

## Citrus tristeza disease (250)

### Common Name

Citrus quick decline virus, grapefruit stem pitting; tristeza

### Scientific Name

*Citrus tristeza virus*, *Citrus tristeza closterovirus*. The abbreviation is CTV. The word "tristeza" is from Portuguese meaning "sadness".

### Distribution

Africa, Asia, North, South and Central America, Caribbean, Europe, Oceania. CTV is common in orchards in Southeast Asia, southern Africa, India, Japan, South America, North America (Florida and California), Oceania. It is recorded from Australia, Cook Islands, Fiji, French Polynesia, Niue, Northern Mariana Islands, Papua New Guinea, Samoa, Tonga, and Wallis & Futuna.

### Hosts

Citrus species and hybrids.

### Symptoms & Life Cycle

CTV is spread by aphids; those that are most important are *Toxoptera citricida* (brown citrus aphid), *Toxoptera aurantii* (black citrus aphid), *Aphis gossypii* (cotton or melon aphid) and *Aphis spiraecola* (green citrus aphid). Among the four, the brown citrus aphid is the most efficient, as it can spread strains that cause stem pitting that the others cannot. The aphids acquire the virus as they feed on the sap of infected plants; this takes 30-60 minutes. The ability to transmit is lost within 24-48 hours.

There are many strains; some show no symptoms, while others are extremely serious and result in death. Symptoms are divided into three types: (i) slow and quick decline; and (ii) stem pitting, and (iii) seedling yellows:

- Decline (slow or quick) occurs when scions are budded onto sour orange rootstocks and become infected with certain strains. CTV causes death of the phloem below the graft union so that carbohydrates from the leaves cannot reach the roots, and nutrients and water from the roots cannot reach the leaves. Trees with slow decline show small leaves, yellowing, especially of the veins (Photo 1), leaf fall, twig dieback and small fruit (Photos 2&3); those with quick decline wilt and die in a few weeks. The inside of bark flaps cut at the graft junction may show pits known as 'honeycombing'.
- Stem pitting is also caused by some CTV strains, regardless of the rootstock used. Grooves and pits occur in the wood of the trunk and branches. Gum may be present, too. There are strains that cause stem pitting on grapefruit, sweet orange and lime. Trees with stem pitting grow poorly, fruit is smaller than normal and, consequently, yields are lower.
- Seedling yellows of, e.g., sour orange and lemon occur in the nursery. Leaves become yellow and the branches die back.

Symptoms of CTV become more obvious in the hotter summer months when water needs are greater and cannot be met by poor root systems.

Usually, aphids disperse only a few kilometres, either by flight or on the wind. However, long-distance spread of aphids is possible by tropical storms and cyclones.

Long-distance spread also occurs with the movement of nursery plants infected with CTV, or infested with CTV-infected aphids.

### Impact

CTV is the most economically important disease of citrus worldwide, and responsible for enormous losses. Damage is worse for sweet orange, mandarin and grapefruit when grafted on to sour orange rootstocks. It is estimated that in Brazil and Argentina, 16 million citrus trees on sour orange rootstocks were killed by CTV after the introduction of the citrus brown aphid that spreads the virus. Major epidemics have also occurred in Peru and Venezuela, as well as in California and Florida. Citrus is commonly grafted onto sour orange, and there may be some 200 million trees still vulnerable to CTV worldwide.



Photo 1. Leaf showing vein-clearing symptoms typical of infection from *Citrus tristeza virus*.



Photo 2. Yellowing of leaves, general dieback and decline of orange trees affected by *Citrus tristeza virus*.



Photo 3. Yellow patterns on the leaves and branch dieback on orange caused by *Citrus tristeza virus*.

## Detection & inspection

Bark flaps cut across the graft union show small holes (honeycombing) on the inside face of the bark flap from the rootstock side of the union. Quick decline trees may only have a yellow-brown stain at the bud union, without honeycombing.

There are three methods of detection used:

- Biological indicator. Buds are taken from diseased trees and grafted onto Mexican lime (West Indian lime) used as an indicator plant. The test can take up to 15 months for results to be seen, but usually symptoms occur within 2-6 months.
- ELISA - enzyme linked immunosorbant assay. Antisera is available that detects most strains that cause decline on sour orange, and also strains that cause stem-pitting.
- PCR - polymerase chain reaction. Useful for stem-pitting strains.

## Management

### QUARANTINE

There are many strains of CTV and they are not found in all countries; this is particularly so for stem-pitting strains. Therefore, it is important that introductions of citrus follow the *FAO/IBPGR Technical Guidelines for the Safe Movement of Citrus Germplasm* ([http://www.bioversityinternational.org/uploads/tx\\_news/FAO\\_IBPGR\\_technical\\_guidelines\\_for\\_the\\_safe\\_movement\\_of\\_citrus\\_germplasm\\_501.pdf](http://www.bioversityinternational.org/uploads/tx_news/FAO_IBPGR_technical_guidelines_for_the_safe_movement_of_citrus_germplasm_501.pdf)). Where possible, introductions should be made as seed and, if vegetative natural is needed, it should be treated to remove possible virus infections, and then tested to make sure the treatments have been successful.

Certification schemes are used to control CTV. Nurseries, whether private or public, provide plants that have been established from budwood-source trees that have been screened for viruses, and grafted onto tolerant rootstocks.

### CULTURAL METHODS

- Use only certified, virus-free budwood, grafted onto resistant rootstocks. Contact your agricultural extension agent for information on certification schemes in your country.
- Replace individual diseased trees (or the entire blocks) if they have reached uneconomical levels with certified trees on tolerant rootstocks. Once trees on sour orange rootstocks have become infected by CTV there is nothing to be done to reverse the symptoms.

### RESISTANT VARIETIES

Only trees on sour orange rootstock are affected by tristeza decline. Sweet orange is usually more affected than grapefruit, whereas lemons on sour orange rootstock are not affected by tristeza decline.

*Poncirus trifoliata* (trifoliolate orange) is commonly used as a rootstock for citrus decline. Other CTV-tolerant root stocks are Rangpur lime, rough lemon and sweet orange. However, CTV is not the only consideration; there are other important diseases and environmental conditions that influence the choice of rootstock. For instance, if *Phytophthora citrophthora* is a concern, trifoliata would be a good choice, but Rangpur lime, rough lemon, and sweet orange are susceptible. In addition, trifoliata has poor tolerance to salt, highly acid and alkaline soils and to drought.

As for scions, tangerines are generally tolerant of stem-pitting strains, and so are most varieties of mandarin, including Satsuma. However, there are severe strains that cause stem pitting, stunting, poor quality fruit, even on tolerant rootstocks. There are no CTV-tolerant limes.

### CHEMICAL CONTROL

Chemical control of aphids is not likely to stop the spread of CTV; this is because spread of the virus is fast, and occurs before the insecticide kills the aphid. However, chemical control of aphids may be beneficial in nurseries, and also to protect trees used as sources of budwood. (**See Fact Sheet no. 38** - Melon aphid, for recommendations).

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Information from CABI (2015) Citrus tristeza virus (grapefruit stem pitting). Crop Protection Compendium. (<https://www.cabi.org/cpc/datasheet/16705>); and Barkley P, et al. (undated) Citrus tristeza virus. Department of Employment, Economic Development and Innovation. Biosecurity Queensland. ([https://www.daf.qld.gov.au/\\_data/assets/pdf\\_file/0019/71830/Citrus-Citrus-tristeza.pdf](https://www.daf.qld.gov.au/_data/assets/pdf_file/0019/71830/Citrus-Citrus-tristeza.pdf)); and from Citrus diseases of tristeza. USDA, University of Florida. (<https://idtools.org/id/citrus/diseases/factsheet.php?name=Tristeza>). Photo 1 Richard Davis, Plant Pathologist, Northern Australia Quarantine Strategy, Department of Agriculture, Water and the Environment, Queensland, Australia.

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