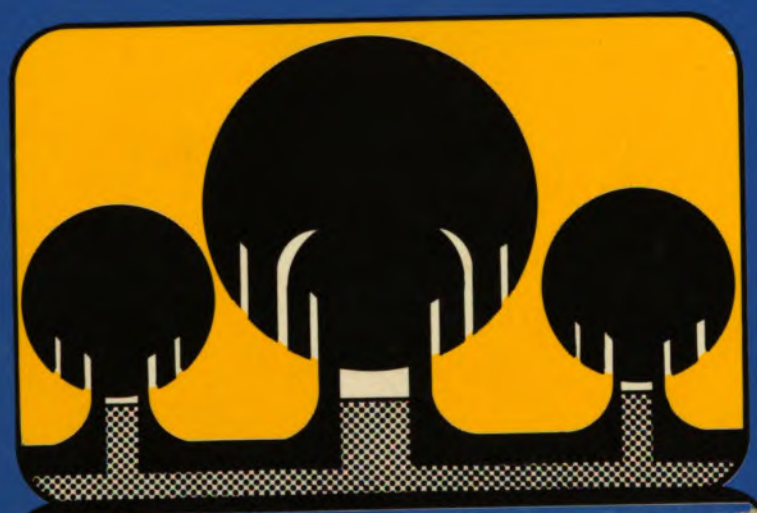
PROGRAMA SANIDAD VEGETAL



AMARILLAMIENTO LETAL DEL COCOTERO

Bibliografía parcialmente anotada

IICA

DOCUMENTACION E INFORMACION AGRICOLA No. 133 ISSN 0301-438x

AMARILLAMIENTO LETAL DEL COCOTERO

Bibliografía parcialmente anotada

Compilada por:

Ana María Arias de Guerrero
Alba Iris Calderón de Cerdas

Centro Interamericano de Documentación e Información Agrícola - CIDIA
Biblioteca Conmemorativa Orton
Turrialba, Costa Rica
1984

IICA
DIA-133 Arias de Guerrero, Ana María, comp.
Amarillamiento letal del cocotero : bibliografía parcialmente anotada / compilada por Ana María Arias de Guerrero y Alba Iris Calderón de Cerdas. -- Turrialba, C.R. : Centro Interamericano de Documentación e Información Agrícola, Biblioteca Conmemorativa Orton, 1984.
68 p. ; 28 cm. -- (Documentación e Información Agrícola / Instituto Interamericano de Cooperación para la Agricultura, ISSN 0301-438X ; no. 133)

1. Amarillamiento letal - Bibliografía
2. Cocotero - Enfermedades y plagas I. Calderón de Cerdas, Alba Iris, comp. II. IICA-CIDIA III. Título IV. Serie
DEWEY 634.61 AGRINTER H20 0311

TABLA DE CONTENIDO

Cómo obtener fotocopias de los documentos indizados

Costo: US$0.20 la página, incluyendo el porte aéreo

Puede aceptarse pago en las siguientes formas:

- Cheque a nombre del IICA
- Cupones AGRINTER que están a la venta en las Oficinas del IICA en los países de América Latina y el Caribe
- Cancelación del costo en moneda nacional en las Oficinas del IICA en cada país

Sus pedidos pueden dirigirlos a la siguiente dirección:

Biblioteca Conmemorativa Orton
IICA-CIDIA
Turrialba, Costa Rica
Código 7170

INTRODUCCION

El micoplasma causante del amarillamiento letal (Lethal yellowing), fue claramente identificado por Plausic-Benjar *et al* en 1972, aunque la sintomatología fue descrita desde 1891 por Fawcett, en Jamaica.

La historia nos señala que estamos ante la amenaza de una enfermedad considerada virulenta y altamente patogénica; no tenemos conocimiento de país alguno que haya sido capaz de evitar su avance y eventual infección de sus áreas cocoteras, donde ha hecho su aparición este micoplasma, puesto que son más de 20 las especies de palmeras susceptibles, lo que agudiza aún más el panorama.

Los efectos desastrosos causados por esta enfermedad, y que han sido divulgados a nivel mundial, deben ser considerados como una llamada de atención a los funcionarios de Sanidad Vegetal y especialmente a los técnicos responsables de la Cuarentena Vegetal, para que sean extremadas las medidas y controles para evitar, o al menos retardar, la introducción de material vegetal contaminado o portador de este patógeno.

Esta bibliografía resume las investigaciones que se han venido realizando, con el afán de darnos un mayor conocimiento sobre aspectos relacionados con el problema que nos ocupa, como son: Sintomatología en la planta, Agente causal, Hospederos, Vectores y otras en materia de mejoramiento genético que los estudiosos han realizado últimamente.

Se agradece la valiosa colaboración del Dr. José Galindo, Fitopatólogo del Centro Agronómico Tropical de Investigación y Enseñanza (CATIE) en la indización temática de los documentos registrados.

La información bibliográfica se logró identificar en publicaciones primarias y secundarias existentes en la Biblioteca Conmemorativa Orton del IICA-CIDIA, logrando reunir 224 referencias de documentos sobre amarillamiento letal del cocotero, producidos a nivel mundial en los últimos 20 años.

Las referencias bibliográficas acompañadas de un asterisco (*) indican su existencia en las colecciones de la Biblioteca Conmemorativa Orton, y están a disposición de los usuarios mediante el servicio de reproducción de documentos.

Ing. *Manuel Fco. Araya Vargas*
Dirección de Sanidad Vegetal
Ministerio de Agricultura y Ganadería
San José, Costa Rica

AMARILLAMIENTO LETAL DEL COCOTERO

* A'BROOK, J. y SCHUILING, M. Nature et importance des insectes capturés dans des pieges a succion en cocoteraie. Oléagineaux 31(11):487-488. 1976. (001

Le vecteur du Jaunissement mortel (L.Y.) du cocotier doit avoir certaines caractéristiques qui pourraient aider a son identification. Des études préliminaires faites à la Jamaique ont indiqué que le L.Y. doit être transmis par un vecteur mobile, capable de migrer aussi bien d'un arbre à un arbre voisin que sur une grande distance. Ce vecteur doit être un suceur de sève puisque, si des organismes mycoplasmiques (M.L.O.) provoquent la maladie, on ne les a trouves que dans le liber des cocotiers atteints. Par analogie avec d'autres maladies de plantes avec étiologies à M.L.O., le vecteur est le plus vraisemblablement une cigale ou une cicadelle, bien qu'on ne puisse exclure d'autres Hemiptères. Cet insecte vecteur, ou un insecte très voisin, doit être présent dans le Nord des Caraibes et en Floride où le L.Y. est épidémique et, probablement aussi, en Afrique de l'Ouest. La propagation du L.Y. (à la Jamaique ou en Floride) peut être due a la dispersion d'un meme vecteur bien que ce ne soit pas nécessairement le cas. Le vecteur doit s'alimenter sur les 12 genres de palmiers connus comme sensibles au L.Y.; Heinze et Schuiling (1973) ont avancé l'idée d'un maximum du taux d'infection de février à août à la Jamaique, qui doit correspondre à un maximum d'activité migratoire du vecteur. Pour étudier certaines de ces caractéristiques d'identification, des pièges à succion ont été montés dans une cocoteraie à 1,5 et 7,0 m au-dessus du sol et on a examiné conjointement les insectes présents dans les arbres. Contrairement à ce qui se présente dans les arbres, les Cicadoidea sont plus nombreux dans l'air que les Fulgoroidea à chaque hauteur étudiée. Ces résultats laissent à penser que si le vecteur du L.Y. est un hôte commun des palmiers, *Haplaxius crudus* Van Duzee et *H. cocois* Fennah peuvent être retenus d'autant qu'ils semblent avoir des vols migratoires pendant la période de "sensibilité" de Heinze et Schuiling. Si le vecteur est un hôte commun des palmiers mais qu'il migre rarement, *Omolicna cubana* Myers et *O. proxima* Fennah (?) peuvent être retenus. Par ailleurs, puisque tous les insectes communs sur palmiers et supposés vecteurs ont été éprouvés avec des résultats négatifs, le vecteur peut être un insecte banal qui se nourrit rarement sur les palmiers. Dans ce dernier cas, les résultats du piégeage par succion suggèrent que *Dawnaria* sp., *Empoasca* spp., et les Psylloidea doivent faire l'objet d'études plus poussées.

* AMARILLAMIENTO LETAL. Ciencia al Día (Venezuela) 13(3):50. 1974. (002

ANGELES BARCELON, M. DE LOS, McCOY, R.E. y DONSELMAN, H.M. New liquid chromatographic approaches for free amino acid analysis in plants and insects. II. Thin-layer chromatographic analysis for eighteen varieties of palm trees. Journal of Chromatography 260(1):147-155. 1983. (003

Analysis are presented for free amino acids in the foliage of 18 palms, including dates, coconuts (Jamaica Tall, Malayan Dwarf and Maypan) and ornamental species, and for free amino acids in the phloem exudate of 3 species including Jamaica Tall coconuts (healthy or infested with lethal yellowing disease). A possible correlation was observed between the presence of arginine in the palms studied and susceptibility to lethal yellowing disease. (Horticultural Abstracts 53(7):5537. 1983).

* BEAKBANE, A.B., SLATER, C.H.W. y POSNETTE, A.F. Mycoplasmas in the phloem of coconut, *Cocos nucifera* L., with lethal yellowing disease. Journal of Horticultural Science 47(2):265. 1972. (004

Mycoplasmas were observed abundantly in the phloem from the midrib of unopened leaves of coconut, *Cocos nucifera* L., suffering from lethal yellowing disease.

_____., FULLER, M.M. y SLATER, C.H.W. Mycoplasma-like organisms traversing cell walls in *Cocos nucifera* L., with lethal yellowing disease. Journal of General Microbiology 89(1):203-204. 1975. (005

When sections of phloem tissue from leaf midribs of coconut palm infected with lethal yellowing in Jamaica were examined electron microscopically, fine filaments extending from mature, spherical MLOs were seen to traverse cell walls through narrow canals, c. 40 nm wide, in thin zones of the sieve tube walls. The width of the cell walls within the zone traversed by the filaments was 250-300 nm, while the thicker regions of these walls measured almost 600 nm. The tripartite unit membrane of the filaments appeared to be continuous with the membrane surrounding the MLO subtending it. During their passage across the walls the filaments tended to break up into small membrane bound units, emerging as complete elementary bodies. This method of translocation, with propagation of the MLOs, differs markedly from the translocation sequence described for MLOs passing through much larger sieve plate pores. (Review of Plant Pathology 55(1):368. 1975).

* BEEN, B.O. Evaluation au champ de la résistance au Jaunissement mortel de variétés de cocotiers. Oléagineaux 35(6):302. 1980. (006

Twenty-eight local and introduced varieties were planted in resistance trials throughout the main coconut growing areas of eastern Jamaica soon after lethal yellowing started to spread in that region. Sixteen years later the disease is still active at only one trial site. Ceylon, Indian and Malayan Dwarfs, and King coconuts appear to be highly resistant; while Bougainville, Cambodia, Malayan, Markham Valley, Panama, Peru, Rotuma, Darawak, Thailand and Yap Talls, and Fiji Dwarfs seem to be less resistant. Highly susceptible varieties are Indian, Jamaica and New Hebrides Talls and Rangiroa Dwarfs; while the less susceptible group comprises Ceylon, Fiji, Rangiroa, Rennell, Samoa, Seychelles, Solomon, Tahiti and Tonga Talls. In the absence of any reliable innoculation technique assessment of resistance was based on natural infection which occurred in the field.

_____. Observations of field resistance to lethal yellowing in coconut varieties and hybrids in Jamaica. Oléagineux 36(1):9-12. 1981. (007

Twenty-nine local and introduced varieties and twenty-three hybrids were planted in resistance trials about nine to seventeen years ago. Lethal yellowing is now still very active at only one trial site. In the absence of any reliable inoculation technique assessment of resistance was based on infection which occurred naturally in the field. Ceylon, Indian and Malayan Dwarfs and the King Coconut appear to be highly resistant; while Bougainville, Cambodia, Kar Kar, Malayan, Panama, Peru, Rotuma, Sarawak, Thailand and Yap Talls and Fiji Dwarfs seem to be less resistant. Highly susceptible varieties are Indian, Jamaica and New Hebrides Talls and Rangiroa Dwarf; while the less

susceptible group comprises Ceylon, Fiji, Rangiroa, Rennell, Samoa, Seychelles, Solomon, Tahiti and Tonga Talls. Most hybrids have levels of resistance intermediate between those of the parents, but generally closer to that of the more resistant parent. A few hybrids showed natural remission of lethal yellowing disease symptoms but none has so far recovered completely.

CALDWELL, J.S. Notes on *Haplaxius* Fowler with descriptions of new species (Hom.: Cixiidae). Proceedings of the Entomological Society of Washington 48:203-206. 1946. (008

* CARIBBEAN PLANT PROTECTION COMMISSION. Recent outbreaks of pests and diseases. Quarterly Report 2(1,3,4). 1969; 3(1,3,5,7). 1970. (009

Lethal yellowing of coconut is spreading in Jamaica. The causal agent is unknown, but is suspected to be transmitted by an insect. Aerial applications of rogor are under trial to control the disease. St. Thomas, the last remaining area of Jamaica free from lethal yellowing, is now reported to be affected. (Review of Plant Pathology 49(11):3564. 1970).

* CARTER, W. Estado actual de las investigaciones acerca de la enfermedad del amarilleo letal del cocotero en Jamaica. Boletín Fitosanitario de la FAO 12(3):67-69. 1964. (010

La enfermedad se encuentra en la comarca de Buff Bay, en el extemo oriental de la costa norte, donde se observa un movimiento hacia el oeste.

* _____. y SUAH, J.R.R. Estudios sobre la propagación de la enfermedad del amarilleo letal en los cocoteros. Boletín Fitosanitario de la FAO 12(4):73-78. 1964. (011

Se ha demostrado que la enfermedad del Caribe y la del Africa occidental son idénticas, basándose únicamente en los síntomas, ya que en ningún caso se conoce el agente etiológico. El régimen de propagación en el campo puede sólo conjugarse con una hipótesis sobre la naturaleza del amarilleo letal, a saber: la enfermedad es de origen infeccioso. El agente infectivo parece hallarse distribuído al azar en torno a un foco inicial causante de una propagación local y que, merced a los vientos y a las corrientes de convección, da lugar a la propagación a saltos. Esta conclusión lleva directamente a una consideración de los vectores, pero hasta tanto que pueda conseguirse inequívocamente la transmisión, el agente etiológico real seguirá siendo desconocido.

* _____., LATTA, R.K. y SUAH, J.R.R. Síntomas del amarilleo letal del cocotero. Boletín Fitosanitario de la FAO 13(3):49-55, 71. 1965. (012

La finalidad del presente artículo es resumir un amplio estudio hecho sobre la sintomatología de la enfermedad en dos puntos muy distanciados entre sí de Jamaica, uno en la antigua zona pandémica del noroeste de la isla y el otro en una zona del nordeste en que la infección se ha establecido en fecha reciente. Estos estudios abarcan una gran variedad de condiciones ambientales y de otro tipo y se recogieron a lo largo de dos años. La sintomatología de la enfermedad expuesta en este estudio indica claramente que el amarillamiento letal del cocotero es fisiológicamente una marchitez en la que entra en juego una interferencia gradual, aunque progresiva de la traslocación.

_____. Lethal yellowing disease of coconut: report to the Government of Jamaica. FAO Report TA 2158. 1966. 24 p. (013

* CARTER, W. Lethal yellowing disease of coconuts. World Crops 18(1):64-69. 1966. (014

A useful review of this disease in Jamaica. Much of the information contained has been noticed. The author supports the probable identity of the disease with Kaincopé disease or Cape St. Paul wilt in Togo and Ghana and considers it probably due to a virus, the vector of which is as yet unknown. Other possible causes are rejected. He found no evidence, however, that palms with symptoms are sources of infection, so that the expensive and laborious procedure of destroying these by fire is not considered essential. The disease is a wilt, involving progressive interference with translocation, particularly in the area near the growing point, immediately below which the phloem becomes almost obliterated. Lack of susceptibility of young seedlings suggests that only when the stump is differentiated is the anatomo-physiological basis for interference with translocation laid down. Malayan dwarf palms have shown continued resistance to the disease over 10 years. (Review of Applied Mycology 45(7):1880. 1966).

* _____. Susceptibility of coconut palm to lethal yellowing disease. Nature 212(5059):320. 1966. (015

When a section of a healthy coconut palm including the growing point and the bases of contiguous fronds was placed in 0.5% acid fuchsin, the dye was uniformly distributed in stem and fronds. In a palm with lethal yellowing disease the dye was limited to a few scattered streaks. In longitudinal sections treated with KI and I to compare differences in starch conc. healthy tissues showed deeper and more extensive coloration in the fronds. The phloem near the growing point appeared to be almost obliterated in diseased tissues. It is concluded that the characteristic central wilting of lethal yellowing is due to a blockage of translocation associated with phloem necrosis, possibly caused by a virus. Evidently young palms are resistant because the stem becomes differentiated only after c.2 year. (Review of Plant Pathology 46(3):711. 1967).

CORBETT, M.K. Diseases of the coconut palm. I. Lethal yellowing or unknown disease. Principes 3(1):5-13. 1959. (016

COWDIE, A.L. y ROMNEY, D.H. Replanting coconuts in Jamaica through the lethal yellowing insurance regulations. Session of the FAO Technical Working Party on Coconut Production, Protection and Processing, 4th, Kingston, 1975. p. 6. (017

CHARUDATTAN, R. y McCOY, R.E. Antigenic difference in phloem exudates of healthy and lethal yellowing-diseased coconut palms. Proceedings of the American Phytopathological Society 2:71. 1975. (Sólo sumario). (018

* CHEN, R.A. Nutritional aspects of lethal yellowing in coconuts. Tropical Agriculture (Trinidad) 43(3):211-218. 1966. (019

In an attempt to examine the nutritional status of lethal yellowing in the coconut palm, tissue analyses were carried out. There is no conclusive evidence from these chemical analyses that the disease is caused by a nutrient deficiency or toxicity, but there is a suggestion of a nutrient imbalance in affected trees. Boron content tends to be lower, and there is an accumulation of calcium at the frond/trunk junction in older trees exhibiting the disease. Carbohydrate metabolism and translocation are affected giving rise to accumulation of sugars in diseased palms. Results suggest that lethal yellowing is not primarily

a wilt disease, although an impairment of the conducting system occurs within the plant. In the xylem, this interference which is exhibited immediately below the frond/trunk junction may be due to impaired calcium metabolism, and the effect is probably secondary in nature.

CHIARAPPA, L. The probable origin of lethal yellowing and its co-identity with other lethal diseases of coconut. FAO-AGP-CNP/79/4. 1979. 12 p. (020

* CHONA, B.L. Lethal yellowing of coconuts (Cape St. Paul wilt). Commonwealth Phytopathological News 4:4. 1965. (021

Seed coconuts of Green and Yellow Malayan Dwarf vars., imported by Ghana in October 1956, were planted in June 1957, along with selections from local tall palms which had remained healthy in affected areas, to test their resistance to the disease under local conditions. All palms remained disease-free until June 1962. Since then 8% of the Green Dwarf, 33% of the Yellow Dwarf, and 42% of the tall palm progeny have become affected. (Review of Plant Pathology 44(10): 3125. 1965).

DABEK, A.J. Some physiological and anatomical aspects of the lethal yellowing disease of coconuts. Ph.D. Thesis. Kingston, Jamaica, University of the West Indies, 1973. 331 p. (022

_____. Biochemistry of coconut palms affected with lethal yellowing disease in Jamaica. Phytopathologische Zeitschrift 81(4):346-353. 1974. (023

The disease causes metabolic changes in the host. General polyphenol levels and peroxidase activity were negatively correlated and fluctuated more than in healthy palms. Orthodihydroxy polyphenols increased to a maximum of 20% above the controls. Catalase activity was abnormally high before symptoms appeared but decreased rapidly afterwards. The incubation period appears to be at least 8-9 months. Results are discussed in relation to presymtom diagnosis and host-pathogen interaction. (Review of Plant Pathology 54(12):5508. 1975).

_____. The incubation period, rate of transmission and effect on growth of coconut lethal yellowing disease in Jamaica. Phytopathologische Zeitschrift 84(1):1-9. 1975. (024

The most common incubation period was 114-191 days. The main period of field infection of coconut palms appears to be Jan.-Aug. Infection can occur throughout the year except from the beginning of Oct. to mid-Nov. Seasonal variations in temperature affect multiplication of the mycoplasma-like organism within the tissues, and may cause a 2-fold difference in the incubation period. This hypothesis also explains why 75% of the infected palms exhibit symptoms in Sept.-Dec. At c. 80 days before symptom expression the growth of infected plants increases up to 40% over that of the healthy controls; it then gradually declines growth failure generally coinciding with appearance of symptoms. The sequence of symptom expression appears to be variable for young, non-bearing palms. (Review of Plant Pathology 55(5):2332. 1976).

* _____. y HUNT, P. Biochemistry of leaf senescense in coconut lethal yellowing, a disease associated with mycoplasma-like organisms. Tropical Agriculture (Trinidad) 53(2):115-123. 1976. (025

Biochemical aspects of senescense were studied in coconut leaf tissue from palms affected by lethal yellowing, a disease with a suspected mycoplasma aetiology. By comparison with water controls, gibberellic

acid, copper, zinc, iron administered separately and kinetin supplied alone or with indoleacetic acid increased the longevity and/or caused re-greening of detached diseased pinnae. Healthy pinnae responded only to gibberellic acid or a mixture of amino acids. The failure of yellow, diseased pinnae to respond to a mixture of amino acids, taken together with the much reduced catalase activity in chlorotic pinnae suggests a disturbed protein metabolism in palms affected by lethal yellowing. The likelihood of a hormonal imbalance associated with lethal yellowing, inducible by mycoplasmas or micronutrient deficiencies is discussed, as is the possibility of ethylene involvement.

* DABEK, A.J., JOHNSON, C.G. y HARRIS, H.C. Mycoplasma-like organisms associated with Kaincopé and Cape St. Paul wilt disease of coconut palms in West Africa. PANS 22(3):354-358. 1976. (026

Mycoplasma-like organisms were observed in tissue from spear leaf and unopened inflorescences of coconut palms affected with Kaincopé disease in Togo and Cape St. Paul wilt in Ghana. The findings are discussed in relation to coconut lethal yellowing disease in the Caribbean and Florida.

_____. Transmission experiments on coconut lethal yellowing disease with *Deltocephalus flavicosta* Stal, a leafhopper vector of periwinkle phyllody in Jamaica. Phytopathologische Zeitschrift 103(2):109-119. 1982. (027

Natural populations from coconut palms with lethal yellowing and leafhoppers fed on diseased palm leaves did not transmit the disease. Natural populations, however, transmitted a mycoplasma-like organism associated with phyllody in *Catharanthus roseus*, but did not re-transmit it to the C. *roseus* after aquisition feeding and incubation for 8 weeks on maize. There was no relationship between MLO associated with CLY and phyllody of C. *roseus*. (Review of Plant Pathology 61(9):5170. 1982).

DEUTSCH, E. Further studies on the distribution of mycoplasma-like organisms in different tissues of lethal diseased coconut palms in Tanzania. Zeitschrift fuer PflanzenKranKheiten und Pflanzenschutz 90(3):278-284. 1983. (028

DIVAKARAN PILLAI, M. Bibliography on lethal yellowing of coconut (*Cocos nucifera* Linn.) /Mycoplasma as the causal agent, transmission by the insect *Myndus (Haplaxius) crudus*/. Indian Coconut Journal 11(10):5-9. 1981. (029

* DOLLET, M. y GIANNOTTI, J. Kaincope disease: presence of mycoplasma in the phloem of diseased coconuts. Oléagineux 31(4):169-171. 1976. (030

Se emprendió un estudio citológico en microscopía electrónica, sobre fragmentos de inflorescencias de cocoteros con ataque de enfermedad de Kaincopé. En los cortes ultrafinos se observó elementos esféricos y ovoides de membrana trilaminar que corresponden a gérmenes de tipo micoplasma. Se proyecta la generalización de este estudio a las enfermedades de amarilleo que presentan muchas analogías con la enfermedad de Kaincopé en Africa y en América.

* _____. et al. Study of a lethal yellowing of coconut palms in Cameroon: Kribi disease. Observation of mycoplasma-like organisms (En francés). Oléagineux 32(7):317-322. 1977. (031

Los cocoteros del Sur de Camerún padecen un amarillamiento letal: la enfermedad de Kribi. Apareció en 1937 en los cocoteros Grand Typica,

y se observó por primera vez en 1975, en los cocoteros Enano Roja Camerún. Una descripción detallada de síntomas en los diversos órganos del cocotero permite una comparación con la enfermedad de Kaincopé. En las células de hacecillos del líner de inflorescencias las observaciones con microscopio electrónico mostraron organismos parecidos a micoplasmas. Se efectúa una comparación con otros amarillamientos del cocotero en el Africa.

* DOLLET, M. et al. Approche de l'étude sérologique des mycoplasmes du jaunissement mortel des cocotiers en Afrique de l'Ouest. Oléagineux 35(6):299. 1980. (032

Serological tests by the Elisa method were carried out on samples of inflorescences and roots from diseased coconuts from Togo. The samples came from three sick coconuts with: 1. the early characteristic symptom of nut drop; 2. yellowing of the lower leaves, and 3. overall yellowing, as well as from a healthy control palm in an uncontaminated zone. The inflorescences had the characteristic symptoms associated with the presence of MLO as we defined them in our previous research. The samples were tested against antisera of the following strains: *Acholeplasma axanthum* S 743, *A. oculi*, *A. modicum*, *A. granularum*, *A. laidlawii* PG 8 and *Spiroplasma citri* (R8 A2), the plant control being periwinkles (*Vinca rosea*) infected by *Spiroplasma citri* and healthy periwinkles. Only the periwinkles infected by *S. citri* gave a positive Elisa test with the corresponding antiserum. Checks for a possible inhibition of the serological reactions by phenomena of oxidation of the ground coconut tissue were made, adding grindings of healthy or diseased coconuts to: 1. sub-cultures of *A. axanthum* and *A. laidlawii* cultures, and 2. purified antigens of the different strains of mycoplasma tested against their antiserum. The results are discussed. Electron microscope examination of samples of these same inflorescences fixed and included reveals the presence of low concentrations of intraphloemic MLO.

* _____. Compte rendu recherche sur l'étiologie du Blast du palmier a huile et du cocotier. Oléagineaux 35(6):304. 1980. (033

The origin of oil palm Blast was attributed by Robertson in 1959 to a mixed fungus infection. Blast was discovered on coconut in the Ivory Coast in 1971. The study of this disease enabled us in the first stage to bring to light the role of insects. Thereafter, by selective contamination in cages we were able to show that it is the species *Recilia mica* (Homoptera: Cicadellidae) which causes Blast in oil palm and coconut. For the etiological research, trials of mechanical transmission were undertaken in 1974, but without any result. Samples for electron microscopy were fixed in 1974, 1975 and 1977. The first examinations showed Rickettsia-like organisms in the xylem of diseased palms. Trials of transmission of Blast on herbaceous plants by *Recilia* were carried out. Symptoms of wilting, including progressive dwarfing of the flowers, crinkling and yellowing of the leaves, then the total disappearance of flowers and the stoppage of growth, were obtained on *Vinca rosea*. The electron microscope examination of these *Vinca* revealed intraphloemic mycoplasma-like organisms. The saliva glands of *Recilia* are now being examined. The role of the R.L.O. and M.L.O. found in the oil palm and on *Vinca* is discussed. Experiments of treatment by tetracycline suggest a mycoplasmic origin.

* DONSELMAN, H.M. Palms resistant to lethal yellowing for Florida. Proceedings of the Florida State Horticultural Society 91:99-101. 1978. (034

The sub-tropical environment of South Florida allows the cultivation of over 500 species of palms. Residential and commercial plantings utilize only 10-15 species commonly available from the nursery. Now that lethal yellowing is threatening many of the more common palms in cultivation, the tropical atmosphere, so effectively created by palms, is in jeopardy. To insure the future of Florida's palms and maintain the unique setting necessary for the tourist trade and residents, new palms resistant to lethal yellowing must be developed. The coconut palm is generally recognized as the symbol of the tropics. Over 50% of the susceptible 'Jamaican Tall' coconut palm have died on the east coast of Florida from lethal yellowing in the past 5 years. During that same period, an estimated 750 000 seed nuts of the resistant 'Malayan Dwarf' coconut have been imported from Jamaica. Accounting for loss due to lack of seed viability, cultural problems, and an unusually cold winter in 1977, about 250 000 'Malayan Dwarfs' are now thought to be established in landscapes or available for planting in South Florida. The christmas palm, *Veitchia merrillii* was at one time the most common homeowner palm in South Florida. Already over 35% of these palms have died along the southeast coast. A resistant replacement palm of similar stature and ease of culture must be found to replace this palm. Additional palms are needed for several of the other 23 dying palm species. Experiments involving over 200 species of palms new to Florida are now underway at the Agricultural Research Center in Fort Lauderdale. Research is necessary to determine germination methods, cultural requirements, and rate of growth of these palms. An area approximately one hectare in size is currently being developed to maintain an outdoor palm nursery and trial garden. Until a method of artificially transmitting lethal yellowing is developed, resistance will be determined through natural selection. Highly susceptible palms will be interplanted with the test plants to increase the incidence of lethal yellowing in the trial.

EDEN-GREEN, S.J. Some attempts to rear potential leafhopper vectors of lethal yellowing. Principes 17:156. 1973. (035

* _____. y SCHUILING, M. Essai de transmission apres "contamination au contact des racines" avec *Hapliscius grudus* (Hom. Cixiidae) et *Proarna hilaris* (Hom. Cicadidae). Oléagineux 31(11):487. 1976. (036

H. crudus et *P. hilaris* sont des vecteurs virtuels du L.Y.; toute leur vie larvaire a lieu sous terre. Larves et adultes peuvent sucer la seve du phloeme respectivement sur racines et feuilles de cocotier. Le but de ces travaux est de vérifier Phypothese selon laquelle les larves contractent le pathogene sur les racines d'arbres malades et, aprés émergence, les adultes le transmettent aux parties aériennes des arbres sains. Des larves de *H. crudus* de tous stades, provenant d'élevage de masse sur l'herbe de Saint-Augustin (*Stenotaphrun secundatum*) ou collectées sur le terrain, ont été mises en cages pendant plus de cinq jours, au niveau d'arbres présentant les premiers symptomes de L.Y.ñ sur de fines racines secondaires spécialement préparées et non détachées. Une forte mortalité empechait de prolonger la période de contamination. Les larves survivantes ont été élevées jusqui'a maturité sur l'herbe de Saint-Augustin au laboratoire. On a transféré les adultes obtenus dans de grands sacs sur des palmiers test ou quelques-uns ont survécu plus d'un mois. De plus, pour controler la contamination par ingestion, des larves ont été collectées au voisinage de cocotiers

affectés par le L.Y., élevées comme précédemment jusqu'au stade adulte, et transférées directement sur une seconde série d'arbres tests. Jusqu'a présent, les résultats ont été négatifs. On n'a pas réussi a réaliser des essais analogues avec *P. hilaris* parce que les larves, qu'on a pu collecter sur le terrain, sont difficiles a manipuler, et que leur longévité parait importante. De ce fait, on a limité les essais aux transferts directs d'adultes collectés dans les zones affectées. Pendant plus d'une année, on a régulierement capturé au crépuscule plus de 40 adultes par récolteur, dans un site ou le L.Y. était virulent. Les insectes survivants ont été transférés sur les fléches ou les palmes nouvellement émises de palmiers tests, et on a souvent observé l'acte alimentaire. La plupart des insectes sont morts en moins d'une semaine bien qu'on ait noté des survies de deux semaines et plus. En juin-juillet 1971, on a procédé a un examen limité de la distribution de *P. hilaris* dans les régions de cocoteraies en utilisant des pieges lumineux a rayons blancs fluorescents. Les résultats ont montré que cette cigale est tres largement distribuée mais n'est que localement abondante. En prévision des difficultés des tests de transmission, il est souhaitable de faire a l'avenir des études sur la biologie et la distribution de cette espece, de façon a estimer sa possible association avec le Jaunissement mortel.

* EDEN-GREEN, S.J. Pourriture du tronc sur des cocotiers non entrés en production et apparemment affectes par le jaunissement mortel. Oléagineux 31(11):485. 1976. (037

On a constaté un grave pourrissement du stipe ou du bulbe sur des cocotiers non encore producteurs, qui montraient les premiers symptomes du Jaunissement mortel. Ce fait n'a apparemment pas été signalé en association avec cette maladie. Il semble que les plus vieux tissus de la base du tronc soient les premiers affectés. Mais on a vu la pourriture gagner l'ensemble des points d'attache des racines sur le bulbe, sur des arbres présentant un jaunissement tres avancé de la frondaison. Les tissus pourris sont brun foncé, généralement fermes et sursaturés d'eau, et ils sont bien délimités par des marges. Ces tissus pourris peuvent s'étendre sur plus de 30 cm vers le stipe. La pourriture du stipe parait être tout a fait distinct de la viscosité du coeur ou pourriture du choux palmiste qui se développe au-dessus du bourgeon. Des connections directes entre ces deux pourritures n'ont été vues que chez de tres jeunes arbres présentant des symptomes tres avancés. Quoique commune sur de jeunes cocotiers, la pourriture du tronc n'est pas spécifique du Jaunissement mortel et elle n'a pas été constatée, jusqui'a présent, sur des arbres producteurs, meme a un stade avancé de la maladie. La caractérisation d'une série de bactéries et de champignons isolés a partir d'arbres affectés est en cours et les résultats permettent de penser que la pourriture résulte d'une agression secondaire par des microorganismes du sol. Il n'est pas exclu que des jeunes arbres puissent etre affectés par une "maladie de la pourriture du tronc" primaire, avec des symptomes exérieurs similaires a ceux du Jaunissement mortel. Les tests de pouvoir pathogene se poursuivent.

_____. Progress of research on lethal yellowing disease. Report of the Research Department, 16th. Jamaica, Coconut Industry Board, 1976. pp. 39-41. (038

* EDEN-GREEN, S.J. Síntomas en las raíces de los cocoteros afectados por la enfermedad del amarilleo letal en Jamaica. Boletín Fitosanitario de la FAO 24(4):119-122. 1976. (039

En este estudio preliminar se provocó el crecimiento de raíces amontonando polvo de bonote húmedo alrededor de los troncos de cocoteros al parecer sanos que se cultivan en una zona en que hay palmas con amarilleo letal. Después de la primera manifestación de los síntomas de amarilleo letal en la copa, observada en general por la caída de las nueces, las raíces a menudo quedaban exentas de daños durante un período variable de hasta tres meses. Cuando aparecían los síntomas, eran afectadas en primer lugar las puntas de las raíces, pero la podredumbre se propagaba con frecuencia de las raíces laterales a las raíces que abrazan la axila, provocando necrosis proximal así como distal. Inmediatamente después se producía el desprendimiento de todo el sistema radicular aquí estudiado, desprendimiento que parecía estar estrechamente relacionado con la aparición del amarilleo progresivo de la fronda.

* _____. La podredumbre del fuste en cocoteros en pre-producción aparentemente enfermos de amarilleo letal. Boletín Fitosanitario de la FAO 26(1):13-15. 1978. (040

En los cocoteros en fase de pre-producción, que presentaban los primeros síntomas del amarilleo letal, se observó una fuerte incidencia de podredumbre del fuste, o podredumbre basal del tallo. Al parecer no se había comunicado este trastorno en relación con la enfermedad. Los tejidos más viejos del ápice del fuste eran los que enfermaban primero, pero se encontraron podredumbres que se extendían por toda la zona de nacimiento de las raíces en los cocoteros que presentaban síntomas más avanzados de amarilleo. Los tejidos podridos se extendían algunas veces por el tronco más de 30 cm en dirección ascendente, pero al parecer eran muy distintos de las enfermedades llamadas "slimy heart" o "cabbage rot" que se desarrollan por encima del punto vegetativo. Aunque también es corriente en los cocoteros jóvenes, la podredumbre del fuste no era una característica permanente y no se encontró en los cocoteros en producción, incluso en fases avanzadas de la enfermedad. La podredumbre es al parecer resultado de una invasión secundaria de microorganismos del suelo, posiblemente después de una rotura del sistema radical.

* _____. Rearing and transmission techniques for *Haplaxius* sp. (Hom.: Cixiidae), a suspected vector of lethal yellowing disease of coconuts. Annals of Applied Biology 89(2):173-176. 1978. (041

Adult *Haplaxius* sp., identified from Jamaica as *H. crudus* or *H. cocois*, are common on coconut foliage in both Jamaica and Florida and are suspected vectors of lethal yellowing disease in both regions. Nymphs, which are subterranean, were mass-reared on roots of the grasses *Stenotaphrum secundatum*, *Axenopus compressus* and *Cynodon* spp. Transmission of the disease was tested by feeding the nymphs on roots of diseased palms, rearing them on grasses and transferring the emergent adults to foliage of test palms for infection feeds. No transmission was proven.

* _____. y SCHUILING, M. Root acquisition feeding transmission tests with *Haplaxius* spp., and *Proarna hilaris*, suspected vectors of lethal yellowing of coconut palms in Jamaica. Plant Disease Reporter 62(7):625-627. 1978. (042

Transmission of the coconut lethal yellowing (LY) disease agent was tested by introducing *Proarna hilaris* (Cicadidae) and *Haplaxius* spp. (Cixiidae) from diseased areas, and by controlled acquisition feeding

of *Haplaxius* on diseased coconut roots. Over 2400 adult *P. hilaris* were introduced to 38 test palms; 900 *Haplaxius* adults, reared from nymphs collected from roots around diseased palms, were transferred to 9 test palms. A further 890 adult *Haplaxius* were transferred to 7 test palms following deliberate acquisition feeding of nymphs on 24 affected coconut roots. No transmission was demonstrated.

* EDEN-GREEN, S.J. Attempts to transmit lethal yellowing disease of coconuts in Jamaica by leafhoppers (Homoptera: Cicadelloidea). Tropical Agriculture (Trinidad) 56(3):185-192. 1979. (043

Transmission of lethal yellowing disease was tested by collecting leafhoppers from undergrowth, confining them for up to 4 days on diseased palm fronds and transferring them to test palms after a minimum 10 day incubation period on alternative herbaceous hosts. Species tested were *Chlorotettix minimus*, *C. viridius*, *C. nigromaculatus*, *Graminella* spp., *Hortensia similis*, *Poeciloscarta histrio*, *Protalebrella braziliensis* and *Sanctanus fasciatus*. In additional laboratory tests, *C. minimus*, *C. viridius*, *Spangbergiella vulnerata* and the planthopper, *Haplaxius crudus*, were injected with extracts from diseased plants followed by similar incubation and transmission techniques. No transmissions were noted.

_____. y TULLY, J.G. Isolation of *Acholeplasma* spp. from coconut palm affected by lethal yellowing disease in Jamaica. Current Microbiology 2(5):311-316. 1979. (044

* _____. Les acholéplasmes et la maladie du jaunissement mortel. I. Situation actuelle. Oléagineux 35(6):299. 1980. (045

Since the isolation of *Acholeplasma axanthum* from coconut phloem sap /I.C.L.Y. 3 proceedings, p. 20/ more than thirty similar isolates have been recovered from crown tissues of coconut palms affected by lethal yellowing. The highest isolation rate, 13% of samples from two palms, was obtained by filtering macerated palm tissues via 0.65 µm pore filters into conventional mycoplasma media supplemented with 10% serum, 0.01%. Tween 80 and 0.1% bovalbumin. No isolate was recovered from the same batches of media inoculated via 0.22 um filters. Most isolates derived from rotten or decaying tissues at the base of expanded leaves and inflorescences and from rotting internal immature leaf tissues; several were also recovered from epidermal tissues scraped off the bases of expanded leaves or spathes, and two were from apparently healthy tissues. Metabolic and serological tests on the incloned isolates indicated that about two thirds were strains of *A. axanthum* and most of the remainder were related to *A. oculi*. Gel electrophoresis protein banding patterns showed general agreement with these results, but suggested considerable variation within the serological groups. These results demonstrate that at least two *Acholeplasma* spp. are associated with lethal yellowing diseased palms, either as epiphytes, saprophytes or pathogens.

* _____. Les acholéplasmes et la maladie du jaunissement mortel. II. Essais de transmission. Oléagineux 35(6):299. 1980. (046

Potential transmission of acholeplasmas to plants was examined by monitoring the multiplication of isolates injected into "Yellows" disease-vectors. In preliminary tests using *Dalbulus maidis*, two

isolates attained titres of 10^8 cfu per insect in all insects sampled within 7 days of injection but three other cultures persisted or multiplied in only a few individuals. Twenty-five isolates were subsequently tested following injection into *Euscelidius variegatus* and about a third multiplied to titres of ca. 10^8 cfu per insect. These included representatives of both the *axanthum* and *oculi* groups. Other isolates declined and died out in most leafhoppers but sometimes persisted or multiplied in a few individuals; in some of these instances multiplication or decline appeared to be related to the dose of organisms injected. Repeated experiments with representative cloned and uncloned isolates gave consistent results. There was no evidence that acholeplasmas were transmitted to plants on which injected insects had fed; one transmission was noted following membrane feeding on sucrose solution but this could not be repeated. Leafhoppers allowed to feed through membranes on acholeplasma suspensions did not acquire these organisms in a persistent manner. The results suggest that acholeplasmas are well adapted to multiplication in leafhoppers, probably in the haemolymph, but are not readily acquired or transmitted by them.

* EDEN-GREEN, S.J. y WATERS, H. Collection and properties of phloem sap from healthy and lethal yellowing-diseased coconut palms in Jamaica. Phytopathology 72(6):667-672. 1982. (047

Techniques were devised for collecting phloem sap from inflorescences and cut trunks of coconut palms under field and laboratory conditions. Although inflorescence sap was obtained from cvc. showing both high and low susceptibility to lethal yellowing (LY), it could not be obtained from the widely grown, susceptible Jamaica Tall. Inflorescense sap had dry wts. of 120-190 mg/ml and osmotic pressures (OPs) of 500-900 mosmol/kg; samples of trunk sap from healthy palms were more dilute (60-90 mg/ml), but had proportionately higher OPs (400-500 mosmol/kg). Vols of trunk sap obtained from LY-diseased palms decreased as symptoms became more advanced, and the samples were more concentrated. Sap was not obtained from palms beyond the mid to late yellowing stages of the disease. No conclusive evidence was obtained for the presence or growth of mycoplasma-like organisms in sap from diseased palms, but samples from inflorescences and trunks of both susceptible and resistant cvs. were suitable as basal media for the growth of representative spp. of 3 genera of mycoplasmas.

* _____. Further studies on root symptoms in coconut palms affected by lethal yellowing disease in Jamaica. Plant Pathology 31(3):215-219. 1982. (048

Roots were induced by banking moist coir dust around the boles of apparently healthy coconut palms growing in an area where lethal yellowing was spreading rapidly. Samples of roots were removed for inspection at 1-2 wk intervals after the detection of the first symptoms in palms. Frond symptoms were recorded weekly. Comparison of symptoms in roots and fronds of 28 of the 36 palms that developed lethal yellowing confirmed the earlier observations that the roots usually remained symptomless for a variable period of up to 4 months, following detection of the first symptoms of the disease. When root symptoms appeared, most of the actively-growing root tips became necrotic within 2-4 wk and the collapse of the root system was closely correlated with the onset of progressive yellowing of fronds.

EFFERSON, N. For coconut growers - lethal yellowing is cause for alarm. In Plant Protection Committee for the South East Asia and Pacific Region. Technical Document no. 121. 1979. (049

También en: World Farming 21(3):10-13. 1979.

The article, first published with coloured illustrations in March 1979 issue of World Farming, describes the impact of this coconut disease, its symptoms, cause and recommendations for its control including the use of resistant var. (tabulated). (Review of Plant Pathology 60(1): 437. 1981)

* _____. Jamaica combate la clorosis letal del cocotero. Agricultura de las Américas 28(3): 14-16, 39, 42. 1979. (050

* ENNIS JUNIOR, W.B. Status of research on lethal yellowing and similar diseases. Oléagineux 37(1):17-24. 1982. (051

The lethal yellowing (L.Y.) disease of the coconut palm has been observed in the Caribbean area for over 100 years. It has killed millions of palms in Jamaica, the Cayman Islands, Cuba, Haiti, Dominican Republic, Bahama Islands and in Florida.Similar, or perhaps identical diseases occur in areas of West and East Africa and a lethal disease of Phoenix palms in Texas has been diagnosed as L.Y. This brief report is based on the findings of many workers in several countries and time limitations will not permit me to identify each worker who has contributed to current knowledge about the disease. My comments can only highlight some of the work done on this disease by scientists working in Jamaica, Florida, France, Great Britain, Togo, Ghana, Cameroon, Tanzania, and the Ivory Coast. Much of this work has been summarized at meetings of the International Council on Lethal Yellowing (ICLY) and in reports prepared for a special meeting of ICLY in Jamaica, August 31-September 2, 1980.

* ESKAFI, F.M. A report to the United States Agency for International Development on lethal yellowing disease of coconut in Jamaica. Florida, University of Florida, 1979. 53 p. (052

* _____. Alimentation des homoptéres sur des cocotiers a la Jamaique. Oléagineux 35(6): 300. 1980. (053

Radioactive isotope 32-P was used to label 45 healthy non-bearing Jamaica Tall variety of coconut trees in Jamaica from January 15 to May 15, 1979 in Caenwood during the dry, and in Plantain Gardens during the rainy season. About 10 000 homopteran insects were trapped on and around these palms by sticky light, yellow, and cone traps. These homopterans were placed on x-ray films daily for initial screening, and after 3 days of exposure, the labeled insects were analyzed with a gas-flow counter for radioactivity. Autoradiographs of labeled insects were evaluated by assigning a 1-10 visual index of light transmission intensity. In addition, homopterans were collected by a D-vac insect sampling machine from the undergrowth and vegetation in the vicinity of the coconut palms and were caged on radiolabeled coconut leaflets. Among the insects fed on palms and caught in traps, 22 species and 7 genera have been tentatively identified, and 5 specimens are unknown. Ten species and one genus were identified to have fed among those confined on radiolabeles leaflets. Total number of labeled insects of each

species collected ranged 1-26, with their radiation counts per minute between 17-235; background counts between 12 and 38. Some species collected with higher numbers and radioactivity have not been previously tested in lethal yellowing transmission studies, or not adequately tested. These include *Dawnaria sordidulum* (Muir), *Idioderna varia* (Van Duzee), *Typhlocybella minima* Baker, *T. maculata* n.sp., *Cedusa wolcotti* (Muir), *Cedusa* sp., *Agalliopsis tropicalis* (?), and several species of the genus Empoasca.

FISHER, J.B., ed. Report of the lethal yellowing symposium at Fairchild Tropical Garden, Miami. Principes 17(4):151-159. 1973. (054

Abstracts of papers at this meeting on lethal yellowing of coconut, 20-22 Sept. 1973, are presented. Observations in Jamaica and Miami indicate a mycoplasma as the agent but the pathogen has not been isolated or transmitted and the vector is unknown. It is too early to accept terramycin treatment as a permanent cure. Prevention remains based on planting resistant varieties such as Malayan Dwarf. (Review of Plant Pathology 53(9):3580. 1974).

_____. Environmental impact of lethal yellowing disease of coconut palms. Environmental Conservation 2(4):299-304. 1975. (055

* _____. y TSAI, J.H. A branched coconut seedling in tissue culture /to obtain germ-free plants for lethal yellowing disease control studies/. Principes 23(3):128-131. 1979. (056

* FISKELL, J.G.A., MARTINEZ, A.P. y VAN WEERDT, L.G. Chemical studies on the roots and leaves of coconut palms affected by lethal yellowing. Proceedings of the Florida State Horticultural Society 72:408-413. 1959. (057

FLORIDA DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES. DIVISION OF PLANT INDUSTRY. 30th Biennial Report 1 July 1972 - 30 June 1974. Gainesville, Florida, 1975? 165 p. (058

Included among the work of the Bureau of Pest Eradication and Control was a programme against lethal yellowing of coconut palms. Regulations to control lettuce mosaic virus were proposed by the Bureau of Plant Inspection. The work of the Bureau of Plant Pathology is also outlined (147-161). (Review of Plant Pathology 57(12):5261. 1978)

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS. PLANT PRODUCTION AND PROTECTION DIVISION. News digest on latest research findings on the etiology and control of the lethal yellowing disease - 1974. Rome, FAO, 1974. 8 p. (059

* FREMOND, Y., ZILLER, R. y NUCE DE LAMOTHE, M. DE. Jaunissement mortel. In _____., Ziller, R. y Nuce de Lamothe, M. de. Le cocotier. París, Maisonneuve & Larose, 1966. pp. 177-178. (060

* GHAURI, M.S.K. The identity of a suspected vector of coconut lethal yellowing disease in Jamaica and notes on *Caribovia intensa* (Walker) (Homoptera: Cicadelloidea). Bulletin on Entomological Research 70(3):411-415. 1980. (061

Specimens of a leafhopper from Jamaica, previously thought to be *Osbornellus bimarginatus* (De Long) and which is suspected of being the vector of lethal yellowing disease of coconut, were found to belong to a new species. This is described as *O. dabeki* sp.n. and compared with related species. Genitalia of the male of *Caribovia intensa* (Wlk.), hitherto unknown, is described, and this species is compared with and shown to be distinct from *C. coffeacola* (Doz.).

GOWDIE, A.L. y ROMNEY, D.H. Replanting coconuts in Jamaica through the lethal yellowing insurance regulations. Agric. Adm. 3(2):125-131. 1976. (062

GRYLLS, N.E. y BOR, N.A. Investigations on the etiology of lethal yellowing of coconuts in Jamaica. II. The role of insects as possible vectors. s.l., FAO, 1968. (FAO Technical Working Party on Coconut Production, Protection and Processing, 3rd Session, Indonesia). (063

* _____. y HUNT, P. A review of the study of the aetiology of coconut lethal yellowing disease. Oléagineux 26(5):311-315. 1971. (064

Este artículo hace el historial del amarilleo mortal del cocotero en la Jamaica cuyos síntomas se comparan con los de otras enfermedades del cocotero de etiología insegura. Existe conjeturas muy fuertes en favor del origen del virus de esta enfermedad transmitida por un insecto. Los ensayos de transmisión, mecánicos o por un insecto-vector, fueron impedidos por ser el cocotero un árbol monocotiledóneo no ramificado. Los cocoteros jóvenes son mucho menos sensibles a la infección natural que los árboles adultos y no presentan siempre síntomas netos de la enfermedad.

* _____. y HUNT, P. Studies on the aetiology of coconut lethal yellowing in Jamaica, by mechanical and bacterial inoculations, and by insect vectors. Oléagineux 26(8/9):543-549. 1971. (065

Fracasaron todos los ensayos de transmisión mecánica de la enfermedad realizados en Jamaica. A veces se pudo observar una necrosis bastante extendida de la hoja más joven (flecha) al rozarla con una preparación bruta de las inflorescencias podridas o del corazón procediendo de árboles en una fase ya avanzada de la enfermedad. El papel probable desarrollado por las bacterias en aquella necrosis (y también como invadidores secundarios en el desarrollo normal del conjunto de los síntomas de la enfermedad) está discutido relativamente al aislamiento de una ERWINIA, fuertemente patógena, cuando se inocula cerca del punto de crecimiento. La actividad del polifenol oxidasa es más intensa en ciertos tejidos de los cocoteros enfermos que en los cocoteros sanos, y con este motivo tales tejidos necesitarían un estudio ulterior como fuente del virus. Los insectos asociados a los cocoteros tienen representantes en todos los grupos taxonómicos principales de los vectores de virus conocidos. Unos insectos que pertenecen a los cinco grupos recogidos a partir de cocoteros enfermos o de la vegetación adyacente, o que se dejó alimentarse en los cocoteros enfermos bajo jaula, fueron introducidos varias veces en grandes recintos de cocoteros de 1,5 a 4 años de edad. Algunas especies de ciertos grupos fueron también introducidas separadamente en pequeñas jaulas colgadas de otros cocoteros. Aunque ciertos árboles demostraron síntomas de enfermedades en las jaulas en que fue suelto *Aleurodicus jamaicensis*, se requiere una nueva transmisión y una transferencia en serie del amarilleo mortal si se quiere evidenciar sin equívoca la transmisión por aquellas especies.

GWIN, G.H. Distribution and impact of lethal yellowing in Florida. In Meeting of the International Council on Lethal Yellowing, 3rd, USA, 1977. Proceedings. s.l., s.e., 1977. pp. 5-6. (066

* HANSEN, H.P. On the so-called "unknown disease" and related diseases on coconut palms in the West Indies. Plant Disease Reporter 36(2):66-67. 1952. (067

HANSEN, H.P. Unknown disease and related diseases of coconut palms in the West Indies. Journal of the Soil Science Society of the Philippines 4(1):47-49. 1952. (068

HARRIES, H.C. The performance of F_1 hybrid coconuts in Jamaica. Journal of Plantation Crops 2(2):15-20. 1974. (069

Dwarf x Tall, Tall x Dwarf and Tall x Tall F_1 hybrid coconuts in Jamaica have characteristics that are intermediate between those of their parents. Each parent is deficient in at least one of the characteristics considered (disease resistance, precocity, leaf production, bunch production, palm size, nut number, nut weight and copra production) so that the overall performance of the hybrid is better than of either parent. Only when considering lethal yellowing disease does the intermediate level of resistance constitute a barrier to the widest use of hybrids. (Horticultural Abstracts 46(4):3937. 1976).

_____. Lethal yellowing disease of coconuts in global perspective. Philippine Journal of Coconut Studies 3(3):1-4. 1978. (070

* _____. The Malayan dwarf supersedes the Jamaica tall coconut. I. Reputation and performance. Oléagineux 25(10):527-531. 1970. (071

Introducido por primera vez en la Jamaica en 1939, el enano malayo vió sus importaciones de semillas desarrollarse de forma considerable después de los huracanes de 1944 y 1951; en efecto, su precocidad asegura a los agricultores que perdieron sus árboles adultos una recuperación rápida de la producción. Cuando apareció el amarilleo mortal en la principal zona de cultivo del cocotero, el "Coconut Industry Board" estuvo muy satisfecho del comportamiento del enano malayo, que no sólo resistía a la enfermedad, sino también poseía un potencial elevado de producción. Los buenos resultados del enano demostraron que su mala fama inicial no se justificaba. Sin embargo, se aplica un programa de introducción, de hibridación y de selección para su mejoramiento. Los próximos artículos de esta serie tratarán de los aspectos agronómico, económico y divulgación del cultivo del enano malayo en Jamaica.

* _____. Selection and breeding of coconuts for resistance to diseases such as lethal yellowing. Oléagineux 28(8/9):395-398. 1973. (072

Data are presented on the incidence of lethal yellowing disease (associated with mycoplasma-like bodies) in some local and introduced varieties grouped according to resistance. The main points for a successful breeding programme are outlined. (Review of Plant Pathology 53(4):1500. 1974).

* _____. Natural symptom remission of lethal yellowing disease of coconut. Tropical Agriculture (Trinidad) 51(4):575-576. 1974. (073

In further studies 34 of the palms at 2 sites, recorded during 1968-71 as having lethal yellowing, had not died within the usual 3-6 months after the original diagnosis. Rate of leaf production and leaf length were reduced and trunks showed very marked tapering. Small, younger leaves were pale but not severely yellowed or bronzed. Nuts fell off and no inflorescences were produced; 15 palms died after 1-2 years. Others did not die and an F_1 hybrid, Panama Tall x Jamaica Tall, subsequently began producing small inflorescences with typical symptoms,

mycoplasma like organisms being present. It is suggested that palms with such remission could be food sources for possible vectors prior to feeding on healthy plants. Should an affected palm resume bearing and only show trunk constriction symptoms, a tolerance might be indicated. There would therefore be more confidence in F_1 hybrids with one susceptible parent. (Review of Plant Pathology 54(4):1394. 1975).

HARRIES, H.C. Selection and breeding of coconuts for resistance to diseases such as lethal yellowing. Indian Journal of Genetics and Plant Breeding 34A:66-74. 1974. (074

_____. Lethal yellowing disease of the coconut in global perspective. Philippine Journal of Coconut Studies 3:1-4. 1978. (075

* HEINZE, K.G. La causa posible del amarilleo letal del cocotero. Boletín Fitosanitario de la FAO 20(3):58-68. 1972. (076

Estudio de investigación sobre la causa y el modo de transmisión de la enfermedad del amarilleo letal del cocotero en Jamaica han demostrado que el vector es transmitido por el aire. Las jaulas a prueba de insectos protegen a los cocoteros contra la enfermedad: la infección natural únicamente ocurrió después de retirar la jaula. El tiempo transcurrido entre la retirada de la jaula y los primeros síntomas, junto con datos anteriores obtenidos de un experimento en el que se transfirieron cocoteros que estaban en bidones al área atacada durante un período definido y luego se retornaron a un área sana para observación, indicaron un período de incubación de aproximadamente 3 y 6 meses. Los experimentos sobre control de nuevos focos naturales de enfermedad en cocoteros maduros parecen ser insatisfactorios, pero indican un período de incubación de no menos de 7 a 15 meses.

_____., PETZOLD, H. y MARWITZ, R. A contribution on the aetiology of lethal yellowing disease of coconut palm (En alemán). Phytopathologische Zeitzchrift 74(3):230-237. 1972. (077

Tissue samples were collected from coconut palms showing lethal yellowing disease symptoms in Jamaica in 1969. Ultra-thin sections of the inflorescenses revealed mycoplasma-like bodies between 100 and 1200 nm long in the phloem cells. Such bodies were not found in the tissues of healthy palms. (Horticultural Abstracts 43:832. 1973)

_____. Report to the Government of Jamaica on lethal yellowing disease of coconut. FAO. United Nations Development Programme Report 1972. 28 p. (078

The disease was not transmitted in experiments with whiteflies, scale insects, mealybugs, aphids and gall mites; only one leafhopper was found to complete its life cycle on coconut. Palms growing in areas where lethal yellowing is endemic remained healthy when protected from insects by cages. The incubation period is believed to be c.3-6 months. The use of infra-red aerial photography for the early detection of the disease showed no advantage over normal colour photography. Studies with chemical control methods resulted in some reduction in disease incidence but shed no further light on the nature of the vector(s). Further attempts to transmit the disease mechanically were unsuccessful. (Review of Plant Pathology 53(2):650. 1974)

HEINZE, K.G. y SCHUILING, M. Experiments on the determination of the incubation period of lethal yellowing disease of coconut in the host plant (En alemán). Anzeiger fur Schadlingskunde 46(5):70-73. 1973. (079

Sets of palms grown in drums were transferred for 1, 2 or 3 months to infection areas. The estimated incubation period was 3-6 months, mean 150-160 days. When palms protected by cages for at least 1 year were exposed to natural infection, symptoms appeared 6 months after removal of the cages. The occurrence of infection only among palms exposed between February and August indicates that the vector is particularly active during these months. (Review of Plant Pathology 53(6):2275. 1974)

* HICHEZ, E. Amarillo letal en la República Dominicana. Sanidad Vegetal (Rep. Dominicana) 1(3): 3-6. 1971. (080

* _____. Situación del amarillo letal en la República Dominicana. Proceedings of the American Society for Horticultural Science. Tropical Region 18:37-41. 1974. (081

También en: Agro (Rep. Dominicana) 3(19):11-12, 40. 1974.

Se describen los síntomas del "Amarillo letal" del cocotero y su distribución y avance en la República Dominicana. Se presentan cifras que dan una idea de la importancia del cultivo del cocotero para la República Dominicana y en consecuencia la importancia de la enfermedad. Como conclusión se detallan las medidas que se toman para controlar la enfermedad.

* HIRUMI, H. y MARAMOROSCH, K. Mycoplasmalike bodies in yellows-diseased *Scoparia dulcis*. Phytopathology 62(6):670. 1972. (082

After recent observations indicating the possible mycoplasma etiology of the lethal yellowing disease of coconut palms, a search was made for yellows-diseased weeds in the proximity of dying coconut palms in Togo, West Africa. Patches and isolated plants of a common weed, identified as *Scoparia dulcis* (Scrophulariaceae), were observed affected by a witches'-broom disease in coconut groves along the coastal area between Lome and Kaincope. An electron-microscopic study revealed the presence of typical mycoplasmalike bodies in phloem elements of the diseased *Scoparia*. The working hypothesis that the yellows disease of the *Scoparia* and lethal yellowing are due to the same etiologic agent, carried by an insect vector from weeds to palms, could explain the observed pattern of spread of the coconut disease in West Africa, but confirmation awaits transmission studies.

* HOWARD, F.W. et al. Susceptibilidad de algunas especies de palmeras a enfermedades asociadas a organismos micoplasmoides en Florida. Boletín Fitosanitario de la FAO 27(4):109-117. 1979. (083

El amarillamiento letal es una enfermedad asociada a organismos micoplasmoides que afecta al cocotero (*Cocos nucifera* L.) en Florida, Bahamas y varias localidades del Caribe y Africa occidental. Organismos micoplasmoides similares o idénticos causan aparentemente el decaimiento letal de otras 24 especies de palmeras. El amarillamiento letal fue registrado por primera vez en el territorio peninsular de Florida en 1971. En 1974 ya se conocían 13 especies de palmeras

susceptibles al decaimiento letal. La tasa anual de nuevas comunicaciones de especies susceptibles ha disminuido desde 1974. Aproximadamente la mitad de las especies de palmeras cultivadas comúnmente en Florida son susceptibles; entre éstas *Veitchia merrillii* (Becc.) H.E. Moore es una de las más susceptibles de las plantadas en zonas urbanas. Los estudios sobre las pérdidas de ejemplares de palmeras debidas a decaimiento letal, hechos en el Jardín Tropical Fairchild, demostraron que el cocotero, *Corypha elata* Roxb. y *Pritchardia* spp. son altamente susceptibles. En otras especies, por ejemplo *V. merrillii*, los porcentajes de pérdidas en el Jardín debidas al decaimiento letal resultaron bajos comparados con las pérdidas en zonas urbanas, lo que se explica por la diversidad de plantas existente en el Jardín. Los datos indican que la enfermedad afecta casi exclusivamente a las palmeras no originarias de Florida y el Caribe. Aparte del cocotero, la palmira (*Borassus flabellifer* L.) y la palma datilera (*Phoenix dactylifera* L.), son otras de las especies económicamente importantes afectadas por el decaimiento letal.

* HOWARD, F.W. Les applications foliaires d'insecticides réduisent l'extension du dépérissement mortel chez les palmiers. Oléagineux 35(6):301. 1980. (084

An experiment was conducted in Hollywood, Florida, in an area where Manila palms, *Veitchia merrilli* (Becc.) H.E. Moore, were infected with M.L.O.-associated lethal decline. Manila palms were given foliar applications of insecticides (diazinon AG 500 at 13 ml/10 l, and dimethoate 400 at 26.4 ml/l) biweekly for 15 months. *Haplaxius crudus* (Van Duzee) was the most abundant auchenorrhynchous insect sampled from the leaves of Manila palms. There were fewer *H. crudus* in samples from palms treated with diazinon than in samples from untreated palms ($P < 0.05$). The rate of spread of the disease declined significantly in the diazinon and dimethoate-treated plots, but not in the untreated plots ($P < 0.05$). The results suggest that a leaf-feeding insect, possibly *H. crudus*, is the vector of LY causative agents.

* _____. Essais de transmission du jaunissement mortel para *Haplaxius crudus*. Oléagineux 35(6):300. 1980. (085

The planthopper, *Haplaxius crudus* (Van Duzee), has been suspected on the basis of its distribution, feeding habits, and host range to be a vector of the causal agent of LY and the apparently identical M.L.O.-associated lethal declines of 25 additional palm species. To test this hypothesis with respect to 2 of the susceptible species, an average of 18 565 of these planthoppers were transferred from palms in LY-infected areas to each of 5 cages containing healthy coconut palms, *Cocos nucifera* L., and Manila palms, *Veitchia merrilli* (Becc.) H.E. Moore. Palms in 5 similar cages did not receive *H. crudus* introductions. Manila palms in 4 of the 5 cages with *H. crudus* contracted M.L.O.-associated lethal decline. This experiment is still in progress.

* _____. Etude des populations d'*Haplaxius crudus* (Van Duzee) en Floride. Oléagineux 35(6): 301. 1980. (086

In Florida, hundreds of thousands of coconut palms have been destroyed by LY on the Florida Keys and on the lower east coast of the mainland. To the north of the generally infected area and on the Florida west

coast there are extensive coconut plantings in which less than a total of 10 cases have been reported. To test the hypothesis that the population density of *Haplaxius crudus*, the suspected vector, is higher in the generally infected area than in relatively disease-free areas, comparative sampling was conducted during 1978 and 1979. The average number of *H. crudus* was 37 times higher in samples from the LY-infected area than in samples from the relatively disease-free area. This information supports the hypothesis that *H. crudus* is the vector.

* HOWARD, F.W. Population densities of *Myndus crudus* Van Duzee (Homoptera: Cixiidae) in relation to coconut lethal yellowing distribution in Florida. Principes 24(4):174-178. 1980. (087

The geographical distribution of the disease in Florida is described. Based on paired sampling within and outside the affected area of the mainland, the planthopper was 40 times more abundant in the infected area ($P < 0.01$). The coincidence in the distribution of the disease with a high polulation density of *M. crudus* increases the probability of the insect being a vector. (Review of Plant Pathology 60(4):2144. 1981).

* _____., NORRIS, R.C. y THOMAS, D.L. Evidence of transmission of palm lethal yellowing agent by a planthopper, *Myndus crudus* (Homoptera: Cixiidae). Tropical Agriculture 60(3):168-171. 1983. 1983. (088

Lethal yellowing (LY) disease developed in 3 of 5 coconut palms, 5 of 7 Manila palms (*Veitchia merrillii*) and 2 of 3 of the palm, *Pritchardia thurstonii*, that were planted in cages into which c. 850 wild planthoppers (*M. crudus*) were introduced each month for 34 months. Transmission of LY disease to one or more palms occured in each of 5 treatment cages. Mycoplasma-like organisms were observed in sieve elements in tissues sampled from all palms that developed LY symptoms, but not in samples from healthy palms. Palms of the same species in 5 cages in which *M. crudus* were not introduced remained healthy. Insects that contaminated the experiment were discounted as possible vectors by biological and experimental design considerations. The number of *M. crudus* used in this experiment and the susceptibilities of the palms were consistent with field observations. The results of this experiment provide the strongest evidence yet published that *M. crudus* is a vector of the LY agent.

* HUNT, P., DABEK, A.J. y SCHUILING, M. Remission of symptoms following tetracycline treatment of lethal yellowing-infected coconut palms. Phytopathology 64(3):307-312. 1974. (089

Of twelve lethal yellowing-infected coconut palms in which a minimum concentration of 3 µg/g tetracycline-HCl was maintained for 5 months, five showed remission of symptoms, five showed delayed symptom development and two showed no difference, when compared with their controls. The strongest responses occurred in palms which initially had the least yellowing. In treated trees, leaf yellowing and nutfall were not arrested until 10-12 weeks after first treatment. Taken in conjunction with the finding of mycoplasmalike organisms in diseased palms, these results strongly support the concept of a mycoplasma etiology for lethal yellowing disease.

* HUNT, P. Une maladie du cocotier d'étiologie incertaine en Indonésie. Oléagineux 35(6):304. 1980. (090

A coconut disease of unknown etiology is reported to have destroyed 13 000 local tall trees recently on the remote Indonesian island of Natuna (South China Sea) and approximately 1 000 trees on Pulan Bintan (near Singapore). Symptoms of sudden nutfall, blackening of open and unopened inflorescence rachillae and male flowers, young spathe discolouration with gummosis, basal spear leaf necrosis and of rapid death resemble but are not identical with those of lethal yellowing. The upward progression of leaf browning, often associated with rachis breaking, resembles the condition associated with the flagellate, Phytomonas. A similar (identical?) disease has started attacking single and small groups of coconut palms on the Sumatran mainland near Pekan Baru. Samples of affected tissues from these palms were free from micro-organisms by light microscopy. The results of electron microscopy will be presented at the conference.

JAMAICA. MINISTRY OF AGRICULTURE AND LANDS. Annual report for the year ended 31st December, 1960. s.l., 1963. 109 p. (091

Lethal yellowing of coconut, to which dwarf type palms still appear to be resistant, continued to spread west and to some extent east along the northern coast, where together with frond drop (35: 366) it is well established in the Rio Bueno area. A new species of *Rotylenchulus* has been found in Jamaica and Florida associated with lethal yellowing, and soil fumigation under healthy trees confined the disease in Florida. (Review of Plant Pathology 43(2):351. 1964).

* JOHNSON, C.G. The search for a vector of lethal yellowing of coconuts in Jamaica from 1962 to 1971: were the experiments really unsuccessful? s.l., FAO, 1975. 16 p. (AGP/CNP/75/48). (092

* _____. y HARRIES, H.C. Resultats d'une récente enquete sur le "Cap Saint-Paul" maladie du cocotier en Afrique de l'ouest. Oléagineux 31(11):488. 1976. (093

Les réstultats d'une visite au Ghana et au Togo sont brievement commentés. Il y a une grande similitude entre les maladies du Cap Saint-Paul au Ghana, du Kaincope au Togo et au Bénin, de Kribi au Cameroun et du Jaunissement mortel dans les Caraibes. Un foyer relativement récent de la maladie du Cap Saint-Paul se manifeste au Cap Three Points du Ghana et menace a présent les zones de culture extensive du cocotier de l'Ouest Ghana et de Cote d'Ivoire. La situation est tres grave, parce que aussi bien l "Nain de Malaisie", que est planté comme variété résistante aux Caraibes, que le "Nain du Cameroun", qui résiste a la maladie au Cameroun, semblent succomber a la maladie dans un essai situé a Dzelukopé au Ghana. Notre opinion réfléchie est qu'il s'agit d'une épidémie intercontinentale largement étendue, a fort pouvoir destructeur et qui sévit des deux cotés de l'Atlantique, avec sans doute une étiologie similaire, sur les variétés de cocotiers qui y sont communes; a savoir le "Grand Ouest Africain" et le "Grand de la Jamaique", Ces variétés sont l'une et l'autre aussi différentes de celles du sud-est Asiatique et du Pacifique.

* JOHNSON, C.G. y EDEN-GREEN, S.J. Búsqueda del vector de la amarillez letal del cocotero en Jamaica: reevaluación de los experimentos de 1962 a 1971. Boletín Fitosanitario de la FAO 26(4):137-149, 162. 1978. (094

* También en: Oléagineux 31(11):486. 1976.

A pesar de 15 años de ensayos intensivos, el vector de la enfermedad de la amarillez letal del cocotero sigue siendo desconocido; en este artículo se describen los experimentos de transmisión en Jamaica, que precedieron a la asociación de organismos micoplasmoides con la enfermedad en 1972. Los grupos de insectos probados fueron seleccionados pensando en que la enfermedad era causada por un virus, y comprendió cicadélidos, aleuródidos, áfidos, cóccidos, pseudocóccidos, trips y otros presuntos vectores. Aunque los resultados se consideraron generalmente como negativos, se lograron algunas transmisiones que se descartaron debido a que se pensó que eran reducidísimas y que no podrían repetirse. Una reevaluación sugiere que ésos pueden haber sido resultados reales, lo cual implica un cicadélido vector, pero probablemente los métodos experimentales usados no fueron los más idóneos para dar una respuesta inequívoca.

LATHAM, J.P. y ELLIOT, R. Detecting lethal yellowing palms for environmental control in Florida. Proceedings of the Annual Meeting of the American Society of Photogrammetry 1975:368-373. 1975. (095

* LATTA, R. Attempts to relate nematodes to lethal yellowing disease of coconut palms in Jamaica. Tropical Agriculture (Trinidad) 43(1):59-68. 1966. (096

Investigations were made at the Irwin Agricultural Station from 1962 to 1965 to study the role of nematodes in lethal yellowing disease of coconut palms. Periodical sampling of sites representing the geographical and soil type ranges of the disease in Jamaica, over a period of one year, revealed 14 genera of parasitic nematodes associated with apparently healthy coconut palms, but the complex differed at each site. A few parasitic nematodes were found in the roots of both diseased and healthy palms, but in very limited numbers. Nematodes were found in all aerial portions of palms, but only a small portion of these were parasitic types. Attempts to stimulate nematode feeding on tender roots by confining large populations around single root tips resulted in only a few specimens entering the roots. Transmission of the disease was attempted by growing palms in soil containing parasitic nematodes from around the roots of diseased palms; by placing soil containing parasitic nematodes from around the roots of diseased palms around the roots of healthy palms; by placing nematodes extracted from the soil and roots of diseased palms in the soil around roots of healthy palms; and by introducing water suspensions of nematodes extracted from soil around the roots of diseased palms directly into healthy palms. No transmission of the disease resulted. The negative transmission trials, and other data yielded by the study, gave no support to a conclusion that nematodes cause or act as vectors of lethal yellowing in Jamaica.

* LETHAL YELLOWING disease of coconuts. Caribbean Farming (Jamaica) 4(1):26-28. 1974. (097

* THE LETHAL yellowing problems of coconuts. Farmer (Jamaica) 76(9):322-325. 1971. (098

* McCOY, R.E. Remission of lethal yellowing in coconut palm treated with tetracycline antibiotics. Plant Disease Reporter 56(12):1019-1021. 1972. (099

Cessation of symptom development and resumption of healthy new growth was achieved in lethal yellowing affected coconut palms directly injected with oxytetracycline-HCl or tetracycline-HCl in trials in Florida supporting the hypothesis that the disease is of mycoplasmal etiology. (Review of Plant Pathology 52(8):2715. 1973).

_____. Antibiotic treatment of lethal yellowing. In Fisher, J.B. Report of the Lethal Yellowing Symposium at Fairchild Tropical Garden, Miami. Principes 17:157-158. 1973. (100

* _____. Effect of various antibiotics on development of lethal yellowing in coconut palm. Proceedings of the Florida State Horticultural Society 86:503-506. 1973. (101

Fifty coconut palms exhibiting early symptoms of lethal yellowing were selected for treatment with oxytetracycline-HCl, tetracycline-HCl, streptomycin nitrate, potassium penicillin-G, or griseofulvin. Two grams of antibiotic in 0.2 or 1.0 liters of water were pressure injected into the trunk of each tree except for the griseofulvin treatments which were applied as a paste into holes bored in the trunk. In addition, applications of 20 and 40 g oxytetracycline-HCl in 20 liters water were made to the soil around several affected trees. Remission of symptom development was obtained only with tetracycline antibiotics directly injected into the palms. Of these, oxytetracycline-HCl produced a more rapid remission and was more likely to prevent further symptom development than was tetracycline-HCl. The ability of the tetracycline antibiotics to effect remission, contrasted with the non-efficaciousness of penicillin and streptomycin, further supports the possibility of a mycoplasmal etiology of lethal yellowing.

* _____. Florida's coconut palms threatened by lethal yellowing /Mycoplasma/. Sunshine State Agricultural Research Report 18(1/2):8-10. 1973. (102

_____. Lethal yellowing in Florida. Proceedings of the Florida Turf-Grass Management Conference 21:97-99. 1973. (103

_____. Research on lethal yellowing of coconut palms. Proceedings of the Florida Pest Control Conference 7:56-62. 1973. (104

_____. Duration of remission of lethal yellowing in coconut palm treated with tetracycline antibiotics. Annual Proceedings of the American Phytopathological Society for 1974 1:164. 1974? (Sólo sumario) (105

* _____. How to treat your palm with antibiotic for control of lethal yellowing of coconut palm and lethal decline of *Pritchardia* palm. Florida Agricultural Experiment Station. Circular S-228. 1974. 7 p. (106

* _____. Techniques for treatment of palm trees with antibiotics. Proceedings of the Florida State Horticultural Society 87:537-540. 1974. (107

Various methods of introducing soluble antibiotics, particularly oxytetracycline-HCl, into the tissues of coconut palms have been evaluated

over the past 2 years, both by evaluation of lethal yellowing disease control, and through assay of tissue levels of antibiotic. Direct liquid injection was most efficient, particularly when coupled with either air or hydraulic pressure. Several direct injection techniques are discussed. Foliage sprays, soil drenches, and implantation of solid tablets were ineffective in producing detectable tissue concentrations of antibiotic or significant disease control.

McCOY, R.E. Antibiotic treatment programme in Florida (lethal yellowing control). Rome, FAO, 1975. 1 p. (AGP/CNP/75/36). (108

* _____. Effect of oxytetracycline dose and stage of disease development on remission of lethal yellowing in coconut palm. Plant Disease Reporter 59(9):717-720. 1975. (109

Symptom expression in lethal yellowing affected coconut palms (*Cocos nucifera*) may be arrested or slowed down by treatment with tetracycline antibiotics. Remission in the form of growth of healthy new inflorescences and fronds was observed in treated palms 3-4 months after initial treatment with oxytetracycline HCl (OTC). This period of remission lasts approximately 4-7 months before symptoms begin to reappear. Doses as small as 50-100 mg OTC/tree have produced a definite response, and doses as high as 20 g/tree have failed to induce any symptoms of foliar toxicity. Palms treated in the early or pre-yellowing stages of disease development responded much better than more advanced cases of disease, although the higher doses tested, 6-30 g OTC/tree, induced remission in trees in the early yellowing stages of symptom development. The effect of the higher doses was also longer lasting.

* _____. Accumulation of antibiotic residues in the fruit of coconut palms treated with oxytetracycline for the control of lethal yellowing. Oléagineux 31(5):215-218. 1976. (110

Fruit from coconut palms, trunk injected with oxytetracline-hydrochloride for control of the lethal yellowing disease, were assayed for antibiotic residues. Fruit in all stages of maturity were harvested 1 week after treatment from trees receiving the highest recommended remedial dosage, 6 g oxytetracycline-HCl per tree. One per cent of these fruit exhibited oxytetracycline-HCl levels in coconut milk of 0.2 µg/ml to 0.3 µg/ml (parts per million); 3% of all milk samples showed possible traces of the antibiotic that were less than 0.2 µg/ml, and 96 % of the milk samples had no detectable traces of antibiotic. Coconut meat from approximately 25 % of the nuts samples contained traces of oxytetracycline-HCl and the overall mean concentration in coconut meat was 0.11 µg/g. Oxytetracycline-HCl concentrations in coconut meat declined with time so that no residues were detected in fruit harvested 4 weeks after treatment.

* _____. Comparative epidemiology of the lethal yellowing, Kaincope, and Cadang-cadang diseases of coconut palm. Plant Disease Reporter 60(6):498-502. 1976. (111

Calculation of apparent infection rate (r) of lethal yellowing (LY) in Florida or Jamaica, gave approximately equivalent values averaging 0.3/unit/month. The highest r value in Florida occurred under high cultural maintenance, the lowest were adjacent to salt water. Calculated r values from literature indicate the Kaincope disease

of Africa spreads at a rate similar to LY; however, cadang-cadang in the Philippines spreads much more slowly, especially when inoculum removal by palm death is considered.

* McCOY, R.E. Efecto de gentamicin, spectinomycin y otros agentes microbiales, sobre el amarillamiento letal del cocotero. Noticias Fitopatológicas (Colombia) 5(1):52. 1976. (112

Los antibióticos tetracyclina-HCl, oxytetracyclina-HCl, y clortetracyclina-HCl pueden suprimir el desarrollo de los síntomas y estimular nuevos crecimientos sanos en los cocoteros enfermos con amarillamiento letal (AL). La acción de otros agentes antimicrobiales, algunos teniendo actividad contra mycoplasma conocido fueron probados contra AL. Cinco palmas con síntomas primarios fueron inyectadas en el tronco con soluciones acuosas de 3 g de ingrediente activo por cada agente probado excepto gentamicin, usado a 500 mg/árbol. De las no tetracyclinas, solamente gentamicin-S04 indujo disminución, ya que nuevo crecimiento sano fue producido en tres de cinco palmas tratadas. Ambos agentes, spectinomycin-S04 y spectinomycin-HCl mostraron disminuir la rata de desarrollo del síntoma pero no indujeron nuevos crecimientos sanos. Los agentes antibacteriales lincomycin-HCl, cloramphenicol, erythromycin-P04 y penicillin-G (sal de procaína) no tuvieron efecto, como tampoco los agentes antifungosos nystatin, benomyl, thiabendazole y dexon. Además la aplicación al suelo de los biócidos carbofuram y aldicarb (25 g/árbol) no tuvo efecto. Aunque el fracaso para inducir la disminución en algunos casos podría ser debido a una falta de translocación del químico aplicado dentro de la planta, estos resultados apoyan el argumento que el AL puede ser causado por un agente parecido a micoplasma en contra a una bacteria, hongo, artrópodo o nemátodo.

* _____. Y CHARUDATTAN, R. Etat d'avancement des recherches en matiere d'isolement et de caractérisation de l'agent pathogene du jaunissement mortel. Oléagineux 31(11):485. 1976. (113

A Fort Lauderdale comme chez R.E. Davis a Beltsville (Maryland) des efforts particuliers ont été fournis pour mettre au point une technique de culture de mycoplasmes a partir de tissus de cocotiers de Floride atteints de Jaunissement mortel. De nombreux milieux ont été utilisés, ayant comme base spit le bouillon "PPLO DIFCO" complété avec une fraction de sérum, soit le milieu pour *Spiroplasma* utilisé pour la culture de l'agent du "Stubbor" des agrumes ou du nanisme du mais ou "Corn Stunt". Meme en faisant varier la concentration en O_2 la quantité de sérum, la pression osmotique el différents composants du milieu, aucun organisme n'a pu etre cultivé. En l'absence de culture pure de l'agent du Jaunissement mortel, l'isolement direct a partir d'exsudats de phloeme a été tenté. La seve élaborée de cocotier malade et de cocotier sain a été caractérisée par un test sérologique apres injection dans des lapins. Les exsudats de phloeme sont filtŕes a travers des filtres a pores de 0,45 µ, dialysés pour enlever l'exces de saccharose, et utilisés ainsi comme antigenes. Deux a trois bandes de précipitation, probablement dues aux protéines de l'hote, sont obtenues par le test de diffusion sur gel entre les antigenes (Ag) des cocotiers sains (C.S.) et des cocotiers malades (J.M.), et les antisérums (As). Il existe un antigene Ag spécifique mis en évidence dans les réactions homologues avec le cocotier malade. Cette réaction est apparue pour les antigenes préparés a partir d'un grand nombre de cocotiers malades. Des tests avec des antisérums absorbés ont montré qu'il existe des différences antigéniques entre les cocotiers malades et les cocotiers

sains. Avec l'antigene J.M. l'antisérum réagit fortement, l'antisérum C.S. ne donne que les bandes de précipitation communes présentes dans les deux réactions mettant en jeu C.S. et J.M., l'antigene C.S. absorbé avec l'antisérum C.S. ne donne aucune bande de précipitation du fait que le composant commun est éliminé, l'antigene J.M. absorbé avec l'antisérum C.S. ne produit aucune bande de précipitation puisque le composant commun est absorbé, l'antigene J.M. absorbé avec l'antisérum J.M. ne produit aucune bande; mais l'antigene C.S. absorbé avec l'antisérum J.M. produit une seule bande de précipitation, spécifique du Jaunissement mortel, puisque le composant protéinique commun appartenant probablement a l'hote, a été éliminé. De plus, l'antigene préparé a partir du palmier *Veitchia* en voie de dépérissement réagit fortement avec l'antisérum J.M. mais seulement faiblement avec l'antisérum C.S., indiquant donc que le composant spécifique du Cocotier malade présent dans l'antigene J.M. est aussi présent dans l'antigene de *Veitchia* préparé de la meme maniere. Enfin, les réactions réciproques de l'antisérum J.M. avec les antigenes d'*Acholeplasma laidlawii* et *Spiroplasma citri* obtenus a partir de cultures sur bouillon "PPLO", et l'antigene J.M. avec l'antisérum de *S. citri* et de *Mycoplasma gallisepticum*, montrent qu'il n'existe aucune relation de l'un a l'autre, ce qui témoigne de la spécificité de ces réactions. La nature de cette différence antigénique n'a pas été déterminée; cependant, si la réaction spécifique du sérum obtenu a partir du cocotier malade est bien due a l'agent causal de la maladie, un outil nouveau et de grand intéret apparait pour l'étude du Jaunissement mortel.

*McCOY, R.E. Etude comparative de l'épidémiologie du jaunissement mortel. Oléagineaux 31(11): 484. 1976. (114

La propagation de toute maladie contagieuse est un processus dynamique qui commence lentement en n'affectant qu'un petit nombre d'individus puis qui progresse de plus en plus vite au fur et a mesure que se nombre augmente. Le taux de propagation du Jaunissement mortel (=Lethal Yellowing = L.Y.) a été mesuré sur le terrain en Floride et comparé a celui du L.Y. de la Jamaique ainsi qu'a ceux du Kaincopé et du Cadang-Cadang respectivement en Afrique de l'Ouest et aux Philippines. Le taux de propagation de toute maladie est basé sur le nombre cumulé de cas d'infections apparentes dans la population, et peut etre déterminé par l'équation de Van der Planks: $dx/dt = RXt(1-Xt)$ ou l'augmentation de la maladie ((X) avec le temps (t) est égale au produit du taux de propagation R par la proportion instantanée des cas de maladie Xt, et par un facteur (1 - Xt) qui rend compte du fait que la population étudiée est un nombre fini. Les chiffres collectés par le Florida Department of Agriculture pendant les 18 premiers mois de l'épidémie a Miami donnent une valeur du taux r = 0,21/unité/mois lorsque la transformation logarithmique Ln $[X/(1 - X)]$ est rapportée au temps décompté en mois. La valeur de R dans des parcelles de cocotiers de Miami, a été calculée pour une période de 16 mois et a varié de 0,15 a 0,42/unité/mois. Les plus fortes valeurs ont éte relevées dans les parcelles les mieux entretenues. Les plus faibles valeurs se manifestent en bordure de mer. Les valeurs du taux de propagation calculées a partir de statistiques du Coconut Industry Board pour une cocoteraie de Jamaique étaient de 0,31 et 0,28/unité/mois pour une période de cinq mois. Ces valeurs prises dans les conditions memes d'une plantation affectée sont tout a fait comparables a celles du taux d'extension du L.Y. en Floride. A titre de comparaison supplémentaire, la valeur de r calculée a partir de chiffres publiés est de 0,25/unité/mois pour le Kaincopé en Afrique de

l'Ouest; alors que pour le Cadang-Cadang elle est de 0,03/unité/ mois aux Philippines. La similitude des taux de propagation du L.Y. et du Kaincopé laisse a penser que ces deux maladies sont identiques. Par contrel la symptomatologie et le taux de propagation du Cadang-Cadang sont suffisamment différents pour suggérer qu'il s'agit d'un autre systeme pathogene-vecteur.

* McCOY, R.E. et al. Field control of coconut lethal yellowing with oxytetracycline hydrochloride. Phytopathology 66(9):1148-1150. 1976. (115

Large scale field testing of oxytetracycline-HCl (OTC) demonstrated that it could exert a definite protective effect on apparently healthy coconut palms in areas of advancing lethal yellowing disease (LY). Rates of spread of LY were decreased X4 - 5 over 12-16 months in field plots in Dade County, Florida when all coconut palms were injected with 1-3 g OTC at 4-month intervals in comparison with adjacent untreated areas.

* _____. Progres des recherches sur l'isolement et la caractérisation du pathogene responsable du jaunissement mortel. Oléagineux 31(11):485. 1976. (116

Dans deux expériences dont les résultats sont présentés, il apparait que des changements se produisent dans la croissance avant l'apparition des symptomes du Jaunissement mortel sur des arbres contaminés. Dans le premier essai ("Expérience de transfert"; Dabeck, sous presse au Phytopathologische Zeitschrift), l'élongation de la fleche et des jeunes feuilles de cocotiers, "Grand de la Jamaique" agés de deux a trois ans, a été enregistrée a environ deux semaines d'intervalle, apres que les arbres eussent été exposés a l'infection naturelle par le L.Y. pendant des périodes controlées de plus de trois mois. Des mesures analogues ont été relevées, a des intervalles d'un mois approximativement, sur une série de cocotiers producteurs agés d'environ 14 ans. dans une zone ou la maladie est virulente. Le taux d'élongation de la fleche, et, aussi bien, celui des quatre plus jeunes feuilles dans le cas des arbres producteurs, sont a peu pres linéaires tant que l'arbre reste sain. Mais d'habitude, il diminue rapidement sur les jeunes arbres au moment de l'attaque par le L.Y. ou juste avant. Sur les arbres producteurs, on a noté une diminution plus lente du taux de croissance, qui commence plusieurs semaines apres l'apparition des symptomes. La comparaison minuteuse des données entre arbres malades et saines dans ces deux expériences a montré que la baisse de croissance des arbres malades est souvent précédée par une augmentation de croissance de plus de 40 p. 100 par rapport aux arbres sains. Les conclusions de précédents auteurs sont comparées et le degré de signification de leurs résultats est discuté.

* _____. Traitement antibiotique du jaunissement mortel en Floride. Oléagineaux 31(11): 486. 1976. (117

L'oxytétracycline HCl (OTC) a été homologuée par l'United States Environment Protection Agency comme produit de traitement contre le Jaunissement mortel (L.Y.) en Floride. Le traitement des arbres malades réalisé avant le jaunissement des feuilles produit une réduction ou un arret de développement des symptomes pendant quatre a sept mois. De faibles doses de l'ordre de 100 mg peuvent avoir un effet définitif sur le L.Y. mais la dose optimale préconisée

est de 1 a 3 g. De fortes doses de l'ordre de 20 g d'OTC provoquent des rémissions pendant un an. De tels traitements thérapeutiques ont induit une complete rémission (arret total du développement des symptomes pendant quatre mois et plus) dans 50 p. 100 des arbres traites. Sur les autres arbres traités, les symptomes du jaunissement continuent a progresser, mais la plupart émettent de nouvelles feuilles et inflorescences saines pendant un certain temps. Enfin, 50 p. 100 de ces derniers arbres (soit 25 p. 100 du total des arbres traités) peuvent parvenir a une complete rémission avec des traitements continus. Les traitements curatifs répétés tous les quatre mois peuvent conduire a la rémission. A la meme frequence d'application, les traitements préventifs avec 1 a 3 g d'OTC ont réduit de trois a cinqu fois le taux de propagation apparant du L.Y. Il est possible qu'avec de tels traitements on puisse prolonger de quatre a cinq ans la production des arbres menacés. Ce délai est suffisant pour permettre l'entrée en production de "Nains de Malaisieq interplantés. Tous les traitements ont été administrés par injection dans le tronc. Les pulvérisations ou l'arrosage du sol sont sans effet. La persistance dans le fuillage de l'OTC injectée a éte d'environ deux mois avec une demi-vie de deux semaines. Chaque gramme d'OTC injecté produit un résidu dans les feuilles de 1 a 3 µg/g (PPM). En pratique, on ne trouve pas de résidus d'OTC dans le lait de coco (eau) bien que 12 p. 100 des noix provenant des arbres traités ont des résidus détectables dans l'albumen. L'importance de ces derniers résidus décroit dans le temps et ils n'ont plus été détectables sur des noix récoltées un mois aprés traitement. D'autres types de palmiers dépérissants répondent au traitement a l'OTC: *Pritchardia thurstonii; P. pacifica, Trachycarpus fortunei* et *Arikuryroba shizophylla.*

* _____. Uptake, translocation, and persistence of oxytetracycline in coconut palm. Phytopathology 66(8):1038-1042. 1976. (118

Oxytetracycline-HCl (OTC) residues were measured in coconut palm (*Cocos nucifera*) by microbiological assay of aqueous extracts of freeze dried or fresh tissue samples. Detectable uptake of OTC was obtained only through the injection of aqueous solutions directly into the trunk of the palms. Soil drenches, foliar sprays and implantation of solid tablets produced no detectable foliar residues. Residues of OTC as high as 20 µg/g fresh weight were found in foliage within 2 days of trunk injection of 6 g of antibiotic. Most of this material accumulated in the middle and upper fronds of the treated trees. Accumulations were lower in roots, trunk, unopened spear or bud leaves, older senescing fronds and in fruit. The half life of OTC in foliage was c.2 weeks. It was suggested that the levels of OTC obtained in treated palms have a toxic effect on the agent of lethal yellowing disease and symptom development may be halted for 2-5 months longer than the period that OTC is detected in the tissues. (Review of Plant Pathology 56(4):1689. 1977).

_____., GWIN, G.H. y DONSELMAN, H.M. Use of oxytetracycline for prophylactic and therapeutic treatment for lethal yellowing in Florida. In Proceedings of the Symposium on Coconut Research and Development, Kasaragod, India, 1976. s.n.t. (119

McCOY, R.E. Growth of mycoplasmas in phloem sap from lethal yellowing-resistant Malayan Dwarf coconut palm. Proceedings of the American Phytopathological Society 4:108. 1977. (120

_____., TULLY, J.G. y OSBORNE, I. Mycoplasma isolation and culture /lethal yellowing disease, coconuts/. In Meeting of the International Council on Lethal Yellowing, 3rd, USA, 1977. Proceedings. s.l., s.e., 1977. pp. 18-21. (121

* _____. Petiole injection of coconut palm, a method to prevent permanent trunk injury during antibiotic treatment for lethal yellowing. Proceedings of the Florida State Horticultural Society 90:114-117. 1977. (122

Treatment of coconut palms with trunk injections of the antibiotic oxytetracycline-HCl has come under widespread use for control of the lethal yellowing disease in Florida. The principal drawback to the treatment methods currently in use is that a permanent injury is made to the trunk at the site of injection. An alternative method of injecting the bases of leaf petioles was found to be of definite therapeutic value in diseased palms, even though high overall tissue concentrations of antibiotic were found only in the treated fronds.

* _____. Systemic treatment of coconut palm with oxytetracycline. In Symposium on Systemic Chemical Treatments in Tree Culture, East Lansing, Mich., 1978. Proceedings. Ed. by J.J. Kielbaso. East Lansing, Mich., Michigan State University, The Kellogg Center for Continuing Education, 1979. pp. 215-222. (123

Systemic treatment of coconut palms by injection of the antibiotic oxytetracycline-HCl has been demonstrated to be a viable control measure for the lethal yellowing disease. Efficient transport of the antibiotic has been achieved only through trunk injection of acqueous solutions. Soil drenches and foliar sprays of oxytetracycline have yielded little or no tissue residues of oxytetracycline, and have not proven therapeutically effective against lethal yellowing. The most efficient method of treatment in terms of quantity of antibiotic transported into foliage has been Mauget or gravity feed trunk injections. Hydraulic pressure injections into the trunk are rapid but cause a large amount of tissue damage and often have not resulted in efficient transport of the injected chemical. The pattern of distribution of injected antibiotic is typical of a xylem transport pathway, although, the injected material must get into the phloem since the suspected causal agent is phloem delimited. Due to the anastomosing vascular network within the trunks of palms, only one injection site is necessary in order to achieve uniform foliar distribution of the antibiotic.

_____. y WILLIAMS, D.S. Chemical treatment for control of plant mycoplasma diseases. In Daniels, M.J. y Markham, P.G., eds. Plant and insect mycoplasma techniques. London, Croom Helm, 1982. pp. 152-173. (124

* _____., WILLIAMS, D.S. y PORTIER, K.M. Evaluation of a spray mixture for lethal yellowing control. Proceedings of the Florida State Horticultural Society 95:258-259. 1982. (125

Efficacy of a sprayable pesticide mixture (J.K. Dunaway, originator) for lethal yellowing (LY) control in coconut palms was compared to

that of oxytetracycline-HCl (OTC) injection. Seventy-seven trees were selected in the pre-yellowing phase of LY and sprayed twice, injected with OTC, or monitored as untreated controls. The spray mixture had no effect on symptom development, or mortality rate, nor was new growth produced in any tree; all trees died. Ninety-two per cent of the untreated control palms were dead after 6 months and the remainder were in the final stages of decline. Eleven of 20 trees receiving OTC were in a state of remission (producing healthy new growth) after 6 months. In addition, OTC treatment reduced mortality rate and suppressed the mean rate of symptom development.

McCOY, R.E., THOMAS, D.L. y TSAI, J.H. Lethal yellowing: a potential danger to date production. Date Palm Journal 1(2):295-305. 1982. (126

Symptoms, aetiology, spread and control of the disease of coconuts, also believed to affect other palms including date, are described and discussed. A list of palm species in South Florida infected by mycoplasmalike organisms and placed under lethal yellowing quarantine is presented. (Review of Plant Pathology 62(3):1156. 1983).

* _____. Use of tetracycline antibiotics to control yellows disease. Plant Disease 66(7): 539-542. 1982. (127

The use of oxytetracycline hydrochloride and related compounds for control of mycoplasma diseases is reviewed and discussed with special reference to coconut (lethal yellowing disease), and in relation to remission, methods of treatment, dose response tests, formulations and stability, and safety of antibiotic use. (Review of Plant Pathology 61(12):6966. 1982).

McCOY, R.E. et al. Lethal yellowing of palms. University of Florida. Bulletin no. 834. 1983. 100 p. (128

* McDONOUGH, J. y ZIMMERMANN, M.H. Effect of lethal yellowing on xylem pressure in coconut palms. Principes 23(3):132-137. 1979. (129

Pressures in the xylem of leaflets of healthy coconut palms vary from ca. -1 bar at night to ca. -10 bars at midday in sunshine. There is little diurnal pressure variation in palms showing lethal yellowing symptoms; midday pressures do not drop below ca. -4 bars. This seems to indicate stomatal closure. High pressures were also found in an apparently healthy tree which began to show symptoms two weeks later. Unusually high midday xylem pressures may therefore be the earliest recognizable symptom of lethal yellowing.

* MARAMOROSCH, K. A survey of coconut diseases of unknown etiology. Rome, FAO, 1964. 39 p. (130

Following a world tour of the main coconut-producing areas the author has observed and compared 10 such diseases and also the red ring nematode disease of South and Central America and South Caribbean. In each case synonyms are listed, the historial back-ground and the symptoms are described, and conclusions as to probable causes noted. An excellent series of coloured illustrations of symptoms is appended. The diseases are divided into 3 groups. Non lethal diseases with recovery include bronze-leaf wilt of the Caribbean, little leaf, described from Jamaica and Trinidad, and a fused leaf condition with distorted nuts, recognized in Jamaica since 1960, where it is known as Chinese

coconuts, and similar in symptomology to the bristle top disease in Guam also described. The Kerala wilt of India, classified as non-lethal with no recovery, is regarded as a debiliting rather than a killing disease. Lethal diseases are subdivided into 3 classes. Those with short pathogenesis, averaging 5 months, are lethal yellowing and Malaysian wilt. The author regards the disease in West Africa as identical with lethal yellowing of the Caribbean. (Review of Plant Pathology 44(7):2578. 1965).

* MARAMOROSCH, K. Amarelecimento letal do coqueiro: distribuição, impacto e implicações mundiais. Fitopatología Brasileira 3(2):135-148. 1978. (131

Esta revisão faz uma descrição detalhada da sintomatología, da distribuição geográfica (no Caribe, América do Norte e Africa) e do agente causal, um microorganismo do tipo micoplasma, do amarelecimiento letal dos coqueiros. Além dos coqueiros, o amarelecimiento letal afeta outras esécies de palmáceas, representando uma séria ameaça às palmeiras oleginosas e ornamentais, e às tamareiras. A maneira como o agente desta moléstia é disseminado ainda não se acha esclarecida. Quimioterapia, utilizando tetraciclina, efetuada na Flórida em pequena escala, simplesmente retardou a despersão do amarelecimiento letal, causando uma remissão temporário em un número limitado de palmeiras tratadas. Cultivares do tipo Anão Malaio (Malayan Dwarf) e certos híbridos são altamente resistentes e recomendados para replantio nas áreas afetadas.

_____. y HUNT, P. Lethal yellowing disease of coconut and other palms. In _____ y Hunt, P. Mycoplasma diseases of trees and shrubs. New York, Academic Press, 1981. pp. 185-210. (132

MARKHAM, P.G. South American palms threatened by disease spread. International Agricultural Development 2(8):6-7. 1982. (133

The identification of lethal yellowing disease in Florida, Texas and Mexico show that the whole coconut industry in South America may be in danger. Symptoms, spread and control of the disease (mainly by planting resistant varieties) are discussed. (Review of Plant Pathology 62(9):3936. 1983).

* MARTINEZ, A.P. El amarilleo letal del cocotero en Florida. Boletín Fitosanitario de la FAO 13(2):25-29. 1965. (134

Las observaciones periódicas realizadas sobre el amarilleo letal existente en Florida han permitido determinar la sucesión de síntomas macroscópicas típicos del síndrome del amarilleo letal del cocotero. Se indican los síntomas del síndrome del amarilleo letal. El único remedio práctico e inmediato al problema es la plantación de cocoteros enanos (*Cocos nucifera*, variedad Malayan). Los trabajos hechos por Latta y sus colaboradores en Jamaica indican que estas palmas poseen elevada resistencia a la enfermedad cuando se plantan en lugares en que las variedades altas han quedado destruídas por el amarilleo letal.

MARTYN, R.D. y MIDCAP, J.T. History, spread and other palm hosts of lethal yellowing of coconut palms. Florida Cooperative Extension Service. Circular 405. 1975. s.p. (135

MATHAI, G. Seasonal variations on foliar yellowing /chlorosis/ in coconut. Indian Coconut Journal 9(10):1-2. 1979. (136

* MAZZANI, B. y BASTIDAS, R. El amarillamiento letal del cocotero. Coco y Palma (Venezuela) no. 5:5-6. 1974. (137

MEETING OF THE INTERNATIONAL COUNCIL ON LETHAL YELLOWING, 2nd. Principes 20(2):57-69. 1976. (138

Abstracts of 21 papers read at the meeting on lethal yellowing of coconut, 22-24 Sept. 1975, at Kingston are presented. The extension of the disease to new areas of Florida indicates that rate of spread depends on the number of palms already affected. Tetracycline antibiotics have provided temporary protection. Although the resistance of Malayan Dwarf is very high in Jamaica, there are doubts about its resistance in West Africa. (Review of Plant Pathology 55(10):4812. 1976).

* MEETING OF THE INTERNATIONAL COUNCIL ON LETHAL YELLOWING, 4th, 13-17 AUGUST, 1979. IRHO (En francés). Oléganineux 35(6):297-304. 1980. (139

Abstracts are given of some papers on lethal yellowing, marchitez, cadang-cadang, blast and similar diseases of coconut and oil palm presented at the meeting in August 1979 at Fort Lauderdale, Florida, USA. (Review of Plant Pathology 61(3):1331. 1982).

MIDCAP, J.T. y McCOY, R.E. Malayan dwarf coconut palm is resistant to lethal yellowing. Agricultural Research Reports 20(3):8-9. 1975. (140

* _____., NEEL, P.L. y HULL, DE A.L. The 'Malayan Dwarf' coconut palm, a lethal yellowing resistant cultivar. Proceedings of the Florida State Horticultural Society 88:377-380. 1975. (141

Florida's tall coconut palm is susceptible to disease, lethal yellowing, which has killed approximately 1/3 of the coconut palms since first reported in Florida in 1955. The "Malayan Dwarf" coconut palm, a semi-dwarf cultivar of *Cocos nucifera* L., is highly resistant to lethal yellowing. The "Malayan Dwarf" differs from the common tall coconut in form, growth rate, mature height, leaf size and number, and earliness of flowering and fruiting. Three color forms are available and can be distinguished by the color of the petiole and fruit. The "Malayan Dwarf" requires proper watering and fertilization for good growth. "Malayan Dwarfs" should be grown from certified Jamaican seed since they occasionally hybridize with susceptible hybrids. "Malayan Dwarf" coconut palms offer an excellent replacement for Florida's susceptible coconut palms.

* MILBURN, J.A., ZIMMERMAN, M.H. y TOMLINSON, P.B. Etudes préliminaires sur la circulation de la seve chez le cocotier. Oléagineux 31(11):485-486. 1976. (142

On admet généralement que la maldie du Jaunissement mortel du cocotier est véhiculée par les tubes criblés libériens du systeme vasculaire entre un certain point d'infection et le méristeme apical qui est tué.

Cependant, il nous manque des données fondamentales concernant: a) la structure intriquée du systeme vasculaire et b) le mécanisme de transport par les tubes criblés du phloeme. La connaissance de ces données est essentielle pour comprendre les modalités de l'infection et de la transmission du pathogene et pour efficacement des méthodes de traitement telles que l'injection d' insecticides ou d'antibiotiques. Cette communication décrit les expériences préliminaires réalisées sur *Cocos*, en octobre 1973 et mai 1974, au Jennings Estate de Miami, Floride. On a constaté que les tensions d'eau du Xylene, mesurées au niveau des feuilles avec une bombe a pression, variaient, selon un cycle journalier, entre environ - 2 bars de nuit et - 10 bars de jour. On a enregistré occasionnellement des tensions plus basses, inférieures a - 14 bars, apparemment causées par de breves périodes d'insolation. Il y a done une efficace régulation de l'approvisionnement en eau dans le cas de changements lents étalés sur plusieurs jours, dans les réserves hydriques du sol. Mais il en va tout autrement dans le cas de changements rapides survenant en quelques heures. On a calculé la pression osmotique des exsudats de tubes criblés a partir de lecture faite au réfractiometre portatif sur de la seve du phloeme obtenue en pratiquant des coupes répétées sur des inflorescences immatures. On a constaté que la pression de turgescence des tubes criblés, mesurée dans les memes tissus avec différents modeles de manometre, se situe au-dessus d'un minimum de 8 bars. Comme la pression osmotique varie de - 10 a - 23 bars, nos résultats sobt compatibles avec l'idée que la circulation de la seve dans les tubes criblés est régie par les gradients de pression de turgescence qui résultent de la pression osmotique du phloeme et de la pression d'eau dans le Xylene. Chez *Cocos* comme chez d'autres plantes, la pression de turgescence des tubes criblés parait se maintenir si la pression d'eau change lentement, mais pas si ce changement se produit brusquement en quelques heures. Ces résultats impliquent que l'infection, naturelle ou artificielle, peut etre favorisée par un brusque choc hydrique qui cause une chute de la pression atmosphérique (de 0 bar). En fait, ce choc semble etre une condition nécessaire a l'infection. Il est possible d'injecter a l'aide d'une seringue des pathogenes ou des produits, particulierement si on opere des coupes en tranches répétées pour augmenter la capacité conduvtive des tubes criblés et si on met a profit un choc hydrique pour abaisser leur pression de turgescence. Cette interprétation de nos résultats peut aussi expliquer d'une part que les cocotiers sous ombrage ont beaucoup moins de change d'etre infectés que ceux qui sont en plein soleil, et d'autre part, que les essais de transmission du pathogene suspecté, réalisés en serre ou dans des conditions analogues, ont pu échouer.

* **MILLER, M.E. y ROBERTS, D.A. Mechanical transmission of the coconut palm lethal-yellowing pathogen from frozen or fresh inocula prepared in two buffers. Phytopathology 60(9):1304. 1970.** (143

Necrotic tissues from coconut palms infected with the lethal-yellowing pathogen were ground, with mortars and pestles, in sodium diethyldithiocarbamate (Na-DIECA) plus 2-mercaptoethanol, pH 8.0, or in Tris (Tris (hydroximethyl)-amino methane)-HCl, pH 7.2. The resulting slurries, to which 500-mesh Carborundum was added, were applied to the basal portions spear leaves of 1.5- to 3-year-old palms by the gauze-pad method of inoculation. Fresh inocula prepared in Na-DIECA infected 4 of 22 palms, whereas those prepared

in Tris infected 11 of 45. Inocula prepared in Tris from necrotic tissue that had been frozen for as long as 18 weeks infected 12 of 42 palms. These results confirm that lethal yellowing of coconut palms is caused by a mechanically transmissible agent, and support the theory that lethal yellowing is a viral disease.

MULLIN, R.S. y ROBERTS, D.A. Lethal yellowing of coconut palms. Florida University Extension Circular no. 358. 1972. 4 p. (144

* NIENHAUS, F. y STEINER, K.G. Mycoplasmalike organisms associated with Kaincopé disease of coconut palms in Togo. Plant Disease Reporter 60(12):1000-1002. 1976. (145

Mycoplasmalike organisms were found in ultrathin sections of inflorescense of "Kaincope" - disease coconut palms in Togo. The findings support the hypothesis that the disease in Africa is similar to "lethal yellowing" found in the Caribbean.

_____. et al. Investigations on the etiology of the lethal disease of coconut palm in Tanzania. Zeitschrift fur Pflanzenkrankheiten und Pflanzenschutz 89(4):185-193. 1982. (146

Organisms resembling mycoplasma were demonstrated in the phloem of 4 non-bearing diseased palms from different localities and in that of 2 bearing ones. DNA accumulation and callose formation was observed by fluorescence microscopy in the diseased tissues. No MLO were found in healthy palms and the fluorescense tests were negative. (Review of Plant Pathology 61(9):5171. 1982).

* NUCE DE LAMOTHE, M. DE y WUIDART, W. Les cocotiers Grands a Port-Bouet (Cote d'Ivoire). II. Grand Rennel, Grand Salomon, Grand Thailande, Grand Nouvelles-Hébrides. Oléagineux 36(7):353-365. 1981. (147

Comme les précédents, ce 3e. article sur la collection de cocotiers de la Station de Recherche Marc-Delorme a Port-Bouet (C.-I.) a pour but de fournier aux sélectionneurs les informations qui guideront leurs choix. Les auteurs y décrivent 4 variétés de "Grands": origines, caracteres végétatifs, mode de reproduction, précocité, composantes du fruit. Le cocotier Grand Rennell est précoce; il produit un nombre moyen de gros fruits dont la composition est tres bonne. Le cocotier Grand Salomon a une forte croissance en hauter et donne un nombre élevé de noix relativement petites. Le Grand Nouvelles-Hébrides est remarquable par sa précocité, son grand nombre de noix et la variabilité de ses caracteres; ses fruits cont petits (190 g de coprah/noix) mais leur rendement en coprah est excellent; il est parfaitement résistant a la maladie d'origine inconnue qui, au Vanuatu, affecte les autres variétés. Le cocotier de Thailande produit un petit nombre de gros fruits; sa productivité est relativement faible mais il a l'avantage d'etre l'un des types les plus tolérants a la maladie du jaunissement mortel qui sévit aux Caraibes. Les 8 variétés de Grands décrites a ce jour pourraient etre classées en 4 groupes aux caractéristiques bien définies: un groupe africain, un groupe du Golfe du Siam, un groupe mélanésien et un groupe polynésien.

* NUIMAN, F.J. y ROBERTS, F.M. Lethal yellowing: the 'unknown disease' of coconut palms in Jamaica. Empire Journal of Experimental Agriculture 23(91):257-267. 1955. (148

Lethal yellowing (formerly called 'west-end but-rot', 'unknown disease', and sometimes confused with 'bronze-leaf wilt') is a serious disease of coconut palms in the Caribbean area. Although clearly of pathogenic origin all attempts to find a fungal or bacterial cause have failed. The characteristic necroses produced by the disease appear only in those parts of the plant where rapid growth and differentiation are taking place, and are initially sterile although they eventually become invaded by saprophytes. A virus causation appears likely, but transmission work to prove this is not at present feasible. A virus hypothesis is supported, however, by absence of other pathogens; epidemiological data; the disease symptoms; the occurrence of double nuclei in the cells of affected plants ; positive, though anomalous, results of serological work; and failure to induce recovery by treatments likely to have been effective with most non-virus pathogens. Direct control seems impracticable, and the use of resistant varieties (one such being already available) seems to offer the best chance of reestablishment of devastated plantations.

PARTHASARATHY, M.V. y FISHER, J.B. The menace of lethal yellowing to Florida palms. Principes 17(2):39-45. 1973. (149

The disease affecting coconut palms has also been found on *Veitchia merrillii* and *Pritchardia pacifica* in Florida. (Review of Plant Pathology 53(1):241. 1974).

* _____. Mycoplasmalike organisms in the phloem of palms in Florida affected by lethal yellowing. Plant Disease Reporter 57(10):861-862. 1973. (150

Mycoplasmalike organims were found in the phloem of 3 species of palms (coconut, *Veitchia merrillii* and *Pritchardia pacifica*) during the early stages of lethal yellowing. These organisms were mostly present in the sieve tubes of unexposed inflorescences and to a lesser extent in the spear leaves. The spread of the disease to additional genera of palms has far reaching implications for Florida palms in general. (Review of Plant Pathology 53(5):1909. 1974).

* _____. Mycoplasmalike organisms associated with lethal yellowing disease of palms. Phytopathology 64(5):667-674. 1974. (151

Polymorphic, mycoplasmalike organisms were present in the sieve elements of young inflorescences of coconut, pritchardia, and veitchia palms affected by the lethal yellowing disease. The microorganisms were confined to recently matured protophloem and early metaphloem elements, and were rarely present in mature late metaphloem sieve elements. The organisms apparently moved from one sieve element to another through the sieve-plate pores along with the assimilate stream. The similarity of diagnostic symptoms of lethal yellowing in coconuts, pritchardias, and veitchias, and the occurrence of mycoplasmalike organisms in the sieve elements of all the three diseased palms during the earliest

symptom of the disease, not only suggest that the three are affected by the same disease, but also suggest a mycoplasmalike etiology for lethal yellowing. This is the first detailed report of mycoplasmalike organisms in the phloem of diseased palms in Florida.

* PARTHASARATHY, M.V. Etudes préliminaires sur l'ultra structure du phloeme dans les cocotiers affectés par la "pourriture du coeur" (Hartrot) au Surinam. Oléagineux 31(11):484. 1976. (152

La maladie du "Hartrot" sur cocotier au Surinam présente un grand nombre des symptomes externes du Jaunissement mortel. Cependant, il n'est pas clairement établi qu'il s'agit d'une meme maladie. L'observation au microscope électronique du phloeme de jeunes feuilles et inflorescences prélevées sur quatre cocotiers a différents stades de la maladie a montré, pour tous les quatre, la présence d'organismes flagellés dans de nombreux éléments criblés fonctionnels. Ces flagellés mesurent environ 1,5 a 2,5 µ de longueur. En se basant sur la taille, les caracteres structuraux et l'hote, on a essayé de classer ces organismes comme des protozoaires de l'ordre des Kinetoplastides, famille des Trypanosomatidae, genre *Phytomonas Donovan*. Aucune hyperplasie ou oblitération nécrotique n'est apparente dans le phbeme affecté par la maladie. Il est cependant nécessaire de faire une étude plus détaillée pour avancer toute conclusion en rapport avec la dégénérescence du phloeme. Le phloeme de jeunes feuilles et inflorescences prélevées sur un arbre sain dans la meme zone que celle des arbres malades n'a pas révélé jusqu'ici la présence du moindre flagellé ou de tout autre micro-organisme dans les éléments criblés. Les flagellés sont les seuls pathogenes présents en début de symptomes et il se multiplient et se dispersent au cours de l'évolution de la maladie; ce qui laisse a penser qu'ils peuvent entre l'agent causal de l"Hartrot". De ce fait, la présente étude indique que, malgré une similitude des symptomes entre Jaunissement mortel-"Hartrot", l'agent causal differe totalement d'une maladie a l'autre.

PILLAI, M. D. Bibliography on lethal yellowing of coconut. Indian Coconut Journal 11(10): 5-9. 1981. (153

* PLAVSIC-BANJAC, B., HUNT, P. y MARAMOROSCH, K. Mycoplasma-like bodies associated with lethal yellowing disease of coconut palms. Phytopathology 62(2):298-299. 1972. (154

Mycoplasma-like bodies were detected in phloem elements from inflorescences of lethal yellowing-diseased coconut palms. This finding suggests a mycoplasma etiology for lethal yellowing, and is the first report of mycoplasmalike bodies in diseased coconut palms.

_____. y MARAMOROSCH, K. Phloem infecting mycoplasmas and xylem infecting rickettsia-like organisms of two plant disease (En serbo-croato). Acta Biologica Iugoslavia, B 10(1): 43-52. 1973. (155

Electron microscopy of coconut inflorescences showed mycoplasma-like organisms in the phloem elements of material with lethal yellowing in Jamaica. In sugarcane with ratoon stunting symptoms from Puerto Rico pleomorphic bodies were detected in the sylem. These differed from typical mycoplasma-like organisms and from bacteria in their internal structure. (Review of Plant Pathology 54(2):383. 1975).

* POPENOE, J. Growing palms with edible fruits in Florida. Proceedings of the Florida State Horticultural Society 90:211-212. 1977. (156

With the great reduction in the number of coconuts and of many other species of palms associated with the disease lethal yellowing, many people are concerned as to whether any palms can be grown in Florida for their fruits. The status of the species of palms that produce worth-while fruits is presented along with some information on their culture.

* POUCHER, C. Lethal yellowing of coconut palm in Florida. Proceedings of the Florida State Horticultural Society 86:480-481. 1973. (157

Lethal yellowing, a deadly disease of coconut palms (*Cocos nucifera*) was observed in Key West from 1955 to 1968. The disease was found on Key Largo in 1969, Little Torch Key in 1971 and on Ramrod and Summerland Keys in 1972. The disease was first detected on the Florida mainland in September 1971, in the Coral Gables area of Miami. In May 1973, the disease was found in Ft. Lauderdale, and on October 17, 1973 in Palm Beach County. Research indicates that lethal yellowing may be caused by a mycoplasma-like organism. Once it attacks the palm, there is no known permanent cure. Within 2 to 3 months the fronds display the symptomatic yellowing and fall, leaving the trunk topless. The aim of the Division of Plant Industry is to remove, as quickly as possible, all diseased palms in the peripheral areas of the infested region to reduce the source of inoculum and hopefully deter the spread of the disease while scientists seek to find a solution to the problem. The only known satisfactory control is the replacement of native coconut palms with the disease-resistant Malayan dwarf varieties.

PRICE, W.C., MARTINEZ, A.P. y ROBERTS, D.A. Mechanical transmission of the lethal yellowing pathogen to young coconut palms. Phytopathology 57:821. 1967. (158

Infected tissue from buds, inflorescences, and leaves of coconut palms with lethal yellowing disease were ground with 0-05 M tris-HCl buffer, at pH 7-2, 600-mesh carborundum added, and the mixture applied to the basal parts of spear leaves exposed by cutting the stipules of older leaves. The inoculated leaves were rinsed with water immediately. Of the 67 test palms, 55 developed lethal yellowing symptoms 5-10 weeks later. (Review of Plant Pathology 46(12):3634-k. 1967).

* _____., MARTINEZ, A.P. y ROBERTS, D.A. Transmisión mecánica del amarilleo letal del cocotero. Boletín Fitosanitario de la FAO 15(6):105-108. 1967. (159

Los resultados de los experimentos que se resumen en el presente trabajo demuestran la naturaleza infecciosa del amarilleo letal del cocotero, considerado hasta ahora como una enfermedad de etiología oscura. El presente informe tiene por objeto dar a conocer a los lectores el método por el cual puede transmitirse el agente causal y señalar la necesidad de continuar los estudios en varias áreas del mundo donde parece que se presenta esta enfermedad. El agente infeccioso del amarilleo letal del cocotero se transmitió mecánicamente desde tres árboles naturalmente infectados en Key West a

cocoteros jóvenes, y desde cada serie de estos cocoteros experimentalmente infectados, a otros cocoteros jóvenes. De un total de 79 plantones infectados que tenían de uno y medio a tres años, resultaron infectados 61; de 15 plantas de seis años, resultaron infectados dos. El tiempo transcurrido hasta que aparecieron los síntomas varió desde cinco a diez semanas en los plantones de uno y medio a tres años, y desde 14 a 30 semanas en las plantas de seis años. El método de inoculación mecánica puede emplearse como medio de ensayar la susceptibilidad de varias especies de plantas al agente infeccioso del amarilleo letal, incluyendo progenies desarrolladas en un programa de selección para producir cocoteros de características hortícolas convenientes que sean resistentes al amarilleo letal. En Jamaica se está llevando a cabo actualmente este programa de selección. Dicho método puede usarse para ensayar la susceptibilidad de los cocoteros a la inoculación mecánica con savia de plantas infectadas con los agentes de marchitamiento Kaincopé, Awka, y marchitamiento Cabo St. Paul, proporcionando así pruebas evidentes de que estas enfermedades están verdaderamente relacionadas entre sí y con el amarilleo letal. Finalmente, este método puede emplearse para determinar si el marchitamiento foliar bronceado del cocotero es infeccioso y está íntimamente relacionado con el amarilleo letal como se había supuesto antes, o si se debe a factores ambientales, como opinó Briton-Jones en 1928.

* PRICE, W.C., MARTINEZ, A.P. y ROBERTS, D.A. Reproduction of the coconut lethal yellowing syndrome by mechanical inoculation of young seedlings. Phytopathology 58(5):593-596. 1968. (160

The lethal yellowing disease of coconut (*Cocos nucifera*) has been regularly reproduced by mechanical inoculation in 1.5- to 6-year-old seedlings. Symptoms developed in as short a time as 5 weeks. Inoculum was taken from necrotic tissue, and that immediately adjacent to it, of young leaves or inflorescences of either naturally infected plants or experimentally infected ones, and was ground in a mortar with a small amount of Tris-HCl buffer at pH 7.2. The stipules were cut from old leaves of the test seedling so as to expose as much as possible of the basal portion of the young "spear" leaf, which was then rubbed with the inoculum to which Carborundum had been added. The results prove that lethal yellowing is caused by an infectious agent of disease.

* PROGRESS IN lethal yellowing. Farmer 74(1):45-49. 1969. (161

In a brief account of this coconut disease it is noted that N.E. Grylls, working for F.A.O. in Jamaica, apparently transmitted it twice from a diseased to a healthy coconut palm by a specie of whitefly. Symptoms appeared after 6 months. Further studies to confirm this apparent transmission of a virus and to investigate the biology of the vector are in progress. (Review of Plant Pathology 48(10):3112. 1969).

PURDY, L.H. Lethal yellowing report no. 5-6. Gainesville, Florida, University of Florida, Department of Plant Pathology, 1974. s.p. (162

REINERT, J.A. Lethal yellowing disease of coconut palms; vector studies. Proceedings S. Nurs. Association Res. Conf. 18:49-50. 1973. (163

_____. Lethal yellowing of coconut palms - vector studies and a possible control. In Fisher, J.B., ed. Report of the Lethal Yellowing Symposium at Fairchild Tropical Garden, Miami. Principes 17:151-159. 1973. (164

También en: Principes 17:155. 1973.

* _____. Traitements insecticides contre le jaunissement mortel de *Cocos nucifera* et *Veitchia merrillii*. Oléagineux 31(11):486. 1976. (165

Le cocotier, *Cocos nucifera*, et le palmier *Veitchia merrillii*, sont les deux palmiers les plus séverement attaqués par le Jaunissement mortel. Des essais ont été réalisés sur les deux especes avec des insecticides endothérapiques appliqués para arrosage du sol. Pour ces essais, on n'a retenu que des arbres apparemment sains, choisis au hasard dans les zones affectées. Les traitements ont été renouvelés tous les six mois. Dans un essai sur *Cocos*, 50 a 60 p. 100 des arbres traités au Diméthoate étaient toujours vivants au bout de 16 mois de traitement alors que 20 p. 100 seulement des arbres non traités demeuraient sains. Dans deux essais avec application au sol de Carbofuran et de Diméthoate sur *Veitchia* 20 a 57 p. 100 ($\bar{x}$ = 39,2 p. 100) des arbres traités etaient vivants apres 18 mois, alors que se n'était le cas que de 18 p. 100 des arbres non traités. Dans le premier de ces essais, il ne restait que 20 p. 100 des arbres traités et 14 p. 100 des non traités apres 30 mois. Dans un troisieme essai sur *Veitchia*, les applications au sol d'Aldicarb se sont avérées significativement supérieures aux autres traitements apres 18 mois. Meme en l'absece d'identification du ou des vecteurs, il ressort de ces résultats que des applications au sol d'insecticides systémiques peuvent protéger les arbres contre le Jaunissement mortel. Ces memes résultats rendent encore plus évident le fait qu'un vecteur est impliqué dans la transmission de la maladie.

* _____. Field biology and control of *Haplaxius crudus* on St. Augustinegrass and Christmas palm. Journal of Economic Entomology 70(1):54-56. 1977. (166

Haplaxius crudus (Van Duzee) develops readily on St. Augustinegrass, *Stenotaphrus secundatum* (Walt.) Kunze, Bahiagrass, *Paspalum notatum* Flugge, and Bermudagrass, *Cynodon dactylon* (L.) Pers. Adults fed on these turfgrasses and on at least 9 species of palms including the Christmas palm, *Veitchia merrillii* (Becc.) Moore, and coconut palm, *Cocos nucifera* L. Mean populations of 3.1/leaf on Christmas palms and 23.7/0.09m^2 on St. Augustinegrass were reported. Populations of *H. crudus* were controlled with aldicarb and with carbofuran and dimethoate soil drenches at rates of 28 g AI/tree on mature Christmas palms. Chlorpyrifos, diaxinon, and propyl thiopyrophosphate provided 100% control, while carbaryl and carbofuran gave excellent control of *H. crudus* on St. Augustinegrass. Malathion also provided good control, but acephate, dimethoate, and methomyl did not give control on this grass. (Horticultural Abstracts 49(7):8663. 1977).

* ROBERTS, D.A. et al. An unexpected outbreak of lethal yellowing in coconut palms on Key Largo, Florida. Phytopathology 62(5):499. 1972. (167

The range of lethal yellowing of coconut palms in the United States has previously been restricted to Key West, Florida, and the adjacent Stock Island. Between September 1969 and April 1971, however, 13 coconut palms died from lethal yellowing in a planting of some 125 trees in Key Largo, ca. 100 miles northeast of Key West. Diseased trees showed symptoms typical of lethal yellowing, and the pathogen was transmitted from a diseased palm to 2 of 23 mechanically inoculated young coconut palms. The source and method of dissemination of the lethal yellowing pathogen to Key Largo are not known. The disease has not occurred in the Key West area since March 1968, and to suggest that trees there were sources of inoculum would presume an inordinately long latent period of 18 months. We believe the pathogen was carried from a Caribbean island to Key Largo by wind-borne arthropod vectors. The recent outbreak of lethal yellowing on Key Largo re-emphasizes the threat of this devastating disease to the thousands of ornamental coconut palms on the nearby mainland of the Florida "Gold Coast".

ROMNEY, D.H. Attempts to control lethal yellowing. In Coconut Industry Board. Research Department. Eleventh report July 1970-June 1971. Kingston, 1971. s.p. (168

_____. Lethal yellowing of the coconut; collection of letters. Principes 16:49-53. 1972. (169

* _____. Past studies on and present status of lethal yellowing disease of coconuts. PANS 18(4):386-395. 1972. (170

The symptoms and extent of lethal yellowing disease of coconuts are described. In research into the cause of the disease nutrient deficiencies, fungi, bacteria, nematodes and, more recently, viruses have been investigated without implicating any causal agent. Mechanical and insect transmission were attempted by a number of methods. The incubation period was shown to be 3-9 months for young palms and 7-15 months for bearing palms. Experiments to control the disease have been unsuccessful. Local and introduced coconut varieties and hybrids are being tested for resistance by field exposure. The Malayan Dwarf variety has been shown to have high resistance and is being used to replant the industry. No other variety or hybrid is deemed as yet to be sufficiently resistant for farm planting. Mycoplasms were recently found associated with the disease. Future research must include confirmation of mycoplasm-lethal yellowing association, continuation of the search for the vector, experimental chemotherapy, and attempts to culture mycoplasms to develop an inoculation technique. Palms showing resistance will be used in the breeding programme. Promising hybrids will be produced in greater numbers for more extensive testing and further introductions will be made.

* _____. Seconde reunion du Conseil International sur le Jaunissement mortel du cocotier. Oléagineux 31(11):483-488. 1976. (171

También en: Principes 20(2):57-69. 1976.

ROMNEY, D.H. y HARRIES, H.C. Distribution and impact of lethal yellowing in the Caribbean. In Meeting of the International Council on Lethal Yellowing, 3rd., s.l., 1977. Proceedings. s.l., s.e., 1977. pp. 6-7. (172

* _____. Agronomic performance of Malayan Dwarf coconut in Jamaica. Oléagineux 35(12):551-554. 1980. (173

Investigaciones sobre cocotales plantados con Enanos de Malasia han mostrado que 78% de plantones distribuidos dentro de un proyecto de replantación alcanzaban la edad de producción. La enfermedad del amarillamiento letal sólo mató un 0,2%. La producción media anual de los árboles de 7 años o más de 65 nueces/árbol. Los rendimientos están reducidos de modo significativo por las malezas, la competencia de bananos o un suelo arcilloso pesado; un 22% de los campos están con daños de ratas, un 15% llevaban nueves con señales de ataques de ácaros *Acerias*. Por término medio 5 727 nueces producen 906 kg (o sea 2 000 lb) de copra.

* _____. Résistance au champ du Nain de Malaisie. Oléagineux 35(6):301. 1980. (174

Out of 1 096 Malayan Dwarfs planted between 1962 and 1967 in resistance trials in areas of lethal yellowing disease (L.Y.), 60 or 5.5% were lost to L.Y. by 1973. Losses to L.Y. in all varieties were almost complete by 1973. Selection of mother-palms and roguing in the nursery commenced during the mid-1960s. Thirteen agronomy experiments planted with this improved planting material between 1966 and 1974, comprising a total of 2 876 Malayan Dwarfs, were exposed to L.Y. for 3 to 11 year, only 9 palms (0.31%) died from L.Y., compared with 1.3 % lost to bud rot and 2.3% to other causes. It is presumed that the resistance to L.Y. of the Malayan Dwarf population in Jamaica improved further as susceptible members died and ceased contributing to seed. In a survey of farmers' fields, conducted between 1971 and 1979, 124 plots each with 25 Malayan Dwarf palms were exposed to L.Y. for 3 to 8 years. Only 6 palms (0.2%) died from L.Y. compared with 2.8% lost to bud rot and 1.8% to other causes. Malayan Dwarf seed exported from Jamaica comes from the same seed sources as seed used in Jamaica. There are currently 4.58 million Malayan Dwarf palms in Jamaica.

* SCHIEBER, E. e HICHEZ FRIAS, E. Lethal yellowing disease of coconut palms in the Dominican Republic. Phytopathology 60(11):1542. 1970. (175

The disease of coconut palm (*Cocos nucifera* L.) known as lethal yellowing was found for the first time in the Dominican Republic. The disease is present in the Province of Puerto Plata and Dajabon in the Atlantic coast and bordering Haiti. Symptoms are similar to those described by Carter in Jamaica and Martínez in Florida, USA. The disease is of importance, since it spreads rapidly killing coconut palms within 6 to 7 months. Eradication of affected trees was started early in 1969 after the disease was found. Testing of resistant material such as Malayan Dwarf under Dominican conditions has been suggested, as well as the survey and studies of the disease in the Department du Nord in Haiti bordering the Dominican Republic.

SCHUILING, M. y JOHNSON, D.G. Current attempts to find a vector associated with lethal yellowing disease of coconut. Principes 17:151-159. 1973. (176

* _____. y JOHNSON, C.G. Recent attempts to find a vector associated with lethal yellowing. Rome, FAO, 1975. 4 p. (AGP/CNP/75/33). (177

* _____. Examen des populations d'insectes sur *Cocos nucifera*. Oléagineux 31(11):487. 1976. (178

Pendant deux ans, on a examiné l'entomofaune de jeunes cocotiers dans six endroits de la Cote Est de la Jamaique. Le but était d'étudier le role des cigales et cicadelles car, il apparait comme le plus vraisemblable que le vecteur du Jaunissement mortel fait partie de ce groupe d'insectes si cette maladie est du a un organisme semblable aux mycoplasmes. Il était aussi nécessaire de mettre en évidence la distribution des Fulgorides utilisées dans les tests de transmission et, également, de vérifier sur chaque espece l'hypothese de Heinze et Schuiling (1973). Selon cette hypothese, les cocotiers, a la Jamaique, ont plus de chances d'etre infectés par le L.Y. de février a aout, et ce fait devrait correspondre a l'incidence d'un vecteur. Le L.Y. s'est produit dans tous les points d'essais et semblait toujours actif dans la région. Une fois par quinzaine, dans chaque point d'essais, on a examiné quarante cocotiers et compté tous les insectes présents sur le feuillage. Il était rare de trouver des Cicadoidea sur les arbres mais on y a vu fréquemment six especes de Fulgoroidea. Si le vecteur du L.Y. est un hote banal du cocotier dans les endroits ou on présume que la maladie est active, alors seul *Omoliena* spp. (Cubana Myers and proxima Fennah?) semble convenir car il est commun a tous les points d'essais avec un maximum d'infestation en aout-septembre. *Cedusa* sp. *aff. flavida* Van Duzee ne semble pas devoir etre retenue, ses populations étant tres inégalement distribuées dans les points d'essais et entre ces points et la survie sur C. *nucifera* tres limitée. La possibilité de transmission d'un arbre a un autre par les adultes implique que ces derniers aient une longévité suffisante pour contracter le germe puis permettre son incubation avant de le transmettre. *Antillixius* sp., bien qu'ayant une distribution irréguliere, s'est manifesté dans chaque point d'essai avec un maximum d'infestation de juillet a septembre. *Colpoptera elevans* Wallser et *Pseudoflata brevis* Van Duzee se sont manifestés dans chaque point d'essai mais ils ont des hotes alternatifs et ne présentent pas de nets maximums d'infestation. *Haplaxius* spp. /*crudus* Van Duzee et *cocois* (Fennah)/ a une distribution tres irréguliere et une infestation maximale de septembre a novembre. Les études n'ont pas indiqué les moments de migration qui constituent un point important pour identifier le vecteur du L.U.

* _____. et al. Récents essais de mise en évidence d'un vecteur associé au jaunissement mortel du cocotier (*Cocos nucifera*). Oléagineux 31(11):486-487. 1976. (179

En inglés en: Principes 20:65. 1976.

En supposant que le Jaunissement mortel (L.Y.) soit causé par un organisme similaire aux mycoplasmes (M.L.O.), les vecteurs les plus vraisemblables semblent etre des suceurs de seve, et plus particulierement des cigales et cicadelles. Des examens attentifs

de la faune du cocotier ont montré que cinq especes de Fulgorides étaient communes, se nourrissaient de la seve du phloeme et pouvaient survivre plusieurs jours sur des feuilles isolées. On a éprouvé deux hypotheses de transmissions. La premiere était que les adultes acquierent les M.L.O. a partir de feuilles ou de fleurs de palmiers atteints par le L.Y. et le transmettent aux feuilles. Des adultes de *H. crudus* Van Duzee, *Antillinius* sp. (Cixiidae) *Omoliena* spp. (cubana Myers et proxima Fennah?) (Derbidae), *Colpoptera elevans* Walker (Issidae) et *Pseno*flata *brevis* Van Duzee (Flatidae) ont été collectés sur le terrain. On a créé les conditions de contamination par ingestion libre en élevant ces insectes soit au laboratoire durant 2 a 4 jours sur des feuilles et inflorescences prélevées sur des arbres malades; soit en plein champ durant 2 semaines sur les fleches d'arbres malades. Apres quoi, toutes les especes ont été placées sur de jeunes feuilles d'arbres tests agés de 2 a 4 ans. Comme la survie aprés contamination et sur les plantes tests était réduite, on a pensé que la plupart des adultes de ces especes avaient une longévité insuffisante pour contacter les M.L.O.S., permettre leur incubation, puis les transmettre. En conséquence, une seconde hypothese a été éprouvée: les adultes transmettent ces germes apres avoir été contaminés pendant la vie larvaire. Des larves de *C. elevans* et *P. brevis* ont été récoltées sur du "raisin de mer" (*Coccoloba uvifera*) et sur de jeunes palmiers, puis mises en condition de contamination durante 2 a 5 jours sur des fleches de'arbres malades et enfin transférées sur la fleche et les jeunes feuilles d'arbres tests. Bien que plusieurs milliers d'insectes aient été expériments, aucun des 122 arbres tests n'a été infecté.

* SEYMOUR, C.P., MILLER, J.W. y ROBERTS, D.A. An outbreak of lethal yellowing of coconut palms in Miami, Florida. Phytopathology 62(7):788. 1972. (180

Lethal yellowing of coconut palms was found for the first time on the Florida mainland (Miami and Coral Gables) in September 1971. A ground survey showed that the primary concentration of 57 diseased trees occurred in a one-half-square-mile area. Helicopter surveys made in December 1971 and March 1972 revealed no other outbreaks on the mainland. Continued ground and helicopter surveys to determine the rate and direction of spread showed that the highest incidence of disease has been restricted to the primary infested area, with the most distant occurrence from the center being 3.5 miles away. Thus far, the disease has progressed in all directions, with the greatest spread toward the southwest. Numbers of diseased trees detected were: Sept.-Nov., 151; Dec., 40; Jan., 27; Feb., 45; and March, 62. Because of the importance of the ca. 400 000 coconut palms in this urban area, an effort was made by the Florida Department of Agriculture and Consumer Service to combat lethal yellowing by (1) continuing ground and helicopter surveys to locate newly diseased trees; (ii) reducing inoculum through the cutting of diseased trees, and (iii) encouraging the replanting with resistant Malayan Dwarf varieties.

_____. Current status of the coconut lethal yellowing problem in Florida. Proceedings of the Tall Timbers Conference on Ecological Animal Control by Habitat Management 6:121-123. 1976. (181

* SEYMOUR, C.P. y POUCHER, C. Le jaunissement mortel en Floride. Oléagineux 31(11):483-484. 1976. (182

En inglés en: Principes

C'est en 1955 a Key West, Floride, qu'on a signalé pour la premiere fois la présence du Jaunissement mortel aux U.S.A. Key West se présentait alors comme une splendide ile tropicale et on y estimait a 20 000 le nombre de cocotiers présents dans les pares et le long des rues et des plages. En 1968 75% de ces arbres, soit 15 000, avaient été détruits par cette maladie. Pendant plusieurs années, la maladie s'est localisée a Key West et Stock Island. En 1970, on l'identifia sur des cocotiers a Key Largo, distant de 160 km de Key West. En 1971, on trouva la maladie sur le continent dans la zone de Coral Gables de Miami, et, mai 1973, elle fut détectée a Broward County pres de Fort Lauderdale, a 40 km au Nord de Miami. Plus tard, cette meme année, on constata la contamination de Palm Beach County a Boca Raton. En 1974, la maladie atteignit Martin County dans son extension vers le Nord, le long de la Cote Est de la Floride puis, finalement Collier County, sur la Cote Ouest pres de Naples. Au début de l'épidémie, en septembre 1971, on dénombrait 57 arbres malades a Coral Gables. Au printemps 1975, on a estimé a 200 000 le nombre de cocotiers détruits para la maladie sur le continent. On admet qu'il existe en Floride, une population de un million a un million et demi de cocotiers. Les plus importantes pertes se sont produites autour de Miami, dans une zone a dorte densité de palmiers. Dans l'état de Floride, le cocotier et d'autres palmiers ont une inestimable valeur esthétique et l'importance économique du tourisme en dépend. L'incidence de telles pertes sur le tourisme est certainement importante, quoique difficle a évaluar. L'auteur expose les activités de la Division of Plant Industry et du Florida Department of Agriculture and Consumer.

SHERMAN, K.E. y MARAMOROSCH, K. Present status of lethal yellowing disease of the coconut palm. Journal of Plantation Crops 5(2):75-83. 1977. (183

The occurrence of the disease in West Africa, several Caribbean Islands and Florida, USA is reviewed. The disease kills rapidly and yearly losses are huge. Reports of isolation of the causative mycoplasma have not been confirmed by proper deposition of a culture in a type culture collection. Temporary remission has been achieved with oxytetracycline injection. The variety Malayan Dwarf is highly resistant and at present the only means of prevention in affected areas. Natural spread of the disease by unidentified vector presents a constant threat to coconut in affected and unaffected areas. (Review of Plant Pathology 57(9):4091. 1978).

SHIKATA, E., MARAMOROSCH, K. y LING, C. Supuesta etiología micoplasmática de los amarilleos. Boletín Fitosanitario de la FAO 17(6): 1969. (184

SPIROPLASMAS AND mycoplasmas. In Plant Breeding Institute (Cambridge, England). Annual report. Cambridge, 1979. pp. 87-92. (185

Topics studies include the mechanism of action of the maize stunt spiroplasma on plants, the pathogenicity of spiroplasmas with

reference to the factor involved in their transmission, and the characterization of mycoplasmas involved with coconut lethal yellowing disease. Most of the isolates obtained from diseased palms were antigenically related to *Acholeplasma axanthum*, while the remainder reacted to antiserum prepared against A. *granularum*, A. *oculi* or A. *laidlawii*. Although A. *laidlawii* has been occasionally isolated from plant tissues, other *Acholeplasma* species have previously been associated only with animal and tissue culture sources, and their repeated isolation from plant tissues is a new feature of the ecology of these organisms. (Review of Plant Pathology 59(5):2004. 1980).

* STEINER, K.G. Etudes conduites sur le "Kaincopé", maladie du cocotier au Togo. Oléagineux 31(11):488. 1976. (186

La maladie de Kaincopé a été observée au Togo pour la premiere fois en 1932. En 1964, elle avait détruit environ 50% des cocoteraies de la région cotiere. Depuis 1974, la maladie a completement disparu de la cote et se propage actuellement vers l'intérieur du pays. Des "Nains de Malaisie" plantés en 1963 ont des productions décevantes, probablement dues au manque de pluie et a la pauvreté des sols. Les hybrides entre cocotiers locaux et "Nains verts de Malaisie" sont plus prometieurs. Les symptomes de la maladie de Kaincopé sont voisins de ceux du Jaunissement mortel des Caraibes mais jusqu'a présent on n'a pas identifié d'organisme mycoplasmique. De juillet 1974 a mai 1975, 52 cocotiers ont été traités avec la Chlortetracycline HCl et al tetracycline HCl. Des solutions titrant 100 mg, 29,3 g et 4 g/l ont été injectées par gravité. L'injection de solution a 100 mg/l n'a donné un résultat que sur 1 cocotier sur 8. Mais 41 a 44 cocotiers traités avec des concentrations de 2 a 4 g/l de tetracycline ont donné une nette réponse. Le développement de la maladie s'est considérablement ralenti. Dans 16 cas sur 21, traités a un stade avancé de la maladie, une rémission de symptomes s'est manifestée sous la forme d'une reprise de croissance. Les arbres ont a nouveau émis des inflorescences saines. Le Jaunissement n'a été observé que dans 15 cas sur 37. Ces résultats vont a l'appui des hypotheses sur l'étiologie mycoplasmique du Kaincopé et sur l'identité de cette maladie avec le Jaunissement mortel.

* _____. Supuesta enfermedad del amarilleo letal del cocotero en Tanzania. Boletín Fitosanitario de la FAO 26(1):10-12. 1978. (187

En la región de Bagamoyo, al norte de Dar es-Salaam, Tanzania, se observaron cocoteros que manifestaban síntomas del amarilleo letal o enfermedad de Kainkopé. En reconocimientos aéreos se observaron también otros brotes mayores en el sur de Dar es-Salaam. Este es el primer informe sobre el amarilleo letal del cocotero en la costa oriental de Africa. No se han podido identificar organismos micoplasmoides en las células floemáticas de los cocoteros enfermos.

* STEMMER, W.P.C. et al. Effects of lethal yellowing on the composition of the phloem sap from coconut palms in Jamaica. Phytopathology 72(6):672-675. 1982. (188

The chemical composition of the phloem sap from healthy and lethal yellowing-diseased coconut palms was analyzed to study the natural

habitat of the mycoplasma-like organism found in the sieve tubes of diseases coconut palms. Saps from healthy or diseased palms did not differ significantly in total solids content; sugar, amino acid and elemental metal compositions; and protein band patterns on polyarcrylamide gels. Saps from their inflorescences, however, differed from trunk sap in total solids content, and in sugar, amino acid and elemental metal composition. (Rev. of Plant Pathology 61(12):7123. 1982).

THOMAS, D.L. Research on lethal yellowing of coconuts. South Fla. Green. 1:3. 1973. (189

* _____. Mycoplasmalike bodies associated with declining palms in south Florida. Proceedings of the American Phytopathological Society 1:97. 1974. (190

Several researchers have reported mycoplasmalike bodies associated with the lethal yellowing disease of coconut palm (*Cocos nucifera* L.). The hypothesis is that a mycoplasmalike organism may be the causal agent of lethal yellowing is strengthened by reports of tetracycline-induced symptom remission together with negative responses to penicillin. In an area of south Florida which has lost over 40 000 coconut palms to lethal yellowing since October 1971, several other palm species are presently declining and dying with symptoms similar to lethal yellowing. Electronmicroscopic investigations have revealed mycoplasmalike bodies in the phloem of the diseased palm species *Arikuryroba schizophylla* (Mart.) Bailey, *Corypha elata* Roxb., *Trachycarpus fortunei* Wendl., and *Phoenix reclinata* Jacq.

* _____. Possible link between declining palm species and lethal yellowing of coconut palms. Proceedings of the Florida State Horticultural Society 87:502-504. 1974. (191

In an area of southern Florida which has lost over 100 000 coconut palms (*Cocos nucifera* L.) to the lethal yellowing (LY) disease since October 1971, several other palm species have declined and died with symptoms similar to LY. Electron microscopic examination has revealed mycoplasmalike bodies in the phloem tissue of the arikury palm, *Arikuryroba schizophylla* (Mart.) Bailey; the palmyra palm, *Borassus flabellifer* L.; the cluster fishtail palm, *Caryota mitis* Lour; the buri palm, *Corypha elata* Roxb,; the spindle palm, *Mascarena verschaffeltii* (Wendl.) Bailey; the Canary Island date palm, *Phoenix canariensis* Hort.; the Senegal date palm, *Phoenix reclinata* Jacq.; and the windmill palm, *Trachycarpus fortunei* Wendl. The discovery of mycoplasmalike bodies similar to those reported in coconut palms infected with LY indicates that possibly all of the above palm species are new hosts for LY.

_____. Possible new hosts for the lethal yellowing disease of coconut palms. Proceedings of the Southern Nurs. Association Research Conference 19:40-41. 1974. (192

_____. Possible hosts of lethal yellowing. Rome, FAO, 1975. 1 p. (AGP/CNP/75/35). (193

* THOMAS, D.L. Les différents hotes possibles du jaunissement mortel. Oléagineux 31(11):484. 1976. (194

Plusieurs représentants de différentes especes de palmiers sont morts dans les zones du sud de la Floride qui ont subi de séveres dégats de Jaunissement mortel sur le cocotier (*Cocos nucifera* L.) alors que les régions saines de ce pays n'ont pas connu de pertes anormales pour les memes especes. Les palmiers affectés présentent souvent une chute de fruits immatures, des nécroses d'inflorescences non ouvertes, des décolorations du feuillage ou encore des striures d'eau au niveau de jeunes folioles. On a prélevé des échantillons de bases de feuilles non encore émises sur des arbres a des degrés divers de maladie pour des examens au microscope électronique. Des corps du type mycoplasmique similaires a ceux observés sur les cocotiers infectés par le Jaunissement mortel ont été observés dans les tubes criblés fonctionnels provenant d'arbres dépérissants appartenant aux especes *Arikuryroba schizophylla* (Mart) L. H. Bailey; *Borassus flabellifer* L.; *Caryotamitis Lour; Chrysalidocarpus cabadae*, H. E. Moore; *Corypha elata* Roxb.; *Dictyosperma album* (Bory) H. Wendl of Drude ex Scheffer; *Mascarena verschaffeltii* (H. Wendl) L. Bailey, *Phoenix canariensis* Hort ex Chabaud, *Phoenix dactilifera* L., *Phoenix reclinata* Jacq.; et *Trachycarpus fortunei* (Hook) H. Wendl. Les concentrations de corps du type mycoplasmique dans le phloeme des arbres affectés étaient souvent faibles mais jamais inférieures a celles constatées dans les tissus similaires de cocotiers infectés par le Jaunissement mortel. La coincidence géographique des dépérissements de palmiers divers et du Jaunissement mortel, l'analogie des symptomes constatés et la présence de corps du type mycoplasmique chez les arbres affectés confirment l'hypothese selon laquelle tous ces palmiers sont des hotes du pathogene responsable du Jaunissement mortel. Cependant l'ultime preuve de l'identité de ces dépérissements doit etre apportée par les études de transmission.

_____., DAVIS, R.E. y WATERS, H. Disease diagnosis /Lethal yellowing, mycoplasma-like organisms, coconuts/. In Meeting of the International Council on Lethal Yellowing, 3rd, USA, 1977. Proceedings. s.l., s.e., 1977. pp. 12-17. (195

* _____. y NORRIS, R.C. The use of electron microscopy for lethal yellowing diagnosis. Proceedings of the Florida State Horticultural Society 93:196-199. 1980. (196

Although symptoms on mature coconut palms are distinct and diagnostic, those on younger, non-fruiting coconut and on other palm species are frequently not so. In these cases the phloem can be examined by electron microscopy for mycoplasma-like organisms. Effectiveness is limited by the apparent absence of MLO from most mature palm tissue; the low concentration of MLO in most palm species; the unpredictable localization of MLO; and the small sample size that can be examined. The method has been used to ascertain MLO infection in 31 palm species and is routinely employed on palms used in disease transmission trials. (Review of Plant Pathology 61(4):1888. 1982).

* THOMAS ALEXANDER, V. Etudes de la résistance variétale a la pourriture du coeur (Hartrot) chez le cocotier. Oléagineux 35(6):302. 1980. (197

Unlike lethal yellowing in which case Malayan dwarf of coconuts has shown significant resistance to susceptibility to the disease, in

the case of "Hartrot" or "Fatal wilt" of coconut palms in Suriname, Malayan dwarfs also are found to succumb to the disease from the trials conducted here. Comparative resistance trials for "Hartrot" with coconut varieties indicated that Surinam dwarf is the most susceptible followed by Cylonese dwarf and then Malayan dwarf. Maximum resistance to the disease infection is noticed in Surinam tall variety of coconuts. This resistance to susceptibility for "Hartrot" exhibited by Surinam tall may be due to the selection of seedlings of this variety planted in the trial from the surviving healthy palms from a tract where the disease has been prevalent for the past so many years and thus showing probably the acquired resistance to the disease.

TIRTAWIDJAJA, S. y SOSROMARSONO, S. Penyakit lethal yellowing pada Kelapa. Gambung, Indonesia, 1976. 15 p. (198

* TOWNSEND, R. et al. Les acholéplasmes et la maladies du jaunissement mortel. II. Estudes microbiologiques et sérologiques. Oléagineux 35(6):300. 1980. (199

More than forty separate Acholeplasma isolates made from palms have been examined by one dimensional polyacrylamide gel electrophoresis (Page). Three groups could be identified on the basis of pattern homology. Isolates in group 1 had many major bands in common with A. *axanthum*, while those in group 2 showed an entirely different pattern which had some similarities with A. *oculi*. Group 3 comprised a single isolate whose pattern was different from any of the seven Acholeplasma type strains. This classification by gel pattern was supported by evidence from fluorescent antibody studies. Positive reactions were observed between antiserum to A. *axanthum* and all group 1 isolates tested. Very weak positive reactions occurred between group 2 isolates and antiserum to A. *oculi*. Triply filtered clones derived from all isolates gave similar results. Four representative clones were selected for DNA hybridisation studies. Preliminary results showed significant homology between DNA from A. *axanthum* and the two group 1 clones but little homology between DNA from A. *axanthum*, A, *laidlawii*, A. *oculi* or A. *granularum* and the clones from groups 2 and 3. Antisera against these four clones have been prepared and their reaction with Acholeplasma type strains is being examined by Elisa. The possible occurrence of these organisms in the sap of palms infected by lethal yellowing is also being investigated by the same method and we hope to present the results of this work.

TRIHARSO. Development of research on lethal yellowing disease of the palm (*Cocos nucifera*). Agricultural Science 2(7):377-383. 1980. (200

Presented to the 3rd International Union of Forestry Research Organization (IUFRO) Working Party Conference on Mycoplasma Diseases, New Jersey, NJ, 1979.

* TSAI, J.H. Estudios de transmisión de tres presuntos insectos vectores del amarilleo letal del cocotero. Boletín Fitosanitario de la FAO 23(5):140-145. 1975. (201

La evidencia indica que la enfermedad del amarilleo letal del cocotero es causada por un organismo micoplasmiforme (MLO). Otras enfermedades vegetales asociadas con organismos micoplasmiformes han sido transmitidas únicamente por un grupo limitado

de cicadelas y fulgóridos. Se ha demostrado experimentalmente que seis especies de insectos homópteros se alimentan de cocotero y palma veitchia. Las ninfas y adultos de *Oncometopia nigricans* se desarrollan y crían sobre cocotero. Su larga vida le hace un vector presunto principal. Tanto ninfas como adultos de *Ormenaria rufifascia*, *Chlorotettix* spp. y *Hortensia similis* puede sobrevivir bien sobre cocotero. *Haplaxius crudus* es un fulgórido predominante, pero tiene una vida bastante limitada sobre cocotero. Se ha encontrado que *Idioderma virescens* se alimenta especialmente de inflorescencias recién abiertas de cocotero y palma veitchia. También se han utilizado como plantas de ensayo otras plantas tales como lechuga, tomate, vinca, pimiento, aster, caléndula y zanahora con la esperanza de encontrar un hospedante alternativo tanto para agente causal como para vector que permitiera acortar los estudios de cría y transmisión.

* TSAI, J.H., WOODIEL, N.L. y KIRSCH, O.H. Rearing techniques for *Haplaxius crudus* (Homoptera: Cixiidae). Florida Entomologist 59(1):41-43. 1976. (202

Pathogen-free *Haplaxius crudus* (Van Duzee) have been successfully reared on St. Augustingrass /*Stenotaphrum secundatum* (Walt.) Kuntze/ runners grown in nutrient solution. This not only provided a means of studying the biology of this insect, but could produce a great number of test insects in a small space. This method could also be used for rearing other root-feeding homopteran insects.

* _____. Etude de la transmission du jaunissement mortel sur le cocotier par des vecteurs potentiels. Oléagineux 31(11):486. 1976. (203

Une approche complete des études de transmission dans les recherches sur le Jaunissement mortel comprend plusieurs parties importantes. Parmi elles, il y a les toxines qui peuvent être induites par le pathogene ou par des invertébrés, la transmission du pathogene par une cuscute et les relations pathogene-vecteur-hote. Dans les études de transmission par une cuscute parasite, on a essayé de faire passer l'agent du Jaunissement mortel du cocotier sur une pervenche. L'établissement de la cuscute sur les folioles a demandé une constante attention. En ce qui concerne les relations pathogene-vecteur, on a pris comme hypothese de base que le pathogene est un mycoplasme ou un complexe virus-mycoplasme. Dans les études de transmission par des vecteurs, l'accent a été mis sur les Homopteres apres qu'il ait été prouvé expérimentalement qu'un petit nombre d'especes de cigales et de cicadelles sont des phytophages du cocotier et du *Veitchia*. *Haplaxius crudus* s'est avéré etre la principale de ces especes. On a étudié et comparé le développement de cet insecte a 15°, 24° et 30? Les techniques utilisées ont été conçues pour facilitier l'étude biologique et pour obtenir un élevage de *H. crudus* relativement indemne de pathogene et sans employer de terre. D'autres plantes comme la laitue, la tomate, la pervenche, le poivre, l'aster, le souci et la carotte ont été expérimentées dans le but de trouver un hote alternatif pour le pathogene. On a utilisé de la seve de phloeme élaborée et non élaborée en nourrissant les insectes *H. crudus*, *Oncometopia nigricans*, *Macroteles fascifrons* et *Hortensio similis* sur des palmiers malades. La seve non élaborée était donnée aux larves et adultes de *H. crudus*, *O, nigricans* et *M. fascifrons* en injection forcée ou

par injection avec une seringue. On laissait ensuite ces insectes se nourrir sur des palmiers sains. La seve élaborée a été utilisée en ingestion libre et en injection sur *H. crudus* et *M. fascifrons*; on laissait ensuite ces insectes se nourrir sur des palmiers sains, des asters et du céleri.

* TSAI, J.H. Attempts to transmit lethal yellowing of coconut palms by the planthopper, *Haplaxius crudus*. Plant Disease Reporter 61(4):304-307. 1977. (204

Attempts to transmit the lethal yellowing disease of coconut palms (*Cocos nucifera*) were based on the premise that the pathogen is a mycoplasmalike organism. The emphasis in the vector trials was placed on *Haplaxius crudus* which has been experimentally proven to feed on coconut and Veitchia palms (*Veitchia merrillii*). Besides direct collecting and feeding of *H. crudus* from diseased palms to healthy palms, partially purified and crude phloem sap from diseased palms were artificially fed and also injected by needle into *H. crudus* in an attempt to transmit lethal yellowing. No transmission has resulted from these various attempts.

* _____. y ANWAR, M. Molting and longevity of *Oncometopia nigricans* (Homoptera: Cicadellidae), a suspected vector of lethal yellowing /a mycoplasmalike organism/ of coconut palms, on various host plants. Florida Entomologist 60(2):105-108. 1977. (205

Coconut and Veitchia palms along with periwinkle, lettuce, false aralia, ixora, hibiscus, and lantana were tested to determine the relationship of these locally grown plants to the biology of *Oncometopia nigricans* (Walker), a possible vector of lethal yellowing in coconut palms. Although the mortality of *O. nigricans* is generally high on coconut and Veitchia palms, some individuals can live 3 or more months on these 2 palms. This insect undergoes 5 molts and can complete its life cycle on coconut palm, ixora, periwinkle, lantana, and lettuce. The average duration of nymphal stages varies with different test plants, but was 54 days on leaf lettuce and 44 days on head lettuce. Lettuce plants are ideal for rearing *O. nigricans* colonies in the laboratory.

_____. y KIRSCH, O.H. Bionomics of *Haplaxius crudus* (Homoptera: Cixiidae) /possible vector of lethal yellowing disease of coconuts, Florida/. Environmental Entomology 17(2):305-308. 1978. (206

* _____. Progrès des recherches sur le(s) vecteur(s) du jaunissement mortel. Oléagineux 35(6):300-301. 1980. (207

Haplaxius crudus, *Idioderma virescens*, *Macrosteles fascifrons*, *Dalbulus maidis*, *Spangbergiella vulnerata*, *Peregrinus maidis*, and *Graminella* spp. were tested as vectors of LY on a variety of palms in the last two years. A total of 51 422 *H. crudus* adults were given 1-3 days acquisition access period (AAP) on diseased palms. At the end of AAP, 23 712 survivals were transferred to 13 tests palms (Cocos, Pritchardia and Caryota). Another 53 305 *H. crudus* adults were collected from LY areas and directly released into four rooms containing 26 potted palms (Pritchardia and Phoenix). A group of 573 *H. crudus* were injected with crude sap and lyophilized meristem tissue

and tested on three potted palms (Pritchardia, Veitchia and Cocos). Of the total 6 680 *M. fascifrons* given 5-9 days AAP, 3 212 insects were transferred either first to an intermediate host or directly to six potted palms (Cocos and Veitchia). For alternate host test, a group of 2 554 *H. crudus* recovered after a 2-day AAP on diseased palms were tested on four vinca plants. Another group of 9 325 *H. crudus* were tested on five vinca plants without AAP. 1 551 *M. fascifrons* were injected with phloem sap and lyophilized meristem tissue and tested on three potted palms (Cocos and Veitchia). Other acquisition tests included 5 480 *D. maidis*, 700 *S. vulnerata*, 1 500 *P. maidis*, and 1 510 *Graminella* spp. Thirteen potted palms (Cocos, Veitchia and Pritchardia) were used as test plants. Thirty-two *I. virescens* were collected from a LY area and caged on a potted palm. So far one *Pritchardia thurstonii*, one *Pritchardia remota*, one *Pritchardia affinis*, one *Caryota mitis*, one *Caryota* sp.,two *Phoenix reclinata* inoculated by *H. crudus* and one *Pritchardia criostachya* inoculated by *I. virescens* showed LY symptoms, but only *P. thurstonii* and *P. remota* were positively confirmed by EM examinations. As this matured *P. thurstonii* was not caged during the test, more tests are in progress to confirm this finding. Investigation on eriophyid mites associated with LY palms yielded no positive results.

TSAI, J.H. y THOMAS, D.L. Transmission of lethal yellowing mycoplasma by *Myndus crudus*. In Maramorosch, K. y Raychaudhuri, S.P., eds. Mycoplasma diseases of trees and shrubs. New York, Academic Press, 1981. pp. 211-229. (208

* VAN SLOBBE, W.G. La maladie de Hartrot (Pourriture du coeur) au Surinam. Oléagineux 31(11): 484. 1976. (209

L'"Hartrot" est signalé au Surinam depuis 1906, ou il a causé parfois la mort de milliers d'arbres dans les cocoteraies de Coronie. Ces dernieres années, on a estimé le nombre des cas de maladie a 2% de la population de palmiers. En juin 1975, 91% des "Nains de Ceylan" des trois couleurs (plantés en 1969), 59% des "Nains de Surinam" (plantés en 1971), et 26% "Nains de Malaisie" (plantés en décembre 1972) sont morts dans un champ d'essai. Dans un autre champ d'essai planté en 1970, la mortalité a été de 22% pour les "Nains de Surinam" (plantés en 1970) de 10% pour les "Nains de Malaisie". Jusqu'a présent, il n'y a pas eu de Nains affectés par la maladie dans d'autres plantations. Au Surinam, on désigne également le "Hartrot" par maladie inconnue, Jaunissement mortel, Maladie Bronzée des feuilles. Dépérissement de Coronie. Les symptomes son les suivants: 1a) L'extrémite et les parties tendres des racines sont de couleur bleue. 1b) Les folioles du sommet des cinq plus jeunes feuilles peuvent prendre un aspect quelque peu flechi. 2a) Quelquefois, mais pas toujours, des taches nécrotiques apparaissent sur la partie apicale des rachillas des spathes non ouvertes. 2b) La surface interne de l'extrémité de la spathe est brun-noir. 2c) Simultanément, un jaunissement simple ou orangé a l'extrémité des plus vieilles feuilles vertes et progresse vers le tronc. Parfois, les plus vieilles feuilles se cassent en leur milieu mais restent pendantes sur l'abre. 3a) Il se produit un noircissement des fleurs et des tres jeunes noix. 3b) La fleche présente quelques taches brunes peu nombreuses. 4a) Les vieilles feuilles pendent le long du tronc,

toutes les noix tombent et le jaunissement s'accentue vers le haut. 4b) La fleche peut etre arrachée et dégage une odeur nauséabonde. **Remarques:** 1) Sur des sols nettement argileux, lorsque la nappe phréatique est assez haute toute l'année (entre 30 et 60 cm de la surface), beaucoup d'arbres paraissent présenter les symptomes en saison des pluies. Sur des sols sableux ayant une couche imperméable a 50 ou 60 cm de profondeur, la maladie semble commencer a la fin de la saison seche. 2) Les arbres sont atteints a n'importe quel stade de croissance mais surtout en début de production. 3) Au cours de l'année derniere le "Nain de Malaise" a également été affecté. 4) La maladie dure un a trois mois, des symptomes initiaux jusqu'a la pourriture finale du coeur. 5) Quelques faits indiquent l'existence d'une corrélation entre d'une part, la maladie et le mauvais drainage du sol (liés ou non entre eux), et, d'autre part, un mauvais état d'entretien comme l'absence de désherbage et de fertilisation.

VAN WEERDT, L.G. y MARTINEZ, A.P. Lethal yellowing in Key West. Florida. State Plant Board. Lab. Notes no. 21. 1959. s.p. (210

* _____., MARTINEZ, A.P. y ESSER, R.P. Results of a survey designed to determine the etiology of "lethal yellowing" of *Cocos nucifera* L. Proceedings of the Florida State Horticultural Society 72:421-430. 1959. (211

* WATERS, H. Comportement alimentaire d'un supposé vecteur du jaunissement mortel, *Haplaxius crudus* Van Duzee (Homoptera, Cixiidae). Oléagineux 31(11):487. 1976. (212

También en inglés en: Principes 20:65-66. 1976.

Dans les études résumées ci-apres, on a admis l'exactitude de l'étiologie mycoplasmique du Jaunissement mortel (L.Y.) du cocotier. Sur la base de cette présomption, le vecteur du L.Y. est probablement un Homoptere suceur de seve. Parmi les supposés vecteur concernés par les recherches de lO.D.M. Lethal Yellowing Research Team a la Jamaique, *Haplaxius crudus* a fait l'objet d'une étude minutieuse du comportement alimentaire des larves et des adultes respectivement sur racines et feuilles de *Cocos nucifera*. Apres l'acte alimentaire, les adultes et les larves de *H. crudus* laissent des empreintes de leur rostre dans les tissus de l'hote; ces empreintes peuvent être rendues visibles par coloration avec la Johansen's safranine ou la fuschine acide a 2%. On peut localiser les points de piqure alimentaire des adultes en humectant la surface des feuilles avec un coton imbibé de bleu de lactophenol. Apres rinçage a l'eau distillée, ce produit révele tres nettement les empreintes labiales sur la surface du limbre. Les larves ne laissent pas d'empreintes aussi nettes, probablement parce qu'elles ont des extrémités de rostre différentes de celles des adultes. On a constaté que les adultes sucent la seve au niveau du phloeme des feuilles et que les larves font de meme sur celui des racines. Pour se nourrir, l'adulte pique de préférence au niveau d'un stomate. Une majorité des sondages alimentaires coincident avec les cellules subsidiaires de garde des stomates. Grace a la technique de l'empreinte labiale, d'autres insectes adultes supposés vecteurs du L.Y. se sont révélés etre des suceurs de seve de phloeme, a savoir: *Antillixius* sp., *Colpoptera elevans*

Wallser, *Omolicna cubana* Myers, *Psenoflata brevis* Van Duzee et *Proarna hilaris*. Ce travail a été financé par le UK Ministry of Overseas Development under the Technical Assistance Scheme R 2636.

* WATERS, H. A technique for the location of planthopper /*Haplaxius crudis*, a possible vector of lethal yellowing of coconuts/ feeding probes using labial imprints. Annals of Applied Biology 85(2):309-311. 1977. (213

Labial imprints mark precisely a planthopper's feeding probe. By staining a leaf surface with 1% aniline blue in lactophenol, the labial imprints may be detected. This technique provides a simple method for the location of stylet tracks without having to kill feeding insects *in situ*. Using the leaf surface staining technique, the labial imprints of *Haplaxius crudus* Van Duzee (Homoptera; Cixiidae), a possible vector of lethal yellowing of coconuts, were shown to be 70-80 µm in diameter with a raised central crown. Such imprints are the mirror image of the distal labial surface.

_____. y OSBOURNE, I. Preliminary studies upon lethal yellowing and the distribution of MLO in coconut palms. In Meeting of the International Council on Lethal Yellowing, 3rd, Florida, 1978. Proceedings. Florida, University of Florida, 1978. p. 15. (Publ. FL-78-2). (214

_____. y HUNT, P. The *in vivo* three-dimensional form of a plant mycoplasma-like organism by the analysis of serial ultrathin sections. Journal of General Microbiology 116(1): 111-131. 1980. (215

MLO associated with lethal yellowing disease of coconut palms exhibited a range of different morphologies even within the same sieve element, as revealed by graphic reconstruction from ribbons of serial ultrathin sections containing 45 sections. Five different morphotypes were recognized among the 120 organisms reconstructed: saccate, erythrocyte-like, cylindrical, moniliform or filiform. The different morphotypes also showed differences in linear dimensions. Saccate MLO were generally the smallest, maximum length 1 µm, whilst the filiform organisms could be > 16 µm long. The morphologies of the MLO were analogous to those now recognized as usual for Mycoplasma and Acholeplasma spp. *in vitro* during the later stages of development. Comparison of the individual profile shapes used in the reconstructions with those of MLO from other diseased plants suggest that many previous interpretations of MLO morphology may have been too simple. With the insight provided by the understanding of the relationship between profile shape and 3-dimensional form, the ultrastructure of individual profiles is shown to be an important indicator of form. (Review of Plant Pathology 59(8):3864. 1980).

* _____., ROMNEY, D.H. y HARRIES, H.C. Nuevos focos de enfermedades y placas: el amarillamiento letal del cocotero. Boletín Fitosanitario de la FAO 28(4):139-141. 1980. (216

Se comprobó en Jamaica que, en los elementos conductores del floema de plantas afectadas por el amarillamiento letal del cocotero, existían organismos micoplasmoides (OMP). Otras especies de palmeras, incluyendo el datilero (*Phoenix dactylifera* L.), que es una especie de importancia económica, pueden mostrar también síntomas de

amarillamiento letal. Se concluye en este informe que la enfermedad existente en Cuba es el mismo amarillamiento letal que se encuentra en los territorios vecinos. Se ha observado que en Cuba las variedades enanas son resistentes al amarillamiento letal, por lo cual se recomienda que las futuras plantaciones se hagan a base de la variedad resistente "Malayan Dwarf".

WHITEHEAD, R.A. Disease resistance and the problem of lethal yellowing in coconuts. Information Bulletin of the Scientific Research Council (Jamaica) 4(3):54-58. 1963. (217

* _____. Le jaunissement mortel du cocotier; probleme de la résistance. Oléagineux 20(5): 307-310. 1965. (218

Les cocotiers Nains sont naturellement résistants a la maladie du Jaunissement mortel également appelée "Chlorose Léthale". Comme cette maladie présente beaucoup d'analogies avec la maladie de Kaincopé au Togo, il fut décidé a la suite d'une étude comparative de ces deux maladies de replanter les zones dévastées du Togo avec du matériel Nain. Les premiers Nains jaunes plantpes en 1960 au coeur de la zone infestée et qui ont produit leurs premiéres noix en 1964, confirment jusqu'ici l'identité de la résistance du matériel Nain au Togo et a la Jamaique. La résistance tres probable de l'hybride entre Nain et Grand, si elle est confirmée, constituera également une solution avantageuse.

* _____. Some notes on dwarf coconut palms in Jamaica. Tropical Agriculture (Trinidad) 43(4): 277-294. 1966. (219

The present article reviews the history and the results of recent research in Jamaica into the botanical and economic characteristics of "Malayan Dwarf" palms, and also refers to observations made elsewhere. Flowering characteristics are discussed and a consideration of colour inheritance, particularly in red-and yellow-fruited palms, leads to confirmation of the suggested self pollinating tendency in "Malayan Dwarf" palms of these two colour forms which is likely to be of value in the commercial production of hybrid seed. Differences between "Malayan Dwarf" palms and the locally important "Jamaica Tall" mainly with respect of plant height, flowering, seed germination, fruit maturation time and fruit composition, are outlined. Early bearing is a characteristic of "Malayan Dwarf" palms and yields of up to two tons of copra per acre have been obtained in Jamaica. Records over a three year period for one 13 acre planting suggest that green-fruited palms yield better than yellow-fruited palms. Data on the productive life of "Malayan Dwarf" palms are limited, but 40 year old palms in St. Lucia, Malaya and Fiji are still producing economic yields. Nut size in the latter two countries is less than that in Jamaica. Evidence for resistance of "Malayan Dwarf" palms to lethal yellowing disease is given and the system adopted for seed production aims to avoid dilution of this resistance. Other aspects of the disease resistance programme are briefly considered. Present gaps in our knowledge and the need for further detailed research are indicated in the discussion, which concludes on a confident note based on general observation of many areas in Jamaica where dwarfs are planted and performance is good and supported by proven resistance to lethal yellowing disease.

* WHITEHEAD, R.A. Selecting and breeding coconut palms (*Cocos nucifera* L.) resistant to lethal yellowing disease: a review of recent work in Jamaica. Euphytica 17(1):81-101. 1968. (220

Selection and breeding is likely to provide the only answer to lethal yellowing disease of coconuts. The present review outlines the short term and long term programmes started in Jamaica and gives details of the exploitation of local varieties and the assembly of genotypes for further work. In the short term programme the botanical and economic characteristics of Malayan Dwarf coconuts have been studied, seed quality has been improved and a gradual change over from the disease susceptible Jamaica Tall variety to the Malayan Dwarf is now taking place. Over a three year period proportionately fewer San Blas than Jamaica Tall palms have died in disease affected areas where both are growing together, and it is considered that the San Blas variety merits further detailed study. The long term programme is mainly concerned with attempts to improve the Malayan Dwarf by hybridisation and to establish whether or not these and other hybrids are resistant to lethal yellowing. In addition, a wide range of genotypes from the major producing areas in the world has been introduced and established in field trials, in an attempt to find further sources of disease resistance. Though useful results have already been obtained, in field tests relying on natural spread of the disease, progress would be more rapid if the disease could be transmitted at will.

WILDMAN, R.B. y HUNT, P. Phytoferritin associated with yellowing in leaves of *Cocos nucifera* (Arecaceae). Protoplasma 87(1/3):121-134. 1976. (221

WILSON, C.L. y SELLSKAR, C.E. Mycoplasma-associated diseases of trees. Journal of Arboriculture 2(1):6-12. 1976. (222

In this review, the symptoms of mycoplasma-associated diseases are discussed and 23 such diseases are listed. Ten of these, including coconut palm lethal yellowing, Paulownia witches' broom, pecan bunch disease, mulberry dwarf, sandal (*Santalum album*) spike and walnut bunch disease, are described in detail. (Horticultural Abstracts 46(11): 9924. 1976).

* WOODIEL, N.L. Insectes associés au cocotier en Floride du sud. Oléagineux 31(11):487. 1976. (223

Au cours d'une étude de deux ans faite a l'University of Florida Agricultural Research Center de Fort Lauderdale, on a utilisé plusieurs méthodes d'échantillonnage pour étudier les insectes mobiles dans les palmeraies et leurs alentours. Pour inventorier les insectes qui se déplacent entre les arbres, on a fait fonctionner des filets rotatifs a trois hauteurs autour des plantations. Pour prélever des échantillons d'insectes qui se localisent aux arbres, on a employé des poteaux et des planches englués. Un piege lumineux et une machine D. Vac ont servi a recueillir des données supplémentaires. Plus de 80 especes de'Homoteres (Auchenorrhynques) ont été capturées au cours de l'étude; beaucoup sont communes a la Jamaique et a la Floride du Sud. *Haplaxius crudus* est une espece d'importance majeure et, d'aprés les

indications recueillies, elle atteint un maximum de densité dans les arbres entre juin et septembre. Elle peut etre présente au voisinage des arbres en populations stables, mais ses rassemblements se font sur les arbres a cette période. Les travaux conduits a la Jamaique montrent que les populations de Floride et de Jamaique manifestent toutes deux ce grégarisme. On présentera ultérieurement d'autres travaux sur le développement de l'inflorescence et les problemes de maladie du "Nain de Malaisie".

ZIMMERMANN, M.H. Mycoplasma diseases and long-distance transport in plants. National Science Council (Taiwan). NSC Symposium Series no. 1. 1979. pp. 37-43. (224

Pathogens can only move in the xylem over distances longer than the length of a vessel if they are <10-20 nm, the approximate size of vessel-to-vessel pit membranes, or if they produce wall-dissolving enzymes. This requirement makes xylem transport of mycoplasmas from roots to leaves unlikely. However, mycoplasmas do not move in the phloem because they can be found in sieve tubes of sink areas which are fully protected from vectors. Sieve tubes are normally under high positive pressure and exude briefly when punctured. Transmission may be successful only under conditions of slack sieve-tube turgor. Xylem pressures in coconut palms with lethal yellowing are unusually high and do not fluctuate diurnally, even before the appearance of any other symptoms. This indicates permanent closure of stomata and makes lethal yellowing the exact opposite of a wilt disease. (Review of Plant Pathology 60(4):1899. 1981).

INDICE DE AUTORES

INDICE DE AUTORES

INDICE DE MATERIA

INDICE DE MATERIA

SERIE DOCUMENTACION E INFORMACION AGRICOLA

1. Colección de referencia de la Biblioteca Conmemorativa Orton. 2 ed. rev. 1967.
2. Publicaciones periódicas de la Biblioteca Conmemorativa Orton. 1964.
3. Tesis de la Escuela para Graduados 1947-1968; resúmenes. 2 ed. rev. y ampl. 1969.
4. Redacción de referencias bibliográficas; normas oficiales del IICA. 2 ed. 1972.
5. Directorio de bibliotecas agrícolas en América Latina. 1964.
6. Catálogo de publicaciones periódicas de la Biblioteca Conmemorativa Orton. 2 ed. rev. y ampl. 1970.
7. Estado actual de bibliotecas agrícolas en América del Sur; resultados de una encuesta personal. 1966.
8. Administración de bibliotecas agrícolas. 1966.
9. Guía de publicaciones periódicas agrícolas de América Latina. 1966.
10. Bibliografía de bibliografías agrícolas de América Latina. 2 ed. rev.y ampl. 1969.
11. I Mesa Redonda sobre el Programa Interamericano de Desarrollo de Bibliotecas Agrícolas, Lima. 1968.
12. Contribuciones del IICA a la literatura de las ciencias agrícolas. 2 ed. rev. y ampl. 1977.
13. Directorio de siglas en ciencias agrícolas. 2 ed. 1971.
14. Guía básica para bibliotecas agrícolas (ed. en portugués y español). 1969.
15. II Mesa Redonda sobre el Programa Interamericano de Desarrollo de Bibliotecas Agrícolas, Bogotá. 1968.
16. Recursos de bibliotecas agrícolas en América Latina. 1969.
17. 2000 libros en ciencias agrícolas en castellano. 1969.
18. III Mesa Redonda sobre el Programa Interamericano de Desarrollo de Bibliotecas Agrícolas, Río de Janeiro. 1969.
19. Publicaciones periódicas y seriadas de América Latina. 1971.
20. Indice Latinoamericano de tesis agrícolas. 1972.
21. Trópico Americano: situación de los servicios bibliotecarios y documentación agrícola. 1972.
22. 3000 libros agrícolas en español. 1973.
23. Bibliografía sobre frijol de costa (*Vigna sinensis*). 1973.
24. Sistema Interamericano de Información para las Ciencias Agrícolas-AGRINTER: bases para su establecimiento. 1973.
25. Bibliografía sobre especies de la fauna silvestre y pesca fluvial y lacustre de América tropical. 1973.
26. Bibliografía sobre plantas de interés económico de la región Amazónica. 2 ed. rev. y ampl. 1978.
27. Bibliografía sobre sistemas de agricultura tropical. 1974.
28. Bibliografías agrícolas de América Central: PANAMA. Suplemento. 1974.
29. Bibliografía sobre catastro rural en América Latina. 1974.
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; una bibliografía parcialmente anotada. 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. 2 ed. rev. en español para el AGRINTER. 1979.

37. Esquema de Categorías de Materias. 3 ed. rev. Trad. para uso del AGRINTER. 1979.

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: orígen 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 en Colombia. 1977.

56. Bibliografía preliminar sobre recursos naturales de Colombia. 1978.

57. Bibliografía selectiva sobre desarrollo rural en Colombia. 1978.

58. Bibliografía sobre comercialización agrícola en América Latina y el Caribe. 1979.

59. Bibliografía selectiva sobre derecho y reforma agraria en América Latina y el Caribe, 1974-1977. 1978.

60. Royas del cafeto (*Hemileia* spp.); bibliografía. 3 ed. 1977.

61. Banco de datos de bibliografías agrícolas de América Latina y el Caribe; índice acumulado. 1977.

62. Normas de enriquecimiento de títulos utilizados en los Sistemas AGRINTER y AGRIS. 2 ed. 1980.

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 agrícola: una síntesis. 1978.

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

67. Bibliografía sobre peste porcina africana y peste porcina clásica; parcialmente anotada. 1978.

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 parcialmente anotada. 1979.

72. Bibliografía sobre sensores remotos. 1979.

73. ISIS: Manual para usuarios. 1979.

74. Bibliografía básica sobre desarrollo rural latinoamericano. 1979.

75. Bibliografía selectiva sobre desarrollo rural en Ecuador. 1979.

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

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

78. Participación de la mujer en el desarrollo rural de América Latina y el Caribe; bibliografía. 1980.

79. Biomasa y otras fuentes no convencionales de energía; bibliografía. 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 Simpn Bolívar. 1980.

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

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

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

88. *Rhadinaphelenchus cocophilus*; anillo rojo del cocotero; una bibliografía parcialmente anotada. 1980.

89. Sigatoka del banano; bibliografía parcialmente anotada. 1980.

90. Mosca del Mediterráneo (*Ceratitis capitata*); bibliografía parcialmente anotada. 1980.

91. Mulher no Brasil; resumo bibliográfico. 1980.

92. Bibliografía sobre desarrollo rural en Bolivia. 1980.

93. Bibliografía agrícola del Uruguay, 1979-1980. 1981.

94. Páginas de contenido en medicina veterinaria. 1981.

95. Curso corto sobre manejo de datos de investigación usando SAS. Trad. del inglés. 1981.

96. Catálogo colectivo de las publicaciones periódicas de las Bibliotecas del CIDIA. 1981.

97. Directorio de recursos humanos del Uruguay, en producción animal. 1981.

98. Una guía del usuario a la versión 3 del programa analítico de recursos geográficos. 1981.

99. Manual de organización de la información en archivos magnéticos (banco de datos). Encuesta rural Nicaragua, 1980. 1981.

100. Tristeza de los cítricos; bibliografía parcialmente anotada. 1981.

101. Manual de organización de la información en archivos magnéticos (banco de datos). Encuesta rural Pacífico Sur, Costa Rica. 1981.

102. Aves depredadoras; bibliografía parcialmente anotada. 1981.

103. Roya y carbón de la caña de azúcar; bibliografía parcialmente anotada. 1981.

104. Bibliografía sobre desarrollo rural del Perú. 1981.

105. Directory of Directors of Animal Health. 1981.

106. Una guía del usuario para la versión 2.0 del programa creador del archivo maestro geográfico. 1981.

107. Descripción de los instrumentos constitucionales del sistema integrado de indicadores sociales de nivel de vida y progreso social en las familias rurales de Centroamérica y Panamá. 1981.

108. Biogás: una bibliografía mundial. 1981.

109. Bibliografía sobre carambola (*Averrhoa carambola* L.). 1982.

110. Perfiles de áreas rurales. 1982.

111. Bibliografía sobre café. 1982.

112. Muestras probabilísticas en marcos de área: diseño, construcción y uso de marcos de área para muestreos por encuesta. 1982.

113. La mujer rural en Paraguay. 1982.

114. Contribuciones del IICA a la literatura sobre ciencias agrícolas, 1977-1982. 1982.

115. Moho azul del tabaco (*Peronospora tabacina* Adam); bibliografía parcialmente anotada. 1982.

116. Catálogo de microfichas de los documentos no convencionales de América Latina y el Caribe. 1982.

117. Bibliotecas depositarias de las publicaciones del IICA. 1982.

118. Bibliografía anotada sobre la mujer y la familia rural en el Ecuador. 1982.

119. Desarrollo de un sistema de información geográfico del Istmo Centroamericano. 1982.

120. Bibliografía de publicaciones del PIADIC. 1982.

121. Bibliografía sobre pejibaye; parcialmente anotada. 1983.

122. Escoba de bruja del cacao (*Marasmius perniciosus*); bibliografía parcialmente anotada. 1983.

123. Bibliografía agrícola andina. 1983.

124. Bibliografía colombiana sobre desarrollo rural, 1970-1983. 1983.

125. Catálogo de publicaciones periódicas de la Biblioteca "Rodrigo Peña", IICA-Colombia. 1983.

126. Mil bibliografías en ciencias agrícolas y desarrollo rural (colección Biblioteca "Rodrigo Peña", IICA-CIDIA). 1984.

127. Resúmenes en desarrollo rural latinoamericano. 1984.

128. Bibliografía agrícola peruana. 1984.

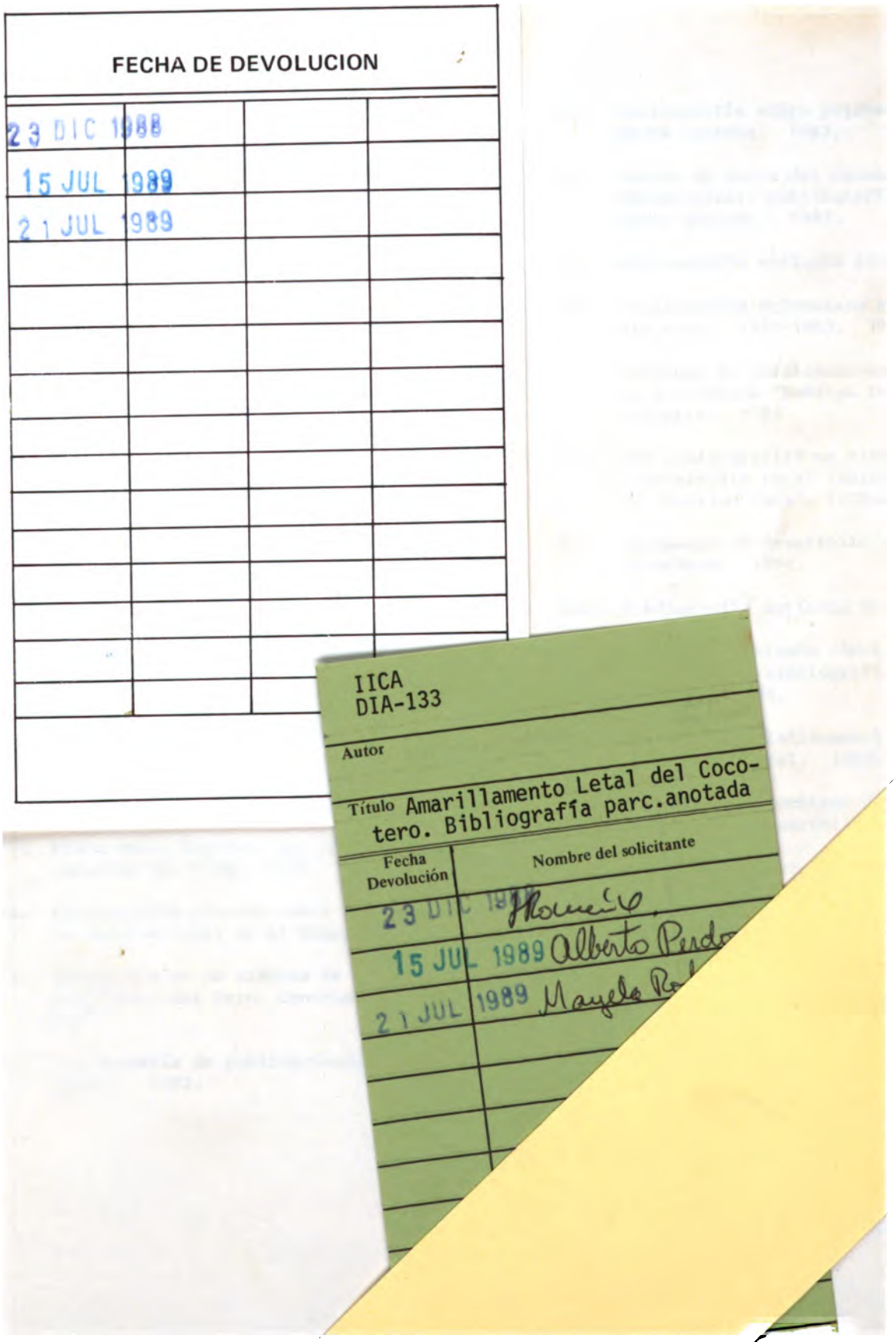
129. Abeja africanizada (*Apis mellifera adansonii*); bibliografía parcialmente anotada. 1984.

130. Bibliografía latinoamericana sobre desarrollo rural. 1984.

131. Directorio colombiano de instituciones agrícolas y desarrollo rural. 1984.

132. Catálogo de tesis de grado de la Facultad de Ciencias Agrícolas de la Universidad de Nariño, 1954-1984. 1984.

133. Amarillamiento letal del cocotero; bibliografía parcialmente anotada. 1984.



FECHA DE DEVOLUCION

23 DIC 1988			
15 JUL 1989			
21 JUL 1989			

IICA
DIA-133

Autor

Título Amarillamento Letal del Cocotero. Bibliografía parc.anotada

Fecha Devolución	Nombre del solicitante
23 DIC 1988	Moreno.
15 JUL 1989	Alberto Pere
21 JUL 1989	Mayela Ro

Editorial IICA