PP-225

UF UNIVERSITY of FLORIDA
IFAS Extension

2011 Florida Citrus Pest Management Guide: Huanglongbing (Citrus Greening)[1]

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Huanglongbing (HLB; citrus greening) is thought to be caused by the bacterium, *Candidatus* Liberibacter asiaticus. The name huanglongbing means "yellow shoot disease," which stems from the bright yellow shoot symptom that commonly occurs on a sector of an infected tree. HLB is a serious citrus disease because it affects all citrus cultivars and causes tree decline. HLB has seriously affected citrus production in a number of countries in Asia, Africa, the Indian subcontinent and the Arabian Peninsula, and was discovered in July 2004 in Brazil. Wherever the disease has appeared, citrus production has been compromised with the loss of millions of trees. HLB has not been reported in Australia or in the Mediterranean Basin. In August 2005, the disease was found in the south Florida region of Homestead and Florida City. Since that time, HLB has been found in commercial and residential sites in all counties with commercial citrus. The bacterium that causes HLB found in Florida is the Asian species which occurs in warm, low-altitude areas and is transmitted by the Asian citrus psyllid (*Diaphorina citri* Kuwayama). The Asian citrus psyllid was discovered in Florida in 1998 and now occurs throughout the state wherever citrus is grown.

The early symptoms of HLB on leaves are vein yellowing and an asymmetrical chlorosis referred to as "blotchy mottle." The blotchy mottle symptom is the most diagnostic symptom of the disease, especially on sweet orange. Leaves may be small and upright with a variety of chlorotic patterns that often resemble mineral deficiencies such as those of zinc, iron, and manganese. Some leaves may be totally devoid of green or with only green islands. The blotchy mottle symptom also may be confused with other diseases or damage such as severe forms of citrus tristeza virus (CTV), Phytophthora root rot, water logging, citrus blight, leafminer tunnels or stubborn, a disease that is not known to be present in Florida. Root systems of infected trees are often poorly developed and new root growth may be suppressed. As mentioned above, early symptoms of yellowing may appear on a single shoot or branch. The yellowing usually spreads throughout the tree over a year, especially on young trees, and affected trees may show twig dieback, causing the

1. This document is PP-225, one of a series of the Plant Pathology Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Date printed: November 2005. Date revised: November 2010. This publication is included in SP-43, 2011 Florida Citrus Pest Management Guide. For a copy of this guide, request information on its purchase at your county extension office. Please visit the EDIS website at http://edis.ifas.ufl.edu.

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productivity to decline within a few years. Fruit are often few in number, small, may be lopsided with a curved central core, and fail to color properly, remaining green at the stylar end. Many fruit drop prematurely from afflicted trees. A yellow stain may be present just beneath the peduncle (stem) on a cut fruit. The affected fruit often contain aborted seeds and have a salty bitter taste.

The causal bacterium, *Ca*. Liberibacter asiaticus has not been cultured and diagnosis is by PCR. Detection of the bacterium is usually only possible from symptomatic tissues. Four different species of *Ca*. Liberibacter exist. There are three species that cause HLB in citrus: *Ca*. L. asiaticus, *Ca*. L. africanus found in Africa and *Ca*. L. americanus discovered in Brazil in 2004. There is also *Ca*. L. africanus sp. capensis that causes a disease in cape chestnut and the most recently discovered, *Ca*. L. psyllauros, is likely responsible for Zebra chip of potato. The host range of the *Ca*. Liberibacter spp. that cause HLB includes all citrus species regardless of rootstock. Normally symptoms are severe on sweet orange, mandarins and mandarin hybrids; moderate on grapefruit, lemon and sour orange. Lime, pummelo and trifoliate orange are listed as more tolerant but this does not mean that the bacterium is unable to infect and multiply in those cultivars. However in south Florida, the symptoms were severe on pummelo, lime and grapefruit.

When psyllids are abundant and conditions are favorable, HLB can spread, destroying existing groves and preventing the commercial production of oranges and other citrus cultivars. Infected mature trees may decline and become non-productive. Young trees that become infected will never come into full production. In China, the disease was reported to kill young trees in 1-2 years. HLB also can be transmitted with infected budwood. Therefore, use of certified disease-free planting materials is essential to minimize further spread.

Recommended Practices

1. HLB is difficult to manage and continued production of citrus has proven difficult and expensive in areas where it is widespread. Since HLB is transmitted by the Asian citrus psyllid, which is well established in Florida, there is clearly a potential for the continued spread of HLB throughout Florida citrus. The use of clean budwood and certified healthy trees is essential. It is now mandatory in Florida that budwood sources and nursery production is carried out under psyllid-proof enclosures and are certified HLB free. Systemic insecticides such as imidacloprid are an important part of psyllid control (see ENY-734 Asian Citrus Psyllid and Citrus Leafminer in this guide). Some biological control of the psyllid is available but the amount of psyllid control provided by introduced parasitoids has been insufficient to slow disease spread.

2. The Asian citrus psyllid feeds on many rutaceous plant species. The psyllid has a preference for the landscape ornamental, orange jessamine (*Murraya paniculata*). It has been found to be a host of *Ca*. Liberibacter spp. and can serve as a potential source of inoculum. Another rutaceous ornamental, *Severinia buxifolia* or orange boxwood, is also a host for the bacterium as well as the psyllid. Movement of these ornamentals is restricted under state compliance agreements and should not be moved from areas where the disease occurs.

3. Scouting for greening infected trees should be done routinely so that infected trees can be removed. It is recommended that scouting be conducted four or more times per year. The frequency of scouting may be higher in areas previously determined to have HLB positive trees. Symptoms are the easiest to find from October to March. However, symptoms may be present at other times of the year. The current methods used to scout are walking, all-terrain vehicles and on vehicle mounted platforms. Symptomatic tree numbers and the rows in which they are found should be marked with colored flagging tape and GPS coordinates taken or the sites marked on a map to facilitate relocation and removal of these trees. In some cases, an HLB PCR diagnostic test may be necessary to confirm the disease (see diagnosis below). Scouting resources are available on the following website: http://www.crec.ifas.ufl.edu/extension/greening/links.htm.

4. Diagnosis of HLB by symptoms alone may be difficult since some nutrient deficiency symptoms and other problems are often confused with some of the symptoms associated with HLB. HLB-affected leaves accumulate starch. An iodine-based starch test can be used to assist in determining what leaves should be sent for PCR diagnosis. The iodine test alone is not used for HLB diagnosis; however, it is a useful indication that the tree likely has HLB. The procedure for the test can be found in UF/IFAS publication HS 1122 An Iodine-Based Starch Test to Assist in Selecting Leaves for HLB Testing (http://edis.ifas.ufl.edu/hs375). Samples of suspected HLB infected trees may be sent for PCR diagnosis to the Southern Gardens Diagnostic Laboratory or to the Southwest Florida REC in Immokalee. The procedures for submission to either lab of suspect samples for PCR testing are available at the following website: http://greening.ifas.ufl.edu.

5. Removal of infected trees is the only way to ensure that they will not serve as a source of the bacteria for psyllid acquisition and subsequent transmission. Prior to removal, the infected tree should be treated with a foliar insecticide (such as Danitol, fenpropathrin) to kill all adult psyllids feeding on that tree. Failure to control these psyllids will result in the infected psyllids dispersing to new plants once the diseased tree is removed. Pruning of symptomatic limbs has been attempted in many countries to reduce the inoculum available to the psyllids. However, because the disease is systemic, pruning has not been successful since other parts of the tree may already be infected but not yet symptomatic. Additionally, since the tree is still infected after pruning, the new flush produced will serve as a feeding site for adult psyllids to acquire *Ca*. Liberibacter spp. The infected psyllids may then disperse to uninfected trees once the new flush hardens off.

6. Integrated pest management strategies should focus on the following: use of disease-free nursery trees, reduction of the inoculum by frequent disease surveys, removal of symptomatic trees, and suppression of Asian citrus psyllid populations through area wide management. Refer to ENY-734, Asian Citrus Psyllid and Citrus Leafminer, in this guide for more information on Asian citrus psyllid management.

Additional Information

Links to websites on HLB and UF/IFAS publications can be accessed through the Citrus Research and Education Center website at the following addresses:

http://greening.ifas.ufl.edu

http://edis.ifas.ufl.edu/CH200

http://edis.ifas.ufl.edu/HS375