

## Economic implications

Citrus greening reduces the quantity and quality of citrus fruit and eventually the infected trees become unproductive. An infected tree produces fruit that is unsuitable for sale as fresh fruit or for juice making.

It is a quarantine pest in the countries where it is not yet present. The spread of this disease within a previously pest-free country can hamper the opportunity of that country to access potential citrus markets which may import only from citrus greening pest-free areas. Citrus greening, therefore, negatively affects access to major international citrus markets, such as the United States of America and the European Union.

## Legislative implications

In terms of the Agricultural Pests Act, 1983 (Act No. 36 of 1983), Control Measures R. 110 of 27 January 1984 (as amended), movement of citrus propagation material from one area to another within the Republic of South Africa is prohibited unless the movement is authorised by means of a permit or the material is certified as pest free. The Department of Agriculture, Forestry and Fisheries renders inspection services and issues permits to ensure compliance with the applicable control measures.

The abovementioned interventions will assist in preventing the further spread of citrus greening.

## Sources of information

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## Need more information?

– to report occurrence or suspected occurrence of the disease –

Directorate: Plant Health  
Division: Early Warning Systems  
Tel: 012 319 6384  
Email: JanHendrikV@daff.gov.za

– for awareness and promotion enquiries –

Directorate: Food Import and Export Standards  
Division: Plant Health Promotion  
Tel: 012 319 6295  
Email: Info.sps@daff.gov.za



'*Candidatus Liberibacter africanus*'  
'*Candidatus Liberibacter asiaticus*'  
'*Candidatus Liberibacter americanus*'

## Description

Citrus greening, also known as yellow dragon disease or Huanglongbing, is one of the most serious bacterial diseases of citrus. There are three known forms of citrus greening causing bacteria, namely the African form ('*Candidatus Liberibacter africanus*'), the Asian form ('*Candidatus Liberibacter asiaticus*') and the American form ('*Candidatus Liberibacter americanus*').

The African form is heat sensitive and symptoms are produced under relatively cool conditions (20–24 °C) while the Asian form develops under both cool and warm temperatures (up to 32 °C). Little is known about temperature requirements of the American form.

## Origin and global distribution

Citrus greening probably originated in China in the 1900s.



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The Asian form ('*Candidatus Liberibacter asiaticus*') is the most severe and geographically widespread. It occurs throughout Asia, the Indian subcontinent and neighbouring islands, the Saudi Arabian peninsula, Brazil, southern Florida, California, Cuba, Mauritius, Reunion and Ethiopia.

The African form ('*Candidatus Liberibacter africanus*') is less severe and is more restricted geographically. It is found in Africa, south of the Sahara.

The American form ('*Candidatus Liberibacter americanus*') is so far known to occur in Brazil, Cuba, Florida, Belize, Mexico and Dominican Republic.

### Symptoms

Citrus plants affected by citrus greening bacteria may not show symptoms for years following infection. Initial symptoms on a tree include the appearance of yellow shoots. As the bacteria move within a tree, the entire canopy progressively develops a yellow colour. The three forms of bacteria produce similar symptoms.

The most characteristic foliar symptoms of citrus greening are blotchy mottling of the leaves and yellowing of leaf veins and shoots. Young leaves may display symptoms that can be misdiagnosed as signs of zinc deficiency. Older leaves take on the mottling charac-

teristic of greening. Other symptoms include twig die-back, poor flowering and stunted growth.

Fruit from diseased trees is small, often abnormal and typically some green colour remains even on ripe fruit. Greening-affected fruit taste bitter, medicinal and sour. Seeds usually abort, and fruit formation is poor. Symptoms vary according to the time of infection, stage of disease, tree species and tree maturity.

### Transmission

This disease is primarily spread by two species of psyllid insect, namely the Asian citrus psyllid (*Diaphorina citri*) and the African citrus psyllid (*Trioza erytreae*). Both species transmit the citrus greening pathogen from infected trees to healthy trees as they feed on the plants. Citrus greening can also be transmitted by grafting infected budwood, by dodder, and, possibly, by infected seed.

### Host range

Citrus greening in South Africa is largely a disease of sweet orange (*Citrus sinensis*), with valencias showing more distinct leaf symptoms than navels. It is also particularly severe on mandarins (*C. reticulata*) and tangelos (*C. sinensis* x *C. reticulata*), but less on lemon (*C. limon*), grapefruit (*C. paradisi*) and sour orange (*C. aurantium*).

However, cultivars such as lime (*C. aurantifolia*), pomelo (*C. grandis*), and trifoliolate orange (*Poncirus trifoliolate*) are tolerant to the disease. In general, most citrus species and their relatives are susceptible.

### Identification methods

The only definitive method of diagnosis on trees suspected to be infected by the citrus greening pathogen (Huanglongbing) is polymerase chain reaction (PCR) in an authorised plant diagnostic laboratory. In South Africa, this can be done by the Department of Agriculture, Forestry and Fisheries' diagnostic laboratories in Stellenbosch.

### Control methods

Control of citrus greening can be achieved through an integrated approach which includes eradicating infected plant material, introducing clean nursery seedlings, adhering to regulatory measures and eliminating insect vectors by means of systemic insecticides (as they are sap feeders).

Treating affected trees with injections of antibiotics alleviates the symptoms, but does not cure the diseased plants. Prompt elimination of diseased trees is strongly advised.



Typical blotchy mottling symptoms of citrus greening on citrus spp



Feeding damage to citrus leaves caused only by the African citrus psyllid, *Trioza erytreae*



Infected orange



Nymph of the Asian citrus psyllid



Adult Asian citrus psyllid



Adult of the African citrus psyllid



Nymph of African citrus psyllid