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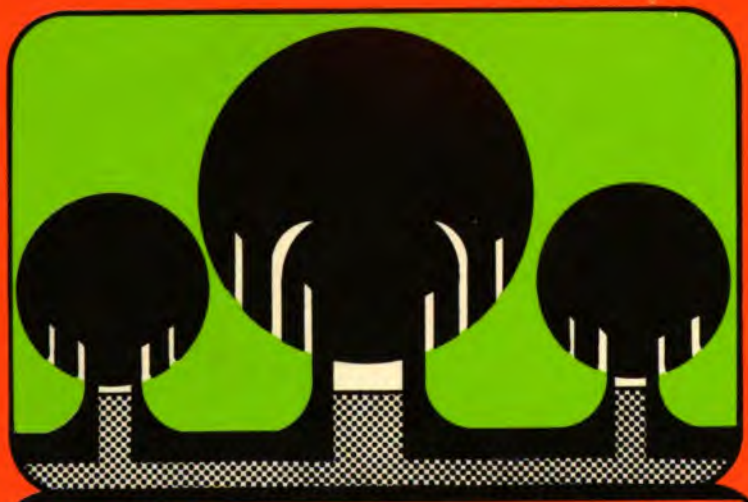
# PROGRAMA SANIDAD VEGETAL



## TRISTEZA DE LOS CITRICOS

Bibliografía parcialmente anotada

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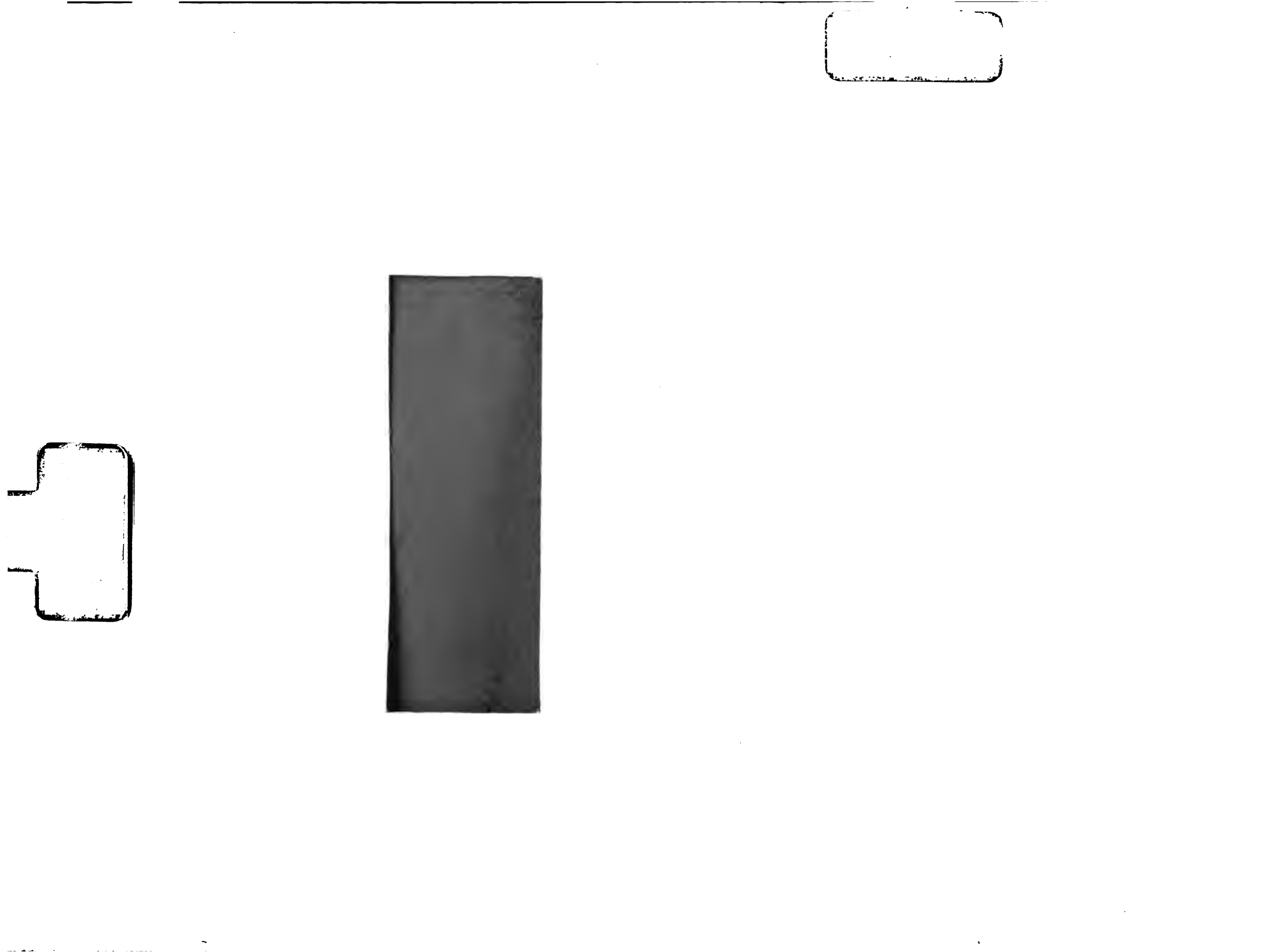

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# TRISTEZA DE LOS CITRICOS

## Bibliografía parcialmente anotada

**Compilada por:**

**Carmen Villegas**
**Laura Coto Royo**

Centro Interamericano de Documentación e Información Agrícola-CIDIA
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# INTRODUCCION

El Programa de Sanidad Vegetal del Instituto Interamericano de Cooperación para la Agricultura-IICA, está cada vez más convencido de la necesidad de agrupar en una sóla actividad fuerte y dinámica, la labor informativa sobre Protección Vegetal, presentando un frente único en el que el trabajo de comunicación sea la preocupación primordial permanente de sus componentes.

En vista de que existe una creciente demanda por parte de los países de la región de contar con información confiable y compatible para preparar planes de investigación y control de los problemas fitosanitarios que en la actualidad los aquejan, se han seleccionado algunos temas de interés para compilar una serie de bibliografías, que permita el acceso a la documentación en forma rápida y exacta sobre determinada plaga o enfermedad.

La presente Bibliografía sobre Tristeza de los Cítricos encierra un significativo cúmulo de conocimientos científicos y técnicos y constituye además un recurso acumulativo de información internacional laboriosamente escogido por un grupo de expertos y cumple con uno de los propósitos del Programa, el de promover la información fitosanitaria a nivel Latinoamericano y del Caribe.

Federico Dao
Director
Programa de Sanidad Vegetal

San José, Costa Rica
Agosto de 1981

# INTRODUCTION

The Plant Protection Program of the Inter-American Institute for Cooperation in Agriculture-IICA, is convinced of the need to compile the written information on the subject of Plant Protection into one strong and dynamic activity, where information gathering is the most important and permanent concern of its components.

In view of the growing demand expressed by the countries of the region, for reliable and compatible information for the preparation of research plans and for the control of plant protection problems they are now facing, a series of bibliographies have been compiled on some specific subjects of interest, in order to provide rapid and precise information on plant pests and diseases.

The Bibliography on Tristeza Disease of Citrus gathers a significant amount of scientific-human knowledge, and constitutes a resource of international information that has been carefully selected by a group of experts and thus fulfills one of the goals of the Program: to promote the dissemination of plant protection information throughout Latin America and the Caribbean.

Federico Dao
Director
Plant Protection Program

San José, Costa Rica
August, 1981

## METODOLOGIA

La compilación de esta Bibliografía sobre Tristeza de los Cítricos, por parte del IICA a través del Programa de Sanidad Vegetal y del Centro Interamericano de Documentación e Información Agrícola (CIDIA), tiene por objetivo principal divulgar la experiencia realizada sobre este tema.

Los documentos presentados son el resultado de una búsqueda retrospectiva que no pretende ser exhaustivo, realizada en las siguientes fuentes bibliográficas:

- Abstracts on Tropical Agriculture (Tropical Abstracts)
- Agrindex
- AGRITROP
- Bibliografía Agrícola Chilena
- Bibliografía Agrícola Peruana
- Bibliografía Agrícola Nacional (México)
- Bibliografía Brasileira de Agricultura
- Bibliografía Brasileira de Ciencias Agrícolas
- Bibliografía sobre Cítricos (Cuba)
- Bibliografías Agrícolas de América Central:
  - Costa Rica
  - Panamá
- Bibliography of Agriculture
- Contribuiçao á bibliografía Brasileira de Citricultura
- Horticultural Abstracts
- Indice Agrícola Colombiano
- Indice Agrícola de América Latina y el Caribe (Bibliografía Agrícola Latinoamericana)
- Indice Bibliográfico Agrícola de Venezuela
- Review of Plant Pathology

El período de búsqueda en los repertorios mundiales se realizó desde 1965 hasta la fecha. Al revisar las fuentes bibliográficas latinoamericanas

constatamos que la producción era poco representativa por lo que retrocedimos hasta 1945. También incorporamos algunos trabajos citados en los documentos de los autores indizados.

Los resúmenes presentados son: a) tomados de los propios documentos; b) de los repertorios bibliográficos analizados, con la indicación del volumen y número de referencia; c) realizados por los compiladores.

La Bibliografía tiene 360 referencias bibliográficas, está organizada en orden alfabético de autor o título. Para facilitar el uso de este trabajo, se elaboraron índices de autores, materia y geográfico.

La Biblioteca Conmemorativa Orton en Turrialba, facilita el acceso a la mayor parte del material incluido en esta Bibliografía. Las referencias que están acompañadas de un asterisco (*) están al alcance de los usuarios a través del Servicio de Reproducción de Documentos del CIDIA.

Esperamos que esta publicación sea una herramienta de trabajo efectiva para el combate y erradicación de la Tristeza de los Cítricos.

Turrialba, Costa Rica
Agosto de 1981

# *TRISTEZA DE LOS CITRICOS*

# TRISTEZA DE LOS CITRICOS

ABBADI, S. Growth characteristics of new *Citrus* rootstocks of possible potential in the Sudan. Indian Journal of Horticulture 26:1-4. 1969. (01

The shoot and root growth under Sudanese conditions were studied of Cleopatra mandarin, Dancy tangerine, Blackman sweet orange, rough lemon, Troyer citrange, trifoliate orange and *Citrus macrophylla* to evaluate them as alternative rootstocks to sour orange. Their advantages over the latter are (a) resistance or tolerance to tristeza virus, (b) greater tolerance of high salt concentrations, and (c) greater adaptability to light soil. Measurements were made of the average height, cross sectional area of the stem, fresh and dry weights of shoot and root, and the shoot: root weight ratio. Rough lemon had the most vigorous shoot and root growth whilst Troyer citrange and trifoliate orange were the least vigorous. Blackman sweet orange ranked second to rough lemon and made more vigorous growth than the standard sour orange. Cleopatra mandarin and trifoliate orange had the largest root: shoot ratios and all rootstocks produced distinct tap roots with varying numbers of lateral and feeder roots. (Horticultural Abstracts 41:2198)

ABUHAB, P. G. Os meios de combate a tristeza dos citros. Sitios e Fazendas (Brasil) 34(10):9-11. 1968. (02

ADANSI, M. A. Citrus stem-pitting virus diseases at Bunso Ghana. Ghana Journal of Agricultural Science 5(2):111-119. 1972. (03

Scions of sweet orange, tangerine, lemon, lime and grapefruit on *Citrus macrophylla* rootstocks showed stem pitting. Three viruses are suspected: tristeza in trees on *C. macrophylla* rootstocks and in West Indian lime on Rough lemon stock, xyloporosis in cases of Satsuma decline, and possibly 'greening' in Satsuma decline without stem-pitting symptoms. (Review of Plant Pathology 52:1901)

* AHLAWAT, Y. S. y SARDAR, K. K. Occurrence of greening and tristeza diseases of citrus in various blocks of Darjeeling district (West Bengal). Science and Culture 42(5):275-277. 1976. (04

The present studies were undertaken to ascertain blockwise occurrence and distribution of greening and tristeza diseases in mandarins (*Citrus reticulata* Blanco.) commonly grown in this district.

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* Se encuentra en la Biblioteca del CIDIA, Turrialba, Costa Rica y puede obtenerse a través de su Servicio de Reproducción de Documentos.

ALMEIDA, J. D'. y BOURDEAUT, J. Informe sobre la actividad 1975. Ministerio del Desarrollo Rural y de la Acción Cooperativa; República Popular del Benin. Paris. Institut de Recherches sur les Fruits et Agrumes. Archives de Recherches no. 6-198. 1976. 43 p. (05

Revista de los trabajos emprendidos por el IRFA en Benin donde se ha creado la Sociedad Nacional de Frutas y Legumbres (SONAFEL). Ensayos de injertos de agrios para el mandarino Dancy y el limonero Eureka en las regiones de Toué y Sékou. Resultados interesantes de la lima Rangpur y del Rough Lemon, aunque sean sensibles a la gomosis de *Phytophthora*. Estudio del comportamiento de la lima mejicana en presencia de Tristeza sobre diferentes injertos en Allahé. Control de la producción de mangos, aguacates, papayos, guayabos, anacardos, granadillos, *Synsepalum dulcificum*. Indicaciones pedológicas y pluviométricas. Experimentación en limonero con vistas a la producción de esencia y jugo. La realización del complejo agro-industria de Allahé debería favorecer el desarrollo frutero. (AGRITROP 1(1):73)

* ARAUJO, C. M. y VASCONCELLOS, H. O. Um sintoma nao descrito de tristeza em limas ácidas. Agronomia (Brasil) 24:41-44. 1966. (06

O trabalho ora apresentado teve a finalidade de verificar as causas e origens das rachaduras ocorridas em certas variedades de limas ácidas, nas partes mais tenras da planta. As investigações seguiram o caminho indicado pelas hipóteses que surgiram para explicar o fato, as quais foram:

1. Lesões originárias do vírus da exocorte;
2. Lesões devidas a ação de toxina de insetos;
3. Lesões causadas pelo vírus de tristeza;
4. Lesões causadas por outro vírus, transmitido por vetores.

Finalizadas as pesquisas, concluiu-se ser a hipótese mais correta, a de que as rachaduras eram causadas pelo agente causal da tristeza.

_____. y VASCONCELLOS, H. O. An unreported symptom of tristeza. In Conference of the International Organization of Citrus Virologists, 4°, Rome, 1966. Proceedings. Edited by J. F. Childs. Gainesville, University of Florida, 1968. pp. 38-41. (07

Bark splitting in Mexican and Tahiti limes was shown to be associated with tristeza virus, rather than with exocortis. It is transmitted by the aphid *Toxoptera citricida*. This suggests that it constitutes a new symptom of tristeza disease in limes. (Horticultural Abstracts 40:2177)

* ATUBRA, O. K. y KREZDORN, A. H. Responses of healthy and virus-infected citrus to growth regulators. Proceedings of the Florida State Horticultural Society 86:24-29. 1973. (08

Spray applications of gibberellic acid (GA) hastened the symptom expression of exocortis-infected plants of Arizona 861 selection of 'Etrog' citron (*Citrus medica* L.) and of tristeza-infected plants of 'Key' lime (*C. aurantifolia* (Christm.)

Swing.) but not of xyloporosis-infected plants of 'Orlando' tangelo (C. *paradisi* Macf. x C. *reticulata* Blanco). Spray applications of 2,4-dichlorophenoxyacetic acid (2,4-D) and $N^6$-benzyladenine (BA), caused morphological changes in both healthy and virus-infected plants of the 'Etrog' citron, 'Key' lime and 'Orlando' tangelo but neither compound hastened symptom expression of exocortis, tristeza or xyloporosis.

* AUBERT, B. Etat des travaux de virologie-bactériologie á l'IRFA á la Réunion entre 1974 et 1977. Fruits 33(11):751-754. 1978. (09

An account is given of work on citrus greening (aetiology, chemical control, agronomic experiments, control of vectors), and on tristeza virus. (Review of Plant Pathology 58:4842)

AZERI, T. y KARACA, I. Investigations on the tristeza (quick decline) virus disease in the Satsuma mandarins; its definitions, crop losses and determination of the strains in Izmir province. Journal of Turkish Phytopathology 7(2/3):51-68. 1978. (10

The incidence of citrus tristeza virus infection in Satsuma mandarins varied from 15 to 22.5% in different parts of the province; some orchards had 30% infection. The disease affected Satsuma mandarins on sour orange rootstocks, causing stunting, general decline, gradual decline, dieback and death. Characteristic honeycomb symptoms were present on the inner surface of the sour orange bark. Severe tristeza strs. caused yellowing, mild stunting and gradual decline in Satsuma mandarins on *Poncirus trifoliata* rootstocks. Five distinct tristeza strs. were present; the severe str. caused veinlet netting and vein corking on lime but mild and moderate strs. were more widely distributed than the severe strs. (Review of Plant Pathology 59:296)

BALARAMAN, K. y RAMAKRISHNAN, K. Studies on strains and strain interaction in citrus tristeza virus. Bangalore. University of Agricultural Sciences. Technical Series no. 19. 1977. 62 p. (11

_____. y RAMAKRISHNAN, K. Cross protection for control of citrus tristeza virus. Indian Horticulture 23(3):22-23. 1978. (12

In pot and field trials, yields of lime trees cross-protected with mild strs. of the virus and challenge-inoculated 8 weeks later with a virulent str. differed only slightly in the first 2 cropping years from those of trees inoculated only with a mild str. and were much greater than those of originally healthy trees; moreover, the latter started dying back following natural infection with severe strs. under field conditions. (Review of Plant Pathology 59:3769)

* _____. y RAMAKRISHNAN, K. Cross-protection of acid-lime with mild strains of tristeza. Indian Journal of Agricultural Sciences 48(12):741-746. 1978. (13

Cross-protection tests with acid-lime (*Citrus aurantifolia* (Christm.) Swing.) using 2 mild strains of tristeza virus

against a severe strain were conducted in pot culture. The seedlings were first bud-inoculated with very mild ($M_1$) and ($M_2$) strains and, after holding them for 8 weeks till evidence of infection was visible in the new leaves, they were challenge-inoculated with severe (V) strain. Statistical analysis of data indicated that the pre-immunized and pre-immunized + challenge-inoculated plants were on par with healthy plants in growth, circumference, leaf size, root and shoot weight and branching pattern, though they had occasional wood pittings and slight veinal fleckings. The mild strains afforded a significant protection against the severe strain.

BALARAMAN, K. y RAMAKRISHNAN, K. Transmission studies with strains of citrus tristezas virus on acid lime. Zeitschrift für Pflanzenkrankheiten und Pflanzenschutz 86(11):653-661. 1979. (14

*Toxoptera citricida* was found to be an efficient vector: *T. aurantii* and *Aphis gossypii* also transmitted but were inefficient. More transmission occurred with the severe str. than with the mild one. At least 15 viruliferous *T. citricida*/plant were required for 100% transmission, with 24h each for acquisition and transmission feeding periods, and >100/plant reduced the incubation period of the virus in the host by 15-20 days. The virus was effectively transmitted by dodder (*Cuscuta reflexa*). Bark and leaf piedece showed max. transmission in grafting experiments. (Review of Plant Pathology 59:4179)

_____. y RAMAKRISHNAN, K. Two new additional hosts of citrus tristeza virus. Current Science 48(10):453-454. 1979. (15

In glasshouse tests a severe str. of the virus infected the indigenous trees *Aegle marmelos* and *Feronia limonia*, causing leaf symptoms, thin wood and bumpy bark, and stunting. These are newly reported hosts for the virus and cannot be used as resistant rootstocks. Three other rutaceous hosts (*Murraya koenigii*, *Ruta graveolens* and *Evodia hupelensis*) are symptomless carriers of the virus. (Review of Plant Pathology 59: 2203)

BARBAGALLO, S. Brevi notizie intorno agli afidi degli agrumi in Sicilia. Tecnica Agricola (Catania) 17:122-128. 1965. (16

*Toxoptera aurantii*, *Aphis spiraecola* and *A. gossypii*, the injuries (including tristeza transmission) they cause to citrus, and their control by various systemic and other insecticides. (Horticultural Abstracts 36:7346)

* BAR-JOSEPH, M.; LOEBENSTEIN, G. y COHEN, J. Partial purification of viruslike particles associated with the citrus tristeza disease. Phytopathology 60(1):75-78. 1970. (17

Threadlike particles associated with the tristeza disease of citrus were partially purified, employing a combination of

gentle grinding, precipitation by polyethylene glycol and differential centrifugation, and using electron microscopy as an assay. Particles in negatively stained dip preparations from leaves or stem bark exhibited a normal length of 200 mμ and a width of 10-11 mμ. Sedimentation constants of purified preparations, determined in sucrose density gradients, ranged from 105 to 131 S. with a calculated value of 140 S (±10) at zero depth. In purified preparations, normal length particles amounted to 26%, whereas variations in the procedure resulted in fragmentation of almost all particles. In different tissues of four citrus varieties, the highest concentrations of particles were always found in the stem bark. Bark from Key limes was the best source for extraction. In Key lime leaves, particle concentration was correlated with symptom intensity.

* BAR-JOSEPH, M. y LOEBENSTEIN, G. Rapid diagnosis of the Citrus tristeza disease by electron microscopy of partially purified preparations. Phytopathology 60(10):1510-1512. 1970. (18

A modified procedure is described for the partial purification of the threadlike particles associated with the citrus tristeza disease. This method enables rapid identification of infected trees by electron microscopy. Diagnosis was accurate when 65 tristeza-infected and 62 control trees were examined by this method.

_____. Virus diseases of citrus trees. Hassadeh 50(3-4):303-304, 420-424. 1970. (19

The virus diseases of citrus trees identified in Israel include psorosis, xyloporosis, exocortis, stubborn and impietratura. All trees affected by tristeza were destroyed and no further cases have been recorded. Measures are required to prevent the introduction of greening and leaf mottle. *Aphis citricidus* is the most effective vector of tristeza, but *A. gossypii* is also a potential vector. Various virus detection procedures are described. (Horticultural Abstracts 42:8357)

* _____., LOEBENSTEIN, G. y COHEN, J. Further purification and characterization of threadlike particles associated with the citrus tristeza disease. Virology 50(3):831-828. 1972. (20

Additional purification of threadlike particles (TLP) from leaves and bark of Egyptian sour lime, *Citrus aurantifolia* (Christm.) Swing., and bark of Palestinian sweet lime, *C. limmentioides* Tanaka, infected with Citrus Tristeza disease, was achieved by density gradient centrifugation in cesium chloride, after fixation with formaldehyde. A buoyant density of 1.328 g/cm$^3$ was determined by the use of two viral markers. The UV adsorption spectrum of TLP was typical of a nucleoprotein, and the 260:280 ratio of 1.21 indicated a nucleic acid content of ca 6%. TLP contained RNA but no DNA and a single protein species with a molecular weight of 25,000 ± 1000. TLP are helically constructed with a basic

pitch of 37 + 2 Å and ten subunits in each turn of the basic helix. A molecular weight of 144 ± 23 x $10^6$ for a particle with a normal length of 2000 nm was estimated.
These properties of TLP, resembling those of other filamentous viruses, as well as their presence in infected tissues only, lend strength to the suggestion that TLP are the causal agent of the tristeza disease.

BAR-JOSEPH, M. Studies on citrus tristeza virus; purification of threadlike particles, vector transmission changes (peroxidase) associated with the disease. Tesis Ph.D. Israel, University of Jerusalem, 1972. (21

* _____. y LOEBENSTEIN, G. Effect of temperature on peroxidase activity, isozyme patterns and concentration of threadlike particles in tristeza-infected citrus plants. Phytoparasitica 1(1):3-12. 1973. (22

Peroxidase activity (PA) in various tristeza-infected citrus varieties was significantly higher than in healthy controls. In leaves and bark of Egyptian sour lime and Palestine sweet lime, PA was correlated with symptom severity and content of threadlike particles (TLP). In infected roots of Egyptian sour lime, there was an increase in PA but TLP content was minimal.
Temperatures above 22°C caused a gradual decrease in PA in both healthy and infected leaves of Egyptian sour lime trees. At 36°C, no differences in PA between infected and healthy samples were observed. In these plants TLP content was minimal and almost no symptoms were observed.
No new isozymes were found in various host tissues infected with tristeza, psorosis, exocortis or impietratura. One isozyme appeared earlier in tristeza-infected plants than in healthy controls, suggesting that isozymes associated with senescence are activated at an earlier stage in infected plants than in healthy ones.

* _____. y LOEBENSTEIN, G. Effects of strain, source plant and temperature on the transmissibility of citrus tristeza virus by the melon aphid. Phytopathology 63(6):716-720. 1973. (23

Three citrus tristeza virus isolates, which were considered to be related strains in cross protection tests, differed markedly in their transmissibility by *Aphis gossypii*. High transmission rates, averaging 40%, were obtained with the VT isolate, compared with less than 5% with the CT and ST isolates; all three were acquired from 'Mme Vinous' sweet orange. The source of the aphid population had no significant effect on transmission rates. Mme Vinous was a much better host for virus acquisition than 'Palestinian' sweet lime, although no differences in the concentration of threadlike particles (TLP) were observed. The differences in transmissibility of the tristeza isolates were not correlated with TLP content. Significantly higher transmission rates were obtained when source plants were kept at 22°C, compared with a decrease in TLP content.
The high transmissibility of the VT strain by *A. gossypii*, compared with the low rates of the two other strains, may explain the natural spread observed recently in Israel, as well as the lack of spread from previously located tristeza sources.

BAR-JOSEPH, M. y LOEBENSTEIN, G. Effect of temperature on concentration of threadlike particles, stem pitting and infectivity of budwood from tristeza-infected Palestine sweet lime. In Conference of the International Organization of Citrus Virologists, 6°, Swaziland, 1972. Proceedings. Edited by L.G. Weathers and M. Cohen. Riverside, University of California, 1974. pp. 86-88. (24

_____., LOEBENSTEIN, G. y OREN, Y. Use of electron microscopy in eradication of tristeza sources recently found in Israel. In Conference of the International Organization of Citrus Virologists, 6°, Swaziland, 1972. Proceedings. Edited by L.G. Weathers and M. Cohen. Riverside, University of California, 1974. pp. 83-85. (25

_____., LOEBENSTEIN, G. y COHEN, J. Comparison of particle characteristics and cytopathology of citrus tristeza virus with other morphologically similar viruses. In Conference of the International Organization of Citrus Virologists, 7°, Athens, 1975. Proceedings. Edited by E.C. Calavan. Riverside, University of California, 1976. pp. 39-46. (26

_____. *et al.* Serodiagnosis of citrus tristeza virus in Shamouti trees. Hassadeh 58(3):457-460. 1977. (27

* _____. Cross protection incompleteness: a possible cause for natural spread of citrus tristeza virus after a prolonged lag period in Israel. Phytopathology 68(8):1110-1111. 1978. (28

Evidence is presented supporting the hypothesis that under certain conditions cross protection fails or is incomplete. Mutants of CTV are acquired by *Aphis gossypii* and transmitted to healthy trees which will serve as sources for further spread. (Review of Plant Pathology 58:3295)

* _____., SACKS, J. M. y GARNSEY, S. M. Detection and estimation of citrus tristeza virus infection rates base on ELISA assays of packing house fruit samples. Phytoparasitica 6(3):145-149. 1978. (29

Enzyme-linked immunosorbent assay (ELISA) proved to be a sensitive detector for citrus tristeza virus (CTV) in orange fruits (*Citrus sinensis* (L.) Osbeck). Samples of five fruits were taken from 350-kg packing house containers and tested by ELISA to predict the infection rate of CTV in two infected orange groves. The predicted infection rates, 1% and 11%, were in reasonable agreement with the observed rates of 1% (15/1400) and 16% (324/2053), respectively. The 360 test samples from reputedly uninfected groves all tested negative. These results suggest that the ELISA procedure may provide a general method of detecting viral or other systemic pathogenic infections using the fruit as the test material in place of tree tissue. Fruit samples can be collected routinely at the packing house to reduce test costs.

_____. Trials with cross protection between various strains of the Tristeza virus. Hassadeh 58(4):665-671. 1978. (30

BAR-JOSEPH, M., RACCAH, B. y LOEBENSTEIN, G. Evaluation of the main variables that affect citrus tristeza virus transmission by aphids. In International Citrus Congress, Florida, 1977. Proceedings. Edited by W. Grierson, Orlando, Fla., International Society of Citriculture, 1979. v. 3, pp. 958-961. (31

Most lab. experiments indicate that *Toxoptera citricidus* transmits this virus more efficiently than other possible vectors although some of the transmission rates obtained with *Aphis gossypii* approached those reported for *T. citricidus*. Rates of transmission by *A. gossypii* are influenced by the cv. serving as the inoculum source. The CTV isolate VT was acquired efficiently from the sweet orange Mme. Vinous and the mandarin Clementine, resulting in 45.4% and 42.3% transmission, respectively, compared with 15% from Eureka lemon and 5.2% from Marsh Seedless grapefruit. Climate affects the adaptability of the infected plant to serve as an inoculum source. Maintenance of source plants at high temps. usually reduces the transmission rates. Some possible explanations for the appearance of tristeza isolates that might be efficiently transmitted by aphids prevalent in the Northern Hemisphere are discussed. (Review of Plant Pathology 59:5172)

* _____., MOSCOVITZ, M. y SHARAFI, Y. Re-use of coated enzyme-linked immunosorbent assay plates. Phytopathology 69(4):424-426. 1979. (32

The dissociation reactions of four plant viruses: citrus tristeza virus (CTV), carnation mottle virus (CarMV), carnation yellow fleck virus (CYFV), and tobacco mosaic virus (TMV) and their respective γ-globulin alkaline phosphatase conjugates, sandwiched to antibody microplates, were examined. Treatment with 0.2 M glycine-HCl buffer pH 2.2 for 60 min caused the double antibody sandwiches of CTV and CarMV to dissociate from the antibody-coated microplates. In similar treatments CYFV was eluted less efficiently. The TMV double-sandwich remained undissociated by acidification but it could be partially dissociated under alkaline conditions (pH 12.1). The application of microplate recycling for economizing routine large-scale screening of CTV is described.

* _____., SHARAFI, Y. y MOSCOVITZ, M. Re-using the non-sandwiched antibody-enzyme conjugates of two plant viruses tested by enzyme-linked immunosorbent assay (ELISA). Plant Disease Reporter 63(3):204-206. 1979. (33

The possible re-use of the γ -globulin-enzyme conjugates of citrus tristeza virus (CTV) and tobacco mosaic virus (TMV) which remain unbound to their respective antigen sandwiches was examined. After four consecutive transfers through wells containing CTV and TMV antigen-antibody complex, the enzyme-linked immunosorbent assay (ELISA) values (OD/405 nm) were reduced to 28% and 44% of those obtained from the respective unused conjugates. Following three transfers through wells that contained control sap, the ELISA values were reduced to 61% and 69% of the values obtained from unused CTV and TMV conjugates, respectively. These findings indicate that

in routine ELISA screenings involving these viruses, when the percentage of infected samples is low, it is feasible to reuse the antibody-enzyme conjugate for four consecutive applications.

* BAR-JOSEPH, M. *et al.* The use of enzyme-linked immunosorbent assay for detection of citrus tristeza virus. Phytopathology 69(2):190-194. 1979. (34

An enzyme-linked immunosorbent assay (ELISA) test was used to identify citrus tristeza virus (CTV) in extracts from citrus tissues. Alkaline phosphatase conjugates were prepared with partially purified γ-globulin from antiserum to purified CTV. Citrus tristeza virus was detected quickly in extracts of experimentally inoculated plants kept in various indoor facilities, and in extracts of infected samples collected from the field. The ELISA procedure was equally effective for detection of most common and seedling yellows isolates of CTV from Israel and from Florida. Isolates that produced only mild symptoms on lime (*Citrus aurantifolia*) 'Mexican' indicator seedlings could be detected by ELISA. The virus was detected in various phloem-containing tissues during warm and cold seasons, but was most readily detected from fruit pedicel bark. A test procedure that incorporated composite sampling and mechanical homogenization was developed to index large numbers of field trees.

* BAZAN DE SEGURA, C. La "tristeza" de los cítricos en el Perú. Lima. Estación Experimental Agrícola La Molina. Informe no. 77. 1952. 14 p. (35

La autora da información sobre su visita de reconocimiento a la Hacienda Huando. Hace al mismo tiempo una síntesis de la distribución de la enfermedad en el mundo, de las pérdidas económicas que causa y de los esfuerzos de investigación realizados para determinar la causa de la "Tristeza" y el agente vector. Establece los síntomas de la enfermedad en las plantas adultas en general y los observados en Huando. Tratándose de un problema tan serio, Perú, en forma inmediata debe iniciar medidas de control e investigaciones como:

- -determinar la dispersión de la enfermedad en el país
- -probar la virulencia del pulgón negro (*Toxoptera aurantiae* Kock)
- -determinar el tipo o tipos de virus exitentes
- -investigar especies citrícolas resistentes para recomendarlas a los agricultores.

* _____. La tristeza; temible enfermedad de los cítricos. La Hacienda 48 (8):32-34, 48, 50. 1953. (36

La autora hace una reseña de la dispersión de la enfermedad a nivel mundial, de los esfuerzos de investigación realizados desde su aparición para establecer la causa de la "Tristeza" y los resultados obtenidos.
Indica el uso de porta injertos resistentes a la "Tristeza" y medidas de control:

- -extracción e incineración "in situ"
- -injerto por aproximación

-afrancamiento del injerto dulce
-reinjertación de la copa con limonero
-control permanente y extirpación del pulgón negro, agente vector.

* BAZAN DE SEGURA, C. Los cítricos y sus principales problemas fitopatológicos en el Perú. Proceedings of the Tropical Region American Society for Horticultural Science 16:77-92. 1972. (37

La autora hace un estudio de las distintas enfermedades virosas en cítricos en el Perú.
Indica que el control de estas enfermedades de virus se ha condicionado a la modalidad y forma de transmisión de cada uno de ellos.
En el caso de la Tristeza, cuya forma más importante de transmisión es por medio de insectos vectores en Perú, fundamentalmente por *Toxoptera citricidus*, se resolvió mediante el uso de patrones tolerantes, que en el Perú son:
"-para la Costa, el limón rugoso, la mandarina 'Cleopatra' y el naranjo dulce. Otro patrón de posibilidades, de acuerdo a lo observado en el comparativo de patrones de la Irrigación de la Esperanza, es el 'Orlando' tangelo, siempre que se cuente con yemas libres de Xiloporosis.
El patrón 'Troyer' citrange se adapta a las condiciones de clima de la costa peruana, pero como el naranjo dulce, necesita de suelos sueltos, profundos y de buena calidad. Para incrementar este patrón, se deberá tener en cuenta que las semillas a usarse deberán provenir de una fuente garantizada en lo que se refiere a Psorosis, ya que es el primer patrón a través del cual se ha observado la transmisibilidad de esta enfermedad.
Además se tendrá en cuenta que al usarse los patrones citranges, las yemas a injertarse, deberán estar libres de Exocortis.
Para la región de la región de la Selva, los patrones más recomendables son: la lima 'Rangpur', el limón rugoso, la mandarina 'Cleopatra' y el naranjo dulce. Este último, por su susceptibilidad a la Gomosis del Cuello, deberá usarse sólo en las laderas. Las yemas a injertarse sobre el patrón lima 'Rangpur' deberán estar libres de las enfermedades de la Xiloporosis y Exocortis.
-las observaciones efectuadas en el Comparativo de Patrones de limón 'Sutil' (Piura), de quince años de edad, permiten concluir que en las condiciones del Perú, los patrones limón rugoso y naranjo dulce, protegen a esa especie citrícola, en relación con la enfermedad de la Tristeza; es decir, se manifiestan también como tolerantes, cosa que no se observa en otras partes del mundo. Por consiguiente en las nuevas plantaciones de limón 'Sutil', deben usarse ambos patrones.
-en todas las plantaciones de cítricos, deberán considerarse por lo menos tres patrones tolerantes a la Tristeza, como una forma de ponerse a cubierto de cualquier sorpresa".

* BELTRAN, J. P. *et al.* Virosis de los cítricos. V. Actividades e isoenzimas de peroxidasa y ribonucleasa en naranjos afectados de tristeza. Revista de Agroquímica y Tecnología de Alimentos 13(2):279-287. 1973. (38

El objeto de este trabajo es aportar datos para el mejor conocimiento de la patogenia de la tristeza de los cítricos y de las causas que originan la diferente tolerancia de distintos portainjertos a la enfermedad. Para ello, en el floema de corteza, del injerto y del portainjertos, de naranjos Washington Navel desarrollados sobre pie de naranjo amargo, afectados de tristeza y exentos de la enfermedad, se determina el contenido proteico y las actividades de ribonucleasa y peroxidasa. Por otra parte, se separan isoenzimas de ribonucleasa y de peroxidasa, mediante electroforesis en gel de poliacrilamida. Las muestras de floema se toman en zonas próximas a la línea de unión del injerto y portainjertos.
En el floema del portainjertos de árboles afectados de tristeza, se ha registrado una actividad de peroxidasa significativamente mayor que la del portainjertos de árboles sanos. Además, se han detectado alteraciones en los zimogramas de peroxidasa del portainjertos de árboles afectados.
Por el contrario, no se encuentran diferencias significativas, entre árboles enfermos y sanos, tanto en la actividad como en los zimogramas de ribonucleasa.
El contenido proteico encontrado en el floema del injerto de árboles enfermos es significativamente menor que el determinado en árboles sanos.
Cabe resaltar finalmente que, tanto en árboles exentos como en los afectados por la virosis, la actividad de ribonucleasa en el floema del portainjertos es unas cinco veces mayor que la encontrada en el injerto.

* _____., CARBONELL, J. y CONEJERO, V. Actividades e isoenzimas de peroxidasa y ribonucleasa en combinaciones resistentes sensibles de naranjos afectados de tristeza. Revista de Agroquímica y Tecnología de Alimentos 16(2):195-208. 1976. (39

Se han determinado las actividades e isoenzimas de peroxidasa y ribonucleasa, así como la concentración de proteínas, en floema de corteza del injerto y del portainjertos de combinaciones de naranjos resistentes (naranjo dulce/naranjo dulce), y sensibles (naranjo dulce/naranjo amargo), exentos y afectados de tristeza, en cuatro épocas del año.
La actividad de peroxidasa en la combinación sensible es significativamente mayor que la de la combinación resistente, tanto en injerto como en portainjertos. La enfermedad produce un aumento de dicha actividad. Se han detectado diferencias entre los zimogramas de peroxidasa del injerto y portainjertos de la combinación sensible, tanto en árboles exentos como afectados de tristeza. Esta enzima no parece estar implicada en el mecanismo de resistencia a tristeza.
La actividad de ribonucleasa en el portainjertos de la combinación sensible es 4-5 veces mayor que en el portainjertos de la combinación resistente, tanto en árboles exentos como afectados. La enfermedad produce alteraciones en la actividad de ribonucleasa en injertos de combinaciones sensibles y resistentes, y en portainjertos de la combinación sensible;

también produce alteraciones en los zimogramas de ribonucleasa del portainjertos de la combinación sensible en otoño y en invierno.
Los resultados obtenidos en la medida de la actividad de ribonucleasa parecen indicar que la replicación del virus está muy favorecida en la combinación sensible a tristeza.
El contenido proteico de la combinación sensible afectada de tristeza es significativamente menor que el encontrado en árboles exentos.

* BISESSAR, S. Review of work in plant pathology in British Guiana, 1950-1964. PANS 11(4):392-396. 1965. (Tristeza p. 394). (40

The Plant Pathology Division of the Ministry of Agriculture, Forests, and Lands was established in 1950, primarily to give attention to the diseases of sugar cane, the country's most important cash crop. In due course, work expanded to investigate and advise on various diseases attacking other crops such as citrus, cocoa, coffee vegetables and grasses. Under the auspices of the Agency for International Development and at the request of British Guiana Government, a survey was conducted of citrus virus diseases in British Guiana.

* _____. El virus de la tristeza de los agrios en Guyana. Boletín Fitosanitario de la FAO 16(3):45-48. 1968. (41

También en: FAO Plant Protection Bulletin y Bulletin Phytosanitaire de la FAO.

Una revisión de las fuentes de las primeras importaciones de agrios en Guyana indica la probabilidad de que la mayoría de virosis de agrios importantes existan en dicho país. Teniendo en cuenta el uso exclusivo de patrones de naranja agria y la presencia de vectores, la tristeza constituye una amenaza particular para la producción de agrios. En consecuencia, en 1961 se llevó a cabo un reconocimiento iniciándose experimentos más tarde que confirmaron la presencia del virus de la tristeza.
El programa de pruebas de transmisión por injerto iniciado en 1962 estableció que el virus de la tristeza existía sólo en un número relativamente pequeño de árboles de naranja dulce sobre algunos patrones de naranja. A juzgar por la mortalidad limitada y la manifestación de los síntomas, parece que interviene una cepa ligera del virus de la tristeza.
Está en marcha el programa de pruebas de transmisión de cítricos domésticos para el virus de la tristeza con idea de conseguir injertos libres de virus.
También se está realizando un experimento de patrón para encontrar sustitutos para naranja agria. Mientras tanto, se está empleando limón áspero para reemplazar a los naranjos muertos y moribundos sobre patrón de naranja agria.
El Ministerio de Agricultura ha distribuido plantas injertadas a precios subvencionados, con el fin de atender la demanda de los cultivadores de cítricos y para la diversificación de los cultivos.

* BITANCOURT, A. A. y RODRIGUEZ FILHO, A. J. Estudos sobre a "tristeza" dos citrus. I. Analise estatistica da distribuição das árvores doentes de um pomar de laranjeira doce enxertada sobre laranjeira azeda. Arquivos do Instituto Biológico (Brasil) 18:313-338. 1948. (42

Foram feitos em 28 de Novembro de 1942, 8 de Outubro de 1943 e 3 de Janeiro de 1945, levantamentos das árvores atacadas de tristeza num pomar de laranjeira doce da variedade Bahia, exertada sobre laranjeira azeda, da Estação Experimental de Limeira. A análise estatística da distribuição das árvores doentes foi feita em primeiro lugar pelo método de análise de levantamentos sucessivos de Cochran (1936) aplicado aos pés situados nas 22 posições mais próximas das árvores doentes no primeiro e no segundo levantamentos, e em segundo lugar pelo método de ZENTMYER, WALLACE e HORSFALL (1944), para parcelas de 350 árvores paralelas à primeira linha do pomar onde se apresentou o maior número de casos da doença no primeiro levantamento. Os resultados das duas análises dão apoio à hipótese de que a tristeza é uma doença infecciosa que póde propagar-se a grandes distâncias das plantas doentes. A primeira fornece informações sobre a "infectividade" das plantas doentes, a segunda sobre a marcha da infecção no pomar, em conjunto; elas conduzem às seguintes conclusões:

1. a doença propagou-se das plantas doentes no primeiro levantamento para as plantas sãs nas 22 posições analisadas, em todas as direções, mas principalmente no quadrante Norte-Leste. Das plantas doentes no segundo levantamento a propagação se fez uniformemente em todas as direções.
2. a infectividade das plantas doentes no primeiro levantamento foi maior do que a das plantas doentes no segundo.
3. o "gradiente de infectividade" das plantas doentes no primeiro levantamento foi mais acentuado do que o das do segundo.
4. a relação entre a porcentagem de plantas doentes no primeiro levantamento nas parcelas e a distância médias delas à extremidade do pomar onde se iniciou a infecção, é a que se podia esperar de uma distribuição ao acaso dos germes da doença ou seus vetores, sendo a distância considerada como um "fator de dosagem" desses germes ou vetores. Para o segundo e o terceiro levantamentos os dados se afastam da relação teorica, o que deve ser atribuido a formação de fócos secundários em diversos pontos do pomar.
5. o "gradiente de infecção" de uma extremidade do pomar à outra foi o mesmo nos três levantamentos.

Das diversas hipóteses sobre a etiologia da tristeza que tinham sido apresentadas no tempo em que foi iniciado o presente estudo, a que mais se coaduna com estes resultados é a de uma doença infecciosa cujos germes ou vetores têm grande facilidade de propagação a distâncias relativamente consideráveis, como por exemplo no caso em que a doença seja espalhada por um inséto alado. Meneghini mostrou recentemente que a tristeza é transmissivel pelo pulgão preto das laranjeiras, *Aphis tavaresi*.

* BITANCOURT, A. A. Estudos sobre a "Tristeza" dos citrus. II. Susceptibilidade das diversas combinações de enxertia de laranjeira doce e laranjeira azeda. Arquivos do Instituto Biológico (Brasil) 20:39-59. 1951. (43

From November 1943 to February 1944 and in October 1944 approach-grafts of sweet orange and sour orange were prepared in several ways so as to obtain the following combinations: I, sweet orange on sweet orange; II, sour orange on sour orange; III, approach-graft of sweet and sour orange; IV, sweet on sour; V, sour on sweet; VI, crown of sweet and of sour on sweet orange roots; VII, crown of sweet and of sour on sour orange roots; VIII, sour orange on roots of sweet and of sour; IX, sweet orange on roots of sweet and of sour; X, "sandwich" of sweet on sour on sweet; XI, "sandwich" of sour on sweet on sour.
The trees were planted on September 18 to 29, 1945 and the first symptoms of "tristeza" were observed in some of the combinations in the beginning of 1947. Final readings were made in September 23, 1947. Symptoms were severe in all the trees of group IV and less marked in groups VII and IX. In all three groups the trunk and roots of sour orange were much less developed than in the controls (group II) or groups with no symptoms. The most interesting group was that of the "sandwich" sweet on sour on sweet (group X) in which the leaves had a normal dark green coloration but formed a very small, poorly developed crown. The sour orange section of the trunk was markedly constricted in relation to the sweet orange parts above and below the sour orange. No symptoms of tristeza were observed in the other groups.
This experiment shows that the symptoms of tristeza will show only when there is a crown of sweet orange foliage on top of a sour orange stock or section of stock. Apparently the virus will multiply in sufficient quantity only if there is enough foliage of sweet orange on top of sour orange but is lethal only to the sour orange tissues. The results with the sweet-sour-sweet "sandwich" (group X) show that the collapse of the phloem in the sour orange bark does not completely prevent the translocation of carbohydrates from the sweet orange top to the sweet orange roots below the sour orange section. Such a translocation possibly occurs through the cell walls rather than through the phloem vessels. It is concluded that the effect of the virus is to alter the metabolism of carbohydrates in the sour orange bark, preventing the synthesis of cellulose and starch in its cells.

* _____. A tristeza dos citrus. Biológico (Brasil) 33(12):271-273. 1967. (44

El autor hace una reseña histórica sobre la aparición de la "Tristeza" en San Pablo, Brasil, a través de la introducción de plantas importadas de Africa del Sur. El desconocimiento que se tenía de esta enfermedad se evidenció con la cantidad de hipótesis surgidas para determinar la causa de la enfermedad. Al inicio de 1946 quedó ya establecido que era una enfermedad causada por un virus. Destaca los esfuerzos de investigación realizados por el Instituto Agronómico y por la Comisión de Estudios creada en 1942 en el Instituto Biológico. Pocas enfermedades de las plantas cultivadas fueron estudiadas

tan intensamente y sobre tan diversos aspectos como la "tristeza".

* BITTERS, W. P. Valencia oranges rootstock trial at South Coast Field Station. California Citrograph 53:163, 172-174. 1978. (45

This is a progress report on the performance of 25 rootstock varieties budded with Campbell nucellar valencia orange. The trial was laid out in 1960 and yields for the period 1964-67 are tabulated. Good early yields were obtained from trees on lemon and lime rootstocks while those on the mandarin group were slow in coming into bearing. Highest yields to date have come from trees on alemow (*C. macrophylla*), *C. volkameriana* and Rangpur lime, in that order, although these have certain disadvantages. Cleopatra mandarin, trifoliate orange and Yuzu are poorly adapted to the coastal area of the trials. Carrizo and Trover citranges, ranking 6th and 7th respectively in the cumulative yield table, are considered the best rootstocks to use, and sweet oranges are promising. The presence of the virus diseases tristeza, vein enation, exocortis and stubborn disease has been confirmed in the trial plots; the last-named is of greatest concern. (Horticultural Abstracts 38:6369)

* _____., COLE, D. A. y McCARTY, C. D. Citrus rootstocks from the papaeda group. Citrograph 58(12):419-420, 438 - 439. 1973. (46

* BLONDEL, L. Quelques aspects généraux du remplacement du bigaradier et de l'utilisation de porte-greffe nouveaux. Fruits 22(1):19-26. 1967. (47

Aunque muy sensible a la Tristeza, la Toronja es casi siempre utilizada como patrón de injerto en las regiones mediterráneas. En razón de la amenaza de esta enfermedad, resulta necesario reemplazar la toronja con patrones nuevos. En este artículo se estudian tres grupos de patrones de injerto:

1. Patrones recomendables (*Poncirus trifoliata*, citrange (citronaranjo) Troyer, naranjo mandarino Cleopatra)
2. Patrones a poner en experimentación
3. Patrones a proscribir

Se expone el programa de la Estación de Investigaciones agrumícolas concerniente al estudio de patrones de injerto.

BLUE, R. L. *et al.* Leaf-disc grafting - a rapid indexing method for detection of some citrus viruses. In Conference of the International Organization of Citrus Virologists, 7°, Athens, 1975. Proceedings. Edited by E. C. Calavan. Riverside, University of California, 1976. pp. 207-212. (48

BOTELHO, D. y SILVA, G. B. DA. A tristeza dos citrus. Boletim do Campo (Brasil) 6(35):11-13. 1950. (49

* BOVE, J. M. Maladies à virus des Citrus dans les pays du bassin méditerranéen. Fruits 22(3):125-140. 1967. (50

Después de haber mostrado el peligro que hacen correr a las plantaciones de agrios de la cuenca mediterránea la Tristeza y el Stubborn, el autor describe los distintos modos de propagación de las virosis de los agrumes (púa de injerto - semilla - transmisión por insectos - savia).
Expone luego la distribución geográfica de las enfermedades de virus en la cuenca mediterránea, y su importancia económica.
Tristeza: Italia, Chipre, Israel, Marruecos, Egipto, España.
Exocortis: Yugoeslavia, Israel, Chipre, Marruecos, Sicilia, Turquía, Costa de Marfil.
Stubborn: Marruecos, Argelia, Tunez, Medio Oriente, Grecia, Córcega, Egipto, Sicilia.
Psorose, Xyloporose, Impietratura, Tatter leaf, Stem Pitting.
En fin, se da una puesta a punto de la lucha contra las virosis de los agrumes: producción de material vegetal indemne de virosis - lucha contra la Tristeza - Medidas preventivas contra el Stubborn.

* BRIDGES, G. D. y YOUTSEY, C. O. Natural tristeza infection of citrus species relatives and hybrids at one Florida location from 1961-1971. Proceedings of the Florida State Horticultural Society 85:44-47. 1972. (51

Since 1961, virus test results demonstrate a rapid increase of tristeza infection among grove trees distributed throughout much of Florida's citrus producing area. Severe local tristeza losses have occurred in several widely separated locations.
Natural infection rates vary among citrus species, relatives, and hybrids in the state's Citrus Budwood Foundation Grove. Differences were maintained and became more apparent under conditions of high inoculum potential. Field spread of tristeza virus occurs readily among sweet oranges, tangelos, mandarins, and various hybrids, while frequency of infection is remarkably less in trifoliate orange and its hybrids, sour orange, and grapefruit.
The current popular use of sour orange as a rootstock for sweet oranges and mandarins is discouraged.

CALABRESE, F. Per l'agrumicoltura italiana vecchi e nuovi portainnesti. Italia Agricola 105:605-622. 1968. (52

Investigations carried out in the U.S.A. and elsewhere on the resistance of citrus rootstocks to tristeza are summarized. The characteristics of the following are described: sour orange, *Poncirus trifoliata*, Troyer citrange, Cleopatra mandarin, *Citrus taiwanica*, *C. macrophylla* and Sacaton citrumelo. The Troyer citrange and *C. taiwanica* appear to be suitable alternatives to the sour orange. The use of Cleopatra is limited by its susceptibility to summer rots, but its advantage is relatively high salt tolerance. *C. macrophylla* has proved suitable for lemons, and the Sacaton citrumelo for both lemons and oranges. (Horticultural Abstracts 39: 1386)

* CALAVAN, E. C. *et al.* Tristeza in Lemon on *Citrus macrophylla* rootstock. California Citrograph 53(4):108, 119, 122. 1967. (53

Directions are given for avoiding tristeza infection of lemon on C. *macrophylla* which, although one of the most popular lemon rootstocks in California, has proved very susceptible to tristeza and cachexia viruses. (Review Applied Mycology 47:1552)

* _____. *et al.* Tristeza related to decline of orange trees on citrange rootstock. California Citrograph 53(3):75, 84-90. 1968. (54

The cause of decline of many trees on rootstocks alleged to be Troyer citrange is tristeza virus. Therefore, the disease should be called tristeza.
More than one strain of tristeza is capable of causing decline on citrange rootstocks. In fact, most of all of the strains in some localities appear to cause decline on some citrange rootstocks.
Decline may first appear about one to two-and-one-half years after infection occurs.
The virus is being spread - by man and by aphids.
Some, possibly all, moderately to severely declined rootstocks are not nucellar seedlings of CRC Troyer citrange.
Off-type citrange rootstocks are likely to be susceptible to tristeza in any area.
Tristeza quarantine and regulatory restrictions should be maintained and strengthened.

* _____., ROISTACHER, C. N. y NAUER, E. M. Thermotherapy of citrus for inactivation of certain viruses. Plant Disease Reporter 56(11):976-980. 1972. (55

Concave gum, infectious variegation, psorosis-A, tristeza, seedling yellows-tristeza, and vein enation viruses of citrus were inactivated by 2- to 3- months' hot-air treatment at alternating temperatures of 40°C for 16 hr/day and 30°C for 8 hr/night (40/30°C). The tatterleaf-citrange stunt virus was inactivated at slightly higher temperatures. Cachexia, yellow vein, and Dweet mottle viruses survived treatments for 2 to 3 months, while exocortis virus survived treatment up to 8 months. Troyer citrange and Rangpur lime seedlings were superior to other varieties as rootstocks for supporting infected buds during treatment. Alternating temperatures (40/30°C) were found superior to constant temperature (38°C) for plant survival and possibly for virus inactivation.

* CALZA, R. *et al.* Efeito de alguns novos inseticidas no combato ao "pulgão preto" dos citros. Biológico (Brasil) 34(12):262-264. 1968. (56

Este ensayo fue realizado en el Municipio de Limeira, S.P., Brasil, para el combate del pulgón negro (*Toxoptera citricidus*). Esta investigación es importante no sólo para el control directo del pulgón, sino también por ser vector de la "Tristeza" de los cítricos.

Los productos experimentados fueron Fitios B-77, Birlene, Mecarbam, Dimetoato, Folithion, Baygon, Methilparathion, Ethilparathion y Dichlorvos. Los tratamientos fueron repetidos 5 veces.
Se pudo constatar que en las condiciones que fue realizado el experimento todos los insecticidas, excepto Mecarbam, en la dosis más baja, mostraron su eficacia en el control de *Toxoptera citricidus*.

CAPOOR, S. P. Role of the tristeza virus in citrus die-back complex. Indian Journal of Horticulture 32(1/2):1-6. 1975. (57

In India the virus is transmitted by 7 spp. of aphids in a non-persistent manner and is not retained after moulting. A mild str. protects Kagzy lime against infection by severe strs. The virus is probably restricted to phloem tissue. Measures of control in orchards are indicated. (Review of Plant Pathology 55:4715)

* CARACTERISTICAS DE portainjertos tolerantes al virus de la tristeza. Noticias Agrícolas (Venezuela) 8(27):105-107. 1979. (58

Se da información sobre las características principales en relación a comportamiento de enfermedades virosas de portainjertos que están siendo estudiados por FUSAGRI.

| Patrón | Tristeza | Xyloporosis | Exocortis | Psorosis | Gomosis | Sequía |
|---|---|---|---|---|---|---|
| Citrus Volkameriana | T | T | T | S | MR | R |
| Citrumelo Swingle | R | T | S | S | R | S |
| Citrange Carrizo | R | T | S | S | R | S |
| Citrange Morton | R | T | S | S | R | S |
| Limón Francés o Rugoso | T | T | T | S | S | R |
| Mandarina Sunki | T | T | T | S | MR | MR |
| Mandarina Cleopatra | T | MT | T | S | S | S |
| Tangelo Orlando | T | S | T | S | MR | S |
| Citrus Taiwanica | T | T | T | S | R | S |
| Lima Rangpur | T | S | S | S | S | R |
| Naranja dulce Criolla | T | T | T | S | S | MR |
| Citrus Amblycarpa | T | T | T | S | R | |

Símbolos utilizados en el Cuadro
R= Resistente
T= Tolerante
S= Susceptible
MR= Medianamente resistente
MT= Medianamente tolerante

(Cuadro tomado directamente de la publicación)

* CARRERO, J. M. Contribución al estudio sobre etiología de las invasiones de "tristeza" en la citricultura mediterránea. Anales del Instituto Nacional de Investigaciones Agrarias, Protección Vegetal no. 4:75-102. 1974. (59

El autor hace un estudio de la evolución de la tristeza en España y un análisis climático del período 1956-1971.
De acuerdo a las investigaciones realizadas sobre la tristeza de los agrios han existido tres años de espectaculares colapsos de combinaciones susceptibles al virus que se cifra en:
1956-60 primera aparición masiva de la "tristeza"
1968 segundo ataque grave de la virosis
1971 nuevo avance brusco de la enfermedad
Las posibles causas etiológicas de la "tristeza" pueden resumirse en:
-densidad de población viral
-consecuencia de una plaga grave
-condiciones climáticas adversas
En las condiciones de España se puede descartar la:
-relación pulgón-tristeza, pues los pulgones aparecieron mucho después de producidos los colapsos y el tradicional celo y cuidado que los citricultores dispensan a su cultivo, hace que las plagas se mantengan a nivel de tolerancia.
La causa estaría determinada por las condiciones climáticas adversas que determinan una inhibición total o parcial de los vasos cribosos (floema) y en consecuencia se rompe el equilibrio dinámico vigor-virus en favor de este último.

CARVALHO, Y. DE. Tristeza dos citrus. Seiva (Brasil) 25(59-60):11-38. 1964. (60

CATARA, A. La 'tristeza' degli agrumi alla luce delle possibilitá di transmissione a mezzo di insetti vettori. Tecnica Agricola (Catania) 17(4):1-7. 1965. (61

In the Mediterranean region the most important vector is *Toxoptera citricidus*. Under existing conditions transmission by aphids is believed unlikely to play a major part in spreading the disease. However, a mutation in a vector or in a virus str. may alter the picture. (Review of Applied Mycology 47:1878)

_____. Le malattie da virus degli agrumi alla luce dei risultati della 4a conferenza dell'I.O.C.V. Rivista di Patologia Vegetale. Serie IV 3(1):47-82. 1967. (62

A brief account is given of recent work on cachexia-xyloporosis, tristeza, stubborn and greening, exocortis, and psorosis viruses, production of virus-free material, mechanical transmission, and isolation and purification of viruses from plants. Mention is also made of 'cristacortis' (Review of Applied Mycology 47:186)

CATARA, A. Un nuovo caso di 'Tristeza' ripropone l'urgenza del controllo sanitario delle nostre coltivazioni agrumicole. Tecnia Agricola (Catania) 20(1):5-15. 1968. (63

A case of tristeza virus on Meyer lemon is reported from Calabria. This and a recent record of the disease in Sardinia point to the need for an indexing programme, particularly of Satsuma mandarin groves. The guidelines for research are indicated on the basis of experience in other countries. (Review of Applied Mycology 48:2381)

* CELINO, C. S., PANALIGAN, D. R. y MOLINO, U. V. Studies on insect transmission of the tristeza virus in the Philippines. Philippine Journal of Plant Industry 31(2):89-93. 1966. (64

Nine different insects were used as vectors in the transmission of the tristeza virus. Only *Toxoptera citricidus*, *T. aurantii* and *Aphis gossypii* transmitted the virus. *T. citricidus* was efficient vector than either *T. aurantii* or *A. gossypii*.

CHAO, H.-Y. *et al.* Distribution of the seedling yellow tristeza and the tristeza susceptibility of six sour orange stocks. Acta Phytopathologica Sinica 9(1):61-64. 1979. (65

Of 873 citrus samples from the provinces of Kwangsi, Kwangtung, Huna, Kiangsi, Chekiang and Szechuan tested, 691 proved positive for citrus tristeza virus. When the infected cv. Tiang-cheng (sweet orange) was grafted on the rootstocks of 6 sour oranges, the cvs. Daidai, Bankan, Shinsan and a Moroccan introduction were highly susceptible, Shau-hung-cheng was susceptible and Guo-tuo-cheng very tolerant. The last is used as a rootstock in some Chekiang districts. (Review of Plant Pathology 59:4182)

* CHEN, M.-H.; MIYAKAWA, T. y MATSUI, C. Tristeza virus in *Citrus reticulata* and *C. tankan*. Phytopathology 61(3):279-282. 1971. (66

Long flexuous particles 2,000 x 12-14 mμ were observed in dip specimens prepared from veinal tissues of Likubin-diseased *Citrus reticulata* or *C. tankan*. Electron microscopy of ultrathin sections from diseased plants showed long flexuous particles restricted to the phloem cell. These intracellular filamentous particles were about 10 mμ in width, and most of them appeared as fibrous masses. In some cells, the filamentous particles were scattered randomly throughout the cells. Although the intracellular concentration of these filamentous particles was rather high, the phloem cells containing the filamentous particles were small in number. It was considered that the long flexuous particles observed in the present study corresponded to those described for citrus tristeza virus. It is not clear whether Likubin-diseased plants contain more than one agent or not.

* CHEN, M.-H.; MIYAKAWA, T. y MATSUI, C. Simultaneous infections of citrus leaves with tristeza virus and mycoplasmalike organisms. Phytopathology 62(6):663-666. 1972. (67

Likubin-diseased citrus trees in orchards are frequently affected by both the Likubin pathogen and tristeza virus. Electron microscopy of Likubin-diseased Tankan leaves revealed the occurrence of both pathogens. Mycoplasmalike organisms and tristeza virus particles were restricted to phloem tissue cells. Within the phloem tissues, the pathogens were encountered both in widely separated or in adjacent cells. Cells rarely contained both pathogens. No intimate association of the pathogens was observed.

* CHILDS, J. F. L. y KNORR, L. C. Control of virus diseases of citrus trees- an evaluation of methods. Phytopathology 55(6):675-680. 1965. (68

Indexing of rigorously selected, apparently healthy, old-line citrus trees in Florida showed them to be widely infected with viruses (5.5% with tristeza, 6.8% with psorosis, 50% with exocortis, and 72% with cachexia). Seedling trees and new-line trees were mostly virus free. The testing proved expensive, slow, and not wholly adequate because only four viruses were indexed of more than a dozen now recognized. Because conclusive evidence of seed transmission of citrus viruses is unknown and most citrus varieties grow true to type from seed by reason of nucellar embryony, it is more economical of time and effort to develop virus-free lines of commercially important varieties by testing nucellar seedlings. Virus disease control through use of virus-free budwood is becoming a critical factor in many areas.

CHOHAN, J. S. Ways to control citrus diseases. Indian Horticulture 13(2): 11-15. 1969. (69

The diseases reviewed here are tristeza, foot rot gummosis (*Phytophthora* spp.), anthraconse (*Colletotrichum gloeosporioides*), fruit rot and leaf spot (*Alternaria citri*) and citrus canker (*Xanthomonas citri*). The symptoms of each condition and the appropriate control measures are described. (Horticultural Abstracts 40:2114)

CHOUDHARI, K. G. y MALI, V. R. Reaction of mosambi (*Citrus sinensis* L. Osbeck) on different rootstock to virus and other disorders under field conditions. Journal of Maharashtra Agricultural Universities 3(1):40-44. 1978. (70

Of 30 stock and scion combinations in the field 6 showed tolerance of viruses, mycoplasmas and fungi. The combination of nucellar scion on *C. limonia* and *C. amblycarpa* was highly tolerant of citrus tristeza and psorosis viruses, and the least affected by fovoid (xyloporosis?), vein enation and greening. *C. limonia* is highly tolerant of and *C. amblycarpa* weakly susceptible to *Phytophthora*. Stocks of some rough lemons (*C. jamberi*) and Rangpur lime (*C. limonia*)

had some horticultural defects but were proposed for further trials. Certain cvs. from 11 C. spp. were unsuitable as rootstocks for C. *sinensis*. (Review of Plant Pathology 58: 3297)

* CITRUS RESEARCH. Virus diseases. Journal of the Agricultural Society of Trinidad 66(1):82-85; 100-101. 1966. (71

At the General Meetings of the Agricultural Society of Trinidad and Tobago held on 20 Jan. and 17 Feb. 1966 the presence in Trinidad of citrus xyloporosis, exocortis, and tristeza viruses, previously suspected, was stated to have been verified. (Review of Applied Mycology 45:3531)

* COHEN, M. Tristeza in Spain. California Citrograph 52(8):320-339. 1967. (72

Observations made during a visit indicated that almost all citrus trees in Spain, being on sour orange rootstocks, are intolerant of the virus. The heaviest losses occur S. of Valencia, where the disease 1st appeared. Tristeza seems to be confined to S.E. Spain, although there is no internal quarantine. Several spp. of aphids, including *Aphis gossypii*, act as vectors. Symptoms vary in severity. (Review of Applied Mycology 46:3100)

* _____. Tristeza strain comparisons in Florida. Phytopathology 57:807. 1967. (73

Nursery-size Duncan grapefruit trees on four different rootstocks, and Pineapple orange trees on sour orange, were bud-inoculated in 1959 with isolates of Florida tristeza from different geographic locations and set out in a field planting with appropriate checks. Two isolates of tristeza were compared in the grapefruit trials and seven in the Pineapple orange inoculations. All tristeza-inoculated grapefruit trees on sour orange, Eureka lemon, shaddock x St. Michael hybrid, and grapefruit seedling rootstocks and tristeza-inoculated Pineapple orange trees were reduced in size compared to noninoculated check trees, but trees inoculated with certain isolates were consistently more stunted than others. Amount of stunting was not correlated with the intensity of vein-clearing and stem-pitting symptoms produced by the tristeza isolates in Key lime seedling indicators. No natural spread of tristeza was evident in this plot until 1966 when six experimental grapefruit trees on sour orange rootstock either went into decline or died. Four of the affected trees were checks and two had been inoculated with a mild strain of tristeza. Other noninoculated grapefruit trees not in decline were also found to be carrying tristeza in 1966; these included trees on all rootstocks. No virus was found in any noninoculated Pineapple orange trees.

COHEN, M. A comparison of some tristeza isolates and a cross-protection trial in Florida. In Conference of the International Organization of Citrus Virologists, 7°, Athens, 1975. Proceedings. Edited by E.C. Calavan. Riverside, University of California, 1976. pp. 50-54. (74

* CORTEZ, R. E. y SALIBE, A. A. Incidence of citrus virus diseases in the Philippines and experimental evidence of their transmissibility. Philippines Journal of Plant Industry 32(3-4):229-233. 1967. (75

**Tristeza, psorosis exocortis and xyloporosis were found to be prevalent. (Horticultural Abstracts 40:4713)**

* _____. y SALIBE, A. A. The tristeza stem-pitting situation in the Philippines. Philippines Journal of Plant Industry 32(1-2):1-5. 1967. (76

**The results of a field survey supported by extensive indexing strongly suggest that all orchard citrus trees in the Philippines are infected with tristeza virus. The widespread occurence of the disease is associated with the high aphid vector population, especially that of *Toxoptera citricidus*. (Horticultural Abstracts 40:4722)**

* COSTA, A. S. Situación actual de la tristeza de los citrus en Sudamérica. Boletín Fitosanitario de la FAO 4(7):97-105. 1956. (77

También en Inglés: FAO Plant Protection Bulletin
" " Francés: Bulletin Phytosanitaire de la FAO

**El autor hace una síntesis de la situación de la "tristeza" de los cítricos en el continente suramericano. Enfoca la importancia económica que tiene la enfermedad, la forma en que fue introducida procedente de Africa, a Argentina y Brasil, bosqueja los esfuerzos realizados para su identificación y la lucha contra la misma antes de que se determinara la naturaleza de la enfermedad. Indica la reacción de los tipos cítricos a la infección.**

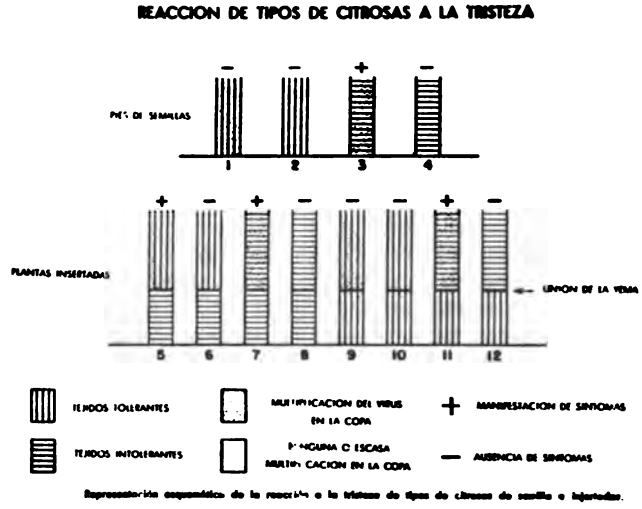


Figura tomada del artículo

Informa que el empleo de un patrón adecuado tolerante es la única forma práctica de combatir la enfermedad en las zonas infectadas. Comunica de los esfuerzos de investigación que se realizan en Brasil en el Instituto Agronômico de Campinas en busca de nuevos y prometedores portainjertos tolerantes y de los problemas planteados por la tristeza en relación con pomelo y con el limonero West Indian. Da información sobre la existencia de varias razas del virus de "tristeza".

* COSTA, A. S. y CARVALHO, A. M. B. Deficiências minerais nas folhas induzidas por moléstias e pragas. Bragantia (Brasil) 24(3):41-50. 1965. (78

Certas moléstias de vírus e o efeito fitotóxico provocado por toxinas de alguns insetos influenciam a composição mineral das folhas de plantas afetadas. As alterações provocadas podem se assemelhar a deficiências minerais puramente nutricionais e, em certos casos, há realmente menor teor do elemento associado aos sintomas da moléstia.
A aplicação do elemento faltante nos casos citados não provoca geralmente recuperação dos tecidos afetados, com exceção da deficiência de zinco associada a infecção de citros pela tristeza. É sugerido que à resposta a aplicação do elemento em deficiência dependerá de ser ou não esta, sintoma primário ou secundário da moléstia.
É salientado que as recomendações sobre adubação, baseadas nos resultados da diagnose foliar, deverão sempre considerar a possibilidade de não serem as deficiências constatadas resultantes sempre da falta de disponibilidade do elemento no solo, mas, possivelmente, da interferência de fatores como a infecção por vírus, ação de toxina de inseto etc.

_____. y MULLER, G. W. Studies on interference between strains of the tristeza virus. Campinas, Brasil, Instituto Agronômico, 1966. 14 p. (79

_____. Serology of citrus tristeza virus. In Conference of the International Organization of Citrus Virologists, 5º, Japan, 1969. Proceedings. Edited by W.C. Price. Gainesville, University of Florida, 1972. p. 66. (80

* CUÑAT, P. *et al.* Virosis de los cítricos. III. Técnicas serológicas para el diagnóstico de la tristeza de los cítricos. Revista de Agroquímica y Tecnología de Alimentos 13(2):274-278. 1973. (81

Partiendo de corteza de naranjos afectados de tristeza, se preparan extractos de partículas de naturaleza nucleoproteica. Por inyección de estos extractos a conejos, se han obtenido los antisueros correspondientes, los cuales, frente a extractos de corteza de naranjos afectados de tristeza (test sobre Lima Mejicana positivo) y de naranjos aparentemente sanos (test sobre Lima Mejicana no positivo) ponen de manifiesto la existencia de un antígeno diferencial, en los primeros. Los antisueros citados se purifican por absorción cruzada con los extractos de naranjos aparentemente sanos. Se demuestra la gran utilidad de los antisueros purificados, para el diagnóstico rápido de la tristeza de los naranjos.

* CUÑAT, P. *et al.* Virosis de los cítricos. VI. Características de partículas filamentosas aisladas de cítricos afectados de tristeza. Revista de Agroquímica y Tecnología de Alimentos 13(2):288-294. 1973. (82

En trabajos anteriores se ha observado que, en los extractos preparados a partir de hojas o corteza de árboles cítricos afectados de tristeza, se encuentran partículas filamentosas de dos tipos: unas de 10-12 nm de diámetro y estructura helicoidal y otras de 6-9 nm de diámetro sin estructura helicoidal aparente. Las partículas de 10-12 nm se encuentran siempre en materiales procedentes de árboles enfermos y no en los de árboles sanos, por lo que, en principio, puede considerarse que son el virus de la tristeza; las de 6-9 nm no están asocicadas a la enfermedad, pues aparecen también en extractos preparados a partir de tejidos de árboles sanos. En este trabajo se inicia el estudio de la naturaleza de ambos tipos de partículas, mediante el examen de su comportamiento ante diversos agentes desnaturalizantes e hidrolíticos de proteínas y la observación de los espectros U.V. de los antedichos extractos.
Se encuentra que el espectro de los extractos que contienen partículas de 10-12 nm es el característico de las nucleoproteínas, mientras que el de los extractos que contienen solamente partículas de 6-9 nm es el típico de proteínas. Estas últimas partículas se alteran frente a urea y pepsina, así como al someterlas a temperaturas de 55-60°C en medios de fuerza iónica alta y moderada, y son resistentes a la acción de la tripsina; las partículas de 10-12 nm se alteran frente a tripsina, urea y pepsina, así como al someterlas a temperaturas de 45-50°C en los medios antedichos, durante los mismos períodos de tiempo.
La fase acuosa obtenida al tratar con fenol-detergente los extractos que contienen partículas de 10-12 nm, presenta el espectro típico de los ácidos nucléicos; ésto no ocurre con los extractos que contienen solamente partículas de 6-9 nm.

* _____.; GARRO, R. y MONCHOLI, V. Razas del virus causante de la tristeza de los cítricos en España. Revista de Agroquímica y Tecnología de Alimentos 19(3):339-349. 1979. (83

Se estudian las reacciones de la lima mejicana, naranjo amargo y naranjo dulce/naranjo amargo, cuando se inoculan con material vegetal de diferente grado de afección por el virus de la tristeza. Los diferentes tipos de reacción inducidos en los plantones indican que del virus responsable existen razas distintas.
La distinta concentración, en partículas virales, de los extractos preparados a partir del citado material vegetal, confirma la existencia de diferentes razas de tristeza en la zona citrícola valenciana. Extractos muy ricos en partículas virales producen síntomas leves, y otros, pobres en partículas virales, producen síntomas moderado-graves.

DIAZ CAMERO, H. La "tristeza" de los cítricos. Ingeniería Agronómica (Venezuela) 3:26-27. 1960. (84

DOLAR, M. S. The host plant distribution, symptoms, the degree of damage, transmission and control methods of Tristeza in citrus orchard of Adana, Antalya, Hatay and Icel. Arastirma Eserli Serisi Bolge Zirai Murcadele Arastirma Anst Mudurlugu 40:44. 1976. (85

DONADIO, L. C. *et al.* Behavior of seedling lines of citrus naturally infected with tristeza virus. In Conference of the International Organization of Citrus Virologists, 6°, Swaziland, 1972. Proceedings. Edited by L.G. Weathers and M. Cohen. Riverside, University of California, 1974. pp. 89-93. (86

DORNELLES, C. M. M. Intensidade dos sintomas de tristeza em clones de laranjeiras tardias no Rio-Grande-do-Sul. In Congresso Brasileiro de Fruticultura, 1°, Campinas, 1971. Resumos. Campinas, Sociedade Brasileira de Fruticultura, 1971. p. 34. (87

_____. Ocorrência de sintomas de "tristeza" em variedades tardias de laranjeiras no Rio Grande do Sul. Agronomia Sulriograndense (Brasil) 8(1): 5-13. 1972. (88

Old clones introduced before tristeza virus appeared in this region of Brazil, new clones introduced from Limeira in 1959, and nucellar seedlings obtained at Taquari after the virus became endemic in the region were evaluated. Symptoms on old clones and nucellar seedlings were mild, while those on new clones were medium to severe. It is suggested that the old clones and nucellar seedlings were first infected with mild strs. and thus protected against the severe strs. prevalent in the São Paulo area. (Review of Plant Pathology 52:2613)

EBRAHIM-NESBAT, F. y NIENHAUS, F. Ocurrence of citrus tristeza virus in Iran. Zeitschrift für Pflanzen-Krankheiten und Pflanzenschutz 85(5):308-312. 1978. (89

Flexuous , filamentous particles of the virus were demonstrated in leaf and bark samples of Key lime seedlings grafted with leaf tissue from Ishikowa mandarin orange trees on trifoliate rootstock as well as from 1-yr-old mandarin orange trees newly imported from Japan. Particles were also found in samples from mandarin orange trees which were imported 7 yr previously from Japan and grown in a plantation near Sari, Caspian Sea area. This is the first record of the virus in Iran. (Review of Plant Pathology 57:5497)

ELSAID, H. M. Detection of virus infection in certain species of citrus. Thesis Ph.D. Baton Rouge, Louisiana State University 1964. 98 p. (90

An indexing program was made for the first time in Louisiana to determine if exocortis, psorosis, tristeza and xyloporosis viruses were present in citrus trees in Plaquemines Parish. Results showed that these 4 viruses were present in Louisiana citrus trees. It was difficult to find any tree free from all 4 viruses. The iodine test was used on trunks of mature trees in the field to determine the presence of tristeza virus.

Results in the fall of 1963 showed that more starch accumulated below than above bud unions. In the spring of 1964, the opposite results were obtained, i.e., more starch was accumulated above than velow bud unions. These trees were presumably infected with tristeza virus.
The iodine test applied to stems of citrus indicator plants in the greenhouse was found to be useful as a relatively non-specific test to detect virus infection. The iodine test applied to young leaves of sour orange plants in the greenhouse was found to be more specific than the above test for detection of infection by psorosis virus. Of 22 differential stains tested, methyl orange, proflavine sulfate and thionin were found useful in detecting infection by psorosis and tristeza viruses on sour orange stems.
Pathological histology of sour orange plants infected separately with each of the 4 viruses studied, indicated that there were no differences between stems of check plants and plants infected with either exocortis or xyloporosis viruses. Stems of psorosis-infected sour orange plants, however, were characterized by phloem necrosis and crystals in xylem vessels. Stems of tristeza-infected sour orange plants were characterized by phloem necrosis. For the first time chromatic cells were reported in tristeza-infected sour orange plants. These chromatic cells were found in phloem tissues and xylem rays.
Root development of all infected citrus indicator plants was reduced. Roots of psorosis-infected sour orange plants were characterized by enlargement of vascular rays in the periderm. Roots of tristeza-infected sour orange plants were characterized by phloem necrosis. Tristeza-infected Key lime plants were characterized by phloem necrosis and chromatic cells. Chromatic cells were reported for the first time in xylem rays. Roots of exocortis-infected trifoliate orange plants contained necrotic phloem.
Observations of symptoms in citrus orchards indicated that exocortis is restricted to 2 areas and xyloporosis to 3 areas in the southern part of Plaquemines Parish. Differential staining and pathological histology of seedlings budwood from Plaquemines Parish indicated that 73 of 81 seedlings were infected with tristeza virus and 30 of 81 seedlings with psorosis virus.

* ELSAID, H. M. y SINCLAIR, J. B. Use of stains and pathological histology to detect virus infection in Citrus. Phytopathology 55(5):543-545. 1965. (91

Differential staining and pathological histology were used to detect infection by four citrus viruses in certain species of citrus. Of 22 stains tested, proflavine sulfate and thionin were found useful in detecting psorosis virus infection and methyl orange and thionin in detecting tristeza virus infection in sour orange stems. Pathological histology of sour orange stems infected separately with each of four viruses showed no differences between checks and exocortis- or xyloporosis-infected plants. Psorosis-infected sour orange stems were characterized by phloem necrosis and crystal formations in xylem vessels. In tristeza-infected sour orange, phloem necrosis was present in roots and stems; in stems, chromatic cells were found in phloem

and xylem rays. Tristeza-infected Key lime roots were characterized by phloem necrosis and chromatic cells in rays of phloem and xylem. Psorosis-infected sour orange roots were characterized by enlarged vascular rays in the periderm. Exocortis-infected trifoliate orange roots contained necrotic phloem.

* ESPECIES DE áfidos que atacan a los cítricos. Noticias Agrícolas (Venezuela) 9(10):49-51. 1980. (92

Se indica:
1. la forma de reproducción de los áfidos en los trópicos y
2. los tipos de daños que ocasionan directos o indirectos; el daño indirecto es causado al trasmitir enfermedades virosas como la "Tristeza" de los cítricos. Se señalan las características de las especies observadas sobre cítricos en Venezuela *Aphis citrícola* van del Goot= *A. spiraecola* Patch); *Toxoptera aurantii* B. dF., *T. citricidus* Kyrkaldy; *Aphis gossypii* Glover; *A. craccivora* Koch.

Se indican medidas de control biológico y químico con el uso de pirimicarb (Pirimor).

EUROPEAN AND MEDITERRANEAN PLANT PROTECTION ORGANISATION. Annual Report, 1965-1966. Paris, 1966. p. 39. (93

Among the items noted are the failure to find the tristeza disease vector, *Toxoptera citricidus*, in surveys of Turkey and Israel, fumigation standards for the disinfestation of plants, fruits and stored products, pesticide residues, seed health certification and the organization of plant health services. (Horticultural Abstracts 36:5864)

FARRAG, S. H. y OMAR, M. A. The present status of citrus virus diseases in Algeria. Agriculture Research Review 47(5):10-15. 1969. (94

Psorosis, cachexia, exocortis and stubborn viruses were widespread in Algeria. Tristeza was found on several citrus spp. and vars. (Review of Plant Pathology 50:1787)

* FELDMAN, A. W. y HANKS, R. W. The occurrence of a gentisic glucoside in the bark and albedo of virus-infected citrus trees. Phytopathology 59(5): 603-606. 1969. (95

Gentisoyl glucose, a monoglucose ester of gentisic acid, was identified as the violet fluorescent material isolated from extracts of albedo and/or bark from 2- to 3-year-old branches of virus-infected citrus trees from South Africa (greening disease), Philippines (leaf mottle disease), Australia (dieback and stem pitting), and California (stubborn disease). Gentisoyl glucose was not found in comparable tissues of citrus trees affected by the viruses that cause cachexia, exocortis, psorosis, crinkly leaf, and tristeza, nor by the incitants responsible for blight, young tree decline, Ellendale decline, and spreading decline.

* FELDMAN, A. W. y HANKS, R. W. Results of initial indexing tests on citrus trees affected with young tree decline and sand hill decline. Plant Disease Reporter 58(1):35-39. 1974. (96

Eighty-two trees from 10 groves were indexed on 12 *Citrus* spp. to determine virus content of trees affected with young tree decline (YTD) and sand hill decline (SHD). Indexing data revealed primarily three transmissible agents: exocortis, tristeza, and a previously unreported stem pitting factor in 'Madam Vinous' sweet orange. Dual infections of tristeza and the Madam Vinous stem pitting factor were present in all grove locations and showed a high incidence of correlation to YTD and SHD when budwood for indexing was obtained from donor trees in very early stage of disease. Currently, neither transmission nor propagation of YTD and SHD has been demonstrated.

* _____. y HANKS, R. W. Young tree decline and sand hill decline; status of indexing investigations. Proceedings of the Florida State Horticultural Society 87:101-106. 1974. (97

One hundred nineteen trees (donors) from 15 groves were indexed on 12 *Citrus* spp. (indicators) to determine virus content of trees affected with young tree decline (YTD) and sand hill decline (SHD). Indexing procedures and selection of indicators were designed to ascertain presence of at least 18 known citrus virus and virus-like diseases. Data from 1972 and 1973 indexing revealed primarily 3 transmissible agents: exocortis, tristeza, and a previously unreported stem pitting factor in seedlings of Mme. Vinous and Pineapple sweet orange. Stem pitting in these sweet orange indicators as well as in Rusk citrange, grapefruit, and *Citrus excelsa* appears to be dormancy/temperature related. Dual infections of tristeza and the Mme. Vinous-Pineapple stem pitting factor were present in all grove locations and there was a good correlation with YTD and SHD when budwood for indexing was obtained from donor trees in the early stage of disease. Although very extensive transmission and propagation experiments are in progress, neither transmission nor propagation of YTD and SHD has yet been demonstrated.

FERNANDEZ VALIELA, M. V. Small fruit and stunting, two new disorders of grapefruit trees in the Delta del Paraná and San Pedro areas of Argentina. In Conference of the International Organization of Citrus Virologists, 4°, Rome, 1966. Proceedings. Edited by J.F.L. Childs. Gainesville, University of Florida, 1968. pp. 213-215. (98

The production of very small fruit on apparently healthy plants appeared to be due to a strain of tristeza virus, although the possibility of a genetic cause has not been discarded. The stunting disorder is more complex, and more than one virus may be involved. The affected trees are being indexed for psorosis, tristeza, exocortis and xyloporosis. Both diseases are apparently only transmissible with buds, since no new diseased plants were detected in the groves during 3 years of careful observations. (Horticultural Abstracts 41:2162)

* FLETCHER, J. T. The use of avirulent virus strains to protect plants against the effects of virulent strains. Annals of Applied Biology 89(1):110-114. 1978. (99

A review, with reference to the cross-protection provided by mild strains against infection by citrus tristeza virus, passion fruit woodiness virus, peach mosaic virus, cacao swollen shoot virus, and tobacco mosaic virus in tomatoes. (Horticultural Abstracts 48:7792)

* FLORES, R.; CONEJERO, V. y GARRO, R. Caracterización parcial de la proteína componente de las partículas nucleoproteicas asociadas a la tristeza de los cítricos. Revista de Agroquímica y Tecnología de Alimentos 15(1): 89-92. 1975. (100

Se obtienen electroforegramas en geles de poliacrilamida con dodecil sulfato sódico, de las proteínas presentes en extractos parcialmente purificados de naranjos infectados y exentos de tristeza.
Los electroforegramas de extractos procedentes de naranjos infectados presentan tres bandas, de las cuales, las dos de menor movilidad aparecen también en los electroforegramas de extractos de naranjos exentos de la enfermedad.
Se concluye que la banda diferencial corresponde al componente proteico de las partículas de 10-12 nm de diámetro, asociadas a la tristeza.
A partir de la movilidad electroforética relativa se ha determinado la masa molecular de dicha proteína, que se estima en 28.800.

* _____. *et al.* Purificación en gradiente de densidad de sulfato de cesio de las partículas nucleoproteicas asociadas a la tristeza de los cítricos. Revista de Agroquímica y Tecnología de Alimentos 15(1):93-97. 1975. (101

Se describe un nuevo método para purificar los extractos de partículas nucleoproteicas asociadas a la tristeza (TLP, "thread like particles"). Se utilizan la centrifugación diferencial, la precipitación fraccionada con polietilenglicol y sulfato amónico y la centrifugación isopícnica en gradiente de densidad de sulfato de cesio. En esta centrifugación, las TLP se concentran en una estrecha banda que corresponde a una densidad de 1'2590 g/ml, y cuyo espectro UV muestra una inflexión a 290 nm que indica la presencia de triptófano en las mismas. El hecho de que en la electroforesis de esta fracción, en gel de poliacrilamida con dodecil sulfato sódico, sólo aparezca la banda correspondiente a la proteína componente de las TLP, demuestra que es de mayor pureza que los extractos obtenidos previamente.

* FOUQUE, A. *et al.* Résultats préliminaires des essais de porte-greffe d'agrumes en Côte d'Ivoire. Fruits 32(5):335-349. 1977. (102

Cuatro años después de haber implantado en Costa de Marfil un estudio de varios porta-injertos tolerantes a la Tristeza, del naranjo "Pineapple", del tangelo "Orlando" y del mandarinero

'Commun", del pomelo 'Marsh', y del limatero 'Mexicain' es posible tener una primera opinión en lo que se refiere a su comportamiento respecto de la gomosis de *Phytophthora* y de su influencia sobre el crecimiento y la productividad de los árboles. En las condiciones de la experimentación, el limatero 'Rangpur', el Rough lemon, el naranjo de siembra y el mandarinero 'Cléopâtre' han resultado muy sensibles al *Phytophthora*. Los porta-injertos más prometedores son actualmente el *Citrus volkameriana* y el citrange 'Troyer', pero los controles de calidad de los frutos que están realizándose podrían dar como resultado una ventaja al primero para la lima y al segundo para la naranja, la mandarina, el pomelo y el tangelo.

FOX, H. Spain fights tristeza. Citrus Vegetale Magazine 33(3):14, 24. 1969. (103

FRASER, L. R. Recent advances in the study of tristeza and seedling yellows. In Conference of the International Organization of Citrus Virologists, 4º, Rome, 1966. Proceedings. Edited by J.F. Childs. Gainesville, University of Florida, 1968. pp. 21-26. (104

A review, covering host reaction, virus structure, cross-protection and strain analysis, vectors, epidemiology, tolerance and distribution of the virus components. (Horticultural Abstracts 40:2173)

_____. y BROADBENT, P. Virus and related diseases of citrus in New South Wales. Rydalmere, New South Wales, Australia, NSW Dep. Agric., 1979. 78 p. (105

This handbook presents the results of research on citrus virus and other diseases carried out as part of the programme of the citrus improvement committee of NSW. Details are given of studies on virus elimination, citrus tristeza virus, citrus exocortis virus and gummy pitting, citrus psorosis virus, citrus dieback, citrus xyloporosis virus, citrus vein enation virus and woody gall, virus complexes in the Meyer lemon, diseases affecting the bud union, crop enhancement factor, disorders of Ellendale tangor, the search for a *Phytophthora*-resistant rootstock for Eureka lemon, sudden death and winter yellows. (Review of Plant Pathology 60:313)

* FUNDACION SERVICIO PARA EL AGRICULTOR, CAGUA. La tristeza de los cítricos. Noticias Agrícolas (Venezuela) 8(18):69-71. 1978. (106

En este artículo se da información sobre la sintomotología de la enfermedad, su causa y las distintas formas de transmisión.
Se indica la solución a este problema mediante el uso de patrones tolerantes a la Tristeza, así como otras medidas aconsejables para lograr frenar la dispersión de la enfermedad como son: la eliminación de las plantas enfermas; impedir la dispersión del áfido transmisor. Ante la amenaza de

grandes pérdidas para la citricultura venezolana FUSAGRI tiene un programa de prevención que contempla: a) el estudio de la adaptabilidad de patrones tolerantes; b) la localización e identificación de plantas enfermas y c) asesoramiento a los agricultores.

* GARNSEY, S. M. Viruses in Florida's "Meyer" lemon trees and their effects on other citrus. Proceedings of the Florida State Horticultural Society 83:66-71. 1970. (107

'Meyer' lemon (a probable hybrid of *Citrus limon* (L.) Burm. f) trees in Florida often contain both the tristeza-seedling yellows and the tatter leaf-citrange stunt virus (TLV-CSV) complexes, but trees with only one or the other virus complex also occur.
Graft inoculations with the TLV-CSV complex caused a bud-union groove, stunting and decline in young sweet orange (*C. sinensis* (L.) Osb.) trees budded on 'Rusk', 'Troyer' and 'Carrizo' citranges (*Poncirus trifoliata* (L.) Raf. x *C. sinensis*) and trifoliate orange (*P. trifoliata*) rootstocks.
Graft inoculations with tissue from tristeza-infected 'Meyer' lemon trees causes severe stunting in sweet orange trees on sour orange (*C. aurantium* L.) rootstock. However, graft inoculations with an aphid-transmitted isolate of tristeza from 'Meyer' lemon caused only mild stunting.

* _____. y JACKSON JUNIOR, J. L. A destructive outbreak of tristeza in central Florida. Proceedings of the Florida State Horticultural Society 88:65-69. 1975. (108

The incidence of tristeza-induced tree decline has increased rapidly in western Orange and southern Lake Counties since 1973. Reset records and aerial mapping showed a cumulative tree loss of 31% in 10 groves with 25,900 tree spaces. Quick decline symptoms have been common, and many trees collapsed and died within several months. The symptoms on 'Mexican' lime (*Citrus aurantifolia* (Christm.) Swing.) indicators inoculated with tissues from quick-decline trees have not been unusually severe. The reason for the sudden, widespread decline is not yet known. The virus has been widespread in this area for many years before this outbreak. Presence of a new isolate of changes in conditions to favor decline development are suggested.

* _____. y YOUNG, R. H. Water flow rates and starch reserves in roots from citrus trees affected by blight and tristeza. Proceedings of the Florida State Horticultural Society 88:79-84. 1975. (109

The effects of blight and tristeza on root systems of declining trees were compared. In blighted trees, apparently healthy feeder roots were abundant and starch levels were near normal, but water flow in varying percentages of 0.3- to 0.5-inch roots was greatly reduced. The percentage of affected roots increased with severity of top symptoms. Feeder roots were sparse and starch levels were low in roots of tristeza-affected trees, but water flow exceeded that of comparable healthy roots. These observations indicate that

the mode of action and cause of these diseases are different. Water flow rates and starch reserves can be measured readily in the field with simple equipment. These measurements are useful aids in making an objective field diagnosis of these two citrus declines.

GARNSEY, S. M. Mechanical transmission of a seedling yellows isolate of citrus tristeza virus. Proceedings of the American Phytopathological Society 4:131. 1977. (110

* _____.; GONSALVES, D. y PURCIFULL, D. Mechanical transmission of citrus tristeza virus. Phytopathology 67(8):965-968. 1977. (111

An isolate of citrus tristeza virus (CTV) was mechanically transmitted by a knife-cut inoculation procedure to Etrog citro (*Citrus medica*) receptor plants. The virus was transmitted directly from donor to receptor plants via a contaminated knife blade in 16 of 120 attempts, and from three bark extracts of varying purity to receptor plants in 20 of 67 attempts. Plants infected by mechanical inoculation showed typical systemic symptoms and contained flexuous, threadlike particles (TLP) that are associated with tristeza infection. Control plants remained healthy.

* _____.; GONSALVES, D. y PURCIFULL, D. E. Rapid diagnosis of citrus tristeza virus infections by sodium dodecyl sulfate-immunodiffusion procedures. Phytopathology 69(1):88-95. 1979. (112

An antiserum to sodium dodecyl sulfate (SDS)-degraded citrus tristeza virus (CTV) coat protein was efficiently produced by toe-pad injection of a rabbit. This serum reacted in SDS agar gel double-diffusion tests to extracts of citrus hosts infected with biologically different CTV isolates. The serum did not react to extracts of healthy citrus or extracts of citrus infected with other viruses. Purified CTV could be detected at concentrations as low as 1-2 µg/ml. Detectable amounts of CTV were found in most phloem-containing vegetative tissues, but the highest titer was consistently found in young shoot bark. Virus titer was highest in young tissues and declined, often quite rapidly under warm conditions, as tissues matured. Virus could be concentrated from aqueous extracts by precipitation with 6% polyethylene glycol 6000 and centrifugation. Tissue could be stored frozen, lyophilized, or air dried for testing. Results obtained from SDS-immunodiffusion tests of 120 field trees correlated well with indexing results obtained from graft in inoculation of *Citrus aurantifolia* 'Mexican' lime indicators. The SDS-immunodiffusion procedure provides a simple, rapid approach to CTV identification applicable to both research and practical needs.

GENGIZ, A. *et al.* Research on citrus virus diseases in the Mediterranean region. Bitki Koruma Bülteni 16(2):63-79. 1976. (113

Observations were made on the distribution and characteristics of citrus virus diseases in 1965-69. Psorosis is the most

widespread and has the max. incidence. Impietratura causes most damage on Jaffa oranges and xyloporosis on tangerines. Exocortis was recorded on certain orange, Satsuma and lemon trees budded on *Poncirus trifoliata* and Troyer citrange. Tristeza was noted on some imported citrus vars. Lemon sieve tube necrosis and a rootstock disease, probably caused by a new virus, were found on lemon. (Review of Plant Pathology 56:1125)

* GIACOMETTI, D. C. y RIOS-CASTAÑO, D. Programa de certificación de yemas para la propagación de cítricos en Colombia. Agricultura Tropical (Colombia) 23(5):277-287. 1967. (114

Se presentan los resultados de las pruebas conducidas para determinar la presencia de los 4 virus más importantes de cítricos en Colombia: tristeza, exocortis, xyloporosis y psorosis A. Esta es la base para futuras recomendaciones donde, en los próximos años, se establecerían huertos comerciales en forma extensa. Se hace énfasis sobre la importancia y necesidad de un programa de certificación de yemas y arbolitos cítricos para Colombia.
Las pruebas conducidas en el huerto viejo de cítricos del Centro Nacional de Investigaciones Agropecuarias Palmira, mostró que la exocortis es el virus más generalizado en los clones de naranja, grapefruit, tangelo, limón y lima; tristeza, psorosis A y xyloporosis, también se presentan; la enfermedad Anillo de la Unión, de causa desconocida también se presenta con cierta frecuencia en árboles con patrón de limón "Rugoso". El sistema de diagnóstico de yemas se considera menos eficiente que el nucelar, lo cual concuerda con lo encontrado por Childs.

* GODFREY-SAM-AGGREY, W. *et al.* Citrus research in Sierra Leone. World Crops 23(4):198-200. 1971. (115

Former research on citrus conducted in Sierra Leone is reviewed. The susceptibility of sour orange to "tristeza" and the presence of the vectors *Toxoptera citricidus* and *T. aurantii* make a research on suitable rootstocks urgently needed. Research efforts are needed also in the field of other virus diseases and of fertilizer response and methods of application. (Tropical Abstracts 27:398)

GONSALVES, D.; GARNSEY, S. M. y PURCIFULL, D. E. Research on citrus tristeza virus generates some rapid identification procedures. Proceedings of the Florida State Horticultural Society 90:75-79. 1977. (116

An account of electron microscopical and serological procedures used in the rapid identification of CTV in citrus trees. (Review of Plant Pathology 58:5862)

_____.; PURCIFULL, D. E. y GARNSEY, S. M. Purification and serology of citrus tristeza virus. Phytopathology 68(4):553-559. 1978. (117

Citrus virus (CTV) was purified from bark and leaf tissue of several citrus species. Tissue frozen in dry ice was pulverized

and extracted several times with 0,10 M tris-HC1, pH 7.6 for bark or pH 8,4 for leaves. After several polyethylene glycol precipitation steps, concentrated viral suspensions were further purified by centrifugation in CsC1 or $Cs_2SO_4$ density gradients. Antisera to formaldehyde-treated CTV, or to untreated CTV preparations reacted with purified CTV in microprecipitin tests. However, antiserum produced to untreated CTV reacted with viral antigen degraded in sodium dodecyl sulfate (SDS) in immunodiffusion tests in agar gels containing SDS and sodium azide, but antiserum to formaldehyde-treated CTV did not. Polyacrylamide gel electrophoresis of SDS-degraded CTV showed one prominent protein component which had a molecular weight of about 25,000 daltons, and a faster moving, fainter-staining region which probably was a degradation products(s) of CTV protein. Material eluted from the major protein zone reacted strongly with CTV-antiserum in SDS-immunodiffusion tests, while that from the faster-moving region reacted weakly. Some preparations of antiserum reacted weakly with extracts from healthy plants. Antiserum absorbed with healthy citrus tissue preparations was specific for CTV antigen. Citrus tristeza virus antigen was easily detected in extracts from young citrus bark and leaf tissue in SDS-immunodiffusion tests, thus indicating the usefulness of this technique for rapid diagnosis of CTV.

* GONZALEZ, R. H. Introducción y dispersión de plagas agrícolas en América Latina; análisis y perspectivas. Boletín Fitosanitario de la FAO 26(2):41-52. 1978. (118

También en Inglés: FAO. Plant Protection Bulletin
" " Francés: Bulletin Phytosanitaire de la FAO

En el presente trabajo se estudia el origen de las principales plagas agrícolas en América Latina, especialmente aquellas de más reciente introducción en la región, (entre ellas la tristeza de los cítricos) sus procedencias, grado de dispersión, métodos de prospección y casos selectos de impacto socioeconómico derivado de su introducción o diseminación.

* GONZALEZ-SICILIA, E. Tristeza. In _____. El cultivo de los agrios. 3 ed. rev. La Habana, Instituto del Libro, 1968. pp. 667-675. (119

El capítulo 18 del libro "El cultivo de los agrios" está dedicado a las enfermedades virosas. En relación a la "Tristeza" encontramos información sobre:

- la aparición y dispersión de la enfermedad a nivel mundial
- detalles de los síntomas de la tristeza
- la causa de la enfermedad que es un virus, las distintas razas y la forma de propagación, las circunstancias que influyen y condicionan la velocidad de difusión de la tristeza al invadir una zona
- la sensibilidad y tolerancia de las combinaciones patrón-injerto
- la dificultad de diagnosticar la "Tristeza", los "test" utilizados para el diagnóstico
- medidas de lucha como son:
  a) El sobreinjertado

b) Sustitución de la raíz del naranjo amargo por otro resistente
c) Franqueo del árbol, mediante la ejecución de incisiones y aporcado del tronco por encima del injerto
d) Injertar el "Roug Lemon" constituyendo con el mismo un puente a través de la unión del injerto primitivo
e) Facilitar la formación de brotes del naranjo amargo a partir del pie.

* GRIMM, G. R. y GARNSEY, S. M. Foot rot and tristeza tolerance of Smooth Seville orange from two source. Proceedings of the Florida State Horticultural Society 81:84-90. 1969. (120

Bifoliate seedlings of two selections of Smooth Seville orange (*Citrus aurantium* L.?) showed outstanding tolerance to foot rot and root rot caused by *Phytophthora parasitica* under test conditions, in which seedlings of common sour orange (C. *aurantium* L.) selections suffered severe injury. They were also more tolerant than sour orange to a severe strain of tristeza when tested as rootstocks with sweet orange tops, but were less tolerant than rough lemon (C. *limon* (L.) Burm. f.), trifoliate (*Poncirus trifoliata*) or sweet orange (C. *sinensis* (L.) Osb.). Other horticultural characteristics of Smooth Seville under Florida conditions have not been evaluated. Seedlings derived from Smooth Seville orange seed, imported from Australia, were identical in appearance and performance to seedlings derived from seed of an Australian sour orange tree of unknown origin in the USDA collection at Orlando.

GUERRA ELIZONDO, O. "Tristeza" de los frutales cítricos. Agronomía (México) 6:2-3. 1949. (121

* HAAG, H. P., SILVA, D. M. y DE OLIVEIRA, J. C. Influence of the tristeza virus on the phosphorus ($P^{32}$) distribution in galego lime (*Citrus aurantifolia* Christm). Revista de Agricultura (Brasil) 42(2):89-91. 1967. (122

Healthy and diseased lime seedlings were supplied with a nutrient solution containing $P^{32}$ for 1, 3 or 18 hours, after which radioautographs showed that P was translocated to all parts of the healthy plant, particularly to the upper leaves, whereas it rose no higher than the base of the stem in the tristeza-diseased plant. It was abundant in the roots of both plants. (Horticultural Abstracts 38:1887)

* HANKS, R. W. y FELDMAN, A. W. Effects on four species of citrus seedlings grafted with buds from healthy and young tree decline-affected trees. Plant Disease Reporter 63(7):587-591. 1979. (123

Seedlings of rough lemon, sour orange, Palestine sweet lime, and sweet orange were inoculated with chip buds to determine whether seedlings of any of these species could be used for indexing for young tree decline. The shoots of all seedlings, except Palestine sweet lime with exocortis inoculation,

were generally unaffected, but the fresh weights of the root systems of rough lemon, sour orange, and sweet orange seedlings were severely reduced by inoculations from both "healthy" and young tree decline-affected trees. Root weights were reduced in Palestine sweet lime only when exocortis viroid was present in the donors. All donor trees carried tristeza virus and many carried exocortis viroid. The possible significance of tristeza in affecting trees on rough lemon is discussed because the virus now seems to be ubiquitous.

* HERNANDEZ, E. y FERIA, A. Virosis de los cítricos. VII. Aglutinación de cloroplastos de naranjos viróticos. Revista de Agroquímica y Tecnología de Alimentos 13(3):423-425. 1973. (124

Antisueros preparados con un concentrado de partículas de 2000 x 10-12 nm, del virus de la tristeza, aglutinan los cloroplastos de hojas de árboles afectados de tristeza. Ensayando el método con hojas de árboles afectados de psoriasis, exocortis, xiloporosis "concave gum", "crinkly leaf" e "impietratura", la aglutinación de cloroplastos es también positiva. Con hojas procedentes de líneas nucelares jóvenes, mantenidas en invernadero, libres de virosis, la aglutinación no se produce. Este resultado puede tener importancia para la selección de patrones exentos de virosis.

* HERNANDEZ YAGO, J. y FORTEZA BOVER, G. Presencia de partículas tipo virus en limas mejicanas infectadas de 'tristeza'. Revista de Agroquímica y Tecnología de Alimentos 13(1):110-117. 1973. (125

Los autores dan a conocer un avance de los resultados obtenidos en el estudio, al microscopio electrónico, de las zonas cloróticas que presentan los nervios de las hojas de limas mejicanas, al cabo de unos meses de haber sido inoculadas por injerto, con corteza procedente de naranjos infectados de "tristeza". Asimismo, comentan las observaciones realizadas en preparaciones llevadas a cabo mediante el método "dip" a partir de corteza y hojas de limas mejicanas sanas e infectadas.
En el floema de los nervios, con síntomas, de limas inoculadas, observan la presencia de algunas células con un contenido denso a los electrones, en el que se encuentran inclusiones formadas por partículas cilíndricas y flexuosas, paralelamente dispuestas. Estas partículas presentan un diámetro de 10-12 nm y longitud superior a los 1.600 nm. Estas características son idénticas a las que ofrecen las partículas aisladas que se observan en las preparaciones realizadas por el método "dip" a partir de corteza y hojas de limas enfermas.

HOUR-ELDIN, F. y TOLBA, M. A. Response of citrus amblycarpa rootstock to several citrus virus diseases. Agricultural Reserve Review 47(5):6-9. 1969. (126

HUANG, C. S. Studies on Citrus virus diseases in Taiwan. I. Reactions of Mexican Lime and Lemon to the apparently healthy and diseased scions of Citrus trees in Taiwan. Journal of Taiwan Agricultural Research 21(1): 62-70. 1972. (127

Apparently healthy and diseased scions, when grafted on Mexican

lime, both induced symptoms of tristeza disease, and vein-corking was not unusual in older leaves. When similar scions were grafted on lemon, symptoms of seedling yellows appeared after 2-3 months. These results indicate that the tristeza virus may be present in apparently healthy as well as obviously diseased trees. New leaves developing on obviously diseased scions showed symptoms similar to those of Mn or Fe deficiency as well as stunting, yellowing and small leaves, especially on Valencia. It also appears that citrus greening may be present as well. (Review of Plant Pathology 51:4004)

HUANG, C.-H. Effect of hot-air treatment on likubin. Tristeza virus and exocortis viroid diseases of citrus. Journal of Agricultural Research of China 27(2):193-197. 1978. (128

Buds from likubin diseased citrus trees were grafted to Rangpur lime seedlings and exposed to daily regimes of 40°C (16 h) and 30° (8 h) for 4 weeks or longer. Such treated plants showed no likubin symptoms in the new growth for 2 yr. All treated plants indexed in Mexican lime seedlings showed tristeza virus symptoms. Evidently the main component of the likubin causal agent was inactivated but tristeza virus was not. Young shoots from tristeza infected Mexican lime seedlings which had been kept at this temp. regime for 15 weeks or at 39-45 and 29-33° for 10 weeks could be freed from tristeza. Temps. of 38 and 28° were not sufficient to inactivate the virus. None of the hot air treated cuttings could be freed from exocortis virus, even after 52 weeks of treatment. (Review of Plant Pathology 58:2798)

_____. Distribution of likubin pathogen in likubin-affected citrus plants. Journal of Agricultural Research of China 28(1):29-33. 1979. (129

* HUME, H. H. Tristeza, a virus disease. In _____. Citrus fruits. New York, Macmillan, 1957. pp. 394-395. (130

IEKI, H. Control of tristeza virus disease of citrus trees by interference effect. Agriculture and Horticulture 54(8):1000-1004. 1979. (131

IREN, S. Plant virus diseases transmitted by arthropods in our country. Bitki Koruma Bülteni 7(3):107-116. 1967. (132

A review of studies on the subject and the viruses identified in Turkey in the last 5 yr is followed by a brief account of the symptoms and vectors of some beet and potato viruses, cucumber mosaic, bean (common) mosaic, and citrus tristeza viruses. (Review of Applied Mycology 47:1796)

JAMOUSSI, B. Les viroses des Citrus en Tunisie et les moyens de lutte. Recherches Agronomiques 39(2):60. 1966. (133

Citrus psorosis, concave gum (psorosis), blind pocket (psorosis), xyloporosis, stubborn disease and exocortis viruses are

reported from Tunisia. Exocortis virus has been found on only 1 tree, and tristeza virus is unknown. (Review of Applied Mycology 46:2228)

KISHI, K. Studies on virus diseases of citrus, pear and peach. Annals of the Phytopathological Society of Japan 40(3):162-164. 1974. (134

Studies on viruses including citrus infectious variegation, citrus tristeza, satsuma dwarf, prunus necrotic ringspot, prune dwarf, peach enation, plum line pattern and prunus latent virus 1, presented in an address to the Sociey at the annual meeting, Tokyo, 4-6 Apr. 1974. (Review of Plant Pathology 54:1182)

KITAJIMA, E. W. y COSTA, A. S. Electron microscopy of the tristeza virus in citrus leaf tissues. In Conference of the International Organization of Citrus Virologists. 4°, Rome, 1966. Proceedings. Edited by J.F.L. Childs. Gainesville, University of Florida, 1968. pp. 59-64. (135

Studies revealed the presence of fibrous inclusions in the phloem cells of leaves of Galego lime (*Citrus aurantifolia*), Ruby Red grapefruit (*C. paradisi*) and Pera sweet orange (*C. sinensis*) seedlings which had been inoculated by grafting or by aphids with mild or severe isolates of tristeza virus. The frequency with which such abnormalities occurred in the phloem tissues was directly correlated with the severity of the virus strain studied and with the susceptibility of the host plant, Ruby Red grapefruit usually being less affected than Galego lime or Pera sweet orange. (Horticultural Abtracts 40:2176)

_____.; MULLER, G. W. y COSTA, A. S. Electron microscopy of tristeza-infected *Passiflora gracilis* Jacq. In Conference of the International Organization of Citrus Virologists, 6°, Swaziland, 1972. Proceedings. Edited by L.G. Weathers and M. Cohen. Riverside, University of California, 1974. pp. 79-82. (136

KLAS, F. E. Epidemiology of the tristeza virus in citrus plantations of Surinam. In International Citrus Congress, Florida, 1977. Proceedings. Edited by W. Grierson. Orlando, Fla., International Society of Citriculture, 1979. v.3, pp. 999-1000. (137

It is believed that citrus tristeza virus occurred in Surinam for at least 16 yr before detection, indicating the presence of a mild str. Based on the rate of spread of the virus, plans may be made for the renovation of diseased plantings. (Review of Plant Pathology 59:5180)

* KLOTZ, L. J. y CALAVAN, E. C. Virus diseases of Citrus. California Citograph 50(11):408, 424; (12):483-484; 51(1):41-42. 1965. (138

Brief notes are given of the incidence, symptoms, transmission, and control of viruses of the citrus psorosis group; the stubborn disease group, which includes little leaf and greening or

yellow branch in S. Africa; the tristeza group; and exocortis, cachexia-zyloporosis, Satsuma dwarf, impietratura, yellow vein, leaf curl, vein enation (woody gall), and tatter leaf. (Review of Applied Mycology 45:1061)

* KLOTZ, L. J. *et al.* Field testing for resistance to fungi and citrus nematodes. Citrograph 57(11):395-396, 411-413. 1972. (139

A progress report on work, extending over several years, on stock/scion combinations suitable for differing conditions which include resistance to *Phytophthora* spp. (root rot and gummosis) and tristeza (quick decline) virus. (Review of Plant Pathology 52:1140)

* KNORR, L. C., MALAGUTI, G. y SERPA, D. Descubrimiento de la "tristeza" de las cítricas en Venezuela. Agronomía Tropical (Venezuela) 10(1):3-12. 1960. (140

Por primera vez en Venezuela, en árboles de limón criollo y limón Meyer, ha sido observado el virus de la "tristeza". También se encontraron árboles de naranja dulce con síntomas sospechosos de tristeza; pero las pruebas sobre limón criollo demostraron que estaban libres del virus. El comportamiento de la enfermedad en Venezuela es más semejante a la tristeza de Florida que a la de Argentina. *Toxoptera citricidus* no se encuentra en Venezuela, donde en las cítricas son comunes *T. aurantii* y *Aphis spiraecola*. Los autores discuten las medidas para el combate de la tristeza en Venezuela, refiriéndose en particular a métodos de exclusión del virus y al uso de patrones tolerantes.

_____. Diagnosing tristeza. Citrus Industry 47(7):14-15. 1966. (141

Advice on identifying tristeza in the field. (Horticultural Abstracts 37:1676)

* _____. Observations of a Florida citriculturist in Trinidad. Journal of the Agricultural Society of Trinidad and Tobago 67(2):219-229. 1967. (142

A survey of citrus diseases established that only a small percentage of trunk scaling in Trinidad was due to psorosis virus, most lesions being due to such other causes as Rio Grande gummosis, concentric canker and physiological gumming. Also present on the island were tristeza, which may have serious consequences, xyloporosis, and exocortis viruses, and suggestions are made to prevent their spread. Of fungus diseases greasy spot (probably due to *Cercospora citrigrisea*) and melanose warrant fungicidal control. (Review of Applied Mycology 47:817)

_____. y PRICE, W. C. Tristeza. In Pratt, R. M. Guía de Florida sobre insectos, enfermedades y trastornos de la nutrición en los frutos cítricos. México, Centro Regional de Ayuda Técnica, 1970. pp. 84-86. (143

Los autores dan una breve información sobre la distribución geográfica de la Tristeza, su sintomatología, forma de pro-

pagación y medidas de prevención.

* KNORR, L. C. y MOIN SHAH, S. Problemas mundiales de los cítricos. V. Nepal. Boletín Fitosanitario de la FAO 19(4):73-79. 1971. (144

También en Inglés: FAO. Plant Protection Bulletin
" " Francés: Bulletín Phytosanitaire de la FAO

Se ha encontrado que una gran parte del desmedro brusco y reciente de los árboles cítricos en Nepal está relacionado con la sustancia marcadora indicativa de la presencia del virus de enverdecimiento. En opinión de los cultivadores, los árboles prosperaron hasta 1964, aproximadamente y entonces sufrieron el marchitamiento descendente, clorosis foliar y caída del fruto, manifestaciones todas éstas que fueron visibles.
La incidencia de la enfermedad del enverdecimiento, tal como se determinó por la prueba cromatográfica, se encontró que alcanzaba el 54 por ciento entre 132 árboles empleados como muestra en el área desde Pokhara a Ranigaun. La propagación por el terreno por el vector *Diaphorina citri* parece que ha tenido lugar a un ritmo uniforme por todo el país, si se toma como base la presencia de la sustancia marcadora en los árboles de plántulas.
En relación a "tristeza", tomando como base los síntomas de aclareamiento de las nerviaciones se encontró esta enfermedad en limonero Kaghzi en Pokhara. El vector eficiente *Toxoptera citricida* está extendido en Nepal. Las pérdidas ocasionadas por "tristeza" son mínimas a causa de que la mayoría de los portainjertos en uso son tolerantes, y en la mayoría de las plantaciones se practica el cultivo de plántulas.
Entre otros insectos y plagas encontrados, parece que los siguientes han sido registrados por primera vez en el país: *Brevipalpus californicus* (Banks), *B. obovatus* Donn., *Phyllocoptruta oleivora* (Ashm.), *Eutetranychus orientalis* (Klein), *Aonidiella aurantii* (Mask.) y *Saissetia coffeae* (Walker). Un informe inédito indica la presencia de la mosca oriental del fruto *Dacus dorsalis* Hendel.
La inaccesibilidad de la mayoría de las plantaciones de cítricos aconseja desistir de un ataque concertado sobre las plagas y enfermedades con protectores químicos, y la naturaleza montañosa del terreno excluye la aplicación obligatoria de las medidas de cuarentena. La única solución para salvar la industria de los cítricos de Nepal parece que reside en las variedades resistentes. El tangor Fewtrell's Early ofrece promesas de tolerancia frente a la virosis del enverdecimiento.

_____. y REDDY, D. B. The decline of citrus in south east Asia. Plant Protection Committee for the South East Asia and Pacific Region, Food and Agriculture Organization. Technical Document no. 84. 1972. 16 p. (145

This paper was presented at the 8th session of the Pl. Prot. Comm. for S.E. Asia and the Pacific region, 4-11 Oct. 1971, at Djakarta, Indonesia. A brief account is given of edaphic factors, cultural practices, and pests and diseases affecting citrus production. The main causes of decline are citrus

tristeza and citrus greening viruses. (Review of Plant Pathology 52:116)

KNORR, L. C.; SCHWARZ, R. E. y PROMMINTARA, M. Tristeza - a citrus virus disease widely disseminated in Thailand. Bangkok,Thailand. Ministry of Agriculture and Cooperatives. Technical Bulletin Plant Protection Service no. 21. 1973. 12 p. (146

An account of the etiology, incidence, symptoms, significance and control of this disease in Thailand. Although at present the virus causes little damage, despite being present in virtually all citrus trees, growers should be aware that new strs. may appear which could attack previously tolerant cvs. (Review of Plant Pathology 55:1798)

KOLLER, O. C. Influencia do virus da "tristeza dos citros" sobre a absorção e translocação do zinco. Tese Dout. Porto Alegre, Brasil, Universidade Federal do Rio Grande do Sul, Faculdade de Agronomia, 1975. 141 p. (147

* KOLLER, O. C. *et al.* Influência do virus da "tristeza" sobre a absorção e translocação do zinco no "limoeiro-galego" (*Citrus aurantifolia* (Christm.) Swingle), enxertado em três porta-enxertos. Agronomia Sulriograndense (Brasil) 15(1):151-162. 1979. (148

Com o objetivo de estudar o efeito do vírus da Tristeza sobre a absorção e translocação do Zn, plantas de limoeiro-galego (*Citrus aurantifolia* (Christm.) Swingle), enxertadas sobre três porta-enxertos, foram cultivadas em vasos com areia e irrigadas com solução nutritiva.
O experimento foi realizado em casa de vegetação, ao abrigo de insetos transmissores de viroses. Após a enxertia, quando as plantas estavam com seis a oito folhas definitivas, metade delas foram inoculadas com o vírus da Tristeza. Após o aparecimento dos sintomas da moléstia, determinou-se a concentração de Zn nas raízes, nos segmentos de caule e nas folhas, emitidos antes da inoculação do vírus e nos segmentos de caule e nas folhas, emitidos após a inoculação do vírus.
Os sintomas da moléstia assemelharam-se mais com os de carencia de boro do que de zinco. Os resultados evidenciaram que, independentemente dos porta-enxertos, o vírus da Tristeza diminuiu a translocação do Zn para as folhas e segmentos de caule desenvolvidos após a inoculação. O vírus da Tristeza afetou a absorção de Zn, pelas raízes, somente nas plantas enxertadas sobre laranjeira-azeda.

KOTZE, J. M. y MARAIS, L. J. Cross-protection-what is it? Citrus and Sub-Tropical Fruit Journal 514:17-18. 1976. (149

KREZDORN, A. H. The tristeza threat increases. Florida Grower and Rancher 70(7):15, 22. 1977. (150

KWANGAI CITRUS YELLOW SHOOT STUDY GROUP. Preliminary study on the pathogen of citrus yellow shoot and its control. Scientia Agricultura Sinica no. 3:84-86. 1978. (151

LOCHE, P. y ZANARDI, D. Considerazioni sulle analogie sintomatologiche tra "cristacortis" e altre malatttie da virus. Italia Agricola 114(3):98-102. 1977. (152

The symptoms of stem pitting are discussed and compared with those of tristeza, xyloporosis, psorosis and its 2 suspected strains, blind pocket psorosis and concave gum psorosis. Data are tabulated on citrus species and cvs susceptible to inoculation with stem pitting virus and the time taken for the symptoms to appear; cvs and species tolerant to the virus; and the incidence of stem pitting on 7 citrus cvs in Sardinia. (Horticultural Abstracts 48:1776)

LOUSSERT, R. Les nouveaux porte-greffes des agrumes. Le bigaradier et la tristeza. Maroc-Fruits no. 529:5, 8. 1978. (153

* McCLEAN, A. P. D. La tristeza y el "stem pitting" de los citrus en Africa del Sur. Boletín Fitosanitario de la FAO 4(6):89-95. 1956. (154

También en Inglés: FAO. Plant Protection Bulletin
" " Francés: Bulletin Phytosanitaire de la FAO

El autor hace una breve reseña sobre el país origen del virus y los trabajos que se llevaron a cabo en América del Sur y Africa del Sur en relación a la tristeza.
Da información sobre los estudios realizados en Pomelo, Limonero y Mandarino.
Establece que:

- El desarrollo de la industria citrícola de Africa del Sur, se ha desarrollado a la par que la virosis, ésto obedece al empleo del limonero rugoso como patrón y a la tolerancia que poseen tanto este limonero como las dos variedades comerciales principales de naranjo dulce (Valencia y Washington Navel) y; que es posible que los efectos nocivos de la tristeza y del "stem-pittin" se manifiesten en los árboles al envejecer, con un decaimiento de su vida productiva.
- El principal problema para el futuro es determinar cuánto tiempo los clones de citrus existentes incluidos los de naranjo dulce, continuarán siendo productivos sometidos a la influencia de la infección virótica, probablemente la solución esté en las plantitas nucelares.
- Se ha establecido la existencia de razas benignas de virus puro; es necesario experimentar aún para saber si este método de inmunización ofrece posibilidades prácticas.

_____. The tristeza virus complex. In Conference of the International Organization of Citrus Virologists, 6º, Swaziland, 1972. Proceedings. Edited by L.G. Weathers and M. Cohen. Riverside, University of California, 1974. pp. 59-66. (155

A brief account of the diseases caused by the citrus tristeza virus complex, the complex in South African citrus trees, variability in the complex, and tristeza in other countries. (Review of Plant Pathology 56:5023)

McCLEAN, A. P. D. Stem-pitting disease on limes in field planting in South Africa. Phytophylactica 7(2):75-80. 1975. (156

Because of its susceptibility to stem pitting, the small acid lime is difficult to grow successfully in countries where tristeza virus and its vector, *Toxoptera citricidus* Kirk, are prevalent. This was verified in 3 field plantings made in South Africa. Seedling trees on their own roots were particularly sensitive. Trees performed better and had a longer life when propagated on rootstocks like rough lemon, sweet orange and mandarin, which are tolerant of stem pitting. Pre-immunizing trees with mild isolates failed to protect them against severe stem pitting when the trees were planted in the open. The trees included seedlings on their own roots and one formed by budding seedling scions on rootstocks. (Review of Plant Pathology 55:742)

_____. Tristeza virus complex; its transmission by the aphid *Toxoptera citricidus*. Phytophylactica 7(3):109-113. 1975. (157

Citrus tristeza virus is transmitted sooner or later by *T. citricidus* to healthy citrus trees grown in the open near infected citrus orchards. Sweet oranges tend to become infected with the whole tristeza complex, and the longer they are exposed the greater is the chance that this will happen. In the earlier stages of exposure the virus transmitted to some sweet oranges may be only a part of the complex and may lack the property of causing seedling yellows. Sometimes the virus picked up causes only very mild stem pitting in lime. When healthy sweet oranges, limes, sweet limes and composite sweet on sour were exposed artificially to aphids made infective by feeding them on sources of the whole complex, the aphids either transmitted the whole complex or, less frequently, only a part of it. Aphids fed on a very mild source of stem pitting transmitted only the form of tristeza that causes very mild stem pitting. (Review of Plant Pathology 55:2720)

_____. Tristeza disease of citrus trees, and sources of tristeza virus that cause the disease. Citrus and Sub-Tropical Fruit Journal no. 523: 7-19. 1977. (158

The investigation described confirms that tristeza disease is a specific reaction of citrus trees of certain stock/scion combinations to a particular form of tristeza virus. The most severe form of the disease is produced by the full tristeza complex which causes yellows in sour oranges, but a milder form is caused by some sources of tristeza virus that apparently lack this characteristic. (Review of Plant Pathology 57:4468)

_____. Tristeza-virus-complex; influence of host species on the complex. Citrus and Sub-Tropical Fruit Journal no. 522:4-16. 1977. (159

Additional evidence is provided that the type of tristeza virus that becomes permanently established in a tree following natural infection depends on the citrus sp. All spp.

grown in the open were infected by tristeza virus which caused stem pitting, but the virus which also caused yellows in sour orange affected only certain spp. Sweet orange trees initially infected with sources of non-yellow tristeza developed seedling yellows when exposed to natural infection. When the full complex was graft transmitted to grapefruit the virus eventually lost the property of causing yellows. In trees infected initially with a mild stem pitting str., the virus became more severe in its effects on lime. There was no evidence that pre-inoculation with the simpler forms of tristeza prevented trees becoming infected with more complex forms when grown in the open. (Review of Plant Pathology 57:2939)

McCLEAN, A. P. D. Tristeza virus: studies on the effectiveness of protective inoculation. Citrus and Sub-Tropical Fruit Journal no. 524:3-12, 18. 1977. (160

Some sources of citrus tristeza virus that were unable to induce yellows in sour orange trees succeeded in preventing sour orange seedlings from developing seedling yellows when introduced before a challenge inoculation with the full tristeza complex. (Review of Plant Pathology 57:4469)

MAITREE PROMMINTARA y KITTISAK KIRATIYA-ANGUL. Study on effect of tristeza to citrus varieties. In _____, Thailand. Ministry of Agriculture and Cooperatives. Annual research report, 1977. Bangkok, 1978. pp. 64-66. (161

MALAYSIA. DEPARTMENT OF AGRICULTURE. Annual report for the year 1969. Kota Kinabalu, Sabah, Malaysia, 1971. 172 p. (162

The presence of citrus tristeza virus on citrus was confirmed. *Phytophthora nicotianae* var. *parasitica*, the cause of foot rot of *Citrus*, was provisionally identified. (Review of Plant Pathology 52:3152)

MALI, V. R. y BALLAL, A. L. Citrus die-back in Marathwada. Research Bulletin of Marathwada Agricultural University 3(1):1-2. 1979. (163

Indexing tests carried out in this area revealed the presence of citrus tristeza, citrus psorosis, citrus xyloporosis and citrus vein enation viruses, bud union crease, citrus greening disease and gummosis (*Phytophthora palmivora*). (Review of Plant Pathology 59:5188)

MARAIS, L. J. y KOTZE, J. M. Mexican lime as a differential host for detecting mild strains of tristeza virus. Citrus and Sub-Tropical Fruit Journal no. 537:13-15. 1978. (164

One-yr-old Mexican lime plants were graft inoculated on the stems with bark tissue from grapefruit or sweet orange trees infected with mild, moderate or severe strs. of citrus tristeza virus, and kept at 27°C for 4 months. Marked differences

in symptom expression were observed on the indicator plants but they were not related to symptom severity on the source plants. (Review of Plant Pathology 58:4386)

MARATHE, T. S. Additional host of tristeza virus disease. Current Science 46(1):27. 1977. (165

*Citrus macroptera* was found to be susceptible. Infected seedlings showed marginal leaf yellowing and stem pitting, but their growth was normal. (Review of Plant Pathology 56:4524)

MARRAS, F. Aspetti fitopatologici dell'agrumicoltura in Francia (Riviera e Corsica), Spagna e Marocco. Studi sassaresi, Sez III, 14(2):517-552. 1966. (166

Observations on the most serious diseases and pests of citrus in these countries, including *Phytophthora* and the viruses tristeza, stubborn, exocortis, cachexia-xyloporosis, psorosis, 'impietratura', and stem pitting are reported and their distribution is summarized. (Review of Applied Mycology 47:814)

MARTI-FABRÉQAT, F. The tristeza disease of citrus. Switzerland. Ciba-Geigy. Citrus Technical Monograph no. 4. 1975. pp. 51-54. (167

* MARTINEZ, A. L. y WALLACE, J. M. A progress report of the studies on citrus decline in the Philippines. Philippines Journal Plant Industry 32(3-4): 253-262. 1967. (168

The viruses of the tristeza-seedling yellows complex are apparently present in all citrus trees in the Philippines that show leaf mottle-yellows. Graft inoculation from such trees results in symptoms of leaf mottle-yellows on a wide range of citrus varieties and species. Transmission of the leaf mottle-yellows virus by *Toxoptera citricidus* suggests that this disease is caused by strains of tristeza-seedling yellows viruses that are not present in some other countries. Preliminary studies with the psyllid *Diaphorina citri* suggest that this insect may transmit some component of the virus mixture existing in the citrus trees in the Philippines. (Horticultural Abstracts 40:4717)

* _____. y EBRAHIMI, Y. Virus de la tristeza en mandarino. Boletín Fitosanitario de la FAO 26(4):172-173. 1978. (169

También en Inglés: FAO. Plant Protection Bulletin
" " Francés: Bulletin Phytosanitaire de la FAO

A fines de 1976 se realizó un estudio sobre la incidencia de enfermedades virosas y semejantes en cítricos.
Los resultados del estudio constituyen la primera prueba experimental de la presencia de virus de la tristeza en árboles de mandarino Satsuma. La tristeza plantea una seria amenaza para la industria citrícola de Irán, ya que cerca del

90% de los árboles están injertados en naranjo agrio.

MATTOS, J. K. A. Tristeza dos citros no Distrito Federal. Cerrado (Brasil) 2(8):10-11. 1970. (170

* _____. *et al.* Estudos sôbre a tristeza dos citros na região geo-econômica do Distrito Federal. Fitopatologia 9(2):60-61. 1974. (171

Sólo sumario

Desde 1969, notou-se nos pomares cítricos do DF, a ocorrência de sintomas típicos de tristeza: (a) caneluras em limoeiros Galego e Tahiti; (b) clorose nas nervuras de lim. Galego; (c) namismo em lja. Pera, Lima, Baianinha, tang. Pocan e mex. Rio; (d) caneluras no porta-enxerto lim. Cravo, similares às induzidas pela variante Capão Bonito de tristeza; (e) "pitting" invertido, acima da zona de enxerto em lim. Tahiti. Mudas de lim. cravo foram inoculadas com 24 fontes de inóculos de diferentes regiões do DF. As leituras foram feitas 10 meses depois na haste do lim. cravo. Caneluras mais fortes foram obtibas quando se enxertou lja. Lima, e menos intensos com lja. Pera. Por outro lado, num pomar de 9 anos notou-se caneluras intensas na copa de lja. Lima e menos intensas e menos frequentes com outras variedades. O porta-enxerto, lim. cravo, exibia caneluras mais fortes quando enxertado com lja. Lima. Talvez possa haver certa ação protetiva da estirpe de tristeza de lja. Pera sobre o do lim. cravo. Borbulhas de plantas premunizadas de lja. Pera e lim. Galego, fornecidas pelo Dr. G.W. Muller (Inst. Agron. Campinas) foram enxertadas em lim. cravo em lim. cravo e expostas à infeçcão natural ou super inoculadas com estirpes locais da tristeza. Paralelamente, tentativas de premunização com material de plantas bem desenvolvidas da região foram feitas. Este experimento está em andamento.

* MEDIDAS DE cuarentena. Boletín Fitosanitario de la FAO 17(4):95. 1979. (172

También en Inglés: FAO. Plant Protection Bulletin
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Decreto dado por el Ministerio Libanés que tiende a conseguir una protección preventiva contra la tristeza de los agrios y el mal seco. (Review of Plant Pathology 49:1555)

* MEISTER, C. W. Differential reaction of citrus species to diseases and pests at Koronivia. Fiji Agricultural Journal 35(2):75-78. 1973. (173

In a collection of seven citrus species and varieties growing at Koronivia, Emperor mandarin showed no anthracnose, Lisbon lemon and three mandarin varieties no canker and two orange varieties no scab. Vein corking, observed for the first time in Fiji, appeared on two mandarin varieties and bark cracking of unknown cause appeared on Lisbon lemon, Persian seedless lime and two orange varieties. Virus disease indexing showed that all trees had tristeza, and Lisbon lemon and exocortis.

* MEISTER, C. W. Programa de "indexing" para identificar las virosis de los citrus de Fiji. Boletín Fitosanitario de la FAO 24(3):86-89. 1976. (174

También en Inglés: FAO. Plant Protection Bulletin
" " Francés: Bulletin Phytosanitaire de la FAO

Las variedades más importantes de naranja, mandarina, pomelo, limón y lima en Fiji fueron indizadas respecto a once virosis y micoplasmosis de los agrios. Se observó que el limonero Lisboa estaba infectado de virus de exocortis y tristeza. Las variedades de naranja y mandarina estaban infectadas de virus de amarilleo de las plántulas, en tanto que el pomelo Buca Bay, el limonero Meyer y el limeto tahitiano sin pepitas estaban infectados de virus de tristeza. De las cinco plántulas de lima de las Indias Occidentales sometidas a prueba, tres contenían el complejo del virus de amarilleo de las plántulas, mientras que el inóculo de los otros dos sólo dio por resultado la reacción a la tristeza.

* MENDEL, K. La amenaza de la tristeza en la cuenca del Mediterráneo. Boletín Fitosanitario de la FAO 4(7):106-108. 1956. (175

También en Inglés: FAO. Plant Protection Bulletin
" " Francés: Bulletín Phytosanitaire de la FAO

El autor se limita en este trabajo a tratar de la existencia de la "tristeza" en la zona del Mediterráneo. Recientemente fue confirmada la presencia de esta enfermedad en Israel en el limonero Meyer.
¿Por qué la tristeza no se ha propagado? Se piensa que no se ha propagado por:
- no existir un insecto vector eficaz en la región
- por la raza de virus de que se trate, en este caso una raza benigna.

En opinión del autor existe un peligro potencial en las siguientes posibilidades:
- posibilidad de que el pulgón local se convierta en un vector eficaz de la enfermedad
- el virus podría quedar "activado" y convertirse en transmisible
- en el reinjerto de variedades normales locales sobre portadores de virus injertados sobre patrones tolerantes

Para evitar la propagación de la enfermedad en la cuenca del Mediterráneo es necesario adoptar medidas eficaces en todos los países de la zona.
- búsqueda en todas las variedades introducidas en los últimos 20 años de la presencia del virus. Si la reacción es positiva todos los árboles de la especie deberán destruirse
- se deben llevar a cabo ensayos de portainjertos tendientes a encontrar un sustituto para los portainjertos susceptibles a la tristeza, especialmente para el naranjo agrio
- las viejas variedades normales deberán rejuvenecerse mediante el desarrollo de estirpes nucelares.
- deberán prohibirse o limitarse por medio de rigurosa cuarentena la introducción de plantas cítricas.

MENDEL, K. New rootstocks for Israeli citriculture. I. Generalities; tree development and yields. Proceedings of Tropical Region American Society Horticultural Science 15:101-112. 1971. (176

In order to find substitutes for the tristeza-susceptible standard roostocks in Israel, the sour orange, *Citrus aurantium*, and the Palestine sweet lime, *C. limettioides*, a large rootstock trial was conducted, including the adaptation of the rootstocks to very different ecologic or edaphic conditions. Results showed that the existing rootstocks could be successfully replaced by the sweet orange group on light soils and by the mandarin group on heavier soils. (Tropical Abstracts 28:2448)

MENDES, C. Incidencia da "Tristeza" dos citros do Vale do Curú, Estado do Ceará. Boletim da Sociedade Cearense de Agronomia (Brasil) 7:57-59. 1976. (177

* MENEGHINI, M. Sobre a natureza e transmissibilidade da doença "tristeza" dos citrus. Biológico (Brasil) 12(12):285-287. 1946. (178

La presente nota trata principalmente de los resultados que se obtuvieron experimentando sobre la transmisión de enfermedades virosas en plantas, por medio de insectos, en este caso utilizando el pulgón negro de la naranja *Aphis tavaresi*.

* _____. Experiências de transmissão da doença "tristeza" dos citrus pelo "pulgão preto" da laranjeira. O Biológico (Brasil) 14(5):115-118. 1948. (179

This paper describes some experiments carried out on the transmission of the "tristeza" disease of orange tree by *Aphis tavaresi* Del Guercio. The results of these experiments can be summarized as follows:

1. A starvation period of 24 hours before the viruliferous aphids were transferred to healthy plants did not cause a noticeable decrease in the infectivity of the insect. After 48 hours this infectivity was almost entirely lost.
2. Sweets orange plants infested with viruliferous aphids and grafted to sour orange 45 days later, became diseased in 9 cases out of 10. Healthy sweet oranges grafted to sour oranges which had been infested with viruliferous aphids 45 days before, became diseased in 2 cases out of 10.
3. The starch reaction test (in the grafting zone) was negative in 7 plants that we considered healthy by their aspect. In 13 plants considered diseased only 8 gave positive reaction.
4. *A. tavaresi* could easily be bred on the Rutaceae *Evodia hupehensis* Dode.
5. Non viruliferous aphids (bred on *E. hupehensis*) did not produce symptoms on plants of sweet grafted on sour orange plants, employed in a larger proportion than 200 per plant. When they were previously fed on shoots of diseased plants, they infected 8 out of 10 plants. These

results again confirm that the disease can be transmitted by A. *tavaresi*, and that this aphid does not exercise any noticiable toxicogenic action on the plants included in the experiments.

* MISCHAN, M.; LIMA, L. DE y SALIBE, A. A. Niveis de microelementos e stem pitting de tristeza em laranjeiras doces. Fitopatologia 11(1):24. 1976. (180

Sólo sumario

Em dez ensaios de porta-enxertos para laranjeiras doces estabelecidos em 1965 na Estação Experimental "Presidente Medici", Botucatú, SP, determinou-se a concentração dos microelementos Zn, Mn, Cu e Fe nas folhas das plantas, por espectrofotometria de absorção atômica. Os níveis desses microelementos foram correlacionados com os valores indicativos da intensidade de "stem pitting" ou canelura de tristeza encontrados nos ramos das laranjeiras (Hamlin, Baianinha, Westin, Rubi e Itaboraí) de todos os ensaios. Todas as laranjeiras eram de clone nucelar, livres de viroses, exceto por uma raça severa do vírus da tristeza. Os resultados indicaram não haver correlação entre os níveis do elemento Zn e "stem pitting", sendo o valor de r = 0,7 com respectivo valor do teste t igual a 1,18. Os elementos Mn e Fe mostraram correlação positiva, com valores, respectivamente de re = 0,37 e r = 0,38 e t = 6,37 e t = 6,56. Já quanto ao elemento Cu encontrou-se correlação negativa, com r = 0,13 e t = 2,11, indicando que nas plantas com níveis mais elevados deste elemento ocorreu menor dano ocasionado pelo vírus da tristeza. É interessante lembar que o poder tóxico do cobre para fungos e outros microorganismos é de há muito conhesido. Os níveis de Cu nas folhas das laranjeiras, em ordem decrescente segundo os porta-enxertos, foram: tagerineira Sunki, 10,14; limoeiro Cravo, 8,08; laranjeira Caipira, 7,84; limoeiro rugoso da Flórida, 7,12; Trifoliata, 5,44 ppm.

MIYAKAWA, T. The susceptibility of *Citrus* spp. and related plants to Satsuma dwarf virus. Annals of Phytopathological Society of Japan 35:224-233. 1969. (181

Seedlings of 18 *Citrus* spp., *Poncirus trifoliata*, *Aeglopsis chevalieri* and 7 hybrids were all susceptible to SDV which induced a non-persistent mottling; this was accompanied in some lines by crinkling which became apparent 1-2 months after inoculation. Buds from seedlings whose foliar symptoms had already disappeared incited dwarfing when grafted into virus-free Satsuma budlings; mottling appeared shortly after inoculation but there was a delay of 3 or more months before leaf bending or cupping occurred. Virus preparations from dwarfed trees in the field were invariably contaminated with tristeza virus; TV was separated from SDV by passage through *P. trifoliata* and the infectivity of SDV on West Indian limes, which are highly sensitive to TV, could then be studied. The presence of TV, however, did not affect the reaction of Satsuma nucellar seedlings or budlings to the SDV preparation. There were noticeable differences in the effects of seven virus isolates on

various nucellar seedlings but it was not certain whether the differences were attributable to different SDV strains. (Horticultural Abstracts 40:9210)

MIYAKAWA, T. Current topic on virus diseases of citrus plants with special reference to tristeza virus in Japan. I. Agriculture and Horticulture 50(2):287-291. 1975. (182

_____. Damages in citrus fruit caused by virus diseases in special reference to tristeza in Japan and recent problem. II. Agriculture and Horticulture 50(3):402-404. 1975. (183

_____. Damages in citrus fruit caused by virus diseases in special reference to tristeza in Japan and recent problems. III. Agriculture and Horticulture 50(4):540-544. 1975. (184

_____. Decline of Yuzu, *Citrus junos* Sieb. ex Tan. caused by tristeza virus. Bulletin of the Tokushima Horticultural Experiment Station no. 5:31-41. 1976. (185

_____. Citrus tristeza virus and its varietal distribution in Japan. Bulletin of the Tokushima Horticultural Experiment Station no. 6:1-7. 1977. (186

* MOJICA B., M. Enfermedades de los cítricos. Agricultura Tropical (Colombia) 24(2):117-121. 1968. (187

El autor hace una reseña de las enfermedades de los cítricos, como factor limitante del porvenir citrícola de una región. Las clasifica de acuerdo con el agente causal en: Patógenas, Virosas y Fisiogénicas. Dentro de cada clasificación da la sintomatología de las enfermedades correspondientes y las medidas preventivas y de control para las mismas.
En relación a la Tristeza de los cítricos, la clasifica en virosa. Establece su: distribución a nivel mundial, su forma de transmisión por medio de las yemas de los injertos o por insectos, especialmente por el áfido negro (*Toxoptera citricidum*. Da la sintomatología de la enfermedad. Indica entre las medidas más recomendadas de control el uso de patrones resistentes y varetas de yemas provenientes de árboles libres de "Tristeza" y el control de áfidos.

MONTEVERDE, E. y BOSCAN DE MARTINEZ, N. La tristeza de los cítricos. Maracay, Venezuela. Centro Nacional de Investigaciones Agropecuarias. Boletín Informativo no. 1. 1977. 24 p. (188

* MOREIRA, C.-S.; COSTA, A. S. y GRANT, T. J. Métodos para identificação e contrôle da tristeza dos citros. Bragantia (Brasil) 13(19):223-236. 1954. (189

Algumas regiões citrícolas, especialmente no continente europeu, ainda não foram, ao que parece, atingidas pela moléstia

tristeza dos citros. Os conhecimentos adquiridos dute as investigações feitas sobre a moléstia permitem indicar como identificá-la e prevenir suas desastrosas conseqüências nos laranjais.
Os sintomas gerais nas plantas afetadas são semelhantes aos causados pela podridão do pé (gomose), podendo-se distinguí-la da tristeza examinando as raízes.
Há combinações cavalo-enxêrto tolerantes e não tolerantes ao vírus. É, porisso, muito importante o reconhecimento da espécie cavalo, o que se pode fazer no pomar examinando a sua brotação ou observando o grau de congenialidade entre cavalo e enxerto. O teste colorimétrico feito com a casca da raíz também auxilia o reconhecimento.
Os sintomas chamados "pitting" das limas ácidas e pomelos, permiten identificação da tristeza no pomar.
O teste de Schneider, Wallace & Dimitan combinado com observações de campo, pode substituir, nas regiões onde a moléstia já foi constatada, os testes de transmissibilidade, mais rigorosos porém demorados, feitos no viveiro ou em estufas. A transmissão por enxertia ou por insetos vetores é feita da planta suspeita para plantas sadias de combinações não tolerantes ao vírus (laranjeira doce sôbre azêda) ou para pés francos do limoeiro galego.
É de interêsse conhecer qual a estirpe do vírus predominante na região, para orientação dos citricultores quanto aos métodos de controle da moléstia.
A identificação da espécie de afídios predominante na região permite prever a velocidade da disseminação da tristeza, porquanto umas são vetores muito eficientes, outras pouco.
O contrôle da tristeza é obtido por métodos indiretos. Nas novas plantações evitam-se as combinações não tolerantes, empregando-se como variedade-cavalo as laranjeiras doces, as tangerineiras, os limoeiros Cravo (Rangpur) e Rugoso.
Às vêzes é possível o emprêgo de pés francos provenientes dos embriões nucelares. Nas plantações já existentes pode-se fazer a substituição total ou parcelada (individual) das plantas, conforme se constate predominância de afídios muito ou pouco eficientes e de estirpes fortes ou fracas do vírus.
A sub-enxertia ("inarching"), a sôbre-enxertia ("topworking") e o afrancamento do enxêrto são outras tantas modalidades de contrôle da tristeza, as quais podem ser vantajosamente empregadas em determinadas condições.
Medidas de quarentena podem retardar a invasão das zonas ainda livres da tristeza, sendo de interesse o esclarecimento do público quanto ao perigo representado pela importaçao de plantas ou suas partes vivas, exceto as sementes.

* MOREIRA, C. S. Estudio de las enfermedades de los agrios. Boletín Fitosanitario de la FAO 15(3):59-60. 1967. (190

También en Inglés: FAO. Plant Protection Bulletin
" " Francés: Bulletin Phytosanitaire de la FAO

A mediados de 1967 se realizó un reconocimiento general de las plantaciones de cítricos de Mauricio y de Reunión. La "Tristeza" se encontró en todas las fincas examinadas, su principal vector es *Toxoptera citricidus*. Se hallaron síntomas en *Citrus aurantifolia*, *C. paradisi* y *C. hystrix*.

* MOREIRA, C. S. A ocorrência de doenças de vírus em citros e sua relação com os centros distribuidores de borbulhas. Revista de Agricultura (Brasil) 44(2-3):41-46. 1969. (191

The occurrence of the three important citrus viruses, namely psorosis, exocortis and xyloporosis in the old clones of sixteen citrus varieties largely cultivated in Brazil is related to the main four propagating centers located in the States of Rio de Janeiro (Deodoro), São Paulo (Piracicaba and Limeira) and Rio Grande do Sul (Taquari). The influence of the private nurseries in the propagation of the considered viruses is very small.
The tristeza disease is endemic in the country since the fourties and its distribution is not related with the propagating centers because it is spread naturally by the efficient vector *Toxoptera citricidus* Kirk.
New introduction of propagative material of varieties that may have interest to the Brazilian citrus growers must be done by seed or under severe quarantine measures if they are not poliembrionic forms.
As all the commercial citrus varieties have been cleaned up from bud transmissible virus through the production of controlled nucellar lines at the Limeira Citrus Experiment Station the other three most important propagative centers should stop the distribution of non tested lines and look for clean material from that center.

* MORIN, C. *et al.* Tristeza. In _____. Cultivos de cítricos. 2 ed. Lima, IICA, 1980. pp. 588-590. (IICA. Serie Libros y Materiales Educativos, no. 39). (192

El Ing. Rafael Francios T. preparó el capítulo sobre Enfermedades de los cítricos y las agrupa para su estudio según su agente causal en criptogámicas, virósicas y las causadas por algas.
En relación a las enfermedades de origen virósico, realiza un análisis de las más importantes, entre ellas destaca la "Tristeza". Da información sobre su: distribución geográfica, su aparición en Perú, sus síntomas y forma de transmisión.
Considera que las enfermedades virósicas son las que constituyen el mayor factor de costo de producción de los cítricos, ya que hasta el momento son incurables, los árboles enfermos reducen mucho su producción y su vida comercial y deben ser reemplazados por árboles jóvenes.

MULLER, G. W. y COSTA, A. S. Further evidence on protective interference in citrus tristeza. In Conference of the International Organization of Citrus Virologists, 4°, Rome, 1966. Proceedings. Edited by J.F. Childs. Gainesville, University of Florida, 1968. (193

_____.; RODRIGUES, O. y COSTA, A. S. A tristeza virus complex severe to sweet orange varieties. In Conference of the International Organization of Citrus Virologists, 4°, Rome, 1966. Proceedings. Edited by J.F.L. Childs. Gainesville, University of Florida, 1968. pp. 59-64. (194

* MULLER, G. W. y COSTA, A. S. Vacina contra a tristeza no reino da laranja doce. Coopercotia (Brasil) 27(248):32-33. 1970. (195

Em resumo: o negócio é conseguir mudas imunizadas de limão-galego, fazer experiências com mudas de laranja-pêra e pomelo, e não aceitar mudas, borbulhas ou enxertos da região de Capão Bonito. Essas mudas podem ser enviadas de lá sem má intenção: às vêzes se faz um viveiro com o propósito de utilizar as laranjeiras novas e se muda de opinião, vendendo as plantas.
De resto, os agrônomos vêm fazendo o que podem pela saúde dos laranjais paulistas. Só que vírus é mais teimoso que burro velho. Leva muito tempo para se encontrar uma solução.

_____. y COSTA, A. S. Estudos sobre a interação entre o virus da tristeza da copa e do porta enxerto. In Congresso Brasileiro de Fruticultura, 1°, Campinas, 1971. Resumos. Campinas, Sociedade Brasileira de Fruticultura, 1971. pp. 35-35A. (196

_____. y COSTA, A. S. Tentativas de recuperação de plantas de citros afetadas por complexos fortes do virus da tristeza por sobre enxertia. In Congresso Brasileiro de Fruticultura, 1°, Campinas, 1971. Resumos. Campinas, Sociedade Brasileira de Fruticultura, 1971. pp. 33-33A. (197

_____. Estudos sobre a interação entre isolados do vírus da tristeza dos citros e controle da moléstia em limão galego por premunização. Tese Dout. Piracicaba, Universidade de São Paulo, Escola Superior de Agricultura "Luiz de Queiroz, 1972. 68 p. (198

Resumen en: Resumos de teses 1973. Piracicaba, Brasil, Universidade de São Paulo. Escola Superior de Agricultura "Luiz de Queiroz". Boletim de Divulgação no. 20. 1975. pp. 188-190.

O uso de porta-enxertos tolerantes ao vírus da tristeza possibilitou o cultivo de citros em áreas onde essa moléstia estava presente. Existem, entretanto, alguns tipos de citros, que enxertados nesses cavalos tolerantes ou mesmo de pé franco, mostram danos causados pelo tristeza. O problema se torna bastante grave quando essas plantas são infetadas por formas severas do vírus capazes de induzir caneluras.
O conhecimento da existência de estirpes fracas do vírus da tristeza, e o fato de que elas podem oferecer proteção, levou à realização de estudos, visando o controle da tristeza em copas de limão Galego através da premunização com estirpes fracas do vírus.
Levantamentos foram efetuados em pomares de limão Galego, laranja Pera e grapefruit Marsh Seedless, severamente injuriados pelo vírus da tristeza, a fim de localizar plantas que se sobressaiam pelo seu vigor excepcional. Material dessas plantas consideradas destacadas foi coletado para fins experimentais.
Plantas de limão Galego consideradas de "elite", selecionadas como matrizes, devem o seu desenvolvimento superior, na maioria dos casos, a estarem infetadas por estirpes ou complexos fracos do vírus da tristeza que as estão protegendo contra as

estirpes usuais responsáveis pelo declínio das árvores vizinhas.
Foi verificado que há evidencia de especificidade entre as estirpes do vírus da tristeza. Isolados coletados como fracos de laranja Pera e grapefruit, foram de uma maneira geral fortes para Galego.
Experimentos conduzidos na casa de vegetação, utilizando mudinhas jovens inoculadas por meio do vetor da tristeza, o pulgão preto dos citros, com isolados fracos e severos do vírus, deram resultados diferenciais mais rápidos do que mudas crescendo em condições de campo inoculadas por união de tecido. Houve no entanto um paralelismo entre as reações observadas na casa de vegetação e no campo.
As reações obtidas da inoculação simultânea de um isolado fraco e um forte do vírus da tristeza, aparentemente não estão correalacionadas com o valor protetivo do fraco contra o forte.
Resultados obtidos após vários anos nas experiências de premunização, realizadas sob condição de plantação experimental, mostraram que clones nucelares novos de limão Galego, premunizados com determinados isolados fracos do vírus da tristeza, desenvolveram-se normalmente, expostos em condições de campo, a superinoculação com estirpes fortes. A produção desses vinha sendo em média, 7 vezes superior a das plantas controles não premunizadas.
O efeito de proteção dos isolados fracos do vírus da tristeza parece ser perpetuado nas enxertias sucessivas feitas a partir do material primeiramente premunizado, a julgar pelo crescimento uniforme verificado em pomares de 2a. e 3a. perpetuação do material premunizado original.
Considera-se já terem sido plantadas mais de 200.000 plantas dos clones premunizados de Galego. A crescente demanda de borbulhas premunizadas certamente assegura a continuidade do cultivo desse tipo de citros que muito tinha diminuido devido ao vírus da tristeza.

* MULLER, G. W. y COSTA, A. S. Possibilidades de controle da tristeza de Capão Bonito através da premunização com estirpes fracas do vírus. Revista da Sociedade Brasileira de Fitopatologia 5:117-119. 1972. (199

A variante Capao Bonito (CB) do vírus da tristeza ocorre na região Sul do Estado de São Paulo. Os prejuízos causados atualmente pelo mesmo são de menor monta para a indústria citricola pelo fato de essa área não ser uma região onde a cultura seja de importância. Representa, porém, sério perigo em potencial para as regiões citrícolas importantes do Estado, pois é de se esperar que esse variante venha a se estabelecer nelas algum dia, apesar das medidas de vigilância sanitária, recentemente tomadas para impedir tal fato.
Na eventualidade de que isso possa vir a acontecer, foi iniciado pelos autores um programa visando o controle dessa moléstia através da técnica de premunização com estirpes fracas adequadas do vírus da tristeza, a semelhança do que vem sendo feito com exito no caso do limão Galego e da laranja Pera.
No presente trabalho, são relatadas tendências preliminares observadas em copas de laranja doce de um experimento de premunização de campo, presentemente (janeiro de 1972) com

5 anos de idade, e resultados obtidos de um teste também de premunização efetuado com plantas de limão Galego, realizado em condições de estufa...
Os resultados preliminares obtidos em campo e os de estufa indicam que há determinadas estirpes fracas para as quais as laranjas doces são altamente tolerantes e que oferecem proteção contra a invasão posterior pelo variante CB. Naturalmente resultados finais só podem ser obtidos a prazo mais longo.

MULLER, G. W. y COSTA, A. S. Reduction in yield of Galego lime avoided by preimmunization with mild strains of tristeza virus. In Conference of the International Organization of Citrus Virologists, 5°, Japan, 1969. Proceedings. Edited by W. C. Price. Gainesville, University of Florida, 1972. pp. 171-175. (200

_____.; COSTA, A. S. y CAMPOS, J. S. Tristeza severa no limão. In Congresso Brasileiro de Fruticultura, 2°, Viçosa, 1973. Anais. s.l., 1973. p. irr. (201

_____. *et al.* Additional evidence that the tristeza virus multiplies in *Passiflora* species. In Conference of the International Organization of Citrus Virologists, 6°, Swaziland, 1972. Proceedings. Edited by L.G. Weathers and M. Cohen. Riverside, University of California, 1974. pp. 75-78. (202

* _____.; COSTA, A. S. y PESSINI, A. L. Proteção parcial contra a infecção natural pelo variante Capão Bonito, conferida pelas estirpes comuns do virus da tristeza. Fitopatologia 9(2):62. 1974. (203

Apezar de o vírus da tristeza ter-se disseminado rapidamente nos pomares citrícolas do Brasil, o variante Capão Bonito, tem mostrado uma lenta disseminação. Os ensaios indicaram não ser um problema de eficiência na transmissão pelo pulgão vector. Uma outra alternativa, de que a estirpe Capão Bonito teria dificuldade em se estabelecer em plantas já infetadas por outras formas ou complexos comuns da tristeza, devido a uma proteção parcial, foi considerada e testada. Vinte plantas sadias e 20 inoculadas (de 5 variedades de lja. dôce) com variantes comuns de tristeza de 4 procedências foram plantadas na Est. Exp. Capão Bonito. Dois anos depois, 4 indivíduos do lote de 100 plantas sadias e 2, das infetadas, se achavam infetadas pelo variante C. Bonito. Após mais 2 anos, essas figuras foram 14 e 6 respectivamente. Os dados obtidos parecem favorecer a hipótese de trabalho. Contudo, a proteção parcial oferecida pelas estirpes comuns a invasão pelo variante C. Bonito não deve ser interpretado no sentido de afrouxar as medidas de vigilância sanitária vegetal, permitindo a introdução em outros locais de mudas procedentes da região de Capão Bonito.

* MULLER, G. W.; COSTA, A. S. y PESSINI, A. L. Tolerância moderada da laranja Valencia e Natal ao variante Capão Bonito do vírus da tristeza. Fitopatología 9(2):62. 1974. (204

Observações iniciais quanto a suscetibilidade das diversas variedades de laranja dôce a estirpe Capão Bonito do vírus da tristeza não indicaram diferenças nas suas reações, mas posteriormente, em diversos ensaios, verificou-se um comportamento diferencial das variedades Valencia e Natal. Estas variedades se mostraram mais resistentes à estirpe Capão Bonito, tanto nos ensaios de exposição natural à infecção, como nas inoculações em condições experimentais, do que outras variedades testadas em condições similares. Mesmo nas inoculações por enxertia, os sintomas de declínio foram menos acentuados em Natal e Valencia, indicando que estas variedades possuem tolerância moderada à moléstia. Este feto parece ser vantajoso do ponto de vista comercial, sugerindo que a disseminação da variante Capão Bonito da tristeza em pomares dessas 2 variedades, atualmente uma parcela considerável dos pomares cítricos paulistas, não acarretaria perdas tão importantes como ocorreira em pomares de outras variedades.

_____.; COSTA, A. S. y YUKI, V. A. Virus inactivation in infected buds or grafts on immune rootstocks by localized heat treatment in mimchambers. Ciência e Cultura (Brasil) 26:1173-1175. 1974. (205

* _____. y COSTA, A. S. Comportamento da laranja Pera premunizada distribuida aos citricultores. Fitopatología 10(2):60. 1975. (206

Sólo sumario

Resultados obtidos após vários anos em experiências nas quais comparou-se o efeito de premunização de 45 isolados considerados fracos, do vírus da tristeza, em clones novos de laranja Pera mostraram que desses, 2 foram considerados bons com um comportamento destacado. A capacidade de preminização notada em Campinas, destes 2 isolados, foi avaliada em outras regiões através de seu comportamento em plantas formadas a partir de borbulhas distribuidos a citricultores interessados, os quais se comprometeram de enxertálos no melhor clone de Pera local. Esta avaliação foi feita através de questionários enviados aos citricultores. Houve 13 respostas, em 46 questionários enviados 12 dos quais afirmavam categoricamente ter sido o comportamento das mudas premunizadas muito superior ao material local. As respostas abrangem cerca de 200.000 plantas, estimando-se que o total de laranjeiras Pera premunizadas seja da ordem de 1.000.000. Este trabalho, praticamente o único no mundo, já em escala comercial, está mostrando a possibilidade de, novamente, se cultivar a laranja Pera, usando o material premunizado com estirpes fracas. Outra avaliação da aceitação do processo da premunização é a comercialização das mudas ou borbulhas premunizadas, que alcança preço superior pela sua intensa procura.

* MULLER, G. W. y COSTA, A. S. Premunizaçao de clones velhos de citros, parcialmente intolerantes a tristeza com isolados fracos do virus. Fitopatología 10(2):59-60. 1975. (207

Sólo sumario

Copas de clones nucelares novos de laranja Pera e limão Galego, premunizadas com estirpes fracas do vírus da tristeza, produzidas na S. Virologia, Inst. Agronomico, estão tendo excelente aceitação por parte dos citricultores do Est. S. Paulo e outros estados. Em vista dos bons resultados obtidos, pensou-se na premunização de clones velhos de cultivares de citrus, parcialmente intolerantes a tristeza, principalmente de laranja Pera, com caracteristicas agronomicas já consagradas, depois da prévia eliminação dos vírus neles existentes, poderia trazer ventagens adicionais. A eliminação dos vírus já existentes nesse material está sendo efetuada através de tratamento térmicos e outros métodos. Uma vez livres do vírus da tristeza, estes clones velhos seriam premunizados com isolados fracos e então comparados em condições iguais com os clones novos premunizados com os mesmos isolados, com o clone velho original e com clones novos infetados com o vírus do clone velho.

* _____. y COSTA, A. S. Intolerancia de *Poncirus trifoliata* a determinados complexos de tristeza. Fitopatologia 11(1):25-26. 1976. (208

Plantas de diversas combinações de citros enxertados em *Poncirus trifoliata*, infectadas pelo variante Capão Bonito do vírus da tristeza mostram sintomas acentuados de declínio e, caneluras no cavalo. Também copas de citros as quais situa-se a laranja Pera, infectadas com certas estirpes do vírus da tristeza, igualmente enxertadas em trifoliata originam plantas de porte reduzido, declínio e presença de protuberâncias da casca e correspondentes depressões do lenho no ponto de união do enxerto e cavalo conhecido como "bud union crease". Finalmente, na Argentina, na Província de Missiones, onde a tristeza existe há muito, plantações de laranja doces, entre as quais destaca-se uma variedade local denominada "Calderon", enxertadas em cavalos de *Poncirus trifoliata*, estão sendo dizimadas paulatinamente por uma moléstia denominada "Declinamiento de los citros". Plantas afetadas mostram um declínio progressivo que pode ou não levar a morte das mesmas. A presenca de frutas pequenos, anormais denominados "bolitas", presentes em maior ou menor quantidade em comparação com os frutos normais, é outro sintoma inicial da moléstia. Caneluras não são notadas na maioria dos cavalos trifoliata de plantas afetadas, havendo no entanto em alguns casos indicação de depressões do lenho correspondentes a saliências da casca. Além disso não são observados sintomas de "bud union crease" no caso de plantas mostrando o "Declinamiento". Os fatos apontados que o tecido no *Poncirus trifoliata* considerado como tolerante ao vírus da tristeza, comporta-se como intolerante a determinadas estirpes ou variante do complexo. As diferenças observadas em relação à sintomatologia dos vários declínios mencionados e na reação de *P. trifoliata* pode ser atribuída na sua maior parte a diferenças entre os componentes

que constituem os complexos de tristeza associados a tais declínios.

* MULLER, G. W. A tristeza dos citros. Summa Phytopathologica 2(4):245-263. 1976. (209

A presente revisão sobre a tristeza dos citros aborda o histórico da moléstia no Brasil e outras partes do mundo, sua distribuição e importância econômica no passado e um quadro atualizado dos problemas ainda ocasionados, bem como medidas de controle que vem sendo adotadas para reduzir as perdas causadas em diferentes tipos de copas comerciais de citros nas diversas regioes produtoras. Trata também de alguns aspectos mais básicos, tais como morfologia, composição da partícula, purificação e serologia; inter-relação vírus-vetor; interferência entre estirpes do complexo; problemas de natureza ainda duvidosa, mas provavelmente associados a estirpes específicas do vírus da tristeza ou a complexos de vírus do qual a tristeza faz parte.

* _____. Molestias de virus de citros. Empresa de Pesquisa Agropecuaria de Minas Gerais. Informe Agropecuario (Brasil) 5(52):45-52. 1979. (210

Os citros estão sujeitos a diversas moléstias de natureza virótica, sendo que estas estão entre as que tem causado maiores danos a cultura. No Brasil ocorrem ou ocorreram de maneira mais intensa nas regiões de cultivo de citros quatro importantes doenças de vírus a saber: tristeza, exocorte, sorose e xiloporose. Das quatro, a tristeza é a mais importante pelo fato de ser disseminada rapidamente na natureza por meio de eficientes insetos vetores. As outras três são geralmente transmitidas por união de tecido (enxertia).

_____. y COSTA, A. S. Tristeza control in Brazil by preimmunization with mild strains. In International Citrus Congress, Florida, 1977. Proceedings. Edited by W. Grierson. Orlando, Fla., International Society of Citriculture, 1979. v. 3, pp. 868-872. (211

Injury by citrus tristeza virus to Pera sweet orange, Galego lime and Ruby Red grapefruit could be prevented by preimmunization with 2 out of 45 originally selected mild strs. Scions of these citrus types preimmunized with either mild str. have grown satisfactorily on 3 tolerant rootstocks for 11 yr when exposed to infection with severe tristeza strs., whereas control plants declined severely. The protection has lasted for 3 or more successive propagations from the initially preimmunized trees and is considered to be lasting. The treatment is now being field tested for tristeza-tolerant citrus types, involving the use of virus-free nucellar clones and old clones freed from tristeza by thermotherapy. (Review of Plant Pathology 59:5147)

NAIDU, R. y GOVINDU, H. C. Tree vaccination a method for the control of lime decline. Farmer Parliament 13(9):19, 24. 1978. (212

* NAMEKATA, T. y ROSSETTI, V. Observações sôbre a tristeza dos citros. Biológico (Brasil) 35(11):289-291. 1969. (213

Em material recebido do km 24 da Rod. R. Tavares, existe probabilidade de conter a mesma estirpe de vírus da tristeza que há anos se verifica em Eldorado Paulista ou da que vem sendo estudada em Capão Bonito. (Biológico (Brasil) 36(12):345. 1970)

* NARIANI, T. K., SAHAMBI, H. S. y CHONA, B. L. Occurrence of tristeza virus in Citrus in Northern India. Indian Phytopathology 18(2):220-221. 1965. (214

Citrus tristeza virus was present in 2 *Citrus sinensis* vars, from the I.A.R.I. indexed on Kagzi lime. (Review of Applied Mycology 45:1064)

* _____.; RAYCHAUDHURI, S. P. y BHALLA, R. B. Citrus tristeza virus in Northern and Central India. Indian Phytopathology 19(4):397-399. 1966. (215

The virus widespread in these areas, has been found on sweet orange, mandarin, grapefruit, Eureka lemon, and sweet lime on rough lemon rootstocks. (Review of Applied Mycology 47: 522)

* _____. y RAYCHAUDHURI, S. P. Occurrence of tristeza and greening viruses in Bihar, West Bengal and Sikkim. Indian Phytopathology 21(3): 343-344. 1968. (216

During Feb.-Mar. 1967, citrus tristeza and greening viruses were observed on Kagzi lime, sweet orange and mandarin. Indexing of budwood showed that the viruses are widespread in these areas where insect vectors are considered to be responsible for their spread. (Review of Plant Pathology 50:935)

* _____.; RAYCHAUDHURI, S. P. y SHARMA, B. C. Citrus viruses in Assam and Orissa. Indian Phytopathology 23(1):141-145. 1970. (217

A report on the occurrence of tristeza and greening viruses and the results of indexing budwood collected from these States. (Review of Plant Pathology 49:3272)

_____. y RAYCHAUDHURI, S. P. Transmission of Citrus tristeza virus by Dodder, *Cuscuta reflexa* Roxb. Annals of Phytopathological Society of Japan 36(4):289-290. 1970. (218

Transmission from Kagzi lime to healthy lime seedlings by *C. reflexa* is reported. (Review of Plant Pathology 50:1790)

* _____. Kagzi lime; common indicator plant for tristeza and greening viruses. Citrograph 56(5):85. 1971. (219

NARIANI, T. K.; VISWANATH, S. M. y MENON, M. R. Occurrence of tristeza and greening diseases of Citrus in Kerala. Agricultural Research Journal of Kerala 8(2):123-124. 1970-71. (220

Citrus tristeza virus and citrus greening were reported for the first time in the State in 1970. (Review of Plant Pathology 51:2471)

* NAVARRO, L.; ROISTACHER, C. N. y MURASHIGE, T. Improvement of shoot-tip grafting *in vitro* for virus-free citrus. Journal of the American Society for Horticultural Science 100(5):471-479. 1975. (221

A 30 to 50% frequency of successful grafts was obtained by using 2-week-old dark grown seedlings as rootstocks and 0.14 to 0.18 mm long shoot tips as scions. The shoot tip was inserted into an inverted-T made at the top of the decapitated rootstock epicotyl. Most scion cultivars gave satisfactory grafts on "Troyer" citrange, whereas lemon, lime and citron yielded successful grafts only on 'Rough' lemon. The grafted plants were allowed to develop *in vitro* under 16 hr daily exposure to 1000 lux Grow Lux illumination and were provided with a nutrient solution containing a high concentration (7.5%) of sucrose. The best source of shoot tips was the flush from defoliated branches of field trees of glasshouse plants. It was also possible to use shoot tips from flushes arising in excised lateral buds cultured *in vitro*. Grafted plants were transplantable to soil 5 to 8 weeks after grafting with over 95% survival. Preliminary data indicated recovery of cultivars freed from tristeza and psorosis viruses. stubborn spiroplasma and exocortis viroid. Pathogen-free, plants showed no reversion to the juvenile phase.

NAVARRO, L. Citrus virus diseases in Spain in relation to plant production; present and future prospects. In International Citrus Congress, Florida, 1977. Proceedings. Orlando, Fla., International Society of Citriculture, 1979. v.3, pp. 136-140. (222

The problems caused by the outbreak of citrus tristeza virus in Spain and the subsequent discovery that most Spanish citrus cvs. were infected with many other viruses, thus forcing the change of rootstocks and cvs. is discussed and the research programme established to solve them is described. The programme includes all cvs. commercially grown in Spain and is directed to obtain virus-free old-line plants by various described techniques. (Review of Plant Pathology 58:5853)

* NEVES, M. Inquérito sobre *Toxoptera citricidus* (Kirkaldy) vector da grave doença dos citrinos denominada "tristeza". Agricultura (Portugal) no. 25:14-27. 1965. (223

El autor informa sobre:
- La peligrosidad de la "Tristeza" y su distribución geográfica
- La revelación hecha en el 5° Congreso de Citricultura Mediterránea realizado en Sicilia en 1959, sobre la

existencia de un ataque epidémico de Tristeza de la Provincia de Valencia en España y sus consecuencias. Las medidas tomadas para evitar la introducción de la "Tristeza" o su expansión en la zona del Mediterráneo.

- Las razones que llevaron a la Organización Europea y del Mediterráneo para la Protección de las Plantas-OEPP, a realizar un relevamiento en la zona de los áfidos de la región Mediterránea, especialmente en los países limítrofes al trópico y sub-trópico, así como en los países con estrecho contacto con los territorios tropicales de manera de determinar donde se encuentra implantado el vector eficaz de la Tristeza el *Toxoptera citricidus*.
- Detalla la realización del relevamiento realizado en Portugal en 1963.

| Regiões Agrícolas da Metrópole sobre as quais incidiu o inquérito | Períodos em que se efectuou a colheita das amostras | Amostras colhidas | Amostras identificadas | Amostras inutilizadas (1) | Número das amostras das espécies de áfidos identificados | | | | | | | Observações |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Toxoptera citricidus* | *Toxoptera aurantii* | *Aphis gossypii* | *Aphis fabae* | *Aphis craccivora* | *Macrosiphum euphorbiae* | *Myzus persicae* | |
| X Região — Santarém | 1/5/63 a 21/6/63 | 309 | 297 | 12 | — | 244 | 11 | 2 | — | 1 | 6 | |
| XIII Região — Setúbal | 20/5/63 a 12/7/63 | 839 | 837 | 2 | — | 780 | 51 | 1 | 1 | — | 1 | |
| XV Região — Tavira | 30/4/63 a 20/5/63 | 119 | 106 | 13 | - | 51 | 12 | 8 | 2 | — | - | |
| XVIII Região — Coimbra | 25/4/63 a 15/6/63 | 49 | 48 | 1 | — | 38 | 8 | — | 2 | — | - | |
| TOTAIS | | 1316 | 1288 | 28 | — | 1116 | 148 | 11 | 5 | 1 | 7 | |

(1) Correspondem às amostras de insectos que devido ao estado de conservação em que foram recebidas não puderam ser identificadas.
(2) Todos os exemplares observados se encontravam isolados e, não constituindo colónia

Tomado de la publicación

- Establece que para Portugal, por su pluricontinentalidad, la investigación sobre "Tristeza" trasciende la competencia de la OEPP y las medidas inmediatas a tomar para evitar la introducción de la "Tristeza" en el territorio metropolitano e impedir su expansión en los territorios de ultramar.

NORMAN, G. *et al.* Ten years of tristeza in Florida. Citrus Industry 42(12): 3. 1961. (224

En este trabajo los autores exponen los resultados de la observación del desarrollo de la tristeza en Florida durante los últimos diez años, deduciendo que la rapidez de propagación de la enfermedad y sus efectos no son tan graves como se temía al principio. Por ello consideran que la idea, tan difundida años atrás, de que resultaría necesario sustituir todos los pies de naranja amarga por otros de naranja dulce, únicos que resisten la enfermedad, no es acertada, ya que estiman que en conjunto, los daños que ocasiona la

tristeza en Florida hasta ahora no son lo bastante elevados para justificar esta medida que encierra en sí muchos inconvenientes. Sin embargo, no dejan de indicar que eventualmente la enfermedad puede hacerse más virulenta y los agricultores deben considerar esta eventualidad frente a las ventajas que presenta el uso de pies de naranja amarga.
Los autores describen dos métodos para diagnosticar la enfermedad: el primero consiste en separar un trozo rectangular de corteza de árbol precisamente en la línea de unión del injerto. Si en la cara de la madera del patrón, que queda al descubierto, existen pequeñas protuberancias o se forman astillas con sus correspondientes vacíos en la cara interior de la corteza separada, el árbol está infectado.
El segundo método consiste en injertar, sobre jóvenes limeros Key en semilleros, tejidos de los árboles que se sospecha están infectados; si el árbol está infectado, la enfermedad se transmite a los limeros jóvenes, poniéndose de manifiesto en poco tiempo, por la pérdida de hojas y la palidez de las venas de las mismas.
Señalan que el establecimiento de estos métodos ha permitido estudiar la propagación de la enfermedad y lo que es más importante, ha hecho posible establecer en Florida, un programa de selección de injertos que es sin duda el factor que más ha contribuido a reducir los grandes daños que se esperan al principio.
La enfermedad se propaga por medio natural mediante diversas especies de áfidos (pulgones) y artificialmente al injertar con esquejes de árboles que, estando aparentemente sanos, son en realidad portadores de virus.
La contribución de los áfidos a la propagación de la enfermedad se ha podido constatar al observar que los años de mayor población de los mismos, ha coincidido con aquellos en que se producía más infección. Parece ser que las especies de áfidos que se desarrollan en Florida no son tan eficaces para la propagación de la tristeza como otras especies, especialmente el *Toxoptera citricidus* (Kirk) que propaga la enfermedad tan rápidamente en otros países. Los autores opinan que esta es una de las causas que ha contribuido a que la propagación de la enfermedad en Florida no haya sido tan rápida como se temía.
Otro factor que ha reducido la virulencia de la tristeza en Florida ha sido el establecimiento del programa de selección de injertos (Budwood Registration Program). Se ha hecho una selección de árboles sanos que proporcionan injertos para las nuevas plantaciones con la seguridad de que no son portadores del virus. No obstante, estos árboles padres deben ser controlados repetidamente para garantizarse de su inmunidad, pues se ha observado que árboles calificados como sanos en una determinada época han aparecido infectados años más tarde.
Como se ha podido observar que muchos árboles infectados de tristeza resisten muy bien la enfermedad, pues no muestran síntomas externos y producen normalmente, se ha considerado que algunas de las razas de virus existentes en Florida son poco virulentas, lo que se toma como un factor más para explicar la reducción del daño previsto. Los autores indican que esta afirmación debe ser tomada con precaución, pues con frecuencia encuentran junto a árboles infectados, que producen normalmente, otros con síntomas claros de tristeza. Como

consideran que no es probable que árboles vecinos sean infectados cada uno por una raza distinta de virus, deducen que ciertos árboles vigorosos y productores son capaces de tolerar la tristeza. Por otro lado señalan que algunos pies de naranja amarga pudieran ser resistentes a la tristeza mientras otros no.
Otro factor a considerar es la posibilidad de que el vigor de la enfermedad esté fuertemente influenciado por el medio ambiente. Se ha comprobado que árboles que han sufrido los efectos de una sequía o, lo contrario, un exceso de agua, o reciben una nutrición deficiente, sucumben más rápidamente a los efectos del virus que los árboles en buen estado vegetativo. (Revista de Agroquímica y Tecnología de Alimentos 2(1):65-66. 1962)

* NORMAN, G. G. y FRITZ, N. L. Infrared photography as an indicator of disease and decline in Citrus trees. Proceedings of the Florida State Horticultural Society 78:59-63. 1965. (225

With 54,310,000 citrus trees in Florida, the problem of inspecting and surveying the groves for dangerous pests and diseases has become more and more difficult. In the past such inspections by the Division of Plant Industry have been based on visual inspection by trained men. In an attempt to find a faster and more accurate means of grove observation, a study of the effectiveness of infrared photography in locating diseased trees was begun in October 1964. It is the purpose of this paper to report an evaluation of the results to date.

* NORMAN, P. A.; SUTTON, R. A. y BURDITT, A. K. Factors affecting transmission of tristeza virus by melon aphids. Journal of Economic Entomology 61(1): 238-242. 1968. (226

A study of the transmission of tristeza virus by the melon aphid, *Aphis gossypii* Glover, revealed very small differences in transmission rate when infected source plants (orange seedlings) and Key lime indicator plants, *Citrus aurantifolia* (Christm.) Swingle, were held in an air-conditioned greenhouse or in an insectary, but the development of symptoms in the indicator plants was accentuated and speeded up in the insectary where temperatures ranged up to 15°C higher in the summer and 10°C lower in the winter than temperatures in the greenhouse. Young 2 to 6-inch Key lime plants were as good virus indicators as older 8 to 12-inch plants. The efficiency of the melon aphid as a vector of tristeza varied from 1 population to another. Numbers of transmissions were higher with 200 aphids per plant than with 10 to 50 aphids per plant, but the rate of transmission was not proportional to the number of aphids per plant. Mixed populations of nymphs and adult aphids transmitted tristeza virus as well as populations of adult aphids. Starvation of aphids for 2 and 4 hours before feeding did not increase the transmission of tristeza virus. Transmission of the virus to indicator plants by aphids feeding on thorns and on mature or immature leaves of infected plants was not significantly different, and transmission of the virus by aphids reared on cotton, *Gossypium hirsutum* L.,

was not significantly different from transmission by aphids reared on kenaf, *Hibiscus cannabinus* L.

NORMAN, P. A. y SUTTON, R. A. Efficiency of mature and immature melon aphids in transmitting tristeza virus. Journal of Economic Entomology 62(5):1237-1238. 1969. (227

* _____. y SUTTON, R. A. Efficiency of three colonies of Melon aphids as transmitters of tristeza virus. Journal of Economic Entomology 62(4): 968. 1969. (228

*Aphis gossypii* from 3 colonies transmitted the severe T3 str. of citrus tristeza virus in the orange vars. Temple and Hamlin, the indicators being seedlings of Key lime. Rates of transmission by each colony were similar. (Review of Plant Pathology 49:2481)

_____.; SUTTON, R. A. y SELHIME, A. G. Further evidence that tristeza virus is transmitted semipersistently by the melon aphid. Journal of Economic Entomology 65(2):593-594. 1972. (229

After 24 h feeding on infected orange seedlings *Aphis gossypii* transmitted the virus to Key lime test plants and, on further transfer after 24 h, to secondary indicators though transmissibility was greatly reduced. (Review of Plant Pathology 52:120)

_____.; SUTTON, R. A. y BURDITT, A. K. Spread of tristeza virus from inoculated trees by aphids in field in Florida. Citrus Industry 52(9): 4-6. 1972. (230

* NOUR-ELDIN, F. y BISHAY, F. Presencia del virus de la tristeza en Egipto. Boletín Fitosanitario. FAO 6(10):158-159. 1958. (231

También en Inglés: FAO. Plant Protection Bulletin
" " Francés: Bulletin Phytosanitaire de la FAO

Los autores como parte de un programa de reconocimiento de virosis y enfermedades virotiformes de los cítricos en Egipto, realizaron injertos experimentales de porciones de árboles sospechosos de estar afectados por la tristeza sobre plantitas de limonero mexicano.
Al examinar las plantitas de ensayo, se observó que las injertadas con puas de los árboles sospechosos, presentaban los síntomas característicos de la "tristeza".
La conclusión de que el virus de "Tristeza" no se propaga en las plantaciones comerciales se basa en los resultados de los reconocimientos de campo y pruebas experimentales de centenares de árboles sospechosos de albergar el virus de la "Tristeza".
En Egipto está presente el *Aphis gossypii* que transmite el virus, pero en forma menos violenta que el *Toxoptera citricidus* que no existe en el país.

NOUR-ELDIN, F. y EL-BANNA, M. T. Distribution and movement of psorosis and tristeza viruses in Citrus plants. Agricultural Research Review 45(1): 107-109. 1967. (232

Psorosis virus moved into the xylem of sweet orange plants and then downward across the ring through the exposed woody cylinder; it was not detected above the ring. There was no evidence of tristeza virus entering the xylem of sweet orange plants. Ringing a branch resulted in the accumulation of carbohydrates above the ring, either in the bark or in the woody cylinder. (Review of Applied Mycology 48:467)

_____. y FUDL-ALLAH, A. E.-S.A. Citrus virus and virus-like diseases in Libya. Lybian Journal of Agriculture 5:101-110. 1976. (233

The 9 diseases revealed in an extensive 6 yr survey included citrus psorosis, tristeza and exocortis viruses and citrus stubborn disease. (Review of Plant Pathology 56:5056)

NOUVELLES PHYTOSANITAIRES en Afrique. Bulletin d'Informations Phytosanitaires, Interafricain no. 1:13-18. 1975? (234

In the Central African Republic extensive damage by citrus tristeza virus is reported on citrus. (Review of Plant Pathology 54:3926)

* OLIVEIRA, A. R. Serologia com o vírus da tristeza dos citrus. Ciência e Cultura (Brasil) 16(2):149. 1964. (235

Paralelamente ao trabalho de purificação parcial do vírus da tristeza dos citrus, foram feitas tentativas para obtenção de um antisoro ativo que permitisse a identificação rápida do vírus.
Vírus parcialmente purificado foi injetado em coelhos via intravenosa e intramuscular com adjuvante Freund incompleto. Com os antisoros obtidos, foram feitos vários testes que indicaram ter o vírus da tristeza induzido a formação de anticorpos.
Os precipitados obtidos nas reações em tubo e preparações contendo vírus e sôro normal foram examinadas ao microscópio electrônico. Tais exames revelaram que as partículas nos precipitados específicos apresentavam um aumento em diâmetro da ordem de 15 mμ, fato que não se deu com as partículas de preparações contendo sôro normal como controle. O aspecto das partículas de vírus da tristeza cobertas com prováveis anticorpos assemelhava-se ao que se tem observado, ao microscópio electrônico, com precipitados serológicos de outros vírus de planta.
Embora ainda os testes serológicos estejam sendo feitos com o vírus da tristeza parcialmente purificado, já há indicações de que possivelmente se possa fazer testes com suco de fôlhas submetido apenas a uma baixa centrifugação.

* _____. Considerações sobre anti-sôros obtidos pela técnica de injeção de antígeno no linfonódulo. Summa Phytopathologica (Brasil) 1(1):61-64. 1975. (236

Citrus tristeza virus and eggplant mosaic virus were injected

into lymphonodules of rabbits and the results were compared with those of other methods. (Review of Plant Pathology 54: 3786)

OMORI, H.; ISHII, T. y MATSUMOTO, H. The relation of severity of stem pitting to fruit size of tristeza-infected Kawano-natsukan (*Citrus natsudaidai* Hayata) in Ehime Prefecture. Bulletin of Ehime Fruit Tree Experiment Station no. 7:45-49. 1979. (237

_____., MATSUMOTO, H. e ISHII, T. Thermotherapy for inactivation of citrus tristeza virus on Washington navel orange (*Citrus sinensis* Osbeck var. hrasilensis Tanaka). Bulletin of Ehime Fruit Tree Experiment Station no. 7:39-44. 1979. (238

ÖZALP, M. O. y AZERI, T. Ege bölgesi turunçgil virüs hastaliklari sürveyi. Bitki Koruma Bülteni 7(4):167-187. 1967. (239

Of a large sample of trees examined at least 60% were infected by virus diseases. These were psorosis (35%), xyloporosis (23%), lemon sieve tube necrosis (18%); exocortis (10%); stubborn, little leaf (3%) and impietratura (1%). In addition to these diseases tristeza was encountered for the first time; its main vector, *Aphis citricidus*, was not found, and of other sucking insects occurring in the region only *Toxoptera aurantii* could occasionally transmit the virus. (Horticultural Abstracts 39:3575)

_____. y HEPER, E. Research on breeding virus-free satsuma (Rize) in the Aegean area. Bitki Koruma Bülteni 14(2):83-106. 1974. (240

Exocortis, psorosis, xyloporosis, tristeza and vein enation viruses were recorded in the area. Using satsuma x *Poncirus trifoliata* or clementine x satsuma 147 virus-free parent trees were obtained. The yield and quality of the crop from these have still to be tested. Satsuma trees are generally grown on P. *trifoliata* stocks, highly susceptible to citrus exocortis virus, which is the main problem in this region. (Review of Plant Pathology 54:2814)

PAMKER, B. L. y GURCHAN SINGH. The distribution, feeding habitats and fecundity of four coccinellidae *Toxoptera citricidae*. Malaysian Agricultural Research 2(1):29-33. 1973. (241

* PAPASOLOMENTOS, A. y ECONOMIDES, C. V. La presencia del virus de la tristeza en algunas especies de agrios en Chipre. Boletín Fitosanitario de la FAO 16(1):8-9. 1968. (242

También en Inglés: FAO. Plant Protection Bulletin
" " Francés: Bulletin Phytosanitaire de la FAO

Mediante un amplio programa de pruebas de índices ideado para detectar transportadores del virus de la tristeza en Chipre, se ha encontrado que cuatro especies de agrios estaban infectadas. Estos resultados sugieren que el virus de la tristeza

ha existido en Chipre por lo menos desde 1929, y probablemente desde antes. A pesar de la gran diseminación de árboles infectados en las diversas zonas productoras de agrios del país, parece que ha habido muy poca propagación natural de la enfermedad. Esto sugiere que las cepas locales de *Aphis gossypii* (Glover) y *Toxoptera aurantii* (Fonsc.) son vectores poco eficientes de las cepas del virus de la tristeza existentes en Chipre.

* PAZ ABOGAVIR, R. Tristeza. In _____. Guía práctica para el cultivo de los cítricos. Tegucigalpa, D.C., Secretaría de Recursos Naturales, 1975. p. 24. (243

Descripción y método de control de la tristeza de los cítricos.

PEREGRINE, W. T. H. ed. Annual report of the plant pathologist, 1969. Brunei, Department of Agriculture, 1970. 15 p. (244

*Oidium nephelii* is reported on Citrus tristeza virus, although common in Sabah, was not found in Brunei, and there was no evidence of *Mycosphaerella fijiensis* on banana. (Review of Plant Pathology 50:2635)

_____. ed. Annual report of the plant pathologist, 1973. Brunei, Department of Agriculture, 1974. 16 p. (245

The more common crop diseases are reviewed, *Rhynchosporium oryzae* on rice caused serious damage on acid peats. The fungus, formerly confused with *Leptosphaeria oryzina*, although widespread in Brunei, is unrecorded in most countries in the region. *Puccinia arachidis* was again found on groundnut in experimental plots and its effect on yield appears to be linked with planting time. Eradication is proving to be difficult. Bananas were severely defoliated by *Mycosphaerella musicola* but M. *fijiensis* on the same crop has not yet been found. Blister rust (*Albugo ipomoeae-panduratae*) continued to render unsaleable substantial quantities of *Ipomoea aquatica*. A 2nd fungicide trial against *Colletotrichum lagenarium* on watermelon showed promising increases in yield. A host list of newly recorded pathogens includes citrus tristeza virus on *Citrus microcarpa* and *Alternaria padwickii* on rice. (Review of Plant Pathology 53:2395)

PRATT, R. M.; CALAVAN, E. C. y HILL, J. P. The tristeza suppression and eradication program in California. In Conference of the International Organization of Citrus Virologists, 5°, Japan, 1969. Proceedings. Edited by W.C. Price. Gainesville, University of Florida, 1972. pp. 158-161. (246

PRICE, W. C. Flexuous rods in phloem cells of Lime plants infected with Citrus tristeza virus. Virology 29(2):285-294. 1966. (247

Such rods, shown by electron microscopy in sections of lime leaves, appeared to be identical with rods detected by the leaf dip technique. They were absent from the parenchyma and

phloem of healthy leaves. Crystalline inclusions of elements in a hexagonal packing were found in both healthy and infected leaves. (Review of Applied Mycology 48:1178)

* PRICE, W. C. Evidence for restriction of a plant virus to phloem cells. Indian Phytopathology 21(2):159-166. 1968. (248

The thread-like particles of tristeza have been detected in leaf-dip preparations and in partially purified preparations of calamondin seedlings that were infected with the T3 strain of the virus. In ultrathin sections of infected calamondin leaves, the same sort of particles were found only in vascular tissues; indeed in only a few phloem elements of each bundle. They were not found in cells of the epidermis, the palisade parenchyma, or the spongy parenchyma. The microscopical evidence that tristeza virus is localized in phloem tissues, together with the work on aphid transmission reported in the literature, suggests that tristeza virus is a circulative non-propagative virus.

_____. Translocation of tristeza and psorosis viruses. In Conference of the International Organization of Citrus Virologists, 4°, Rome, 1966. Proceedings. Edited by J. F. Childs. Gainesville, University of Florida, 1968. pp. 52-58. (249

Experiments were conducted using West Indian lime as a host plant for tristeza virus and Pineapple sweet orange as a host for psorosis virus. The main channel of translocation of both viruses was the phloem. After the virus reached the phloem translocation both up and down was relatively rapid. There seems to be little relationship between the speed at which the virus is translocated and the time required for it to kill a citrus tree. (Horticultural Abstracts 40:2175)

_____. Citrus tristeza. In Gibbs, A. J.; Harrison, B. D. y Murant, A. F., eds. C.M.I./A.A.B. descriptions of plant viruses. Kew, CMI, AAB, 1970. (250

The 2nd set contains descriptions of carnation ringspot by M. Hollings & Olwen M. Stone, red clover vein mosaic by A. Varma, cocksfoot mottle by P. L. Catherall, cauliflower mosaic and pea enation mosaic by R. J. Shepherd, lettuce necrotic yellows by R. I. B. Francki & J. W. Randles, *Cymbidium* mosaic by Francki, grapevine fanleaf by W. B. Hewitt et al., broad bean stain by Gibbs & Helen G. Smith, apple chlorotic leafspot and apple stem grooving by R. M. Lister, barley yellow dwarf by W. F. Rochow, citrus tristeza by W. C. Price, wound tumour and potato yellow dwarf by L. M. Black, potato leaf roll by D. Peters, potato Y by S. Delgado-Sanchez & R. G. Grogan, tomato black ring by Murant, tomato spotted wilt by T. S. Ie and bean yellow mosaic by L. Bos. (Review of Plant Pathology 50:1127)

_____. Report to the government of the Philippines on the cadang-cadang disease of coconut and citrus virus diseases. United Nations Development Programme, FAO no. TA 3037, 1971. 30 p. (251

Coconut cadang-cadang disease has been known for at least 40

yr and has been the subject of 20 yr research. It is concluded that it is not due to nutritional deficiency, soil toxicity or air pollution, but attempts to transmit it with numerous insect spp. have failed. The disease continues to spread, but at a decreasing rate; in one area there was a recorded linear increase of 2%/yr over 9 yr, possibly related to the age of the palms. No relationship has been found between specific weeds and disease incidence. Land on which coconut crop has been destroyed by the disease can be replanted to coconuts and will crop well until the trees become diseased in 20-25 yr.
The major virus disease of citrus, known locally as leaf mottle yellows or leaf mottling, would appear to be the same as the citrus greening disease of S. Africa. Its distribution in the area is noted. Citrus tristeza virus is also present and local studies on it are briefly described.
(Review of Plant Pathology 52:3607)

* PRIMO, E. *et al.* Diagnóstico precoz de la tristeza del naranjo. I. Separación y reacciones serológicas de partículas nucleoproteicas. Revista de Agroquímica y Tecnología de Alimentos 11(2):229-235. 1971. (252

A partir de hojas y corteza de naranjas Washington Navel y Valencia Late afectados de tristeza, y de Lima Mejicana inoculada con yemas de árboles enfermos, se obtienen partículas de naturaleza nucleoproteica, parcialmente purificadas por precipitación con polietilenglicol y centrifugación diferencial. La presencia de las mencionadas partículas se ha puesto de manifiesto por microscopía electrónica.
Se preparan antisueros y se estudian las reacciones serológicas de los mismos con las antedichas partículas nucleoproteicas. Las técnicas utilizadas son: la microprecipitación, la doble difusión en agar y la electroforesis cruzada ("crossing over"). La reacción de precipitación entre partículas nucleoproteicas y antisuero es visible a la dilución 1/1024 del antisuero.

EL PULGON es la causa de la enfermedad "tristeza" de los cítricos. Mejores Cosechas con Shell (Venezuela) 5(55):2. 1957. (253

RACCAH, B.; BAR-JOSEPH, M. y LOEBENSTEIN, G. Attempts to transmit citrus tristeza by aphids prevalent on citrus trees in Israel. Hassadeh 55(8): 1275-1278. 1975. (254

* _____.; LOEBENSTEIN, G. y BAR-JOSEPH, M. Transmission of citrus tristeza virus by the melon aphid. Phytopathology 66(9):1102-1104. 1976. (255

The VT isolate of citrus tristeza virus was transmitted efficiently by ten aphids (36%); and even with five aphids per test plant substantial transmissions (11%) were obtained. No transmission was obtained from acquisition or infection feeding periods of 5 minutes, and about 6 hours for each period was required to obtain near-maximal transmissions. Melon aphids retained inoculativity after 3.5 hours of pos-

acquisition fasting and when feedling for 2 or 6 hours on an intermediate cucumber plant or lime seedling, respectively. These features are characteristic of a semipersistent mode of transmission.

RACCAH, B. *et al.* Transmission of tristeza by aphids prevalent on citrus and operation of the tristeza suppression programms in Israel. In Conference of the International Organization of Citrus Virologists, 7°, Athens, 1975. Proceedings. Edited by E. C. Calavan. Riverside, University of California, 1976. pp. 47-49. (256

_____.; BAR-JOSEPH, M. y LOEBENSTEIN, G. The role of aphid vectors and variation in virus isolates in the epidemiology of tristeza disease. In Scott, P. R. y Bainbridge, A. eds. Plant disease epidemiology. Oxford, UK. Blackwell Scientific Publications, 1978. pp. 221-227. (257

Following a review of the incidence and spread of citrus tristeza virus, and the role of different aphid spp. in transmission of the disease, experiments are described indicating the variability among tristeza isolates in their transmission by 5 common aphid spp. in Israel. (Review of Plant Pathology 58:1558)

_____.; NEUBAUER, I. y SINGER, S. Transmission of tristeza isolates. Hassadeh 58(6):1203-1204. 1978. (258

* _____.; LOEBENSTEIN, G. y SINGER, S. Aphid-transmissibility variants of citrus tristeza virus in infected citrus trees. Phytopathology 70(2):89-93. 1980. (259

Each of four orange trees infected with citrus tristeza virus (CTV), contained several variants of the virus that differed in aphid transmissibility. In order to ascertain the presence of these variants, small pieces of budwood of two trees, from which an overall low rate of transmission (7.5%) had been obtained, were grafted on 2-yr-old orange plants. When those plants were used in aphid-transmission experiments, highly (above 30%); intermediate (5-20%), and poorly (less than 5%) aphid-transmissibility variants were obtained. One of these trees came from an orchard in which no natural spread had been observed for two decades, although recently natural spreading had become apparent, and the second tree was grafted with budwood originating from this orchard. Using the same procedure with two trees from a region where natural transmission was evident during the last decade and overall transmission rates reached 25%, poorly transmissible variants also were obtained. Aphids apparently transmit simultaneously more than one isolate, as a spectrum of variants was observed from aphid-inoculated seedlings. It is suggested that tristeza-infected trees may harbor more than one variant; and that trees from a location where only limited natural spread is observed could contain CTV variants that are highly transmissible, but which are quantitatively suppressed by a dominating poorly transmissible variant.

RAJ, S. A. Grow your Sathgudi and acid lime on tristeza tolerant citrus root stocks. Farm Fact 8(1):42-44. 1973. (260

_____.; SUBBARAJA, K. T. y DURAIRAJ, P. Occurrence of citrus tristeza in Tamil Nadu. Madras Agricultural Journal 60(7):627. 1973. (261

Lime trees in 3 areas were found on indexing to be infected with citrus tristeza virus. (Review of Plant Pathology 54: 2241)

_____.; SUBBARAJA, K. T. y DURAIRAJ, P. Role of root-stock on acid lime (*Citrus aurantifolia*) swingle decline. AIJARA 4/5:203-206. 1972/1973. (262

_____. *et al.* Effect of different rootstocks on the tristeza incidence, growth and yield in Sathgudi. South Indian Horticulture 23(1/2):33-38. 1975. (263

* REBOUR, H. Tristeza o degeneración infecciosa de los cítricos. In _____. Los agrios. Manual práctico de citricultura. 2 ed. rev. y ampl. Madrid, Mundi-Prensa, 1969. pp. 259-261. (264

Este manual dedicado a los agricultores, trata en el Capítulo sobre Técnica de producción de cítricos, el tema de las enfermedades producidas por virus y una de las que analiza es la Tristeza. Indica:
- La sintomatología como un agotamiento brusco y generalizado del árbol, la muerte sobreviene en algunos años, sólo hay síntomas foliares sobre la lima de México.
- La forma de transmisión por injertos y por áfidos.

Da procedimientos de lucha
- sobreinjertar
- injertar sobre patrones tolerantes

REFATTI, E. Aspetti fitopatologici connessi con il piano agrumi CEE e progetto speciale n. 11 della cassa per il Mezzogiorno. Tecnica Agricola 27 (3):1-30. 1975. (265

In Sicily the virus or virus-like diseases of citrus fruits are psorosis A and concave gum, blind pocket and crinkly leaf psorosis viruses, citrus infectious variegation, cristacortis, ringspot, impietratura, cachexia-xyloporosis, stubborn, tristeza and exocortis. Problems connected with regrafting and replanting are reviewed. (Review of Plant Pathology 55:4110)

* REICHERT, I. y BENTAL, A. Nuevas variedades cítricas infectadas de tristeza descubiertas en Israel. Boletín Fitosanitario de la FAO 5(8):133-134. 1957. (266

También en Inglés: FAO. Plant Protection Bulletin
" " Francés: Bulletin Phytosanitaire de la FAO

Los autores indican que ocho variedades cítricas, además del limonero Meyer son portadoras del virus de tristeza en Israel

en 1956.

| Variedad | Origen y año de introducción | Patrón | Síntomas sobre el limero agrio egipcio | |
|---|---|---|---|---|
| | | | Aclaramiento de las nerviaciones | Cacarañas de la madera |
| **Mandarino** | | | | |
| Ellendale | Australia 1933 | Cleopatra | + | + |
| Beauty of Glen-Retreat | Australia 1935 | Limonero rugoso | + | + |
| Cape Naartje Platskill | Africa del Sur 1935 | Limonero rugoso | + | — |
| Emperor | Australia 1935 | Limonero rugoso | + | + |
| Oneco | Florida 1937 | Naranjo agrio | + | — |
| Fewtrell's Early | Australia 1933 | Limonero rugoso | + | — |
| **Naranjo dulce** | | | | |
| Paperrind St. Michael | Africa del Sur 1935 | Naranjo agrio | + | — |
| **Pomelo** | | | | |
| Whenecy | Australia 1937 | Naranjo agrio | + | — |

El hecho de que el virus no se haya propagado se debe a que en esta región no existe un insecto vector eficaz.

* RETUERMA, M. L. y PRICE, W. C. Evidencia de que el virus tristeza es transmitido por estilete. Boletín Fitosanitario de la FAO 20(5):111-114. 1972. (267

También en Inglés: FAO. Plant Protection Bulletin
" " Francés: Bulletin Phytosanitaire de la FAO

El virus tristeza de los agrios puede ser adquirido por colonias del áfido tropical de los agrios (*Toxoptera citricidus* Kirkaldy) en un período de adquisición de tan sólo cuatro a cinco segundos y puede transmitirle a plántulas de lima de Indias occidentales, *Citrus aurantifolia* (Christm.) Swing., en un período de inoculación de cinco segundos. El tiempo total transcurrido entre el probado sobre una planta originaria y el final del período de inoculación fue de únicamente 1 1/2 minutos. Se ha demostrado, por tanto, que el virus tristeza es transportado por estilete. El período máximo que el virus fue retenido por el áfido durante el tiempo de alimentación fue de seis horas. Ninfas de *T. citricidus* fueron capaces de adquirir y transmitir virus tristeza, pero con menos eficiencia que los adultos.

REYES, F. J. Susceptibilidad de algunos patrones tolerantes a tristeza y otras enfermedades virosas y virus transmitidos por semillas en cítricas. Cagua, Venezuela, FUSAGRI, 1978. 5 p. (268

* RIOS CASTAÑO, D. y GIACOMETTI, D. C. La tristeza de los cítricos en Colombia. Agricultura Tropical (Colombia) 21(3):161-169. 1965. (269

Mediante el injerto de una sección de hoja de árboles sospechosos en plántulas de limón Mexicano en condiciones de

umbráculo en Palmira, e injerto de yema en condiciones de vivero en "Tulio Ospina", se lograron los síntomas típicos de tristeza presentes en los clones de las variedades de limón Meyer, citrange Rustic y naranjas Washington Navel, Mediterranean Sweet, Macaé, Wialua e Indian River. En condiciones de campo no se han observado síntomas de la enfermedad, especialmente el "stem-pitting" en la copa de limón Mexicano, naranja dulce y toronja.
Los trabajos de investigación llevaron a la conclusión de que el virus no está generalizado aunque posiblemente existe desde 1933 con la introducción del limón Meyer de California.
Se destaca la importancia que tiene la enfermedad de la tristeza en el desarrollo de los programas citrícolas recalcando que el "stem-pitting" es una nueva amenaza a pesar de que es posible que el vector *T. citricidus* no exista en el país.
Finalmente, se hace hincapié en abandonar el uso del naranjo Agrio como patrón utilizando en cambio el limón Rugoso, la mandarina Cleopatra y la naranja Dulce Común, e injertando sólo yemas de árboles madres sanos.

* RIVERO, J. M. DEL. Los estados de carencia en los agrios. 2a. ed. rev. y ampl. Madrid, Mundi-Prensa, 1968. 510 p. (270

Incluye Tristeza

RODRIGUEZ, O. Combate à tristeza e ao cancro citrico. Sitios e Fazendas (Brasil) 33(12):82. 1967. (271

_____. Apos a tristeza, a abundancia. In _____. Guia da produção rural, 1970. São Paulo, Coopercotia, 1970. pp. 116-124. (272

_____. A tristeza dos citros não tem fim. Ciência Agropecuaria (Brasil) 11(189):6. 1971. (273

* RODRIGUEZ PUJOL, A. Informe sobre el estado actual del problema de declinamiento de citrus en la zona de Misiones. IDIA (Argentina) no. 257:1-6. 1969. (274

El autor informa sobre la gira de inspección realizada del 4 al 11 de setiembre en la zona de Puerto Rico, Monte Carlo y Eldorado. En la gira se tuvo en cuenta en forma especial la reacción de las diversas especies, variedades y combinaciones de injerto-portainjerto. Además del comportamiento y evolución de la enfermedad. Hace un resumen de las observaciones y presenta las conclusiones que de ellas se derivan. Establece que deberán realizarse plantaciones piloto de diversas variedades y portainjertos que permitan en el futuro, obtener conclusiones acerca de su comportamiento, ya que las recomendaciones que ahora establece están basadas en el comportamiento actual de variedades y combinaciones poco comunes en la zona.

* ROISTACHER, C. N. *et al.* Incidence of viruses in Citrus budwood introduced into the USA from foreign countries. Phytopathology 57(2):101. 1967. (275

Between 1954 and 1966, 138 citrus introductions from 26 countries were indexed for virus content in the quarantine facilities at Riverside, Calif. The indexing program provided a means of testing for a number of citrus viruses on prescribed indicator plants. When a given introduction was found to be infected with a virus, it was usually eliminated without further testing. All 138 introductions were tested for tristeza, psorosis, vein enation, and yellow vein viruses. Of these, 106 were tested additionally for seedling yellows, satsuma dwarf, concave gum, and tatter leaf viruses, and 77 of the 106 were indexed for exocortis virus. Thirty-seven introductions were indexed over the necessary 3 or more years for xyloporosis (cachexia) virus. Seventy % of the foreign budwood selections were found to be virus infected. Many of the selections contained more than one virus, particularly those from Sicily and Spain, all of which were doubly infected with exocortis and concave gum viruses. The viruses found and the number of times each was encountered were as follows: exocortis, 45; tristeza, 27; psorosis, 18; concave gum, 18; seedling yellows, 5; xyloporosis, 2; and vein enation, 1. These studies illustrate the high incidence of virus infection in old-clone citrus throughout the world.

* ROISTACHER, C. N. y CALAVAN, E. C. Inactivation of five citrus viruses in plants held at warm glasshouse temperatures. Plant Disease Reporter 58(9): 850-853. 1974. (276

Warm temperatures (28 to 40°C daytime maximum and 25.6°C nighttime minimun) in a glasshouse for 3 to 4 months inactivated psorosis, concave gum, infectious variegation and vein enation viruses from newly developed citrus shoots. Tristeza virus was more difficult to eliminate, but a supplemental treatment in hot-moist air at 50°C for 3 to 7 hours eliminated seedling yellows-tristeza virus from sweet orange budwood.

* _____. *et al.* Suppression of tristeza virus symptoms in Mexican lime seedlings grown at warm temperatures. Plant Disease Reporter 58(8):757-760. 1974. (277

Tristeza virus symptoms in Mexican lime seedlings grown under warm conditions (82 to 104°F daytime and 78 to 80°F nighttime temperatures) were totally suppressed for six isolates. One isolate of seedling yellows-tristeza virus induced good leaf vein clearing symptoms under warm conditions but the incidence of stem pitting was greatly reduced. The absence of symptoms in plants grown under warm conditions in the tests was shown to be a masking effect, because the virus was readily transmitted from all symptomless plants.

* _____. Tristeza in the central valley; a warning. Citrograph 62(1):15-23. 1976. (278

Tristeza, second only to Asian greening disease, is the most destructive of all virus or virus-like diseases of citrus.

Tristeza is present in much of southern California with the exception of the Coachella Valley and is also present in a limited degree in many areas of central California and apparently is spreading. The objective of this article is to issue a warning; that it can happen here; that unless increased surveillance is exercised now, we face the real possibility of losing the war against tristeza in the central valley.
Any successful program for tristeza eradication must have the backing of the growers, scientists and legislators with full awareness by all concerned of the seriousness of the problem. Presented here will be a worldwide history of tristeza, some recent developments, vector relationships and our current California situation.

* ROISTACHER, C. N. y KITTO, S. L. Elimination of additional citrus viruses by shoot-tip grafting in vitro. Plant Disease Reporter 61(7):594-596. 1977. (279

The viruses of Dweet mottle, psorosis-A (isolate P-209) psorosis-B, vein enation and seedling yellows-tristeza (isolates SY-550, 553, and 554) were eliminated from various citrus cultivars by the technique of shoot-tip grafting *in vitro*. The tatter leaf virus in Meyer lemon was not eliminated in this or in a previous experiment. Both the seedling yellows-tristeza virus and citrus exocortis viroid present in Meyer lemon were readily eliminated, however. Seedlings of Arizona 861 citron were found to be an effective receptor rootstock for all of the shoot-tip scions tested.

_____. Elimination of citrus pathogens in propagative budwood. I. Budwood selection, indexing and thermotherapy. In International Citrus Congress, Florida, 1977. Proceedings. Edited by W. Grierson. Orlando, Fla., International Society of Citriculture, 1979. v.3, pp. 965-972. (280

Methods and concepts for bypassing pathogens by budwood selection and indexing, and by heat treatment of old clone-infected budwood are presented. The advantages and disadvantages of growing nucellar budlines to obtain virus-free selections are discussed. Various methods for eradication of citrus viruses by thermotherapy include preconditioning, use of moist hot air, hot water, specialized heat-treatment chambers and small heat-treating plant enclosures. Thermotherapy has successfully eliminated the greening organism and the viruses of concave grum, impietratura, infectious variegation, psorosis-A, tatter leaf, tristeza, seedling yellows-tristeza and vein enation from citrus budwood. (Review of Plant Pathology 59:5174)

_____. *et al.* Spread of seedling yellows tristeza at research centre. Citrograph 64(7):167-169. 1979. (281

Indexing tests on the citrus collection at Riverside revealed the virulent seedling yellows str. of citrus tristeza virus in the progeny of some old selections imported into Calif. in 1910-1930. Evidence of natural spread of this str. was obtained. Results indicate that *Aphis gossypii* is a highly efficient vector. (Review of Plant Pathology 58:5364)

ROSSETTI, V.; NAKADAIRA, J. T. y CALZA, R. Observações sôbre as doenças e pragas dos citros no litoral da Argentina e Uruguai. Biológico (Brasil) 31(10):203-215. 1965. (282

Including notes on: varietal susceptibility to tristeza, psorosis, xyloporosis, exocortis, leprosis (caused or transmitted by *Brevipalpus obovatus*), cancrosis B, and gummosis (caused by *Phytophthora* spp.); brief notes on a disease of unknown origin in *Poncirus trifoliata*, bud union ring, bark necrosis in lemons, trunk flattening in *P. trifoliata*, leaf and fruit spotting caused by *Cercospora aurantii*, and a few uncommon diseases under observation; and notes on the control of *Lecanium deltae*, *Aonidiella aurantii*, aphids, mites (*Brevipalpus obovatus*, *Anychus verganii* = *Eutetranychus vansii* and *Phyllocoptruta oleivora*) and rodents. (Horticultural Abstracts 36:5405)

RUSSO, F. I portinnesti degli agrumi. Frutticoltura 38(12):3-8. 1976. (283

Since the widely used rootstock *Citrus aurantium* is susceptible to tristeza, a substitute is needed. The relationship of various other rootstocks to fruit quality, soil and climatic conditions and plant vigour are discussed, and rootstock research since 1952 is reviewed. (Horticultural Abstracts 47:9837)

SALIBE, A. A. Reação de algumas laranjas doces ao virus da tristeza. Ciência e Cultura (Brasil) 19(2):301-302. 1967. (284

_____. Reacão de alguns porta-enxertos de citros ao vírus da tristeza. Ciência e Cultura (Brasil) 19(2):300-301. 1967. (285

_____. O vírus da tristeza da laranja-pera. Sitios e Fazendas (Brasil) no. especial:70-71. 1968. (286

_____. y CORTEZ, R. E. Efeito do vírus da tristeza no desenvolvimiento de plantas cítricas. In Reunião Anual da SBPC, 22°, Salvador, 1970. Resumos. São Paulo, Sociedade Brasileira para o Progresso da Ciência, 1970. pp. 208-209. (287

_____. Incidência de tristeza em limoeiro cravo, *Citrus limonia*, Osbeck. In Jornada Científica da Faculdade de Ciencias Médicas e Biologicas, Botucatu, 1971. Anais. Botucatu, Associação dos Docentes da Faculdade de Ciencias Médicas e Biológicas, 1971. v.1, pp. 102-103. (288

_____. Persistencia do vírus da tristeza em plantas de diferentes especies de citros. Ciência e Cultura (Brasil) supl. 23:215. 1971. (289

Sólo resumen

* SALIBE, A. A. y MISCHAN, M. M. Efeito da variedade, do portaenxerto e da localicade na incidência de stem pitting de tristeza em laranjeiras doces. Fitopatologia 11(1):30. 1976. (290

Estudou-se a incidência de caneluras em ramos jovens de laranjeiras doces de 5 variedades, clones nucelares, livres de vírus exceto uma raça severa de tristeza. As plantas faziam parte de dez ensaios instalados em Botucatú e cinco dos ensaios achavam-se numa área elevada (780m) e os demais em lugar baixo (480m), distantes 2000m em linha reta. Cada ensaio compose-se uma variedade copa enxertada sobre 5 cavalos. De cada planta, em todos os 10 ensaios foram coletados 10 ramos novos, no mesmo período vegetativo, os quais foram descascados, atribuindo-se notas de acordo com a incidência de caneluras, de 1 a 5. Os dados obtidos mostraram um efeito significativo das variedades, do porta enxerto e também da localidade na incidência das caneluras. Variedades copa: Westin (3,8), Baianinha (3,2), Itaboraí (3,1), Rubí (2,4), Hamlin (1,6). Porta-enxertos: Trifoliata (3,7), limão cravo (2,8); limão rugoso da Flórida (2,8), laranja caipira (2,6) e tangerina Sunki (2,3). O efeito da localidade foi menos marcante, mas significativa para as copas de laranjeiras Hamlin, Baianinha e Westin. Elas mostraram-se mais afetadas pela tristeza em localidade mais baixa de clima ameno.

_____. y MISCHAN, M. M. Rootstock effect on tristeza stem-pitting expresion in sweet orange trees. In Conference of the International Organization of Citrus Virologists, 7º, Athens, 1975. Proceedings. Edited by E.C. Calavan. Riverside, University of California, 1976. pp. 75-78. (291

_____. The stem-pitting effects of tristeza on different citrus hosts and their economic significance. In International Citrus Congress, Florida, 1977. Proceedings. Edited by W. Grierson. Orlando, Fla., International Society of Citriculture, 1979. v.3, pp. 953-955. (292

More economic losses are caused by these effects than the previous destruction of all trees budded on intolerant rootstocks. Stem pitting is caused by the localized destruction of the meristem in citrus trees which are partially intolerant of citrus tristeza virus. Affected trees are stunted and produce small fruits. Stem pitting varies from a few large, long grooves to numerous, short, shallow pits giving a porous appearance to the wood. (Review of Plant Pathology 59:5170)

* SAMSON, J. A. Maladies à virus des citrus au Surinam. Fruits 28(5):363-365. 1973. (293

Information is given on the incidence of tristeza, exocortis psorosis, cachexia, stubborn disease and bud union constriction in Surinam. Interim results of a rootstock trial are noted. (Horticultural Abstracts 44:1881)

* SANCHEZ A., L. y WEATHERS, L. J. La amenaza de la tristeza de los cítricos en Chile. Agricultura Técnica (Chile) 30(3):166-170. 1970. (294

El virus de la tristeza fue encontrado en varios árboles de

Tangelo Sampson en un huerto en la zona de Peumo. Estos árboles fueron importados a Chile desde USA en 1942.
El virus de la tristeza también fue encontrado en tres limoneros Genova, dos limoneros Rugosos y dos limas Bearss en un huerto de Isla de Maipo, los que habían sido importados desde USA en 1947.
El virus de la tristeza no fue identificado en ninguno de los árboles de naranjo dulce cultivados comercialmente y en ningún otro tipo de cítrico.

* SANCHEZ DE BUSTAMANTE, C. A. Tristeza o podredumbre de las raicillas. In Sarasola, A. Fitopatología; curso moderno. Buenos Aires, Hemisferio Sur, 1975. v.3, pp. 180-186. (295

El autor clasifica a los virus que atacan a los cítricos en dos:
- -Virosis que se transmiten sólo o casi solamente por injertos, Psorosis, Exocortis y Xiloporosis.
- -Virosis que se transmiten por injerto y por insectos o ácaros vectores, Tristeza, Stem-pitting.

En relación a Tristeza o Podredumbre de las raicillas indica que es una de las virosis más estudiadas y destaca alguna de las investigaciones realizadas desde 1890 hasta llegar a establecer:
- -Su etiología virótica
- -La forma de transmisión por injerto y los distintos vectores *Paraloxoptera citricidus = P. argentinensis; Aphis citricidus = A. tavaresi; Aphis gossypii; Cuscuta subinclusa* y *Ferrisia virgata* como posible transmisor en Africa.
- -Las reacciones de las especies cítricas al virus
- -Los portainjertos tolerantes, así como los intolerantes o sensibles a la enfermedad.
  Las razas del virus de la Tristeza ("strains") sus similitudes y diferencias.
- -La falta de un síntoma específico que la caracterice. Los observados corresponden a los de la destrucción del sistema radicular debido a muchas causas.
  Las medidas de control cuarentena y utilización de combinaciones tolerantes, son los únicos medios prácticos hasta el momento.
- -Control de insectos vectores
- -Medidas para recuperación de plantas de valor
- -Injerto por aproximación
- -Afrancamiento del injerto dulce
- -Reinjertación de la copa del limonero
  Emisión de brotes del portainjerto agrio
- -Medida preventiva
  Empleo de portainjertos tolerantes y empleo de yemas testadas como libres de virus.

SAO PAULO. SECRETARIA DA AGRICULTURA. Instruções sobre a tristeza dos citros-Variante Capão Bonito. São Paulo, 1971. 15 p. (296

SARRENECHE G., B. La tristeza de los cítricos. Medellín, Universidad Nacional de Colombia, 1975. 34 p. (297

SASAKI, A. A mild strain of tristeza virus in Hassaku trees (*Citrus hassaku* Hort. et Y. Tanaka) in Hiroshima Prefecture. Annals of the Phytopathological Society of Japan 33(3):162-167. 1967. (298

_____.; TSUCHIZAKI, T. y SAITO, Y. Discrimination between mild and severe strains of citrus tristeza virus by fluorescent antibody technique. Annals of the Phytopathological Society of Japan 44(2):205-208. 1978. (299

Differences in the numbers and distribution of specific fluorescent phloem cells in various tissues of several citrus spp. following inoculation with mild or severe strs. of CTV enabled the strs. to be distinguished. Fluorescent cells in petioles infected with a mild str. were fewer than in petioles infected with the severe str. 21-90 days after sprouting. Results suggested that the severe str. multiplied in the phloem cells and was transmitted to neighbouring cells more rapidly than the mild str. With this technique it should be possible to distinguish between mild and severe strs. in petioles and twigs 14-30 days after sprouting. (Review of Plant Pathology 58:2243)

* SCHWARZ, R. E. Aphid-borne virus diseases of Citrus and their vectors in South Africa. A. Investigations into the epidemiology of aphid-transmissible virus diseases of Citrus by means of trap plants. South African Journal of Agricultural Science 8(3)839 852. 1965. (300

The epidemiology of insect-transmissible virus diseases of citrus was investigated by means of exposing glasshouse-raised seedlings (trap plants) to the aphid fligh for certain periods. The attractiveness of the trap plants was increased by attaching yellow artificial leaves to them. For investigations of the tristeza virus of citrus, groups of four West Indian lime trap plants each were exposed at ten different sites at Neslpruit, Eastern Transvaal, and at nine different sites at Buffelspoort, Western Transvaal for a period of four weeks each. These exposures were carried out at Nelspruit from September, 1961 to May, 1963. The infections of the trap plants with strains of the tristeza virus correlated closely with the number of winged *T. citricidus* collected from these plants whereas the correlation with the number of *T. citricidus* collected from the yellow water traps was much less pronounced. There was no significant correlation between the flight activity of *Aphis gossypii* and the infection of the trap plants with tristeza.
Of the 298 tristeza isolates trapped at Nelspruit, 260 gave a severe and 38 an intermediate West Indian lime reaction; 231 were positive and 67 negative for the yellows reaction. Of the 24 isolates trapped a Buffelspoort, 22 gave a severe and two an intermediate West Indian lime reaction; 17 were positive and seven negative for the yellows reaction.
The vein enation virus was found in only two out of 1,360 exposed West Indian lime trap plants but in 11 out of 32 rough lemon trap plants exposed for three months, and in five out of 32 in another group of 32, also exposed for about three months. This would indicate that rough lemon is a more suitable trap plant for vein enation virus than the West Indian lime. From one of the West Indian lime trap plants a

virus that causes mottling in sweet orange and in Palestine sweet lime was isolated. When 32 Empress mandarin trap plants were exposed to the insect flight for six months, three of the seedlings showed a severe yellowing of the leaves. The virus proved to be graft-transmissible and caused severe yellows symptoms on Empress mandarin and sweet orange. The virus is referred to as "reticulata" yellows and its symptoms differ from all the other citrus viruses known in South Africa.

* SCHWARZ, R. E. Increased desoxyribonucleic acid and starch content of leaves of tristeza-infected West Indian lime seedlings. South African Journal of Agricultural Science 9(1):23-30. 1966. (301

The desoxyribonucleic acid (DNA) and starch content of tristeza virus-infected West Indian lime seedling leaves was found to be higher than those of healthy seedlings. The highest and most consistent increase in DNA and starch content was found in young, fully unfolded leaves.

_____. Pre-immunisation a techniquc for reducing the effects of stem pitting on grape-fruit. South African Citrus Journal 438:25-26. 1970. (302

Rootstocks raised as free from tristeza virus as possible are grafted with budwood from an outstanding grapefruit tree from a nucellar orchard 8-10 yr old which shows general and severe tristeza infections. Thus only the insect transmissible viruses are likely to be transmitted with the budwood. The chances are also increased that the outstanding trees are pre-immunized and not just trees that have not become infected. (Review of Plant Pathology 50:3739)

* _____. Comparing Tristeza disease of citrus in four continents. Tropenlandwirt 80:29-37. 1979. (303

The Tristeza disease of citrus, which causes a dieback of the combination sweet orange on bitter sweet orange and stem pitting in cultivars like acid lime and grapefruit, occurs in various citrus-growing parts of the world in different complexes. In addition the spread of the disease by its aphid vectors as well as its indirect control by using tolerant stocks differs. In parts of Spain, Tristeza has been spread by the relatively inefficient vector, the cotton aphid, only during the last 20 years. The Tristeza-sensitive rootstock, bittersweet orange, is being replaced by Troyer citrange and Cleopatra mandarin. For propagation, either nucellar material or material that has been made virus-free by using the micrografting technique, is being used. In Southern Africa, where Tristeza has been endemic and the efficient vector, the black citrus aphid, has been present since the start of citriculture, the Tristeza-tolerant rough lemon stock is mainly being used. Tristeza causes a strong pitting on grapefruit. Tristeza and its efficient vector, the black citrus aphid, has been brought to Argentina and Brazil in the early 30th. After the death of about 20 million trees on bittersweet stock in both countries, this stock was replaced by tolerant stocks like Rangpur lime,

trifoliata orange and mandarin. In some foci in Brazil (Capão Bonito) a new tristeza variant made its appearance in the late 50th; this variant produces severe stem pitting on sweet orange and Rangpur lime. At about the same time, a Tristeza-like disease "declinamiento" or "fruta bolita" made its appearance in Argentina, causing a dieback on the combination sweet orange on Trifoliata. In Asia, a severe Tristeza stem pitting complex causes, in addition to the symptom found in other parts of the world, severe stem pitting on sweet orange. For that reason mainly pitting resistant mandarin cultivars are planted and it is propagated either by air layering (stock free cultivation) or by using Tristeza-resistant stocks like mandarin and Trifoliata.

SCHWARZ, R. E. Declines on trifoliata orange and other tristeza-tolerant rootstocks. In International Citrus Congress, Florida, 1977. Proceedings. Edited by W. Grierson. Orlando, Fla., International Society of Citriculture, 1979. v.3, pp. 955-958. (304

A brief review of these declines caused by a variety of factors, and including declinamiento or fruta bolita of Misiones, Argentina, citrus tristeza virus, marchitamiento repentino from Uruguay, Australian citrus dieback, citrus young tree decline, Araraquara decline in Brazil and CDX disease in Peru. (Review of Plant Pathology 59:5171)

SERPA ARCAS, D. Cleopatra; una alternativa. Barquisimeto, Venezuela, Universidad Centro Occidental, 1978. 28 p. (305

SERVAZZI, O.; MARRAS, F. y FODDAI, A. La presenza del virus della 'tristeza' degli agrumi in Sardegna. Studi Sassaresi, III 15(1):215-219. 1967. (306

The virus was newly recorded in Sardinia on Satsuma mandarin, and was transmitted to Mexican lime. Destruction of infected plants is recommended as a prophylactic measure. (Review of Applied Mycology 48:157)

SHIKATA, E. y SASAKI, A. Long flexuous threads associated with Hassaku dwarf disease of Citrus trees. Journal of the Faculty of Agriculture Hokkaido University 56(2):219-224. 1969. (307

Particles 2000X10-12 mμ were found in exudates from Mexican lime infected with either a severe str. (HS-34) or a mild str. (HM-50) of Hassaku dwarf. Similar ones occurred in phloem cells of leaves from either this lime of Hassaku (*Citrus hassaku*) infected with HS-34 and none was found in exudates or leaves from healthy plants. The results confirm that Hassaku dwarf is caused by citrus tristeza virus. (Review of Plant Pathology 49:757)

SILVA, O. M. y OLIVEIRA, J. C. Translocação do fosforo-32 em citrus afetado pelo virus da tristeza. In Brasil. Centro da Energia Nuclear na Agricultura. Relatório de atividades 1971. Piracicaba, Escola Superior de Agricultura Luiz de Queiroz, 1971. p. 44. (Sólo resumen). (308

* SIMANTON, W. A. y KNORR, L. C. Aphid populations in relation to tristeza in Florida citrus. Florida Entomologist 52(1):21-27. 1969. (309

Analysis of 16 years of monthly records of aphid populations in 130 Florida citrus groves disclosed *Aphis spiraecola*, *A. gossypii* and *Toxoptera aurantii* as the only species commonly attacking citrus. All three species are known to transmit tristeza virus. Populations of each species in the 6 years of highest statewide population were compared for 3 geographical areas within the citrus belt. In West area where spread of tristeza is great, *Aphis gossypii* was most abundant and dominant. In Central area where tristeza spread is also great *A. gossypii* was seldom abundant but total aphid population was higher and *A. spiraecola* was dominant. In East area where tristeza is found occasionally but appears not to be spreading, all 3 species were present but aphid infestations were usually less severe. No direct linear relationship between tristeza spread and numbers of aphids was evident. It is recognized that factors such as abundance of trees acting as virus reservoirs, different strains of virus, and the possibility of aphid strains of greater transmission efficiency may also be involved.

SINGH, A. B. Comparative transmission of citrus tristeza virus by aphids acquired from leaves, leaf extracts and bark extracts through stretched parafilm membrane. Indian Journal of Microbiology 18(1):40-43. 1978. (310

The virus was readily transmitted by feeding the aphids *Toxoptera citricidus*, *Aphis craccivora* and *A. gossypii* on leaf and bark extracts through the stretched membrane. The first and second were the most and least efficient vectors, respectively. Kagzi lime, grapefruit and sour orange were used as inoculum sources. With a particular aphid sp. the rate of transmission was highest and lowest with Kagzi lime and sour orange, respectively. Higher and lower transmission rates may be due to the relative virus concs. in the host plants. It was concluded that the virus may not be a typical stylet-borne virus and may be transmitted in both stylet-borne and circulative non-propagative manners. (Review of Plant Pathology 59:295)

_____. y CHAKRABORTY, N. K. Transmission of citrus tristeza virus by a membrane-feeding technique. Horticultural Research 17(2):83-85. 1978. (311

CTV was transmitted by feeding the aphid *Toxoptera citricidus* on an extract of CTV-infected Kagzi lime leaves through a stretched parafilm 'M' membrane. The proportion of aphids transmitting the virus after feeding through the membrane (21 of 60) was slightly greater than that transmitting it after feeding on infected leaves (16 of 60). (Review of Plant Pathology 57:3971).

SINGH, B. P. y BIGGS, R. H. Influence of tristeza on free amino acids of Key lime. Indian Journal of Horticulture 22:162-166. 1965 (312

With the aid of paper chromatography cysteine, glycine, serine,

histidine, lysine, arginine, citrulline, tryptophan and proline were found to be present in 80% ethyl alcohol extracts of Key lime leaves. Comparison between chromatograms of extracts from tristeza-infected and non-infected tissues showed that lysine was absent in the infected tissue on the 7th day after tristeza inoculation and re-appeared again on the 28th day after infection, but still at an amount much less than in the control, Serine, glycine and tryptophan were also reduced considerably in the infected tissue on the 7th and 28th days after infection. (Horticultural Abstracts 36:7333)

SINGH, B. P. Phytohormonal control of tristeza in citrus. I. Gibberelic acid. Plant Science 1:154-156, 1969. (313

Healthy and infected Key lime leaves were soaked in solutions containing o,$10^{-3}$, $10^{-4}$ or $10^{-5}$ M gibberellic acid and grafted on healthy seedlings. A conc. of $10^{-5}$ M was most effective in suppressing the reduction of growth caused by the virus. (Review of Plant Pathology 50:3737)

* _____. Influence of gibberellic acid on the physiology of tristeza infected citrus. Indian Phytopathology 24(4):769-776. 1971. (314

The effects of gibberellic acid on symptom patterns and chemical constituents of Key lime infected by citrus tristeza virus are described and discussed. (Review of Plant Pathology 52:1536)

* _____. Influence of tristeza on soluble nucleotides of Key lime. Indian Phytopathology 24(3):533-538. 1971. (315

Using modified column chromatographic and spectroscopic techniques, it was found that soluble nucleotides increased in the early stages of viral invasion and decreased in the later stages. On the seventh day after infection ATP, ADP, AMP, UTP, UMP, GTP, GDP, CTP and CMP were present in lesser quantities in infected than in non-infected leaves. However, on the fourteenth day after infection all acid-soluble nucleotides were significantly less in the virus-infected than in the non-infected leaves, except CMP. Then, in the later stages of infection, the quantity of any soluble nucleotide was less in the viral-infected tissue than in normal tissue.

_____. Effect of chemicals on tristeza infected Key lime. I. Thiouracil. Plant Science 5:140-144. 1973. (316

Healthy plants were sprayed once with 2-thiouracil at 0-3 ppm and either inoculated with citrus tristeza virus or not inoculated; then 3 more sprays were applied at weekly intervals. On inoculated plants thiouracil accelerated the appearance of symptoms and aggravated their severity. Data are also given on the effect of tristeza virus and thiouracil treatment, alone or in various combinations on the leaf P and alcohol-soluble sugars content and $O_2$ uptake. (Review of Plant Pathology 55:4111)

SINGH, B. P.; VERMA, A. K. y SINGH, U. N. Effect of gamma irradiation on tristeza. Proceedings of the National Academy of Sciences, B 43(1/2): 26-28. 1973. (317

Irradiation of lime at 6 and 8 krad prevented the decrease in length of laterals due to the virus. No symptoms developed on indicator plants grafted with buds from the 8 krad treatment. (Review of Plant Pathology 55:5191)

* _____. Influence of 2-thiouracil on tristeza-infected Key lime. Indian Phytopathology 26(2):367-368. 1973. (318

Treatment increased the severity of citrus tristeza virus symptoms and decreased the time lag between inoculation and symptom appearance. (Review of Plant Pathology 53:4446)

_____. *et al.* Influence of gamma irradiation on the physiology of tristeza infected "Kagzi" lime (*Citrus aurantifolia* (Chrism) Swing). Indian Journal of Horticulture 34(1):1-3. 1977. (319

* STUBBS, L. L. Transmission and protective inoculation studies with viruses of the Citrus tristeza complex. Australian Journal of Agricultural Research 15(5):752-770. 1964. (320

An investigation since 1949 of viruses of the citrus tristeza complex indicated that the association of virulent, yellows, and tristeza-inducing viruses with orange and mandarin and that of avirulent types with grapefruit, lemon, and sour orange is a general but not absolute rule, as some exceptions were noted.
Attempts to separate yellows and non-yellows components from a virulent isolate, by applying short and long feed techniques to the vector aphid, *Toxoptera citricidus* Kirk, were unsuccessful.
A comparison of the vector efficiency of 12 clonal lines of *T. citricidus* aphids revealed different transfer characteristics between clones. However, transmission results from two experiments were inconclusive.
Cross-protection experiments were conducted over an 11 year period with seedling trees of grapefruit and sweet and sour orange seedling combinations. In these, mild isolates from grapefruit and lemon differed considerably in initial protective ability. Over a long period, however, even a strain of low initial protective ability exerted a considerable influence, as determined by tree growth. The virulent challenge virus used in these experiments retained its yellows-and tristeza-inducing ability when it was the sole inoculant, but not in trees previously inoculated with a mild isolate. The results of transmission and cross-protection tests are interpreted as evidence that viruses of the tristeza complex are related entities, varying in virulence but rarely if ever existing as pure strains. An explanation of host-reaction phenomena in terms of the combined effect of host selectivity of strains and mutual interference between tristeza variants is discussed.

TAKAHARA, T.; OKUDAI, N. y OIYAMA, I. Studies on the elimination of Citrus tristeza virus from Citrus trees. Agriculture and Horticulture 55(2): 333-334. 1980. (321

TANAKA, H.; YAMADA, S. y KISHI, K. Cross protection tests on the tristeza virus strains carried in Satsuma Mandarin and Hassaku trees. Bulletin of the Horticultural Research Station, B no. 8:79-90. 1968. (322

Mexican lime seedlings graft inoculated singly or doubly with apparently healthy Hassaku (*Citrus hassaku*) (HM) displayed only mild tristeza symptoms. Seedlings inoculated with apparently healthy Satsuma mandarin (*C. unshiu*) (SH) generally showed more severe symptoms. HM carries a mild virus str. while SH carries both mild and severe strs. Seedlings inoculated with buds from trees with Satsuma dwarf (SD) and Hassaku dwarf (HS), which carried the most virulent strs., also developed severe symptoms. Inoculation with HM of SH inferred a high degree of protection against these severe strs. Mild and severe strs. of tristeza virus in Satsuma mandarin and Hassaku in Japan are closely related. (Review of Plant Pathology 50:1789)

_____.; YAMADA, S. y NAKANISHI, J. Approach to eliminating tristeza virus from citrus trees by using trifoliate orange seedlings. Bulletin of the Horticultural Research Station, B no. 11:157-165. 1971. (323

Almost all field grown citrus trees in Japan are infected with citrus tristeza virus which may cause severe reactions on citrus virus indicators, thus precluding indexing for other viruses. In the experiments described CTV was separated from other viruses by grafting trifoliate orange seedlings with buds from diseases source trees. (Review of Plant Pathology 53:945)

TANAKA, S. Present problems of Citrus disease control in Japan. Bulletin of the Faculty of Agriculture Tamagawa University 7-8:43-50. 1968. (324

The most important diseases mentioned in this review are scab (*Elsinoe fawcettii*), melanose (*Diaporthe citri*), canker (*Xanthomonas citri*), anthracnose (*Colletotrichum gloeosporioides*), greasy spot (*Mycosphaerella horii*), storage rots, and virus diseases including citrus tristeza and Satsuma dwarf; Mention is also made of some minor diseases, including 'oleocellosis-like symptoms' on Iyo orange, sometimes resembling black spot, but from which *Guignardia citricarpa* was not obtainable, and which may be due to mechanical or insect injury. The difficulties of applying fungicides in the hilly and scattered citrus growing areas are discussed. (Review of Applied Mycology 48:155)

TERRANOVA, G. Le virosi e la riconversione varietale in agrumicoltura. Informatore Fitopatologico 24(10):5-12. 1974. (325

The topics discussed in this review are the spread of virus diseases and their economic importance; symptoms of tristeza, psorosis, cachexia-xyloporosis, exocortis, cristacortis, impietratura and stubborn; regrafting and replanting. (Review of Plant Pathology 54:2243)

THORNTON, I. R. y STUBBS, L. L. Control of tristeza decline of grapefruit on sour orange rootstock by preinduced immunity. In Conference of the International Organization of Citrus Virologists, 7°, Athens, 1975. Proceedings. Edited by E.C. Calavan. Riverside, University of California, 1976. pp. 55-57. (326

* TING, W.-P. y ARASU, N. T. A survey of tristeza virus on citrus in West Malaysia. Malaysian Agricultural Journal 47(3):299-304. 1970. (327

The citrus industry in West Malaysia is in an early stage of development and is threatened by tristeza and psorosis. A survey has been conducted to study the seriousness of the threat from tristeza. Results of the survey showed that tristeza is widespread in all the citrus growing districts of West Malaysia and that all the varieties, with the possible exception of kumquat, are affected by the virus. Efforts are being made to find suitable rootstocks and to produce virus-free scion material.

* TIRTAWIDJAJA, S.; HADIWIDJAJA, T. y LASHEEN, A. M. Citrus vein-phloem degeneration virus a possible cause of Citrus chlorosis in Java. Proceedings of the American Society for Horticultural Science 86:235-243. 1965. (328

Inoculation trials by grafting proved the virus nature of the cause of a chlorosis of citrus in Java now termed citrus vein-phloem degeneration. Most of the citrus species and varieties including rough lemon and Japanese citron rootstocks appear to be susceptible. Experiments with several species of insects and other animals have not yet identified a vector or vectors. The virus differs from so called "infectious variegation" or "infectious chlorosis" and from "Ellendale mandarin virus" as shown by differences in hosts. Host reactions, failure of transmission by *A. tavaresi*, and the behaviour of inoculated *Poncirus trifoliata* seedlings as symptomless carriers indicate it is not a strain of tristeza, though tristeza exerts some protection against this virus. The vein phloem degeneration virus has a short incubation period of 3 to 5 months. This with host differences distinguishes it from xyloporosis. Reactions to the virus include necrosis of the phloem in the leaf veins and petioles and accumulation of starch in leaf cells.

TOLBA, M. A.; RAGAB, M. M. y NOUR-ELDIN, F. Studies on citrus tristeza virus disease. I. Transmission and effect of the causal virus on citrus plants. Agricultural Reserve Review 46(4):87-99. 1968. (329

The virus was easily transmitted by grafting from infected citrus plants. Sap inoculation failed to induce the disease. Vein clearing was induced within 4 weeks and wood pitting within 2-6 months on Balady lime seedlings. Bud inoculation of virus-free Navel orange trees on sour orange or grapefruit rootstocks resulted in declining growth within 5-9 months, but no appreciable decline was seen when inoculated Navel trees were growing on trifoliate orange, Cleopatra mandarin, Rangpur lime, Orlando tangelo, rough lemon, Balady sweet orange,

Balady mandarine or citrange rootstocks, which are considered tolerant. Comparable infected trees grafted on sour orange, grapefruit, Mexican lime, shaddock or Eureka lemon rootstocks showed severe stunting and decline within 3 years of inoculation. On citron, trees were moderately affected. Studies of the bud-union of infected and non-infected Navel orange on non-tolerant rootstocks showed sieve tube and companion cell necrosis just below the line of union. No such necrosis was seen in the phloem of the sweet orange scion on any rootstock, or in the phloem of tolerant rootstocks. No indications of the presence of tristeza in commercial plantings were found. (Horticultural Abstracts 40:2174)

TOLBA, M. A.; RAGAB, M. M. y NOUR-ELDIN, F. Studies on citrus tristeza virus disease. II. Distribution and movement of the causal virus in citrus plants. In Conference of the International Organization of Citrus Virologists, 7º, Athens, 1975. Proceedings. Edited by E.C. Calavan. Riverside, University of California, 1976. pp. 63-67. 1976. (330

* TSUECHIZAKI, T.; SASAKI, A. y SAITO, Y. Purification of citrus tristeza virus from diseased citrus fruits and the detection of the virus in citrus tissues by fluorescent antibody techniques. Phytopathology 68(1):139-142. 1978. (331

Citrus tristeza virus (CTV) can be purified more easily from diseased fruits than from bark. The purification procedure was: gentle grinding of the pericarp without flavedo of Hassaku or navel orange fruits, clarification with carbon tetrachloride, polyethylene glycol precipitations, and a sucrose density gradient centrifugation. It was shown by electron microscopy that 50% of the particles in the purified preparations were of the normal length (2,000 nm). The ratio of UV absorption at 260 nm and 280 nm ($A_{260/280}$) for purified virus was 1.22. Antiserum against the Hassaku dwarf strain of CTV was prepared in a rabbit given one intravenous and three intramuscular injections of purified preparations. The antiserum reacted to the same dilution end points in complement fixation tests with three strains of CTV: the Hassaku dwarf strain, the seedling yellows strain, and the mild strain Fluorescent antibodies of the Hassaku dwarf strain of CTV were used for the detection of CTV within tissues of several citrus species. This technique may become a useful tool for the detection of CTV in citrus tissues.

USHIYAMA, K.; MUROFUSHI, Y. y SUGITA, K. Tristeza stem-pitting disease of Valencia, Fukuhara orange, Kawano natsudaidai and Yuzu trees on trifoliate orange in Kanagawa. Bulletin of the Kanagawa Horticultural Experiment Station no. 24:9-15. 1977. (332

* VACCINATION FOR citrus disease? Citrograph 62(8):248, 252. 1977. (333

An account is given of the work, done over the past 10 yr at Univ. Calif. (Riverside) by J. M. Wallace, P.R. Desjardins and R. J. Drake, on the immunization of extremely susceptible citrus trees against seedling yellows of tristeza viruses.

The trees were inoculated with 'seedling yellows-tristeza' virus obtained from seedling Eureka lemons and sour orange trees after they had recovered from severe stages of seedling yellows. (Review of Plant Pathology 57:603)

* VARMA, P. M.; RAO, D. G. y CAPOOR, S. P. Transmission of tristeza virus by *Aphis craccivora* Koch and *Dactynotus jaceae* (L.). Indian Journal of Agricultural Science 35(2):85-89. 1965. (334

*Aphis craccivora* Koch and *Dactynotus jaceae* (L.) have been shown to be the vectors of tristeza virus in the Maharashtra region. This brings the total of aphid species transmitting the virus to five.

VERMA, A. K. y SINGH, B. D. Indexing of tristeza, greening and their complex in citrus. Haryana Journal of Horticultural Sciences 6(1/2):1-4. 1977. (335

Kagzi lime was a better indicator plant than sweet orange for citrus tristeza virus, but both indicators reacted similarly to citrus greening virus. Data are presented on the percentage infection that resulted when budding, tissue grafting, wedge grafting and side grafting were used to inoculate Kagzi lime with the 2 viruses, and sweet orange with greening. For tristeza tissue grafting was the most efficient method but for greening side grafting gave the best results. (Review of Plant Pathology 57:5494)

_____. y SINGH, B. P. Metabolic changes induced by greening tristeza and complex form in Kagzi lime *Citrus aurantifolia*. Indian Journal of Experimental Biology 15(9):811-814. 1977. (336

Citrus tristeza and greening viruses alone and in combination modified the metabolic changes in Kagzi during infection. Changes in free amino acids are mainly in glycine, glutamic acid, lysine and cysteine. The reducing and non-reducing sugar and calcium content were not significantly changed. (Review of Plant Pathology 58:5359)

* _____. y SINGH, B. P. Influence of tristeza, greening and their complex on respiration of Kagzi lime leaves. Indian Phytopathology 31(1):79. 1978. (337

During the early stages of infection of the lime cv. Kagzi the $O_2$ uptake continued to increase, but just prior to and during the appearance of visible symptoms of citrus tristeza virus or citrus greening the uptake decreased. Uptake was more in greening infection than with tristeza and least in tissue infected with both simultaneously. (Review of Plant Pathology 58:5361)

* VIROSIS DE los cítricos. Noticias Agrícolas (Venezuela) 8(32):125-128. 1979. (338

En este artículo en relación a tristeza se informa que en Venezuela en 1960, fue reportado el virus de tristeza, pero

que hasta el momento no se ha localizado la enfermedad en siembras comerciales, pero que constituye una gran amenaza porque el vector *Toxoptera citricidus* está diseminado en toda la zona citrícola y porque el portainjerto utilizado, 'naranja cajera' es extremadamente susceptible a este virus. Se señala como medidas de control las de:

- Erradicación de las plantas enfermas
- Utilizar portainjertos tolerantes
- Propagando yemas libres de virus

VOGEL, R. Informe de misión en Polinesia Francesa, del 21 de noviembre al 9 de diciembre de 1978. París. Institut de Recherches sur les Fruits et Agrumes. Archives de Recherches no. 9-28. 1979. 16 p. (339

Misión con objeto de determinar las modificaciones que requiere el programa de saneamiento del huerto de agrios, propuesto en 1975, en vista de la rápida dispersión de la Tristeza, introducida posteriormente mediante la importación fraudulenta de material vegetal.
Los numerosos controles efectuados han permitido elaborar las siguientes conclusiones respecto a:
1) La Tristeza. Introducida recientemente a pesar de la legislación indicada en los anexos y propagada rápidamente por el pulgón vector *Toxoptera citricidus*, esta enfermedad se ha constatado en las 4 islas visitadas (Tahiti, Moorea, Huahiné y Raiatea) y todos los árboles injertados en naranjo amargo van a debilitarse y morir dentro de unos años, empezando por los naranjos. Inverse pitting, Vein Clearing, Vein Corking y Stem pitting son síntomas que se dan actualmente con frecuencia en los huertos observados. Por lo tanto, el limero 'Mexicain', muy sensible, debe ser reemplazado por el limero 'Tahiti', mucho más tolerante. En cuanto a las otras especies, el injerto en naranjo amargo, que afortunadamente no se practica desde 1975, así como los árboles de pie y los acodos (sensibles a la gomosis causada por *Phytophthora*) deberán reemplazarse por injertos en otros patrones capaces de producir asociaciones que toleren la Tristeza (Citranjos 'Troyer' y 'Carrizo', citrumelos '1452' y '4475', *Poncirus trifoliata*, para las variedades sanas de naranjo, mandarino, tangelo y pomelo introducidas en Córcega). Las variedades sanas de limero y de limonero procedentes de Córcega y las variedades locales de naranjo, mandarino y pomelo cuyo estado sanitario no se conozca con exactitud, serán injertadas en *Citrus volkameriana*. Las variedades locales que, una vez indexadas, resulten estar indemnes, podrán injertarse en *P. trifoliata*, Citranjos o Citrumelos. En todas las islas propicias al cultivo de los agrios deberán crearse semilleros que contengan todos los patrones de injerto preconizados. Debe abandonarse la variedad *Citrus macrophylla*, demasiado sensible a la Tristeza. La realización de ensayos permitirá, al cabo de unos años, la selección de los mejores patrones.
2) La presencia de otras enfermedades en las variedades locales (Psorosis escamosa, Caquiexia-Xiloporosis) ha requerido la introducción de variedades comerciales (Clementino: 'S.R.A.'; Naranjo: 'Pineapple', 'Valencia late', 'Washington Navel'; Mandarino: 'Commun', 'Fairchild', 'Frémont', 'Fortune', 'Kara', 'King', 'Kinnow', 'Malvasio' y 'Ponkan'; Tangelo o

tangor: 'Orlando', 'Minneola', 'Ortanique'; Limonero: 'Eureka' y 'Lisbonne'; Pomelo: 'Marsh', 'Red Blush', 'Thompson'; Limero: 'Tahiti'; Limequat: 'Lakeland'; Kumquat: 'Nagami'). Junto con estas introducciones, está llevándose a cabo un trabajo de selección de líneas nucelarias y de indexación de las variedades locales.
3) Habiéndose constatado que la Exocortis afecta a las 'Valencia late' injertadas en *P. trifoliata*, debe divulgarse a toda costa y en todo lugar la desinfección, mediante llama o lejía concentrada, de los instrumentos con que se opera en los árboles (navajas de injertar, podaderas, sierras, etc.).
4) La presencia del Woody gall, del Stubborn y del Greening, aunque probablemente, no ha sido aún confirmada.
5) Se aconseja vivamente la organización de una campaña de información pública acerca de estos problemas a fin de impedir que vuela a importarse fraudulentamente material vegetal contaminado. (Agritrop 80-186)

VUUREN, S. P. VAN. Virus diseases in citrus... prevention and control. Farming in South Africa 46(9):21, 23, 25. 1970. (340

* WALLACE, J. M. La tristeza de los citrus con referencia especial a su situación en los Estados Unidos. Boletín Fitosanitario de la FAO 4(6): 77-88. 1956. (341

También en Inglés: FAO. Plant Protection Bulletin
" " Francés: Bulletin Phytosanitaire de la FAO

El autor hace un estudio sobre la historia, las causas de la enfermedad y la importancia económica que la misma tiene. Hace una descripción de los síntomas de la Tristeza, informando que en California y en Arizona observó diversos tipos de "pitting" en los citrus no infectados por el virus de Tristeza y en California también observó un considerable margen de variaciones en el grado y tipo de "pitting" de los pimpollos de limoneros infectados por el virus de la Tristeza mediante inoculación por insectos y mantenido libres de infección por otros virus.
En relación a los insectos vectores, se demostró que en California y en Florida, el *Aphis gossypii* puede transmitir el virus. En Florida se consiguió también la transmisión con *A. spiraecola*.
En cuanto a la susceptibilidad a la Tristeza en ensayos efectuados en California, el citranjo Troyer (*Poncirus trifoliata* x *Citrus sinensis*) y el mandarino Cleopatra parecen muy prometedores como portainjertos para el naranjo dulce.
En lo que se refiere a medidas de lucha en California, el éxito mayor en la salvación de plantaciones de naranjo dulce injertado sobre pie de naranjo agrio se realizó mediante la reinjertación de la copa con limonero.

_____. Tristeza and seedling yellows. In Childs, J. F. L. Indexing procedures for 15 virus diseases of citrus trees. U.S. Department of Agriculture. Handbook no. 333. 1968. pp. 20-27. (342

WALLACE, J. M. y DRAKE, R. J. Use of seedlings-yellows recovery and protection phenomena in producing tristeza-tolerant susceptible scion rootstock combinations. In Conference of the International Organization of Citrus Virologists, 5°, Japan, 1969. Proceedings. Edited by W.C. Price. Gainesville, University of Florida, 1972. pp. 137-143. (343

_____. y DRAKE, R. J. Field performance of tristeza susceptible citrus trees carrying virus derived from plants that recovered from seedling yellows. In Conference of the International Organization of Citrus Virologists, 6°, Swaziland, 1972. Proceedings. Edited by L. G. Weathers and M Cohen. Riverside, University of California, 1974. pp. 67-74. (344

This is a further report on the performance of 'preimmunized' budded trees grown at Riverside under field exposure to natural infection with citrus tristeza virus. Although some isolates of seedling yellows virus have provided protection against tristeza for 6 yr, such protected trees are less vigorous than similar ones in the absence of tristeza infection. Any practical use of this artificially induced protection would be limited to regions where the seedling yellows complex is either absent or is not being spread to orchard trees by vectors. It is believed that the avirulent tristeza strs. encountered in the USA have not been derived from seedling yellows and it is easier to select preimmunizing isolates through the seedling yellows recovery reaction than by searching for such isolates in mildly affected orchard trees. (Review of Plant Pathology 56:5024)

_____. y DRAKE, R. J. Progress report of studies in California on preimmunization against tristeza in budded citrus trees. In Conference of the International Organization of Citrus Virologists, 7°, Athens, 1975. Proceedings. Edited by E.C. Calavan. Riverside, University of California, 1976. pp. 58-62. (345

* WEATHERS, L. G.; SANCHEZ A., L. y PLATT, R. G. Naturaleza y distribución de las enfermedades virosas de cítricos en Chile. Agricultura Técnica (Chile) 29(4):166-169. 1969. (346

Observaciones de campo y pruebas de transmisión indican que los virus de psorosis y exocortis están presentes en la mayoría de los huertos de cítricos en Chile, e infectan todas las variedades comerciales.
Cuando ambos virus están presentes en los limoneros formando un complejo, frecuentemente se notan respuestas sinergéticas. Cachexia se encontró sólo en un mandarino y se desconoce su incidencia como un virus latente. Los virus de tristeza, tatter-leaf y citrange-stunt están corrientemente presentes en los limoneros Meyer en Chile, pero éstos no fueron encontrados en huertos comerciales.

* WEATHERS, L. G. y SANCHEZ, A. L. Tristeza disease of Citrus in Chile. Plant Disease Reporter 54(7):542-544. 1970. (347

Tristeza virus was found in several 'Sampson' tangelo trees in one property in the Peumo citrus area. These trees were

imported to Chile in 1942 from de U.S.A. Three 'Genoa' lemon, two 'Rough' lemon, and two 'Bearss' lime trees in one property in Isla de Maipo imported to Chile in 1947 from de U.S.A. were found to be infected with tristeza virus. Tristeza virus was not retrieved from any locally-grown commercial sweet orange trees or from any other kind of citrus in Chile.

* WEBBER, H. J. Enfermedad "tristeza" en los patrones de agrios. Vida Agrícola (Perú) 22:937-939. 1945. (348

Con fecha 26 de setiembre el Ministerio de Agricultura dictó una resolución que prohibe la introducción de plantas cítricas y partes de ellas, con el fin de evitar traer al país la nueva enfermedad de los cítricos llamada"tristeza", que tanto preocupa en estos momentos. Esta enfermedad afecta a los naranjos injertados sobre patrones de naranja agria. Los patrones de naranja agria han sido recomendados como una medida para evitar la enfermedad de la "gomosis" del tronco, que tan general es en el país. La introducción de la tristeza crearía así un problema nuevo de singular gravedad.

* WEIR, C. C. Tristeza. In _____. Citrus growing in Jamaica. Kingston, Citrus Grower's Association, s.f. pp. 48-49. (349

WINNING THE battle against tristeza. California Farmer 246(16):17. 1977. (350

WUTSCHER, H. K. y SHULL, A. V. Performance of old-line and young-line. Valencia orange trees on five tristeza tolerant rootstocks in Rio Grande Valley. Rio Grande Valley of Horticultural Society Journal 24:12-17. 1970. (351

* _____. Swingle citrumelo, an ultraresistant rootstock. Citrograph 59(11): 387, 388, 391. 1974. (352

Swingle citrumelo, a rootstock for grapefruit and other citrus previously known as Citrumelo CPB 4475, is almost immune to tristeza virus, as well as being tolerant to exocortis and xyloporosis viruses, the citrus nematode and footrot (*Phytophthora parasitica*). In several trials with grapefruit scions it outyielded many other rootstocks. (Horticultural Abstracts 45:4426)

* WUTSCHER, H. K. Citrus trees virus and viruslike diseases. HortScience 12 (5):478-484. 1977. (353

Virus diseases have caused more damage to citrus than to any other fruit crop. In this concise review the 4 principal diseases (tristeza, psorosis, exocortis and xyloporosis), several less important viruses and many virus-like diseases of citrus are considered. Prospects for decreasing citrus virus problems are discussed. (Horticultural Abstracts 48: 4946)

* YAMADA, S.-I. y TANAKA, H. Virus diseases of the citrus and researches conducted on them in Japan. Japan Agricultural Research Quarterly 3(1):10-14. 1968. (354

The principal virus diseases of citrus in Japan are described. Satsuma dwarf is widely distributed and is thought to be identical with, or closely related to, the citrus crinkly-leaf virus of other countries. Related diseases in Japan are citrus mosaic, Natsudaidai dwarf-A and navel infectious mottling, which occur in limited areas. Hassaku dwarf virus disease is also severe; a limited related from is Natsudaidai dwarf-B. The pathogen in both cases is the tristeza virus. Exocortis appears to exist only in foreign introductions and has not been found in commercial plantings. Latent tristeza virus has been found in almost all citrus trees; its limited or negligible effect on productivity is ascribed to the general use of trifoliate or yuzu (C. *junos*) rootstocks. Vein enation virus is also widespread in a latent form. (Horticultural Abstracts 40:2130)

_____. y TANAKA, H. Latent tristeza virus of Satsuma Mandarin in Japan. Bulletin of the Horticultural Research Station Serie B 9:145-161. 1969. (355

Most of the Japanese citrus vars. indexed on Mexican lime seedlings produced a positive tristeza reaction. Severe symptoms were caused by some apparently healthy Satsuma mandarin, sweet orange, sour orange, grapefruit, Iyo (*Citrus iyo*), and Yuzu (*C. junos*). A virus in the Satsuma var. Silverhill causing a very severe reaction ir lime was found to be identical with that causing seedling yellows. The escape of commercial vars. in Japan from severe tristeza damage so far is attributed to the immunity of the trifoliate orange (*Poncirus trifoliata*) rootstock. (Review of Plant Pathology 50:674)

_____. *et al.* Reaction of Satsuma mandarin to tristeza virus (CTV) and indexing of CTV infection on satsuma mandarin. Bulletin of the Fruit Tree Research Station B no. 6:109-117. 1979. (356

Up to now it was assumed that the stem pitting symptom of the citrus tristeza virus disease (CTV) did not affect the satsuma mandarin (*Citrus unshiu*). This trial from Japan showed that this mandarin is indeed tolerant to the disease and only shows slight stem pitting. The Wase satsuma mandarin strain was even more tolerant. (Abstracts on Tropical Agriculture 6 (3):29325)

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ZANARDI, D. y LOCHE, P. Problems related to the occurrence of exocortis, tristeza and nematodes in citrus orchards. Italia Agricola 114(6):91-97. 1977. (359

* ZIEGLER, L. W. y WOLFE, H. S. Citrus growing in Florida. Gainesville, University of Florida, 1961. 248 p. (360

Incluye Tristeza

# INDICE DE AUTORES

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# *INDICE DE MATERIA*

# INDICE DE MATERIA

**Patrones**



Informe de actividades



General

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# INDICE GEOGRAFICO

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