



Fig. 1. Sweet orange plant affected by Huanglongbing showing yellow shoot symptoms (a), leaf mottling on grapefruit leaves, a characteristic symptom of Huanglongbing (b), lopsided fruit caused by citrus greening on grapefruit (c). Image supplied by J.M. Bove. INRA, Bordeaux (FR).

Disease: Citrus greening (Huanglongbing)

Classification: K: Bacteria, P: Proteobacteria, C: Alphaproteobacteria, O: Rhizobiales F: Rhizobiaceae

Citrus greening or Huanglongbing (HLB) is considered one of the most destructive diseases in the citrus industry worldwide, and accounts for substantial economic losses in Asia, Africa and America. The causal agents of the disease are *Candidatus Liberibacter* spp., gram-negative bacteria that are limited to the phloem. (*Candidatus* refers to organisms that have not been cultured consistently and *Liberibacter* refers to bacteria in the phloem).

The Pathogen: Currently, three forms of pathogen causing HLB is known: *Candidatus Liberibacter asiaticus* (CLAs) occurring in Asia and the Americas, *Candidatus Liberibacter africanus* documented in Africa (CLaf), and *Candidatus Liberibacter americanus* (CLam) in Brazil. The African form of HLB is transmitted by the African citrus psyllid (*Trioza erytreae*) and usually occurs in cool and moist highland regions. The Asian form, CLas, transmitted by the Asian citrus psyllid or ACP (*Diaphorina citri*), is more heat tolerant. CLas has been observed in the alimentary canal, salivary glands and haemolymph of ACP and can multiply in its vector. Transmission to a previously uninfected tree primarily takes place when infectious adults inject saliva into plant tissue. HLB transmission can also occur by grafting of infected plant materials on to rootstock.

Host Range: All the species in the genus *Citrus* (all types and varieties), as well as other genera in the Rutaceae including two species of *Murraya*, *Calodendrum*, *Fortunella* (Kumquat), *Poncirus*, *Severinia* and *Triphasia*.

Distribution: Citrus greening is widespread in many countries in Asia, America and Africa including but not limited to Bangladesh, Burundi, Cameroun, Central African Republic, Comoros, Ethiopia, Hong Kong, Japan, Kenya, Madagascar, Malawi, Malaysia, Mauritius, Nepal, Pakistan, Reunion, Rwanda, Saudi Arabia, Tanzania, Thailand, Yemen, Brazil and USA.

Impact: Severe damage has been reported by the Asian form of citrus greening in Brazil and Florida. Citrus greening can affect the commercial citrus grove in different ways such as increased mortality rate of the trees and increased production costs. For Florida it has been estimated that the disease decreased the value of citrus output by up to 4.5 billion dollars between 2006-07 and 2010-11.

Detection and control: So far there is no known cure for the disease, although recently heat therapy is mentioned as a possible method to reduce the damage to plants. In managing the disease, the monitoring and control of the vector (Asian citrus psyllid) is extremely important in preventing the spread of the disease to new areas. Coordinated sprays for psyllid control is effective before the population of psyllids reaches a threshold level.

Further Reading: da Graca, J. V., & Korsten, L. (2004). Citrus Huanglongbing: Review, present status and future strategies. In *Diseases of Fruits and Vegetables Volume 1* (pp. 229–245). Springer.

Bové, Joseph M. "Huanglongbing: a destructive, newly-emerging, century-old disease of citrus." *Journal of plant pathology* (2006): 7-37.

Key Contact: Dr Hossein A. Narouei Khandan; e-mail: hakhandan@ufl.edu