

Transmission of Psorosis Virus by Dodder

THIS ARTICLE REPORTS the transmission of psorosis virus by dodder (*Cuscuta compacta* Juss) to approximately 5 per cent of sweet orange [*Citrus sinensis* (L.) Osbeck] seedlings tested. A brief account of the work has been reported (3). After this paper was prepared for presentation at the Conference, it was learned that Weathers and Harjung (6) had also succeeded in transmitting psorosis virus by dodder. Transmission by dodder, even at a low rate, offers the possibility of infecting some herbaceous plant in which psorosis virus will multiply and cause conspicuous symptoms. Work with such a plant, instead of citrus, would greatly facilitate studies designed to elucidate the nature of the virus itself.

Materials and Methods

Three sources of psorosis virus were used in the tests, but there appeared to be no essential differences among them. The principal source was budwood from a King orange (*C. nobilis* Loureiro) tree (KI-42-6-17) obtained in April, 1960, through the courtesy of G. G. Norman from the Citrus Budwood Registration Program of the Florida State Department of Agriculture. At that time, tree KI-42-6-17 was free of tristeza and xyloporosis viruses as indicated by indexing in plants of Key lime [*Citrus aurantifolia* (Christm.) Swing.] and Orlando tangelo (*C. reticulata* Blanco x *C. paradisi* Macf.) and was thought to be free of exocortis virus; subsequently, results of indexing in plants of *Poncirus trifoliata* (L.) Raf. indicated that it carries exocortis virus. Budwood from the tree has been maintained by grafting into rough lemon (*C. jambhiri* Lushington) and Pineapple sweet orange seedlings.

The dodder, identified by Erdman West, Department of Plant Pathol-

ogy, University of Florida, was maintained on plants of periwinkle (*Vinca rosea* L.) that had been grown from seed. Strands of dodder were removed from the periwinkle plant and each was twined around a young shoot of a diseased citrus seedling growing in a 4-inch or 6-inch pot. After the dodder had become established on the diseased plant, one or more strands were attached to a healthy seedling without removing them from the diseased plant; the healthy test plant was thus connected to the diseased plant by a dodder bridge. The connection was maintained for periods of a week to two or three months.

Experimental Results

The first Pineapple sweet orange plant to become infected as a result of transmission by dodder developed unusual symptoms. Within six days after the test plant was attached to a diseased plant by dodder, its leaves began to develop vein clearing. The clearing started in a young leaf of a shoot to which the dodder was attached and extended down the shoot into all the leaves on the shoot (Fig. 1). Within the following week or two, vein clearing developed in leaves on other branches of the test plant, extending even into leaves that were almost fully mature.

Symptoms in this plant were somewhat similar to those produced by yellow-vein virus in some species of citrus (4). The vein-clearing symptom was not, however, transmitted from this test plant to other sweet orange seedlings either by grafting or by *C. compacta*. The symptoms were probably the response of a particular sweet orange plant to psorosis virus, a response that may have been influenced by the stage of growth of the test plant and also by the fact that the virus was introduced directly into the top of the plant by dodder. If the symptoms had been the response to a second virus, such as that of yellow-vein, they should have developed also in test plants that were subinoculated by grafting with budwood from the plant in which the symptoms first appeared. But they did not develop in such plants. Weathers (5) observed that symptoms of psorosis soon dominated when psorosis virus and yellow-vein virus were introduced concurrently into plants of Key lime. He also observed that symptoms were more severe in doubly inoculated plants than in those inoculated with psorosis virus alone. There is presently no reason to believe, therefore, that this first Pineapple sweet orange plant infected by means of dodder was indeed infected by a mixture of viruses or by a virus other than that of psorosis for subinoculation by grafting into additional test plants resulted in typical, though mild, symptoms of psorosis.



FIGURE 1. *Vein clearing that developed in leaves of a Pineapple sweet orange seedling when psorosis virus was transmitted to it by *Cuscuta compacta* Juss. The photograph was taken just six days after the dodder connection was made.*

Of the 103 Pineapple sweet orange seedlings inoculated by means of *C. compacta*, 6 developed symptoms of psorosis within 6, 14, 28, 37, 76, and 104 days, respectively, after the dodder was attached. Except in the case of the 6-day infection, which was described above, symptoms in leaves were mild but otherwise typical for psorosis. This mildness was probably the result of the conditions under which the test plants were grown, since similar symptoms were produced in plants to which the virus was transmitted by grafting.

In an attempt to increase the rate of transmission by *C. compacta*, 8 of the 103 test plants mentioned above were shaded by covering them with brown kraft paper bags after the dodder was first attached to them in the summer of 1963. None of the 8 plants became diseased, contrary to what might have been anticipated from the work of Cochran (2) with tobacco mosaic virus.

On several occasions, strands of dodder were removed from the periwinkle plants and placed on healthy Pineapple sweet orange seedlings.

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None of the 16 seedlings parasitized in this manner by dodder developed symptoms resembling those of psorosis. None of the periwinkle plants on which the dodder was maintained showed evidence of a virus infection. These results make it unlikely that the dodder originally carried a virus capable of infecting sweet orange plants, or that the symptoms were the direct result of dodder parasitizing the plants.

Discussion

It is possible that conditions can be found for increasing the rate of transmission of psorosis virus by dodder. The tests reported above were carried out during various seasons of the year without any indication that transmission is more rapid in one season than another. Some of them also were carried out in an air-conditioned greenhouse in which the temperature was maintained at about 22°C. The rate of transmission was no greater in this greenhouse than in another in which the temperature fluctuated with the season.

Bennett (1) reported the failure to transmit psorosis virus to any one of 10 citrus seedlings tested by means of *C. subinclusa* Durand and Hilgard and to any one of 10 additional seedlings by *C. campestris* Yunck. Whereas neither of these species proved capable of vectoring the virus, it is possible that both may transmit but at a low rate. Results obtained with *C. compacta* suggest that additional tests with *C. subinclusa* and *C. campestris*, and perhaps other species would be worthwhile attempting.

Progress in elucidating the basic nature of psorosis virus has been slow because it has been necessary to work with citrus plants to which the virus has been transmitted by grafting. Leaf symptoms often take a long time to appear and are transient. Dodder transmission offers the possibility of testing many herbaceous plants for susceptibility to psorosis virus, one or more of which might be susceptible. A plant that can be grown quickly from seed, that responds quickly to infection, and in which the virus multiplies readily will provide a means for determining the physical properties of the virus and perhaps facilitate its purification and characterization. Whether or not *Cuscuta compacta* transmitted only a mild strain of virus in the tests reported remains to be determined. The rate of transmission suggests the possibility that dodder may be useful in separating strains of virus from a mixture.

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