GERALD G. NORMAN

The Incidence of Exocortis Virus in Florida Citrus Varieties

In 1955, the Florida Citrus Budwood Registration Program began testing 620 mature trees of 27 different citrus varieties for presence of exocortis virus. The trifoliate orange [*Poncirus trifoliata* (L.) Raf.] served as an index plant for 566 of these trees and the Morton citrange [*Citrus sinensis* (L.) Osbeck x *P. trifoliata*] as an index plant for 54 of them. The incidence of exocortis virus in the mature field trees as revealed by the response of the index plants and the incidence and degree of stunting of the index plants themselves are herein reported.

Source of Mature Trees

The trees were submitted by citrus growers as candidates for registration, with the exception of 39 mature seedling line trees selected by the State Division of Plant Industry. The trees tested are located in widely separated plantings throughout the citrus area of Florida and represent the entire range of commercial scion varieties, including sweet orange (*C. sinensis*), grapefruit (*C. paradisi* Macf.), mandarin (*C. reticulata* Blanco), tangelo (*C. paradisi* x *C. reticulata*), and lime (*C. latifolia* Tanaka).

Over 99 per cent of the trees tested were growing on rootstocks tolerant of exocortis virus and thus would not have displayed symptoms of exocortis even when they were infected with the virus. Standard rootstock varieties such as Florida rough lemon (*C. jambhiri* Lushington), sour orange (*C. aurantium* L.), and Cleopatra mandarin [*C. reshni* (Engl.) Hort. ex Tanaka], from both budded and seedling sources were also included in the tests. Budwood from the mature trees was col-

lected by field inspectors and mailed to centrally located testing facilities in Winter Haven.

Method of Indexing

The candidate trees were first indexed on seedlings of Key lime [*C. aurantifolia* (Christm.) Swing.] to determine the presence or absence of tristeza virus. When they had thus been shown to be free from tristeza virus, tests were started for psorosis, xyloporosis, and exocortis viruses.

In the tests for exocortis virus, trifoliate orange and Morton citrange seedlings were lined out two feet apart in rows which were four feet apart. Two or more buds from the same candidate tree were placed in each of the two test plants. When the buds sprouted, they were allowed to grow into a top; the shoots of trifoliate orange that developed were removed. The budded test trees received a balanced fertilizer at six-week intervals from early March to September. Cultivation and irrigation were provided as needed. The test trees were pruned semiannually to permit entry of equipment between the rows.

The Morton citrange seedlings were from a single clonal source. The trifoliate orange seedlings were from a small area where a single clone of large flowered-type has escaped cultivation. The rootstocks in both cases are therefore believed to be genetically uniform.

Results

Virus incidence.—Fifty-five per cent of all the trees tested were infected with exocortis virus. Symptoms of scaling and shelling of the bark generally appear in trifoliate orange or Morton citrange seedlings in from three to six years after budding; 11 per cent of the index trees showed no symptoms, however, until seven or more years after budding and four showed no symptoms until eight years after budding. Sixty-three per cent of all mature trees tested were infected with xyloporosis virus. Twenty-eight trees, or 4.6 per cent, were infected with psorosis virus, and 57 per cent of the 28 trees infected with psorosis virus were also infected with xyloporosis virus.

Stunting in index trees.—Degrees of stunting were classified as follows:

After 8½ years of growth, trees measuring less than one inch in diameter above the union were classed as severely stunted. Trees measuring 1-2 inches in diameter above the union were classed as moderately stunted. Trees 2-4 inches in diameter were classed as normal. Trees more than 4 inches in diameter were classed as vigorous.

By this classification, 34 per cent of all the trees on trifoliate orange index plants were severely stunted, 46 per cent were moderately stunted, 18 per cent were normal, and 2 per cent were vigorous.

Many of the severely stunted trees had no bark shelling and scaling symptoms of exocortis even though moderately stunted or normal-sized companion trees budded from the same source exhibited conspicuous shelling and scaling. Presence of psorosis virus or xyloporosis virus, or both, appears to have had no influence on the time necessary for shelling and scaling to develop on the trifoliate orange or Morton citrange, or on the degree or severity of such shelling and scaling, or on the degree of stunting of the index trees. There also appeared to be no relationship between the location of buds in the index seedlings and the symptoms produced; some buds were inserted in the seedlings at ground level and others as high as 16 inches above the ground.

In some cases, both test trees were uniformly stunted, either severely or moderately. In other cases, one tree was severely stunted but had no scaling and the other tree was moderately stunted or normal and developed the scaling (Fig. 1).

About three years after the tests were started, periodic measurements of the diameter of the test trees above and below the union and of the height of each tree were discontinued when it was found that the severely stunted trees did not increase further in growth and that the degree

FIGURE 1. *Variability in vigor of the same strain of nucellar Valencia sweet orange on trifoliate orange seedling rootstock ten years after budding. The two trees were propagated with buds from the same tree.*

of stunting fell into several well-defined categories, as described above.

There are some exceptions to the foregoing in that all the Florida rough lemon sources, whether seedling or old-line, budded into trifoliate orange were severely stunted whereas all sour orange sources budded into trifoliate orange index plants were extremely vigorous. The Temple orange (*C. reticulata* x *C. sinensis*) sources also seemed to be predominantly stunted when grown on trifoliate orange rootstock.

Whatever it is that induced stunting on trifoliate orange rootstock seems to have had little effect on Morton citrange rootstock since only three of the 54 trees on Morton citrange were stunted even though the percentage of trees infected with the virus of exocortis was presumably the same on Morton citrange as on trifoliate orange rootstock.

In the case of companion test trees grafted with buds from seedling sources, sometimes one tree grew vigorously and the other was extremely stunted, neither of which was scaling.

From the foregoing, the author concludes that, under Florida conditions, both old-line and seedling line sources indexed to trifoliate orange rootstocks may often lead to varying degrees of stunting without any scaling or shelling of the rootstock. It is further concluded that there is a stunting factor in various scion varieties that has no relationship to exocortis virus.