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## Narrow Leaf, a Previously Undescribed Virus Effect on Citrus

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A DISEASE, referred to as narrow leaf, discovered in 1967 among Tarocco sweet orange trees in a nursery in Sardinia (Italy) is characterized by a form of leaf-narrowing quite different from that found in any previously described citrus virus disease. Affected leaves are lobate, asymmetrical, curled, sometimes crinkled and twisted, thick, and very leathery (Fig. 1). In some cases they are so narrowed that they are reduced to the midrib and small parts of perinervial tissue. Symptoms are most pronounced in spring. Preliminary results of experiments to determine the transmissibility and identity of the causal agent are reported herein.

Narrow leaf has been found only in some nursery plants of Tarocco sweet orange. Many citrus trees in addition to Tarocco orange have been examined in all citrus-growing regions in Sardinia, but there is no evidence indicating that the disease occurs in other citrus varieties or species.

### *Experimental Work*

Transmission trials by chip budding from affected Tarocco orange trees to 2-year-old Tarocco, Hamlin, and Koethen orange and to sour orange seedlings were undertaken in spring 1968. A high percentage of the inoculated seedlings developed typical symptoms of the dis-

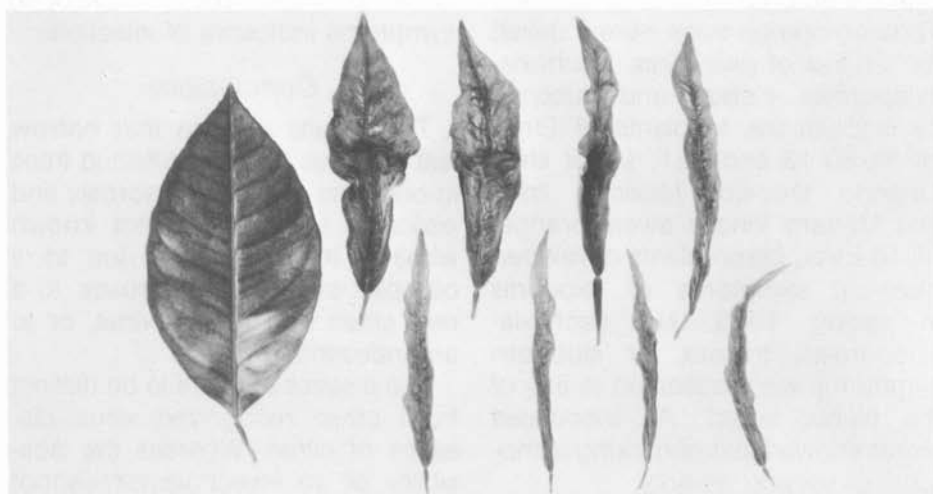


FIGURE 1. *Right.* Leaves of Tarocco sweet orange affected by narrow leaf. *Left.* Healthy leaf.

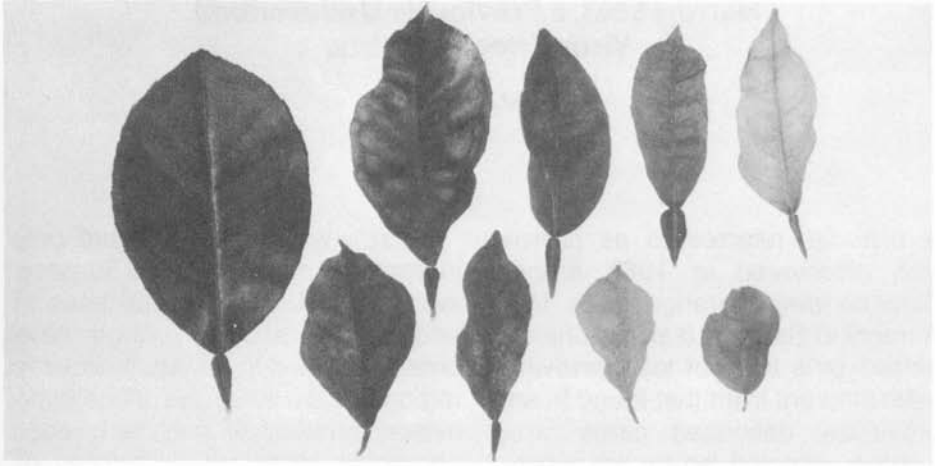


FIGURE 2. Right. Leaves of inoculated Hamlin sweet orange seedlings with typical reaction to narrow leaf. Left. Healthy control.

ease (Fig. 2). Transmission was obtained in all cases in which tissue grafting was successful. Time for appearance of symptoms generally varied from 20 to 30 days, but in some cases it was as long as 7 weeks. The inoculated seedlings also showed young-leaf symptoms of psorosis.

In the autumn of 1968, 2 affected Tarocco orange trees were indexed for viruses of exocortis, cachexia-xyloporosis, tristeza, and stubborn by inoculations to plants of Etrog citron 60-13 and 861, sweet lime, Orlando tangelo, Mexican lime, and Madam Vinous sweet orange. All 10 Etrog citron plants developed clear-cut symptoms of exocortis in spring 1969. No cachexia-xyloporosis, tristeza, or stubborn symptoms were observed in any of the plants tested. All inoculated plants showed leaf-narrowing symptoms of varying severity.

Considerable efforts have been made, starting in April 1969, to

transmit the causal agent of narrow leaf by mechanical means to the following herbaceous plants: *Chenopodium album* L., *C. amaranticolor* Coste and Reyn., *C. quinoa* Willd., *Nicotiana tabacum* L., *N. glutinosa* L., *Gomphrena globosa* L., *Cucumis sativus* L., *Zinnia elegans* Jacq., and *Petunia* spp. None of these plants developed symptoms indicative of infection.

### Conclusions

The results indicate that narrow leaf is a virus disease. Affected trees in our tests also carry psorosis and exocortis viruses. It is not known whether the disease is due to a complex of 2 or more viruses, to a new strain of a known virus, or to an undescribed virus.

The disease appears to be distinct from other recognized virus diseases of citrus. Whereas the possibility of an insect vector cannot be excluded, it seems the disease is transmitted mainly by grafting.