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***A Virus-Like Disorder of Malvasio Tangerine on
Rough Lemon Rootstock***

THE MALVASIO TANGERINE is probably a hybrid between *Citrus reticulata* Blanco and *C. sinensis* Osbeck. It was selected as a late variety by the Concordia Experiment Station in a citrus plantation belonging to a grower whose name was then given to the variety. A characteristic of the variety is a tendency to show foliar symptoms of mineral deficiency, especially zinc; such symptoms may be very strong in isolated twigs scattered over the treetop even when other varieties do not show them.

In the fall of 1960, 70 rough lemon seedlings in a nursery were grafted with buds from a tree of Malvasio tangerine that had grown on a rough lemon (*C. jambhiri* Lushington) rootstock and 70 additional seedlings were grafted with buds from a Malvasio tangerine tree on trifoliolate orange [*Poncirus trifoliata* (L.) Raf.] rootstock. The parent trees were vigorous and appeared to be healthy except for the deficiency symptoms previously mentioned. During the fall of 1961, 20 per cent of the grafted trees in the nursery appeared to be healthy with no deficiency symptoms, 30 per cent were normally developed except that they showed deficiency symptoms, and the remaining 50 per cent were stunted, some being only 20 cm high, and had moderate to severe deficiency symptoms. The stunted trees had a constriction immediately above the bud-union on the cambial zone with stem-pitting symptoms and gum discoloration and were easily broken at this point. The main roots of these trees had a tendency to penetrate vertically into the soil and to have very few fine roots (Fig. 1).

In the fall of 1962, additional inoculations were made to determine whether or not the disorder is infectious. Twenty rough lemon seedlings were inoculated in each of the following 8 groups, except only ten seed-

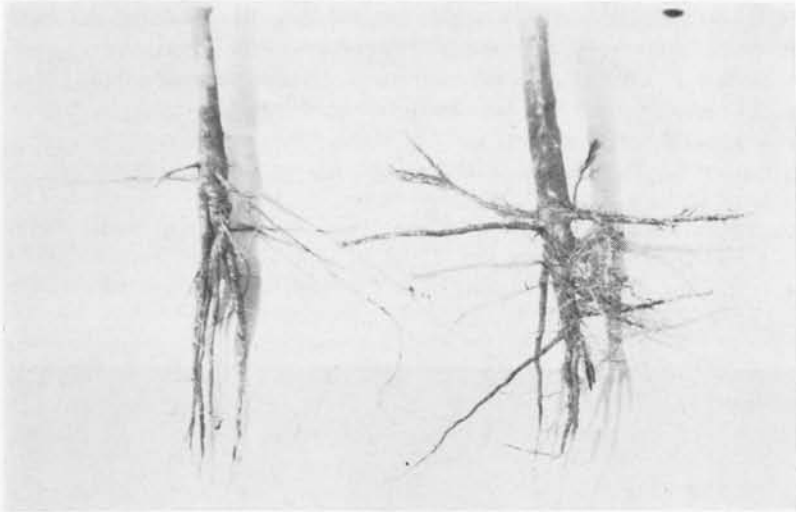


FIGURE 1. Roots of nursery trees of *Malvasio tangerine* on rough lemon rootstock. Left: Affected by a virus-like disorder, showing deposition of gum at the bud-union, lack of lateral roots, and very few fine roots; the foliage of this tree had symptoms of nutrient deficiency. Right: Apparently healthy.

lings were used in groups 6, 7, and 8. The symptoms described are those that were present a year after inoculation.

Group 1.—Buds were taken from the original parent trees. Only 11 plants were obtained and 5 of these had deficiency symptoms; the other 9 plants broke at the bud-union.

Group 2.—Buds were obtained from the diseased plants in the nursery row. Four plants broke at the bud-union and 6 had deficiency symptoms.

Group 3.—Buds were from a *Malvasio tangerine* seedling. Twenty normal plants of good development, without deficiency symptoms, were obtained.

Group 4.—Buds from *Malvasio tangerine* seedlings were grafted to rough lemon seedlings and 15 days later the seedlings were inoculated by grafting with a piece of bark from a diseased tree in the nursery row. Twenty plants were obtained, all of which were stunted; eight plants had deficiency symptoms.

Group 5.—Buds were taken from a *Malvasio tangerine* tree grown on Rangpur lime (*C. limonia* Osbeck) rootstock. Only 13 of the buds developed into trees. Two of them appeared to be normal, seven had deficiency symptoms, and four were stunted, being less than 30 cm high.

Group 6.—Buds taken from a sweet orange seedling were grafted into rough lemon seedlings and then a piece of bark from a diseased

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Malvasio tangerine tree was also grafted into the seedling. All buds developed into trees and none had symptoms of the disorder.

Group 7.—Buds were taken from a Messina lemon seedling and bark from a diseased Malvasio tangerine seedling. The lemon buds grew into trees that were stunted and had small chlorotic leaves.

Group 8.—Buds taken from a Marsh grapefruit seedling and pieces of bark from a diseased Malvasio tangerine seedling were used. The grapefruit buds grew into trees that were stunted, with small leaves that had deficiency symptoms. Lines of gum discoloration coinciding with the line of the inoculating bark appeared in the wood underneath the bark.



FIGURE 2. Fully developed leaves of Marsh grapefruit on rough lemon after inoculation with the disorder found in Malvasio tangerine.

Discussion

The experiments reported in this paper demonstrate that Malvasio tangerine, Messina lemon, and Marsh grapefruit are affected by a disorder that is transmissible by grafting. They suggest that the disorder is caused by a virus distinct from the viruses of psorosis, exocortis, and xyloporosis, and that the causal virus is not transmitted through seed. The extent to which the virus of tristeza, which is generally present in trees in Argentina, contributes to the disorder has not been determined.