

*The Budwood Registration Program
for the Rio Citrus Area*

THE RIO CITRUS AREA is second in importance in Brazil, as measured by acreage planted. There are approximately seven million trees in production and a half million trees are being planted yearly. Rangpur lime is the principal rootstock although China sweet orange is also used in some plantings.

Studies on citrus virus diseases have been under way at the Instituto de Ecologia e Experimentação Agrícolas since 1954 and constitute one of the major projects in the Citrus Research Program. Registration of outstanding trees free from bud-transmissible virus diseases became one of the main objectives in the Citrus Research Program.

TRISTEZA (STEM PITTING).—The tropical citrus aphid, *Toxoptera citricidus* (Kirk.) occurs in the Rio citrus area and the tristeza virus is considered to be universally present. Stem pitting on Pera sweet orange was recognized in 1958 by Giacometti (4) and in 1959 by Moreira (11, 12) for the state of Sao Paulo. Stem pitting is an important problem on West Indian lime and on Marsh seedless grapefruit (3).

Some Pera sweet orange trees show severe stem pitting while others show mild or very mild symptoms (4). In the Budwood Registration Program, candidate trees with severe stem pitting in the trunk, main branches, and limbs are dropped. Trees considered carriers of mild or very mild strains of tristeza virus, but which are free of psorosis and other viruses, are cut back and new shoots are checked six months later for stem-pitting symptoms. Of 1,261 candidate trees in the Weinschenck Farm, 885 were dropped because they showed severe tristeza stem pitting.

West Indian lime, Marsh seedless grapefruit, and Pera sweet orange with mild symptoms of stem pitting maintain their commercial performance for many years. Grant (7) states that a very mild strain, causing very mild stem pitting, appears to be the most stable strain. This may explain the satisfactory behavior of mild strain infected trees in the Rio area.

Bahia navel, Natal, Valencia, Hamlin, Lima, Piralima, Seleta, and Valencia sweet oranges are considered tolerant to stem pitting because no symptoms or only mild ones have been found in these varieties.

PSOROSIS.—This virus disease was first reported in the Rio citrus area in 1936 by Fawcett, Grillo, and Bitancourt (2). Giacometti (3) emphasized the importance of psorosis in Pera sweet orange. Twenty one per cent of 376 candidate trees of Pera sweet orange in the Budwood Registration Program (8) are carriers of psorosis virus. The trees are 15 to 20 years old and bark lesions as well as young leaf symptoms were used for diagnosis. In this area, Bahia navel, Valencia, Hamlin, and Natal oranges also generally have psorosis.

XYLOPOROSIS.—This disease was first reported in Brazil on sweet lime by Moreira (9) in 1938; and in 1957, Grant, Moreira, and Costa (6) demonstrated susceptibility of Rangpur lime to xyloporosis virus. Giacometti (5) reported the presence of the disease in the Rio citrus area, based on symptoms observed on Rangpur lime rootstock.

Xyloporosis occurs in Pera, Bahia navel, and Lima sweet oranges; and in Marsh seedless grapefruit, Dancy tangerine, and willow leaf mandarin. In this latter mandarin, trees after 4 to 6 years from budding-show shelling of the bark above the bud union. Beneath the bark there are pits and pegs, with phloem discoloration similar to that described by Childs (1). In the Budwood Program, of 297 candidate trees, 26 per cent were dropped because they were infected with xyloporosis.

EXOCORTIS.—In São Paulo, Moreira (10) has shown the relationship between exocortis and the Rangpur lime disease. Giacometti (3,5) noted that Bahia navel, Lima, Piralima, and Hamlin sweet oranges, Tahiti lime, Eureka lemon, and Marsh seedless grapefruit budded on Rangpur lime rootstock show typical exocortis symptoms. Pera sweet orange, the principal variety grown in the Rio citrus area, can be considered as free of the exocortis virus, while in the state of São Paulo some of its clones are carriers of the exocortis virus.

Procedure and Methods of Diagnosis

All the nurserymen or growers interested in having citrus trees registered in the Program have to apply according to the following instructions: The grower may apply for inspection and selection of 30 trees. The trees may include varieties of sweet orange, tangerine, lime, lemon, and grapefruit. The candidate trees must be older than 10 years and budded on Rangpur lime rootstock. Preliminary selection is based on vigor, productiveness, and trueness to type.

PRELIMINARY INSPECTION.—Scaling of the bark is considered a positive symptom for exocortis. Xyloporosis is detected by pits and pegs and is determined by removal of 3 bark disks, taken at the ground level, at the middle and at the bud union of the rootstock. Psorosis is determined by the presence of typical bark or leaf symptoms; young leaves are examined during May to September flushes of growth. "Clorose zonada" may be a virus disease (2); mature leaves and fruits show easily detectable symptoms. All selected trees must be free of these virus diseases.

Studies on Nucellar Lines

The Budwood Registration Program is attempting to establish nucellar lines of commercial citrus varieties obtained from different sources. Comparisons of nucellar lines with 5-year-old budded trees of Hamlin, Lima, and Barao nucellar sweet orange have shown that trees of nucellar lines are vigorous but slow in fruit production, while those of Baianinha and Pera sweet orange, willow leaf mandarin, Dancy tangerine, and Eureka lemon come into bearing as early as old clones. Generally fruit quality of nucellar lines in the first years is inferior to that of old apparently healthy trees.

Six nucellar lines of Pera sweet orange, taken from seedlings 8 years old have shown various reactions to tristeza virus, as far as stem pitting is concerned; 2 of them show severe symptoms, 3 show mild and 1 shows very mild symptoms. This may be related to natural field infection with strains of tristeza virus or may be related to different degrees of tissue tolerance of the selections.

The Budwood Registration Program is in its early stages of development. Trees have been selected on a few farms when the growers wish to extend their plantings. It is expected that there will be more requests for inspection and selection of candidate trees. In addition to this general

program, there will be established, at the Instituto de Ecologia e Experimentação Agrícolas, plantings of selected old-line clones and of nucellar clones. Once established these can serve as sources of budwood for distribution to nurserymen and growers in other sections.

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Literature Cited

1. CHILDS, J. F. L. 1950. The cachexia disease of Orlando tangelo. *Plant Disease Repr.* 34: 295-298.
2. FAWCETT, H. S., H. V. S. GRILLO, and A. A. BITANCOURT. 1936. Relatório sobre as doenças dos Citrus no Distrito Federal, Estado do Rio de Janeiro e Minas Gerais. *Rodriguezia* 2: 329-344.
3. GIACOMETTI, D. C. 1957. Doenças de vírus e cavalos para Citrus. *Rev. Ceres* 10 (56): 127-136.
4. GIACOMETTI, D. C. 1958. Stem-pitting on Pera sweet orange a threat to the Brazilian citrus grower. Unpublished.
5. GIACOMETTI, D. C. 1958. As doenças "exocorte" e "xiloporose" dos Citrus, S.I.A. M.A. Rec. Tec. No. 25: 1-2.
6. GRANT, T. J., S. MOREIRA, and A. S. COSTA. 1957. Observations on abnormal citrus rootstock reactions in Brazil. *Plant Disease Repr.* 41: 243-248.
7. GRANT, T. J. 1959. Tristeza virus strains, p. 45-55. *In* J. M. Wallace [ed.], *Citrus Virus Diseases*. Univ. Calif., Div. Agr. Sci., Berkeley.
8. LEITE, N. 1959. Programa de Registro de Árvores Matrizes. V. Dia da Laranja. *Inst. Ecol. Expt. Agr.* 4 p.
9. MOREIRA, S. 1958. Xiloporose. *J. Agron. S. Paulo* 1 (3): 217-231.
10. MOREIRA, S. 1955. Sintomas de "exocorte" em limoeiro Cravo. *Bragantia* 14: 19-21.
11. MOREIRA, S. 1959. Tristeza na laranja Pera. *Bol. Campo Blemco S/A* 123: 3-4.
12. MOREIRA, S. 1960. Um novo problema para nossa citricultura. *Rev. Agr. (Piracicaba)* 35 (2): 77-82.