Post-freeze Status of *Citrus psorosis virus* in Texas

Mani Skaria, Hongqin Miao, and Esiquiel Avila

ABSTRACT. The spread of psorosis disease of citrus in orchards planted with nucellar, virus-free trees has been reported in Texas. In addition, more recent observations of psorosis symptoms in virus-free, Rio Red grapefruit trees suggest a possible natural transmission of this virus in Texas. It is our hypothesis that had it not been for the four tree-killing freezes in the past 50 yr, the psorosis incidence in Texas would have been higher.

Psorosis disease of citrus has been known for the past 105 yr (7) and its viral etiology for 69 yr (2). The term "psorosis" has been used to describe several graft-transmissible diseases that produce leaf flecking of indicator plants; however, some have been characterized as different viruses. It is the oldest citrus virus known, and historically led to the establishment of virus-free budwood programs in many citrus-producing areas. The disease is presumed to be caused by *Citrus psorosis virus* (CPsV), with the genus name *Ophiovirus* (4). The disease produces characteristic bark scaling that is different from that caused by fungus *Phytophthora* or Rio Grande gummosis diseases. Moreover, this disease may cause ringspots on leaves and fruit; however, many trees may grow in the field as symptomless carriers.

Reports from Argentina (1) and Texas (6) on the increase in the incidence of psorosis symptoms suggest a possible natural transmission of this virus. Specifically, in Texas, Timmer and Garnsey (6) showed that the incidence of psorosis symptoms in nucellar, virus-free orchards increased from 0-11 trees over a period of 7 yr (1971-78). The percentage of psorosis increased from 0.7 to 2.0 in five orchards totaling approximately 3,400 trees. Vector transmission of psorosis has been suspected but not yet confirmed.

The Texas citrus industry in the Lower Rio Grande Valley dates back to the fruiting season of 1919-20 with a production of 12,000 boxes of fruit. The area and fruit production continued to increase; however, between January 1951 and December 1989, four tree-killing freezes occurred in Texas. These freezes had crippled the area to as low as 4,800 ha, but production has always been re-established. The current area under citrus is approximately 12,800 ha, with 70% grapefruit and 30% oranges. Among the three or four grapefruit cultivars, Rio Red is planted in over 70% of the area.

The killing of so many trees probably helped to reduce the incidence of citrus trees with prososis symptoms in commercial orchards. In addition, the development and commercial success of a new (psorosis-free) grapefruit cultivar, Rio Red, through a mutation breeding, probably also helped to reduce its overall impact in Texas. However, in the past 6 yr we have observed field symptoms of psorosis in new, post-1989 trees, old trees pruned after the 1983 freeze, dooryard trees planted post 1983, and nucellar trees. Psorosis symptoms have been observed in Rio Red orchards that originated from a single source of psorosis-free trees, implying possible natural transmission. In a recent survey for citrus root weevil (*Diaprepes abbreviatus*) and fungus *Phytophthora* distribution in orchards, we have observed psorosis incidence up to 13.6% in a mixed planting of two old line grapefruit cultivars and a navel orange. In

another orchard that had *D. abbreviatus, Phytophthora*, and poor soil conditions, despite low psorosis incidence, the trees exhibited a compounding effect.

The incidence of psorosis in nucellar trees and in originally virus-free Rio Red grapefruit trees in Texas suggests that there may be natural transmission of the virus, supporting the earlier observation (6). Another *Ophiovirus*, *Tulip mild mottle mosaic virus*, is reported to be transmitted through the soil (5), and a third, *Mirafiori lettuce virus*, has recently been shown to be vectored by the soil-inhabiting fungus, *Olpidium brassicae* (3). We believe that the incidence of psorosis in Texas would have been higher had it not been for the tree killing freezes. A new virus-free program will help reduce graft-transmissible psorosis incidence, but investigations into the possibility of transmission in the field should be intensified.

LITERATURE CITED

1. Beñatena, H. N. and M. M. Portillo
   1984. Natural spread of psorosis in sweet orange seedlings. In: *Proc. 9th Conf. IOCV*, 159-164. IOCV, Riverside, CA.
2. Fawcett, H. S.
   1933. New symptoms of psorosis indicating a virus disease of citrus. Phytopathology 23: 930 (Abstr.).
3. Lot, H., R. N. Campbell, S. Souche, R. G. Milne, and P. Roggero
   2002. Transmission by *Olpidium brassicae* of *Mirafiori lettuce virus* and *Lettuce big-vein virus*, and their roles in lettuce big-vein etiology. Phytopathology 92: 288-293.
4. Milne, R. G., K. Djelouah, M. L. Garcia, E. Dal Bó, and O. Grau
   1996. Structure of citrus-ringspot psorosis-associated virus particles: implication for diagnosis and taxonomy. In: *Proc. 13th Conf. IOCV*, 189-197. IOCV, Riverside, CA.
5. Morikawa, T., Y. Nomura, T. Yamamoto, and T. Natsuaki
   1995. Partial characterization of virus-like particles associated with tulip mild mottle mosaic. Ann. Phytopathol. Soc. Jap. 61: 578-581.
6. Timmer, L. W. and S. M. Garnsey
   1980. Natural spread of citrus ringspot virus in Texas and its association with psorosis-like diseases in Florida and Texas. In: *Proc. 8th Conf. IOCV*, 167-173. IOCV, Riverside, CA.
7. Swingle, W. T. and H. J. Webber
   1896. The principle diseases of citrus fruits in Florida. U.S. Dept. Agric. Div. Veg. Physiol. Pathol. Bull. 8: 42 pp.