UC Riverside

International Organization of Citrus Virologists Conference Proceedings (1957-2010)

Title

Preferential Feeding by Aphis Gossypii on Young Leaves of Sweet Orange, Grapefruit and Lemon

Permalink

https://escholarship.org/uc/item/1mw5t2b0

Journal

International Organization of Citrus Virologists Conference Proceedings (1957-2010), 9(9)

ISSN

2313-5123

Authors

Roistacher, C. N.
Bar-Joseph, M.
Carson, T.

Publication Date

1984

DOI

10.5070/C51mw5t2b0

Peer reviewed

eScholarship.org Powered by the California Digital Library
University of California

Preferential Feeding by Aphis gossypii on Young Leaves of Sweet Orange, Grapefruit and Lemon

C. N. Roistacher, M. Bar-Joseph and T. Carson

ABSTRACT. A group of three seedlings, one each of sweet orange, grapefruit and lemon were transplanted to individual containers and later caged for aphid feeding. Sweet orange or muskmelon leaves containing quantities of *Aphis gossypii* were cut up and transferred to the bottom of the cages, and the aphids were permitted free choice of feeding on the newly emerging young leaves of the three cultivars. After 24 hours of feeding at 24 C, the total number of aphids found on the young leaves was counted and individual leaf area was measured. There were 58.5% fewer aphids per cm^2 of leaf area on young lemon leaves compared on young leaves of grapefruit or sweet orange. There was no difference in preference by *A. gossypi* between young leaves of grapefruit or sweet orange.

Index words. Tristeza, aphid feeding.

Recent studies by Roistacher and Bar-Joseph (4) showed variable transmission rates for three isolates of citrus tristeza virus (CTV) vectored by *Aphis gossypii* Glover from sweet orange, grapefruit and lemon acquisition hosts to various infection hosts. The transmission rate for all three virus isolates combined from sweet orange to Mexican lime, grapefruit and lemon was 99, 65 and 28%, respectively, whereas transmission from grapefruit to grapefruit or lemon was low (9%) and there was no transmission from lemon to lemon.

Lemon has always been considered a poor host for CTV. A recent index of 2,481 lemon trees in four blocks in the University of California Citrus Research Center (CRC) orchards at Riverside detected only three infections. Similarly, an index of 226 grapefruit trees at the CRC showed 11 tristeza infections, whereas infection of sweet orange and mandarin tree was over 90%. Transmission of CTV, a semipersistently transmissible virus (1) by vector to a given host would depend upon the susceptibility of the host to CTV inoculation by vector and upon the readiness of the aphid population to colonize and feed on the host. In this study, we attempted to determine feeding preference of *A. gossypii* for young leaves of sweet orange, grapefruit and lemon when all three cultivars were caged together in a closed system and aphids were given a free choice for feeding.

MATERIALS AND METHODS

Plants and growth. Small nucellar seedlings of Madam Vinous sweet orange, Duncan grapefruit and Eureka lemon, approximately 12 cm length, were selected for uniformity and size. These were transplanted, one seedling of each cultivar, to soil in a 4-liter plastic container. Three seedlings each (one of each cultivar) in fifteen containers were grown and fertilized using the U. C. system for plant growth modified for citrus (2). Glasshouse temperatures were 29/20 C daytime maximum/nighttime minimum.

Aphid feeding. After emergence of new growth, approximately 5-8 weeks from transplanting, 13 groups of plants were exposed to feeding by aphids. The method of aphid feeding and transfer was as described previously (3). Approximately three or four mature leaves directly below the new growth flush were removed, and the three plants were loosely tied together to permit merging of the young leaves at the

top. Leaves of sweet orange or muskmelon (*Cucumis melo* L. 'PMR 45') containing aphids in all stages of instar development were cut into strips approximately 1/2 by 2 cm and placed at the bottom of the cages as shown in Fig. 1. Split cages with plastic foam sponge edges were secured around the three plants with rubber bands. Aphids were observed climbing the sides of the cages or climbing up the stems, and appeared to move freely from leaf to leaf and from plant to plant.

After a 24-hour feeding period at 24 C in an illuminated controlled-temperature cabinet, the cages were carefully removed and the number of aphids found on each leaf of the three host plants were counted. The aphids were brushed off and measurements taken of each leaf. Leaf area was determined by first tracing representative small, medium and large young leaves on closely lined graph paper and then counting the number of small squares. A factor for determining area of leaves for each of the 3 varieties was obtained by multiplying leaf length x width and dividing by the actual leaf area as measured. The area of each new leaf measured was then calculated as leaf area = length x width/factor.

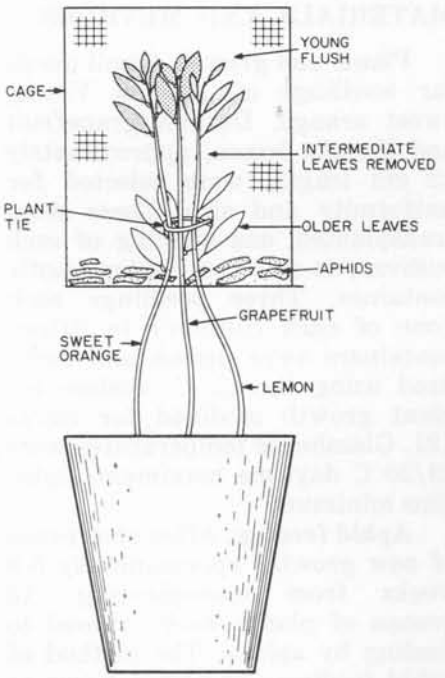

Fig. 1. Illustration of the technique used for determining aphid selectivity. Cut leaves of sweet orange or muskmelon containing aphids were placed at the bottom of a screened plastic cage. Aphids were free to climb the stem or sides of the cage and feed on young leaves of sweet orange, grapefruit or lemon all growing in the same container.

Aphids were found only on the young leaves, most were observed to be feeding and none were found on mature leaves below. Since growth flush was not simultaneous for all of the cans of transplanted seedlings, three separate feedings of five, four and three groups of plants respectively were made at weekly intervals as the growth flushes developed.

RESULTS AND DISCUSSION

A total of 173 leaves containing aphids were measured for area and the total number of aphids found after a 24-hour feeding period was 4,697. Table 1 summarizes the numbers of plants used, the total number of aphids found, the total leaf area, the total number of young leaves on which aphids were found and the number of aphids found per cm^2 of leaf area for sweet orange, grapefruit and lemon. Analysis of variance showed no difference in aphid selectivity between sweet orange or grapefruit; approximately equal number of aphids were found per unit leaf area on these two cultivars. However, there were 58.5% less aphids per unit leaf area on lemon leaves compared to sweet orange and grapefruit leaves. This significant reduction of aphids on lemon indicates a distinct preference by the aphids for sweet orange or grapefruit leaves over lemon. Moreover, analysis of aphid numbers found on

TABLE 1
DISTRIBUTION OF *APHIS GOSSYPII* ON YOUNG LEAVES OF SWEET ORANGE, GRAPEFRUIT AND LEMON AFTER A 24 HOUR FEEDING PERIOD

Host	Total plants	Total leaves	Total aphids found	Total leaf area (cm^2)	Aphids/cm^2 leaf area
Sweet Orange	13	58	2315	609	3.80
Grapefruit	13	63	1626	420	3.87
Lemon	12	52	756	477	1.59**

** Significantly different from sweet orange and grapefruit ($P < 0.01$).

individually caged lemon, grapefruit and sweet orange seedlings (4) revealed no significant variation in aphid count when alternate feeding hosts were not available.

Low transmission rates of tristeza isolates by aphids from various citrus cultivars to lemon, or from lemon to various citrus cultivars, and the erratic distribution of virus found in the young leaves of graft-inoculated lemon plants has been recently reported (4). The present study indicates that low attractivity of lemon leaves for *A. gossypii* further reduces the efficacy of lemon as a transmission or receptor host for CTV. Field observation and indexing revealed a very low distribution of tristeza in 2,481 lemon trees at the CRC at Riverside even though these trees were surrounded by tristeza-infected sweet orange and mandarin trees.

These results also show that young grapefruit and sweet orange leaves were equally attractive for *A. gossypii* feeding. This finding, coupled with our recent findings that certain isolates of seedling yellows tristeza were highly transmissible from sweet orange to grapefruit (4) points to the danger of having such seedling yellows tristeza isolates present in states or countries where less virulent isolates of tristeza virus predominate. Certain virulent seedling yellows isolates move readily from sweet orange (or perhaps from mandarin) to grapefruit by *A. gossypii*, which not only is an efficient vector for these seedling yellows tristeza isolates, but as indicated in this study, also readily feeds on young grapefruit leaves.

The results of these experiments are primarily relevant to the natural movement of aphids from a tree to immediate adjacent trees. CTV dispersed by winged aphids to trees at longer distances will depend on additional factors, such as the attractiveness of a given citrus cultivar for aphid alightment. Thus, further tests with winged aphid colonization will have to be carried out for determining aphid preference under grove conditions.

ACKNOWLEDGMENTS

The authors gratefully acknowledge aid in statistical analysis by C. K. Huszar, Department of Statistics, University of California, Riverside. These studies were funded in part by a grant from the California Citrus Research Board.

LITERATURE CITED

1. BAR-JOSEPH, M., B. RACCAH and G. LOEBENSTEIN
   1977. Evaluation of the main variables that affect citrus tristeza virus transmission by aphids. Proc. Int. Soc. Citriculture 3: 958-961.
2. NAUER, E. M., C. N. ROISTACHER, and C. K. LABANAUSKAS
   1968. Growing citrus in modified U C potting mixtures. Calif. Citrograph 53: 456, 458, 460-61.
3. ROISTACHER, C. N.
   1981. Blueprint for disaster—Part II. Changes in transmissibility of seedling yellows. Citrograph 67: 29-32.
4. ROISTACHER, C. N. and M. BAR-JOSEPH
   1983. Transmission of tristeza and seedling yellows-tristeza virus by *Aphis gossypii* from sweet orange grapefruit and lemon to Mexican lime, grapefruit and lemon. p. 9-18. *In* Proc. 9th Conf. IOCU, 1983. IOCU, Riverside.