Psorosis Transmission Through Seeds of Trifoliate Orange

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Psorosis has been spreading in citrus plantings of the Salto area, Uruguay, in a way other than the use of infected budwood. Psorosis bark scaling is widespread and trunk lesions are found in trees of most plantings over 10 years old. In some Valencia orange plantings about 25 years old, up to 50 per cent of the trees are diseased. Death of entire branches affected by bark scaling frequently occurs. Young trees are sometimes diseased and some instances of severe scaling and gumming were seen in six-year-old navel orange trees.

Frequently, outstanding Valencia orange trees that began developing psorosis lesions after reaching 30 years of age had vegetatively-propagated daughter trees that became diseased at a much younger age. Varieties found diseased are Valencia, Washington navel, Hamlin and common seedy oranges and Thompson and Marsh seedless grapefruits. Trees of several mandarin varieties show leaf symptoms of psorosis but rarely have any bark scaling.

The widespread occurrence of psorosis in practically all clones of commercial varieties is believed to result from the propagation of a few psorosis-infected trees that survived destruction caused by tristeza virus around 1940 (Tucci *et al.*, 1965). Nucellar clones of some valuable varieties were introduced into the country from various sources and other clones were produced and selected locally. Leaf symptoms of psorosis were soon observed in many nucellar-line trees carefully propagated from the original budwood, suggesting the possibility that the virus was being spread in some unusual way. All infected trees were on trifoliate orange, practically the only rootstock used in the country.

This paper reports the results of a number of trials conducted at the Salto Citrus Experiment Station to elucidate the means of spread of psorosis virus in the area.

MATERIALS AND METHODS

Investigations on the spread of psorosis virus began in 1973 with a series of examinations of young leaves of original nucellar seedling orange trees and of propagations from these mother trees. The mother trees were located at the Citrus Experiment Station in Salto, "Las Brujas" Experiment Station in Montevideo, and the Faculty of Agronomy in Salto.

Mechanical, insect, and seed transmission attempts, using the local common sweet orange as an indicator plant were conducted at the Salto Citrus Experiment Station beginning in 1974. Mechanical transmission was attempted by the techniques of Garnsey and Jones (1967) and Grant and Corbett (1961). Insect transmission trials were conducted in the field and screenhouse using aphids and other common insects. Insects were collected from trees showing severe bark scaling and transferred to young sweet orange seedlings in individual cages.

For the seed transmission experiment, seeds of trifoliate orange were collected from a large fruiting rootstock sprout growing from a 20-year-old Hamlin orange tree severely affected by scaly bark psorosis. Trifoliate orange seedlings about 10 cm high were approach grafted to healthy sweet orange seedlings of the same size. The trifoliate scions of these paired seedlings were decapitated, leaving the sweet orange scions with roots of both seedlings. The test plants were inspected periodically for psorosis leaf symptoms.

RESULTS

Field observations. Psorosis symptoms were found in young leaves of about 20 per cent of the nucellar budline mother trees grown from budwood introduced from Corsica, France; Sao Paulo, Brazil; and Concordia, Argentina. All infected trees were on trifoliate orange rootstock.

Unbudded nucellar seedlings of various sweet orange varieties at the Faculty of Agronomy in Salto were healthy. However, propagations from these seedlings on trifoliate orange and Florida rough lemon rootstocks in a commercial orchard resulted in trees with a high percentage of infection. In a large nursery of orange varieties on trifoliate orange rootstock, 10 per cent of the young plants had psorosis leaf symptoms.

Transmission experiments. Ten months after the start of the seed transmission test, one per cent of the grafted seedlings showed typical psorosis leaf symptoms. The experiment included 200 paired test plants and 100 control plants, 50 sweet orange seedlings and 50 sweet orange/psorosis-free trifoliate orange. None of the control plants developed symptoms. Budwood from the young plants showing psorosis leaf symptoms transmitted psorosis virus to healthy sweet orange seedlings. The mechanical and insect transmission experiments were all negative one year after the beginning of the work.

DISCUSSION AND CONCLUSIONS

Experimental evidence was obtained that the psorosis virus passes through the seeds of trifoliate orange. Instances of seed transmission of citrus viruses are rare. Wallace (1957) mentioned two cases of transmission of crinkly-leaf virus through lemon seeds. Salibe and Moreira (1965) reported the occurrence of exocortis virus in noninoculated seedlings of Baianinha navel orange. Bridges *et al.* (1965) and Childs and Johnson (1966) reported transmission of psorosis virus through the seeds of Carrizo citrange at levels of 15 to 31 per cent. Pujol (1966*b*) reported transmission of psorosis virus through seeds of Troyer citrange. To these reports we now add psorosis transmission through seeds of trifoliate orange at levels ranging from 1 to 10 per cent. It is also possible that psorosis virus passes through the seeds of Florida rough lemon.

Natural spread of psorosis virus by an insect vector has been suspected by Pujol (1966*a*) and Pujol and Benatena (1965) in Argentina and by Passos *et al.* (1974) in Brazil but their evidence is not conclusive. The results of our work do not eliminate the possibility that an insect vector of psorosis virus occurs in the Salto area; however, we found no evidence to support this theory.

Additional studies may prove that psorosis virus can pass through the seeds of other citrus varieties. This possibility and our results emphasize the need for healthy certified mother trees for citrus rootstocks. A program of indexing and certification of psorosis-free trifoliate orange mother trees has been initiated in Uruguay.

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