Transmission of Satsuma Dwarf Virus from Herbaceous Plants to Citrus by Approach Grafts

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IN 1962 THE AUTHOR and his co-worker (2, 3, 4) transmitted satsuma dwarf virus (SDV) mechanically to young plants of white sesame and various leguminous species, and concluded that white sesame and Satisfaction kidney bean are the most adequate indicator plants for SDV. However, they were unable to transmit SDV from these herbaceous plants to satsuma seedlings by means of sap inoculation or by dodder. This failure led to some question about the usefulness of sesame and kidney bean as indicator plants for SDV.

As a result of seeing in 1963 some unpublished studies of Nyland and Yarwood in which the approach-graft technique was being used, the author in 1967 began attempts to transmit SDV from sesame and *Crotalaria spectabilis* Roth to citrus by approach grafts. At about the same time, Weathers et al. (5) reported the transmission of exocortis virus from citron to herbaceous plants by approach grafts, and the following year Kishi (1) reported transmission of SDV from herbaceous plants to citrus by sap injection.

Procedures and Results

From June to July 1967, plants of sesame and crotalaria infected with SDV were approach grafted to 22 2-year-old healthy satsuma seedlings. A 3-cm length of epidermis with a thin layer of cortex was peeled from one side of a young angular shoot of a satsuma seedling. The herbaceous plant was treated similarly. The stems of the 2 plants were united at the peeled sites and bound securely in place with vinyl tape. The grafted plants were kept in a vinyl house where all the herbaceous plants died during winter. Eight of 22 seedlings thus grafted were eliminated because of cold injury or other cause.

In May–July 1968, the young shoots of the 14 inoculated satsuma seedlings that survived were tested repeatedly for presence of SDV by mechanical inoculation of white sesame, Satisfaction kidney bean, or crotalaria plants. Symptoms typical of SDV developed within 2 weeks in the indicator plants that were inoculated with sap of 3 of 14 satsuma seedlings tested. In late fall 1968, 1 of the 3 infected satsuma seedlings developed the spoon-shaped leaves typical of satsuma dwarf.

Additional attempts to recover SDV from the 14 inoculated satsuma seedlings were made in spring and summer 1969. SDV was recovered from 7 of the seedlings, including the 3 that previously tested positive.

It is concluded from the results that about 50 per cent of the satsuma

seedlings inoculated by approach grafts became infected with SDV, and that the virus multiplied in them. The infected seedlings developed typical SD symptoms in their young leaves.

Six healthy satsuma seedlings were inoculated by approach grafts with infected herbaceous plants in June–July 1968 and were tested for SDV by mechanical inoculation of herbaceous indicator plants in May–August 1969. Symptoms in the sesame indicator plants indicated that 4 of the inoculated satsuma seedlings had become infected. These 4 seedlings were subsequently tested by inoculation of new indicator plants, including sesame, kidney bean, and crotalaria, always with positive results.

Additional satsuma seedlings were inoculated by approach grafts with infected sesame plants in July 1969; 1 of the lot exhibited typical leaf symptoms in the young fall shoots.

Discussion

The approach-graft method of SDV transmission from herbaceous plants to satsuma seedlings seems to be easier than the sap-injection method. There is, however, some difficulty in matching the infected herbaceous plants with young satsuma shoots available for approach grafting. Shoots of both plants should be young and succulent. Usually spring shoots of satsuma grow earlier than those of the herbaceous plants. If air-conditioned greenhouses were available, the young satsuma shoots and herbaceous plants could be easily grown at the same time. It might then be possible to increase the percentage of transmission from the 50–70 per cent obtainable in an ordinary vinyl house to a percentage somewhat closer to 100.

SDV can be recovered more easily from crotalaria than from sesame by the approach-graft method because the former is more vigorous and longer-lived than the latter. The stem tissues of crotalaria are more elastic than those of sesame, making crotalaria easier to handle. Infected sesame plants nevertheless provide effective inoculum for transmission.

As an indicator plant for SDV, Satisfaction kidney bean is adequate in the spring season. Sesame and crotalaria are better than bean during summer because they endure high temperatures better. Sesame is not an adequate indicator in the fall; being a short-day plant, it begins to bloom in late September in central Japan.

Literature Cited

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