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A Quick Field Test for Xyloporosis Virus

THIS PAPER reports the results of experiments carried out to develop a quick field test for xyloporosis virus. The technique employed by Moreira (4) when he developed a quick test for exocortis virus was tried for xyloporosis virus, using the Orlando tangelo (*Citrus paradisi* L. x *C. reticulata* Blanco) as an indicator. In doing so, it was assumed that xyloporosis and cachexia are caused by the same virus (2, 3, 5) and that the Orlando tangelo is a faster and more reliable indicator of the virus than Palestine sweet lime (*C. limettioides* Tanaka) (1, 6).

Inoculation of Orlando Tangelo Seedlings

Buds from three Barão orange [*C. sinensis* (L.) Osbeck] trees infected with xyloporosis virus were budded into 20 Orlando tangelo seedlings, one year old in the nursery. Many buds were used to inoculate each seedling. These buddings were made November 30, 1959, and 20 days later the seedlings were cut back above the point of inoculation. Two or three sprouts of the Orlando tangelo were allowed to grow from each seedling, but not from the inoculating Barão orange buds. These sprouts were examined from time to time for xyloporosis symptoms by removing a piece of the bark above the union with the main stem. About three years were required for the first seedlings to start to show symptoms. In February, 1963, some wood pitting and gummy-pegs were found in 15 of the 20 infected Orlando tangelo seedlings. Under Brazilian conditions the Orlando tangelo is a slow grower. To overcome this disadvantage, some other tests were carried out by budding Orlando tangelo into vigorous seedlings of other varieties previously inoculated with xyloporosis virus.

Orlando Tangelo Budded into Infected Seedlings

Thirty vigorous Rangpur lime (*C. limonia* Osbeck) seedlings, two years old in the nursery, were inoculated with buds from a xyloporosis-infected Barão orange tree. Thirty seedlings were inoculated with buds from a nucellar xyloporosis-free Barão orange tree, to serve as controls. Only one inoculating bud was used for each seedling. One month later, all seedlings were budded above the point of inoculation with a bud from a healthy Orlando tangelo seedling. Twenty days later all seedlings were cut back and the Orlando tangelo buds were allowed to sprout. These buddings were made in September-October, 1961. The Orlando tangelo sprouts have grown vigorously and examinations a year later revealed xyloporosis symptoms in 21 (70 per cent) of the plants inoculated with xyloporosis virus. Wood pitting and gummy-pegs appeared earlier in the most vigorous plants and in those in which the Orlando tangelo was budded just above the inoculating bud. Some of the Orlando tangelo trees exhibited symptoms as soon as 10 months after budding. In most plants the symptoms appeared first at the bud-union while in some others they were found 10-15 cm above that point. The observations were conducted by taking out a piece of bark at the bud-union (Fig. 1). One last examination, in September, 1963, two years after budding, showed that 24 of the 30 xyloporosis-infected trees were exhibiting symptoms; 11 very severe, 7 severe, and 6 mild. Six of them were apparently healthy, suggesting an uneven distribution of the xyloporosis virus in the Barão orange tree used as a source of inoculum. The most severely affected Orlando tangelo trees showed yellowing of leaves and defoliation. In many trees, wood pitting and heavy gum impregnation in the phloem were found from the bud-union up to the secondary branches of the Orlando tangelo. Some of these trees showed, in addition to common wood pitting, inverted bark pitting with corresponding pegs from the wood.

None of the 30 control Orlando tangelo trees showed any symptoms. No symptoms were found in the Rangpur lime rootstock.

A replication of this test was carried out, using 2-year-old Cleopatra tangerine [*C. reshni* (Engl.) Hort. ex Tanaka] seedlings. These seedlings were inoculated with buds from another Barão orange tree infected with xyloporosis virus and, at the same time, were budded with Orlando tangelo buds. In this experiment, the Orlando tangelo buds were taken from many seedlings. Readings in September, 1963, about 18 months later, revealed xyloporosis symptoms in 19 (63.3 per cent) of the in-

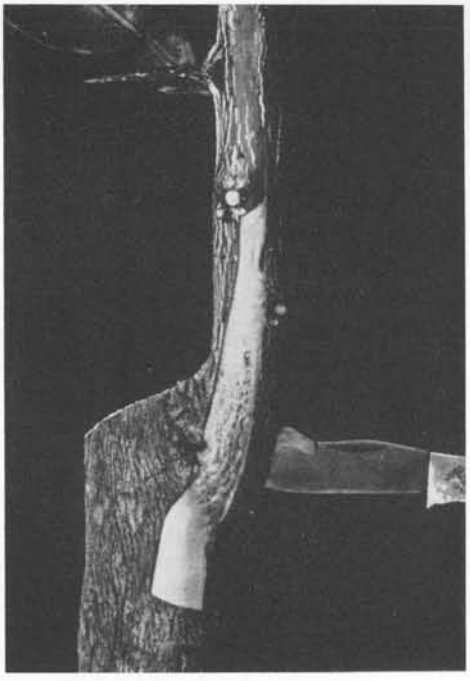

FIGURE 1. *Quick test for xyloporosis virus: Orlando tangelo on infected Rangpur lime rootstock showing severe symptoms of xyloporosis 13 months after budding.*

fected trees, these symptoms being very severe in 7, severe in 10, and mild in 2 trees. Eleven infected trees failed to show symptoms. Five of these apparently healthy trees were very vigorous as were all trees formed with buds from a supposed nucellar Orlando tangelo seedling, which was possibly a hybrid. Some of the other trees did not show symptoms probably because they had made poor growth. None of the control trees developed any xyloporosis symptom.

Topworking Trees

Testing for xyloporosis virus by topworking young and old trees was also tried. Five young and five old Barão orange trees were topworked, each one with 8 or 10 buds from a nucellar Orlando tangelo seedling. These buddings were made in February, 1962, and a month later the branches were pruned to force the Orlando tangelo buds to sprout. Sprouting was irregular and growth variable. Twenty months later, the most vigorous sprouts, mostly those on the younger trees, were showing symptoms of xyloporosis.

Conclusions

The results of the experiments here reported suggest that testing for xyloporosis virus should be carried out in the following manner. Inoculate 1- or 2-year-old vigorous seedlings with buds taken from the tree to be tested. Rangpur lime, Cleopatra tangerine, or any other vigorous seedling can be used. One bud from a nucellar Orlando tangelo seedling should be budded above the inoculating buds. Cut back the seedlings above these buds. Eliminate all sprouts, allowing only the Orlando tangelo buds to sprout. Examine these sprouts for wood pitting and gummy-pegs from time to time by taking out a strip of bark at the bud-union. Under good growing conditions, symptoms are expected to develop within 10-24 months after budding if the tree under test is infected with xyloporosis virus. It is advisable to use 3 or 4 test plants for each tree to be tested and to bud 3 or 4 inoculating buds into each seedling.

The variation in the time required for symptoms to develop indicated that xyloporosis virus may exist in a multiplicity of strains, even within the same tree. The severe strains cause, in addition to intense wood pitting and gummy-pegs, yellowing and defoliation of the infected Orlando tangelo sprouts.

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