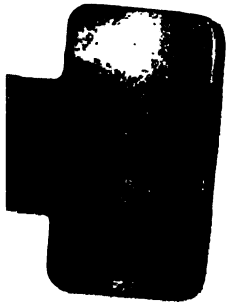
AGRINTER DIA 87
IICA-CIDIA

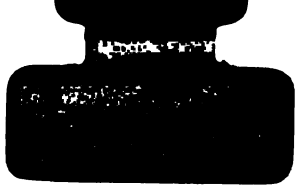
PROGRAMA SANIDAD VEGETAL

Cáncer de los cítricos
(*Xanthomonas citri*)

Bibliografía parcialmente anotada

IICA





DOCUMENTACION E INFORMACION AGRICOLA No. 87 ISSN 0301 - 438X

Cáncer de los cítricos
(*Xanthomonas citri*)

Bibliografía parcialmente anotada

Compilada por:

Carmen Villegas
Laura Coto Royo

Centro Interamericano de Documentación, Información y Comunicación Agrícola-CIDIA
Biblioteca y Terminal de Servicios
Turrialba, Costa Rica
1980

00008078

IICA
DIA–87

Villegas, Carmen, comp.

Cáncer de los cítricos (*Xanthomonas citri*); bibliografía parcialmente anotada. Comp. por C. Villegas y L. Coto Royo. –Turrialba, Costa Rica, CIDIA, 1980.

41 p. – (Su Documentación e Información Agrícola; no. 87).

1. Cítricos – Enfermedades – Bibliografía 2. Cáncer de los cítricos 3. Xanthomonas citri I. Coto Royo, L., comp. II. Título III. Serie

AGRIS H20 1000

Dewey 634.3

TABLA DE CONTENIDO

I N T R O D U C C I O N

La creciente importancia económica que tienen las pérdidas ocasionadas por plagas y enfermedades de los cultivos, ha sido preocupación permanente del Instituto Interamericano de Ciencias Agrícolas. Hoy más que nunca, este problema requiere de la atención y sobre todo de una acción enérgica y bien articulada de los que de una u otra forma estamos comprometidos en el desarrollo rural de América Latina y el Caribe.

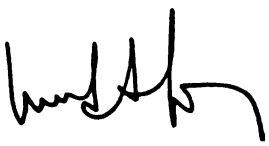
El sistema económico viene siendo seriamente afectado por el aumento en los precios del petróleo, el que tanto como fuente de energía, como por sus derivados agroquímicos, es un elemento fundamental para la producción del sector agrícola. La crisis energética y su impacto en los precios de los insumos para la producción se equipara con las pérdidas por plagas y enfermedades. Esto sumado a las pérdidas cualitativas y cuantitativas del valor de la producción agrícola, permite preveer consecuencias de magnitudes incalculables para el desarrollo.

En esta difícil coyuntura, cualquier esfuerzo tendiente a contrarrestar la influencia de los factores que inciden negativamente en la producción y la productividad agrícola, debe ser considerado como obra trascendente y humanista.

La información científica y tecnológica relacionada con las plagas y enfermedades que afectan los cultivos de valor económico, es vital para el diseño de estrategias y acciones tendientes al mejoramiento de la sanidad de los cultivos, que permitan edificar una barrera de contención para reducir los riesgos y las pérdidas de la producción y productividad sectorial.

El Instituto Interamericano de Ciencias Agrícolas estableció en 1979 el Programa de Sanidad Vegetal, respondiendo a un mandato de su Junta Directiva, con el propósito fundamental de crear un mecanismo de coordinación para lograr la prevención, combate y, en lo posible, la erradicación de enfermedades y plagas que están ocasionando serios perjuicios a la economía de los países y que amenazan extenderse a otras regiones.

Dentro de estos propósitos, el Programa de Sanidad Vegetal del IICA se complace en presentar esta bibliografía sobre el Cáncer de los Cítricos como parte de la serie bibliográfica en fitosanidad, que tiene como objetivo principal contribuir con los organismos del sector agrícola del continente en la difícil tarea del desarrollo rural.



José Emilio G. Araujo
Director General

San José, Costa Rica
Agosto de 1980

METODOLOGIA

La compilación de esta Bibliografía sobre el Cáncer de los Cítricos, por parte del IICA a través del Programa de Sanidad Vegetal y del Centro Interamericano de Documentación, Información y Comunicación 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
- Agrinter (Bibliografía Agrícola Latinoamericana)
- Bibliography of Agriculture
- Horticultural Abstracts
- Review of Plant Pathology (Review of Applied Mycology)

El período de búsqueda en los repertorios se realizó desde enero de 1970 hasta la fecha, pero al revisar los documentos indizados, nos encontramos con que la bibliografía citada por los autores era importante para complementar la información documentaria ofrecida, e incorporamos estas referencias hasta 1965.

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

La Bibliografía tiene 108 referencias bibliográficas, está organizada en orden alfabético de autor o título. Para facilitar el uso de este trabajo, se elaboraron índices de autores y materia.

La Biblioteca Conmemorativa Orton en Turrialba, facilita el acceso a la mayor parte del material incluído 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 del Cáncer de los Cítricos.

Turrialba, Costa Rica
Agosto de 1980

RECONOCIMIENTO

Expresamos nuestro agradecimiento al Ing. Jorge H. Echeverri R., Fitopatólogo del Programa Cooperativo para la Protección y Modernización de la Caficultura en México, Centroamérica y Panamá (PROMECAFE), por su colaboración en la revisión del índice de materia.

CANCER DE LOS CITRICOS

"CANCROSIS"

"CANCRO"

CANCER DE LOS CITRICOS
(*Xanthomonas citri*)

ACITA, J. O. Pruebas *in vitro* e *in vivo* de antibióticos, para el control de la cancrosis cítrica y la podredumbre negra de las crucíferas. Tesis Ing. Agr. Buenos Aires, Universidad, Facultad de Agronomía, 1977. 26 p. (01

ARAI, K. et al. Electron microscopy of *Xanthomonas citri* phages CP_1 and CP_2 infection. Annals of the Phytopathological Society of Japan 40(2):98-102. 1974. (02

* ATLAS DE GOTUZZO, E. y ROSSI, L. A. Cancrosis de los cítricos. Revista de Investigaciones Agropecuarias (Serie 5) - Patología Vegetal (Argentina) 4(5): 69-81. 1967. (03

Se describe la sintomatología de la enfermedad observada en hojas, frutos y ramitas de pomelo, naranjo y limonero, procedentes de Saladas y Mburucuyá (prov. de Corrientes). Se realiza el estudio de las características morfofisiológicas de las cepas bacterianas patógenas aisladas de dicho material. Se efectúan inoculaciones directas en limonero, pomelo y naranjo y cruzadas en pomelo, naranjo dulce y trifolio, obteniéndose resultados positivos. Del material inoculado, se reaíslan bacterias de características similares a las originales, cumpliéndose así con los postulados de Koch. Se concluye que el agente etiológico de la cancrosis observada sobre limonero, naranjo y pomelo es *Xanthomonas citri* (Hasse) Dowson. Algunas de las cepas pueden clasificarse por sus características como *Xanthomonas citri*, forma atípica.

* _____. Cancrosis de los cítricos. In Fitopatología, curso moderno. Buenos Aires, Hemisferio Sur, 1975. v.3, pp. 4-9. (04

Se da la descripción del agente causal de la enfermedad, la distribución geográfica de la misma y la sintomatología. Se analizan las condiciones predisponentes, se indican algunas especies resistentes a la enfermedad y se da información para su control. (CV)

BACH, E. E. et al. Estudo do relacionamento sorológico de *Xanthomonas citri* (Hasse) Dowson aos níveis genérico e interespecífico. In Congresso Paulista de Fitopatología, 1°., Botucatu, Brasil, 1978. Resumos. Botucatu, 1978? p. 13. (05

Baseando-se na metodologia descrita por Bach et al. (trabalho apresentado no 1° CPF), pela qual foram obtidos anti-soros intraespecíficos para patotipos de *Xanthomonas citri*, o presente trabalho foi desenvolvido no sentido de estudar as relações sorológicas desta bactéria aos níveis genéricos e interespecíficos. Os anti-soros para *Xanthomonas citri* foram ensaiados, em testes de dupla-difusão em ágar contra preparações de *Pseudomonas marginalis*, *Corynebacterium michiganense*, *Agrobacterium radiobacter*, *Erwinia carotovora*, *Xanthomonas campestris*, *Xanthomonas dieffenbachiae* e *Xanthomonas manihotis*, submetidas a

tratamento em banho-maria fervente (45 minutos) em presença de solução de ácido acético 0,03N. Os resultados obtidos, nas condições em que os experimentos foram conduzidos, permitem afirmar que os anti-soros obtidos para *Xanthomonas citri* são específicos do nível de gênero pois não se observou reação com *P. marginalis*, *C. michiganense*, *A. radiobacter* e *E. carotovora*. Por outro lado, os anti-soros para cepas de *Xanthomonas citri* isoladas de limão siciliano (*Citrus limon* (L.) Burn) e de laranja Bahia (*Citrus sinensis* Osb.) reagiram interespecificamente com *X. manihotis* e os anti-soros para a cepa de *X. citri* isolada de limão galego (*Citrus aurantifolia* Sw.) reagiram interespecificamente com *X. campestris*. Não se observou reação entre estes anti-soros e preparações de *X. dieffenbachiae*. Ensaios em dupla-difusão em ágar, utilizando anti-soros para *X. manihotis*, obtidos em coelhos imunizados pela via endovenosa, com suspensão desta bactéria, confirmaram os resultados acima mencionados. Estas observações concordam, em parte, com as mencionadas por Namekata e Yano. (Summa Phytopathologica 4:14)

* BACH, E. E. et al. Estudos sorológicos de patotipos de *Xanthomonas citri* (Hasse) Dowson. In Congresso Paulista de Fitopatología, 1°., Botucatu, Brasil, 1978. Resumo dos trabalhos. Summa Phytopathologica (Brasil) 4(1):7-8. 1978. (06

También en inglés, p. 27.

Baseando-se em Namekata e Yano, o presente trabalho foi desenvolvido no sentido de se estabelecer uma metodologia adequada para obtenção de anti-soros específicos para patotipos de *Xanthomonas citri*, a fim de determinar suas relações sorológicas ao nível intraespecífico. Foram imunizados seis coelhos, por injeção no linfonódulo, com suspensão de *X. citri*, proveniente de cepas isoladas de limão siciliano (*Citrus limon* (L.) - Burn), laranja Bahia (*Citrus sinensis* Osb.) e limão galego (*Citrus aurantifolia* Sw.), cultivadas em meio de ágar nutritivo (2 coelhos/cepa). Foram executadas sangrias periódicas e os anti-soros obtidos foram ensaiados, em testes de dupla-difusão em ágar, contra preparações obtidas a partir de várias cepas de *Xanthomonas citri*, submetidas a tratamento em banho-maria fervente (45 minutos) em presença de solução de ácido acético 0,03N. Os resultados, nas condições em que os experimentos foram conduzidos, indicam que os anti-soros obtidos para a cepa de *Xanthomonas citri* isolada do limão galego são específicos em relação aos obtidos contra as duas outras cepas (limão siciliano e laranja Bahia). Testes de patogenicidade com os tres isolados confirmaram os testes sorológicos, revelando que a cepa isolada do limão galego seria o agente da cancrose do limoeiro galego (*Xanthomonas citri* n.f.sp. *aurantifolia*), e as do limão siciliano e da laranja Bahia seriam agentes da cancrose A ou cancrose asiática.

* _____ et al. Serological studies of *Xanthomonas citri* (Hasse) Dowson. Arquivos do Instituto Biológico (Brasil) 45(4):229-235. 1978. (07

Testes de difusão em gel foram realizados com preparações de antígenos termoestáveis de diversos isolados de *Agrobacterium radiobacter* (Beijerinck & van Delden) Conn. subsp. *tumefaciens*

(Smith & Towsend) Keane; *Corynebacterium michiganense* (Erwin F. Smith) Jensen; *Erwinia carotovora* (Jones) Holland; *Pseudomonas marginalis* (Brown) Stevens; *Xanthomonas campestris* (Pammel) Dowson; *Xanthomonas citri* (Hasse) Dowson; *Xanthomonas citri* (Hasse) Dowson f. sp. *aurantifolia* Namekata; *Xanthomonas dieffenbachiae* (Mac Culloch & Pirone) Dowson; *Xanthomonas manihotis* (Arthaud-Berthet) Starr, e anti-soros para *Xanthomonas citri* (Hasse) Dowson, *Xanthomonas citri* (Hasse) Dowson f. sp. *aurantifolia* Namekata e *Xanthomonas manihotis* (Arthaud-Berthet) Starr. Os resultados obtidos indicam que os anti-soros reagiram especificamente ao nível intraespecífico para *X. citri* e *X. citri* f. sp. *aurantifolia* e revelam relacionamento sorológico entre *X. citri* e *X. manihotis*, e entre *X. citri* f. sp. *aurantifolia* e *X. campestris*.

BENIWAL, S. P. S. y CHAUBEY, S. N. Thiram, a fungicide effective against *Xanthomonas citri* (Hasse) Dowson. Pesticides 10(9):31, 36. 1976. (08

Of the antibiotics and fungicides tested against *X. citri*, thiram was the most effective at checking growth at up to 500 p.p.m. At higher concs. thiram was as effective as streptomycin sulphate, streptocycline and Agrimycin. Thiram activity was reduced when tested in combination with any of these antibiotics. Tests showed that thiram persisted on Eureka lemon 15 days after spraying. The results indicate that thiram may be useful in controlling citrus canker. (Review of Plant Pathology 58:3305)

BHASKARAN, R. y NATARAJAN, C. Effect of quinone-amino acid interaction on growth and polygalacturonase activity of *Xanthomonas citri*. Labdev Journal of Science and Technology, B 10(3/4):163-164. 1972. (09

Both hydroquinone (the more toxic) and methionine inhibited growth of *X. citri*. Polygalacturonase activity was inhibited by hydroquinone but only slightly affected by methionine, which reduced the toxicity of hydroquinone. (Review of Plant Pathology 53:2574)

* BITTERS, W. P., COLE, D. A. y McCARTY, C. D. Citrus rootstocks from the Papeda group. Citrograph 58(12):419, 420, 438, 439. 1973. (10

The characteristics are described of several species and hybrids of the sub-genus *Papeda* including the naturally occurring hybrids *Citrus macrophylla* (alemow) and *C. ichangensis* x *C. reticulata* (= *C. junos*, yuzu). *C. macrophylla* is highly resistant to *Phytophthora* and tolerant of exocortis; it is also well adapted for micronutrient uptake and has high B tolerance. Yuzu is resistant to gummosis and is not affected by bacterial canker. Trees on this rootstock had high leaf Fe and Mn contents, but were low in Ca, indicating that they might be useful on calcareous soils. Yuzu is extremely hardy as well as being resistant to *Phytophthora*. (Horticultural Abstracts 44:7989)

CARVALHO, M. C. DE. Pragas e doenças de citrinos e tratamentos recommendados em Sofala e Tete. Gazeta do Agricultor 26(298):162-191. 1974. (11

Disease recorded in Mozambique and discussed are *Xanthomonas citri*, *Guignardia citricapra*, damping-off due to *Fusarium*, *Rhizoctonia* and *Sclerotium*, *Diaporthe citri*, *Sphaceloma fawcettii*, *Diplodia natalensis*, *Capnodium citri*, *Glomerella cingulata*, sooty blotch (*Stomiopeltis citris?*) and *Armillaria mellea*. (Review of Plant Pathology 55:4109)

CHAKRAVARTI, B. P., PORWAL, S. y RANGARAJAN, M. Studies on citrus canker in Rajasthan. I. Disease incidence and survival of the pathogen. Labdev Journal of Science and Technology, B 4:262-265. 1966. (12

_____ y HEDGE, S. V. Studies on citrus canker in Rajasthan. III. Control of citrus canker by antibiotics and chemicals. Punjab Hort. Journal 10: 161-165. 1970. (13

In field spray trials on the control of citrus canker (*Xanthomonas citri*) Agrimycin at 1,000 p.p.m. gave the best control, followed by Agrimycin + Bisdithane at 1,000 p.p.m., Ultrasulphur at 5,760 p.p.m., Agrimycin at 500 p.p.m. and sodium arsenite + copper suphate at 100 p.p.m. (Horticultural Abstracts 41:9758)

CHAKRAWAR, V. R. Prospects of seedless lemon under sub-tropical conditions of Aurangabad. Journal of Maharashtra Agricultural Universities 2(1):62-63. 1977. (14

The seedless lemon (*Citrus limon*) was compared with the local Kagzi lime (*C. aurantifolia*) for trunk girth, crown volume, and the number and weight of fruits/tree. The data are tabulated. The lemon trees considerably outyielded the lime trees and were also free from dieback and canker (*Xanthomonas citri*). (Horticultural Abstracts 48:3920)

* CHEEMA, S. S. et al. Incidence of citrus canker on field grown nucellar and budded citrus plants. Indian Phytopathology 28(3):441-442. 1976. (15

The nucellar cvs. were highly susceptible to *Xanthomonas citri* while old line sweet orange cvs. budded on rough lemon were free from infection. Marsh Seedless grapefruit showed mild infection. Rootstocks do not appear to impart scion resistance to *X. citri* and the vigorous growth of nucellar cvs. may make them more susceptible. (Review of Plant Pathology 56:2513)

CHOHAN, J. S. Ways to control citrus diseases. Indian Horticulture 13(2): 11-15. 1969. (16

The diseases reviewed here are tristeza, foot rot gummosis (*Phytophthora* spp.), anthracnose (*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)

* DIAMANTE DE ZUBRZYCKI, A. y ZUBRZYCKI, H. M. Diferencias fisiológicas y estructurales en hojas de cultivares cítricos con diferentes susceptibilidad a *Xanthomonas citri* (Hasse) Dowson. Fitopatología 15(1):34-35. 1980. (17

Resúmenes de los trabajos presentados en el: Congreso Latinoamericano de Fitopatología, 1°., Maracaibo, 1979.

El objetivo del trabajo fue determinar diferencias fisiológicas y estructurales en hojas, para caracterizar a genotipos cítricos con diferente susceptibilidad a *Xanthomonas citri*. Se determinó que los cítricos en la zona de Bella Vista, Corientes (Argentina), presentaron tres a cuatro brotaciones anuales, con diferente gradación. El estudio cuantitativo del crecimiento de los brotes de otoño, mostró que en un cultivar con alta susceptibilidad a *Xanthomonas citri* como es el pomelo, los brotes crecen más que en la Naranja Valencia Wood que presenta moderada resistencia. Se diferenciaron las hojas dentro del brote, en tres grupos, determinándose la función de crecimiento de cada grupo en todos los cultivares. Se demostró que las hojas ubicadas en la parte media del brote (Grupo II) son las que presentan el mayor incremento de crecimiento diario, siguiéndole en orden de crecimiento las del ápice y luego de la base del brote (Grupo III y I) respectivamente. En cultivares de naranja con diferente susceptibilidad a *Xanthomonas citri*, se halló una asociación directa entre crecimiento diario en hojas y susceptibles. En hojas maduras, el número de estomas por unidad de superficie, presentó una relación inversa con la susceptibilidad de los cultivares. Se determinó que en un mismo genotipo la densidad estomática por unidad de superficie fue superior en hojas jóvenes que en maduras. En todos los casos analizados, la superficie foliar y el número de estomas presentaron una asociación directa altamente significativa. Los resultados sobre momento, intensidad y duración de las brotaciones, como las características del crecimiento de sus hojas, permitieron hallar relaciones directas con la susceptibilidad y resistencia de los cultivares cítricos evaluados. El conocimiento de la actividad vegetativa, su intensidad y duración, permitirá confeccionar un calendario de pulverizaciones para cada cultivar para un eficiente control terapéutico de *Xanthomonas citri*.

* FALICO DE ALCARAZ, L. M. y RODRIGUEZ, D. S. Cancrosis bacteriana en limoneros. Resultados de las primeras observaciones realizadas en la zona de Bella Vista (Provincia de Corrientes). IDIA (Argentina), no. 270:23-28. 1970. (18

Este informe es el resultado obtenido de un año de observaciones realizadas en cuatro quintas de limoneros de Bella Vista, Corrientes, Argentina, para establecer la presencia de hojas y frutos enfermos en distinta época del año y su relación con los principales factores climáticos, y así organizar el programa de pulverizaciones. Del análisis de los datos obtenidos, los autores deducen las siguientes conclusiones:

1) El porcentaje de frutos enfermos, se mantuvo todo el año, por arriba del porcentaje de hojas enfermas. 2) En frutos, el porcentaje de presencia de la enfermedad y la intensidad de infección disminuyen entre junio y setiembre. 3) En frutos, la enfermedad comienza a manifestarse después de setiembre, aumenta casi verticalmente hasta marzo, y a partir de marzo comienza a declinar. 4) En frutos, la intensidad de la infección se mantiene entre setiembre y marzo, y aumenta considerablemente entre marzo y junio. 5) En hojas, el porcentaje de presencia aumenta entre setiembre y marzo, y disminuye a partir de marzo, hasta setiembre.

* FALICO DE ALCARAZ, L. Ensayo comparativo de productos terapéuticos para el control de la "cancrosis del limonero" (*Xanthomonas citri*) (Hasse) Dow. en Bella Vista (Corrientes). IDIA (Argentina), no. 321/324:11-14. 1974. (19

La finalidad del presente trabajo fue la de probar la efectividad de algunos productos terapéuticos para el control de la "cancrosis del limonero" (*Xanthomonas citri*). El ensayo se realizó en cuatro quintas de limoneros del Departamento de Bella Vista, Corrientes, Argentina. Los tratamientos fueron los siguientes: 1) Oxicloruro de cobre común (50% cobre metálico) al 5 por mil. 2) Sulfato de cobre tribásico (33% de cobre metálico) al 5 por mil. 3) Oxicloruro de cobre micronizado (47% de cobre metálico) al 2,5 por mil. 4) Metirán cobre (bisulfuro de polietilén tiurán 36%, más oxicloruro de cobre 53%) al 2 por mil. 5) Testigo. Del análisis de los datos observados, los autores llegan a estas conclusiones: Pulverizaciones efectuadas cada 60 días con Sulfato de cobre tribásico al 5 por mil, permiten un buen control de la cancrosis del limonero o cancrosis "B" (*Xanthomonas citri* (Hasse) Dow.). Las heridas provocadas por el efecto abrasivo del viento con la arena, favorecen decididamente el aumento de las infecciones. Deben considerarse prioritarias las cortinas rompeviento cuando se implanten quintas de limoneros en tierras de textura arenoso-suelto.

* _____. Variabilidad de *Xanthomonas citri* (Hasse) Dow. en aislamientos de distinta procedencia. Fitopatología (Perú) 12(1):6-14. 1977. (20

Se comprobó la variabilidad de *Xanthomonas citri*, mediante un estudio comparativo entre aislamientos de cancrosis "B" procedentes de distintas zonas cítricas de la región nordeste de Argentina, y un aislamiento de cancrosis "A", procedente de Brasil. Las diferencias bioquímicas y culturales, y los distintos grados de patogenicidad determinados entre los aislamientos de cancrosis "B" y el de cancrosis "A", demostraron que la cancrosis "B" es producida por una "forma fisiológica" de *Xanthomonas citri*. Las variaciones de virulencia entre los aislamientos de cancrosis "B" procedentes de una misma zona, demostraron que la población de *X. citri* en Argentina está constituída por una mezcla de biotipos más o menos virulentos. El pomelo y el naranjo fueron las especies cítricas más susceptibles a todos los aislamientos de *X. citri*; asimismo las hojas jóvenes fueron significativamente más susceptibles a la bacteria, que las hojas viejas.

* FALICO DE ALCARAZ, L. Relación entre el desarrollo del tejido foliar cítrico y la predisposición a *Xanthomonas citri* (Hasse) Dow. Fitopatología (Perú) 15(1):63-66. 1980. (21

Estudios realizados en cuatro especies cítricas en relación al estado de desarrollo de su tejido foliar y la susceptibilidad a *Xanthomonas citri*, demostraron que los brotes jóvenes fueron los de mayor susceptibilidad a la infección. No solo los brotes más tiernos y jóvenes fueron los más susceptibles sino que es necesario que los mismos estén en pleno desarrollo y actividad meristemática. Las diferencias de susceptibilidad entre brotes de diferentes estados de desarrollo fue la misma para todas las especies y variedades estudiadas. Esto indica que la predisposición del tejido foliar está en relación directa con el estado de desarrollo de los mismos y es independiente de la susceptibilidad de la especie o variedad en estado adulto. Mayor infección se obtuvo cuando los valores de temperatura media fueron altos.

* _____. La variabilidad de *Xanthomonas citri* (Hasse) Dow. en el litoral Argentino. Fitopatología (Perú) 15(1):35. 1980. (22

Resúmenes de los trabajos presentados en el: Congreso Latinoamericano de Fitopatología, 1°., Maracaibo, 1979.

El objetivo del presente trabajo es demostrar la variabilidad de la población de *Xanthomonas citri* (Hasse) Dow. existente en el Litoral Argentino, y determinar las características diferenciales de los biotipos detectados. Se hicieron 110 aislamientos de *Xanthomonas citri* de material cítrico procedente de las provincias del Litoral Argentino. Con 65 aislamientos se hicieron los test bioquímicos, y observación de las características morfológicas de las colonias para detectar variaciones entre ellos. Cuatro aislamientos se seleccionaron para inocular sin heridas las especies *Citrus sinensis*, *C. jambhiri*, *C. limonia*, *C. aurantium* y *C. reshni*. La intensidad de la infección se evaluó 30 días después de la inoculación registrándose el número de pústulas por cm^2. Se identificaron dos biotipos de *Xanthomonas citri* cuyas características diferenciales fueron: Biotipo I: Acidificó intensamente la leche tornasol (utiliza hasta lactosa), tuvo consistencia gelatinosa en agar-wakimoto, y afecta con mayor agresividad todas las especies cítricas testadas; Biotipo II: Acidificó escasamente la leche tornasol (utilizando sólo glucosa), tuvo consistencia cremosa en agar-wakimoto, y ataca con menos virulencia a todas las especies cítricas testadas. No se detectó interacción diferencial entre los biotipos y las especies cítricas testadas. *Citrus reshni* fue el huésped más susceptible. Las demás especies cítricas no manifestaron diferencias de susceptibilidad entre sí.

* GANESH, S. y YADAVA, H. R. Citrus canker control with fungicides and antibiotics. PANS 24(4):341. 1978. (23

In 2-year trials on the control of *Xanthomonas citri* on citrus trees, several fungicides and antibiotics were sprayed at 15-day intervals, starting in early July after pruning the old affected

leaves and twigs and before the appearance of the disease. Almost complete control was obtained with copper oxychloride (0.3%), mancozeb (0.2%) and streptomycin + oxytetracycline (0.005%). Yields were greatly enhanced and fruit drop reduced by the first two fungicides. The incidence of fruit cracking was also reduced by captan. (Horticultural Abstracts 49:2247)

* GONZALEZ, R. H. Introduction and spread of agricultural pests in Latin America: analysis and prospects. FAO Plant Protection Bulletin 26(2):41-52. 1978. (24

Accounts are given of the main pests in the area, their establishment and colonization, survey methods used, the impact of the entry of new organisms in the region, and case studies on coffee rust (*Hemileia vastatrix*), citrus canker (*Xanthomonas citri*) and citrus tristeza virus. (Review of Plant Pathology.58:2643)

Originaria de Asia, es introducida a América por inmigrantes japoneses en Brasil, pasando luego a otros países de América. (CV)

GOTO, M. Studies on citrus canker in Japan. In International Citrus Symposium, 1st., Riverside, 1968. Proceedings. Riverside, 1969. v.3, pp. 1251-1252. (25

Strains of *Xanthomonas citri* isolated from Satsuma trees were clearly distinguished from strains occurring on non-Satsuma citrus trees in the same groves. Over-wintering of the pathogen was frequently observed in lesions on shoots which had developed in late summer and autumn, and the pruning of such shoots offers a practical method of eradicating canker in adult Satsuma trees, since lesions on spring leaves and stems are a negligible source of infection. The viability of the pathogen varied from 8 hours to 3 days in outdoor tests on lemon leaves. The susceptibility to stomatal infection of Satsuma and Natsudaidai leaves decreased with leaf age, probably for morphological reasons. Newly developed stems are attacked at the base, and the susceptible region moves towards the apex until elongation has ceased, when the stem becomes resistant. Young fruit was highly susceptible to stomatal infection but wound infection predominated as the fruit aged. (Horticultural Abstracts 41:2313)

_____. Studies on citrus canker disease. II. Leaf infiltration technique for the detection of *Xanthomonas citri* (Hasse) Dowson, with special reference to the comparison with the phage method. Bulletin of the Faculty of Agriculture, Shizuoka University 20:1-19. 1970. (26

_____, TADAUCHI, Y. y OKABE, N. Interaction between *Xanthomonas citri* and some saprophytic bacteria. Annals of the Phytopathological Society of Japan 37:398. 1971. (27

GOTO, M. y STARR, M. P. Lysogenization of *Xanthomonas phaseoli* and X. *begoniae* by temperate X. *citri* bacteriophages; effects on virulence, phage sensitivity, and other biological properties. Annals of the Phytopathological Society of Japan 38(4):267-274. 1972. (28

X. *begoniae* and X. *phaseoli* were lysogenized by temperate phages from X. *citri* and repeated transfer through their original host plants did not result in the loss of lysogenicity. Although the lysogenized bacteria showed changes in susceptibility to either temperate or virulent phages no changes were noted in characteristics such as plant pathogenicity and use of C sources. (Review of Plant Pathology 52:2139)

_____ y STARR, M. P. Phage-host relationships of *Xanthomonas citri* compared with those of other Xanthomonads. Annals of the Phytopathological Society of Japan 38(3):226-248. 1972. (29

The X. phages found in soil form tiny, pinheaded-sized plaques and have broad host ranges, whereas those in diseased plant tissues usually have very restricted ones. (Review of Plant Pathology 52:1392)

* _____. Survival of *Xanthomonas citri* in the bark tissues of citrus trees. Canadian Journal of Botany 50(12):2629-2635. 1972. (30

By leaf infiltration technique and by isolation method, the causal bacterium of citrus canker, *Xanthomonas citri*, was detected from discolored bark tissues of trunks, low scaffold limbs, and lateral branches of adult trees of lemon (*Citrus limon*, variety Lisbon), Natsudaidai (*C. natsudaidai*), and Unshu (*C. unshu*, variety Sugiyama). The pathogen was detected from 32% of the bark tissues taken from lemon trees, 15% from Natsudaidai, and 10% from Unshu. These isolation frequencies as well as the bacterial populations detected from the tissues correlated with degree of susceptibility of the twigs to citrus canker. Such discolored bark areas were considered to be the old canker lesions formed on the twigs in the seedling stage. In Unshu trees, the bacterium was also detected with high frequency but low populations from 6-month- to 3-year-old healthy-appearing green twigs, although any visible symptoms were not subsequently produced on them. In recovery experiments, large numbers of X. *citri* cells were isolated 3 years after inoculation, from the bark of the trunk of a 12-year-old lemon tree.

_____, OHTA, K. y OKABE, N. Studies on saprophytic survival of *Xanthomonas citri* (Hasse) Dowson. I. Detection of the bacterium from a grass (*Zoysia japonica*). Annals of the Phytopathological Society of Japan 41(1):9-14. 1975. (31

Populations of X. *citri* of 10^3 cells/g sample or less were detected on Z. *japonica* in citrus groves. Phage types A and C were frequently detected in winter and type B in summer. Only isolates of phage type B were found on lesions of citrus trees nearest to the grass, while phage type A

was found on trees growing 80-100 m away. No isolates of phage type C were detected on the citrus trees. Evidently phage types A and B are able to survive for several months on Z. *japonica* while type C survives on the grass quite independently of nearby citrus trees. (Review of Plant Pathology 55:746)

GOTO, M., OHTA, K. y OKABE, N. Studies on saprophytic survival of *Xanthomonas citri* (Hasse) Dowson. II. Longevity and survival density of the bacterium on artificially infested weeds, plant residues and soils. Annals of the Phytopathological Society of Japan 41(2):141-147. 1975. (32

Following infestation in early spring, by dipping in suspensions of c. 10^8 cells/ml, X. *citri* survived 1-3 months on weeds, dead rice straw and in soils. After infestation in autumn the bacterium survived 7 months on either intact parts or dead leaves of *Zoysia japonica* and *Vetiveria zizanoides*, and 5 months in air dried soils. Populations of X. *citri* remained at 10^2-10^3 cells/g sample after an initial rapid decrease on intact Z. *japonica* and rice straw. In wet soils in the open the population decreased almost linearly, but was maintained at a low level in dry soil in the glasshouse for 8 months. On roots of *Citrus natsudaidai* populations showed no initial decrease and were maintained at a high level for 10 months. The population of phage type C on Z. *japonica* and rice straw was x10-100 higher than those of types A and B in late autumn and winter, but these differences were not found in soils. The possibility is discussed that phage type C is a distinct ecotype able to survive saprophytically under natural conditions without causing severe infection on citrus. (Review of Plant Pathology 55:1802)

_____. Selective population changes of *Xanthomonas citri* (Hasse) Dowson in diseased tissues. Annals of the Phytopathological Society of Japan 42(2): 174-180. 1976. (33

The comparative ability of 3 phage types of X. *citri* (A, B and C) to survive in diseased tissues was examined by inoculating an equal mixture of all 3 on leaves of adult *Citrus natsudaidai* and C. *unshu* trees. The population of C was soon overcome by those of A and B and quickly decreased to a level undetectable by conventional plating methods. When inoculated singly, however, the population of C was maintained. The selective reduction of C was accelerated by serial passages through host plants. No difference was observed in the processes of phage type selection by the two hosts. There is apparent host specificity of A and B to Natsudaidai and Unshu, respectively, based on isolation frequencies in field surveys, and no particular relationship was revealed between them in respect of growth and survival in diseased tissues. (Review of Plant Pathology 55:5754)

_____, TOYOSHIMA, A. y TANAKA, S. Studies on saprophytic survival of *Xanthomonas citri* (Hasse) Dowson. III. Inoculum density of the bacterium surviving in the saprophytic form. Annals of the Phytopathological Society of Japan 44(2):197-201. 1978. (34

Rhizomes of *Zoysia macrostachya*, citrus roots, rice straw mulch and plain soil were placed in boxes and infested with

suspensions of *X. citri*. Potted wounded Natsudaidai seedlings were placed on the boxes and inoculated by splashing with a rain simulator before being placed in a glasshouse. The minimum density of *X. citri* for infection was 10^2/g regardless of the type of infested material. Above this level the infection ratio increased with the population of the pathogen surviving under various conditions. Longevity was increased by either the grass rhizomes or citrus roots, while rice straw also provided the pathogen with a suitable habitat. (Review of Plant Pathology 58:2245)

* GOVIND BALLABH PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, PANTNAGAR. Annual report of research 1974-75. Pantnagar, 1976. p. 115. (35

The work on the control of citrus canker, clearly establishes the effectiveness of thiram in checking the growth of *X. citri*.

GRASSO, S. Appunti sulle principali malattie crittogamiche degli agrumi osservate in alcuni paesi dell'Asia orientale (Giappone, Formosa, Hong Kong e Filippine). Técnica Agrícola 22(6):577-591. 1970. (36

An account of the occurrence in these regions of diseases due to *Elsinoë fawcetti*, *Diaporthe citri*, *Xanthomonas citri*, *Mycosphaerella horii*, *Guignardia citricarpa* and *Colletotrichum gloeosporioides*. (Horticultural Abstracts 43:797)

HAMLIN, S. A. Studies on occurrence of pathotypes in *X. citri* (Hasse) Dowson. Punjab Horticultural Journal 7:90-93. 1967. (37

HSIEH, S. I. et al. Ultrastructural studies on Taiwan citrus canker disease. Chinese Journal of Microbiology 7(4):150-156. 1974. (38

Xanthomonas citri invaded the host cells through the intercellular spaces. In the epidermal cells plasmolysis occurred and many organelles were degraded. The pathogen probably secretes pectin decomposing enzymes to facilitate tissue penetration. (Review of Plant Pathology 54:5439)

* JAYARAMAN, K., OBLISAMI, G. y RANGASWAMI, G. An erythromycinlike antibiotic produced by *Streptomyces griseoplanus*. Current Science 39(4):91-93. 1970. (39

Isolation and characterization of an antibiotic, tentatively designated as C-6, from a species of *Streptomyces* was reported by Rangaswami et al. This antibiotic has been found to be highly inhibitory to several bacterial plant pathogens including *Pseudomonas solanacearum*, *Xanthomonas malvacearum*, *X. citri* and *X. oryzae*. In this paper the identity of the antagonistic *Streptomyces* and of the antibiotic are reported.

KAPUR, S. P. y CHEEMA, S. S. Citrus canker and its control. Progress in Farming 12(8):5. 1976. (40

* KHAN, I. D. y HINGORANI, M. K. Strain studies in *Xanthomonas citri* (Hasse) Dowson. Journal of Horticultural Science 45(1):15-17. 1970. (41

Fifteen isolates of X. *citri* (Hasse) Dowson obtained from diseased material collected from different locations in India were compared in studies of their morphological, cultural, biochemical and pathogenic characteristics. The gelatin liquefaction test delimited the isolates into six strains. On the basis of virulence to *Murraya exotica* L. differentiation of the isolates into three groups or strains has been proposed.

KISHORE, V. y CHAND, J. N. Citrus canker in Haryana. Haryana Agricultural University Journal of Research 2(2):124-127. 1972. (42

Kagzil lime (*Citrus aurantifolia*) appears to be the specie most susceptible to *Xanthomonas citri*. Two of the eight isolates tested differed in pathogenicity, indicating more than one strain of the bacterium. Numbers of stomata and size of guard cells and stomatal apertures were maximum in C. *aurantifolia* and minimum in the resistant C. *reticulata*. (Review of Plant Pathology 53:4452)

_____ y CHAND, J. N. Resistance of citrus to citrus canker caused by *Xanthomonas citri* (Hasse) Dowson: analysis of amino acids. Haryana Journal of Horticultural Sciences 2(1/2):46-49. 1973. (43

Biochemical analysis of healthy leaves and leaves inoculated with X. *citri* are presented for *Citrus reticulata*, C. *sinensis*, C. *jambhiri* and C. *aurantifolia*. The most resistant species, C. *reticulata*, contained 13 amino acids whereas C. *aurantifolia*, which is susceptible, contained 17 amino compounds. C. *aurantifolia* and C. *jambhiri* (the next most susceptible) were the only species that contained β-alanine and phenylalanine. Lysine and proline were present in C. *reticulata*, but absent in C. *aurantifolia*. The amino acid content was lower in infected than in healthy leaves, regardless of the species. The decrease was most marked for glutamine, threonine, serine, glycine, asparagine and leucine. (Horticultural Abstracts 45:7810)

* _____ y CHAND, J. N. Resistance of citrus to citrus canker caused by *Xanthomonas citri*: analysis of phenols and sugars. Indian Phytopathology 28(1): 46-47. 1975. (44

Analysis for phenols and sugars of the healthy and artificially infected (X. *citri*) leaves of four species of citrus, *Citrus reticulata*, C. *sinensis*, C. *jambhiri* and C. *aurantifolia* was carried out. Total phenols were more in the resistant C. *reticulata* than in others. Flavanol glycosides formed the major portion of total phenols. The most susceptible species (C. *aurantifolia*) contained very few phenolics. Amongst sugars, arabinose and mannose were found only in C. *aurantifolia* (susceptible) and there was no other qualitative difference in sugars of the four species.

* KNORR, L. C. Citrus diseases - a bibliography. PANS 19(3):441-477. 1973. (45

This account has been largely drawn from Citrus Diseases and Disorders by the same author, and due for publication in 1973 by the University of Florida Press. An extensive table lists the diseases, causal agents, importance, parts primarily affected, and distribution, with relevant remarks and selected references. (Review of Plant Pathology 53:1380)

KOIZUMI, M. Ecological studies on citrus canker caused by *Xanthomonas citri*. II. Factors influencing multiplication of CP_1 phages; III. Seasonal changes in number of causal bacteria and its bacteriophages CP_1 in rain water flowing down from the diseased trees. Bulletin of the Horticultural Research Station, Okitsu, B 9:117-127, 129-144. 1969. (46

a. Data are presented on the effects of temperature, citrus sap and bactericides on the multiplication of CP_1 phages in bacterial suspensions or lesion-floating solutions of vitamin-free casein hydrolysate with $CaCl_2$. When this phage was used as a tracer the bacteria were inhibited much more by streptomycin than by Bordeaux. b. The number of CP_1 phages in rain water on diseased trees increased rapidly two weeks after the appearance of new lesions and was maximum during rainy seasons. Phage numbers changed according to temperature from December to April and subsequently decreased. In cool seasons most of the CP_1 phages exuded from lesions were bound to bacteria; at other times there were free phages. In spring the number of *X. citri* bacteria in rain water increased gradually when the temperature exceeded 10°C, until they initiated infections in late April-mid-May. During this period bacteria were more abundant than phages, presumably since the pathogen was multiplying more rapidly than infection by the phage was taking place. Bordeaux sprays reduced the number of bacteria and increased the population of CP_1 phages. The number of phages in March-April was correlated with the ratio of diseased leaves to overwintered ones. (Review of Plant Pathology 50:682)

_____. Studies on citrus canker symptoms on satsuma fruit and the occurrence of the causal bacteria in the affected tissues. Bulletin of the Horticultural Research Station, Okitsu, B 12:229-243. 1972. (47

Lesions on young fruit (60% developed), inoculated before late August are described; collapsed cells were cut off by phelloderm and at harvest few bacteria (*Xanthomonas citri*) were present. Lesions on fruit inoculated in early and in late September are also described. Their development appeared to be increased by strong winds and hot weather, and they contained more bacteria at harvest. (Horticultural Abstracts 44:9002)

_____ y YAMADA, S.-I. Studies on drug resistance of *Xanthomonas citri* (Hasse) Dowson. Bulletin of the Horticultural Research Station, Okitsu, B 12:245-256. 1972. (48

Resistance of *X. citri*, the agent of citrus canker, to 2-amino-1,3,4-thiadiazole (ATDA), TF-130 (related to ATDA) and streptomycin (SM) was examined. After 1 or 2 sprays

with 1000 p.p.m. ATDA or 100 p.p.m. TF-130, lesions formed on intact leaves of *Citrus natsudaidai*. Increase in the ratio of SM resistance following spraying at 200 IU/ml was less than that of the two other compounds. When Washington navel orange trees were sprayed repeatedly in the field there was a remarkable increase in the ratio of resistant bacteria in lesions after three sprays of ATDA or TF-130 in the first year. After the winter of the first year the ratio did not decrease. Both ATDA and TF-130 were more effective than Bordeaux in the first year but less effective in the second and third. No increase in the ratio of SM resistant bacteria or reduction of the effect of SM spray was observed. (Review of Plant Pathology 54: 857).

KOIZUMI, M. Studies on the symptoms of citrus canker formed on Satsuma mandarin fruit, and existence of causal bacteria in the affected tissues. Bulletin of the Horticultural Research Station, Okitsu, B 12:229-244. 1972. (49

_____. Overwintering of *Xanthomonas citri* (Hasse) Dowson, the causal bacteria of citrus canker. III. Multiplication of the bacteria in the overwintered lesions. Kyushu Agricultural Research, no. 36:100-101. 1974. (50

_____. Behavior of *Xanthomonas citri* (Hasse) Dowson in the infection process. I. Multiplication of the bacteria and histological changes following needle-prick inoculation. Annals of the Phytopathological Society of Japan 42(4): 407-416. 1976. (51

Bacteria multiplied soon after inoculation in wounded tissues and intercellular spaces when detached *Citrus natsudaidai* (susceptible) leaves were incubated at 6-25° but not at 40°C. Intercellular spaces of parenchyma tissues were not occupied by bacterial masses during multiplication. After the disappearance of the chloroplasts parenchyma cells hypertrophied. Parenchyma cells also enlarged, but to a lesser extent, in non-inoculated leaves. The hypertrophied cells formed meristematic tissues. The bacteria multiplied abundantly after cell hypertrophy, filling the spaces between enlarged cells and oozing. The period from inoculation to multiplication was influenced solely by temperature and not by inoculum size or host resistance. In the more resistant C. *junos* and C. *madurensis*, multiplication after hypertrophy was less than in moderately resistant plants. In the detached leaves water-soaked lesions occurred at the same time as hypertrophy, whereas in attached leaves they were delayed two or more days, and diseased tissues were smaller and less hypertrophied. (Review of Plant Pathology 56:2514)

_____. Behavior of *Xanthomonas citri* (Hasse) Dowson in the infection process. II. Multiplication of the bacteria and histological changes of the host plant following rubber-block press or infiltration inoculation. Annals of the Phytopathological Society of Japan 42(5):517-525. 1976. (52

Following inoculation of *Citrus natsudaidai* with X. *citri* by the rubber block press method, bacteria invaded the intercellular spaces near the substomatal chamber, but did not

increase significantly until disease developed at cell levels. Enlargement of the nucleolus and disappearance of chloroplasts occurred in 2-3 layers of spongy parenchyma cells near stomata 4-5 days, 3-4 days and 2-3 days after incubation at 20, 23 and 25°C, respectively. Bacterial numbers increased for 1-2 days, then remained constant or decreased, and then increased considerably with the number of diseased cells. The interval between these two phases of bacterial increase reflected the process of celullar damage. There was no noticeable difference in this time interval in various hosts with differing resistance. When injected into spongy parenchyma (infiltration inoculation), bacteria started to multiply soon after inoculation, and diseased cells were found in 1-2 cell layers four days after incubation at 20°, extending to 4-5 layers 4-5 days later. Water soaked spots appeared under the surface of the leaf when diseased cells increased to c. 10 layers and hypertrophied. Cell division in affected tissues was not observed. Numerous bacteria were present in the intercellular spaces and peripheral spaces of diseased tissues. These results suggest that the bacteria affect adjacent parenchyma cells to cause disease after a temperature dependent incubation period, and that diseased cells support bacterial multiplication. (Review of Plant Pathology 56:4058)

* KOIZUMI, M. The incubation period of citrus canker in relation to temperature. Bulletin of the Fruit Tree Research Station, B no. 3:33-46. 1976. (53

Relation of temperature to the period from inoculation of *Xanthomonas citri* (Hasse) Dowson to disease appearance in cell level (infection period), or to the period from inoculation to appearance of water-soaked spots (incubation period) on leaves of the host plants was examined. Minimum temperature for the disease development by needle-prick inoculation was about 13°C, and maximum temperature was about 38°C. In the case of tubber-block press inoculation, maximum temperature was about 36°C, with exception of less than 36°C on *Citrus paradisi* Macf. Incubation period completely coincided with incubation period on detached leaves inoculated by needle-prick, and was related to the temperature (X°C) as follows: $f(X) = 2925.8 - 372.60X + 18.2912X^2 - 0.40271X^3 + 0.0033365X^4$. Where X is greater than or equal to 13°C and less than or equal to 36°C. A reciprocal of f (X) is the velocity approaching the accomplishment of infection at X°C. Integral of $1/f(X)$ from zero to a time after inoculation, with respect to time, shows index of disease progress (IDP) at the time. Under the condition of temperature shifting, IDP is calculated approximately as follows:

$$IDP = \sum_{i=0}^{n} 1/f(X_i)$$

Where X_i is each temperature from zero to n hours after inoculation. IDPs, at the time of water-soaked lesion appearance under various temperatures, based on the results of experiments, were calculated as 1.0 on wounded inoculation, 1.0 to 2.0 on rubber-block press inoculated immature leaves and 2.0 and 3.0 on rubber-block press inoculated mature leaves. With the spray inoculations, the incubation period was greatly influenced by leaf age, that is, water-soaked spots developed at the time

that IDP reached 3.0 to 4.0, 4.0 to 5.0, and more than 5.0, on those leaves which had ratios of leaf length at inoculation, to those after 35 days of 0.51 to 0.90, 0.91 to 0.98, and more than 0.98, respectively. No relation between incubation period and the resistance of the host plant to the disease was observed. Bacteria were dispersed from a leaf after the appearance of water-soaked lesions and dispersal increased greatly when lesions ruptured.

KOIZUMI, M. Behaviour of *Xanthomonas citri* (Hasse) Dowson and histological changes of diseased tissues in the process of lesion extension. Annals of the Phytopathological Society of Japan 43(2):129-136. 1977. (54

* _____. Factors related to the occurrence of spring canker caused by *Xanthomonas citri*. Bulletin of the Fruit Tree Research Station, B no. 4:115-129. 1977. (55

In order to clarify factors related to the occurrence of spring canker caused by *Xanthomonas citri* (Hasse) Dowson, periodical inoculations were made into attached citrus leaves or shoots in the field, from October to April, and computer analysis on the increase of the index of disease progress (IDP) after inoculation was carried out. Results obtained are as follows: Spring cankers developed on the leaves which were inoculated in autumn. Many latent bacteria overwintered in the host tissues in which IDP had increased more than 1.0, that is, host cells had been diseased and bacteria had multiplied around them before the average daily maximum temperature in 10 days dropped to 13°C or lower, at which IDP scarcely increased. If IDP had not reached 1.0, bacteria died off during winter. An occasional warm period during winter had little influence on overwintering of bacteria in latent infections unless IDP increased markedly. Spring cankers also developed abundantly on the overwintered leaves or stems which were inoculated in early spring, throughout March and April especially by spray of rubber-block press method. From the fact that inoculum sources were available during this season, it seemed to be evident that natural infections occurred on overwintering shoots. Lesions were observed when IDP reached 2.0 in the case of wound inoculation and 3.0 or more in the case of stomatal infection, when there was a warm spring, lesions appeared in early April and later, caused by bacteria in latent infections or in early spring infections, in contrast with appearance in early May and later when there was a cool spring.

KUHARA, S. Present epidemic status and control of the citrus canker disease (*Xanthomonas citri* (Hasse) Dowson) in Japan. Review of Plant Protection Research 11:132-142. 1978. (56

A review of the occurrence, control and related problems of X. *citri*. (Review of Plant Pathology 58:5374)

MATHAR, A. S. et al. Efficacy of different fungicides and antibiotics in the control of citrus canker caused by *Xanthomonas citri* (Hasse) Dowson. Madras Agricultural Journal 60(7):626. 1973. (57

All of five fungicidal and antibiotic treatments significantly reduced canker incidence on lime but 0.0025% streptocycline was best. (Review of Plant Pathology 54:1750)

MATSUO, N. y WAKIMOTO, S. An antibacterial substance produced by *Xanthomonas citri*. Annals of the Phytopathological Society of Japan 43(1):9-14. 1977. (58

When *X. citri* isolate Ku 7101 was treated with chloroform vapour, heat or UV light it produced an antibacterial substance. The substance was only active against Ku 7101 and *X. campestris* among the many bacteria tested which included 9 Gram + and 39 Gram - spp. Sensitivity of Ku 7101 to the substance was lost within a short time, but varied with the method of preservation. The substance did not appear to be a temperate phage since it did not form plaque or precipitate after 4h centrifugation at 200,000 x *g*, but to be a low molecular bacteriocin. (Review of Plant Pathology 56:5635)

* MEISTER, C. W. Differential reactions of citrus species to diseases and pests at Koronivia. Fiji Agricultural Journal 35(2):75-78. 1973. (59

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 had exocortis.

MESSINA, M. A. Los métodos serológicos en el estudio de la bacteria que produce la "cancrosis cítrica" en la Argentina. I. Hallazgo de un nuevo serotipo: metodología empleada en el estudio completo. Argentina, Estación Agropecuaria Paraná. Serie Técnica, no. 46. 1976. (60

_____. Los métodos serológicos en el estudio de la bacteria que produce la "cancrosis cítrica" en la Argentina. II. Primera comprobación experimental del medio de distribución ecológica. Argentina, Estación Experimental Regional Agropecuaria Paraná. Serie Técnica, no. 48. 1977. 11 p. (61

Using serological methods, it could be shown that the causal agent of citrus canker (*Xanthomonas citri*) is transmitted from diseased trees to healthy plants via the hands of fruit pickers or pruning shears. (Abstracts on Tropical Agriculture 5:26656)

MONDAL, R. y MUKHERJEE, N. Sensitivity of two plant pathogenic bacteria to some inorganic and organic compounds. Phytopathologische Zeitschrift 83(1):87-90. 1975. (62

Out of 31 compounds tested 20 inhibited *Xanthomonas oryzae* and *X. citri in vitro*. Hg chloride, Hg iodide, and cobalt and cadmium nitrates were toxic to both bacteria at 0.01 M. Others, including some lead and organic compounds, were effective only at higher cones. (Review of Plant Pathology 55:1035)

MONIZ, L., MOHIUDDIN, S. G. y PATIL, B. D. Reactions of citrus varieties and species to isolates of *Xanthomonas citri* (Hasse) Dowson. Research Journal of the Mahatma Phule Agricultural University 5(2):124-125. 1974. (63

Of the nine varieties and species tested in the glasshouse under optimum conditions *Citrus limonia* was highly susceptible while *C. karna*, *C. sinensis* (3 vars.), *C. limon*, *C. jambhiri* and *C. mederaspalana* were moderately resistant. The varieties and species exhibited different patterns of resistance and susceptibility to the different isolates, which suggests that physiologic races of the bacterium exist. (Review of Plant Pathology 55:1803)

* MOREIRA, S. Cancro cítrico - ameaça a citricultura brasileira. Revista de Agricultura (Brasil) 50(1-2):79-84. 1975. (64

En este artículo el autor da información sobre el origen de la enfermedad, su localización geográfica mundial, la sintomatología y las formas de propagación. Analiza el estado de la citricultura en Brasil, las actuales campañas de erradicación del cáncer de los cítricos que se realiza en Sao Paulo. Indica sobre la medida indispensable necesaria para llegar a la erradicación total de la enfermedad en Brasil y la providencia a tomar en el ámbito externo. (CV)

NAMEKATA, T. y OLIVEIRA, A. R. DE. Comparative serological studies between *Xanthomonas citri* and a bacterium causing canker on Mexican lime. In International Conference on Plant Pathogenic Bacteria, 3rd, Wageningen, 1971. Proceedings. Wageningen, Centre for Agricultural Publishing and Documentation, 1971. pp. 151-152. (65

_____. Estudos comparativos entre *Xanthomonas citri* (Hasse) Dowson, agente causal do "canco cítrico" e *Xanthomonas citri* (Hasse) Dow., n.f. s.p. *aurantifolia* agente causal da cancrose do limoeiro galego. Tese Dout. Piracicaba, Escola Superior de Agricultura "Luiz de Queiroz", 1971. s.p. (66

OBATA, T., TSUBOI, F. y WAKIMOTO, S. Studies on the detection of *Xanthomonas citri* by phage technique and the surface sterilization of Unshu orange for export to the United States. Research Bulletin of Plant Protection Japan 44(2):26-37. 1969. (67

Two *X. citri* phages (CP_1 and CP_2) are known to exist in Japan; each has a clear and specific host range but almost all *X. citri*

isolates are sensitive to one of them. In these experiments CP_1 and CP_2 levels rose significantly in the presence of their respective host bacteria. The rise was apparent in 1-2 hours for CP_1 and after 3 hours for CP_2 so that at least 5 hours shaking of the phage and bacteria preparation at 25°C would be needed for detection of *X. citri* by this method. CP_1 and CP_2 could detect 5 and 10^5 bacterial cells/ml, respectively. They were rapidly inactivated in distilled water but could be stored for a month in special medium at 5°. The surface of Unshiu orange fruit could be satisfactorily sterilized by a 2-minute dip in a sodium hypochlorite solution containing 100 p.p.m. Cl, but since considerable decomposition occurs a solution of double this concentration is recommended. A starch-iodine test is described which can indicate when the hypochlorite solution needs boosting or renewing. (Horticultural Abstracts 40: 7258)

OBATA, T. Distribution of *Xanthomonas citri* strain in relation to the sensitivity to phages CP_1 and CP_2. Annals of the Phytopathological Society of Japan 40(1):6-13. 1974. (68

Numerous *X. citri* isolates, representing 5 major citrus regions, were tested for susceptibility to the phages. Throughout the regions CP_2, sensitive strains were predominant in Satsuma orange plantings, while in plantings of other variety strains sensitive to either phage occurred in varying ratios. There was no obvious geographical pattern of strain distribution. Two different strains can occur as a mixture on one leaf but a single lesion is usually composed of one homologous strain. Of 1,256 isolates collected in wide surveys, only 17 were resistant to both phages. None of 2,514 isolates examined in intensive spot surveys was resistant to both. The intraspecific lysis spectrum of CP_1 + CP_2 is comprehensive enough to include virtually all *X. citri* strains occurring in Japanese citrus export regions. (Review of Plant Pathology 53:4816)

OHTA, T. y HAYASHIDA, M. Influence of amount of nitrogen and phosphorus fertilization on the occurrence of citrus canker. Kyushu Agricultural Research, no. 36:98-99. 1974. (69

_____. On the pathogenicity of *Pseudomonas* sp., an isolate antagonistic to *Xanthomonas citri*. Kyushu Agricultural Research, no. 37:111. 1975. (70

* OLIVEIRA, A. R. y NAMEKATA, T. Preservação da bactéria *Xanthomonas citri* (Hasse) Dowson emulsionada com adjuvante de Freund. Summa Phytopathologica (Brasil) 1(2):141-142. 1975. (71

O desenvolvimento de uma metodologia para manutenção de culturas puras de microorganismos de interesse para a pesquisa científica, foi sempre objeto de estudo contínuo. Há métodos que podem ser considerados gerais. No entanto, o pesquisador, para conservar suas culturas, verifica que para cada microorganismo em estudo é necessário fazer um ajuste na técnica para conservação do seu material. Sabemos que muitos laboratórios de fitopatologia, instalados em Escolas

de Agronomia e Institutos de Pesquisas Agronômicas no Brasil e no Exterior, não dispõem de facilidades e equipamentos para manutenção de coleçoes de microorganismos. Este trabalho teve por objetivo obter informações sobre o uso de adjuvante como veículo para conservar e manter coleções de bactérias fitopatológicas, utilizando o mínimo de equipamentos e instalações.

OOTA, T. Inoculation of *Xanthomonas citri* (Hasse) Dowson by a simplified injection method into leaf tissue. Kyushu Association of Plant Protection. Proceedings 18:136-137. 1972. (72

* PADMANABHAN, D., VIDHYASEKARAN, P. y RAJAGOPALAN, C. K. S. Changes in photosynthesis and carbohydrate content in canker and halo regions in *Xanthomonas citri* infected citrus leaves. Indian Phytopathology 27(2):215-217. 1974. (73

Chlorophyll *a* and *b*, carotene and xanthophyll content decreased in the canker, halo and pre-halo regions of the leaves infected by *Xanthomonas citri*. The ratio between chlorophyll *a* and *b* narrowed in the infected regions. Photosynthesis was impaired in the infected regions. Starch content was not affected much in the halo region. But the total sugars content decreased in all the infected regions. While sucrose and glucose contents decreased in the canker, halo and pre-halo regions, fructose content increased in these regions.

* _____, VIDHYASEKARAN, P. y RAJAGOPALAN, C. K. S. Mineral composition of canker, halo and green regions of citrus leaves infected by *Xanthomonas citri*. Indian Phytopathology 27(4):640-641. 1974. (74

* _____, VIDHYASEKARAN, P. y RAJAGOPALAN, C. K. S. Nitrogen constituents of canker and halo regions in citrus leaves infected by *Xanthomonas citri*. Indian Phytopathology 27(3):404-405. 1974. (75

* _____, VIDHYASEKARAN, P. y RAJAGOPALAN, C. K. S. Accumulation of malic acid in halo region of citrus leaves infected by *Xanthomonas citri*. Indian Phytopathology 28(2):276-277. 1975. (76

_____, VIDHYASEKARAN, P. y RAJAGOPALAN, C. K. S. Physiology of citrus leaves infected by *Xanthomonas citri* (Hasse) Dowson with special reference to halo formation: respiration and oxidative enzymes. Indian Journal of Experimental Biology 11(4):359-361. 1976. (77

The halo zones of *X. citri*-infected leaves of acid lime (*Citrus aurantifolia*) showed an increased rate of respiration compared with normal leaves but the canker tissue showed a decreased rate. Peroxidase and ascorbic acid oxidase activities were increased and phenoloxidase activity inhibited in both halo and canker regions. Catalase activity was very high in the halo regions. (Horticultural Abstracts 44:10026)

PAIK, W. H. Survey on the citrus pest control status in Korea. Seoul University Journal, B 25(10):199-223. 1975. (78

After a survey on Cheju Island carried out in 1972 the fungicides recommended against canker (*Xanthomonas citri*), scar (*Elsinoë fawcettii*) and melanose (*Diaporthe citri*) are Bordeaux, difolatan and zineb, respectively. (Review of Plant Pathology 56:4051)

PATEL, R. S. y DESAI, M. V. Control of citrus canker. Indian Journal of Horticulture 27:93-98. 1970. (79

The intensity of canker [*Xanthomonas citri*] on *Citrus aurantifolia* was significantly reduced over a 3-year period by spraying with 1% bordeaux 3 or 4 times a year combined with the annual removal of infected twigs. (Horticultural Abstracts 41:9759)

* PEREIRA, A. L. G. et al. Sobrevivência de *Xanthomonas citri* (Hasse) Dowson em capim amargoso (*Trichachne insularis* (L.) Nees) de pomares erradicados, no Estado de São Paulo. Biológico (Brasil) 42(11-12):217-221. 1976. (80

O objeto do presente experimento foi estudar as plantas nativas de pomares erradicados da região de Martinópolis, Estado de São Paulo e determinar os prováveis hospedeiros da bactéria *Xanthomonas citri* agente causal do canco cítrico. Foi coletada nessa área touceira de *Trichachne insularis* e empregado o método utilizado por Goto com algumas modificações, para a detecção de bactéria localizadas na superfície das raízes e na região da rizosfera. O microorganismo isolado foi inoculado em plantas jovens de laranja baianinha (*Citrus sinensis*) e limão galego (*Citrus aurantifolia*) cultivadas em vasos. Os diversos reisolamentos inoculados experimentalmente revelarem sempre um alto e constante poder de patogenicidade para citros. Com base nas características morfológicas, culturais, bioquímicas e de patogenicidade, a bactéria isolada da região da rizosfera e superfície das raízes do capim amargoso, foi identificada como sendo *Xanthomonas citri* (Hasse) Dowson. Em vista deste resultado, aconselhamos que na metodologia da "Campanha da Erradicação do Cancro Cítrico" conste, também, a eliminação do capim amargoso devido ao fato de albergar a bactéria *Xanthomonas citri* responsável pelo cancro cítrico.

* _____ et al. A sobrevivência de *Xanthomonas citri* (Hasse) Dowson, agente causal do "canco cítrico" na rizosfera de capim colonião (*Panicum maximum* Jacq.). Biológico (Brasil) 44(6):135-138. 1978. (81

Foram estudadas plantas provenientes de pomar erradicado de propriedade do Sr. Francisco Lopes Nascimento, localizado no bairro do Jacaré, em Martinópolis, Estado de São Paulo onde posteriormente foi assinalada a reinfecção por *Xanthomonas citri* em plantio experimental de *Citrus* sp. Das touceiras de "capim colonião" (*Panicum maximum* Jacq.) com o respectivo sistema radicular, foi isolada uma bactéria que pelas suas características culturais, morfológicas e de patogenicidade

foi classificada como *Xanthomonas citri* (Hasse) Dowson. O microorganismo isolado foi inoculado em plantas jovens de laranja baianinha (*Citrus sinensis* Osbeck) e limão galego (*Citrus aurantifolia* Swingle) cultivadas em vaso e revelaram sempre um alto e constante poder de patogenicidade para os citros. A inoculação da bactéria em "capim colonião" não apresentou, aparentemente, qualquer alteração em folhas, hastes ou raízes do mesmo, podendo-se admitir que a bactéria se localiza na superfície das raízes ou propriamente na região da rizosfera da planta e consegue a sua sobrevivência à custa dos exudatos emitidos pelas raízes da planta. Como a bactéria vive às expensas dos exudatos, sem causar danos à planta, o termo "residente" para a bactéria, aplica-se muito bem para este caso. Como contribuição a "Campanha Nacional de Erradicação do Cancro Citrico" propõe também a obrigatoriedade da eliminação do "capim colonião" pela sua capacidade de albergar o patógeno responsável pelo "canco cítrico".

* PORTO, O. DE M. Possibilidades de ocorrencias de canco cítrico no Rio Grande do Sul. In Instituto de Pesquisas Agronômicas, Porto Alegre, R.S. Fruticultura no Rio Grande do Sul. Contribuição da pesquisa. Brasil. Instituto de Pesquisas Agronômicas. Boletím Técnico, no. 2. 1978. pp. 35-37. (82

* PRASAD, M. V. R., MOSES, G. J. y REDDY, G. S. Variability in *Xanthomonas citri*, the incitant of citrus canker. Indian Phytopathology 31(2):227-229. 1978. (83

The results are presented of inoculation tests with 19 isolates of *X. citri* on 30 species and varieties in the Rutaceae. (Review of Plant Pathology 59:1260)

* PRATT, R. M. Guía de Florida sobre insectos, enfermedades y trastornos de la nutrición en los frutos cítricos en color. México, Centro Regional de Ayuda Técnica para el Desarrollo Internacional, 1970. 198 p. (84

Cáncer de los cítricos, pp. 192-193.

El autor hace una descripción de la sintomatología de la enfermedad, su llegada a Florida, Estados Unidos, y la forma en que se erradicó. (CV)

RAJ, S. A., RAMADOSS, N. y AHMED, N. J. Reaction of citrus varieties to canker infection and leaf miner attack. Annamalai University Agricultural Research Annual 6:164-166. 1976. (85

No correlation was found between leaf miner infestation and susceptibility to canker (*Xanthomonas citri*) among 30 citrus varieties. (Review of Plant Pathology 57:4472)

RAM, G., NIRWAN, R. S. y SAXANA, M. L. Citrus canker and its control with fungicides. Punjab Horticultural Journal 12(4):240-243. 1972. (86

Citrus canker (*Xanthomonas citri*) was controlled by spraying at 10-day intervals from June to September with Blitox (copper oxychloride) + Tenac, each at 0.3%, or nickel chloride at 0.15%, after removing infected leaves and twigs. Nickel sulphate at 0.2% and sodium arsenite + copper sulphate, each at 0.1%, were also effective. (Horticultural Abstracts 44:3487)

* RAY, S. y ADDY, S. K. Residue levels of dodine in relation to canker development in citrus trees. Indian Phytopathology 29(3):246-250. 1976. (87

Sensitivity of dodine (n-dodecyl guanidine acetate) *in vitro* to *Xanthomonas citri* a member of *X. campestris* group, indicated that a concentration of 12 µg/ml was bactericidal. Periodical estimation of the levels of dodine residues over foliar surfaces and observations on the incidence of the disease corresponding to the dates of residue analysis were made. Residue of the order of 0.94 µg/cm^2 on leaf surface after weathering was considered as critical threshold for effective protection of the plants from disease development. Weather, particularly rainfall was found important.

RODRIGUEZ PUJOL, A. y TIMMER, L. Observaciones y trabajos relacionados con cancrosis de los citrus en Argentina. Concordia, Argentina. Instituto Nacional de Tecnología Agropecuaria. Serie Notas Técnicas, no. 3. 1969. s.p. (88

SAKURAI, H. y SHIMADA, T. Studies on the antimicrobial effects of actinomycin-C group antibiotics on phytopathogenic micro-organisms. Bulletin of the Agricultural Chemicals Inspection Station, no. 11:122-126. 1971. (89

A freshly isolated soil *Streptomyces* sp. produced 2 actinomycin-C fractions. Both, especially the first, were effective at 20 p.p.m. against *Pythium aphanidermatum* on kidney beans and both, especially the second, controlled citrus canker (*Xanthomonas citri*). Both were phytotoxic to bean primary leaves but not to citrus leaves. (Horticultural Abstracts 43:4475)

* SANTOS, C. A. L. DOS y LEIDERMAN, L. Erradicação de plantas cítricas com herbicidas. Biológico (Brasil) 43(3/4):91-92. 1977. (90

En 1975 el Instituto Biológico de Brasil, instaló campos experimentales en Limeira y Bebedouro, Sao Paulo, para el estudio de la erradicación y eliminación de cáncer de los cítricos, con un método nuevo. Los ensayos realizados consistieron en la aplicación, a las plantas enfermas, en pie, sin cortarlas, de herbicidas pulverizados alrededor del tronco a 50 cm de altura del suelo. Los herbicidas utilizados, diluídos en aceite, diesel o agua, fueron los siguientes: 2,4,5-T (Tributon 720); Dicamba + 2,4,5-T (Banvel 450); Picloram + 2,4,5-T (Tordon 155) y Picloram + 2,4-D (Tordon 101). A través de los datos obtenidos durante un año, los tratamientos que mejores resultados presentan son Tributon 720 y Tordon 155 al 4%, diluídos en aceite diesel. (CV)

SERIZAWA, S., INOUE, K. y GOTO, M. Studies on citrus canker. I. Dispersal of the citrus canker organism. Bulletin of the Shizuoka Prefectural Citrus Experiment Station, no. 8:81-85. 1969. (91

In conditions of heavy rain and high wind *Xanthomonas citri* originating from a heavily-diseased orange seedling attacked other seedlings up to 5-7 m distant. This distance was the extent of the experimental plot, and the infection is assumed to be capable of spreading further. The disease usually developed on wounds or injuries caused by citrus lead miner (*Phyllocnistis citrella*) on summer or autumn shoots. In indoor experiments the causal agent was shown to come from wet lesions and to be dispersed by wind. (Horticultural Abstracts 40:7192)

_____ e INOUE, K. Studies on citrus canker. III. The influence of wind on infection. Bulletin of the Shizuoka Prefectural Citrus Experiment Station, no. 11:54-67. 1974. (92

_____. Aspects on citrus canker (*Xanthomonas citri*) control. Shokubutsu Boek 29(1):20-26. 1975. (93

_____. Use of copper fungicides against citrus canker (*Xanthomonas citri*). Shokubutsu Boeki 30(7):280-286. 1976. (94

_____ e INOUE, K. Studies on citrus canker. IV. Influences of rainfall on the residual effectiveness of Bordeaux mixture and inorganic copper. Bulletin of the Shizuoka Prefectural Citrus Experiment Station, no. 14:13-28. 1978. (95

When Bordeaux mixture was sprayed on *Citrus natsudaidai* the amount of rainfall and the number of days after application that rain fell influenced the duration of effectiveness. The formation of water-soluble Cu rapidly increased after 30-40 days, so rainfall after this period greatly reduced the effectiveness of the spray. The bactericidal activity against *Xanthomonas citri* of 2-6-1 Bordeaux mixture was slightly weaker than that of the 2-2-1 mixture but the residual effectiveness was longer. The Cu concentration within the leaves was not correlated with the control. When calcium carbonate was added to the wettable powder of cupric hydroxide the bactericidal effect was less than when cupric hydroxide was used alone but the residual effectiveness was longer. (Horticultural Abstracts 49: 5331)

SHAHARE, K. C. Streptocycline' against citrus canker disease. Plant Protection Bulletin 22(3):38-39. 1970. (96

SINDHA MATHAR, A. et al. Efficacy of different fungicides and antibiotics on the control of citrus canker caused by *Xanthomonas citri* (Hasse) Dowson. Madras Agricultural Journal 60(7):626. 1973. (97

Bordeaux mixture (1%), copper oxychloride (0.25%), streptocycline (0.0025%) and streptomycin (200 ppm) all controlled citrus canker. (Abstracts on Tropical Agriculture 1:7500836)

SINGH, K. P., KALEEM, M. y EDWARD, J. C. Changes in the free amino acids of citrus leaves in relation to citrus greening and citrus canker. Current Science 45(13):502-503. 1976. (98

Data are presented on the amino acid composition of citrus leaves affected by greening virus disease or by bacterial canker /*Xanthomonas citri*/, compared with that of healthy leaves. Diseased leaves usually had lower amino acid contents than healthy leaves. (Horticultural Abstracts 47:5990)

SINHA, M. K. y UPPAL, D. K. Indexing of citrus germplasm against diseases. I. Canker (*Xanthomonas citri* (Hasse) Dowson). Madras Agricultural Journal 58(11):851-853. 1971. (99

Sixty-five species/varieties are grouped into five categories on the basis of their resistance or susceptibility to *X. citri*. (Horticultural Abstracts 43:8059)

_____, BATRA, R. C. y UPPAL, D. K. Role of citrus leaf-miner (*Phyllocnistis citrella* Staintan), on the prevalence and severity of citrus canker (*Xanthomonas citri* (Hasse) Dowson). Madras Agricultural Journal 59(4):240-245. 1972. (100

In a survey of 35 citrus species and varieties the prevalence and severity of canker was greatly increased where there were injuries caused by *P. citrella*. (Horticultural Abstracts 43: 5562)

* STALL, R. E., ECHENIQUE, B. I. C. DE y MARCO, G. M. Timing of sprays for control of citrus cancrosis. Fitopatología (Perú) 15(1):55. 1980. (101

Resúmenes de los trabajos presentados en el Congreso Latinoamericano de Fitopatología, 1°., Maracaibo, 1979.

Copper was sprayed on orange and grapefruit trees in Corrientes, Argentina to determine an optimum time of application for control of cancrosis caused by *Xanthomonas citri* (Hasse) Dowson. Trees were sprayed periodically during development of new flushes of growth, i.e. at initiation of shoot growth and at 14, 28 and 42 days later. Application of copper at 14 days after initiation of new growth gave best control on both orange and grapefruit. Most infection of leaves occurred between 14 and 28 days after initiation of shoot development.

TANAKA, S. Fruit tree diseases in the Northern Pacific Basin with special reference to the striking contrast between East and West. Bulletin of the Faculty of Agriculture, Tamagawa University 9:55-59. 1969. (102

The main fruit tree diseases of Japan are compared with those of the west coast of North America. Rain-and air-borne diseases are far more prevalent in Japan than in South California where citrus scab (*Elsinoë fawcettii*) and canker (*Xanthomonas citri*) are absent, whereas soil-borne and virus diseases cause more damage in the west coast of North America than in Japan. This is possibly due to the wetter climate in Japan, where irrigation is unnecessary. (Review of Plant Pathology 49:2804)

VIBHUTE, Y. B. y WADJE, S. S. Antimicrobial activity of some halogenoflavones and flavanones. Hindustan Antibiotics Bulletin 18(1/2):42-44. 1975. (103

The antimicrobial activities of 7 flavones and 6 flavanones were tested against *Xanthomonas malvacearum* from cotton, *X. citri* from citrus, *Curvularia lunata* /*Cochliobolus lunatus*/ from cotton and *Helminthosporium turcicum* /*Setosphaeria turcica*/ from sorghum. Spore germination of *C. lunatus* was partly or completely inhibited by all compounds tested and that of *S. turcica* was completely inhibited by 1 each of the flavones and flavanones. In general, flavones were more effective than flavanones against fungi and bacteria. Some of the flavones were more inhibitory to bacteria than was agrimycin-100. (Review of Plant Pathology 56:3409)

* VIDHYASEKARAN, P. y DURAIRAJ, P. Quality of the citrus fruits infected by *Xanthomonas citri*. Indian Phytopathology 24(4):781-782. 1971. (104

Infection of lime (*Citrus aurantifolia*) resulted in a reduction of juice content and of sugars. There was an increase in citric acid and a decrease in ascorbic acid. Severly infected fruits showed a high phenolic content. (Review of Plant Pathology 52:2276)

WAKIMOTO, S. Some characteristics of citrus canker bacteria, *Xanthomonas citri* (Hasse) Dowson, and the related phages isolated from Japan. Annals of the Phytopathological Society of Japan 33(5):301-310. 1967. (105

In further studies 41 isolates of *X. citri* formed three groups on the basis of phage sensitivity. Lysotype A was sensitive to phage CP_1 but not CP_2, B to CP_2 but not CP_1, and C was resistant to both phages. Lysotypes A and B are widely distributed. The virulent phage CP_1, which has a mutant, CP_{1a}, is the most common in Japan, and has a spherical head 68 mμ diam. with a tail 160x 15 mμ. Phage CP_2 has a polyhedral head, 70 mμ, and no visible tail. Both phages are inactivated at 55°C after 10 minutes. No differences in pathogenicity were observed among the *X. citri* isolates. (Review of Plant Pathology 47:1887)

WU, W. C. Phage-induced alterations of cell disposition, phage adsorption and sensitivity, and virulence in *Xanthomonas citri*. Annals of the Phytopathological Society of Japan 38(4):333-341. 1972. (106

When the temperature phage PX67 lysogenized the smooth str. XCJ19 of *X. citri*, the colony type was altered from smooth to dwarf, while reversion occurred in the lysogenic dwarf colonies back to smooth colonies. Some of the reverted clones were lysogenic and others non-lysogenic, either resistant or sensitive to phage PX67. It was suggested that the receptor sites of PX67 were the same as those for the virulent phage CP_2. The lysogenic dwarf convertant liberated phage PX67 at a greater frequency than its lysogenic smooth revertant, and did not grow sufficiently to develop canker lesions in the host. (Review of Plant Pathology 52:2140)

WU, W. C. Phage-induced alteration of colony type in *Xanthomonas citri*. Annals of the Phytopathological Society of Japan 38(2):146-155. 1972. (107

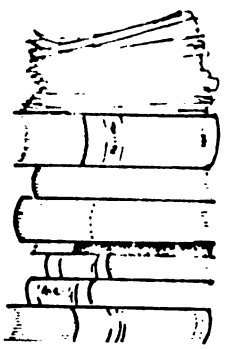
When *X. citri* XCJ19 was infected with temperature phage PXC8 its smooth colony cells altered and produced dwarf colonies which were lysogenic. After incubation (72 h in nutrient broth) the dwarf type reverted (in 0.1-6% of its cells) to produce smooth colonies, among which 60% were lysogenic, 25% resistant and 15% sensitive. The lysogenic dwarf convertants could not be recovered to produce smooth colonies by supplements of amino acids, vitamins or nucleic acid bases but they lysed and spontaneously liberated PXC7 at a considerably higher frequency, and decreased the growth rates and number of bacterial cells in the colonies, compared with lysogenic smooth revertants. This indicates that the lysogenic dwarf convertants had arisen from CXJ19 by the extraordinary high frequency of spontaneous induction of the phage after lysogenation. Although resembling the smooth strain in most tests, the convertants showed changes in cell disposition and response to virulent phage CP_1. (Review of Plant Pathology 52:579)

* ZUBRZYCKI, H. M. y DIAMANTE DE ZUBRZYCKI, A. Evaluación y análisis de la resistencia a *Xanthomonas citri* (Hasse) Dowson en cultivares de naranja (*Citrus sinensis* L. Osb.), limón (*C. limón* L. Burm) y pomelo (*C. paradasi* Macf.). Fitopatología (Perú) 15(1):32-33. 1980. (108

Resúmenes de los trabajos presentados en el Congreso Latinoamericano de Fitopatología, 1°., Maracaibo, 1979.

El objetivo del trabajo fue evaluar la resistencia a *Xanthomonas citri* (Hasse) Dowson, en diferentes cultivares de naranja (*C. sinensis* L. Osb.), limón (*C. limón* L. Burm) y pomelo (*C. paradasi* Macf.), y analizar la expresión de la resistencia bajo aspectos cualicuantitativos. Se evaluaron infecciones naturales en hojas de plantas adultas durante tres años, en 39 cultivares de naranja, 5 de limón y 11 de pomelo. Se determinó infección mediante presencia (P) e intensidad de daño (ID), sobre cinco plantas de cada cultivar. Se observó que la infección en cada una de las cuatro brotaciones anuales está condicionada por factores ambientales durante el período de crecimiento y susceptibilidad de las hojas. Se comprobó que la segunda brotación (octubre-noviembre) y tercera (enero-febrero) se infectan más que la de julio-agosto (primera) y abril-mayo (cuarta), siendo la infección en la tercera mayor que en la segunda. Se determinó que la evaluación de infección en estas dos brotaciones, permiten una eficiente estimación de la resistencia de cada cultivar. De acuerdo a valores de ID, se determinó que los cultivares de naranjas precoces, intermedias y tardías pertenecen a una misma población respecto a resistencia a *Xanthomonas citri*. Los pomelos fueron significativamente más susceptibles que naranjas y limoneros, no existiendo diferencias entre los dos últimos. Se hallaron diferencia de resistencia dentro de clones de naranja Pera y Valencia Late. La variabilidad disponible para el caracter de resistencia o susceptibilidad a *Xanthomonas citri*, fue mayor en naranja que en pomelos. En una planta cítrica existen hojas con diferentes tamaños, pero no se halló correlación entre superficie de hoja y número de pústulas o grado de

infección (ID). Se comprobó que a mayor resistencia del huésped correspondió área afectada y número de pústulas para provocar abscisión de hoja. De acuerdo a la gradación contínua de infección que presentaron los cultivares de naranja, se presume que en esta especie, la resistencia a *Xanthomonas citri* es del tipo "no específico".



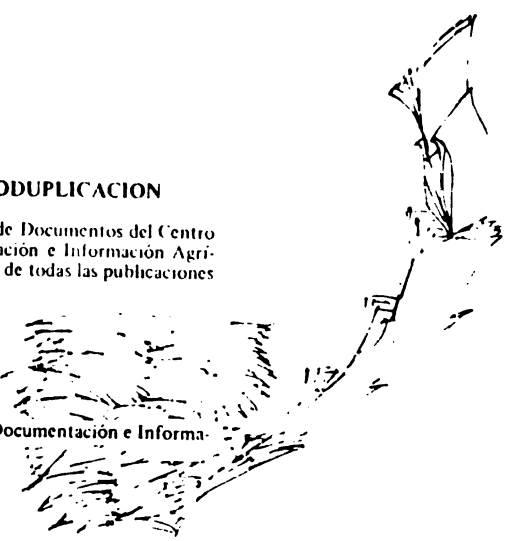
SERVICIO DE FOTODUPLICACION

El Servicio de Reproducción de Documentos del Centro Interamericano de Documentación e Información Agrícola suministra copias en IBM de todas las publicaciones existentes en su colección.

Precio: US$ 0,20 por hoja.

Para pedidos dirigirse a:

CIDIA
Centro Interamericano de Documentación e Información Agrícola
Turrialba, Costa Rica



INDICE DE AUTORES

INDICE DE AUTORES

INDICE DE AUTORES

INDICE DE MATERIAS

INDICE DE MATERIAS

INDICE DE MATERIA

Distribución de la enfermedad y las pérdidas

Etiología

2 Electron microscopy of *Xanthomonas citri* phages CP_1 and CP_2 infection
3 Cancrosis de los cítricos
4 Cancrosis de los cítricos
5 Estudo do relacionamento sorológico de *Xanthomonas citri* (Hasse) Dowson aos níveis genérico e interespecífico
6 Estudos sorológicos de patotipos de *Xanthomonas citri* (Hasse) Dowson
12 Studies on citrus canker in Rajasthan. I. Disease incidence and survival of the pathogen
16 Ways to control citrus diseases
20 Variabilidad de *Xanthomonas citri* (Hasse) Dow. en aislamientos de distinta procedencia
22 La variabilidad de *Xanthomonas citri* (Hasse) Dow. en el litoral Argentino
25 Studies on citrus canker in Japan
26 Studies on citrus canker disease. II. Leaf infiltration technique for the detection of *Xanthomonas citri* (Hasse) Dowson, with special reference to the comparison with the phage method
27 Interaction between *Xanthomonas citri* and some saprophytic bacteria
28 Lysogenization of *Xanthomonas phaseoli* and *X. begoniae* by temperate *X. citri* bacteriophages; effects on virulence, phage sensitivity, and other biological properties
29 Phage-host relationships of *Xanthomonas citri* compared with those of other Xanthomonads
30 Survival of *Xanthomonas citri* in the bark tissues of citrus trees
31 Studies on saprophytic survival of *Xanthomonas citri* (Hasse) Dowson. I. Detection of the bacterium from a grass (*Zoysia japonica*)
32 Studies on saprophytic survival of *Xanthomonas citri* (Hasse) Dowson. II. Longevity and survival density of the bacterium on artificially infested weeds, plant residues and soils
33 Selective population changes of *Xanthomonas citri* (Hasse) Dowson in diseased tissues
34 Studies on saprophytic survival of *Xanthomonas citri* (Hasse) Dowson. III. Inoculum density of the bacterium survival in the saprophytic form
37 Studies on occurrence of pathotypes in *X. citri* (Hasse) Dowson
38 Ultrastructural studies on Taiwan citrus canker disease
41 Strain studies in *Xanthomonas citri* (Hasse) Dowson
42 Citrus canker in Haryana
45 Citrus diseases - a bibliography
46 Ecological studies on citrus canker caused by *Xanthomonas citri*. II. Factors influencing multiplication of CP_1 phages; III. Seasonal changes in number of causal bacteria and its bacteriophages CP_1 in rain water flowing down from the diseased trees
47 Studies on citrus canker symptoms on satsuma fruit and the occurrence of the causal bacteria in the affected tissues
49 Studies on the symptoms of citrus canker formed on Satsuma mandarin fruit, and existence of causal bacteria in the affected tissues
50 Overwintering of *Xanthomonas citri* (Hasse) Dowson, the causal bacteria of citrus canker. III. Multiplication of the bacteria in the over-wintered lesions
51 Behavior of *Xanthomonas citri* (Hasse) Dowson in the infection process. I. Multiplication of the bacteria and histological changes following needle-prick inoculation

52 Behavior of *Xanthomonas citri* (Hasse) Dowson in the infection process. II. Multiplication of the bacteria and histological changes of the host plant following rubber-block press or infiltration inoculation

54 Behaviour of *Xanthomonas citri* (Hasse) Dowson and histological changes of diseased tissues in the process of lesion extension

55 Factors related to the occurrence of spring canker caused by *Xanthomonas citri*

60 Los métodos serológicos en el estudio de la bacteria que produce la "cancrosis cítrica" en la Argentina. I. Hallazgo de un nuevo serotipo: metodología empleada en el estudio completo

61 Los métodos serológicos en el estudio de la bacteria que produce la "cancrosis cítrica" en la Argentina. II. Primera comprobación experimental del medio de distribución ecológica

63 Reactions of citrus varieties and species to isolates of *Xanthomonas citri* (Hasse) Dowson

65 Comparative serological studies between *Xanthomonas citri* and a bacterium causing canker on Mexican lime

66 Estudos comparativos entre *Xanthomonas citri* (Hasse) Dowson, agente causal do "canco cítrico" e *Xanthomonas citri* (Hasse) Dow., n.f. s.p. *aurantifolia* agente causal da cancrose do limoeiro galego

67 Studies on the detection of *Xanthomonas citri* by phage technique and the surface sterilization of Unshu orange for export to the United States

68 Distribution of *Xanthomonas citri* strain in relation to the sensitivity to phages CP_1 and CP_2

70 On the pathogenicity of *Pseudomonas* sp., an isolate antagonistic to *Xanthomonas citri*

71 Preservação da bactéria *Xanthomonas citri* (Hasse) Dowson emulsionada com adjuvante de Freund

72 Inoculation of *Xanthomonas citri* (Hasse) Dowson by a simplified injection method into leaf tissue

80 Sobrevivência de *Xanthomonas citri* (Hasse) Dowson em capim amargoso (*Trichachne insularis* (L.) Nees) de pomares erradicados, no Estado de São Paulo

81 A sobrevivência de *Xanthomonas citri* (Hasse) Dowson, agente causal do "canco cítrico" na rizosfera de capim colonião (*Panicum maximum* Jacq.)

83 Variability in *Xanthomonas citri*, the incitant of citrus canker

84 Guía de Florida sobre insectos, enfermedades y trastornos de la nutrición en los frutos cítricos en color

91 Studies on citrus canker. I. Dispersal of the citrus canker organism

92 Studies on citrus canker. III. The influence of wind on infection

93 Aspects on citrus canker (*Xanthomonas citri*) control

100 Role of citrus leaf-miner (*Phyllocnistis citrella* Staintan), on the prevalence and severity of citrus canker (*Xanthomonas citri* (Hasse) Dowson

102 Fruit tree diseases in the Northern Pacific Basin with special reference to the striking contrast between East and West

105 Some characteristics of citrus canker bacteria, *Xanthomonas citri* (Hasse) Dowson, and the related phages isolated from Japan

106 Phage-induced alterations of cell disposition, phage adsorption and sensitivity, and virulence in *Xanthomonas citri*

107 Phage-induced alteration of colony type in *Xanthomonas citri*

Citología e histología

38 Ultrastructural studies on Taiwan citrus canker disease
51 Behavior of *Xanthomonas citri* (Hasse) Dowson in the infection process. I. Multiplication of the bacteria and histological changes following needle-prick inoculation
52 Behavior of *Xanthomonas citri* (Hasse) Dowson in the infection process. II. Multiplication of the bacteria and histological changes of the host plant following rubber-block press or infiltration inoculation
54 Behaviour of *Xanthomonas citri* (Hasse) Dowson and histological changes of diseased tissues in the process of lesion extension
107 Phage-induced alteration of colony type in *Xanthomonas citri*

Fisiología y bioquímica

3 Cancrosis de los cítricos
5 Estudo do relacionamento sorológico de *Xanthomonas citri* (Hasse) Dowson aos níveis genérico e interespecífico
6 Estudos sorológicos de patotipos de *Xanthomonas citri* (Hasse) Dowson
7 Serological studies of *Xanthomonas citri* (Hasse) Dowson
9 Effect of quinone-amino acid interaction on growth and plygalacturonase activity of *Xanthomonas citri*
17 Diferencias fisiológicas y estructurales en hojas de cultivares cítricos con diferentes susceptibilidad a *Xanthomonas citri* (Hasse) Dowson
20 Variabilidad de *Xanthomonas citri* (Hasse) Dow. en aislamientos de distinta procedencia
21 Relación entre el desarrollo del tejido foliar cítrico y la predisposición a *Xanthomonas citri* (Hasse) Dow.
25 Studies on citrus canker in Japan
38 Ultrastructural studies on Taiwan citrus canker disease
39 An erythromycinlike antibiotic produced by *Streptomyces griseoplanus*
41 Strain studies in *Xanthomonas citri* (Hasse) Dowson
43 Resistance of citrus to citrus canker caused by *Xanthomonas citri* (Hasse) Dowson: analysis of amino acids
44 Resistance of citrus to citrus canker caused by *Xanthomonas citri*: analysis of phenols and sugars
48 Studies on drug resistance of *Xanthomonas citri* (Hasse) Dowson
58 An antibacterial substance produced by *Xanthomonas citri*
62 Sensitivity of two plant pathogenic bacteria to some inorganic and organic compounds
73 Changes in photosynthesis and carbohydrate content in canker and halo regions in *Xanthomonas citri* infected citrus leaves
74 Mineral composition of canker, halo and green regions of citrus leaves infected by *Xanthomonas citri*
75 Nitrogen consituents of canker and halo regions in citrus leaves infected by *Xanthomonas citri*
76 Accumulation of malic acid in halo region of citrus leaves infected by *Xanthomonas citri*
77 Physiology of citrus leaves infected by *Xanthomonas citri* (Hasse) Dowson with special reference to halo formation: respiration and oxidative enzymes
87 Residue levels of dodine in relation to canker development in citrus trees

89 Studies on the antimicrobial effects of actinomycin-C group antibiotics on phytopathogenic micro-organisms
98 Changes in the free amino acids of citrus leaves in relation to citrus greening and citrus canker
103 Antimicrobial activity of some halogenoflavones and flavanones

Epidemiología

4 Cancrosis de los cítricos
10 Citrus rootstocks from the Papeda group
14 Prospects of seedless lemon under sub-tropical conditions of Aurangabad
18 Cancrosis bacteriana en limoneros. Resultados de las primeras observaciones realizadas en la zona de Bella Vista (Provincia de Corrientes)
20 Variabilidad de *Xanthomonas citri* (Hasse) Dow. en aislamientos de distinta procedencia
21 Relación entre el desarrollo del tejido foliar cítrico y la predisposición a *Xanthomonas citri* (Hasse) Dow.
24 Introduction and spread of agricultural pests in Latin America: analysis and prospects
25 Studies on citrus canker in Japan
28 Lysogenization of *Xanthomonas phaseoli* and *X. begoniae* by temperate *X. citri* bacteriophages; effects on virulence, phage sensitivity, and other biological properties
46 Ecological studies on citrus canker caused by *Xanthomonas citri*. II. Factors influencing multiplication of CP_1 phages; III. Seasonal changes in number of causal bacteria and its bacteriophages CP_1 in rain water flowing down from the diseased trees
50 Overwintering of *Xanthomonas citri* (Hasse) Dowson, the causal bacteria of citrus canker. III. Multiplication of the bacteria in the over-wintered lesions
51 Behavior of *Xanthomonas citri* (Hasse) Dowson in the infection process. I. Multiplication of the bacteria and histological changes following needle-prick inoculation
52 Behavior of *Xanthomonas citri* (Hasse) Dowson in the infection process. II. Multiplication of the bacteria and histological changes of the host plant following rubber-block press or infiltration inoculation
53 The incubation period of citrus canker in relation to temperature
55 Factors related to the occurrence of spring canker caused by *Xanthomonas citri*
69 Influence of amount of nitrogen and phosphorus fertilization on the occurrence of citrus canker
87 Residue levels of dodine in relation to canker development in citrus trees
91 Studies on citrus canker. I. Dispersal of the citrus canker organism
92 Studies on citrus canker. III. The influence of wind on infection
102 Fruit tree diseases in the Northern Pacific Basin with special reference to the striking contrast between East and West

Resistencia

10 Citrus rootstocks from the Papeda group
14 Prospects of seedles lemon under sub-tropical conditions of Aurangabad
15 Incidence of citrus canker on field grown nucellar and budded citrus plants
17 Diferencias fisiológicas y estructurales en hojas de cultivares cítricos con diferentes susceptibilidad a *Xanthomonas citri* (Hasse) Dowson
20 Variabilidad de *Xanthomonas citri* (Hasse) Dow. en aislamientos de distinta procedencia
21 Relación entre el desarrollo del tejido foliar cítrico y la predisposición a *Xanthomonas citri* (Hasse) Dow.
22 La variabilidad de *Xanthomonas citri* (Hasse) Dow. en el litoral Argentino
42 Citrus canker in Haryana
43 Resistance of citrus to citrus canker caused by *Xanthomonas citri* (Hasse) Dowson: analysis of amino acids
44 Resistance of citrus to citrus canker caused by *Xanthomonas citri*: analysis of phenols and sugars
59 Differential reactions of citrus species to diseases and pests at Koronivia
63 Reactions of citrus varieties and species to isolates of *Xanthomonas citri* (Hasse) Dowson
83 Variability of *Xanthomonas citri*, the incitant of citrus canker
85 Reaction of citrus varieties to canker infection and leaf miner attack
99 Indexing of citrus germplasm against diseases. I. Canker (*Xanthomonas citri* (Hasse) Dowson)
108 Evaluación y análisis de la resistencia a *Xanthomonas citri* (Hasse) Dowson en cultivares de naranja (*Citrus sinensis* L. Osb.), limón (*C. limon* L. Burm) y pomelo (*C. paradasi* Macf.)

Combate de la enfermedad

1 Pruebas *in vitro* e *in vivo* de antibióticos, para el control de la cancrosis cítrica y la podredumbre negra de las crucíferas
8 Thiram, a fungicide effective against *Xanthomonas citri* (Hasse) Dowson
11 Pragas e doenças de citrinos e tratamentos recommendados em Sofala e Tete
12 Studies on citrus canker in Rajasthan. I. Disease incidence and survival of the pathogen
13 Studies on citrus canker in Rajasthan. III. Control of citrus canker by antibiotics and chemicals
16 Ways to control citrus diseases
19 Ensayo comparativo de productos terapéuticos para el control de la "cancrosis del limonero" (*Xanthomonas citri* (Hasse) Dow. en Bella Vista (Corrientes)
23 Citrus canker control with fungicides and antibiotics
25 Studies on citrus canker in Japan
35 Annual report of research 1974-75
39 An erythromycinlike antibiotic produced by *Streptomyces griseoplanus*
40 Citrus canker and its control
48 Studies on drug resistance of *Xanthomonas citri* (Hasse) Dowson

56 Present epidemic status and control of the citrus canker disease (*Xanthomonas citri* (Hasse) Dowson) in Japan

57 Efficacy of different fungicides and antibiotics in the control of citrus canker caused by *Xanthomonas citri* (Hasse) Dowson

64 Canco cítrico - ameaça a citricultura brasileira

67 Studies on the detection of *Xanthomonas citri* by phage technique and the surface sterilization of Unshu orange for export to the United States

78 Survey on the citrus pest control status in Korea

79 Control of citrus canker

80 Sobrevivência de *Xanthomonas citri* (Hasse) Dowson em capim amargoso (*Trichachne insularis* (L.) Nees) de pomares erradicados, no Estado de São Paulo

81 A sobrevivência de *Xanthomonas citri* (Hasse) Dowson, agente causal do "canco cítrico" na rizosfera de capim colonião (*Panicum maximum* Jacq.)

84 Guía de Florida sobre insectos, enfermedades y trastornos de la nutrición en los frutos cítricos en color

86 Citrus canker and its control with fungicides

89 Studies on the antimicrobial effects of actinomycin-C group antibiotics on phytopathogenic micro-organisms

90 Erradicação de plantas cítricas com herbicidas

94 Use of copper fungicides against citrus canker (*Xanthomonas citri*)

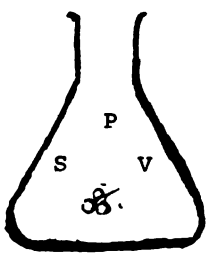
95 Studies on citrus canker. IV. Influences of rainfall on the residual effectiveness of Bordeaux mixture and inorganic copper

96 Streptocycline' against citrus canker disease

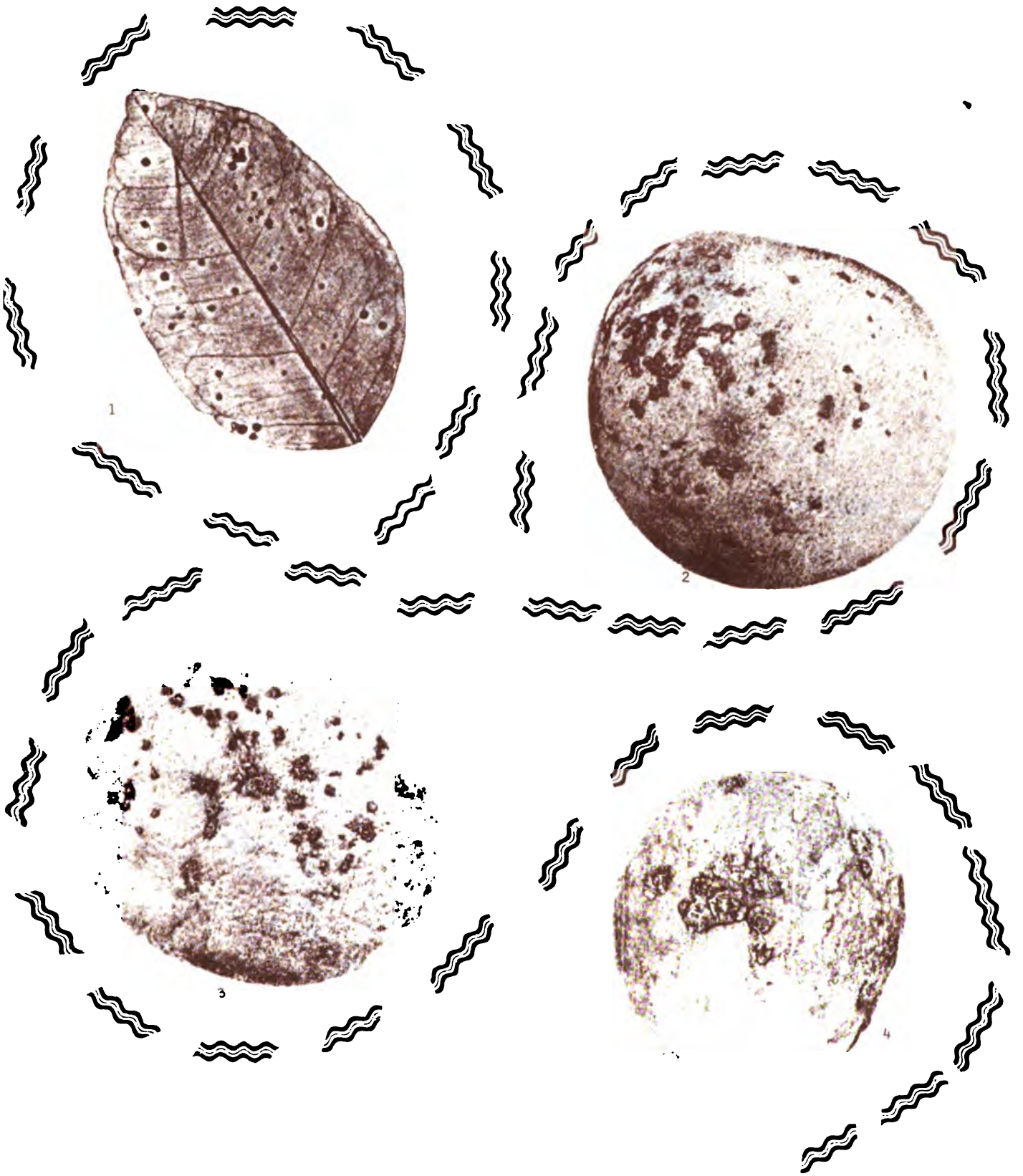
97 Efficacy of different fungicides and antibiotics on the control of citrus canker caused by *Xanthomonas citri* (Hasse) Dowson

101 Timing of sprays for control of citrus cancrosis

103 Antimicrobial activity of some halogenoflavones and flavanones



LESIONES PRODUCIDAS POR *XANTHOMONAS CITRI*

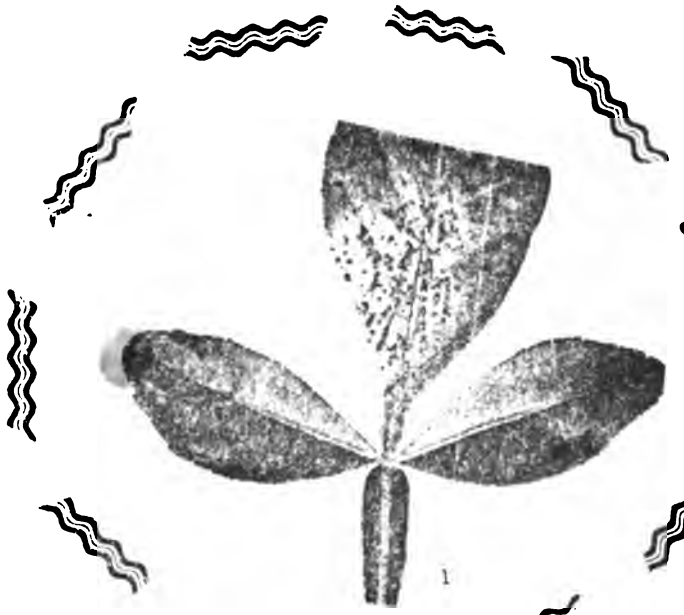


1. Lesiones en hoja de pomelo. Naturalmente infectada.
2. Lesiones en pomelo. Naturalmente infectado.
3. Lesiones en limón. Naturalmente infectado.
4. Lesiones en naranja. Naturalmente infectada.

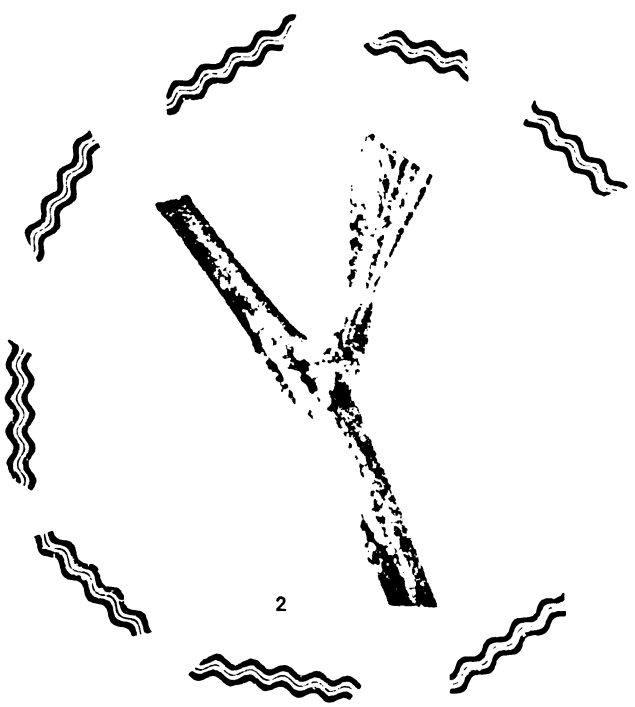
Fotocopias tomadas del documento correspondiente a la referencia número 4.

LESIONES PRODUCIDAS POR *XANTHOMONAS CITRI*

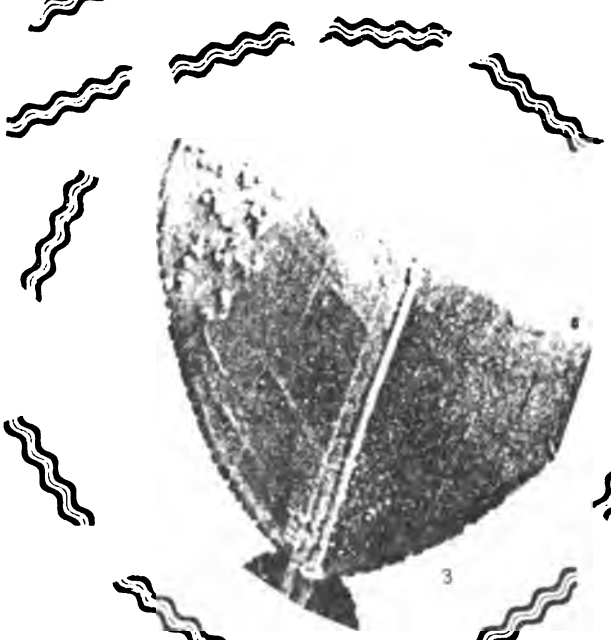
MATERIAL INOCULADO



1



2



3

1. Hojas inoculadas con cepas aisladas de naranjo
2. Ramita de pomelo inoculada con cepas aisladas de naranjo
3. Hoja de pomelo inoculada con cepas aisladas de limón

30. Indice Latinoamericano de Tesis Agrícolas. Suplemento no. 1, 1968-1972. 1974.

31. Bibliografía peruana de pastos y forrajes. 1974.

32. Bibliografías agrícolas de América Central: EL SALVADOR. 1974.

33. Ecología del trópico americano. 1974.

34. Bibliografías agrícolas de América Central: HONDURAS. 1974.

35. Bibliografía selectiva sobre reforma agraria en América Latina 1964-1972. 1974.

36. Manual para Descripción Bibliográfica. Trad. y adapt. del Manual de AGRIS. 1974.

37. Categorías de Materias. Trad. de las Categorías de AGRIS. 1977.

38. Indice de mapas de América Latina y el Caribe existentes en el IICA-CIDIA. 1975.

39. Bibliografías agrícolas de América Central: GUATEMALA. 1975.

40. Bibliografía selectiva sobre derecho y reforma agraria en América Latina, 1972-1974. 1975.

41. La mujer en el medio rural; bibliografía. 1975.

42. Bibliografía colombiana de pastos y forrajes. 1975.

43. Bibliografía sobre silvicultura y ecología forestal tropical. 1975.

44. Silvicultura de bosques tropicales; bibliografía. 1975.

45. Bibliografía internacional sobre la quínua y cañahua. 1976.

46. Bibliografía sobre camélidos sudamericanos. 1976.

47. Bibliografía sobre bovinos criollos de Latinoamérica. 1976.

48. Manual de organización, planificación y operación de los Comités Nacionales de Coordinación (PIADIC). 1976.

49. AGRINTER: origen y evolución. Bibliografía anotada. 1976.

50. Bibliografía universitaria de la investigación agrícola en el Perú. 1976.

51. Directrices para la selección de documentos en los Sistemas AGRINTER y AGRIS. Rev. 1976.

52. Lista de publicaciones periódicas y seriadas. 1976.

53. Bibliografía sobre formas asociativas de producción en el agro. 1977.

54. Camote, maní y soya en América Latina 1970-1975; una bibliografía parcialmente anotada. 1977.

55. Bibliografía sobre aspectos sociales de la producción agropecuaria. 1977.

56. Bibliografía selectiva sobre recursos naturales de Colombia. 1977.

57. Bibliografía colombiana sobre desarrollo rural. 1977.

58. Bibliografía selectiva sobre comercialización agrícola. 1977.

59. Bibliografía sobre reforma agraria en América Latina 1974-1976. 1977.

60. Royas del cafeto (*Hemileia* spp.): bibliografía. 1977.

61. Banco de datos de bibliografías agrícolas de América Latina y el Caribe: Indice acumulativo. 1977.

62. Normas de enriquecimiento de títulos. 1978.

63. Vocabulario agrícola en español. 1978.

64. Bibliografía forestal del Perú. 1978.

65. La acción del IICA en el campo de las bibliotecas, documentación e información agrícolas: una síntesis. 1978.

66. Bibliografía sobre ciencias de la información (aportes del IICA). 1978.

67. Bibliografía sobre peste porcina africana. 1979.

68. Centro Interamericano de Documentación, Información y Comunicación Agrícola - CIDIA. 1978.

69. Bibliografía forestal de América tropical. 1979.

70. Bibliografía selectiva sobre desarrollo rural en Venezuela. 1979.

71. Moniliasis: bibliografía. 1979.

72. Bibliografía sobre sensores remotos. 1979.

73. ISIS: Manual para usuarios. 1979.

74. Bibliografía básica sobre desarrollo rural latinoamericano. 1979.

75. Bibliografía sobre desarrollo rural en Ecuador. 1979.

76. Manual para la preparación de perfiles de área para la formulación de alternativas de producción. 1979.

77. Sistema de Información para la Investigación Agropecuaria - SINIA. 1979.

78. Participación de la mujer en el desarrollo rural. 1980.

79. Bibliografía sobre fuentes alternativas de energía derivadas de productos agropecuarios/ forestales. 1980.

80. Bibliografía sobre colonización en América Latina. 1980.

81. Análisis sobre el desarrollo del Sistema Interamericano de Información Agrícola-AGRINTER. 1980.

82. Rural women: a Caribbean bibliography with special reference to Jamaica. 1980.

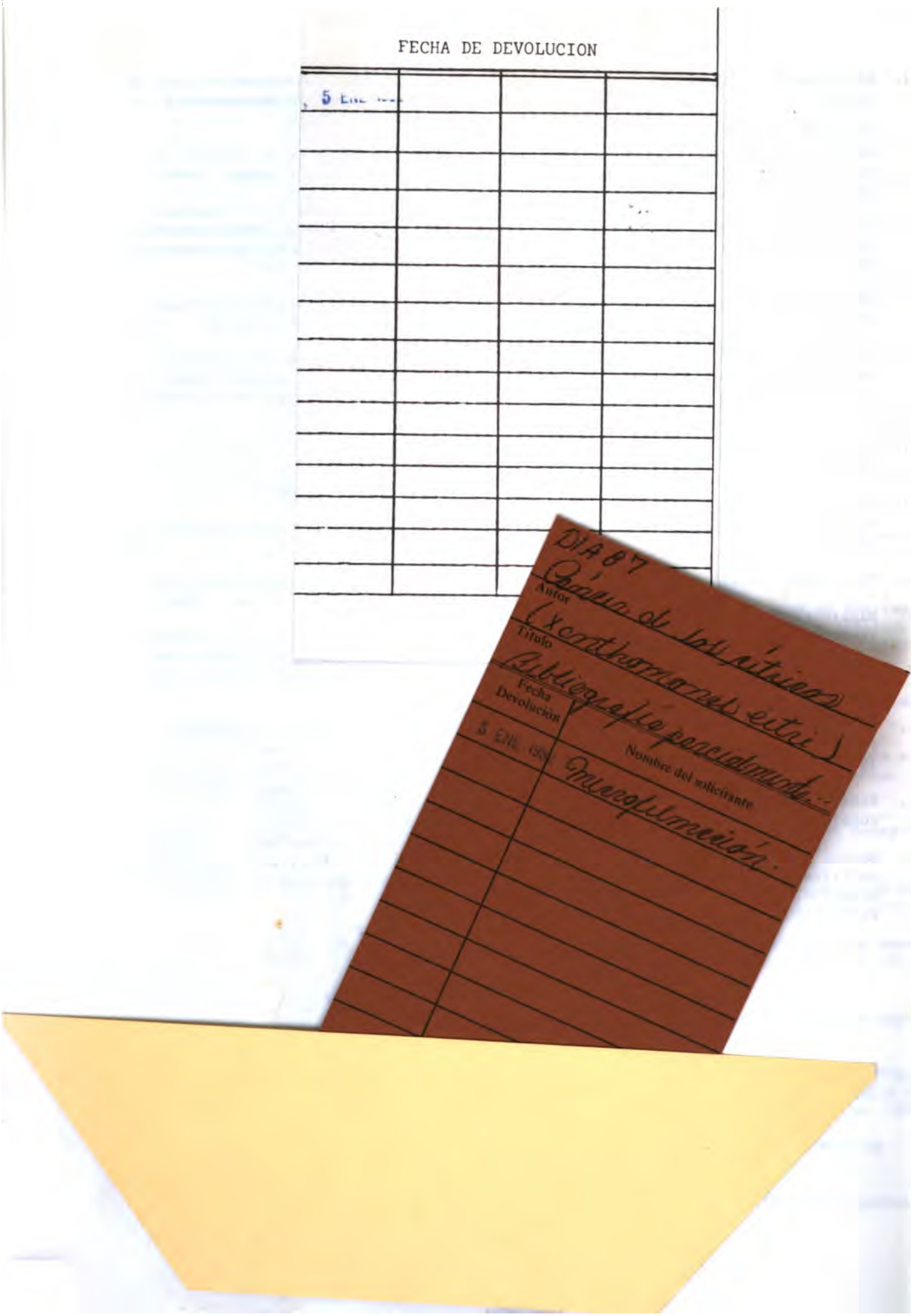
83. Bibliografía Agrícola de Costa Rica. 2 ed. rev. y act. 1980.

84. Documentos producidos por el Fondo Simón Bolívar. 1980.

85. Catálogo colectivo de publicaciones periódicas existentes en bibliotecas agrícolas del Uruguay. 1980.

86. Bibliography of literature related to research and development in the agricultural sector of Jamaica 1959-1979. 1980.

87. Cáncer de los cítricos (*Xanthomonas citri*); bibliografía parcialmente anotada. 1980.


FECHA DE DEVOLUCION
Autor
Título
Fecha Devolución
Nombre del solicitante

IICA

IMPRENTA IICA

DOCUMENTO
MICROFILMADO
Fecha: _____