Huanglongbing – a nursery industry biosecurity threat

Background

Huanglongbing (HLB), which can be translated as "yellow shoot disease", is a bacterial disease that is lethal to *Citrus* and some other plants in the family Rutaceae. In citrus, HLB causes branch or leaf yellowing (Fig. 1), leaf drop, misshapen fruit, fruit drop and tree decline. HLB is considered to be the most devastating disease of citrus and related ornamentals worldwide. HLB probably originated in China or India [7], and was given its name because of its characteristic symptom, a yellowing of some new shoots in an otherwise green canopy (Fig. 2) [2]. Precise estimates of tree losses due to HLB worldwide are scant, but conservative estimates are in the hundreds of millions of trees. All species and cultivars of citrus are affected, such as orange, grapefruit, mandarin, tangelo, kumquat, lemon, lime, pomelo, trifoliate orange and tangelo, native citrus and orange jasmine (*Murraya* spp.). Trees may die within 5-8 years of infection.

Fig. 1. Asymmetrical leaf chlorosis caused by HLB.

HLB occurs in many parts of the world, including Asia, parts of North, Central and South America, and Africa. Closer to Australia, it is found from Sumatra to Papua, Indonesia, East Timor, Papua New Guinea and the Philippines. HLB and the psyllid insects that transmit it are not known to occur in Australia, but their potential for introduction is acute.

HLB is caused by at least three species of the genus '*Candidatus* Liberibacter', named according to the region from which they have originated, Asia, Africa and South America. All three of these species have very similar behaviour in that they live in the host plant's phloem and impede the movement of nutrients. Collectively they are referred to here as HLB. HLB is vectored by a number of psyllids insects, the main vectors are Asian citrus psyllid (ACP – Fig 4)) and African citrus psyllid.

Dispersal

Long-distance spread can occur by the movement of HLB-infected planting material (plants, budwood, cuttings and rootstocks) of infected hosts. Movement of plant material infested with HLB-infective citrus psyllids may also spread HLB; ACP can survive up to 20-30 days on picked fruits and/or leaves [8]. Most short-distance spread occurs by the insect vectors, the ACP and the African citrus psyllid. Movement of other host plants such as orange jasmine (*Murraya* spp.) and curry leaf (*Bergera koenigii*) also pose a risk of introducing HLB-infestive ACP. Long distance movement of ACP has been documented on wind currents across the American Everglades [9], thus spread from Indonesia and Papua New Guinea to northern Australia is a high risk. Illegally imported host and non-host foliage may also spread HLB infestive psyllids, as indicated by interceptions into California from

outside continental USA [2] and Australian quarantine [1]. Curry leaves are considered high risk for transporting *D. citri* and foliage from various herbs have also been detected with the psyllids, sometimes containing with HLB [2]. Evidence indicates that HLB is not seed transmitted, despite early claims that it might be [1, 4, 10].

The rate at which HLB spreads is significantly influenced by the extent of the inoculum reservoir, local vector populations, the age of host plants when first infected and many environmental factors [7]. In areas where host plants are not managed well (where vectors and infected plants are not controlled) in young plants, 50% or more of plants may become infected in 3-5 years. In older plants, under the same scenario, it may take 5 or more years [7].

Overseas, where HLB and its vectors are both present, HLB is more prevalent at the edges of citrus orchards and along roads, canals, ponds and other geographical features within citrus plantations [7]. This is probably due to the behaviour of citrus psyllids preferring such sites, and therefore increasing the rate of transmission to such trees. However, some psyllids still move into the centre of citrus blocks. For more information on ACP, refer to the nursery factsheet [3].

Host range

All species and cultivars of citrus are affected, such as orange, grapefruit, mandarin, tangelo, kumquat, lemon, lime, pomelo, trifoliate orange and tangelo and native citrus. *Murraya* spp. (Mock orange/orange jasmine) are also good hosts for HLB. Additional hosts include curry leaf, cape chestnut, periwinkle, *Clausena* spp., Indian wood apple, tobacco, tomato, tabog, limeberry and white ironwood.

Symptoms

Symptoms of HLB may not occur for months, or even years, after infection. The first sign of HLB is often the production of a single chlorotic (yellow) shoot that contrasts against an otherwise healthy, green canopy. Infected leaves can show chlorotic mottling, often referred to as 'blotchy mottle', which is considered more indicative of HLB when the mottling is asymmetric about the mid-rib. Veins can become yellow, swollen and/or corky. Leaf symptoms sometimes resemble that of zinc deficiency. Depending on the duration of infection or host age when infected, disease symptoms can be uniform throughout the canopy, send a tree into decline within 12 months, and prevent fruit set Fig 3). Leaves on trees

Fig. 2. Citrus tree showing certain shoots with chlorotic leaves.

[1] http://www.abc.net.au/news/2013-08-14/vic-country-hour-14-july-2013/4886660

[2] www.cdfa.ca.gov/phpps/ar/2009_ar/PHPPS_AR_2009_PE.pdf; http://www.sdcounty.ca.gov/reusable_components/images/awm/Docs/ipd_asian_citrus_psyllid.pdf

[3] http://www.ngia.com.au/Category?Action=View&Category_id=682&Highlight1=fact%20sheet&Highlight2=fact%20sheet or search for 'fact sheets' on the NGIA website.

with these advanced symptoms also tend to be smaller and more upright than those of healthy trees and are yellow with nutrient deficiency symptoms. Severely infected trees may flush out of phase with healthy trees and produce flowers and fruit out of season.

Fruit produced are generally small, lopsided and often fail to lose their green colour or are coloured unevenly at maturity (Fig. 3). Fruit generally only produce small, dark, aborted seeds and have a bitter flavour to the juice. Infected trees also tend to exhibit premature and excessive fruit drop.

Leaf mottling caused by zinc deficiency superficially resembles that caused by HLB. Leaf mottling by zinc deficiency runs along veins, whereas HLB mottling crosses leaf veins. Australian citrus dieback (ACD), also a bacterial disease, causes similar asymmetric leaf mottling to HLB and reduces the size of fruit. However, ACD does not cause fruit deformity and does not cause fruit to become very bitter. In addition, ACD does not cause trees to die [3, 5]. Foliar symptoms of HLB on *Murraya* spp. are similar to that on citrus.

Management overseas

Management of HLB is difficult because trees can not be cured and symptoms do not develop for months or even years after infection [11]. Intensive applications of pesticides during flushing growth combined with use of only approved nursery stock grown free of HLB as well as the aggressive removal of infected trees can reduce the rate of newly infected trees but generally is not sufficient to fully manage HLB and ACP [9].

Fig. 3. Fruit symptoms including aborted seeds and mottled colouration (above) and declining tree (below).

Production nurseries in Florida, where both ACP and HLB are present, generally had very good hygiene, management and very low levels of ACP. Retail nurseries, on the other hand, often were found with ACP and were confirmed as a source of spread of HLB to new areas. The full extent of the spread caused by sales of infected stock then takes years to be fully realised. In such cases, presence of ACP on a tree can be assumed to indicate that HLB is also present [11]. *Murraya* species, which tend to flush more continuously than citrus, must be treated in a similar manner as they also are

susceptible to HLB, and ACP feeding on infected plants can transmit the disease [6, 11]. It has been suggested that, without management of ACP and removal of infected trees, 100% infection will take only about 8 years [2].

Fig. 4. Adult and nymphal ACP feeding on citrus.

There is considerable research into developing ACP- and disease-resistant citrus trees but such varieties are not yet available [9]. Recent research indicates that plant hormone therapy may manage symptoms of HLB [12], but are not yet available. In Florida, nursery producers that wish to grow *Citrus* and *Murraya* species must follow strict guidelines, the most important of which is that stock must be propagated in an approved greenhouse structure including enclosed sides and tops to exclude insects with positive pressure and double door entries. Trees infested with ACP at retail nurseries in Florida are subject to quarantine action [4].

If you see this pest

If you see or suspect that you have HLB contact your local biosecurity organisation or the Exotic Plant Pest Hotline (1800 084 881). Do not move the plant material suspected to be infected with HLB. There is no better way to manage HLB than to keep it out of Australia. Currently there is no management strategy of ACP and HLB that is completely successful.

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[4] The entire report can be found at: <https://www.flrules.org/gateway/ChapterHome.asp?Chapter=5B-62>