the egg through five nymphal stages—or instars—to the adult stage. The eggs hatch in 2 to 4 days; the immature nymphs complete their development in 10 to 40 days. The whole life cycle is completed in 15 to 47 days, depending on prevailing temperatures. The optimum temperature range for psyllids is between 77 and 84 degrees F.

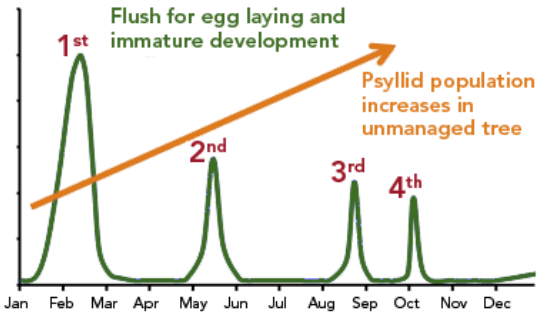

Figure 5. Typical major citrus flushing periods in the Rio Grande Valley.

Females can deposit 600 to 900 eggs during their 2- to 3-month lifespan. In South Texas, psyllid populations increase through the growing season and become most numerous after the citrus plants produce new foliar growth known as flushing periods (Fig. 5).

Damage: Citrus psyllids that are not infected with the HLB bacteria are only minor pests of citrus. However, in large numbers they can cause significant damage including leaf distortion, leaf curling, lateral leaf notching and dead terminals (Fig. 6).

Figure 6. Psyllid damage to a citrus shoot.

In nurseries, psyllids are especially damaging because they can stunt seedling development and ruin young plants.

Host plants: Host plants for psyllids include many of the close citrus relatives (Fig. 7). A recent report indicates that ficus (*Ficus carica*) may be an alternate host for the psyllid.

Buying and selling ornamental plants such as orange jasmine (a preferred host) has been associated with introducing the ACP into new areas.

Aegle sp.	*Aeglopsis* sp.	*Afraegle* sp.
Artocarpus sp.	*Atalantia* spp.	*Balsamocitrus* sp.
Citropsis sp.	*Citrus* spp.	*Clausena* spp.
Eremocitrus spp.	*Fortunella* spp.	*Limonia* sp.
Merrillia sp.	*Microcitrus* sp.	*Murraya* spp.
Naringi sp.	*Pamburus* sp.	*Poncirus* sp.
Severinia sp.	*Swinglea* sp.	*Toddalia* sp.
Triphasia sp.	*Vepris* sp.	

Fig 7. Citrus relatives that may host the citrus psillid.

Citrus greening

Although a new emerging issue in the US, citrus greening is one of the oldest diseases of citrus. It was first reported in the late 1800s in China's Guangdong province. Citrus greening was first detected in Florida in 2005 and in the lower Rio Grande Valley of Texas in early 2012.

The pathogen: The bacterium that causes HLB infects the plant phloem, the liquid-carrying vessels of plants. Though there are three species of the bacterium associated with citrus greening worldwide, *Candidatus L. asiaticus* is the only species known to occur in the United States.

The bacterium can be spread by grafting infected plant material onto healthy plants or by adult citrus psyllids while feeding. Young nymphs can also spread the disease. Nymphs acquire the pathogen most readily and studies show that the bacterium can be transmitted from adult psyllids to their offspring.

Citrus greening host plants: Several citrus and citrus relatives are hosts to the citrus greening bacterium. The disease has also been transmitted experimentally to plants outside the Rutaceae family.

Figure 8. Leaf with blotchy mottle (left) caused by citrus greening compared to a normal leaf (right).

HLB symptoms: The earliest symptom is yellowing at one or more terminals. Infected leaves show multiple shades of yellow and green called blotchy mottle (Fig. 8). The blotching patterns are asymmetrical and distinguish symptoms of citrus greening from similar symptoms caused by deficiencies of minerals such as zinc, manganese, magnesium, calcium, and iron.

The disease also deforms the fruit and causes the color to revert to green (Fig. 9). The fruit do not concentrate sugar and become bitter. Once infected, trees usually decline and die within 3 to 5 years.

Figure 9. Reverse coloration or fruit greening (left) and malformed fruit (right) caused by citrus greening by HLB.

Symptoms on mature trees do not appear until 2 to 4 years after infection. This latency period makes it difficult to diagnose and monitor the progress of the disease. Laboratory tests are needed to confirm the presence of citrus greening.

Integrated management

The best way to avoid losses due to citrus greening is to keep healthy plants from becoming infected. You can minimize the risk of infection by avoiding citrus plants or plant parts from infected areas. Also avoid related plants, such as orange jasmine, from questionable sources. Inspect citrus plants and their botanical relatives frequently for citrus psyllids.

If you find psyllids, chemical control of the insects is the most viable options to reduce the incidence and spread of HLB. Several insecticides are registered for use against psyllids in Texas including imidacloprid, thiamethoxam, and clothianidin in drench or foliar applications.

Insect growth regulators, such as pyriproxyfen, target nymphs and can be rotated into a treatment program to reduce the risk of insecticide resistance.

You may obtain a complete list of registered pesticides from your county Extension office or from the Citrus Center.

Natural enemies of the psyllid include the parasitoid wasp (*Tamarixia radiate*), and several species of ladybeetles such as the ashy gray ladybeetle (*Olla v. nigrum*) (Fig. 10). These can be used as part of long-term management strategy, but biological control alone is not a reliable strategy for controlling ACP in nurseries.

Figure 10. Asian citrus psyllid nymphs parasitized (left) by two color variants of the ashy gray ladybeetle (right).

More information

Asian citrus psyllid and citrus greening disease: *http://www.texascitrusgreening.org*

Insects and Entomology at Texas A&M University: *http://insects.tamu.edu/*

Plant diseases, and plant pathology and microbiology at Texas A&M University: *http://plantpathology.tamu.edu/*

Raul Villanueva: *rtvillanueva@ag.tamu.edu* or (956) 969-5604

Mamodou Sétamou: *mamoudou.setamou@tamu.edu* or (956) 447-3370

Carlos Bográn: *c-bogran@tamu.edu* or (979) 845-6800

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