Rearing the Tristeza Vector, *Toxoptera citricida*, on Squash

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A MAJOR PROBLEM in tristeza virus investigations in Brazil is maintaining a source of non-viruliferous aphids (*Toxoptera citricida* Kirk.) throughout the year. Meneghini (2) considered citrus plants unsuitable for maintaining aphid colonies and found *Evoidia hupelensis* Dode a more satisfactory host. Costa and Grant (1) tried many species other than those belonging to the family Rutaceae, but found none satisfactory. However, Stubbs (3) successfully reared the tropical citrus aphid on the Mexican orange (*Choisya ternata* H.B.K.).

In conjunction with attempts to extend the host range of the tristeza virus to plants outside the Rutaceae family by infesting them with the tropical citrus aphid, tests were arranged to evaluate the test plants as food and breeding hosts for the insect. This work has been continued many years, and almost 200 different species, mostly annuals, were tested. The results of these tests are described in this paper.

Materials and Methods

Seedlings to be tested were raised in a greenhouse. A minimum of 5 seedlings for each species tested were transferred to the insectary prior to inoculation. Five comparable seedlings from the same batch of plants were taken to a similar insectary to serve as controls. Viruliferous aphids obtained from a source, Barão B sweet orange [*Citrus sinensis* (L.) Osb.], carrying a strong strain of tristeza virus were used in most of the tests. Leaves of the source plant carrying viruliferous aphids were placed on the seedlings to be tested, and the aphids were allowed to transfer to test seedlings as the leaves on which they were feeding wilted. They were left on the inoculated test plants until they died or multiplied. When the aphids had all died, the test seedlings and the controls were transferred to the greenhouse for observation. The feeding and breeding behavior of the aphids were recorded.

Seedlings of over 200 species belonging to 21 families were used in the tests. The number of species in each family varied widely. Compositae, Cucurbitaceae, Malvaceae, and Solanaceae were better represented than the others.

Results

HOST PLANTS.—On most species tested, the aphids fed long enough for successful inoculation of susceptible species. Feeding was excellent on many species of Malvaceae, Leguminosae, Compositae, and Cucurbitaceae. Some multiplication was observed on *Gomphrena globosa* L., *Gossypium hirsutum* L., and *Malva parviflora* L. However, the population increase on these hosts was only temporary, and after a time the colonies died out. Satisfactory breeding of the aphid was obtained on squash (*Cucurbita moschata* Duchesne) (Fig. 1), and after the initial favorable results, considerable attention was given to species of Cucurbitaceae, and especially to varieties of the following species: *Cucurbita*

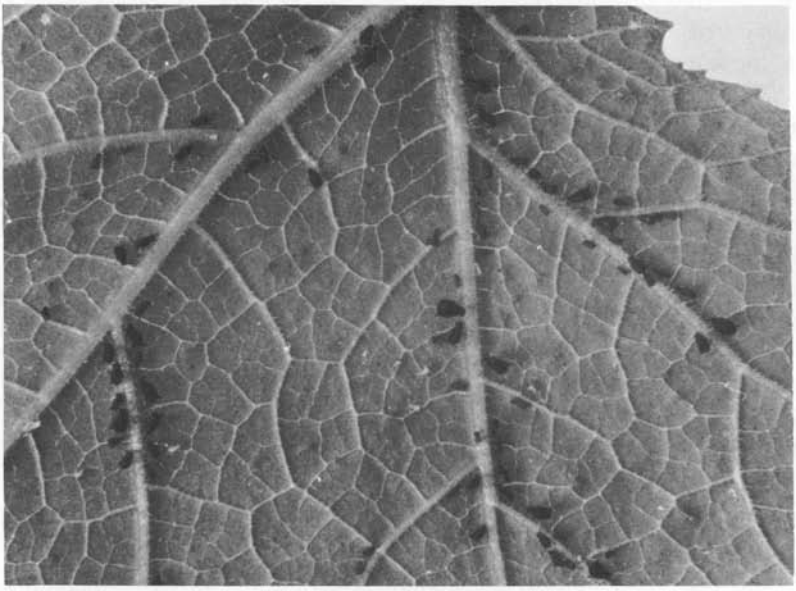

FIGURE 1. *Tropical citrus aphids feeding along the veins of a squash leaf.*

moschata, *C. maxima* Duchesne, *C. pepo* L., *Cucumis sativus* L., *C. melo* L., and *Citrullus vulgaris* Schrad. The best multiplication occurred on the Redonda de Amparo variety, and after that discovery, this variety was used for several years to maintain non-viruliferous colonies of the tropical citrus aphid.

Squash plants have several characteristics that make them especially useful as host plants for aphids. They germinate promptly, grow easily

from seed, and grow continuously for several weeks. When growth diminishes, usually because the plant becomes too large for the pot, the aphid colony can be transferred easily.

GROWTH OF *T. citricida* KIRK. ON SQUASH.—Aphids, newly transferred from citrus, have some difficulty in becoming established on squash, but this is overcome after a short time. The population of *T. citricida* Kirk. on Redonda de Amparo is seldom as high as it is on some *Citrus* species when new flushes of growth are available. However, the aphids produce fairly good populations practically throughout the year, and especially in the cool winter months.

ADAPTATION OF SQUASH-REARED APHIDS TO CITRUS.—Aphids reared on squash transfer more successfully from squash to citrus than vice versa. We noticed no difference in the behavior of squash-reared aphids as compared with citrus-reared aphids when they were transferred to citrus at the same time. Also, squash-reared aphids multiply normally on citrus.

TRANSMISSION OF TRISTEZA VIRUS BY SQUASH-REARED APHIDS.—Aphids reared on squash were compared with citrus-reared aphids regarding their ability to transmit tristeza virus. Insects from both habitats were fed on young shoots of Barão sweet orange plants infected with tristeza virus. After an acquisition feeding of 2 days, they were transferred to healthy Galego lime [C. *aurantifolia* (Christm.) Swing.] test seedlings. Three tests were performed. In each test, 5 seedlings were colonized with 1, 3, 9, and 27 aphid nymphs per plant from each source, a total of 20 plants per test. For the 3 tests, the total tristeza virus transmission by squash-reared aphids was, respectively, 0/15, 2/15, 4/15, and 7/15. Transmission by the citrus-reared aphids was, respectively, 0/15, 1/15, 5/15, and 8/15.

Discussion

Colonies of the tropical citrus aphid seldom attain as high populations on squash as on some citrus species. However, fairly good populations can be maintained on squash practically all year in Campinas, Brazil. Thus, squash plants, Redonda de Amparo variety, were entirely adequate for maintaining colonies of *T. citricida* Kirk. under insectary conditions.

Because squash plants are immune to tristeza virus, viruliferous aphids collected from field citrus plants and allowed to feed on the squash plant for 72 hours are rendered non-viruliferous.

Comparative tests indicate that tropical citrus aphids reared on squash transmit the tristeza virus as readily as do citrus-reared aphids. For

many transmission tests, aphids reared on squash have been used directly, or after producing one generation on infected citrus, always with completely satisfactory results.

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Literature Cited

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