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# Citrus Tristeza Virus

- **Citrus Tristeza Virus (CTV)** causes economically the most damaging disease of Citrus.
- CTV is a phloem-limited virus whose natural host range is restricted to citrus and other related species.

- During the 19th century, *Phytophthora* root rot caused destruction of sweet orange trees. As a result of this, *Phytophthora*-tolerant sour orange rootstock was adopted by farmers.
- From 1890, area under citrus cultivation increased and citrus plants were supplied from CTV affected areas to CTV-free areas.

# Taxonomy

**Family:** Closteroviridae

**Genus:** Closterovirus

**Species:** Citrus Tristeza virus

# Losses caused by CTV

- Severe decline of millions of citrus trees occurred due to CTV epidemics in areas where the sour orange (*Citrus aurantium*) was used as a rootstock.
- In 1930, Argentina had 19 million trees on sour orange rootstock. After 15 years, 10 million productive trees were lost.
- In Brazil, over a period of 12 years, the disease destroyed more than 6 million trees.
- California lost about 3 million trees. Similarly, in Florida, thousands of trees became unproductive.
- In Spain, about 10 million trees were destroyed.

# Symptoms

- **There are three distinct syndromes of CTV infection:**
- Quick decline, stem pitting and seedling yellows.
- The most notorious is quick decline (QD) which is associated with the name Tristeza.
- Stem pitting causes economic losses in many countries of the world.
- Seedling yellow is usually observed by biological indexing but in rare cases in the field.

# Symptoms...

- **Stem Pitting (SP)**
- Stem pitting symptom results from interference with growth of the stem.
- The cambium divides and differentiates in healthy areas producing new xylem on the inward side and new phloem towards bark side leading to increased girth of the tree trunk.
- Stem pits develop in areas where growth is restricted. The surrounding areas grow normally leaving the disrupted areas as pits.

# Symptoms

- Poor growth of trees is observed which are affected with severe stem pitting.
- The flow of photosynthetic products and water and nutrients is hampered.
- If bark from the trunk is removed, deep and elongated pits can be observed in the wood.
- If symptoms become severe, trunks show a rope like appearance.
- Stunting of severely affected trees occur yielding poor quality fruit.



# Stem Pitting



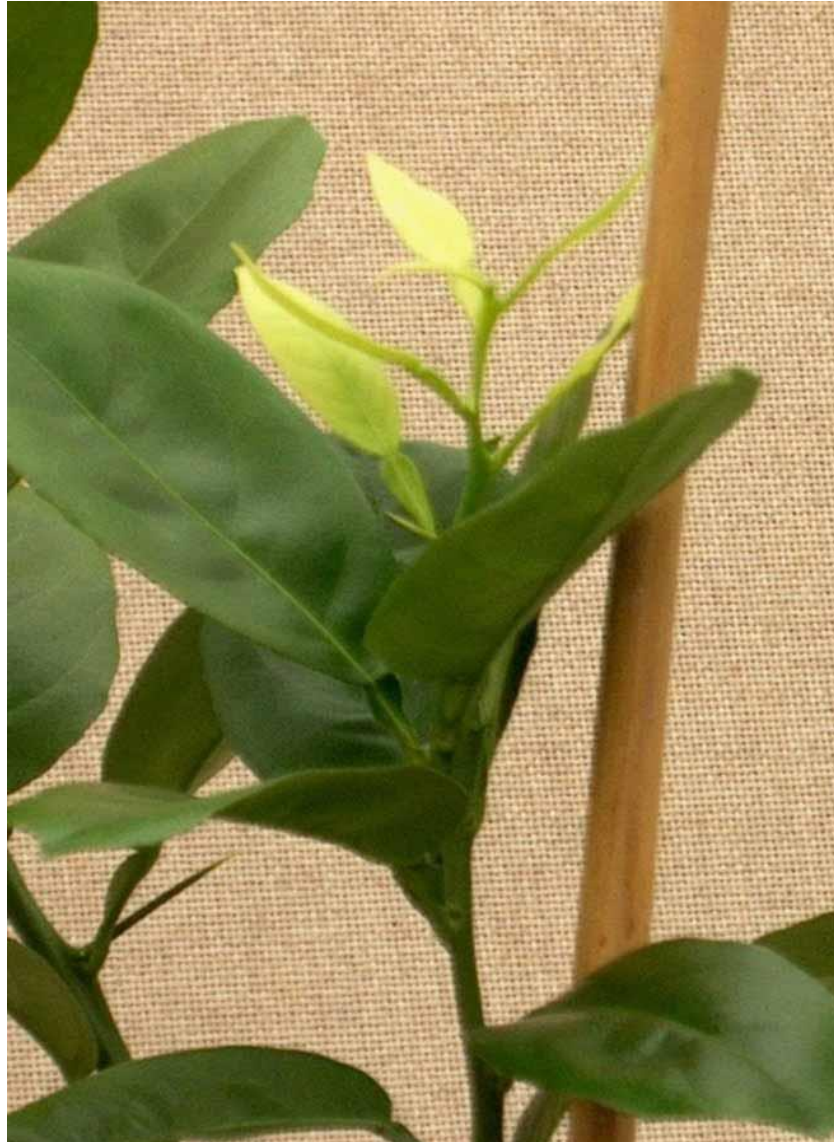
# Stem Pitting



# Seedling Yellows (SY)

- In case of mild seedling yellow symptoms, slight yellowing of new leaves occurs.
- Severe SY results in production of very small new leaves.
- These leaves become much chlorotic and the plants stop their growth.

# Seedling Yellow (leaf symptoms)



# Decline

- Decline is the most devastating disease caused by CTV.
- The infected trees show defoliation, root decay, stunted growth and twig dieback.
- Death of declined tree occurs showing fruiting on tree but with no leaves.

# Leaf Clearing Symptoms Caused by CTV



# Branch Dieback caused by CTV



# CTV Symptoms (Decline)





# CTV Symptoms (Decline)



# Transmission

- Dispersal of CTV occurs by propagation of virus-infected buds and through vector transmission.
- Virus-infected buds are responsible for most CTV introductions into new areas.
- Vector transmission is important for local spread.
- The virus has been also been experimentally transmitted to healthy plants by dodder (*Cuscuta subinclusa*).
- **The most efficient vector species:**
  - *Toxoptera citricida*
  - *Aphis gossypii* (Glover)

# Movement in Citrus Host

- Systemic movement is thought to involve two distinct processes:
- **Cell-to-cell movement** which allows the virus to transverse the cell wall between adjacent cells.
- **Long-distance movement** that allows the virus to enter the sieve elements from an adjacent cell.
- Specific virus-encoded movement proteins as well as some host proteins are utilized by most viruses facilitating their translocation through plasmodesmata channels.

# Disease Cycle

- The aphid acquires the virus after feeding on infected plants for 5-60 minutes and can transmit virus to healthy plant.
- CTV is considered to be graft-transmitted but seed transmission has not been reported.
- Mild strains of virus don't produce noticeable symptoms while others are severe causing decline and death of the tree.

# Factors Favouring

- Composition of the aphid fauna, aphid population density and environmental conditions favouring new flush determine the rate of spread of virus.
- In locations where *A. gossypii* was predominant, CTV incidence increased from 5 to 95% infected trees in 8–15 years.
- In areas where *T. citricida* was predominant, the disease assumed alarming position in only 2–4 years with a rapid increase.

# Management

- **1. Quarantine:**
- Quarantine schemes need to be adopted.
- **2. Cultural methods:**
- Use only certified, virus-free bud wood, grafted onto resistant rootstocks.
- In Pakistan, *Citrus jambhiri* (Jatti khatti) is resistant root stock.
- Replace individual diseased trees or the entire blocks if they have become unproductive with certified trees on tolerant rootstocks.
- **3. Vector control:**
- Insecticidal spray should be done to control aphids in nurseries and on trees to be used as sources of bud wood.

# \*Sources

- 1. Recommended books.
  - 2. Latest research articles downloaded from Google.
  - 3. Google images.
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- \*Solely for academic purpose and guidance of students.