

**A Preliminary Report on Transmission of Zonate  
Chlorosis and Varietal Susceptibility  
to the Disease**

VICTORIA ROSSETTI, CELIA de C. LASCA,  
J. T. NAKADAIRA, and C. J. S. AGUIAR

FAILURE TO TRANSMIT leprosis or zonate chlorosis by the standard methods has led to the conclusion (1, 4) that both diseases may result from the toxic effect of the saliva of certain mites associated with these diseases or from a virus transmitted by the mites.

The mite *Brevipalpus phoenicis* (Geijskes) is found in several regions of the State of São Paulo, Brazil, and has been found on trees affected

by leprosis in the Limeira region (3). Its association with the disease was proved experimentally (2). *B. phoenicis* was also found on trees affected by zonate chlorosis in the Ubatuba coastal region. However, the same mite is also prevalent in the Bebedouro region where leprosis or zonate chlorosis has never been observed.

The different reactions of trees of the same variety in different regions, apparently caused by the same species of mite, suggest the possibility that leprosis and zonate chlorosis may be caused by different non-systemic viruses transmitted by *Brevipalpus* mites in those regions where the mites have fed on infected trees.

**OCCURRENCE OF MITES.**—On ten occasions since 1963, mites (a total of 73) were collected from leprosis-infected trees in the Limeira region. These mites were part of populations that caused leprosis in 46 to 76 days on healthy young potted plants. Most were identified as *B. phoenicis*; only two individuals were identified as *B. obovatus* Donnadieu. However, one collection of eight mites from infected trees were all identified as *B. obovatus*. This is the first record of this species in Brazil.

In Ubatuba, three collections of mites (a total of 31) were made from zonate-chlorosis-affected trees. These collections were made from populations that caused zonate chlorosis in 5 to 23 days on young healthy potted plants. One mite was identified as *B. obovatus*, and the remainder as *B. phoenicis*. Mites collected from healthy trees in the Bebedouro region were identified as *B. phoenicis*. All identifications were made by Martin H. Muma, of the Citrus Experiment Station, Lake Alfred, Florida.

**TRANSMISSION TRIALS.**—In greenhouse experiments, *Brevipalpus* mites from Bebedouro (BB) were individually confined in small cages placed on infected leaves of infected plants and were allowed to feed on zonate chlorosis spots. The cages were made of small squares of cardboard with a central round hole, covered with cellophane in which fine perforations were made to avoid excessive humidity in the chamber (Fig. 1). This formed a chamber 5 mm in diameter. One or 2 mites were transferred to the chamber of the cage which was then placed over a zonate-chlorosis spot on the upper or lower side of the leaf. A solid piece of cardboard was placed on the reverse side of the leaf and both were secured to the leaf with a paper clip (Fig. 1).

After feeding on the infected leaves for 6 to 10 days, the mites were transferred to healthy leaves of young potted plants of Rangpur lime (*Citrus reticulata* var. *austera* hyb.) and Pera sweet orange [*C. sinensis* (L.) Osb.]. Comparable plants were similarly infested with *Brevipalpus* mites collected from leprosis-infected leaves in the Limeira region (BL),

from zonate-chlorosis-infected leaves of Ubatuba (BU), and from non-infected fruits and leaves of Bebedouro (BB).

### *Results and Conclusions*

Only 2 out of 18 small plants infested with BB mites, previously fed on zonate-chlorosis lesions, showed symptoms similar to those of that disease, on one of their leaves. In all the other cases the mites failed to transmit the disease. No reaction was obtained with BB mites from non-infected material. Thus, BL mites induced leprosis symptoms and BU mites induced zonate chlorosis. These apparent transmissions of both



FIGURE 1. Cardboard cages in which mites were allowed to feed on zonate chlorosis spots on infected leaves.

leprosis and zonate chlorosis require further investigation using modified techniques and different periods of exposure of mites to diseased material.

**SUSCEPTIBILITY OF CITRUS VARIETIES.**—An experiment was performed to determine the susceptibility of 20 citrus varieties to zonate chlorosis. Potted plants of these varieties were exposed to natural infection, under infected trees, so that leaves of the potted plants mingled with the leaves of the infected trees. The potted plants were randomly distributed under 5 infected trees. The position of the potted plants was changed every month, so that all plants were exposed to infection from all possible positions in 1 year. A scale of susceptibility was devised, based on the mean percentage of infected leaves that developed in each variety. In ascending order of intensity, this scale is as follows: Galego lime [*C. auranti-*

*folia* (Christm.) Swing.], 2.49; Cleopatra tangerine (*C. reticulata* Blanco), 2.67; Tahiti lime (*C. aurantifolia* hyb.), 4.82; Marsh seedless grapefruit (*C. paradisi* Macf.), 6.06; Valencia sweet orange, 6.10; Cravo tangerine, 7.32; sour orange (*C. aurantium* L.), 10.28; Caipira, Pera, and Piralima sweet orange varieties, 12.50, 13.72, and 14.03, respectively; Rio mandarin, 14.76; Eureka lemon [*C. limon* (L.) Burm. f.], 16.54; Rangpur lime, 23.18; Bahia, Natal, and Bahianinha sweet orange varieties, 25.87, 31.16, and 35.22, respectively; *Poncirus trifoliata*, 38.22; kumquat [*Fortunella margarita* (Lour.) Swing.], 41.33; Ponkan tangerine, 51.63; and Barão sweet orange, 63.59.

#### Literature Cited

1. KNORR, L. C., WEBSTER, B. N., and MALAGUTI, G. 1960. Injuries in citrus attributed to *Brevipalpus* mites, including *Brevipalpus* gall, a newly reported disorder in sour orange seedlings. Food and Agricultural Organization Plant Prot. Bull. 8: 141-149.
2. MUSUMECI, M. R., and ROSSETTI, V. 1963. Transmissão dos sintomas da leprose dos citros pelo ácaro *Brevipalpus phoenicis*. (Abstr.) Presented to the 15th Meeting of the Sociedade Bras. para o Progresso da Ciencia, July, 1963.
3. ROSSETTI, V., FASSA, T. G., and MUSUMECI, M. R. 1959. Um novo acaro nos laranjais paulistas. O. Biológico 25: 273-275.
4. ROSSETTI, V., NAKADAIRA, J. T., CALZA, R., and MIRANDA, C. A. B. 1965. Estudos sobre a clorose zonada dos citros. I. Sintomatologia, distribuição geográfica no Brasil e variedades susceptíveis. II. Natureza e transmissibilidade. Arquivos do Instituto Biológico 32: 111-125.