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ANNOTATED BIBLIOGRAPHY ON HARTROT OF COCONUT AND OIL PALMS

Prepared by

Miguel Revelo
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IICA

OFFICES IN SURINAME AND TRINIDAD AND TOBAGO

PARAMARIBO, SURINAME
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FOREWORD

The agricultural production in the Latin-American and Caribbean countries has suffered from the spread of plant diseases, which affects the crop production for food, agro-industry and exports. The Office of IICA in Suriname and the Ministry of Agriculture, Animal Husbandry and Fisheries, LVV, as part of the institutional activity on this matter, have developed the project entitled "Establishment of a Coconut and Oil Palm Research Center in Suriname". One of the goals of this project is the identification, indexing and dissemination of the technical literature on "Hartrot" ("Marchitez sorpresiva") dieseases of coconut, *Cocos nucifera* L. and African and American oil palms, *Elaeis guineensis* Jacq. and *E. oleifera* (H.B.K.) Cortes.

This annotated bibliography is one of the products of the project. Its preparation was undertaken by M. Revelo, IICA/Suriname specialist, with the collaboration of P. Castelen, J. Asgarali and W.E. Fung Kon Sang, specialists of the Palm Research Center of the Ministry of Agriculture, Animal Husbandry and Fisheries of Suriname.

The publication of this work is sponsored by the IICA Offices in Suriname and Trinidad and Tobago.

We are indebted to the personnel of the Ministry of Agriculture of Suriname who cooperated in this effort and we acknowledge especially the technical support of Mr. Hugo Caceres, Information Specialist of the IICA Office in Trinidad and Tobago.

I hope that this document will be beneficial to the scientists working in research on oil palm and coconut in Suriname as well as those in other countries.

Guillermo E. Villanueva
Director, IICA - Suriname

INTRODUCTION

The technical papers and documents included in this bibliography are with few exceptions, the most important information produced during the past 25 years on the subject. The most important information of each document is presented in a summarized form prepared by the authors of this annotated bibliography. The authors were able to locate and read practically all of the original publications; however, in a few cases only the summary had to be prepared using secondary sources.

The sources of information were:

1. Dialog (Information service, Inc.)
2. The Library at the Ministry of Agriculture, Animal Husbandry and Fisheries of Suriname
3. The Library at the Centro Nacional de Investigaciones Agropecuarias, Tibaitata, in Bogota, Colombia
4. Technical unpublished reports of the Agricultural Experiment Station of the Ministry of Agriculture, Animal Husbandry and Fisheries of Suriname.
5. Technical reports of the Instituto Colombiano Agropecuario
6. Personal files of the authors and other sources

The bibliography here presented includes 216 individual references; these references are classified under 76 specific topics through the subject index. An author index is also provided.

CONTENTS

BIBLIOGRAPHIC INDEX

1. AGRIOS, G.N. Plant Pathology. 2 ed. London, Academic Press, 1978. 703 p.

Chapter 16 deals with several aspects of the plant diseases caused by protozoa. It provides a brief introduction to the history of the discovery of protozoa in plants, including general aspects on the morphology and the taxonomy of these microorganisms. There are general discussions and comments in connection with the "phloem necrosis" of coffee, caused by *Phytomonas* (leptomonas) *Leptovasorum* and the "Hartrot" disease of coconuts caused by *Phytomonas* sp.

2. ALEXANDER, V.T. The relation between rainfall and the incidence of "Hartrot" or "Fatal Wilt" in coconut. Ministry of Agriculture, Animal Husbandry and Fisheries, Palm Research Centre, Suriname. Internal Report No. 60. 1984. 6pp.

This report contians the results of a field test by means of which it was attempted to disclose any existing relationship between the amount of rainfall and the incidence of the "Hartrot" disease of coconuts. The test was performed at La Poule Experimental Station, near Paramaribo in Suriname, from mid-1979 to mid-1983. Each month the number of diseased trees and the amount of rainfall were recorded. The observations were made on weeded and non weeded coconut plots and treated and non treated with agrochemicals to control the disease. The results are presented on tables and graphs and according to the author, there is a positive relationship between the amount of rainfall and the incidence of "Hartrot" or "Fatal Wilt" except with the coconut plots treated with Endrin and with complete weed control where the cause of the disease, the author says, is non existing.

3. ALEXANDER, V.T. and P. KASTELEIN. Hartrot or "Sudden Wither" disease in hybrids of *Elaeis oleifera* x*Elaeis guineensis*. De Surinaamse Landbouw 31 (1): 18-22. 1983.

Until recently the hybrids of *Elaeis oleifera* x*Elaeis guineensis* were considered to be resistant to "Hartrot" or "Sudden Wither"; a disease that is accepted to be associated with protozoa flagellate of the *Phytomonas* genus.

Hybrids planted at La Poule Exp. Sta. in 1977 in Suriname, developed disease symptoms in 1982. There is a symptom description which includes changes in color beginning with the lower leaves, presence of flagellates in roots and meristem tissue, spear rot, fruit fall and rot and death of tree in 4 to 8 weeks after first visible symptom. So far, they say, no *E. oleifera* wild plant has been observed affected by the disease.

4. ALEXANDER, V.T. Preliminary observation on the control of "Hartrot" of coconut by insecticidal application. De Surinaamse Landbouw 29: 1-3. 1981.

Flagellates of the Phytomonas genus are found in the phloem of coconut plants affected by"Hartrot" or "Fatal Wilt". Similar flagellates are also found in "Marchitez sorpresiva" affected oil palms.

Since it had been reported that several broad spectrum insecticides can provide some kind of control of the unknown vector or vectors of the Hartrot causing flagellates, tests were carried out in Suriname, in 1977-1979, on a four year old Malayan Dwarf palms growing in an endemic "Hartrot" region. Endrin was applied every three months as a

soil drench using 80 ml. (emulsifiable concentration of 19.5%) in 2 lts. water per palm. Carbaryl (Sevin 80% w.p.) was applied every three months, as surface spray, using 6 mg (sic) in one lt. of water per plant. At the conclusion of the test, 22 months after its start, the following results were obtained: 11 of 53 untreated palms treated with endrin and sevin, respectively. These results do not show any degree of control and the apparently better results with Sevin are statistically not significant.

5. ALEXANDER, V.T. Present status of research of "Hartrot" of coconut in Suriname and proposal for a regional strategy for control. *In* Meeting of the Society for Plant Protection in the Caribbean, 1st., Kingston, Jamaica, 1981. Proceedings. Port-of-Spain, Trinidad, IICA Office, 1981. pp.85-95. (IICA Miscellaneous Publication No.378. ISSN 0534-5391).

There are some historical accounts starting with the first report of the disease by A.W. Drost, in 1908, who called it "Hartrot". A similar wilt associated also with flagellates is mentioned in Colombia, since 1963, and in Peru and Ecuador shortly after; this disease is called "Marchitez sorpresiva". "Hartrot" and "Marchitez sorpresiva" are very poorly understood since little is known about the host pathogen relationship. Research done by many authors are significant but still very preliminary in nature; more basic work on the host plants, insect vector or vectors and the presumed pathogen *(Phytomonas staheli)* needs to be done as condition to find an effective method of control. In attempts to control the disease in Suriname, field experiments were conducted with different coconut varieties, and several agrochemical treatments were evaluated. Several cultural practices were also tried. The author says that "this may be due to the weakness of this trial in having excessive weed growth"; therefore the Endrin applied as soil drench may not have been affected in eliminating the possible vector or vectors. He says nothing is known about the incubation period of flagellates in the plant.

6. ALEXANDER, V.T. Present status of research including resistance of different varieties of coconut to "Hartrot" in Suriname. In Colloque international sur la protection des cultures tropicales. Lyon, France, 1981. Resumes. p.63.

The author recalls that "Hartrot" of coconuts was originally reported about eight decades ago and that only in 1976 flagellates of the Phytomonas genus were discovered in the phloem of "Hartrot" affected coconut palms in Suriname. In dealing with the attempts to control the disease the author reports the field trials conducted with different coconut varieties to test them for resistance or susceptibility to the disease; the evaluation of several agrochemicals and the effect of some cultural treatments including the weed control. As results so far obtained the author mentions that the "Suriname Tall" coconut variety and some hybrids were somewhat tolerant to the disease; the dwarf varieties resulted to be susceptible. In the chemical treatments the use of soil applications of Endrin provided good control of the disease and, as far as the cultural practices are concerned, the weed control had remarkable effect in controlling the disease. Further research is recommended.

The results so far obtained indicate the existence of varying degrees of susceptibility to the Hartrot disease between coconut varieties. The "Suriname tall" is the most resistant; similarly, hybrids with "Suriname tall", as one of the parents, show significant tolerance. The results also indicate that the incidence of the disease commences even before the bearing stage. In the case of chemical treatments only Endrin 0.1% applied

every two months proved to be successful in controlling the disease, as it was found to control "Marchitez sorpresiva" in Colombia.

In connection with the cultural treatments complete weed control in the coconut plots seemed to be effective against the disease.

There are some comments about the economic reasons that make him recommend a complete research program in coconuts and oil palm in America.

7. ALEXANDER, V.T. *et al.* Research on Hartrot of palms during 1979-1980. Ministry of Agriculture, Animal Husbandry, Fishery and Forestry. Agricultural Experimental Station, Paramaribo. Internal Report No.46. 1981. 45pp.

This report contains a rather detailed summary of diffeent hartrot related research activities in Suriname.

The Agronomy Division reports the results obtained in a field trail to control the Hartrot disease of coconuts with agrochemical products. As final results the authors recommend periodical applications of endrin to the soil around the trees, a complete weed control and the use of tolerant coconut varieties such as the Suriname Tall. The chemical nematocides and fungicides did not exert any effect upon the disease. The Entomology Division reports a good deal of findings in the search program for flagellate insect vectors started in 1979 and continued for 11 weeks at several endrin treated and non-treated coconut plots, in Suriname. The use of "pitfalls" traps yielded a slightly higher total number insect species in the non-treated plots but the chinch bug species were almost non-existing. The use of a sticking glue on the trunk resulted in the capture of several insect species including the pentatomid *Macropygium reticulare* on the mid rib of lower coconut leaves.

The use of light traps produced the capture of insect species of the Pentatomidae, Lygaeidae and Pyrrocoridae families. The lygaeids were the most abundant but none was captured on coconut plants. Visual observations under the debris disclosed the presence of the pentatomids *Berecynthus dilirator, Alitocoris* sp. and an unidentified collobatristid. *Edessa* was found on the trees and, *M. reticulare* under the weed vegetation. Some other chinch bug species were also collected from weeds growing near the coconut palms. Dissection of bugs and microscopic examination of 200 salivary glands, looking for plant flagellates of the Phytomonas genus, are reported. Flagellates were found in *Alitocoris* sp., *M. reticulare, Edessa* sp., *E. cornuta* and *B. delirator*. Since *M. reticulare* was the most abundant some ecological and population density studies were made. The Nematology Division reports Hartrot related evaluations of Nematode species found in coconut plants treated and non treated with the carobofurran namatocide and with the endrin insecticide. Six nematode genera were found, with no apparent effect of the agrochemicals on the individual nematode populations. The carbofuran did not exert any effect on the Hartrot disease. The Mycology Division reports the results obtained from the analysis and observations of root samples taken from trees growing in Hartrot affected and non plots, and treated and non treated with several agrochemicals. *Penicillium* sp., *Aspergillus* sp. and *Fursarium* sp. were the most continuously found species, but no relation with the presence or absence of the Hartrot disease is reported.

8. ALEXANDER, V.T. Varietal resistance studies of "Hartrot" disease of coconuts. De Surinaamse Landouw 29: 20-23, 1981.

There is a description of symptoms on the base of several published informations. There is also a general account on economic aspects of the disease. He discusses the genetic aspect in connection with the possibility of disease control. He mentions that the coconut, Malayan Dwarfs, were tested for resistance to the Lethal Yellowing disease in Jamaica, were tested also against "Hartrot" in Suriname along with Ceylonese Dwarfs, Suriname Dwarfs and Suriname Tall. First trials were made in 1970 and other trials in 1976 and 1977, including some hybrids. As general results he states that there are varying degrees of susceptibility to "Hartrot". As special note he mentions the disease starts before the bearing stage; some were affected being 1.5 to 2 years old.

No resistance in Malyan, Ceylonese Dwarfs or Suriname Dwarf (?). Only Suriname Tall (?) showed a slight degree of tolerance.

The most susceptible was Suriname Dwarf followed by Ceylonese Dwarf and Malayan Dwarf.

The hybrids showed also some degree of tolerance.

9. ALEXANDER, V.T. Preliminary observations on the control of Hatrot of coconut by insecticidal application. *In* International Council on Lethal Yellowing, 4th., Fort Lauderdale, Florida, U.S.A., 1979. Proceedings. p.17

The symptoms of Hartrot or Fatal Wilt of coconut palms in Suriname are quite similar to those of Lethal Yellowing.

Flagellate protozoa are found in the phloem of diseased palms. In trying to control the disease by eliminating the possible vector(s), Endrin 20% and Sevin 80% insecticides were applied periodically to the base and to the soil around the palms, using 80cc Endrin 20% in 5-10 litres of water. This treatment, that is claimed to provide good results in oil palms affected by flagellates in Suriname and Colombia, gave no control after 20 months trial in Hartrot affected coconuts in Suriname.

10. AMSTERDAM TECHNICAL ASSISTANCE COMPANY — COLDESA. Replanting diseased oil palm areas with *Elaeis oleifera* x *E. Guineensis* hybrids at "La Arenosa" State in Colombia. Oil Palm News (England) No.18:1-6. 1974.

There is a general description of the plantation which is located on the North West part of Colombia. The first planting was made in 1962, using a Malaysia D x P material. In 1964 and 1968 Suriname D x P, African and Coldesa D x P were materials planted too.

In 1964 the first cases of "Spearrot/Budrot" were found and in the following years the disease spread to the whole plantation. There is a symptoms' description of the disease which, according to the writers is the most characteristic, taking into consideration the existing variations. In spite of several research works undertaken by national and international experts, nothing positive was discovered. They believed, though, the disease was infective. By chance they noticed that some hybrids were quite resistant to the disease.

In 1963 hybrids O x G from Suriname were first planted. There is a complete description of the hybrid material including yields, oil content, etc. In 1972 it was decided to replant the disease affected area with hybrids. They say that the hybrid seemed resistant to "Marchitez sorpresiva" disease.

11. ARNAUD, F. et RABECHAULT, H. Premieres observations sur les caracteres cytohistochimiques de la resistance du palmier a huile au "Deperissement brutal". Oleagineau 27 (11): 525-529. 1972.

The authors refer to the occurrence of a disease of the oil palm in South America which is still of unknown origin and which is locally called "Marchitex sorpresiva" or "Hoja tostada". The disease causes "Sudden wither" of the palm.

Since the disease has not been found affecting the interspecific hybrid *Elaeis oleifera (melanocucca)* x *E. guineensis,* a comparative histochemical study of root samples of the hybrid and the parental species was conducted. The initial results are here reported. Some differences were found in the morphological aspect as well as in the biochemical make-up of the samples. The "Marchitez sorpresiva" resistant hybrid and the *E. oleifera* species showed a higher content of a polyphenoloc compound in the endodermis, which was identified as a kind fo tanin. This could be a sort of resistant factor, the authors say.

12. ASGARALI, J. en RAMKALUP, P. Studie over de wants *Lincus* sp. (Pentatomidae) als mogelijke vector van hartrot in kokos (in Suriname). (Study of *Lincus* sp. (Pentatomidae) as the possible vector of "Hartrot" in coconut, in Suriname). Ministry of Agriculture, Animal Husbandry and Fisheries. Palm Research Center. Submitted for publication in De Surinaamse Landbouw, May 1985. 5p. 1985.

Two species of chinch bugs were collected on diseased coconut trees at the Kirkshoop Experimental Station. The species found were identified as Lincus vandoesburgi and L. lamellinger. The bugs collected from "Hartrot" diseased trees were the only ones used in transmission trials; other bugs collected from healthy coconut trees were used for rearing purposes. Bugs were checked for the presence of flagellates in the salivary glands, using randomly selected specimens.

The transmission trials were carried out on two out of five, five-year-old coconut palms, adjacent to the entomological laboratory at Paramaribo, Suriname. The bugs were placed in the leaf-axils of healthy trees, starting in May 1984 until September of the same year, at two month intervals. On one palm (palm No.2) 75 nymphs and 49 adult bugs were placed; on a second palm (tree No.5) 33 nymphs and 66 adults were placed.

The Tree No.2 showed the first symptoms in December 1984 and after that two more trees (trees Nos.1 and 4) showed symptoms of the disease in spite of no infected infected bugs being placed in them. Posterior disection of the diseased palms, not previously infected with the contaminated bugs, showed the presence of insects indicating that some bugs moved from the adjacent infested trees. Tree No.5, which was one of the two infested with contaminated bugs, did not show any disease symptoms by the time of the last observation (May 1985).

Flagellates were found in the roots of diseased palms as well as in the inflorescences. The bugs found in diseased trees also had flagellates in their salivary glands.

Rearing attempts of *Lincus* sp. under laboratory conditions proved to be a difficult task. Only the organic litter found between the leaf sheaths allowed the survival of nymphs up to the third instar.

In spite of the above mentioned results the authors consider that more controlled trials are needed to demonstrate the vectorial capacity of the *Lincus* bugs.

13. ATEHORTUA, J. Preguntas y comentorios Tema III. Palmas (Colombia) 6 (3): 80-84. 1985.

As founder of Oleaginosas Risaralda and Manager of it for more than 15 years, the author considers it appropriate to explain how and why more that 2700 ha. of oil palm were lost in a 5-6 year period, due to a wilt that nowadays is widely knows as "Marchitez sorpresiva". He says that shortly after the problem started, the plantation was visited by all national and several foreign experts in oil cultivation. The Risaralda plantation people believed in these experts and did whatever they advised to do to control the disease.

In spite of the total loss of the economic resources of Oleaginosas Risaralda, the author says it is coming back as oil palm grower with the 200 oil palm ha. that have not been mentioned or asked for, by some of the technicians that knew about them and were attending the conference.

The problem he says, was initially blamed to an inappropriate location of the farm, to inappropriate soil conditions and management, to a lack of preliminary studies, and to other reasons. He gives an historical account of the actions taken and among them he specifically mentions the recommendation of insecticide applications given by Dr. M. Revelo to control the *Scaptocoris divergens* chinch or any other existing insects. He says that the insecticide applications stopped the disease for two years.

The Risaralda plantation organized the Plant Sanitation Department and Dr. E. Zuleta, as head of it, favoured Dr. A. Sanchez Potes' theory that the disease was caused by soil factors. For this reason he decided to stop the insecticide applications.

Mr. Atehortua says that the plantation people should not be blamed for the problem; he considers that they were human mistakes, errors of good faith, lack of experience and insufficient knowledge.

More comments are made in connection with the recommended insecticide treatments. The insecticide was endrin and the author says that those applications really stopped the disease, in spite of no assurance that the control of *S. divergens* or other insect species was the cause for the temporary stop of the disease.

There are other comments about later initial findings dealing with *Myndus crudus (Haplaxius pallidus)* and the flagellated protozoans found at Risaralda and other plantations.

14. AYALA, S.C., QUINTERO, O.B. and BARRETO, P. Trypanosomes of latiferons plants and their insect vectors in Colombia and Costa Rica. Rev. Biol. Top. (Costa Rica) 23 (1):5-15. 1975.

Report the finding of *Phytomonas elmassiani* in 333 out of 408 (81.4%) plants of *Anclepias curassavica* taken from 13 localities in Colombia. Similar samples in Costa Rica showed that, 14 out of 40 (35%) plants from 4 different sites, had flagellates. Similar flagellates were also found in *Asclepias fruticose* and *Sarcostema clausum* (an asclepiad vine) in Colombia.

The parasite could be transmitted to laboratory reared *A. curassavica* and *A. Fruticosa* by wild naturally infected *Oncopeltus cingulifer* and *O. unifasciatellus* as well as by laboratory infected nymphs of both species. In wild insects only *O. cingulifer* had flagellates in the salivary glands.

They say that only sucking insects feeding in the lacticiferous tubes are flagellate carriers.

15. BAIN, F.M. Bronze leaf wilt disease of the coconut palm. Government Printing Office, Port-of-Spain. 1937. 48pp.

A description of the disease symptoms and a review of the previous studies on bronze leaf wilt are given. In trying to identify the causes of the disease a rather detailed survey of the soil characteristics of the coconut plantation is reported. In looking for any existing correlation with the disease the author reports specialized analyses of soil texture, organic matter content, carbon nitrogen ratio, availability of mineral nutrients including potassium, phosphates and nitrates. The moisture content as well as the water table fluctuations in disease affected and non affected areas were also studied.

Unfavourable soil conditions and water supply deficiencies seemed to be associated with the disease incidence.

Some recommendations for the control of the disease are discussed and supported with field and experimental observations.

16. BARRETO, J.M. Marchitez del cocotero en la peninsula de Paria, Estado Sucre. Coco y Palma (Venezuela) 26:3-5. 1982.

There is a symptom description on local Tall and Panama Tall coconut varieties. Detailed symptoms are given for leaves, fruits, roots and stem. As special informations, besides the common symptom, the necrosis of the albumen, the acid and flat taste of the water and the foul smell of the growing point are given.

Besides the presence of flagellated protozoans, the occurrence of club shaped and gram positive bacteria is reported.

Oncopeltus sp. is mentioned as the specific insect vector, and *Asclepias curassavica* as flagellate host plant species; both, he says have similar flagellated protozoa the time elapsed from the first symptom to the death of the plant is estimated at about 5 to 6 weeks.

17. BARROW, R.M. and OLIVER, F. A wilt disease of coconut in Trinidad and its association with a flagellated protozoan. J. Agric. Soc., Trinidad-Tobago. 77: 206-208. 1977.

Samples of inflorescences, leaves and stem diseased coconut palms showed flagellate protozoa in the phloem sieve tubes. The authors consider that much of what has been recorded as Bronze Leaf Wilting (B.L.W.) in Trinidad is now believed to be associated with *Phytomonas* sp. pathogens which by plugging the phloem sieve tubes, caused the death of the tree. They say that a similar *Phytomonas* has been found in Hartrot affected coconut palms in Suriname.

As special information they report that as Cedros Peninsula and Moruga are the most affected areas in Trinidad, the disease is not found in Tobago.

18. BEZERRA, J.L. e FIGUEIRIDO, J.M. Comunicacao. Ocorrencia de *Phytomonas staheli* Mc Ghee and Mc Ghee en enoqueiro (*Cocos nucifera* L.) no Estado da Bahia, Brasil. Fitopatologia Brasileira (Brasil) 7:139-143. 1982.

The coconut plantations in Bahia are affected by a disease that resembles "Cedros Wilt", "Hartrot", or "Fatal Wilt" in Suriname and Guyana, which is reported to be associated with *P. staheli*. The symptoms are similar and the presence of flagellates in the sap of diseased trees was confirmed by examination under light microscope. They say that the giant green coconut is very susceptible and the red dwarf tolerant to the disease under Brazilian conditions. They say a similar disease of oil palm was reported in Peru, Colombia and Ecuador.

There is a symptoms' description and advise to check several plant tissues for presence of flagellates. There is a description of the pathogen along with the description of the technique used for microscopic examination.

19. BOR, N. Coroni Wilt: The "unknown disease" of the coconut palm in Suriname. Agricultural Experimental Station. Unpublished Internal Report No. 1. 1969.

In dealing with the economic aspect of the disease the author says that 2% of palm losses were recorded in some gears in Suriname.

After working in Jamaica and having enough experience in identifying "Lethal yellowing" affected coconut trees, he described the disease and concluded it was not "Lethal Yellowing". He suggested to call it "Coroni wilt".

20. BRITON-JONES, R.H. The diseases of the coconut palm (Revised by E.E. Cheesman). London, Bailliere, Tindal and Cox. 1940.

In connection with the "Hartrot-Cedros wilt" disease of coconuts the author called it "Bronze leaf wilt", many years before, referring to a disease that had destroyed large coconut plantations in Cuba, Jamaica and Trinidad. There is a description of the disease that he considered to be restricted to the Caribbean area.

21. BRITON-JONES, R.H. Wilt diseases of coconut palms in Trinidad (Part II). Tropical Agriculture (London), Supplement, 6 (12):p.12. 1929.

The author reports further evidence that "Bronze leaf wilt" is caused by a combination of physical factors including the soil moisture content which is influenced, of course, by the soil quality, the soil texture, the humus content and the agricultural practices, among the most important factors.

22. BRITON-JONES, R.H. Wilt diseases of coconut palms in Trinidad (Part 1). Tropical Agriculture, London. (Supplement), 5 (5): 1-12. 1928.

Two forms of wilt disease are described; one is called "Bronze leaf wilt" and the other "Yellow leaf or Tapering stem wilt".

The main cause for the "Bronze leaf wilt" is shown to be the drought which not necesarily requires to be for prolonged periods. It may be evident after a short dry period but under particularly poor soil conditions. Typical symptoms of this disease have been artificially reproduced, the author reports.

Control measures for the disease are discussed under the headings "Preventive Measures" and "Palliative Measures". Improvement of the drainage is an important control measure for this type of coconut wilt.

23. BUSTAMANTE, E. Informe sobre la marchitez sorpresiva de la palma africana (*Elaeis guineensis* Jacq.) en las plantaciones de Risaralda y San Alberto. Bogota, Instituto Columbiano Agropecuario, ICA, Programa de Fitopatologia. 1972. 7p. Unpublished report.

In dealing with the "Marchitez sorpresiva" (Sudden wither) of the oil palm in Colombia, the author reviews the up-dated knowledge on this disease. He provides a description of the pathological disturbance and, in connection with the several formulated hypotheses, the author provides important information on the phytopathological area. In spite of the presence of several fungi and bacteria in tissue samples from "Marchitez sorpresiva"affected palms, the conclusion is that those found pathogens are not the direct cause of the disease. A good deal of supporting field data and observations are provided.

24. CAMARGO, E.P. *et al.* Electrophoretic analysis of endonuclease generated fragments of K-DNA of esterases isoencymes and of surface proteins as aids for species identification of insect trypanosomatids. J. Protozoalogy. 29:251-258. 1982.

Deals with the technique designed to identify and characterize plant flagellate isolates. This technique uses the biochemical aspects.

25. CAMBRONY, D., BONNOT, F. et DOLET, M. Etude morphologique et comparaison des protozoaires flagelles (*Phytomonas*) asocies a la marchitez du palmier a huile et de ceuxs hebergs par les plantes a latex (Euphorbiacees, Asclepiadiacees). *In:* Colloque international sur la protection des cultures tropicales. Lyons, France, 1981. Resumes, p.65.

This document reports the results of the attempts to differentiate flagellated protozoans from the Phytomonas genus by morphological comparisons. More than 2,000 organisms obtained from: (a) "Marchitez sorpresiva" affected oil palm; (b) "Hartrot" affected coconut palms; (c) lactiferons plants from Ecuador, including *Asclepias curassavica, Euphorbia lasiocarpa, E. hirta, E. prostata, E. berteriana, E. hyssopifolia,* and (d) lactiferous species from the Mediterranean basin, including *E. pina* and *E. characias,* were carefully analyzed using different morphological characteristics.

As general results the authors report that *Phytomonas* from coconut and oil palm are slightly different in some morphological aspects and in the better fixation in methanol and Giemsa, when compared with *Phytomonas* from lactiferous plants. Apart from this not even the use of a computer enable them to differentiate flagellates from different sources and to trace down the flagellate identity.

26. CHENG, D. and SIMPSON, L. Isolation and characterization of kinetoplast DNA and RNA of *Phytomonas davidi*. Plasmid 1 (3): 297-315. 1978.

This paper presents the results obtained in a biochemical research work which may be considered as a new approach to characterize protozoan species. For this particular research Kinetoplast DNA and RNA networks were isolated from stationary-phase culture forms of *Phytomonas davidi*. Detailed data with reference to appropriate comparing parameters are provided along with a complete description of the technique applied.

27. COLLOQUE INTERNATIONAL SUR LA PROTECTION DES CULTURES TROPICALES. Lyon, France, 1981. 15p.

This publication contains the general summary of the International Conference on Tropical Crop Protection, held at Lyon (France) in July 1981. In dealing with the progress achieved in pathological research a short note is included on the flagellated protozoa of the *Phytomonas* genus and the association they have shown with the "Hartrot" disease of coconuts in Suriname, the "Marchitex sopresiva" disease of the oil palm in Colombia, and the "Cedros wilt" of coconuts in Central America. References are made to some morphological characteristics of the pathogen and their presence in the sieve tubes of the phloem of the palms as well as in the latex of several Euphorbs, including *Euphorbia pinea* in the Mediterranean basin. Special reference is also made to the artificial culture of *Phytomonas sp.* from *E. pinea*.

28. CORRADO, F. La maladie du palmier a huile dans les Llanos de Colombie. Oleagineux 25 (7): 383-384. 1970.

There is a report on the presence of "marchitez sorpresiva" in oil palm in Colombia and Brasil.

The author states that sometimes the disease symptoms may be confused because the "Marchitez sorpresiva" may attack palms already affected by "Bud rot".

After some technical considerations he concluded that soil conditions is not a causative factor for the "Marchitez sorpresiva" disease.

29. COSTADUROS, R. The coconut palm and coconut products. The Courier No. 86: 62-65. 1984.

There are some historical accounts related with the coconut crop. There is a price analysis for the coconut products and other vegetable oils.

There are some outlooks for the new varieties and prospects for new plantations and possible destination of the coconut production.There are also statistical information by countries.

30. CHEVAUGEON, J. Summing up of the studies of international congress on the protection of tropical crops. Oleagineux 37(1): 34-38. 1982.

Protozoa intervene in oil palm pathology. They have been observed in the sieve tubes of "Hartrot" affected coconut palms in Suriname. Flagellate protozoans of the *Phytomonas* genus are implicated also in the "Marchitez sorpresiva" disease of oil palm and in the "Cedros wilt" disease of coconuts in Central America. Due to the small size the pathogens are able to get through the sieve tube pores. Phytomonas have also been found in some weed species growing within or near oil palm plantations in Latin America as well as in Mediterranean Euphorbiaceae. *Euphorbia pinea* Phytomonas have been cultured.

In dealing with control practices he says that weed control becomes crucial when weeds are reservoirs of pathogens causing "Hartrot" in coconuts. Integrated control using insecticide treatments, destruction of reservoirs plants with herbicides and resistant hybrids is recommended against Hartrot of coconuts in Suriname.

31. DESMIER DE CHENON, R. Research on the genus *Lincus* stal, Hemiptera Pentatomidae Discocephalinae and its possible role in the transmission of the marchitez of oil palm and Hartrot of coconut. Oleagineux 39 (1): 1-6. 1984.

Lincus spp. are closely associated with "Marchitez sorpresiva" of oil palm in Ecuador and "Hartrot" of coconut in French Guiana, both diseases suspected to be caused by a protozoan flagellate of the *Phytomonas* genus. Infected insects were placed on healthy oil palms and the Marchitez sorpresiva symptoms appeared after 2,5 to 3,5 months. The age of the oil palm plants was 5 and 4 years. *L. croupius* and *L. styliger* found on coconut plants in French Guyana are suspected to be insect vectors for the Hartrot causing pathogen.

32. DESMIER DE CHENON, R. *et al.* Research on genus *Lincus*, Pentatomidae, Discocephalinae and its possible role in the transmission of the "Marchitez" of oil palm and "Hartrot" of coconut. *In:* Reunion del Comite Tecnico Regional de Sanidad Vegetal (Area Central IICA), 4a, Cancun, Mexico, 1983. Memorias. Cayoacan, Mexico D.F. Canceco G., S. y Garcia E., A. eds. 1983. p.p.51-55.

The presence of similar flagellate in "Hartrot " affected coconut palms and "Marchitez sorpresiva" affected oil palms, in addition to the similarity of syndroms, have led to consider both diseases as the same.

Different insect species have been suspected for the transmission of the suspected pathogen. *Oncopeltus* of the Lygaeidae and *Macropygium reticulare* (F.) of the Pentatomidae are species observed in Ecuador, Colombia, Brasil, French Guiana, Suriname and Trinidad. In these two last countries the *M. reticulare* is associated with the pentatonid *Berecynthus delirator* (F.). Now the *Lincus* spp. are also suspected to be associated with the disease in Ecuador and French Guiana.

Some trials were performed at the Shushufindi plantation in Ecuador and the results showed that the insects were able to transmit the pathogen to healthy palms which, after 95 to 101 days, showed the characteristic symptoms of the "Marchitez sorpresiva" disease in oil palms.

33. DINTHER, J.B.M. VAN. Insect pests of cultivated plants in Suriname. Agricultural Experimental Station, Bulletin No. 76.; 26-29. 1960.

This is a well illustrated and detailed list of insect pests of economically important crops of Suriname. In dealing with representative members of the Pentatomidae family specific mention is made to *Lincus spathuliger*, *Lincus* sp., *Macropygium reticulare*, *Ochlerus cinctus*, and *O. sordidus* which were collected on the stem bases of coffee plants as early as 1932. This species (*Lincus* sp.) was suspected to be the transmitter of a flagellated protozoan of the *Phytomonas* genus which is the cuasative agent of a coffee phloem necrosis, the author says. Other additional bug species are also included.

34. DINTHER, J.B.M. VAN. Insects of coconut palms in Suriname. Ministry of Agriculture. Agricultural Experimental Station. Bulletin 69. 1956.

This publication provides the test and description of the prevailing insect pest species of the coconut palm, found in Suriname. The 20 species tested were found in a sanitation survey made in 1953 to 1955. No chinch bugs of the Pentatomidae family are included in the list of reported insect pest species.

35. DOLLET, M. Plant diseases caused by Flagellate protozoa (*Phytomonas*) Ann. Rev. Phytopathology 22: 115-132. 1984.

There are historical accounts on the "Hartrot" disease as well as on "Marchitez sorpresiva". These two diseases of economic importance in coconuts and oil palms are now accepted to be caused by phloem inhabiting flagellate protozoa of the *Phytomonas* genus, although nobody has been able to fulfill the Koch's postulate.

In connection with flagellate protozoa in plants there are well documented comments on morphology and structure, infection in plants, reports on Mechanical transmission, insect vectors, epidemiology of the diseases, pathogenecity of *Phytomonas* spp. and other topics. In dealing with intraphloemic Phytomonas there are special comments on "Phloem necrosis of coffee", "Hartrot of coconut", "Marchitez" of oil palm and special discussions on *in vitro* culture of *Phytomonas*. There are two paragraphs of conclusive comments on the subject matter which, in general, call for more detailed and specialized research to better understand the plant diseases caused by flagellate protozoa of the *Phytomonas* genus.

36. DOLLET, M. Diseases caused by flagellate protozoa (*Phytomonas* sp. Trypanosomatidae) in oil palm and coconut in South America. *In*: Reunion del Comite Tecnico Regional de Sanidad Vegetal (Area Central IICA) 4a. Cancun, Mexico, 1983. Memorias. Coyoacan, Mexico D.F. Canceco G., S. y Garcia E., A. eds. 1983. p.p.47-55.

Diseases caused by plant flagellate of the *Phytomonas* genus occur throughout the Nothern South American regions. He refers to "Marchitez sorpresiva" of oil palm and Hartrot of coconuts. There are some symptoms' description of both diseases.

He considers that Hartrot killed 15,000 coconut palms in 3 years in Trinidad and says also that in Suriname it was a limiting factor for coconut growing for the last 100 years. In Colombia, he says, Marchitez destroyed small private oil palm plantations in less than 12 years. He says that IRHO perfected a preventive control with insecticides in

1975 and that the hybrid oil palm O x G is fairly tolerant. The chemical treatment has not been quite effective in Suriname and French Guiana. Genetic control of Hartrot seems to be difficult with the available coconut varieties.

Flagellate protozoa of the *Phytomonas* genus are found in the phloem of coconut and oil palm and in the latex of some lactiferous plants. He advises a research program to better understand the etiology of the diseases and the related aspects of host plants, insect vectors, and in vitro culture techniques for the flagellates.

37. DOLLET, M. Diseases of the lethal yellow type in Africa. *In:* Reunion del Comite Tecnico Regional de Sanidad Vegetal (Area Central IICA), 4a, Cancun, Mexico, 1983. Memorias. Coyoacan, Mexico D.F. Canceco G., S. y Garcia E., A. Eds. 1983. p.p.1-4.

Many countries in Africa are faced with problems of wilts of the coconut Lethal Yellowing type. He briefly describes Keincope disease and Kribi disease, including some comments dealing with symptoms. He says too that nobody could say that Lethal Yellowing disease of coconuts really exists in Nigeria but he states that there are evidences that this disease has not been detected in Benin but it does exist in Togo.

He includes some important comments in connection with Genetic Origin and Yellowing. For such purposes he mentions that in France they are using electrophoretic techniques to study the enzyme systems of the available coconut materials. So far, he reports, 8 different ecotypes have been defined.

There are some reports from East Africa on a specific lethal coconut disease first observed in 1969. He says that in three well defined areas of Africa coconut wilt linked to intraphloemic mycoplasma like organisms exists. Keincope disease is one example. He advocates for more research programs because the present knowledge is unable to explain the observed differences between the American and the African Lethal Yellowing diseases.

38. DOLLET, M. et al. Observations of flagellate protozoa *Phytomonas* sp. in the xylem of *Euphorbia lasiocarpa* in Ecuador. Canadian Journal of Botany 61 (1):237-240.

Lacticiferous tubes of *Asclepias curassavica* L. and *Euphorbia lasicocarpa* K1. contain flagellated protozoa of the *Phytomonas* genus. In *E. lasicocarpa* they occur also in the xylem and in the intercellular spaces. This finding is discussed in connection with insect vectors' feeding habits.

The research work was performed with plant samples taken at Quininde (Ecuador) and analyzed at the Montpelier laboratory in France.

There is a symptom description of the pathogenic effect on *Euphorbia* plants infested by *Phytomonas* sp.

39. DOLLET, M. Intraphloemic flagellate protozoa (*Phytomonas* sp. Trypanosomatidae) diseases of the oil palm and coconut in Latin America. Oleagineux 37 (1): 11-12. 1982.

There are some comments on general aspects of the oil palm cultivation in Latin America with special references to the "Marchitez sorpresiva disease" in Colombia. He mentions that as soon as the disease appeared on the San Alberto (Indupalma) in Colombia, research programs were started to find a solution; reports that from the

entomological studies finally were able to advise a preventing treatment by using insecticides.

There is also a comment on the coconut disease called "Cedros Wilt" in Trinidad and "Hartrot" in Suriname which, as in the case of the "Marchitez sorpresiva" protozoan flagellates of the *Phytomonas* genus were found in the phloem of diseased palms. There is a summary of the research work done by many well-known researchers in connection with flagellates and identification techniques.

There is a historical account about the flagellate host plant species and the nowdays attention given to the flagellate host plant, insect vectors relationships.

As general conclusions include mention to the preventive treatment against "Marchitez sorpresiva" in oil palm, the possibility of genetic resistance for this disease with the O x G hybrid, the need for a practical method to culture flagellates under laboratory conditions and the need for a practical, identification technique for flagellate species.

40. DOLLET, M. CAMBRONY, D. and GARGANI, D. In vitro axenic cultivation of *Phytomonas* sp. (Trypanosomatidae) of Euphorbia, transmitted through *Stenocephalus agilis* Scop. (Coreidae). Comptes Rendus des Seances de l'Academie des Sciences, Ser. III 295 (9): 547-550. 1982.

In vitro axenic cultivation of *Phytomonas* sp. obtained from *Stenocephalus agilis* Scop (Coridae) was successfully cultivated in liquid medium. The flagellated protozoan is currently found in the lactiferous tubes of *Euphorbia pinea* L. and transmitted by the S. *agilis* bug.

For the laboratory cultivation of *Phytomonas* sp. the authors report the use of a liquid medium, similar to Grace's culture medium for insect rearing with only a slight modification. The authors tested 30 different media. The slightly modified Grace's culture medium was the only one to successfully support the *Phytomonas sp.* growth. The main requirements for growth are briefly discussed. Among other informations the authors report that *Phytomonas* sp., obtained from *E. pinea* growing in the South of France, was very resistant to antibiotics. The same medium supported a culture of flagellates obtained from *E. characias*.

41. DOLLET, M. Les maladies des palmiers et cocotiers, a protozoaires flagelles intraphloemiques (*Phytomonas* sp. Typanosomatidae) en Amerique Latine. *In:* Colloque international sur la protection des cultures tropicales. Lyon, France, 1981. Resumes. p.63.

The author refers to three main diseases in South America. The "Hartrot" disease of coconut that destroyed more than 85,000 palms from 1918 to 1935, in Suriname; the "Marchitez sorpresiva" of the oil palm, that caused serious damages to many small oil palm plantations, shortly after its introduction in Colombia, and the "Cedros Wilt" disease that ruined not less than 15,000 palms in Trinidad, from 1975 to 1978. He refers also that the coffee plant is another crop seriously affected by a disease closely related with a protozoan species.

Research programs to elucidate the causal entity of the "Hartrot" and "Marchitez sorpresiva" disclosed, by electronic microscopy examination, the close association of the disease symptoms with the presence of some species of flagellated protozoa of the Trypanosomatidae family. These organisms resulted to be a new type of pathogens for the plant pathologists.

The best approach to solve these problems is an integrated control program, the author says. The suggested program includes: (1) Artificial cultivation of flagellates; (2) Research on suspected insect vector species of the Pentatomidae family; (3) Research on flagellate host plant species; (4) Development of coconut and oil palm resistant hybrids, and (5) the use of chemicals. Commenting that some lactiferous plants are known to harbour flagellates in its latex, and that several of such plants grow within the coconut fields, the author then presents a short summary of the progress achieved so far with the actions taken to control these diseases. Special references are made to the positive results obtained in preventing the spread of the "Marchitez sorpresiva" and "Hartrot" diseases with the soil applications of endrin, to the progress made in the field of flagellate cultivation, to the identification of suspected insect vectors, and to the finding of genetic resistant to the "Marchitez sorpresiva" disease in some oil palms hybrids obtained by crossing *Elaeis oleifera* x*E. guineensis*.

42. DOLLET, M. Current IRHO Research on intraphloemic flagellated protozoa associated with "Marchitez sorpresiva" in South America. *In:* Meeting of the International Council on Lethal Yellowing, 4th. Fort Lauderdale, Florida, U.S.A., 1980. Proceedings. Agricultural Research Centre Institute of Food and Agricultural Sciences. University of Florida. Publication F1-180-1, pp.17, 1980.

On the coastal area of Ecuador several coconut palms suffering from a wilt disease revealed the presence of flagellated protozoa of the Phytomonas genus, in the phloem of about 80% of the diseased coconut trees. A study of weed growing near to oil palm and coconut trees showed that five *Euphorbia* species and the milk-weed *Asclepias curassavica* had flagellates in the latex. This study showed also that *E. prostrata* and *E. foliolosa* were the only species showing disease symptoms. No pathogenic effects were present in *A. curassavica*. In a mixed plantation of coconut and cocoa, a cocoa tree was found affected by a wilt similar to that of phloem necrosis of coffee. Chemoterapeutic trials showed that injections of Pentamidine dichlohydrate, isometamidium chloride, stilbamidina isothionate or endrin did not stop the development of the disease and none of the palms showed any improvement.

43. DOLLET, M. *et al.* Current IRHO research on coconut and oil palm wilt in South America associated with flagellate protozoa (*Phytomonas*) in the phloem. Oleagineux 34 (10): 449-452. 1979.

On the coast of Ecuador many coconut trees suffering from wilts did not reveal any red ring evidence. Flagellate protozoa of the *Phytomonas* genus, similar to the ones found in oil palm affected by "Marchitez sorpresiva", were found in the sap of roots, meristematic tissue and inflorescences.

A study of weeds near oil palm and coconut plantations showed that 5 *Euphorbia* spp. and *Asclepias curassavica* revealed they were harbouring flagellates. *E. prostrata* and *E. foliolosa* were the only species showing disease symptoms. No pathogenic effects were seen in *A. curassavica*.

When diseased coconut palms and oil palms were injected with Pentamidine dichlorhydrate, isometamidium chloride, stilbamidine isothionate or endrin, none of the plants showed any improvement. Pentamidine dichlorydrate was active "in vitro" against flagellates of oil palm but unsuccessful under field conditions.

44. DOLLET, M. Flagellated protozoa associated with "Marchitez sorpresiva" of oil palm in South America. *In* Meeting of the International Council on Lethal Yellowing, 3rd., Palm Beach County, Fla., U.S.A., 1977. Proceedings. Fort Lauderdale, Fla., U.S.A. Agricultural Research Centre Institute of Food and Agricultural Sciences, University of Florida. Publication F1-78-2: 34. 1978.

"Marchitez sorpresiva" is a "Sudden Wilting" of oil palms more than two years old; it was first noticed in Colombia in 1963 and later in Peru (1970) and Ecuador (1973). There is a description of the characteristic symptoms of the disease.

The authors mention that the electron microscopic study of samples taken from inflorescences of palms with early symptoms of the disease, from Peru and Colombia, revealed the presence of high numbers of flagellated protozoa identifiable as Trypanosomatids of the *Phytomonas* genus. The author says these organisms are phloem inhabiting that move from one sieve tube to another via the pores. These organisms are also visible with light microscopes. Flagellates are present in several part plants and may be slender forms with flagellum and round forms with no flagella.

Comments that the presence of this pathogen in great numbers and the exclusion of all other gems in palms affected with early symptoms, besides their specific association, makes him think that such pathogen is the origin of the disease. The author compares "Marchitez sorpresiva" with two other intraphloemic diseases: "Hartrot" disease of coconuts and"phloem rot" of coffee, where flagellated protozoa stem seem also to be associated.

45. DOLLET, M. Kaincope disease and Kibri disease, two West African coconut yellows associated with the presence of mycoplasma like organisms. *In* International Council on Lethal Yellowing, 3rd. Palm Beach County, U.S.A., 1978. Proceedings. Fort Lauderdale, U.S.A. Agricultural Research Centre Institute of Food and Agricultural Sciences, University of Florida. Publication F1-78-2. p.12.

There are two yellowing diseases of coconut in well geographically demarked areas. Kaincope in Togo and Ghana and Kribi disease in the South of the Cameroons, 1500 km apart one from the other and with different ecological conditions. In 1975 mycoplasma-like organisms were found in coconuts affected by Kaincope disease.

He says that the external symptoms are the same in both cases: 1. Premature nut fall, 2. Yellowing and drying of leaves, 3. Slowing up the growth, and 4. rapid death of the tree. With the first sign of the disease, serious pathological anomalies are noted in the young still unopened inflorescences such as yellowing and browning of the male flowers followed by necrosis; sometimes there is a blackening of the young ovules in the inflorescences and the endocarp of young nuts may turn of grey colour.

Electronic microscopie studies in inflorescences of Kribi diseases trees (from the Kribi region) revealed mycoplasma-like organisms.

They were found in *Typical tall* and *Cameroon red Dwarf* coconuts. According to the author the isolated islets of non affected coconut trees remain as a mystery, like the resistance to Kaincope disease in the Benin coconut groves.

46. DOLLET, M. and LOPEZ, G. Study of the association between flagellate protozoa and "Marchitez sorpresiva" in South American oil palms. Oleagineux 33 (5): 209-217. 1978.

Electron and light microscopic studies of oil palm samples from Peru, Colombia and Suriname showed a specific association of the disease symptoms with the presence of flagellate protoxoa in the sieve tubes of inflorescences of oil palms affected by "Marchitez sorpresiva".

The morphology and ultrastructure of the parasite allow to place them in the family Trypanosomatidae and genus Phytomonas. The elongated form of the pathogen (making about 85% of the ones observed) was found in roots, meristematic tissue, spear base and inflorescences. The round form, with or without flagella, was found mainly in the roots and a squat flagellated form (intermediate between the two forms) were also found. The disease, they say, may be diagnosed by microscopic examination of smears stained with Giemsa or Toluidine blue.

47. DOLLET, M. GIANNOTTI, J. and OLLAGNIER, M. Observation de protozoaires flagelles dans les tubes cribles de palmiers a huile malades. Comptes Rendus de l'Academic des Sciences, D284: 643-645. 1977.

This is one of the first reports dealing with the finding of flagellated protozoa in the phloem of oil palms affected by the "Marchitez sorpresiva" syndrome (Sudden wither). The finding was reported in tissue samples of oil palm from Peru. Because of the morphological characteristics the organism is classified under the Trypanosomatidae family and *Phytomonas* genus. Structural details are given.

48. DOLLING, W.R. Pentatomid bugs (Hemiptera) that transmit a flagellate disease of cultivated palms in South America. Bulletin of Entomological Research 74 (3): 473-476. 1984.

Descriptions are given of two new species of pentatomid bugs one of which, according to some authors, is suspected to transmit the causing pathogen of the "Marchitez sorpresiva" disease of oil palm in Ecuador. The other bug species is also suspected to be associated with the "Hartrot" disease of coconut (also suspected to be *Phytomonas staheli* Mc Ghee and Mc Ghee), in French Guiana. Notes are given on a 3rd species also associated with Hartrot disease of coconuts in French Guiana. The species of pentatomid bugs are *Lincus lethifer, L. apollo* and *L. croupius* Rolston, respectively.

49. DONOVAN, C. Kala-azar in Madras, specially with regard to its connection with the dog and the bug (Conarrhinus). Lancet 177: 1495-1496. 1909.

Because of the different morphological characteristics, when compared with members of other genera, and because of the special hosts, Donovan suggested the genus Phytomonas to group under it the flagellate protozoa found in several host plant species. This suggestion was made in 1909 and nowadays is unanimously accepted.

50. DOORIS, P.M. and MC GHEE, R.B. Immunologic and electrophoretic characteristics of two species of Crithidia. The Journal of Protozoology, 23 (3): 433-437. 1976.

Several criteria have been used to differentiate species of the Trypanosomatidae family but none of them is free of considerable efficiencies and higher or lower limitations, as it has been the case of the morphological characteristics. In this paper ;the authors report the results they obtained when the flagellates *Crithidia harmosa* and *Crithidia fasciculata* were compared immunologically by the indirect fluourescent antibody (F.A.) method and by agglutination.

The description of the used methods and materials contains first a proper information about the sources of *C. harmosa* and *C. fasciculata* and how those flagellates were maintained in the Cowperthwaite's medium before being used for experiments, and then an appropriate description of the Immunization Regimen in which they used Leghorn male chickens. The agglutination procedure, the Fluorescent antibody technique and the Polyacrylamide gel Electrophoresis method, are properly explained in their key points, parameters and special procedures.

As general results the authors report that the Fluorescent Antibody technique gave more specific results with cellular-debris than with the use of whole cell antigens. They say also that the immune sera obtained from chickens (innoculated 9 days before with whole cell antigens) had higher homologous titers than those obtained after four days. Both methods revealed major antigenic differences between the two species. The electrophoretic patterns of both flagellate species obtained by polycrylamide gel slab electrophoresis were different in the numbers and in the relative mobilities of their component bands. *C. harmosa* was then different from *C. fasciculata* according to the mobility and number of demonstrable protein components.

51. DROST, A.W. Jaarverslag over 1920. Dep. Landbouw Suriname. p.64. 1921.

This annual report contains a short information about the "Fatal Wilt" of coconuts in Suriname. The author reports that some oil palms (Elaeis guinensis), produced from oil palm seed imported from Africa, were heavily affected by "Hartrot" ("Fatal Wilt"). he reports also that the development of the disease was so fast that there was not time for any control measure.

52. DROST, A.W. Cocos palmen, bestrijding der hartrotziekte. Jaarverslag over 1913. Dep. v.d. Landbouw Suriname. 25-27. 1914.

In dealing with the "Hartrot" disease of coconuts the author mentions that the disease shows more severity in coconut fields where the weed control practice is neglected by the farmers. Among the control measures he recommends the removal of all diseased trees and the burning of them as soon as possible after the disease symptoms are first detected. There is also the recommendation to treat the still non affected palms with Bordeaux mixture, as a preventive measure.

53. DROST, A.W. Hartrot ziekte in cocos. Jaarverslag over 1907. Inspectie Landbouw. West Indie (Suriname): 19-20. 1908.

This is the first reference to a coconut disease in Suriname called "Hartrot". The author is credited for having coined the name. In this year report there is also a reference to certain "Hartrot" control experiments by using an agrochemical substance called PYOCTANINE. The initial results are reported as successful. The control experiments are to be continued.

54. DUMAS, R.E. and SCHUT, B. Preliminary results of ring-weeding in young dwarf coconuts. De Surinaamse Landbouw 24 (1): 30-41.

Malayan dwarf coconut seedlings were planted in acid (p H 3.1) sulphate clay soil in 1972 with good drainage, water level 50-80 cm and kudzu as cover crop.

No weeding (except for some climbing plants) was compared with hand and chemical weeding in a radius of 1 mt., the first year, and 2 mts. the following years. The kudzu cover was initially infested with paragrass *Brachiaria purpurascens*, *Ipomoea fastigiata*, *Mikamia* sp., *Cordia macrostachya* and *Lantana camara;* later on was partially replaced by the paragrass.

In November 1975 Hartrot disease started in a close by field and in early 1976 the first diseased palm was found in the non weeded plot of the weed control experiment. In May 1976 coconut mortality due to Hartrot was 24, 59% in the weeded plot, 2, 94% in the chemical weeded and 0% in the hand weeded plot. In November 1976 the mortality ws 86%, 76% and 68%, respectively. In January 1977 the mortality was 92%, 90% and 91%, respectively. The weed control experiment has been finished in July 1976.

55. DUMEZ, D. Problemas fitosanitarios en la region del Meta y en la plantacion de Risaralda. Paris, Institut de Recherches pour les Huiles et Oléagineux (IRHO), 1968. Mimeograph. 11p.

This paper is an internal report of a visit to the Risaralda and other oil palm plantations in Colombia. The visit was part of the general technical efforts to find out the causal entity of the "Marchitez sorpresiva" disease (Sudden wither) of the oil palm. There is a general description of the disease symptoms and, in connection with the suggested hypothesis, the author does not believe that the chinch bug *Scaptocoris divergens* is the direct cause of the problem; the soil drainage is also ruled out and the fungi *Rhizoctonia* sp. and *Phytophtora* sp. are not considered as the causal pathogens.

56. DUTCHIE, D.W. Coconut wilt in Essequibo and Pomeroon Districts. Agricultural Journal of British Guiana 9 (3): 147-152. 1938.

This publication describes a disease in oil palm trees of five to twenty five years of age. The characteristic symptoms of the disease are co-identical to the Cedros wilt (Hartrot) described in other countries. The author provides description of the disease affecting coconut palms in the Essequibo and Pomeroon Districts in British Guiana. The disease is suspected to be caused by unfavourable environmental conditions.

57. DZIDO, J.L; GENTY, P.H. and OLLAGNIER, M. The most important oil palm diseases in Ecuador. Oleagineux 33 (2): 55-63. 1978.

Three important diseases of oil palm are described and discussed. "Marchitez sorpresiva" (Sudden wilt) which they say is associated with the root miner *Sagalassa valida*. Among other aspects they say that the role of the flagellated protozoa found in the sieve tubes of affected palms still requires clarification, they report that the use of Endrin has arrested the disease. Hartrot which they say may be caused by several lepidopterous larva, could not be controlled with the use of benomyl treatments. The only control method, they say, is the removal of the diseased trees. The third disease mentioned is the so called "Ring spot" which is, according to these authors, a disease of young palms. The causing pathogen is unknown but the disease, they report, is more severe with a *Panicum maximum* ground cover than with *Pueraria javanica* because of the different sucking insect populations associated with the two cover plants. As control measures they recommend: Use of Peuraria as cover, control of grasses, chemical weeding of palm circles and removal of diseased trees.

58. FEDERACION NACIONAL DE CULTIVADORES DE PALMA AFRICANA, BOGOTA. Informe de investigacion, 1985. Bogota, 1985. 19p.

In connection with "Marchitez sorpresiva" there is an historical account from the beginning of 1963, when the disease was first reported in Colombia. After 22 years the disease is now better understood; several researchers now think it is closely associated with flagellate protozoa, the ultimate cause for the death of the plant.

The Federacion Nacional de Cultivadores de Palma Africana FEDEPALMA is doing research to control the disease and the first step was to prepare a partially annotated bibliography of some of the main published papers dealing with Colombian and foreign research activities. There are short comments in connection with symptoms of the disease, extent of damage, geographical distribution, and flagellate protozoa. Specific mentions are made to the *Phytomonas*-weeds relationship in members of the Euphorbiaceae, Asclepiaceae and Urticaceae families. References to insect vector species are made, including the initially suspected species in Colombia and the last experiences of transmission trials using Lincus sp. in Ecuador. 22 references are listed.

59. FISH, W.R., HOLZ, G.G. Jr. and BEACH, D.H. Cultivation of trypanosomatids. Journal of Parasitology 64(3): 546-547. 1978.

The authors report that a new nutritional medium, identified as RE III, was tested to artificially cultivate 26 different trypanosomatids, including representatives of the *Phytomonas* genus. Successful results are reported with RE III which is, according the authors, a good all-round chemically-defined medium. It made possible to support trypanosomatid populations suitable for biochemical studies and to be used as a starting point in nutritional research.

60. FISHER, J.B. and TSAI, J.H. Feeding sites of leafhoppers and planthoppers on plant tissues. *In* Meeting of the International Council on Lethal Yellowing, 3rd., Palm Beach County, Florida, U.S.A., 1977. Proceedings. Fort Lauderdale, Florida, U.S.A. Agricultrual Research Center Institute of Food and Agricultural Sciences, University of Florida. Publication FL-78-2, 23p.

The mouth parts of *Haplaxius Crudus* (*Myndus crudus*) (Van Duzee) and other five plant hoppers or leafhopper species are modified for piercing plant tissues and sucking sap from plant tissues. At the same time they are involved in acquisition and inoculation of plant pathogens. The insects were caged in a small area of coconut leaves and roots and later plant tissues were fixed and serially sectioned. The salivary sheaths left behind by the insects were stained and used as criteria to identify the sites of stylet penetrations. The stylet penetrations were intercellular and intracellular. Occasionally, phloem feeders fed on xylem and xylem feeders on phloem. Styulex penetrations appeared to be at random. *M. crudus* nymphs feed on roots, adults on leaves in tests performed with coconut plants.

61. FRANCA, C. La flagellose des Euphorbes. Archiv. Protistenk. (France). 34: 108-132, 1914.

Franca is one of the few authors to have made histological examinations of Euphorbs infected by flagellates of the *Phytomonas* genus. According to this author the infection normally does not spread because the nodes may be clogged by accumulation of flagellates and by the coagulation of the latex.

There is a report saying that when the insect vector feeds on the main stem, flagellates may be found in the latex tubes as well as in the nearest vascular bundles in the phloem and xylem. Franca claims to have achieved a localized infection twice in about 100 tests, once with a capillary tube and another time by piercing a branch with a needle threaded with cotton soaked in infected latex. This paper contains a description of symptoms caused by flagellates on *Euphorbia segetalis* and introduces the notion of "natural remission" when the infection remains localized. The histological observations of plants under natural remision showed that the starch grains disappeared from the latex and from the parenchyma cells. The chloroplasts diminished and later disappeared. Franca used the term of "nutritional disease".

62. FRANCHINI, G. Sur un flagelle nouveau du latex de deux Apocynées. Bulletin de la Societe de Pathologie Exotique 15: 109-113. 1922.

This paper reports the finding of flagellated protozoa of the *Herpetomonas* (*Phytomonas*) in the latex of *funtumia elastica* (Apocynaceae) growing in a glasshouse at the Agricultural College of Florence, Italy. The author reports that the amastigote form was predominant. The same finding is also reported in the latex of a specimen of a second apocynace called *Thevetia nereifolia* which was growing close by to F. elastica which was suspected to be the source of infection for the *T. nereifolia*.

The author reports the finding of flagellates in the latex of the main stem, young branches and some leaves of *F. elastica*, but no organisms were found in the roots.

There is a rather detailed morphological description of the parasite and the indication that ether-alcohol and Giemsa or Hematoxylin were used for fixation purposes.

63. FREMOND, Y., ZILLER, R. and DE NUCE DE LA MOTHE, M. El cocotero: Trad. de Angel M. Hernandez Cardona. Barcelona, Editorial Blume, 1969. pp.147-174.

There are many diseases with still unknown causes. The fact that most symptoms are very similar, a good number of diseases are very difficult to differentiate and still many pathological disorders are identified with the name of the location where they were first found or by one of the most striking symptoms. The authors say that it will not be possible to attempt a true classification until better knowledge of the basic causes be available.

There is a table in which the symptoms of the "Lethal Yellowing" disease as they have been observed in Jamaica, Haiti and Key West are compared among them and with those of the "Bronze leaf wilt" disease and the "Kaincope" disease. There are 18 different parameters to compare. Other diseases briefly commented on are root disease from Travacore, the cadang-Cadang disease, the pencil point disease, the lightening, the red ring disease and the Bud rot disease of coconuts. There is no mention to the "Hartrot-Cedros Wilt" disease nor to the insect vectors.

64. GASON, J.P. El cultivo de la palma y la investigacion. Palmas (Colombia) 2 (2): 5-22, 1981.

Under the Plant Sanitation heading some general comments are made in connection with the cultivation of oil palm in Colombia. There are three main threatening diseases among which "Marchitez sorpresiva" is included.

"Marchitez sorpresiva", he says, destroyed about two-thirds of palms in a 2,500 ha plantation within a 12 year period; other plantations were also seriously affected. The disease is described providing details of the characteristic symptoms.

The joint research of several Colombian and foreign entities, among which the Institute de Rechercher pour les Huiles et Oleagineux (RHO) is included, made it possible to progressively disregard many of the existing hypotheses about the responsible causes such as the soil water level toxicity, nematodes, fungi, pathogens transmitted by piercing sucking insects, etc. P.H. Genty and G. Lopez found that the "Marchitez sorpresiva" was closely associated with the root miner *Sagalassa valida* in Colombia, Ecuador and Peru. The use of endrin around the trees controlled the disease. In 1976 M. Dollet found trypanosomatid protozoans in diseased palms.

Posterior studies from Peru, Colombia, Ecuador and Suriname made him possible to show that such flagellates are linked with the "Marchitez". Similar flagellates have been found to be associated with a coffee disease in Suriname, at the beginning of this century, and to a wilting disease of the coconut in five South American countries. The current research is aimed to disclose the pathogenic effect of such trypanosomatid flagellates and to devise a chemotherapeutic control procedure.

65. GENTY, P.H. Resultados preliminares sobre el papel del pentatomidae del genero *Lincus* en la transmission de la Marchitez de la palma en America Latina. Palmas (Colombia) 6 (2): 15-17. 1985.

Several suspected insect species were carefully observed since 1982 as possible vectors for flagellate protozoa of the *Phytomonas* genus. *Macropygium* spp. bugs were first studied in Suriname and in Ecuador, because some of them are found on the root area as well as in the leaf axils on *Cocos nucifera* and *Elaeis guineensis*. All trials made to transmit the disease were unsuccessful.

Other pentatomids of the *Lincus* genus were studied in Ecuador, French Guyana and Brasil. In December 1984 Mr. de Chenon was able to transmit the disease, using *Lincus* sp. as insect vector, at the Shushufindi plantation in Ecuador, using 3 to 4 years old oil palms. In June and again in August and October of 1984 several hundreds of flagellate contaminated adults and nymphs of chinch bug *Lincus* sp. were placed on healthy oil palm plants. Typical symptoms of the "Marchitez sorpresiva" disease and presence of flagellates in the phloem were first seen during the second half of December 1984 after 4 to 6 months of placing the insects on the plants.

66. GENTHY, P.H. Rescherche entomologique sur le palmier a huile en Amerique Latine. Oleagineux 36 (12): 585-590. 1981.

As in the case of extensive cultures, the large oil palm plantations in the humid tropical zones of America have modified the environment, and insects that remain scarce for as long as there be heavy sunshine and little foliage, multiply greatly on adult palms where they find a better environment.

In dealing with the research on "Marchitez sorpresiva" the author says the disease was a major cause to withhold the increase of the palm area in South America.

There is a symptom description with informations on the geographic distribution and economic importance, after it showed up for the first time at the Risaralda plantation on the North East part of Colombia, in 1963, where 2,500 ha were practically destroyed in 15 years. The Indupalma plantation in association with the Institute de Rechercher pour les Huiles et Oleagineux (IRHO) and some Colombian and foreign institutions studied all possible hypotheses on the causes of the disease and, at the end, lack of mineral nutrients, physiological causes, nematodes, fungi and pathogenic organisms of the virus and mycoplasma type were disregarded.

In 1972 the root miner *Sagalassa valida* was found to be associated not only with severe destruction of the root system but also with the "Marchitez sorpresiva" disease. Related studies led them to find that the soil treatment with endrin around the palm at the rate of 2 lts per tree of a 1% solution, greatly reduced the number of Marchitez sorpresiva affected trees, although the treatments (made every two months) were aimed to destroy the newly hatched larva of the *S. valida* root miner. These treatments he says were repeated in all "Marchitez sorpresiva" affected areas of Colombia, Ecuador, Peru and Suriname, for many years, with the same positive results.

Since the *Sagalassa valida* larvae have a chewing mouth part type, it is quite difficult to accept that are a direct or indirect cause of the transmission of the disease.

In 1976 some etiological studies made it possible for M. Dollet to find typanosomatid flagellates of the *Phytomons* type in the phloem of diseased trees in Ecuador and Peru first, and later in Colombia too. Posterior observations made Colombia, Ecuador, Pru and Suriname showed that the disease symptoms on affected trees are correlated with the presence of flagellates in the sieve tubes of the phloem of

roots, inflorescences, stems, leaves, meristematic zone and spears.

The presence of flagellates and the easy method to check for their presence in the plant organs is a fast way to check for diseased palms.

Actual research is now being done to find the actual insect vector of the piercing sucking mouth type. *Macropygium reticulare* was found to have flagellates in the salivary glands but transmission trials with it were unsuccessful.

67. GENTY, P.H. Les ravageurs et les maladies du palmier a huile et du cocotier. Les lepidopteres mineurs de racines: *Sagalassa valida* W. Oleagineux 32 (7): 311-314. 1977.

In connection with the "Marchitez sorpresiva" disease of oil palms in Colombia the author considers there are good evidences to associate the damage of the root miner *Sagalassa valida* W. with the disease.

Special information is that related with the beneficial effect of the insecticide endrin, against the "Marchitez sorpresiva" disease, when it is applied on the soil around the palms.

68. GENTY, P.H. Informe de mision sobre una enfermedad similar a la "Marchitez sorpresiva" en varias plantaciones de palma africana en el Ecuador. Quinto, Ecuador, 1973. Asociacion Nacional de cultivadores de palma africana, ANCUPA, 1973. 6p.

This paper deals with the "Marchitez sorpresiva" (Sudden wither) disease of the oil palm in Ecuador. The author provides some general informations, with description of the disease. In connection with the root miner, *Sagalassa valida*, he comments that without being the real and direct responsible cause for the disease, it may cause the predisposing conditions for the onset of the causal entity of the disease.

69. GENTY, P.H. Observations preliminaries des Lepidoptere mineur des racines du palmier a huile, Sagalassa valida Walker. Oleagineux 28 (2): 59-65. 1973.

In connection with the "Marchitez sorpresiva" disease of oil palm in Colombia the author considers that the insect damage is associated with the onset of the disease. The insect species is the root miner *Sagalassa valida* Walker.

70. GIBSON, I.A.S. Two important disorders of oil palm in Latin America. Pans 25 (3): 270-274. 1979.

Two diseases of the African oil palm, "Marchitez sorpresiva" (Sudden Wilt) and Lethal spear rot have caused losses in Latin America to limit further plantings of this crop in some regions. The actiology of these diseases is not completely understood but resistance to both diseases is reported in the American oil species *Elaeis oleifera* and hybrids between *E. oleifera* x *E. guineensis*.

Many actiologies for "Marchitez sorpresiva" have been proposed, including trypanosomes for the *Phytomonas* genus. For Lethal spear rot *Erwinina lathyri* (herbicola) is considered as the causal pathogen, although recently *Fusarium moniliforme* have been demonstrated to be a primary cause in Colombia.

There is a symptom description in 2-6 year old palms, including the concept that may be more than one disorder to explain for the variations in symptoms. There are general comments in connection with the association of the root miner *Sagalassa valida* W. and the disease. He mentions also the hypothesis that a mycoplasma-like organism be responsible for "Marchitez sorpresiva"; other hypothesis that he still considers circumstantial is the role of the flagellate protozoa *Phytomonas* sp.

71. GOLD, A.H., PAULUS, A.O., VAN GUNDY, S.D. and ALLEN, W.W. Report of the University of California team that investigated oil palm (*Elaeis guineensis*) diseases in Colombia. Bogota, s.e. 1972. 57p.

The technical team visited the Risaralda plantation, the Indupalma plantation at San Alberto and the Coldesa plantation at Turbo, in Colombia, from August 23 to September 6 of 1972.

The group observed and sampled trees stricken with Marchitez sorpresiva and spear rot. Analysis of specimens were done at the University of Los Angeles, USA.

In connection with "Marchitez sorpresiva" they made careful analysis of possible causes of the disease, keeping in mind the preliminary research undertaken by the Institut de Recherches pour les Huiles et Oleagineux (IRHO) and the Colombian Institutions led by the Instituto Colombiano Agropecuario, ICA. These institutions analyzed several possible causes including floodings, soil toxins, nutrient deficiencies, water stress, nematode attack, pathogenic fungi, viruses or mycoplasmas and insect damage.

A.H. Gold states, after a somewhat detailed analysis of the problem that "Marchitez sorpresiva" is an infectious disease, with apparently seasonal incidence.

He comments on the hypothesis proposed J.L. Renard (from the IRHO group) that the disease may be caused by a mycoplasma and, without opposing to it, he points out the difficulties to test it by means of insects or by injecting juices from diseased trees. Another hypothesis proposed by M. Ollagnier (other technician from the IRHO group) is related with the direct role of the root miner *Sagalassa valida* which has been largely studied by P.H. Genty from the IRHO and Indupalma. Again, as in the case of viruses or mycoplasmas, A.H. Gold says that the only true test is to experimentally reproduce the disease with the month.

A.O. Paulus, from the California technical team, makes a detailed analysis of the fungal and bacterial hypothesis. He reports the finding of several pathogens in nutritional media using root samples from Risaralda, Coldesa and Indupalma. Bacteria of *Erwinia* genus were isolated from many of the decaying roots. Fusarium oxysporum was isolated from *Elaeis oleifera* roots in limited numbers. The tests done at Risaralda showed the presence of *Fusarium oxysporum, Thielaviopsis, Rhizoctonia solani* and *Pythium* in roots of oil palm trees. *Erwinia* was found in limited amounts. A.O. Paulus suggests that oil palm trees affected by "Marchitez sorpresiva" be cut down and allowed to decompose, assuming that some transmissible entity might be present.

He thinks also that *E. oleifera* or its hybrids show excellent tolerance to the disease conditions that are present at Coldesa and Indupalma. The author suggests also not to plant oil palm within 50 mts of the rivers because "Marchitez sorpresiva" seems very prevalent near rivers or waterways.

S.D. van Gundy, from the California team, reviews the possibility that "Marchitez sorpresiva" may be caused by nematodes and, in doing so, he proposed 3 hypotheses to be tested. The first hypothesis was to test the presence of *Radinaphelenchus cocophilus* the incitant of red ring disease of coconuts, samples of stems, leaves, buds and roots from Marchitez affected palms, were tested and, since the organism was not found, he

concludes the R. *cocophilus* was not the cause of the "sudden wilt". The second hypothesis was to test for the presence of *Xiphinema* spp., *Trichodorus* spp. and *Longidorus* spp. which might act as virus vectors. He concluded that "marchitez sorpresiva" is extremely doubtful to be caused or vectored by these organisms. The third hypothesis was to look for plant parasitic root feeding nematodes that might be able to cause a severe root reduction or lethal stress. He says that in spite of having found *Helicotylenchus* sp. and other species, it is unlikely that they be the cause of the disease. There is a long list of nematode species found in healthy and disease palms as well as in the soil and neighbouring plant species.

W. Allen, the fourth member of the California Team, analyzed the entomological aspect of the disease. after detailed observations he concluded that stem boring insects such as *Rynchophorus* were not associated with "Marchitez sorpresiva" and that the absence of stem boring weevils and the nematode *Radinaphelenchus cocophilus*, made evident that "sudden wilt" was not an atypical expression of the "red ring" disease. In connection with *Strategus* sp. he said that it is not likely that it be the direct or indirect cause of the disease. The root miner, tentatively identified as a member of the Aegeriidae family by P.H. Genty was common at San Alberto, Risaralda and Turbo and some Marchitez affected trees had up to 50% of their peripheral roots attacked by the caterpillars. In connection with this fact he said that under the present knowledge it wouldbe wrong to infer that this caterpillar is the primary cause of the disease or that it is one of the important predisposing factors.

He concluded advising a series of tests to actually gain basic information to assess the real and actual role of the insect.

72. GRIFFITH, R. Cedros wilt disease of coconuts. Red Ring Research Division; Ministry of Agriculture, Lands and Fisheries. Trinidad and Tobago, 1981. 56pp.

The "Cedros Wilt" disease of coconuts is present in South America and West Antilles. The characteristic disease symptoms in affected mature palms are an initial yellowing of the leaves beginning with the older ones, and then a fast drying, posteriorly followed by a breakage at the basal part. There is an immature nut fall. From the initial symptom to the death of the tree one to two months may elapse. There is a bud rot with unpleasant odor.

Two species of pathogens are constantly found in association with Cedros wilt affected coconut palms, one is a trypanosomatid flagellate (*Phytomonas elmassiani*) and a bacterium (*Micrococcus* (*agilis*) roseus. These microorganisms, he says, have experimentally been transmitted from the milk weed plant *Asclepias curassavica* to healthy coconut plants and have produced disease symptoms similar to those of the Cedros wilt disease of coconuts. The organisms were recovered and identified by comparison with the initial species. The transmission procedures included an injection technique through the haustorium of growing seedlings and with the chinch bug *Oncopeltus cingulifer* previously fed on milkweed plants growing in the coconut agroecosystem.

In other transmission trials with the bug *Mecistorhinus picea,* collected from Cedros wilt diseased palms, showed that both pathogens were transmitted from diseased to healthy palms and caused a disease with identical symptoms to Cedros wilt.

By performing some histological studies he was able to see that flagellates migrated fast to the roots and multiplied in the cotical cells, causing visible mechanical destruction and root functional failure. The flagellates were twisted forms of about 27 um in length during pathogenesis.

No transmission occurred in the tests in which *Dysdercus* sp., contaminated with similar flagellates and found in the coconut states, were used. The flagellates found in the *Dysdercus* sp. bug were capable of transovarial transmission; the flagellates found in Oncopeltus sp. and Mecistorhinus sp. are not able of transovarial transmission. The author proposes that flagellate species might best be determined by ecological adaptations rather than by differences in sizes.

The onset of the disease in coconut palms starts with the visit of *Oncopeltus* bugs that were initially feeding on A. *currassavica*. From palm to palm the *Mecistorhinus* sp. bug is indicated as the only flagellate carrier.

73. GRIFFITH, R. The origin and method of transmission of microorganisms associated with Cedros wilt disease of coconuts. *In* Colloque international sur la protection des cultures tropicales. Lyon, France, 1981. p.63.

The author reports that "Cedros Wilt" is a disease of coconut which has been found in many tropical American countries including Mexico, Ecuador, Venezuela, Guyana, Suriname, Trinidad and St. Vincent. The characteristic symptoms of the disease are given.

The associated pathogens are a Trypanosomatid flagellate *(Phytomonas elmassiani)* and a bacterium *(Micrococcus (agilis) roseus* Flugge. These pathogens, the author says are normally associated with the latex cells of the milkweed *Asclepias curasavica*, upon which the related insect *Oncopeltus cingulifer* develops and houses promastigote forms of the flagellate and the bacterium in its haemocoel and salivary glands. The flagellates are not transovarial. Flagellates inhabit in nature sieve elements of the phloem of diseased palms. Dense concentrations occur in the leaves, from where they migrate to the roots and to the inflorescences and young shoot.

Oncopeltus sp. may incidentally feed on the coconut leaves injecting the microorganisms into the phloem of the plant. The abundance of insects correlate directly with the intensity of the disease, the author says.

Transmission has been confirmed by field and laboratory experiences with *Oncopeltus*. *Mecistorhinus picea* (a pentatomid bug) feeds on leaves of coconut palms and transports the pathogens from palm to palm; laboratory transmission trials confirmed this method of cluster formation. Artificial transmission has been achieved by injecting a suspension of the organisms into the "haustorium" of developing seedlings; *P. elmossiane* obtained from milk-weed plants and diseased palms have caused disease in this way. The bacterium alone is not able to cause the disease when injected into the plant; it is sapophytic and may be considered as a microcommensal, following death of the cells. There is a morphological description of the pathogens.

74. GRIFFITH, R. The origin and mode of transmission of Cedros Wilt disease of coconuts. Jour. Agric. Soc. of Trinidad and Tobago 81 (1): 74-98. 1981.

Symptom description of the disease in the typical coconut variety is given. The disease occurs in Trinidad and many Latin American countries and trees of all ages are affected. The author says that the distribution of the disease coincides exactly with the distribution of the ecological distribution of *Asclepias curassavica* in Central America, West Indies and South America, which carries the Trypanosomatid *Phytomonas* sp. and hosts also the *Oncopeltus* spp. bugs.

The role of flagellates and its association with the bacterium *Micrococcus (agilis) roseus* in the disease are discussed in detail. The author says that feeding and multiplication of both organisms causes disfunction of the palm under the stress of continuous irritation and posterior decomposition by enzymes produced by bacterial activity. Bacterial studies allowed the author to report that the wilting process induced by the bacterium is the result of the interference with the movement of water in the vessels and tracheids, by bacterial cells, with or without the presence of tylosis. Flagellates of the *Phytomonas* genus are described.

The Cedros wilt disease of coconuts in Trinidad, previously considered of uncertain aetiology, was experimentally induced by micro-organisms obtained from *Asclepias curassavica* and from insect vectors. To establish the relationship *Oncopeltus* — coconut and to find out if the chance feeding was enough to start the disease he did several trials; the results he obtained are: (a) *Oncopeltus* eggs were not contaminated with flagellates but the bacterium was present in 9 out of 76 eggs, (b) no flagellates were found in nymphs not exposed to flagellate contaminated plants, (c) all *Oncopeltus* adults and nymphs from contaminated coconut contained flagellates.

Artificial inoculations were successfully performed by asceptically injecting a suspension of flagellates and bacteria through the haustorium into the germinating nut so the pathogens could migrate with the food current into the phloem.

75. GRIFFITH, R. The transmission of micro-organisms associated with Cedros Wilt disease of coconuts. Jour. Agric. Soc. Trinidad and Tobago 80 (4): 303-310. 1980.

The author reports that *Asclepias curassavica* (the milkweed) is a host plant for the flagellates that cause the Cedros wilt disease of coconuts; this disease was initially considered as of unknown etiology. *Oncopeltus cingulifer,* a pentatomid bug, was found to be the insect vector.

Artificial transmissions of the disease were accomplished using *O. cingulifer* specimens previously contaminated with the pathogens by making them to feed on *Asclepias curassavica* plants, or by artificial injection of the inoculum through the houstorium of young seedlings. Effective transmissions were also obtained using *Mecistorhinus picea,* another pentatomid bug collected from diseased coconut trees. The transmitted pathogens were a flagellated protozoan (*Phytomonas* sp.) and a bacterium *(Micrococus (agilis) roseus.*

76. GRIFFITH, R. Progress on Cedros Wilt disease of coconuts. Jour. Agr. Soc. Trinidad and Tobago 77 (224-238). 1977.

From the Bronze Leaf Wilt syndrome in Trinidad two diseases were separated: Bronze Leaf Wilt and Cedros Wilt disease. The former is a physiological wilt and the latter an infectious disease. There are some historical accounts going back as far as 1930; a geographical distribution of the disease is also given.

A summary of the nature and results of the control measures applied since 1910 is provided including the information about the useless effect of various fertilizers; only phytosanitary measures such as cutting and burning of diseased trees seemed to have some positive effect.

Attempts to determine the causative pathogen or pathogens permitted the author to be the first in showing that the bacterium *Micrococcus (agilis) roseus* was directly related with the Cedros Wilt disease in Trinidad, not as a secondary organism but as a primary one along with *Phytomonas* sp.

There are comparisons with the Hartrot disease of Suriname and accounts related with the isolation of a Typanosomatid from Cedros Wilt in Trinidad and Guyana.

77. HALL, C.J.J. VAN. Jaarverslag over 1906 (Verslag over het jaar 1906). Inspectie Landbouw. West Indie (Suriname) 21. 1907.

A disease of coconuts at Coroni and Nickeri (Suriname) is reported causing a rot of the heart. The author says that this disease resembles a disease called by the English name of "Bud rot" and which is caused by a fungus that affects both, the heart of the palm and the fruits. In the "bud rot" disease bacterial follow the fungal infection and causing the rotting symptoms.

78. HANSON, W.L., Mc GHEE, R.B. and BLAKE, J.D. Experimental infection of various latex plants of the family Asclepiadaceae with *Phytomonas elmassiani*. Journal of Protozoalogy 13 (2): 324-327. 1966.

In connection with the effect of the host plant in the physiology and morphology of the flagellated protozoans, of the *Phytomonas* genus, the authors say that the host plant species do influence themorphological aspect to the extent that it is practically very difficult to look for similarities with flagellates of the same species found in other host plant species. They studied the mode of transmission by insects using the lygaeid *Oncopeltus fasciatus* Dallas on *Asclepias* sp., *Senetera maritima, Amphistelma scoparia, Allamanda notifolia*, and *Plumeria ruba*. They established that *Phytomonas elmassiani* of *Asclepias curassavica*, which is transmitted by *O. fasciatus*, has no pathogenic effect on *Asclepias* or Euphorbs.

The authors report that the sucking type insects are the only ones that can transmit the pathogens, among lactiferous plants, when feeding in the lactiferous tubes.

79. HARTLEY, C.W.S. The oil palm, 2 ed. London. Longman, 1977. 806p. (Tropical Agriculture Series).

In connection with the "Marchitez sorpresiva" disease the author says that the "Sudden Wither" (Marchitez sorpresiva) is of unknown cause and that besides Colombia, Ecuador and Peru, a similar disease has been prevalent in the Taperoa area of Brasil. There is quite a detailed description of symptoms but the author points out that similar symptoms proceeding at a slower rate are sometimes referred to as "Marchitez progressiva" in some parts of Colombia. He says also that descriptions of the disease in the literature may be different due, in part, to the presence of other diseases such as bud rots. In many places the disease is first seen near the rivers or on the periphery near forests.

The *Sagalassa valida* root miner, the author says, "altered current views of the disease" but its role remains uncertain even though some people think it may have a secondary role. He points that the endrin treatments are inconsistent and doubtful since it has been observed that on the most devastated plantation in Colombia it has not been

possible to find *Sagalassa* in the quantities expected and that, on the other hand, evidences of *Sagalassa* attack has been seen in several areas of Colombia, Ecuador and other countries where "Sudden Wither" has not appeared.

There are some comments on the role of the plant hopper *Myndus crudus (Haplaxius pallidus),* the grass *Panicum maximum* and the effect of weed control and chemical insect control (using malathion) on the disease. Reports that 53% control was obtained by the authors with the combined weed and insect control treatments. Cases of "Sudden Wither" in *Elaeis oleifera* or the interspecific hybrid have not been definitely recorded; this means that the use of the hybrid could be a practical method to avoid the disease. Certain *E. guineensis* palms resisted the disease in some affected plantations; could be an indication of the presence of resistant progenies within the species.

80. HARTLEY, C.W.S. Some notes on the oil palm in Latin America. Oleagineux 20: 359. 1965.

In dealing with "Sudden Wither" ("Marchitez sorpresiva") disease the author favors the use of genetic resistant material against this disease. He advises this control system because he considers there is some field evidence about the occurrence of resistant biotypes of *Elaeis guineensis*.

81. HARVEY, R.B. and LEE, S.B. Flagellates of lacticiferous plants. Plant Physiology 18 (4): 633-655. 1943.

Twelve species of plants growing at the U.S. Plant Introduction Garden, Coconut Grove in Florida, and neighbouring areas as well as on the Keys, are newly reported as flagellate host plants. Photographs of the organisms isolated from different plant species of the Asclepiadacea and Euphorbiaceae families are reproduced in the paper.

The incidence of flagellate infestation in the *chamaesyce* species was found to be variable and dependent, to some extent, on habitat, soil and weather conditions. Attempts to cultivate plant flagellates under laboratory conditions, using nutritional media successfully tested with flagellates of animal diseases, are reported. Culture for 30 days but without mentioning cell division is reported in a medium injected into live coconuts. Rapid cell multiplication is reported in a similar medium to which fresh *Hevea* latex was added. The use of coconut milk as nutritional medium failed. No pathogenic effects to the host plant and no flagellate seed transmission are reported.

82. HOLMES, F.O. *Herpetomonas bancrofti* n. sp. from the latex of a *Ficus* in Queensland. Contribution Boyce Thompson Institute 3: 375-383. 1931.

In dealing with the list of host plant species for flagellated protozoa of the *Herpetomonas* genus, the author reports a *Ficus* species from Queensland in which the organism was found in the latex.

83. HOLMES, F.O. Geographical distribution of the milkweed flagellate, Herpetomonas elmassiani (Migone). Phytopathology 15 (5): 297-299. 1925.

This paper reports that the flagellated protozoan *Herpetomonas elmassiani* (Migone) not only occurs in Maryland (U.S.A.) but also in Northern States of the country. The latex of the milkweed *Asclepias syriaca* L. was found to contain the organism in plant samples taken on the Atlantic Coast, near New Jersey and a few miles from the Hudson river. *A. syriaca* samples taken in the States of New York and Massachusetts did not reveal the presence of the organism. Evidences are presented that the lygaeid *Oncopeltus fasciatus* Dallas is an insect vector for the milkweed flagellate organism.

84. HOLMES, F.O. Non-pathogenecity of the milkweed flagellate in Maryland. Phytopathology 15 (5): 294-296. 1925.

Referring to the claims of many European authors that flagellates of Euphorbs cause pronounced symptoms when they are numerous in the latex of the plants, he recalls observations made in the autumn of 1923, in Maryland, which seemed to indicate that the milkweed *Asclepias syriaca* L. showed yellow leaves, easily detached from the twigs and, watery latex with little or no starch in it when affected by *Herpetomonas elmassiani* (Migone). In additional studies it was found that these same symptoms were also present in plants non infected by flagellates but approaching maturity. Additional observations revealed also that *H. elmassiani* may be present in the latex of the milkweed *A. syriaca,* in very large numbers, without appearing to interfere with the normal growth or general physiology of the plant.

85. HOLMES, F.O. The relationship of *Herpetomonas elmassiane* (Migone) to its plant and insect hosts. Biol. Bull. 49: 323-327. 1925.

Mobility of flagellates depends on the insect vectors and their feeding habits on different plants. The insects usually associated with the transmission of flagellates may vary according to the country and the prevailing plant species. Flagellates of the Phytomonas *(Herpetomonas)* genus are carried by *stenocephalus agilis* in Portugal, by *Dieuches humilis* in Dahomey, by *Nysius euphorniae* in Mauritius and by *Oncopeltus* sp. in America.

86. HOOF, H.A. VAN. Afsterving van oliepalmen. De Surinaamse Landbouw, 10 (4): 168. 1962.

In referring to the plant sanitation aspects of the oil palm, the author reports some cases of dead oil palm at the Oema Experimental Station, near Paramaribo, in Suriname. The author mentions that the palms were killed by a disease quite similar (in symptoms) to the "Hartrot" disease of coconuts and to the "Bud rot" caused by *Phytophthora.*

87. JONES, F.A. Cedros or fatal wilt disease of coconut in Guyana. Georgetown, Guyana, National Agricultural Research Institute (NARI), 1968. 11p.

There are historical informations on the disease. Similar symptoms have been identified as early as 1938 in Guyana, in the Essequibo Coast and Pomeroon, assuming it was a disease caused by unfavourable soil conditions. The economic aspect of the disease is commented and documented with estimated figures of destroyed palms. A summary of the present status of the disease in Guyana is presented along with a rather detailed description of the disease. Mentioning that circumstantial evidences point toward a flagellated protozoan species of the *Phytomonas* genus as the causal entity of the disease, the author provide s amorphological description of the pathogen, along with related comments on host plant species of the Asclepiadaceae and Euphorbiaceae families and insect vectors of the *Macropygium, Oncopeltus* and *Berecynthus* genera. Considerations on physiological aspects of the pathogen are presented too.

In dealing with the control and management strategies for Cedros Wilt the author recommends the early destruction of affected palms and the control of weeds with special emphasis on "milkweed" species. The search for coconut resistant varieties is strongly suggested.

The final part of the paper is a rather detailed presentation of the disease short term control strategy for Guyana, including a training programme for field technicians, technical assistance for coconut growers and coordination with international researchers, among other measures.

88. JONES, F. Cedros Wilt - an important coconut disease. Training course on control of Cedros Wilt on coconuts. Georgetown, Guyana, National Agricultural Research Institute (NARI), 1985. 2p.

This paper provides some historical information on the presence of "Cedros Wilt" disesase of coconuts in several regions of the country including the Corentyne (1977), Timehri (1982), and Bartica (1983) areas. The author identifies the typanosomatid *Phytomonas* sp. as the causal entity of the disease.

There are some economic evaluations of the losses caused by the disease, including the report that 96% of the palms had died in some farmer's plots over a six year period and that the disease is most severe on the East coast of Demerara, at the Bodhoo and Campbell States in Mahaica.

There is a symptom description of the disease and some guidelines on how to observe and identify the pathogen in tissue samples of the host plant. There are some recommendations to implement a Cedros Wilt control program in Guyana.

89. JONG, R. DE. Studie over de vector van Hartrot ziekte in kokos. Ministry of Agriculture, Animal Husbandry and Fisheries. Agricultural Experimental Station, Suriname. Internal Report No. 44. 1981.

This report contains the results of some research experiences with the pentatomid bugs *Macropygium reticulare, Berecynthis delirator* and *Alitocoris* sp. which are often found in coconut fields in Suriname. The salivary glands of these bugs are frequently contaminated with flagellates protozoa of the *Phytomonas* genus. *Phytomonas* genus is suspected to be closely associated with the "Hartrot" disease of the coconut palm.

The author considers that there is a probable relationship between *M. reticulare* and the Hartrot disease, although it is not completely proven yet. The author also reports that the incidence of the disease is less evident in coconut fields treated with endrin, that *Alitocoris* sp. is less frequently found in coconut plots treated with endrin insecticide, and this insect is infested in higher percentages with flagellates. The higher contamination with flagellates and the reduced presence in endrin treated coconut fields is interpreted by the author as an indication of the true vectorial activity of *Alitocoris* sp.

90. KASTELEIN, P., PARSADI, M. and FUNG KON SANG, W.E. *Bentinckia nicobarica* (Kurz) Becc (Palmae): another host plant for the Trypanosomatid flagellate *Phytomonas* staheli. Ministry of Agriculture, Animal Husbandry and Fisheries; Palm Research Center, Suriname. Internal Report. 1986. 4p.

The association of a flagellated protozoan of the *Phytomonas* genus with a wilting process, in a specimen of *Bentinckia nicobarica* (Kurz) Becc. palm, is reported. This palm species is considered to be an exotic species for Suriname.

The flagellates were observed in the sieve tubes of roots, apical region of the stem and young inflorescences of the palm specimen after it showed progressive chlorosis and dropping of the leaves starting from the oldest to the younger ones. This symptom was observed in September 1985 at the garden of the Agricultural Exp. Sta. at Paramaribo, Suriname. The palm species is of Indian origin.

Morphology and size of the flagellates were similar to those of *Phytomonas staheli* Mc Ghee and Mc Ghee, the suspected agent of "Hartrot" disease in coconut and oil palms.

91. KASTELEIN, P., SANCHIT-BEKKER, M.L. and DIPOTAROENO-SAKRAMA, M.S. Confusion in the recognition of "Hartrot" and red ring disease in coconut. Ministry of Agriculture, Animal Husbandry and Fisheries; Palm Research Center, Suriname. Submitted for publication in De Surinaamse Landbouw; 1986.

In a coconut plantation where both "Hartrot" and red ring disease occur, it is experienced that these two diseases may be difficult to be distinguished by external symptoms. Examination of wilt diseased palms for the presence of both, the "Hartrot" associated trypanosomatid flagellate *Phytomonas staheli* and the red ring nematode *Rhadinaphelenchus cocophilus* revealed the co-existence of these two pathogens in a wilt diseased coconut palm.

92. KASTELEIN, P. The transmission of *Phytomonas* sp. (*Trypanosomatidae*), a flagellate associated with the plant Cecropia palmata Willd. (*Moraceae*) by the bug *Edessa loxdali* Westwood (*Pentatomidae*). Ministry of Agriculture, Animal Husbandry and Fisheries; Palm Research Center, Paramaribo. Submitted for publication in De Surinaamse Landbouw: 1986.

The trypanosomatid flagellate *Phytomonas* sp. associated with the plant *Cercopia palmata* (Willd (*Moraceae*) is transmitted through the pentatomid bug *Edesa loxdali* Westwood. Both adults and nymphs can transmit the flagellates.

93. KASTELEIN, P. De ervaringen met een bestrijdingsstrategie tegen hartrot in kokos; eindverslag over VP 609. (Experiences with a strategy to control "Hartrot" in coconut: Final report on VP 609. Ministry of Agriculture, Animal Husbandry and Fisheries; Palm Research Centre. Paramaribo. Internal Report on VP 609. 1985. 8pp.

During 1983 and 1984 in a private coconut field affected by Hartrot, which is located at Uitkijkpolder, near Paramaribo, in Suriname, the following strategy based on the latest findings on the control of Hartrot was tested. The strategy included elimination of diseased trees and soil application of the insecticide Endrin around the bases of diseased and surrounding trees, in addition to a strict weed control program.

Every month, until November 1983, all affected palms were eliminated. Until September 1984 no new cases of "Hartrot" occured and, after treating, a single case occurred in September 1984 and following the endrin application, the disease was stopped till the end of the experiment in January 1985.

94. KASTELEIN, P. and ASGARALI, J. Overdracht van *Phytomonas* sp. (Trypanosomatidae), een flagellaat geassocieerd met *Cecropia surinamensis* (Moraceae), door de wants *Edessa* sp. (Pentatomidae), (The transmission of the flagellate *Phytomonas* sp. (Trypanosomatidae), associated with the plant host *Cecropia surinamensis* (Moraceae), by the bug *Edessa* sp. (Pentatomidae). Ministry of Agriculture, Animal Husbandry and Fisheries; Palm Research Centre, Suriname. Internal Report 1985. 6pp.

At the end of 1983, it was noticed that the bug Edessa sp. (Pentatomidae) occurred on the flagellate host plant *Cecropia surinamensis (Moraceae)*, growing in the severely "Hartrot" affected coconut plantation PO86, at La Poule experimental estate.

At about the same period this *Edessa* sp. was also found to occur in some fields with both *C. surinamensis* and coconut in the Dirkshoop, Experimental estate, near Paramaribo, Suriname.

By the end of 1983 no cases of "Hartrot" had occurred for a long time in the latter estate. The DH14 plot had specially high numbers of the bug on the *C. surinamensis* plants growing between the coconut rows; an appropriate survey for flagellate infected *C. surinamensis* revealed that 67 per cent of the plants were infected. A few months after recording the presence of *Edessa* sp., coconut plots DH14 and the bordering DH71 were affected by many "Hartrot" disease cases.

At the DH36, an isolated coconut field, not too far from the other fields, *Edessa* sp. was not observed on any *C. surinamensis*, no flagellate infected *C. surinamensis* were found and no cases of "Hartrot" disease were noticed.

Bearing in mind that several bug species have been reported as vectors for *Phytomonas* associated with other host plants and the Edessa sp. may have flagellates in the salivary glands, it was attempted to infect caged *C. surinamensis* seedlings with flagellates by placing inside Edessa sp. specimens collected from infected *C. surinamensis* plants, growing in the field. The same transmission trial was also attempted using caged coconut seedlings, in view that the *Edessa* bugs had also been found on coconut plants.

Both adults and nymphs of Edessa sp. were able to transmit the flagellates fom one *C. surinamensis* plant to another. The transmission trial with coconut plants failed.

95. KASTELEIN, P. et al. Het effect van enige bestrijdingsmiddelen op *Phytomonas staheli:* een labscreening. (The effect of some plant protection chemicals on *Phytomonas staheli:* a laboratory screening). Ministry of Agriculture, Animal Husbandry and Fisheries; Palm Research Centre, Suriname. Internal Report. 1984. 5p.

Endrin is being applied with success as a soil-drench in the control of "Hartrot" in coconut and oil palm. For its ecological hazards a less harmful chemical is desired.

Field observations suggested that Endrin has a direct action on the flagellates of the roots in the topsoil. In root pieces submerged in a 0.5 per centa.i. solution of Endrin, which is the concentration used in the field, 60-80 per cent of the flagellates were dead after three days compared to only 5-10 per cent on control roots submerged in water. Based on the assumption that a suitable alternative plant protection chemical could have similar effects on the flagellates in roots as Endrin does, a laboratory screening was carried out using 5 per cent concentrations of the active ingredient of different types of insecticides and fungicides.

Five per cent concentration of the fungicides tested had no or only little effect on the flagellate activity. Some insecticides were able to kill the flagellates within 24 hours.

These were: "Fenvalerate", "Deltamethrin", Permetrin+DDVP", ", "Dicofol", "Endrin", "Azinphos-ethyl", "Mevinphos", "Endosulfan" and "Propoxur". With those chemicals the lowest effective doses were determined. Among these "Deltamethrin" inactivated the flagellates at the lowest percentage of the active ingredient. "Endolsulfan" was the least effective. All chemicals proved to have a phytotoxic effect on the roots in the higher concentrations. In the case of "Deltamethrin", "Azinphos-ethyl" and "Mevinphos" the flagellate inactivating effect was non existing if the root tissues were not affected. In the case of the other chemicals and flagellate activity was affected within a certain range of concentrations with no obvious tissue affection.

The fact that all effective formulations were fluids and the similarity of the toxic effect on roots suggests that the effect of these insecticides may not be the effect of the active ingredient(s) alone, but may also be the phytotoxic property of some common compound such as the solvent, the emulsifying agent, or any other inactive ingredient. This needs further clarification and therefore it is not possible yet to select an alternative compound for "Endrin".

96. KASTELEIN, P. and PARSADI, M. Observations on cultures of the protozoa *Phytomonas* sp. (Trypanosomatidae) associated with the lactifer *Allamanda cathartica* L. (Apocynaceae). De surinaamse Landbouw 32 (3) : 85-89. 1984.

The effect of seven culture media on growth, activity and morphology of some flagellated protozoa of the *Phytomonas genus*, associated with the laticifer *Allamanda catharica* L., was investigated.

There is an identification of the seven tested nutritional media and, in connection with the results, the authors say that growth was best in enriched Grace's and Giardia media, whereas in Leishmania and G.L.S.H. media, little or no growth at all occurred. In all media both promastigote and amastigote forms were present. Giardia was the only medium in which the amastigote forms were present. Giardia was the only medium in which the amastigote form was predominant. Activity and morphology in cultures corresponding to the Grace's medium were equal to those in milky juice of the host plant, whereas in media M199, F16 and Eagle MEM, agitated and long forms are reported. Significant differences in lengths were found in at least one medium.

Forms with bifurcated posterior ends and a few promastigotes with a spine-like elongation, developing close to the flagellar pocket were observed.

Individuals with two spines were also observed. Grace and Giradia allowed transfers of subcultures in fresh media.

97. KASTELEIN, P., KARIJOSEMITO, C. and PARSADI, M. Preliminary observations in culturing plant associated flagellates (*Phytomonas* spp., *Trypanosomatidae*). Mesa Redonda Latino-Americana sobre "palma aceitera" (Dende). 3a., Belem, Brasil, 1984. Mimeograph s.p.

Attempts have been made to culture *Phytomonas* flagellates from *Allamanda cathartica, Bonafousia tetrastachya* and *Mandevilla scabra* of the *Apocynaceae* family, *Blepharodon nitidus* of the Asclepiadaceae family, *Euphorbia hirta* and *E. hyssopifolia* of the *Euphorbiaceae* family and *Cocos nucifera* of the *Palmae* family.

With flagellates from *A. cathartica* and *B. nitidus* pure cultures were obtained in a modified Grace's Insect Tissue Culture Medium. These cultures were lost, however, after successive sub-cultivation. In the case of *Phytomonas staheli* of coconut, promising results in a medium of young drinking coconuts were obtained.

98. KASTELEIN, P. KARIJOSEMITO, C. and SEGEREN, P. The role of weeds in the incidence of "Hartrot" or "Fatal Wilt" of palms: III Enumeration of weeds as hosts of the protozoa *Phytomonas* (Trypanosomatidae) and attempts of culturing the flagellates. De Surinaamse Landbouw 32 (1): 25-42. 1984.

Several common weeds growing in or around a seriously hartrot-affected coconut plantation at La Poule estate have been screened for association with phytomonad flagellates (Trypanosomatidae). Later on, based on the results of this survey, species of lactiferous families from other coconut and oil palm plantations were also screened. The inventory revealed *Allamanda cathartica* L., *Bonafousia tetrastachya* (H.B.K.) Mgf., Mandevilla scabra (R. et S.) K. Schum and *Rhabdadenia biflora* (Jacq.) Mull. Arg. of the *Apocynaceae* family, *Blepharodon nitidus* (Vell.) Macbr. of the *Asclepiadaceae* family, *Euphorbia hirta* L., *E. hyssopifolia* L. and *E. thymifolia* L. of the *Euphorbiaceae* family and *Cecropia surinamensis* Miq. of the *Moraceae* family as host for *Phytomonas*. In these locations only *C. surinamensis* seems to suffer from the infestation when the number of flagellates in the bast is high.

Except for *Phytomonas* sp. from *A. cathartica*, cultivation attempts with flagellates from six of these hosts failed. With the flagellates from *A. cathartica* twice pure cultures were obtained which were lost, however, after successive sub-cultivation.

99. KASTELEIN, P. Verslag over een jaar ervaring met een bestrijdings-strategie tegen Hartrot in kokos. (VP 609: Report on a year experience with a strategy to control "Hartrot" in coconut. Ministry of Agriculture, Animal Husbandry and Fisheries. Palm Research Centre, Suriname. Internal Report on VP 609. 1984. 13pp.

In a private plantation of coconut at Uitikijkpolder, observation trial VP 609 was conducted to find out whether the strategy of eliminating Hartrot affected palms, application of Endrin as soil drench (60 cc Endrin 20 EC per tree) around the base of these and the surrounding non-affected palms and practice of a rigid weed control, could

prevent further spread of the "Hartrot" disease. The trial was started in February 1983.

During the first nine months of the trial a total of 44 trees (11%) of the bearing palms were lost due to "Hartrot" disease. By the end of the nine month period no new cases of the disease were noticed. The trial will continue for one more year.

100. KASTELEIN, P. Observatie naar de latence periode van hartrot en de eerste symptomen van de ziekte bij kokos (Observation for the latent period of "Hartrot" and the first symptom of the disease in coconut). Ministry of Agriculture, Animal Husbandry and Fisheries. Palm Research Center, Suriname. Internal Report. 1983. 7pp.

In Hartrot affected coconut palms high numbers of flagellates are concentrated in the phloem of "sinks" like roots, apex, young inflorescences and tender leaves. In the stem flagellates are distributed more diffusely. About the presence and distribution of flagellates before symptom expression little is known at present. By monthly observations to look for the presence of flagellates in roots and tender leaves and external symptoms in 18 coconut palms, it had been attempted to gain a better insight on the early stages of the disease.

In seven of the checked palms, flagellates were found in the sampled tissues before expression of external symptoms. The observed latent period of the disease varied from 9 days till 43 days after the initial finding of flagellates in the internal tissues. Shortly before or almost simultaneously with the expression of the first signs of the disease, flagellates were also present in the young leaves of the palm. Dropping of immature nuts, sometimes coupled with yellowing and browning of the older leaves, was the first observed external symptom.

101. KASTELEIN, P. SEGEREN, P. and ALEXANDER, V.T. Investigations of the trypanosomatid flagellate associated with "Hartrot" disease in coconut palms of Suriname. De Surinaamse Landbouw 30 (1): 4-8. 1982.

The trypanosomatid flagellate *Phytomonas staheli* Mc Ghee and Mc Ghee has been found to be associated with the "Hartrot" disease of coconuts. No other micro-organism has been found in so constant association with the disease. Some unsuccessful attempts to artificially reproduce the disease are reported in this paper.

Inoculation of young seedlings through the haustorium were made with sap obtained from "Hartrot" affected coconut palms. The flagellate suspension were prepared by centrifugation of sap at 25°C and then washed and resuspended in 5% sucrose. The inoculation procedure was similar to the technique used by R. Griffith in Trinidad.

The flagellate suspension failed to induce the disease. The flagellates did not penetrate the plant tissue. The flagellates died within twenty four hours at the site of deposition.

102. LAFONT, A. Sur la presence d' un *Leptomonas*, parasite de la clase des flagellés, dans le latex de trois Euphorbiacees. Ann. Inst. Pasteur 24: 205-219. 1910.

The fundamental information of this paper is the description of the pathological syndrome in certain Euphorbs, affected by a Trypanosomatid parasite. There is also information about the presence of the so called amastigote form of the flagellates in the latex of the Euphorbs plants. This information confirms previous reports that the promastigote form is not the only one in this parasite.

103. LAFTONT, A. Sur la presence d'un parasite de la clase des flagelles dans le latex de l'*Euphorbia pilulifera*. Compt. Rend. Soc. Biol. 66:1011-1013. 1909.

A member of the protozoan family was discovered in the latex of an Euphorbiaceae species, in Mauritius, in 1909. That protozoan is now placed under the *Phytomonas* genus. At the time of this discovery that protozoan was suggested to be included as *Leptomonas davidi*.

The presence of a pathogen so close related with the chagas and sleeping disease causing pathogens was a surprising notice for medical doctors and veterinarians who, until then, believed protozoans were related only with human or animal diseases.

The author gives some symptoms seen in *E. pilulifera* contaminated with flagellate protozoa. The symptoms include reduction in growth, leaves that dry and fall, deformed leaves, stems that dry up, and gradual perishing.

104. LANDE, H.L. VAN DE. A representative of the Asclepiadaceae family as a host plant for flagellates. De Surinaamse Landbouw 30 (2/3):14-18. 1982.

States that flagellates are suspected to be closely related with the Hartrot disease of coconut and oil palm. The author states also that such flagellates use several weed species as host plants.

Several plant species of the Asclepiadaceae family were collected and subjected to close examination, looking for the presence of flagellates. Latex from stem, leaf penduncle and fruits were used for microscopic examination of Giemsa stained smears on glass plates. As general results, the author reports finding the highest number of flagellates in latex obtained from wounds made on young fruits. Active flagellates were still seen in latex samples kept for two weeks under refrigeration (about 5°C) temperature. The host plant species is the Asclepiad *Blepharodon nitidus* (Vell) Macbr. and the place of study Suriname. There is a rather detailed botanical description of the plant.

105. LOPEZ, G., GENTY, Ph. and OLLAGNIER, M. Control preventivo de la "Marchitez sorpresiva" del *Elaeis guineensis* en *America Latina*. Oleagineux 30(6):243-250. 1975.

The "Marchitez sorpresiva" disease may cause high losses in oil palm plantations in Latin America. The disease was first reported in 1963 at the Risaralda plantation in Colombia. Shortly after, it showed up in other plantations in Colombia, Ecuador and Peru. They say that 75% of the palms were lost at Risaralda and 10 to 20% of the trees in other plantations. There is a rather detailed description of the disease symptoms.

For sometimes it was believed that some toxic element carried by the water was the causal entity. This hypothesis, as well as some biological causes were soon discarded

including the insects, nematodes, fungi, bacteria, mycoplasma, virus etc. They say that even the electronic observations made in Colombia, U.S.A. and France failed to show any mycoplasma or virus bodies in the samples.

In 1972 the root miner *Sagalassa valida* W. was associated with "Marchitez sorpresiva" affected areas and it was concluded that the mechanical damage may facilitate the entrance of any soil borne pathogen. It was also found that the insect had a primary host plant (a palm species of the *Bactris* genus) which was found close to the oil palm plantation at Indupalma, in Colombia. During the time of the studies with the *S. valida* a bacterium species of the *Pseudomonas* genus was constantly found in diseased roots; they think this bacterium may have a secondary role in the infection process of the "Marchitez sorpresiva".

Cytological studies using root samples of the American oil palm *Elaeis oleifera* (*melanococca*) uncovered the presence of tannins which could explain why *E. oleifera* is resistant to the "Marchitez sorpresiva" disease. The same chemicals were found also in the root system of the interspecific hybrid *guineensis* x *oleifera*.

With the idea that the root miner may be related with the disease, insect trials were made to see if the control of the insect had any effect on the disease. They used 2 lts. of Endrin 1, 5%, commercial product (0.29% active ingredient) per tree, applied every two months on a circle around each palm. The results were quite good because, the authors say, there was a drastic reduction of the damage and a noticeable reduction in the number of palms affected by "Marchitez sorpresiva". After those experiences they consider as a standard reommendation the use of endrin to control the disease. They do not think that *Myndus crudus* is related with the disease.

106. MAAS, P.W.T. A coconut abnormality of unknown etiology in Suriname. Food and Agriculture Organization of the United Nations; Plant Protection Bulletin 19; 80-85. 1971.

There is a description of what is known as "Hartrot" disease of coconuts in Suriname. With appropriate comments on the symptoms and the economic implications the author says that the disease actually blocked the coconut cultivation in the country (Suriname).

107. MAAS, P.W., en WOUNDENBERG, J. De belangrijkste ziekten en plagen van de kokos in Suriname met speciale aandacht voor groeiomstandigheden. De Surinaamse Landbouw 18(2):87-109. 1970.

This is an agronomical document in which agricultural considerations are made in connections with the climatic conditions, genetic aspects and agricultural practices required for a good coconut plantation. The plant sanitation aspect is carefully evaluated and, among the sanitation problems, the "Hartrot" disease is mentioned as one of the important pathogenic problems.

108. MAAS, P.W. en WAUDENBERG, J. VAN. Het optreden van Hartrotziekte. De stand en productie van kokos in the districten Suriname, Para, Brokopondo en Marowijne. Agricultural Experimental Station. Suriname. Internal Report Plz. No. 8. 1969.

This paper contains some technical considerations on specifically named causes that affected the coconut production in Suriname. The authors believe in an existing relationship between the death of coconut palms, a wilting disease of the palms, and the long droughts in several districts in Suriname. A mass die-off took place in the ill-drained coastal plain, in the Suriname district, after an extremely dry period; in the Para district, with a better water management, the die-off was less severe. In the Brokopondo and Marowijne districts, with good water supply, there was no death of palms.

The incidence of the "Hartrot" disease in the Suriname and Para districts was favoured by a long shortage of water in the soils, the authors say.

109. MALAGUTI, G. Marchitez sorpresiva, enfermedad de la palma de aceite. Coco y Palma (Venezuela) No. 1:4-5. 1973.

The paper includes general information dealing with the occurrence of the "Marchitez sorpresiva" disease of oil palm in Colombia, Ecuador, Venezuela and other countries.

There are some general comments on the chinch bug *Scaptocoris divergens* which might be implicated in the transmission of the disease in Colombia, according to this author.

110. MARTIN, G. Palm oil and the world market in oils and fats. The Courier No. 86:53-55. 1984.

There is a rather well documented review on the production of edible oils during the past 30 years and the past market participation of the palm oil, starting in the 1960 decade. There is an account of the research highlights, including references to the flagellate protozoa in connection with the plant sanitation aspect of the oil palm.

111. MARTINEZ LOPEZ, G. Observaciones sobre distintos casos de marchitez de la palma Africana en Colombia. Palmas (Colombia) 6(3):65-67. 1985.

The author says that during the last 15 years several cases and situations in the plant sanitation aspect of the oil palm cultivation have occurred in Colombia; some wilts not lethal and non related with lack of water or nutritional deficiencies, drastically differ from some wilting symptoms in which there is no recovery and where the final stage is the unavoidable death of the plant. In considering these cases the author refers to two different wilts which have indistinctly been named as "Marchitez sorpresiva" of the African oil palm.

He says that Marchitez sorpresiva type A is the same that destroyed the Risaralda plantation in Colombia, the same that was experimentally found to be associated with *Myndus crudus* (Van Duzee) and the gramineous cover, and the same that was experimentally transmitted by *M. crudus* previously contaminated with the causal pathogen by making the insects feed first on contaminated oil palms. In type A the author says there is no necrosis of internal tissues close to the meristematic region. Attempts to identifty the causal pathogen failed. "Marchitez sorpresiva" type B produces also the

death of the affected palm; there is an initial discoloration of the internal tissues close to the meristematic zone, followed by necrosis, and the presence of a flagellated protozoan has been found in palms affected by marchitez of this type.

There are symptom descriptions for both "Marchitez sorpresiva" types.

The author considers there are two different causal pathogens and clearly points out that the interspecific hybrid *Elaeis guineensis* x *E. oleifera* is resistant to "Marchitez sorpresiva" type A.

112. MARTINEZ, L.G., GIMENEZ, O.D. and MENA, T.E. Flagellated protozoans in coconut palms in the Southwest of Colombia. *In* Meeting of the International Council on Lethal Yellowing, 4th., Fort Lauderdale, Florida, U.S.A. 1980. Proceedings. Fort Lauderdale, Agricultural Research Center Institute of Food and Agricultural Sciences, University of Florida. Publication F1-80-1. 17p. 1978.

A disease of unknown cause if affecting the coconut cultivars on the Pacific coastal areas in the Southwest part of Colombia. There is a brief description of the symptoms. Microscopie examination of tisue samples taken from diseased coconut palms disclosed the presence of flagellated protozoa that resembled the *Phytomonas* protozoa found and reported to be associated with the "Hartrot" disease of the coconuts in several South and Central American countries, and with one type of "Marchitez sorpresiva" of the oil palm in some South American countries. The pathogenecity of the flagellates found in the Colombian coconut plantations and the mode of spread have not been determned yet. This disease has not been a problem in the African oil palms growing in the same area. *Myndus* (*Haplaxius*) sp., has not been observed in the area, the authors say.

113. MARTINEZ, L.G. y MENA, E. Estado actual de las investigaciones sobre "Marchitez sorpresiva" de la palma Africana (*Elaeis guineensis* Jaq.). Fitopatologia Colombiana 7(1):136-137, 1978.

The main subject of this paper is the information that *Myndus crudus* (Van Duzee) (*Haplaxius pallidus*) was found to be the insect vector for the yet unknown pathogen responsible for the "Marchitez sorpresiva" disease of the oil palm, in Colombia.

114. MARTINEZ LOPEZ, G. Transmission of sudden wilt disease of oil palm. *In* Meeting of the International Council on Lethal Yellowing, 3rd., Palm Beach County, Florida, U.S.A. 1977. Proceedings. Fort Lauderdale, Florida, U.S.A. Agricultural Research Center Institute of Food and Agricultural Sciences. University of Florida. Publication FL-78-2:34-45. 1978.

Sudden wilt disease of still unknown etiology is a serious pathological disturbance in oil palm in Colombia, the author says. There is a symptom description and indication that the disease is more severe in areas where *Panicum maximum* Jacq. is the predominant weed species. Nymphs of *Haplaxius pallidus* (*Myndus crudus*) develop on *P. maximum* and the adult lives on oil palm.

In studies oriented to determine any vectorial activity of the insect, he was able to reproduce the symptoms of the disease by placing contaminated insects and waiting for 98 to 260 days, with an average incubation period of the disease of 132, 4 days. There are details of the number of insects used per plant.

Other transmissions trials included use of undiluted extracts from the innersoft mass of young leaves and leaf bases of diseased plants; the extract was injected in the trunk near the growing point. With this procedure he was able to reproduce the symptoms of the disease in 40% of the tested plants. In a second experiment 34% of the tested plants developed the disease symptoms in less than 150 days.

115. MARTINEZ LOPEZ, G., MENA T.E. y CARDONA MEJIA, C. Control de la Marchitez sorpresiva de la palma Africana (*Elaeis guineensis* Jacq.). *In* congreso de la Asociacion Colombia de Fitopatologia, 2 do., Bogota, Colombia, Septiembre 1976. Resumen. 1976. p.32.

The fundamental information of this paper is the report that the control of "Marchitez sorpresiva" disease of oil palm in Colombia could be better achieved by controlling the gramineous species *Panicum maximum.* This procedure is based on the fact that *Myndus crudus* (*Haplaxius pallidus*) Van Duzee, the vector of the suspected "Marchitez sorpresiva" causing pathogen, develops its entire immature stages on the grass. As adult it feeds on several plant species including oil palm leaves.

116. MARTINEZ LOPEZ, G., MENA T., y MEJIA C. Effecto de la tetraciclina sobre el desarrollo de los sintomas de la Marchitez sorpresiva de la palma Africana (*Elaeis guineensis* Jacq.). *In* Congreso de la Asociacion Colombiana de Fitopatologia, 2 do., Bogota, Colombia, Septiembre 1976. Resumenes. 1976. p.34.

The main information of this reference is the report that the use of tetracycline, as injections in the trunk of oil palm affected by early symptoms of the "Marchitez sorpresiva", did not produce any positive results. Not one of the tested dosages stopped or withheld the disease symptom progress.

117. MC COY, R.E. Sensitivity of *Phytomonas davidi* to anti-microbial substances. Plant Dis. Reporter 67 (8):855-857. 1983.

Phytomonas davidi a plant infecting protozoan of the *Phytomonas* genus was exposed to the biotic action of 14 antimicrobial substances in liquid growth media. Cycloheximide, crystal violet and a compound named TC 1474 inhibited the pathogen growth at concentrations of 0.1 to 1 mu. g./ml of medium. The autitrypanosomals homidium bromide and berenil inhibited the growth at concentrations of 370 and 111 mu. g/ml., respectively, whereas quinine HC1, trypanomycin and sulfaquinoxaline had little or no effect at 1 mg./ml. Three antibaterial and two antifungal compounds had little effect on growth of *P. davidi* indicating a posible value in formulating selective media. *P. davidi* collected from naturally infected *chamaesyce hypericifolia* and placed in dilutions of the growth inhibiting compounds, reacted similarly except to cycloheximide, which showed little or no direct toxicity to wild or cultural *P. davidi.* None of the tested substances had activity against the organism in *Ch. hypericifolia* plants treated by root immersion.

118. MC COY, R.E. and MARTINEZ LOPEZ, G. *Phytomonas staheli* associated with coconut and oil palm diseases in Colombia. Plant Disease Reporter 66 (8):675-677. 1982.

Phytomonas staheli Mc Ghee and Mc Ghee was observed in tissue samples and sap from widely separated regions in Colombia. Light and transmission electron microscopy showed these organisms in sieve tube elements of the phloem of the root system, bud and inflorescences. Flagellates were present in dwarf coconut plants affected with "Marchitez sorpresiva", at Tumaco, on the Pacific coast near the border with Ecuador, in mature disease oil palms from the Amazon Basin and in young African oil palms of the so called nine case (caso nueve) syndrome in the North Central part of Colombia. The organisms found were indistinguishable from *P. staheli*.

The authors report that preliminary attempts to culture the pathogen failed.

119. MC COY, R.E. Flagellated protozoa threatening new plant pathogens from South America. Proceedings of the Florida State Horticultural Society 94:220-221. 1981.

Locations where several recently described lethal diseases of coconut and oil palms in South America and the Caribbean are given. Those diseases have been found to be associated with Trypanosomes of the *Phytomonas* genus. There is a general description of a *Phytomonas* species, including measures and morphological characteristics of the promastigote form with its flagellum and kinetoplast. There is a brief summary of historical accounts in connection with the discovery of the plant flagellates and the first reports of the diseases of coconuts and oil palms named as "Hartrot", "Cedros Wilt" and "Marchitez sorpresiva"."

In dealing with the list of economically important host plants the author gives specific comments on the "phloem necrosis" of coffee and its pathogen *Phytomonas leptovasorum* reported from Suriname, Guyana, Brasil and Colombia.

The "Hartrot" disease of coconuts is reviewed providing informations on characteristic symptoms and techniques to detect the presence of flagellates in roots, inflorescences bud and other plant parts. Special comments are made to the work of R. Griffith from Trinidad, who claims that Cedros Wilt is a disease caused by *Phytomonas elmassiani* being the lygaeid *Oncopeltus cingulifer* stal. the insect vector that carries the pathogen from the flagellated host plant *Asclepias curassavica* L. to the coconut palms. Griffith's evidence that *Mecistorhinus picea* Palisot de Beauvois is responsible for palm to palm spread of *ph. elmassiani* is also presented.

Other special comments are presented in connection with the "Marchitez sorpressiva" disease (Sudden Wilt) from Colombia, Peru, Ecuador and Suriname. There is a general description of symptoms but clearly points out that more than one type of sudden wilt may be found in Colombia; the so called "Caso nueve" (nine case) in the Central Magdalena Valley of Colombia is described saying that in this case only palms of less than 3 years old are affected.

The author mentions that the Malayan Dwarf coconut being resistant to the Lethal Yellowing disease, is susceptible to the pathogenic action of *Phytomonas staheli*. He considers this a threat to Florida USA and nearby islands in the West Indies.

120. Mc COY, R.E. and MARTINEZ LOPEZ, G. Occurrence of flagellated protozoa in "Case-9" disease of African oil in Colombia. *In* Meeting of the International Council on Lethal Yellowing, 4th., Fort Lauderdale, Florida, U.S.A. 1980. Proceedings. Fort Lauderdale, Agricultural Research Center Institute of Food and Agricultural Sciences, University of Florida. Publication FL-80-1. 1980.

This paper deals with the so called "Case-9" which refers to a disease observed at the Colombian plantation "Monterrey" in the Middle Magdalena Valley, near Puerto Wilches. The disease was found in young oil palms and, acording to the authors, Case-9 is similar to sudden wilt (Marchitez sorpresiva) in that the primary symptom is a rapid collapse and "burning" of the foliage, but with significant differences in the general symptomatology and epidemiology. The authors report that the differentiation of "Case-9" from the standard sudden wilt disease of the oil palm in Colombia is a recommendation made by O. Jimenez and A. Reyes from the Monterrey plantation. Young leaf base samples collected from a diseased palm contained flagellated protozoa, similar to the *Phytomonas* found in sudden wilt diseased oil palms and Hartrot diseased coconut plants.

121. Mc GHEE R.B. and PSTELL F.J. Transmission of the trypanosomatid flagellate *Phytomonas davidi* a symbiont of the Euphorbiaceae by the hemipteran bug *Pachbrachius* (*bilobata*) *scutellatus*. Journal of Protozoology 29 (3):445-448. 1982.

The trypanosomatid *Phytomonas davidi* is found in the latex of several plants of Euphorbiaceae family, including *chaemaesyce hirta* and *Ch. hyssopifolia*, to lattitude 32°N in U.S.A. The hemipteran *Pachybrachius - bilobata - scultellatus* (Lygaeidae) is the insect vector from plant to plant.

Flagellates found in the salivary glands of the bug were about half the size when compared with the size of the flagellates found in plants or in the gut of the insect.

The authors report that 58, 77% of the *Ch. hypericifolia* plants from Lake City, Fla. U.S.A., was found contaminated with *Ph. davidi*.

Informations are given about the transmission trials made with several insect species and *Ch. hirta* seedlings. *P. bilobata scutellatus* was the only species that transmitted the pathogen to non infested *C. hirta* seedlings. Again, 6 to 12 clean *C. Hirta* seedlings exposed to 40 *P. bilobata scutellatus*, collected from infected *Ch. hirta*, from St. Simons Island (Georgia, USA), showed *Phytomonas* infection two weeks later.

122. Mc GHEE, R.B. Report on investigation of Hartrot disease in coconut and oil palm of Suriname S.A. Unpublished report, Paramaribo, Suriname. Landbouw proefstation, 10p. 1981.

There are some introductory paragraphs giving historical accounts about the discovery of the *Phytomonas* sp. and the diseases associated with them in Suriname, including "phloem necrosis" in coffee, "Hartrot" in coconuts and "Marchitez sorpresiva" in oil palm.

R.B. Mc Ghee, M.V. Parthasarathy and H.E. Moore Jr. made a technical visit to Suriname from July 12 to August 1, 1977. The following results were accomplished in such a visit: (1) Giemsa stain was adapted to detect the presence and study the morphology of *Phytomonas*; (2) *Ph. elmassiani* was found in the latex of *Asclepias* curassavica, *Ph. davidi* in *Chamaesyce hirta*, *C. prostata C. hypericifolia* but not in Euphorbia heterophylla. No parasites were discoverd in Ficus or *Coffee*. (3) Five

nutritional media were tested. One diphasic medium consisting of chicken blood agar and Phillips' medium as overlay, sustained growth and reproduction of the organism for 8 days. (4) A comparative study of *Phytomonas* from oil palm showed that this organism was identical to *Phytomonas* from coconut but different from other examined. (5) Reproduction of the parasite was, as previously observed by Parthasarathy, by binary fission, mainly. (6) *Ph. elmassiani* and *Ph. davidi* are transmitted from plant to plant by hemipteran species. With local technicians a search was made to capture hemipterans in the vicinity of diseased trees. Some trypanosomatids were discovered in the intestinal tracts of bugs of the Pentatomidae family.

There are recommendations on the next actions to perform including the suggestion to form a new species for the *Phytomonas sp.* affecting coconut and oil palm.

The results just mentioned were taken in consideration for a new visit to Suriname, from March 22 to April 5, 1981 and specific recommendations were made to study the morphology, ultrastructure, cultivation and transmission of *Phytomonas staheli*. Some details for specific techniques are outlined.

123. Mc GHEE R.B. and COSGROVE W.B. Biology and physiology of the lower Trypanosomatidae. Microbiological Reviews 44(1):140-173. 1980.

This is a detailed review of 295 related papers and specialized publications. Two main topics are discussed in connection with the trypanosomatid organisms. Under the "general biology and sytematics" heading several aspects are analyzed in detail. The taxonomic status of the six genera under the Trypanosomatidae family is reviewed with appropriate comments about existing problems originated by errors, misinterpretations of morphological stages, mixed infections, and poorly controlled experimentation. In connection with the *Phytomonas* genus six species are so far considered, each from a different family of plants. Distribution, ecology and pathogenecity and possible zoonosis are topics conveniently discussed with reference to specific examples, including the case studies with *Phytomonas leptovasorum*, Ph. *davidi*, Ph. *elmassiani* and Ph. *staheli*.

The last 14 pages of the publication deals with aspects of "cell biology and physiology of the lower trypanosomatids". Special comments are presented in connection with the cell surface and plasma membrane, with the cytoplasmic organelles and the Kinetoplast-Mitochrondrion complex, with the nucleous and cell division, with the flagellar structure and its activity, and with the endosymbiotes. Several examples and references to specific cases, conditions and related experiences are provided to fully document all comments and opinions. Several graphs and data are included in the publication.

124. Mc GHEE, R.B. and Mc GHEE, A.H. Biology and structure of *Phytomonas staheli* sp. n., a Trypanosomatid located in sieve tubes of coconut and oil palms. Journal of Protozoology 26 (3):348-351. 1979.

This paper contains basically the results of a mission carried out in Suriname. The mission was organized to study the Hartrot disease of coconut and oil palms.

A flagellated protozoan of the *Phytomonas* genus was found in the phloem of diseased oil palms and coconuts early in 1976. This pathogen has been subjected to several studies.

Flagellate rearing attempts were made, using several nutritional media. Blood agar slants with 5 different types of blood overlayed with a liquid phase were tested for flagellate rearing; penicillin and streptomycin were used as antibiotics. The following

results are reported by the authors: (a) Detection of parasites in Giemsa's stained preparations; (b) Survey for *Phytomonas* in other plants; (c) Cultivation attempts, and (d) Comparison of morphologic characteristics of *Phytomonas* from Palmae, Asclepiadaceae, Euphorbiaceae and Rubiaceae.

From the four cultivation attempts only one tube slant containing chicken blood showed appreciable multiplication of phytomonads but the population declined and failed 8 days after the inoculation. From the comparation of the morphologic characeristics, and the results of other related studies, the authors conclude that the Phytomonads found in "Hartrot" affected coconut palms and "Marchitez sorpresiva" affected oil palms are identical but both differ from *Ph. davidi, Ph. elmassiani, Ph.bancrofti* and *Ph. leptovasorum*.

Anticipating that much more work remains to be done, the authors consider they have observed a strict family host specificity among *Phytomonas*. As final diagnosis the *Phytomonas staheli* sp. n. is described from the oil palm (*Elaeis guineensis*) and the coconut palm (*Cocos nucifera*) of Suriname and South America. The slender flagellates are of the promastigote type with mean measures of $20.8 \pm 3.5 \times 0.5 \pm 0$ um for the oil palm organism, and $19.9 \pm 3.0 \times 0.6 \pm 0.08$ um for the coconut pathogen.

125. Mc GHEE, R.B. and POSTELL, F.J. Axenic cultivation of *Phytomonas davidi* Lafont (Trypanosomatidae), a symbiote of lactiferous plants (Euphorbiaceae). The Journal of Protozoology, 23 (2):238-241. 1976.

Phytomonas davidi, originally discovered by Lafont on *Euphorbia pilulifera*, in 1909, has been found also in *E. gemella Lagasca*, *E. hirta* L. (usually considered synonimous with *E. gamella*), *E. hypericifolia* L. and in one instance in *E. cyathophora* Murray, in U.S.A. This latter species is probably best referred as *E. heterophylla* L. This plant, collected in 1969, was transplanted to Athens (Georgia) for cultivation purposes.

The authors report in this paper the successful cultivation of *P. davidi* and some of its morphologic and biologic characteristics. There is an appropriate information about the nutritional media they used and the modifications they introduced. After giving a good summary of useful informations about the cultural techniques they used, and about the experimental conditions under which the research was conducted, they report that successful cultures could be established in diphasic medium consisting of duck blood agar and modified Phillip's medium as overlay. They report that optimal growth was obtained using Mansour's medium, as overlay, and poorest growth when the Cowperthwaite's medium was used for the same purpose but buffered at pH 5.0. Cultivation of the parasite resulted in marked alteration of the structure; marked changes tending toward choanomastigotes, rather than the elongate twisted promastigote form, were observed too.

126. Mc GHEE, R.B. and HANSON, W.L. Changes in structure of *Phytomonas elmassiani* in experimental infections of Apocynaceae, a presumably foreign host. Journal of Protozoology 18 (1):80-81. 1971.

They say that the structure of *Phytomonas elmassiani* is influenced by the environmental conditions. This implies that flagellates taken from the latex of Euphorbs may change, in the morphological aspect, when passed to the environmental conditions of the palm phloem.

They report positive results in transmission trials using *Oncopeltus fasciatus* Dallas as insect vector of *Ph. elmassiani*.

127. Mc GHEE, R.B. and Mc GHEE, A.H. The relation of migration of *Oncopeltus fasicatus* to distribution of *Phytomonas elmassiani* in the Eastern United States. Journal of Protozoology, 18(2):344-352. 1971.

Several studies with flagellate host plant species are reported in this paper. From 4866 plants of the Asplepiadaceae family, 291 (6%) belonging to 11 different species (9 not previously reported) were found to be infected by *Phytomonas elmassiani*. The great majority of the infected species belonged to the *Asclepias* genus. The infected plants were located from 25, 5° to 41, 0°N latitude and from 74, 0° to 90, 5° west longitude, in USA. *Asclepias curassavica* was found to be infested with *Oncopeltus fasciatus* and to harbour flagellates all the year around in the southernmost part of USA.

The authors report that usually, but not always, the flagellate infection is correlated with presence and abundance of insect vectors. In some areas the *Lygaeus kalmii* was associated with flagellate host plants. This insect is capable of transmiting the pathogen too.

The authors say that flagellosis due to *P. elmassiani* may be maintained in nature through its presence in a perennating annual (*A. curassavica*) in the southernmost parts of USA, through the occasional re-emergence of vernal growth from a previous year's infected root crown, through low grade transmission by *L. kalmii*, and through migration of infected *O. fasciatus* from the South of the country to the northern regions, spreading infection wherever and whatever asclepiad species it may find to feed upon.

128. Mc GHEE, R.B. and HANSON, W.L. Comparison of the life cycle of *Leptomonas oncopelti* and *Phytomonas elmassiani*. The Journal of Protozoology, 11(4):555-562. 1964.

The results of the studies on the incidence of infection of *Asclepias syriaca*, with the trypanosomatid *Phytomonas elmassiani* and the life cycle of this parasite under laboratory controlled conditions are here reported. A well documented description of the techniques and experimental procedures used is provided.

The authors report that once the phytomonad is ingested by the bug *Oncopeltus fasciatus*, the reproduction of the organism apparently ceases. The growth of individual phytomonads continues until giant forms are reached in about ten days after the ingestion; those giant forms are present in the haemocoel and, after about 12 days, similar forms may be foundin the insect's salivary glands where fission takes place with formations of forms similar to the ones found in the plant. Other information refers to the fact that about two weeks after these infected bugs had fed on non infected milkweed plants, parasite may be found in the plant's latex. In comparing the behaviour of *Leptomonas oncopelti* the authors say that the lack of reproduction inside the digestive

tract, the formation of giant forms and the migration to the salivary glands contrast markedly with *P. elmassiani*. In *L. oncopelti*, budding is the procedure to form leismaniform organisms which are supposed to be the infective stage of this leptomonad.

All of the laboratory observations are well explained and many graphic illustrations are included in the paper.

129. MENA TASCON, E. y MARTINEZ LOPEZ G. Identificacion del insecto vector de la Marchitez sorpresiva de la palma Africana (*Elaeis guineensis* Jacq.). Fitopatologia Colombiana 6 (1):2-14. 1977.

Studies oriented to identify the insect vector of the "Marchitez sorpresiva" causing pathogen in oil palm, in Colombia, indicated that the pathogenic entity is transmitted by adults of the cixiid *Myndus crudus* (*Hplaxius pallidus* Caldwell) Van Duzee. The insect feeds on the root crown of *Panicum maximum* and other gramineous species, as a nymph, and on the leaves of oil palm and other plants as adult.

Characteristic symptoms of the disease showed up in 13 out of 100 palms previously subjected to the feeding process of 6 to 19 young adults (on each palm) which were first infected by making them feed for 24 to 48 hours on "Marchitez sorpresiva" affected oil palms. The minimum feeding time on the healthy 5 to 6 year oil palms were 12 days. The first disease symptoms were seen after 93 days of incubation period, with an average period of 147, 9 days. Similar symptoms developed in two of 100 non inoculated control palms and none in the 20 palms subjected to the feeding action of 30 young adults not previously contaminated on diseased palms. Other transmission trials were performed by means of injections of sap and plant juice from diseased palms. The injections were accomplished through a hole made in the trunk of healthy six year old palms, near the meristematic zone. In the first trial the characteristic symptoms of the disease appeared in eight out of 20 injected palms (40%), 220 days after the treatment, using 500 ml. of undiluted sap-juice per palm. In 10 palms in which the sap-juice was diluted in 1 to 1 proportion in rain water the transmission of the disease was accomplished in only 1 palm (10%). In the 30 non treated control palms the disease showed up in 3 of them (10%).

A second test was performed in a healthier area of the plantation. In this trial the sap was used undiluted injecting 500 ml. per palm. 50 five to six year old palms were treated leaving 50 more as controls. The disease symptoms appeared on 28 of the treated palms after 175 days; no disease palms appeared in the 50 non treated palms. The average incubation period was 161 days with a minimum of 74 days.

The authors say these results confirm the pathogenic origin of the disease and the vectorial activity of the insect.

130. MENA TASON, E., VALLEJO, G. y MARTINEZ LOPEZ, G. Evidencias de la Marchitez sorpresiva de la palma Africana en el hibrido interespecifico Noli (*Elaeis oleifera* Gaertn.) x palma Africana (*Elaeis guineensis* Jacq.). In Congreso de la Asociacion Colombiana de Fitopatologia, 2 do., Bogota, Colombia, 1976. Resumenes.1976. p.33.

The main finding of the authors is the high susceptibility of the interspecific hybrid American oil palm (*Elaeis oleifera* Gaertn.) x African oil palm (*Elaeis guineensis* Jacq.) to the "Marchitez sorpresiva" disease, in Colombia. This is the first report on the subject matter.

131. MENA TASCON, E. y MARTINEZ LOPEZ, G. Posible transmision mecanica del agente causal de la Marchitez sorpresiva de la palma Africana (*Elaeis guineensis* Jacq.). *In* Congreso de la Asociacion Colombiana de fitopatologia, 2 do., Bogota Colombia, 1976. Resumenes, 1976. p.49.

The authors report positive results in mechanical transmission trials of the suspected "Marchitez sorpresiva" causing pathogen, in oil palm, in Colombia. The technique used included the injection of sap and plant juice taken from the stem of diseased oil palms, through a hole in the stem of healthy oil palm plants. The hole was about 2.5 cm in diameter and it was bored near the apical meristem.

132. MENA TASCON, E. y MARTINEZ LOPEZ G. Transmission de la Marchitez sorpresiva de la palma Africana (*Elaeis guineensis* Jacq.) por *Haplaxius pallidus* Caldwell (Homoptera: Cixiidae). In Congreso de la Asociacion Colombiana de Fitopatologia 2 do., Bogota, Colombia, 1976. Resumenes. 1976. p.43.

The basic information of this paper is the identification of *Haplaxius pallidus* Caldwell (a Cixiid plant hopper that nowdays is named *Myndus crudus* (Van Duzee), as the insect vector of the "Marchitez sorpresiva" (Sudden wither) causing pathogen in Colombia. The insect breeds and feeds during the nymphal stage on the *Panicum maximum* Jacq. grass, as well as on other gramineous species.

The experiences here reported are the transmission trials using *M. crudus* as insect vector. The insects were first contaminated with the suspected pathogen by making them feed on "Marchitez sorpresiva" diseased palms and then placing them on healthy oil palms. The reproduction of the disease symptoms was the confirmatory proof.

133. MENA TASCON, E. *et al.* Effecto del uso de insecticidas y control de malezas en la incidencia de la Marchitez sorpresiva de la palma Africana (*Elaeis guineensis* Jacq.). Revista Colombiana de Entomologia 1 (1);9-14. 1975.

Previous studies on the "Marchitez sorpresiva" disease (Sudden Wither) of oil palm in Colombia showed a possible relationship with the grass *Panicum maximum*. The results of some detailed studies are given in this paper.

805 days of continued observations showed that in oil palm plots in which weed and insect control was exerted the rate of palm mortality was 2, 3%; in plots where the weed or only the insects were controlled the palm mortality was 12, 8 and 34, 6%, respectively. In the plots with no weed and insect control (check plots) the disease caused the mortality of 53% of the palms.

The authors consider that these results suggest that the disease might be caused by a pathogenic organism which could be carried by an insect species. A possible association is reported between the disease and the presence of adult forms of the Cixiid *Haplaxius pallidus* Caldwell (nowadays known as *Myndus crudus* (Van Duzee), which during the nymphal stages feeds on the grass and as adult on the leaves of oil palm and other plant species. The *P. maximum* grass was the predominant weed species at the Risaralda plantation, in Colombia, where the disease was first detected, the authors say.

The experimental plots were two hectares each in size. The weed control was achieved by a combination of mechanical tools and the use of Diuron and Paraquat. The insect control was performed with regular application of Malathion sprayed on the plants and to the surface of the soil. The paper provides numerical data and graphs.

134. MENENDEZ, T. Informe sobre aspectos geneticos del programa de mejoramiento de palma Africana del Instituto Colombiano Agropecuario, ICA. Bogota, Instituto Colombiano Agropecuario, Programa de Oleaginosas Perennes. 1974. 10p. (Unpublished Internal Report).

In dealing with the "Marchitez sorpresiva" of the oil palm a brief historical account is provided by the author. There is a general description of symptoms of the disease, including the observation that the problem usually begins near the river banks.

Of special importance are the comments that many discrepancies are found among the disease descriptions provided by several authors. As examples he points that the "chlorotic state", referred by A. Sanchez Potes, is not always present; in other cases the association with the rotting of the bud or the spear is not a true condition of the disease. He says also that the period to die varies from two weeks to several months suggesting two forms of "Marchitez sorporesiva".

In other comments he indicates that genetic resistance to the disease may be found in the interspecific hybrid *Elaeis oleifera* x *E. guineensis*.

135. MEUNIER, J., BENOIT, H. and DOLLET, M. Diseases of uncertain etiology and varietal resistance of coconut. Reunion del Comite Tecnico Regional de Sanidad Vegetal (Area Central IICA), 4a., Cancun, Mexico, 1983. Mimeograph. 4p. 1983.

This is a rather general publication in which several aspects are briefly commented. The authors point out that many papers have been published on the disease aspects of coconut but some of them are more emotional than scientific contributions. They say that numerous yellowings, rottings, witherings, decayings and abnormal conditions, show by their name imprecision of knowledge and give the idea that there are as many diseases in localities where coconut is planted. Within the flagellate protozoa diseases they mention "Hartrot" in Suriname and "Cedros Wilt" in Trinidad.

In connection with varietal resistance to diseases they say that the situation is similar. The available information gives the idea that there are as many coconut "varieties" as harvest or introdution places. In connection with "Hartrot-Cedros wilt" disease of coconut they mention that some Suriname Tall and perhaps the West African Tall (WAT) could have some resistance factors but Dwarfs seem to be rather sensitive to the disease.

136. MOLYNEUX, D.H. and ASHFORD, R.W. The biology of Trypanosoma and Leishmania. Parasites of man and domestic animals. London, Taylor and Francis, 1983 pp.3-13.

The *Phytomonas* genus is included under the Subphylum Mastigophora, order Kinetoplastida and family Trypanosomatidae. This classification is made because of the morphology and particular cellular structure of the organisms.

137. NIESCHULZ, O. Die parasitschen Protozoen der Pflanzen. *In* Handbuch der pathogenen Protozoen. Leipzig, Von Prowazek, 1925. pp.1799-1813.

The current knowledge on the distribution of amoeba, flagellates and spirochetes in plants and lists of host plants are given. Among other informations the author reports that flagellates have been found, in plant species belonging to the Euphorbiaceae, Asclepiadaceaae, Apocynaceae, Sapotaceae, Urticaaceae and Cruciferae families. For the *Leptomonas* (*Phytomonas*) *dividi* protozoan the life cycle is described. Among other additional information the pathogenesis of the latex inhabiting flagellates and the results of some cultivation attempts are briefly discussed.

138. NOLLER, W. Die nachsten Verwandten der Blutflagellaten und ihre Beziehungen zu den blutbewohnenden formen. *In* Handbuch der pathogenen Protozoen. Leipzig, Von Prowazek, 1931. pp.1969-2143.

This paper presents a general review of blood and other related flagellates. Appropriate attention is given to the host range for the *Phytomonas* genus and an extensive list of plant flagellates with their respestive host plant species is included.

139. NORRIS, R.C. and Mc COY, R.E. Collection of palm samples for electron microscopic examination. Fort Lauderdale. Agricultural Research Center. Institute of Food and Agricultural Sciences. University of Florida. Research Report FL-82-4. 1982. 6p.

This paper provides a sampling technique for electronic microscope (x-ray emision) examination of plant tissues. In dealing with coconut samples of "Hartrot" affected palms, the unopened inflorescences, the basal parts of not yet emerged leaves and the stem parts within 15 cm. from the apical meristem, are recommended.

140. OCHS, R. Estudio de la situacion de las plantaciones de Risaralda. Paris, Institut de Recherches pour les Huiles et Oléagineux (IRHO), 1971. 12p. Unpublished Report.

This is a restricted distribution report in which the author summarizes the up to date knowledge on the "Marchitez sorpresiva" (Sudden wither) of the oil palm at the Risaralda and other oil palm plantations in Colombia. Several hypotheses were proposed to explain the origin and cause of the disease, including the soil factors, the physsiological aspect, and the entomological pathological entities. The author reports that the improved soil management resulted in a better color and growth of palms but with no effect on the disease. The physical condition of the soil, the climate charcteristics and the wind did not have any direct effect on the disease; the same was true with the plant nutrition. The chinch bug *Scaptocoris divergens* was discarded as the cause for the "Marchitez sorpresiva", and the fungi, bacteria and viruses were also excluded from the list of suspected causes. The disease continued to be of unknown origin.

141. OLIVEIRA, D.P. de *et al.* Estudos com *Phytomonas staheli* Mc Ghee and Mc Ghee na Bahia, Brasil. *In* Mesa Redonda Latino-Americana sobre "Palma Aceitera" (Dendé), 3a., Belem, Brasil, 1984. Resumenes. s.p.

The "Marchitez sorpresiva" disease is becoming an important oil palm disease in Brasil. It is associated with the parasite *Phytomonas staheli*. There is a rather detailed description of symptoms, including spear rot and an eventual affection of the apical meristem. The disease may kill the plant within 4 to 5 months after the initial symptom is seen.

Experimental reproduction of the disease has not been achieved because all attempts to cultivate the suspected pathogen under laboratory conditions, have been unsuccesful. Efforts to cultivate the pathogen, under laboratory conditons had permitted only an extended survival of 12 hours using 3% sorbitol.

The paper describes some ultrastructural aspects of the pathogen and the initial attempts to control the disease.

142. OLIVEIRA, D.P. de e BEZERRA, J.L. Ocorrencia de "Marchitez sorpresiva" do dendezeiro no Estado da Bahia, Brasil. Revisita Theobroma 12 (2):107-108. 1982.

Identical symptoms to those observed in oil palms affected by "Marchitez sorpresiva" disease in Colombia have also been detected in an oil palm plantation at Una, South of Bahia, Brasil. There is a general description of symptoms.

The initial diagnosis of the disease, in an 18 year old oil palm plantation, in January 1982, was based on external symptoms and later on confirmed with laboratory analysis. The microscopic examination of tissue samples showed the presence of a flagellated protozoan of the *Phytomonas* genus in the sap of diseased palms. There is a general description of the technique used to process the tissue samples, including the staining procedure.

143. OLLAGNIER, M. Oil palms and coconut palms. The Courier No. 82: 72-76. 1983.

This paper presents some statistical information with figures of oil palm and coconut products produced during the last 20 years.

There is a general review of the research programs and achievements with special reference to the activity performed by the Institut de Recherches pour les Huiles et Oleagineux (I.R.H.O.), including genetic aspects, tissue culture, plant sanitation, and other topics. He points out that plant sanitation problems are more serious in oil palm in America because the plant is not yet adapted to the American environment. In connection with "Marchitez sorpresiva" the author says that the French researchers are busy trying to learn much more about the associated flagellate protozoan and the design of better techniques for the control of the disease.

144. PARTHASARATHY, M.V. A preliminary report on Trypanosomatid flagellate associated Hartrot disease in coconut and oil palms of Suriname, South America. Ministry of Agriculture, Animal Husbandry and Fisheries. Landbouw proefstation, Paramaribo, Suriname. Internal Report No. 1035, 1981. 7p.

Accepting first that there is an association of Trypanosomatid flagellate *Phytomonas* with the "Hartrot" disease of coconut and oil palms in Suriname, he presents a report of activities and progress in connection with the technical visit he made from March 27 to April 6, 1981, to Suriname.

The structural relationships between coconut palm tissues and Phytomonas were a matter of study through the process of tissue samples under laboratory conditions. Slides for microscopic examination were prepared and tissue samples of several plant parts were prepared for further electron microscopy analysis at Cornell University.

Attempts to culture *Phytomonas* with special reference to *Ph. staheli* are reported along with the preliminary findings which were not quite satisfactory because of contamination problems with the nutritional media. The effect of several drugs was evaluated against *Ph. staheli*. Although more experimental evidence is needed, the author says, preliminary data shows that 1% oxaphenylarsin is extremely effective on the pathogen. The effect of tonicity and pH on the flagellate were also studied.

Several discussions and workshops were held with technicians on different topics, including entomological aspects and laboratory techniques.

There are eight recommendations in which the technical adviser includes a broad program of work. He recommends to investigate the host pathogen relationship and the study of the life cycle of the suspected insect vector *Macropyguim reticulare*. Some guidelines for the laboratory cultivation of *Ph. staheli*, to continue with the evaluation of endrin insecticide under field conditions, and to continue with the evaluation of genetically resistant varieties and hybrids of coconuts and oil palm, among other related recommendations are given.

145. PARTHASARATHY, M.B., Mc GHEE, R.B. and Mc GHEE, A.H. Structural relationship between coconut palm tissues and *Phytomonas*, the presumed pathogen of Hartrot. *In* Colloque international sur la protection des cultures tropicales. Lyon, France, 1981. Resumes, p.63.

The authors say that having established the association of trypanosomatid flagellate *Phytomonas* with the "Hartrot" disease of coconut and oil palm in Suriname, some aspects of the structural relationship between the plant host and the flagellates are reported here.

Structure of the phloem in various organs of the coconut palm and sizes of *Phytomonas* found in the phloem of different organs of affected palms were studied; size range of the pathogen is variable, especially in young inflorescence axes. Numerical data are provided. From these evaluations the authors conclude that flagellates with a diameter of up to 0.3 um can, conceivably, pass through the narrow sieve plate pores in the phloem of secondary inflorescences axes. A detailed structural analysis of infected inflorescences and unexpanded leaf bases indicated that phloem in many vascular bundles in those organs contained flagellates. The presence of flagellates in large amounts in the vascular bundles and its implication on phloem transport is also discussed.

146. PARTHASARATHY, M.V. and SLOBBE, W.G. VAN. Hartrot or fatal wilt of palms. I Coconuts (*Cocos nucifera*). Principes 22 (1):3-14. 1978.

This paper presents a short historical account of the disease since 1908 when it was first reported in Suriname.

The authors provided a detailed description of the disease symptoms as these were seen in a Malayan Dwarf variety. As a special comment they say that rotting of the spear leaf and apical region or "Palm heart" is apparently due to the secondary infection of bacteria and other organisms. They say also that in view that rotting of the spear leaf and apical region is not the primary symptom, the term "Hartrot" is perhaps not the best as far as the characteristic symptom of the disease is concerned.

In a comparison with the symptoms of other similar diseases the authors point out the distinctive characteristics that make possible not to confuse the "Hartrot" disease with "Lethal Yellowing" or "Bronze leaf" wilts, for instance. If there is a single feature to distinguish "Hartrot" from all other wilting diseases is the presence of flagellates in the phloem of differentiating organs; these organisms belong to the *Phytomonas* genus. A technical procedure to check for the presence of flagellates in some organs of the affected coconut plants is provided.

Preliminary attempts to culture the flagellates failed. From the preliminary observations on the effect of drugs on the flagellates, the authors report that no control was achieved with penicillin, streptomycin, oxytetracycline, tryparsamide or Berenil, in vitro or in vivo.

The authors conclude that although the causative agent of "Hartrot" is yet to be proved according Koch's postulate, there is enough circumstantial evidence to suggest that the flagellate *Phytomonas* could be causal entity.

147. PARTHASARATHY, M.V. Observations on the phloem inhabiting flagellate *Phytomonas* in palms. *In* Meeting of the International Council on Lethal Yellowing, 3rd., Palm Beach County Fla., U.S.A., 1977. Proceedings. Fort Lauderdale Fla., U.S.A. Agricultural Research Center Institute of Food and Agricultural Sciences. University of Florida. Publication FL-78-2. 35p.

Trypanosomatid flagellates of the *Phytomonas* genus were found in tissue samples taken from coconut, oil and maripa palms affected by "Hartrot", in Suriname. The pathogens were 12-22 um in length, not including the flagellum. No significant differences in length were found in the organisms taken from different species of palms. Many of the flagellates appeared twisted and most of the observed organisms were promastigates. Several binary and multiple fissions were seen.

The similarity in length and ultrastruture organization of the flagellates infecting the 3 species of palms suggests that the organisms belong to the same species of *Phytomonas*.

Gives report that 3% concentrations of penicillin, streptomycin, oxytetracycline, Tryparsamide and Berenil had no apparent effect on the flagelates. Only sieve elements heavily infected with flagellates had an electrondense material between the plasmalema and the cell wall. Plastids with starch granules appeared to be rare in sieve elements infected with flagellates. The author says that the preliminary observations suggest that the flagellates induce premature collapse of protophloem in immature inflorescences of "Hartrot" affected oil palms.

148. PARTHASARATHY, M.V. Preliminary studies on the ultrastructure of phloem in coconuts affected by "Hartrot" in Suriname (Abstract). Principes 20:59. 1976.

This reference presents one of the very first notices about the presence of typanosomatid flagellates in the sieve tubes of "Hartrot" affected coconut palms in Suriname. Among other informations the author reports that neither hyperplasia nor necrotic obliteration have been found in the phloem of "Hartrot" affected coconut palms.

149. PARTHASARATHY, M.V., SLOBBE, W.G. VAN and SOUDANT, T.C. Trypanosomatid flagellate in the phloem of diseased coconut palms. Science 192:1346-1348. 1976.

Electron microscopy examination of the phloem of "Hartrot" affected coconut palms from Suriname revealed the presence of a plant-infecting flagellate of the *Phytomonas* genus, in the mature sieve tubes. This is the second report of a trypanosomatid infection in a non-lactiferous plant. These reported findings suggest that the trypanosomatid is associated with the "Hartrot" disease.

The samples of young leaves and inflorescences from coconut palms, that showed different stages of the disease, were collected at three different localities in Suriname, along with comparable tissue samples from healthy palms. No flagellates were found in the plant samples from healthy plants. The flagellates found in the diseased plants were present only in the enucleate mature sieve elements and not in the nucleate cell of the host. There are several electron micrographs of the trypanosomatid flagellate as well as longitudinal and transverse sections of the plant samples and the pathogen.

There is a very detailed description of the morphology and ultrastructure of the organism, including measures. On the basis of their preliminary study, the authors say, that being aware that the presence of the flagellates may be the result rather than the cause of the disease, and that the causal relationship need to be proved according to Koch's postulates, the absence of organisms other than flagellates in the earliest symptom of the disease and the correlated, increase and spread of the flagellates in the sieve tubes as the disease progresses that is a suggestion that the flagellates are pathogenic to their hosts and hence the possible causative agents of Hartrot.

Flagellates do not cause injury to lactifer plants because, they say, lactifers organs (where the organisms are located) are excretory structures containing considerable amounts of particles of the hydrocarbon families of terpenes.

Vectors for the coconut and coffee infecting flagellates have not yet been identified.

150. PAULIN, J.J. and Mc GHEE, R.B. An ultrastructural study of the trypanosomatid, *Phytomonas elmassiani*, from the milkweed, *Asclepias syriaca*. The Journal of Parasitology, 37 (6):1279-1287. 1971.

This paper contains the report of the observations made on promastigotes and flagellate forms of the protozoan *Phytomonas elmassiani* obtained from the latex of infected milkweed plants. The technical procedure used for observations, with the aid of contrast and electron microscopy, is described. Detailed description of the fine structure of *P. elmassiani* from *A. syriaca* is presented along with comparisons with other members of theTrypanosomatidae family. The finding of a paraxial rod lying parallel to the flagellar axoneme, in promastigotes is first reported. The observations on dividing forms is considered by the authors as an indication that replication and growth precedes kinetoplast and nuclear division in prokinetosomes. They report also that equatorial and

longitudinal division may occur in the cells. A lot of explanations and several microphotographs of cell cross sections are included. The examined organisms were: (a) Typical promastigotes, (b) Forms with diminished flagella, and (c) Forms lacking flagella.

151. PETRY, K., BALTZ, T. and DOLLET, M. Monoclonal antibodies for detection of *Phytomonas* sp., flagellate protozoa associated with plant diseases. A.A.B. Virology Group Meeting on "New developments in techniques for virus detection", Cambridge, April 1985. Mimeograph 3 p. 1985.

Intraphloemic flagellated protozoa (Trypanosomatidae) having the same morphology are associated with wilts of oil palm ("Marchitez sorpresiva", coconut ("Hartrot"), and coffee ("Phloem necrosis")). Other plants, such as some of the lactiferous species, are harboring Phytomonas species of similar morphology with no apparent injurious effects. These flagellate host plants may be growing in the same environmental conditions where the oil palm, coconut and coffee species grow and are affected by the diseases mentioned before. Serological studies were undertaken to disclose if: (1) The disease just mentioned are caused by the same or different *Phytomonas*; (2) Can the lactiferous plants be reservoirs of the mentioned diseases; (3) Is it really justified, the arbitrarily created *Phytomonas* genus. Preliminary results are presented and discussed in this paper. The proposed questions cannot be answered with the gathered informations, the author says.

152. POSTELL, F.J. and Mc GHEE, R.B. An ultrastructural study of *Phytomonas davidi* Lafont (Trypanosomatidae). Journal of Protozoology, 28 (1):78-83. 1981.

This paper presents the results of extensive ultrastructural studies of *Phytomonas davidi* obtained from latex of *Euphorbia cyathophora*, from a laboratory culture medium and from salivary glands of *Pachybrachius bilobata scutellatus*. There is a well detailed description of the process used to prepare the samples for the electron microscopy examination.

As general results the authors conclude that from the ultrastructural view point, the *P. davidi* from the three sources does not differ significantly from previously described typanosomatid flagellates, as far as the presence of subpellicular microtubules, kinetoplast mitochondrial complex, K-DNA, and presence of four subflagellar pocket microtubules is concerned. In spite of the above, the authors found (as it is shown in the detailed descriptions and the microphotographs they present in their paper) some differences among the organisms; the concentration of the sub-pellicular microtubules is greater in the organisms from latex, when compared with those found in the insect's salivary glands; the subpellicular microtubules are interconnected by cross bridges in the latex flagellates and, as morphology and devlopment of the mitochondrial cristae is concerned, they report the finding of some variations according to the source of the pathogens. Other informations given by the authors are the extensively developed plate-like cristae observed in organisms taken from culture medium, the sparse tubulare christae seen in the latex forms and the highly developed tubular christae found in flagellates obtained from insects.

153. RENARD, J.L.y QUILLEC, G. Enfermedades destructoras de la palma Africana en el Africa y Sur America. Palmas (Colombia) 6 (1):9-16. 1985. (Reimpreso de Ollagineux 39 (2):57-67. 1984)).

This is a general paper in which several diseases of the oil palm are commented. In connection with "Marchitez sorpresiva" (Sudden wither) the authors provide some historical accounts with statistical figures of losses reported in Colombia. The presence of the disease is also mentioned in Ecuador, Peru, Venezuela, Suriname and Brasil.

They consider it is truly established that the disease is associated with intraphloemic flagellated protozoans, that the presence of the organisms is uneven in the plant and that a fast technique to identify them is the use of a light microscope to examine a drop of sap extracted from roots, meristematic tissue or unopened inflorescences.

There is a general description of the disease symptoms being specific in saying that there is no rotting of the spear, as a general rule.

They consider that the flagellates' vectors are not yet truly determined. They say that several hypothesis were proposed, among which the plant hopper *Myndus crudus* Van Duzee (*Haplaxius pallidus* Caldwell) and the root miner *Sagalassa valida* Walker were mentioned by the only evidence that the insecticidal treatments seemed to show to slow down the progress of the disease, they say. *Macropygium reticulare* (Fab.) has also been linked to the transmission of the disease in Suriname and recent observations point to the possibility that the *Lincus* genus may be equally related with the disease in Ecuador. The Euphorbs, such as *Asclepias curassavica*, are known to harbour flagellates but no relationship has yet been established between the contaminated host plant species and the Marchitez sorpresiva disease.

The interspecific hybrid *E. guineensis* x *E. melanococca* seems to be tolerant to the disease. They consider that the higher phenol content and the sclerotized hypodermis in the hybrid might be resistant factors to the disease.

154. REVELO, M.A. Descontaminacion de insectos vectores como estrategia de control de Hartrot y Marchitez sorpresiva. *In* Congreso de la Sociedad Colombiana de Entomologia, 12 a., Medellin, 1985. Resumenes. pp.74-75. 1985.

"Hartrot" disease of coconuts and "Marchitez sorpresiva" of oil palms are mentioned as special case studies in Suriname and Colombia, respectively. Both diseases are closely associated with a similar species of a flagellated protozoan of the *Phytomonas* genus.

After presenting a summary of the available information contained in about 150 references, he mentions that the associated flagellate species is *Phytomonas staheli* Mc Ghee and Mc Ghee. There is a list of ten flagellate host plant species and eight insect species in which plant flagellates have been found.

A strategy to control "Hartrot" or "Marchitez sorpresiva" in a previsible short term is presented. The technical approach is aimed to render harmless the insect vector species by "cleaning" them from the flagellate contamination. This objective is accomplished through elimination of the infection foci in the plantations and to a distance out of the fly rage of the insect vectors outside the borders of the plantation. Management and control of the contaminated key host plant species is suggested.

155. REVELO, M.A. Economic importance of oil palm and coconut products for the American Tropical countries. Paramaribo, Suriname. Inter-American Institute for Cooperation on Agriculture, IICA Office in Suriname, 9p. 1985. (Unpublished report).

There is an updated information on economic aspects of the coconut and oil palm products including statistical figures about production and consumption in the world.

Within the technological problems of the oil palm and coconut cultivation special comments are given in connection with the "Hartrot" and "Marchitez sorpresiva" diseases. Descriptions of the diseases are provided in individual forms for coconut and oil palm, as they have been observed in Suriname and Colombia. A technical strategy to solve the problems is presented with the assumption that both diseases are of infective type and caused by a pathogenic organism which is assumed to be a flagellated protozoan of the *Phytomonas* genus. The strategy is based on the facts that the pathogen needs insect vectors to move from one plant to another. Several technical approaches are presented and commented on in detail.

156. REVELO, P., M.A. Hartrot-Cedros wilt disease of coconut and oil palm. Technical report and strategy to control the disease in Guyana. Paramaribo, Suriname, Inter-American Institute for Cooperation on Agriculture, IICA Office, September 1985, 20p. (Unpublished report).

The point 1. of the report is a documented summary of historical accounts and known technical facts from many American countries. Point 2. deals with economic aspects of the disease on the coconut palm species, including estimates of actual and potential damages. Point 3. is a detailed description of symptoms on the coconut palm including the time required to kill the plant after the first symptom is observed. The disease symptoms in oil palm are also presented with many details. Point 4. corresponds to a particular description of the suspected pathogen including morphological details, average size of the organism and particular characteristics of the suspected flagellate species, *Phytomonas staheli* Mc Ghee and Mc Ghee. Point 5. deals with the etiology of the disease in which it is stated that there seems to be no doubts in accepting that flagellates are truly related with the disease, that flagellates are naturally harbored in alternate or primary host plants, and that there must be an insect vector or insect vectors to transfer them from the primary host plant species to the coconut and oil palms and from one to another coconut or oil palm plants. Point 6. updates the present knowledge in connection with insect vector species so far linked with the transmission of flagellate species of the Phytomonas genus, including some of the existing conflicting views among many authors. Point 7. refers to the known facts in connection with host plant species and the relative importance for specific plant flagellates.

Point 8. summarizes the available control recommendations and presents a proposal for an applied control strategy of the disease. This strategy is based in four special items including (a) descontamination of insect vectors; (b) flagellate host plant elimination within pre-established areas; (c) progressive elimination of close sources of infection; and (d) use of chemical weed killers under a normalized program. Other details and time schedule for the control strategy are given.

157. REVELO, M.A. Hartrot-Cedros wilt a disease of oil palm and coconut in Tropical America. Technical review. *In* Mesa Redonda Latino-Americana sobre "Palma Aceitera" (Dendé), 3a., Belem, Brasil, 1984. 28p.

This paper is a detailed technical review of the updated knowledge on "Hartrot" disease of coconuts and "Marchitez sorpresiva" of oil palm. The paper is organized in six sections.

Section 1 includes historical accounts of both diseases, giving information on the initial confusions about the true identity of the "Hartrot" disturbance and the "Marchitez sopresiva" syndrome, until 1976 and 1977 when it was found that both diseases were closely related with a flagellated protozoan of the *Phytomonas* genus.

Section 2 corresponds to the economic aspect of the diseases. Section 3 is a detailed description of the characteristic symptoms of the "Hartrot" of coconuts and "Marchitez sorpresiva" of oil palms, including some existing differences among the two diseases.

Section 4 presents a documented summary of the up to date status of the "Hartrot" research in Trinidad and Suriname, in connection with the etiology of the disease, reports of transmission trials, informations about insect vectors and alternate host plants, taxonomic aspects of the flagellate species, and specific comments on some discrepancies or different points of view of the research work performed in Trinidad and that of Suriname.

Point 5 deals with the available recommendations to control the disease which include preventive measures, weed control and the use of soil applications of the insecticide endrin. For a better solution the researchers are in favor of the genetic resistance of the disease.

Point 6 is basically the presentation of the suggested strategy to eventually get a solution to the problem. The six points of the strategy are the basic research program in which the Surinamese Government and the Inter-American Institute for Cooperation on Agriculture are engaged in a special joint project.

158. REVELO, M.A. Tecnologia fitosanitaria en palma aceitera y cocotero. Problemas clasicos de actualidad en America. In Mesa Redonda Latino-Americana sobre "Palma Aceitera" (Dende), 3a., Belem, Brasil, 1984. 30p.

This paper presents first a historical account of the oil palm and coconut cultivation in America and provides figures on planted areas and yield estimates.

Part of the paper deals with the possibility of use of some vital signs and some morphological and physiological aspects of the plants, in a conveniently selected set of parameters, to evaluate and compare the relative effect of diseases of pathogenic and non-pathogenic nature. Inflorescence development, vegetative dry matter production, growth rate, bunch index, leaf area index, net assimilation ratio, leaf area ratio, and many abnormal physiological conditions are listed.

Section 4 includes the description of symptoms, causal organisms, extent of damage, specific characteristics and control recommentdations for nine of the more important plant sanitation problems of the oil palm and coconut in Tropical America. "Marchitez sorpresiva" (Sudden wither) of the oil palm and "Hartrot" disease of the coconuts are commented with enough details and with updated technical findings and facts.

159. REVELO, M.A. Estado fitosanitario del cocotero en el Litoral Atlantico de Costa Rica. San Jose. Sociedad Alemana de Cooperacion Tecnica (GTZ), 1983. 26p. (Unpublished report).

This report presents the findings and observations made during a plant sanitation survey to the coconut plantations of the Atlantic coastal area of Costa Rica, in the late part of 1983.

In connectin with the prevailing diseases of the coconut palm the author reports the finding for the first time in Costa Rica, of two coconut palms affected by "Hartrot" disease, one of them near the Parismina river mouth. There is a detailed description of the characteristic symptoms of this disease as well as those of the red ring disease and other pathological disturbances.

160. REVELO, M.A. Fitosanidad del cultivo de la palma aceitera. Avances technicos en Latino-America. Fitopatologia. *In* Mesa Redonda Internacional sobre la Palma aceitera Africana, 2a., Tela, Honduras, 1982. Memoria. Tegucigalpa, Honduras, Instituto Nacional Agrario, 11982. pp.204-216.

Appropriate description for all of the most important diseases of the oil palm in tropical America are given. Special comments are available in connection with the "Marchitez sorpresiva" (Sudden wither) of the oil palm, a disease first reported in Colombia, in 1963. There is a symptom description, along with a historical account of the main research activities performed in Colombia, before the flagellated protozoans were found to be associated with "Marchitez sorpresiva" affected oil palms, in 1977. Specific mention is given to the three hypotheses originally considered in trying to find the real cause of the disease.

As the direct role of the root chinch bug *Scaptocoris divergens* is discarded, the possible relationship of the plant hopper *Myndus crudus* Van Duzee (*Haplaxius pallidus* Caldwell) and the grass Panicum maximum is mentioned in connection with the disease.

161. REVELO, P., M.A. Hartrot-Cedros wilt del cocotero y la palma aceitera en Suriname y Trinidad-Tobago. Informe Tecnico. Galfito, Costa Rica. Compania Bananera de Costa Rica, 1982. 35p. Unpublished Report).

This is a detailed technical report of a visit made to Trinidad-Tobago and Suriname to review the research work done on Cedros wilt and Hartrot, respectively, upon request of the Chilenan Office of the Food and Agriculture Organization of the United Nations.

The report is made up of nine different sections.

Section 1. corresponds to the historical accounts beginning with the first notice given by A.W. Drost, in Suriname, in 1908, about the coconut disease he called "Hartrot" and later about the "Fatal wither" of oil palms he saw in Suriname, in 1921.

Section 2. includes detailed description of symptoms of the "Hartrot" disease of coconuts and the "Marchitez sorpresiva" (Sudden wither) of oil palm.

Section 3. is a summarized information on the association of flagellated protozoans of the *Phytomonas* genus with the Hartrot disease. Claims made by R. Griffith from Trinidad that *Ph. elmassiani* and the bacterium *Micrococcus* (*Agilis*) *roseus* are causal pathogens in the Trinidadian Hartrot version are included.

Section 4. is a description of some other related diseases. A detailed account on "Marchitez sorpresiva" in Colombia is provided, including a summary of the research done to find the causal entity of the disease and how to control it.

Section 5. is a rather detailed report of the up to date research done in Trinidad in connection with the "Cedros wilt" disease (Hartrot in Suriname). It includes some general concepts, etiology of the disease, artificial transmission trials, and informations on insect vectors and host plant species.

Section 6. is the updated status of the Hartrot research in Suriname. In this section the author presents the relevant descrepancies of the Surinamese technical findings with some of the research findings and claims of R. Griffith from Trinidad. Among the mentioned discrepancies are the associated flagellate species, the predominant role of the *Asclepias curassavica* as flagellate host plant and source of the inoculum, the predominant role of a bacterium as one of the direct causal pathogen, and the controversial technical aspects of the artificial inoculations performed in Trinidad.

Section 7. is the information on the true occurrence of Hartrot in an interspecific oil palm hybrid in Suriname. This finding is one of the contributions credited to the Surinamese researchers.

Section 8. is the technical point of view of the FAO consultant. It summarizes the technical findings of the "Hartrot-Cedros wilt" research programs in Trinidad and Suriname, including the coincidental aspects and findings as well as the discrepant ones.

Section 9. is a set of technical recommendations, including the suggestion of a tentative research program.

162. REVELO, M.A. Manejo de plagas y plaguicidas en plantaciones de palma de aceite. Temas de Orientacion Agropecuaria. La Palma Africana de Aceite (Colombia). No. 149:189-200. 1981.

This is a paper in which general comments are made in connection with the Management of Insect Pests and Pesticides in Oil Palm Plantations, with special reference to Colombia. There are statistical informations on planted hectares and oil palm production. Special mention is given to the personal contribution of several researchers.

There is a short summary of the insect pests of the oil palm in Colombia and, with a preliminary information about a plant sanitation problem in the Bucarelia plantation, the author explains the technical strategy by means of which it was possible to control, without chemical insecticides, a serious outbreak of the leaf eater *Euprosterna elaeasa.*

There is a short comment on "Marchitez sorpresiva" (Sudden wither) saying that the disease etiology is still not quite understood, even though a flagellated protozoan is suspected to be closely associated with the disease.

163. REVELO, M.A. Manejo de plagas y plaguicidas en plantaciones de palma de aceite en Colombia. *In* Congreso de la Sociedad Colombiana de Entomologia "SOCOLEN", 7a., Bucaramanga. 1980. Memorias. s.n.t. pp.51-66.

In dealing with the "Marchitez sorpresiva" disease (sudden wither) of the Risaralda plantation in Colombia the author says that, in spite that a flagellated protozoan of the *Phytomonas* genus is suspected to be associated with the disease, nothing is completely clear yet and the etiology of the disease is still only partially known. He says also that in the Risaralda case many mistakes were made because there was not enough experience in how to handle pathological problems in oil palm.

164. REVELO, M. Informe de la visita tecnica a la plantacion de palma Africana "Oleaginosas Risaralda S.A." Ministero de Agricultura; Division de Investigaciones Agropecuarias, DIA, Seccion de Entomologia, Bogota, Colombia, 1965. 6p. Unpublished report.

This is a report of observations made in a field visit to the oil palm plantation Oleaginosas Risaralda, in the North East of Colombia. The oil palm plants were three to four years old and the "Marchitez sorpresiva" disease was causing increasing plant killing. Underground and aboveground plant parts were observed in affected and non-affected palms. Plant disections are reported too.

Scaptocoris divergens Froeschner a Cydnid commonly called "Yellow chinch bug" of the roots was the only insect species found in large numbers causing direct damage to the root system of the palm, as deep as 0.8m from the soil surface. Nymphs and adults are reported causing direct damage.

In spite of the serious doubts that this insect is the direct cause of the "Marchitez sorpresiva" the author recommended soil applications of residual insecticides. Endrin and Heptachlor were suggested.

165. REYES, R.A. Antecedentes, estado actual y algunas consideraciones sobre la "Marchitez sorpresiva" de la palma Africana (*Elaeis guineensis*) en Colombia. Palmas (Colombia) 6 (3):71-79. 1985.

The author provides a well documented historical account of the "Marchitez sorpresiva" (Sudden wither) in Colombia, including the research activities undertaken by many local researchers and some foreign visiting technicians.

Specialized comments are given on the agricultural practices and control recommendations to solve the disease problem.

In trying to explain the origin of the disease, he summarizes the negative results of the research made to find if the physical factors were associated with the disease. With the entomological and pathological aspects the direct participation of the root chinch bug *Scaptocoris divergens* was ruled out; the same was done with the nematodes, fungi, bacteria and viruses.

Special mention is given to the transmission trials made with *Myndus crudus* and its relation with the grass *Panicum maximum*. There is also a short comment in connection with the previously suspected insect vector *Sagalassa valida*.The presence of flagellated protozoans of the *Phytomonas* genus, in Marchitez sorpresiva affected plants, in 1976, is considered as the starting point for the new approach to solve the disease problem. He refers to some of the findings in many countries, including Suriname, French Guyana, Trinidad and Ecuador, and to the confirmed vectorial activity of *Lincus* spp. and *M. crudus*.

There is a special comment on the actions taken to control the disease at the Monterrey plantation in the Medium Magdalena Valley, in Colombia. These actions include the removal of diseased palms and the use of endrin application to the soil; other agronomic practices are recommended too.

As a final comment the author recommends further studies on the disease etiology, the search for insect vector species, the inventory of flagellate host plant species and the search for a reliable diagnosis technique.

166. ROLSTON, L.H. A revision of the genus *Lincus* stal (Hemiptera: Pentatomidae: Discocephalinae: Ochlerini). New York Entomological Soceity 91 (1):1-47. 1983.

The genus Lincus is redefined and the *Minilincus Ruckers*, 1958, is placed in synonym.

30 known species of *Lincus* are described in detail and a convenient taxonomic key is provided to help in the identification and recognition. 19 new species are listed. This genus has been widely found in South, Central and Caribbean America.

167. RORER, J.B. Root disease. Report of Mycologist for year ending March 31, 1911 (Part II). Board of Agriculture Trinidad and Tobago. Cir. 4:27-33. 1911.

According to R. Griffith from Trinidad, J.B. Rorer, in early attempts to determine the Cedros wilt causing pathogen, stated "The causal bacterium was grown on beef and potato agar for sometime and successful inoculations were made by pouring a suspension of the culture in the trunk through holes at the crown of the tree". The referred pathogen is the bacterium *Micrococcus* (*agilis*) *roseus* and the "Cedros wilt" disease corresponded to what was called Bacterial Bud-rot in 1911.

168. SALDARRIAGA, V.A. Reconocimiento de plagas en palma Africana en la plantacion Risaralda, Norte de Santander. Bogota, Instituto Colombiano Agropecuario, ICA, Programa de Entomologia, 1972. 7p. Unpublished report.

This paper corresponds to one of the several entomological surveys at the Risaralda oil palm plantation in the North-east of Colombia. This plantation was the first affected by the "Marchitez sorpresiva" (Sudden wither) disease, in 1963, and still of unknown origin at the time of this report. The survey confirmed the presence of the "chinche amarilla de la raiz" (Yellow root chinch) *Scaptocoris divergens* Froeschner and the Cixiid *Haplaxius pallidus* Caldwell (*Myndus crudus* Van Duzee), among not less than two dozens of piercing sucking type insect species feeding on the roots, leaves or fruits, but the general conclusion is that not one of them can be considered as the direct cause of the disease. The direct damage is not powerful enough to kill the palms as swiftly as the "Marchitez sorpresiva" does.

169. SANCHES POTES, A. Enfermedades de la palma Africana en Colombia. *In* Mesa Redonda Latino-Americana sobre "Palma Aceitera" (Dendé). 3a., Belém, Brasil, 1984. 43p.

Descriptions of several diseases of the oil palm in Colombia are given. Among those diseases the "Marchitez sorpresiva" (Sudden wither) is listed. The authors called it "HOJA TOSTADA" also (Toasted leaf) when it first appeared at the Risaralda Plantation in the Zulia Valley, in the North East of Colombia, in 1963, and practically destroyed 2500 ha. in a 15 year time. The disease was also registered in the oil palm plantations of Colombia, Peru, Ecuador, Suriname, Honduras and lately in Brasil. There is a complete description of the disease symptoms, as they were observed at the first affected Colombian plantation. The symptoms are not reversible, he says.

After referring to the initial hypothesis in the attempts made to find the real cause of the disease, the author comments on the finding of a flagellated protozoan in diseased oil palms in Ecuador and Peru, in 1976, giving informations on the parts of the plant where the pathogens can be found and the technique to follow for a fast and sure diagnosis procedure. The finding that the hemipteran *Macropygium reticulare* was detected sucking on the oil palm roots, in 1979, is also mentioned.

A final note is provided on the existence of genetic resistance to the disease in the interspecific oil palm hybrid *Elaeis guineensis* x *E. oleifera.* The author also provides a technical explanation for the resistance in the *E. oleifera* species.

170. SANCHES POTES, A. Enfermedades de la palma Africana de aceite en Colombia. *In* Curso Basico de Capacitacion en el cultivo de la Palma de Aceite. Proyecto TCP-COS-0104. San Jose, Costa Rica, Organizacion de las Naciones Unidas para la Agricultura y la Alimentacion (FAO), Instituto de Desarrollo Agrario (IDA). 1982. pp.190-223.

There is a description of the prevailing diseases of the oil palm in Colombia; the "Marchitez sorpresiva" or "Sudden death" of the oil palm is included among them.

The Marchitez sorpresiva (Sudden wither), also called "Toasted leaf" by the author, is a serious disease not found in any other part of the world besides the tropical American countries. The name was suggested by this author because the characteristic symptoms and the swift evolution of the disease. The disease was first reported in 1963 in Colombia, in the Zulia Valley.

There is a detailed description of the disease symptoms and special comments on the theories by means of which several researchers tried to explain the origin of the disease. None of them but the pathological cause prevailed.

It is interesting to note that when this paper was written the author did not include any comment in connection with the flagellated protozoan found in "Marchitez sorpresiva" affected oil palms in Ecuador, five years earlier. The author lists the fungal pathogens found in the root system of the diseased palms but is quite specific in saying that posterior pathological tests ruled out any relationship with the disease. He mentions also the presence of the root chinch bug *Scaptocoris divergens* and the root miner *Sagalassa valida* but, again, as in the case of the found fungi, he does not believe they are the direct cause of the disease.

The author reports the research done by an official institution, in connection with the plant hopper *Myndus crudus* Van Duzee (*Haplaxius pallidus* Caldwell) and the grass *Panicum maximum*, and the positive results obtained with a combined application of an insecticide and a weed killer. He concludes that the results obtained in this test favor the hypothesis that the "Marchitez sorpresiva" may be caused by a pathogenic entity, which may be transmitted by the plant hopper *M. crudus,* which lives in the grass.

171. SANCHEZ, P.A. Enfermedades de la palma Africana de aceite en Colombia. Temas de Orientacion Agropecuaria (Colombia) No. 149:162-188. 1981.

The main oil palm diseases in Colombia are described in this paper. The "Marchitez sorpresiva" (Sudden wither) disease, also known as "Hoja tostada" (Toasted leaf) is included as one of the more serious pathological problems in the Colombian oil palm plantations. The disease was first reported at the Risaralda plantation in the North East part of Colombia, in 1963. The economic impact of the disease is reported from the stand view point of killed trees; the author says that 56% of the palms planted in 1961

had died by 1971 and that 45% of the palms planted in 1971 had been killed by March 1975. The author estimates that not less than 2300 ha. had been destroyed in Colombia alone, as a consequence of the disease.

There is a rather detailed description of the disease with informations about the pattern of onset and spread in the affected fields. The research projects and the technical actions taken to uncover the cause of the disease and the studies performed in looking for a control procedure are also commented on.

Climatic conditions, soil aspects, excess or shortage of water supply, entomological and pathological aspects and physiological stress are among the investigated causals. The collected data suggested that the most likely cause could be a pathogenic organism, different from fungi, bacteria, virusses and mycoplasmas, that may be transported by an insect vector. The author seems to favor also the coincidence of some abnormal environmental conditions which might predispose a physiological stress in the palms.

The direct role of the chinch bug *Scaptocoris divergens* Froechner is ruled out and the indirect participation of the cixiid *Myndus crudus* Van Duzee is reported by comparing the results of some field tests in which the control of the grass *Panicum maximum* and of the insect resulted in 2, 3% kill of the plants in comparison with the 53% death of the non-treated plots.

172. SANCHEZ POTES, A. Dos enfermedades de importancia economica que afectan la palma Africana de aceite en Colombia. Bogota, Instituto Colombiano Agropecuario, ICA, Programa de Oleaginosas perenenes, 1973. 13p. Unpublished report.

The basic information of this paper is the report about two special diseases of the oil palm in Colombia. One of the reported diseases is the pathological disturbance that the author was the first to call "Marchitez sorpresiva" (Sudden wither) or "Hoja toastada" (Toasted leaf). This disease was first found at the Risaralda plantation in the North East of Colombia.

The author provides a description of symptoms in which (a) degeneration and death of the roots, (b) loss of the glossy appearance of the fruits, early drop of fruits, bunch rot and abortion of the inflorescences, and (c) progressive drying of the leaves, beginning with the oldest ones, after yellowing of the leaflets, is mentioned. The author adds that sometimes variations on the general symptoms may occur.

173. SANCHES POTES, A. Informe sobre una visita a la plantacion de palma Africana Oleaginosas Risaralda S.A. Zulia (Norte de Santander). Bogota, Instituto Colombiano Agropecuario, ICA, Programa de Oleaginosas perennes, Palmira, 1972. 12p. Unpublished report.

This is an up to date summarized report on the "Marchitez sorpresiva" (Sudden wither) disease of oil palm in the Colombian plantations. He provides a convenient description of the disease symptoms and, in dealing with the actions taken to uncover the causes of the disease, he presents specialized comments on the suspected causals, including soil characteristics, soil drainage, soil compaction, plant nutrition, potassium deficiency, and agronomic management. The insecticide applications, the role of the pentatomid *Scaptocaris divergens* and the participation of several bacterial and fungal organisms, found in laboratory isolates from root and other tissue samples from diseased oil palms, are also analyzed. There are no definite conclusions and the disease continues to be of still unknown origin.

174. SANCHEZ POTES, A. Nuevas observaciones sobre la marchitez progresiva y la marchitez sorpresiva de la palma Africana en la zona del Meta. Agricultura Tropical (Colombia) 24 (8):451-460. 1968.

Seven oil palm plantations of one to five years old were visited in the Acacias and San Martin localities, in the Meta Province, in the East part of Colombia. This field visit disclosed the presence of several diseases and some agronomic problems which, acording to the author's view points, were predisposing factors for the development and spread of the diseases. The agronomic problems were highly related with soil characteristics and management.

Two types of "Marchitez" (wilts) were detected. The "Marchitez or Muerte progressiva" (Wither or progressive death) which was associated, according to the author, with mineral deficiencies. There is a detailed description of the symptoms. The other wilt was "Marchitez o muerte sorpresiva" (Wither or sudden death) which shows a symptom complex affecting both the root system and the external parts of the plant. There is a detailed description of the root symptoms, including a grading scale in which grade 0 - 1 was 0 - 20% of affected roots and grade 4 - 5 that in which 80 - 100% of the roots were affected. The disease symptoms in the external parts of the plant are described in detail too. He mentions that the first external symptoms are seen on the fruits, bunches and inflorescences and, approximately two weeks later, in the spear leaves and meristematic tissue followed by a rapid dry out of the leaves beginning with the oldest ones and progressing to the younger ones. There is also a description of the appearance of the internal tissues of the stem. The death of the palm may occur within 20 to 30 days after the initial external symptoms are seen.

Similar symptoms are reported in a 3 year old coconut palm and in a 30 to 60 year oil "UNAMO" (?) palm.

Seven pathogens, one bacterium included, were isolated from different plant parts but the author does not think they are associated with the disease. He recommneds further pathogenecity tests to disclsoe if any one of those microorganism is the primary cause of the disease.

175. SANCHEZ POTES, A. Informe sobre el estado fitosanitario de algunas plantaciones de palma Africana localizadas en el Departamento del Meta (zonas de Acacias y Cumaral). Agricultura Tropical (Colombia). 23(2):70-87. 1967.

In this paper the author presents a detailed report about the visit he made in December 1966 to the oil palm plantation in the East part of Colombia. The specific locations of the plantations are Acacias and Cumaral in the Meta Province.

The plant sanitation survey revealed the occurrence of several pathological problems, among which the "Marchitez sorpresiva" (Sudden wither) is listed.

The "Marchitez sorpresiva" (Sudden wither) is called also "Hoja tostada" (Toasted leaf) by the author. He reports to have found affected oil palms of 2 to 3 years of age in the visited localities. He provides a description of the characteristic symptoms and specifically the author describes it as a disease of unknown etiology. The author provides some general agronomic comments not quite favorable for some of the plantations.

176. SANCHEZ POTES, A. Informe adicional sobre el estado fitosanitario de algunas plantaciones de palma Africana localizadas en el Departamento del Meta (zona de Acacias y Cumaral). Bogota, Instituto de Fomento Algodonero, IFA. 1966. 18p. Manuscript.

This is a complementary report to a previous visit in which the "Marchitez sorpresiva" disease (Sudden wither) of oil palm was detected in some oil palm plantations in the East part of Colombia. In this paper the author includes a series of agronomic recommendations, as part of the sanitary measures, and reports the fungi species found in the laboratory analysis or root samples taken from affected oil palms. *Fusarium* sp. and *Rhizoetonia* sp. were isolated from the root samples. The "Marchitez sorpresiva" disease is described as a disease of still unknown etiology.

177. SANCHES POTES, A. Aspectos relativos a la Marchitez Traqueomicosis o Wilt tal como se presenta en la explotacion de la palma Africana en Risaralda. Bogota, Instituto de Famento Algodonero, 1965. 6p. Manuscript.

This is one of the first reports written by the author in connection with the disease now known as "Marchitez sorpresiva" (Sudden wither) of the oil palm in Colombia. The author found a similarity with an oil palm disease in Africa which is called Tracheomycose, lemon frond, wilt disease, and boyomi or Fusarium wilt caused by strains of *Fusarium oxysporum*. Altogether he was not sure about the identity of the disease he recommended to improve the drainage system of the plantation. There is a symptom description of the disease.

178. SANCHEZ POTES, A. Enfermedades del cocotero y de la palma Africana en Colombia. Bogota, Instituto de Famento Algodonero, IFA. 1965. 49p.

One of the earliest reports in which the "Marchitez sorpresiva" or "Hoja tostada" (Sudden wither or Toasted leaf) disease of the oil palm in Colombia is mentioned. The author provides a description of the symptoms he observed at the Risaralda plantation in the Zulia Valley, in the North East of Colombia, where the disease first was reported in 1963. No sure indication whatsoever is given about the causal entity of the disease; only theories are mentioned.

179. SANDOVAL, S.J. Combate del "gusano barrenador" de raices de la palma Africana. Instituto Nacional de Investigaciones Agropecuarias, INIAP, Ecuador. Estacion Experimental "Santo Domingo", Santo Domingo. Boletin Divulgativo No. 85. 1976.

Sagalassa valida, the oil palm root miner, is becoming an important insect pest of the oil palm in Ecuador. Besides the direct damage, the author reports a possible association with the "Marchitez sorpresiva" (Sudden wither) disease. There is a damage description and control recommendations by means of an insecticide treatment. The recommended insecticide is endrin.

180. SCHUT, B. Oil palm accessions of Suriname. Agricultural Experimental Station, Paramaribo. De Surinaamse Landbouw 24 (1):42-47. 1976.

Information is presented in a chronological order of eight accessions of oil palm in Suriname, originating from Asia and Africa. Several experimental plantations were established in the coastal plain as well as some others in the interior part of the country. The period of oil palms introduction in Suriname covers more than one hundred years.

The field experimentation with oil palm was restricted to superficial evaluations, according to the author. As a consequence of this fact the plant sanitation aspect is poorly reported. Nevertheless some indications of pathological problems are included within some of the provided technical data. In reporting the results of the La Poule experiment, for instance, the author says that after three years of full production the yield recording was finished because "an unknown wilting disease killed increased numbers of palms". At the beginning of 1961, 5% had succumbed, at the end of that year 23% was dead; in 1968, 80% was destroyed, in 1969, 98%, and in 1975, 99, 5% of the planting was eliminated. The author reports also that palms of various families were equally affected by the disease, including dwarf coconut trees. The author reports that the reason for the abrupt failure of oil palm plantations, such as La Poule and Slootwijk, have not yet been established with certainty but the "fatal wilting disease complex" is mentioned as one of the pathological problems. The author thinks, the disease had appeared in Suriname in the early twenties.

181. SEGEREN, P. and DE JONG, R. Inventory of possible insect vectors of "Hartrot" disease of coconut in Suriname. De Surinaamse Lanbouw 33 (1):211-28. 1985.

Insect species of the Heteroptera Orden were collected from several coconut fields in Suriname and subjected to careful studies with regard to their possible role as vectors for the "Hartrot" causing pathogen. The suspected causal entity of the "Hartrot" disease is the Trypanosomatid *Phytomonas staheli* Mc Ghee and Mc Ghee.

Species of nine Heteroptera families are listed with references to the habitat in which they were found are provided. The collection methods included collections by hand, light traps, pitfall traps and sticky traps. Sites of collection in the country are given too. 38 species of insects are listed with exception of the Reduvids which are not included.

The most abundant bug species found on or under coconut trees are *Edessa cornuta*, *Lincus* sp. and *Lincus spathuliger*. On weeds near coconut trees *Edessa rufomarginate* and *Edessa* sp.; in debris under the coconu tree *Macropygium reticulare*, *Berecynthus delirator*, *Agroecus griseus*, *Alitocorus parvus* and *Trichocentrus* sp. Salivary glands of 490 specimens were examined for the presence of flagellates; there is a table in which the per cents of contaminated insect species are given.The more contaminated insect species are Edessa sp., 44%, *A. griseus* 40%, *Lincus* sp. 24% and *M. reticulare* 15%.

Several other additional information are included in the paper.

182. SEGEREN, P. and ALEXANDER, V.T. The role of weeds in the incidence of "Hartrot" or "Fatal wilt" of palms. I. The effect of weeding in coconuts. De Surinaamse Landbouw 32 (1):7-12. 1984.

The "Hartrot" disease of coconuts has been known for about 80 years in Suriname. The associaton with a Trypanosomatid flagellate of the *Phytomonas* genus, became evident in 1976.

The influence of the weed cover and the mortality of coconut trees due to the Hartrot disease seemed to have a direct relationship. Some technical evidences on this aspect are related in this paper. Four different experiments of weed control at ma Retraite, La Poule and Jenny, and one Hartrot vector experiment, at Jenny also, permitted the authors to detect a clear influence of the presence of weeds under coconut palms on the mortality rate due to "Hartrot". The disease was more severe in coconut fields without weed control programs. Comparisons of mortality rates in the different experiments are given. The authors conclude also that the relationship between high mortality rates of palms, due to Hartrot, and the presence of weeds around trees is specially noticeable on clay soils in Suriname and to a lesser degree on sandy soils.

183. SEGEREN, P., SPARNAAY, TH. and KASTELEIN, P. The role of weeds in the incidence of "Hartrot" or "Fatal Wilt" of palms. II Inventory of weeds in eight coconut fields. De Surinaamse Landbouw 32(1):113-24. 1984.

This paper presents an inventory of 191 plant species representing 45 families and 118 genera which were found growing in or near coconut fields in Suriname. The paper has two detailed tables in which the results of the observations and data taken are presented, including the individual presence of the weeds in coconut affected or not affected by the disease. *Cercopia surinamensis* (Moraceae), *Ludwigia erecta* (Onagraceae) and *Cyperus ferax* (Cyperaceae) were found in 4 of 5 fields affected by the disease and none in disease free fields. *Phyllantus urinaria* (Euphorbiaceae) was found exclusively in diseased fields, whereas *Solanum stramonifolium* (Solanaceae) and *Cyperus ligularis* (Cyperaceae) were found within all surveyed fields.

184. SEGEREN, P.A. Entomologische studies aan de Hartrot ziekte op kokos en olie palm. Ministry of Agriculture, Animal Husbandry and Fisheries. Agriculture Experimental Station. Suriname. Internal Report No. 45. 1983. p.irr.

This technical document is a rather detailed report of several entomological studies, including some transmission trials with flagellated protozoa associated with the Hartrot disease of coconuts in Suriname. Extensive and intensive insect collections of the piercing sucking type were made at seven geographical locations in Suriname. The collected insects were found in diseased and healthy coconut palms, on weed species growing within or near coconut fields and on the ground below the weed cover and near the trunk of the coconut plants. The location at which the insects were collected are described and many ecological data are provided.

The salivary glands of the collected bug species were checked for the presence of Hartrot associated flagellates with the most frequently found insect species the above mentioned transmission trials were performed. The insect names are given. No success is reported in the artificial transmission trials.

185. SEGEREN P. Preliminary study on the vector(s) of Hartrot disease of coconut in Suriname. De Surinaamse Landbouw 30 (1):17-23. 1982.

The conditions and circumstances under which the "Hartrot" disease of coconuts takes place are being studied in Suriname. The disease is believed to be associated with a Trypanosomatid of the Phytomonas genus and since dense weed growth seems to predispose and facilitate the spread of the disease, search for flagellate host plants and insect vectors is being pursued.

Starting with the initial insect surveys in coconut plantations the Pentatomid bug *Macropygium reticulare* (F.) was the most frequent species found confined to humid and dark places near the root zone of the coconut tree, in between the stem and leaf sheath and on the midribs of horizontally hanging leaves touching the weed vegetation. The trypanosomatid *Phytomonas* sp. was found in the salivary glands of several specimens of the insect. The flagellate found, had high similarities with the species *PH. staheli* described as being associated with "Hartrot" affected coconut palm in Suriname. *Berecynthus delirator* (F.) was another Pentatomid bug found by several localities in Suriname, including La Poule Experiment Station. The bug was found in lesser numbers than *M. reticulare*, mostly in debris and under the coconut trees. Flagellates were also found in the salivary glands of *B. delirator*.

186. SLOBBE, W.G. VAN. Ziekten en Plagen of the olie palmondernemingen Denpasa (Belen), Victoria, Phedra en Patamacca. Amsterdam. H.V.A. International, 1983. 30p. (Unpublished Report 023).

A review of several diseases and insect pests of the oil palm is given. The Hartrot disease is included among the prevailing diseases in Suriname.

There are some historical accounts including the report that some diseased oil palms at the Victoria plantation were discovered to have a protozoan flagellate of the *Phytomonas* genus, in June 1976. Other information include the use of endrin applications to prevent the spread of the disease, the report of unsuccessful attempts to culture the organism of the *Phytomonas* genus in several wild plants of different botanical families, and the finding of some Pentatomid bugs with flagellates in the salivary glands in Suriname, among other information. There is a symptom description of the disease and some indications on how to kill diseased palms with paraquat and how to process tissue samples for laboratory analysis.

187. SLOBBE, W.G. VAN, PARTHASARATHY, M.V. and HENSEN, J.A. Hartrot or Fatal Wilt of palms. II Oil Palm (*Elaeis guineensis*) and other palms. Principes 22 (1):115-25, 1978.

There is a historical account of the so called Fatal Wilt disease of oil palms in Suriname from 1921 to date. Several important figures and data are provided.

The discovery of flagellates in the phloem of a 22 year old diseased oil palm, in September 1976, at Oema, led to the recognition of the disease. There is a rather detailed description of the external symptoms of the disease from observations made on diseased oil palms at the Victoria oil palm plantation. There is also the report of retarded growth of the unopened inflorescences which might be an indication that their development was affected before the appearance of the external symptoms.

In attempting to make comparisons with other wilting diseases of the oil palm in Suriname, the authors found it not possible to do so because no detailed description of the reported wilts are available. The wilting diseases from South America known as "maladie de la pourriture des racines et de la fleche", "Le desséchement des feuilles maladie" and the "Marchitez sorpresiva" are the only descriptions that appear to be similar to the wilt disease being reported in Suriname.

The authors say that on the basis of the symptoms seen on the diseased oil palms at the Victoria plantation, and because of the association of flagellates with the diseased palms, they feel this type of wilt is the same as the "Hartrot" of coconut palms. They say also that the wilt diseases associated with flagellates in Ecuador and Peru are likely to be "Hartrot".

The authors report that most cultivars of oil palm have no resistance to the "Hartrot"; *E. oleifera* and its hybrid with *E. guineensis* are the only palms so far not seen affected by the disease. Some wild palms have shown symptoms similar to Hartrot but flagellates have been found only in *Maximiliana maripa.*

There is no definite proof that flagellates are the "Hartrot" causing pathogens.

A possible line of defence against the disease may be the identification of the insect(s) vector(s) and the use of broad spectrum insecticides. The lygaeid hemipterans, adults and nymphs, are suspected to be the vectors of *Phytomonas* sp.

188. SLOBBE, W.G. VAN. Phytomonas flagellates in coconut (Hartrot disease, Cedros wilt) and oil palm (Hartrot disease, Marchitez sorpresiva). *In* Meeting of the International Council on Lethal Yellowing, 3rd., Palm Beach County, Fla. U.S.A., 1977. Proceedings. Fort Lauderdale, Fla. U.S.A. Agricultural Research Center Institute of Food and Agricultural Sciences. University of Florida. Publication F1-78-2:36-37. 1978.

A coffee disease that was probably caused by a flagellated protozoan was detected in 1929 in Suriname; in September 1975. The "Hartrot" disease of coconuts was also found to be closely associated with a Trypanosomatid of the *Phytomonas* genus and in the second half of 1976 a similar organism was found in "Marchitez sorpresiva" affected oil palms in Peru.

"Hartrot" is a misleading name, the author says, because the disease is a wilt; "Hartrot" is a Dutch name for heart rot. The disease has been in Suriname for many years and the "Hartrot" name has been used for more than 70 years. There are some comments in connection with the symptoms in the coconut palm, its similarities with other diseases, estimates of killed palms between 1918 and 1933 in Suriname, and reports of its occurrence in other countries such as Trinidad where the disease is known as "Cedros Wilt".

Techniques to identify the presence of flagellates in specific plant parts are given.

In connection with oil palm the author gives some historical accounts from Suriname. He also says that contrary to his own experiences in coconut it is difficult to detect flagellates in oil palm.

There is some information on the epidemiology aspect as well as on the vector and host plants subjects.

A special comment is given to the control of "Marchitez sorpresiva" by means of endrin applications to the soil, near the trunk, in some countries of South America. The author says that indications are that the same treatment might work on coconut palms but it is not yet known because the treatments were just initiated.

189. SLOBBE, W.G. VAAN. Symptomology of "Hartrot" disease in coconut and oil palm. *In* Meeting of the International Council on Lethal Yellowing, 3rd., Palm Beach County, Fla., U.S.A. 1977. Proceedings. Fort Lauderdale, Fla., U.S.A. Agricultural Research Center Institute of Food and Agricultural Sciences University of Florida, Publication FL-78-2. p.35. 1978.

The author gives a description of symptoms saying that the whole process takes from 2 to 4 weeks from the earliest symptom to complete browning of the canopy. Recovery of diseased palms has not been observed.

There is a description of symptom differences among the two palm species. The author says that the brown color of the leaves in oil palm is more pronounced than in coconut and that sometimes the roots have a characteristic smell; cavities are occasionally found in the trunk of the "Marchitez sorpresiva" affected oil palms. Before the canopy of coconut trees turn completely brown, the spear rot has already affected the growing point; in oil palm the apex seems to be healthy after the browning of the canopy.

Special mention is made of the fact that the cartepillar *Sagalassa valida* Walker affects the root of oil palm but has not been found in coconut.

190. SLOBBE, W.G. VAN. Phloem inhabiting *Phytomonas* protozoa in diseased coffee, coconut palms and African oil palms. De Surinaamse Landbouw 25 (1):4-13. 1977.

This well documented paper presents the results of the studies, research projects, observations and comments of some scientists that visited Suriname in connection with the "Hartrot" disease of coconut and oil palms. Some hypotheses on related aspects of the disease are also presented.

Using the "phloem necrosis" of coffee, as the classical plant disease associated with a Trypanosomatid flagellate of the *Phytomonas* genus, the author presents a historical account in tropical America.

The Hartrot disease of coconuts is reviewed since 1908 when A.W. Drost first referred to it. Historical facts and a complete summary of the technical activities, findings and opinions of many researchers are provided.

In connection with the oil palm the author provides historical informations from Suriname saying, for instance, that in October 1976 some oil palm died at the "Victoria" plantation due to an unknown disease with symptoms not exactly identical to those observed previously in some oil palms at the Oema Experiment Station in which flagellates had been detected earlier.

Samples of the diseased palms at Victoria were sent to Dr. M.V. Parthasarathy, from the Cornell University, and in Januarry 1977 this scientist sent a letter stating that flagellates were found in the oil palm samples sent from the Victoria plantation. In February 1977 M. Dollet and his collaborators published the finding of flagellates in "Marchitez sorpresiva" affected oil palms from Peru.

In another section the "Hartrot" disease is particularly commented on with several details and data from Suriname. The insect vector aspect as well as the flagellate host plant relationships are also conveniently discussed.

Among the presented hypotheses the author favors the opinion that the Pentatomid bugs should be given more attention, that the insecticide treatment may provide positive results, that most infections start near the trunk in the young soft primary roots, and since in Suriname mostly coconut bearing trees become affected it might be an indication that the Pentatomid bugs infect the palms via inflorescences too. The author says that the fact that the disease occurs in most countries, the alternate host plants and the vectors are possibly rather common. Other additional information is provided.

191. SLOBBE, W.G. VAN. Hartrot disease in Suriname (Abstract). Principes 20:60. 1976.

This paper is a short note giving information on the symtomatology of the "Hartrot" disease of coconuts in Suriname. The disease description includes observations on some ecological aspects of the "Hartrot" affected fields. Other additional comments are provided.

192. SPARNAAY, TH. The rol van de onkruidvegetatie in kokosvelden m.b.t. het optreden van de hartrot ziekte. Ministry of Agriculture, Animal Husbandry and Fisheries. Agricultural Experimental Station. Suriname. Internal Report No. 41. 1981.

This paper contains the results of the inventory of weeds growing in or near coconut fields with and without incidence of the Hartrot disease. The collected date show that *Cecropia surrinamensis*, *Ludwigia erecta* and *Cyperus ferax* were found in four out of five fields affected by the disease but not in healthy fields. *Phyllanthus urinaria* was exclusively found in all Hartrot affected fields whereas *Solanum stramonifolium* and *Cyperus ligularis* were found in all surveyed fields.

At La Poule, near Paramaribo, the influence of weed vegetation types in coconut fields and the density on the coconut mortality due to the Hartrot disease were studied. No clear influence on the disease mortality rate was found from the different weed cover densities. As special information the non existence of *Asclepias curassavica* is recorded.

193. STAHEL, G. Die Siebrohrenkranheit (Phloëmnecrose, Flagellatose) des Kaffeebaumes. Neth. Jour. Agric. Sci. 2 (4):260-264. 1954.

A short historical account of the Author's work on the "phloem necrosis" of coffee, in Suriname, is given. Among other information the discovery of trypanosomatid flagellates of the *Phytomonas* genus in the phloem vessels of affected trees is mentioned. Besides the report that phloem vessels undergo multiple division, the author also reports that the chinch bug *Lincus* sp. is suspected to be the insect vector for the pathogen, although he did not succeed in transmitting the disease. Another important comment is the suspicion that primary host plants for the pathogen may be found within the Surinamese flora and that, for the future, some other diseases caused by flagellates are predicted.

194. STAHEL, G. De productie der olie palmen op Zanderij I. De West, Paramaribo; January 7, 1938:4.

There are some general informations including the report that the yield of the oil palms, planted at Zanderij I in sandy soils, is directly influenced by the fertilization rate and the notice that about 30% of the oil palms planted in the interior part of Suriname have died or are affected by a die-back type disease. He concluded that the affected plantations were stricken by the "Hartrot" disease and by a heavy infestation of the giant borer *Castnia daedalus*. Other reports tell that from 140 oil palms planted at the Cultuurtuin Experimental Station, in 1930 only 3 remained, seven years later; the author initially identified the "Hartrot" disease as the cause of the palms' death but later on he changed his concept.

195. STAHEL, G. De tegenwoordige stand van het onderzoek naar de overdrager der zeefvatenziekte van de koffie. Meded. Dep. Landbouw. Suriname No. 7. 1934.

This paper presents several experiences with the phloem necrosis of coffee, the transmisison trials with the suspected causing pathogen and the attempts to find evidences about the vectorial capacity of some insect species. The author is convinced that some insects with piercing sucking mouth parts type are the vectors of the *Phytomonas leptovasorium*. The author excludes the root bug *Rhizoecus coffeae* as vector of the "phloem necrosis" but is convinced that *Lincus* sp., which is commonly found in coffee plantations, is able to transmit the disease causal pathogen in spite of his failed attempts to prove it.

Continuing the previous experiences of grafting roots from diseased trees to healthy ones he was able to make up 11 passages taking diseased roots from the previously infected tree. The flagellate showed cell division in the phloem. The flagellate moved about 35 cm upwards in the tree and never was found in branches less than 1 cm in diameter.

196. STAHEL, G. Zur Kenntnis der Siebröhrenkrankheit (Phloëmnekrose) des Kaffeebaumes in Suriname III (Suriname). Phytopathologische Zeitschrift 6 (4):336-357. 1933.

The external symptoms of the disease are described and the results of several artificial infection trials are reported. Grafting roots from diseased trees was a system that succeeded, in 26 out of 45 attempts, in reproducing the symptoms of the disease after 5 months. Grafting of twigs and pieces of bast on the stem did not reproduce the disease because, the author says, the flagellates die before the grafts grow. Transmission trials in which the scale insect *Rhizoecus coffeae* was used as a vector, failed.

Cultivation attempts of the suspected causal organism of the "Phloem necrosis" disease, *Phytomonas leptovasorum*, using a nutritional medium in which blood was replaced by homogenated tissues of soja seedlings and meristematic palm tissues, were unsuccessful.

The spread of *Ph. Leptovasorum* in the bast is described in detail, including the characteristic multiple division in the phloem. Presence of flagellates in coffee are reported as early as 1770.

197. STAHEL, G. Zur Kenntnis der Siebröhren kranheit (Phloëmnekrose) des Kaffeebaumes in Suriname II. (Suriname). Phytopathologische Zeitschrift 4 (5):539-544. 1932.

The author reports that organisms similar to *Phytomonas* have been observed in a wilting disease of coffee. This disease was called "coffee necrosis" by the author. Microscopic examination of root samples from wilting coffee from British Guyana and Northern Brasil showed that "coffee necrosis" also occurs in those countries. The author has not been able to fulfill the Koch's postulate.

198. STAHEL, G. Zur Kenntnis der Siebröhrenkranheit (Phloëmnekrose) des Kaffebaumes in Suriname. I. Microskopishce Untersuchungen und Infektionsversuche. Phytopathologische Zeitschrift 4 (1):65-82. 1931.

The author reports that "Phloem necrosis" of coffee is a disease of the phloem of roots and stems but not of the twigs. A description of the disease symptom is given, including the dying of the vessels of the phloem and the formation of multiple divided vessels by the cambium. The cell walls of the dead vessels are impregnated with gums. The author reports also that flagellates of the typanosomatid genus *Phytomonas* may be seen in the phloem a few weeks before the vessels died and before the first external symptoms of the disease are seen (after the death of the primary sieve tubes).

The author reports that the disease can artificially be transmitted by root grafting after a five month incubation period. He reports also that cultivation of flagellates in some blood agar nutritional media was not possible; the organisms stayed alive for some months but no division was observed. He could not fulfill the Koch's postulate.

199. STAHEL, G. De zeefvaten ziekte (Phloem necrose) van de Liberiakoffie in Suriname. Dep. Landbouw (Suriname) Bulletin No. 40. 1920.

The author reports two types of "Phloem necrosis" of coffee in Suriname: the acute and the chronic. The leaves suddenly wilt and dry on the tree in the acute type, while in the chronic type the older leaves slowly turn yellow and drop to the ground and the younger ones wither and die without dropping. In diseased trees no starch can be found in the roots and the sieve tubes are dead and filled with gum.

200. SURRE, CH. Communicacion de fecha noviembre 26, de 1968, a Oleaginosas Risaralda S.A. Paris, Institut de Recherches pour les Huiles et Oleagineux (IRHO), 1968. 3p. (Unpublished Report).

The report contains an analysis of the foliar nutrition aspect and any existing correlation with the "Marchitez sorpresiva" (Sudden Wither) disease of oil palms at the Risaralda Plantation in Colombia. The author states that he could not find any relationship with the disease and that the mineral nutrition content indicated only a good or poor growth rate of the plants.

201. THOMAS, D.L. *et al.* Electron microscopy of flagellate protozoa associated with Marchitez sorpresiva disease of African oil palm in Ecuador. Phytopathology 69:222-226. 1979.

There is a description of symptoms of "Marchitez sorpresiva" disease of oil palm, as it is seen in Ecuador.

Uniflagellate protozoa of the *Phytomonas* genus were found only in mature sieve tube elements of the protophloem, and metaphloem in samples of diseased oil palms from Ecuador. The authors report an uneven distribution.

There is a detailed description of the organism found including the report that the flagellum appeared to be quite similar to that of *Phytomonas elmassiani*.

202. THOMAS, D.L., Mc COY, R.E. and ESPINOSA, A.F. Association of flagellate protozoa with "Marchitez sorpresiva" (Sudden wilt") disease of oil palms in Eucador. *In* Annual Meeting of the American Phytopathological Society, 69th., East Lansing, Michigan. 1977. Proceedings. 4:137. 1978.

The electron microscopic examination of tissue samples from "Marchitez sorpresiva" (Sudden Wither) affected oil palms from Ecuador revealed the presence of a flagellated protozoan of the *Phytomonas* genus.

The organism was found in mature sieve elements of the phloem, in sample tissues taken from immature frond bases, unopened inflorescences and meristematic tissue just from below the apical meristem. Similar tissue samples from healthy oil palms did not contain the organism. The organism found was classified under the Trypanosomatidae family on the basis of their ultrastructure. There is a morphological description of the organism.

203. THOMAS, D.L. Phloem inhabiting *Phytomonas* protozoan from diseased African oil palms. *In* Meeting of the International Council on Lethal Yellowing 3rd., Palm Beach County, Fla., U.S.A., 1977. Proceedings. Fort Lauderdale, Fla., U.S.A. Agricultural Research Center Institute of Food and Agricultural Sciences. University of Florida. Publication FL-78-2. p.37. 1978.

Tissue samples from two palms affected by "Marchitez sorpresiva" disease and from one healthy palm were collected in Ecuador.

Samples were from unopened inflorescences, unemerged frond bases and from trunk tissue near the apical meristem. Mature sieve tubes from diseased palms contained uniflagellated protozoa of the *Phytomonas* genus and Trypanosomatidae family. Uneven distribution of flagellates was observed throughout the surveyed tissues and only 17% of the 139 vascular bundles contained the organisms, Promastigote form with electron-dense cytoplasm and irregular globose form with more electron-transparent cytoplasm were found. Intermediate stages were also present; no phloem necrosis was noted.

The etiologic role of the protozoa found was not determined but this study supports similar reports from Peru, Colombia and Suriname. This evidence strongly suggests that protozoa might be involved in the disease syndrome.

204. TSAI, J.H. Attempts to transmit Lethal Yellowing of coconut palms by the plant hopper *Aplaxius crudus*. Plant Disease Reporter 61: 304-307. 1977.

This paper describes the technique used to transmit the lethal yellowing disease to healthy coconut trees. The author used the plant hopper *Aplaxius pallidus* as the insect vector.

Besides direct collecting and feeding of *H. crudus* on diseased palms, before placing them on the healthy ones, partially purified and crude phloem sap from diseased coconut trees were artificially fed or injected by needle into *H. crudus*, to get transmission of the suspected pathogen. No transmission was achieved.

205. TURNER, P.D. Oil palm diseases and disorders. London. Oxford University Press, 1981, pp.122-124.

The author provides the different Spanish and French names assigned to the disease in Colombia, Venezuela, Suriname, Ecuador, Peru, Brasil and Trinidad. He provides also the name of some other palms affected by the disease.

There is a symptom description of the disease and, in dealing with the cause he provides a well documented account of the observation, attempts and research trials made to disclose the real cause of the disease, including the generic names of the pathogenic organisms isolated from roots of diseased palms. After reviewing the work done to disclose the real cause of the disease he comments on the latest information by means of which the causal entity of the "Marchitez sorpresiva" (Sudden Wither) is associated with an infection of a flagellated protozoan of the *Phytomonas* genus. He provides a brief description of the organism with information about the plant tissues in which it could be found, including the technique used to prepare stained plates for microscopic examination.

The insect vector role is commented on with details and references to previous research works, including the Colombian special trials with *Haplaxius pallidus* (*Myndus crudus* Van Duzee) and its connection with the grass *Panicum maximum*.

As far as the flagellate host plants are concerned the author provides a well documented information giving names of contaminated plant species, including several Euphorbs and the "milk-weed" *Asclepias curassavica*.

In dealing with control recommendations the author is specific in saying that there was no treatment so far known (1981) for "Marchitez sorpresiva" disease. He comments on the claimed protection achieved with the soil treatments with endrin, the positive results of the *P. maximum* control within the inter row spaces and the promise of the use of resistant planting materials. He is specific in saying that *Elaeis oleifera* (the American oil palm species) as well as its hybrid with *E. guineensis* are resistant to the disease.

206. URUETA SANDINO, E. La marchitez sorpresiva de la palma africana. Palmas (Colombia), 6 (3):67-71. 1985.

This paper is an up to date information on several aspects of the Marchitez sorpresiva (Sudden Wither) of the oil palm in Colombia, including the results of the latest transmission trials. The author first provides information on the early Colombian reports and then gives a condensed summary of the international bibliography on the subject matter and the suspected causal pathogen *Phytomonas staheli* Mc Ghee and Mc Ghee. Some comments on morphological and physiological aspects, as well as with some related facts on known host plant species are given.

The highlights of the Colombian early research programs are properly presented, including some of the unsuccessful transmission trials. The final part of the paper is the presentation of the research program which is being carried out by the Instituto Colombiano Agropecuario, ICA, in the Meta State, in the East part of Colombia. The program includes (a) Economic evaluation of the disease, (b) Etiology of the disease, (c) Methods for early and reliable diagnosis of the disease, (d) Flagellate host plant and insect species, (e) Methods of control, including the chemical therapy. As initial results the author reports the presence of *Phytomonas* sp., possibly *elmassiani*, in *Asclepias curassavica* in the Meta State.

In the analyzed "Marchitez sorpresiva" foci only one specimen of *Sagalassa valida* was found and *Myndus* (*Haplaxius*) and *Lincus* sp. have not been found yet. Root juice containing *Ph. staheli* was injected in healthy oil palm seedlings but the disease was not reproduced, nor could the flagellates be established in the plant tissue.

207. VALLEJO, R. y CASSALETT, D., C. Perspecttivas del cultivo de los hibridos interespecificos de noli (*Elaeis oleifera* (H.B.K.) Cortes x palma africana de aceite (*Elaeis guineensis* Jacq.)) en Colombia. Revista ICA (Colombia) 10(1):19-35. 1975.

In dealing with the control of the "Marchitez sorpresiva" disease of the oil palm (Sudden Wither) in Colombia, the authors first comment on the characteristic symptoms of the disease and then they suggest a disease control approach. After finding that some hybrids of *Elaeis oleifera* with *E. guineensis* from Suriname, apparently were not affected by the "Lethal Spear Rot" and that they also showed resistance to some other diseases, including "Marchitez sorpresiva", the authors suggest to pay more attention to the *E. oleifera* as a source of genetic resistance for the "sudden wither" disease.

208. VERMEULEN, H. Investigations into the cause of the phloem necrosis disease of *Coffea liberica* in Suriname, South America. Neth. Jour. Plant. Path. 74:202-218. 1968.

The presence of the flagellate *Phytomonas leptovasorum* in the phloem vessels of *coffea liberica* affected by the "phloem necrosis" disease, in Suriname, is reported along with the multiple division of sieve tubes. The author says also that the wilting observed in the "phloem necrosis" disease is different from that caused by the fungus *Ceratocystis fimbriata* and that no viruses, bacteria or nematodes could be detected in "phloem necrosis" affected coffee plants.

Infection of young coffee trees by root grafting was achieved but the disease symptoms were somewhat less acute than in older trees. The infection of other coffee varieties is also reported to be less severe than in *C. liberica*. The infection could be natural or artificial and hemipteran species are suspected to be the vectors for the natural infection.

Attempts to culture *Ph. leptovasorum* failed. He could not fulfill the Koch's postulate but he was able to detect flagellates in the mid-gut of some bugs.

209. VERMEULEN, H. A wilt of *Coffea liberica* in Suriname and its association with a flagellate, *Phytomonas leptovasorum* Stahel. Journal of Protozoology. 10(2):2116-222. 1963.

In connection with the plant flagellates of the *Phytomonas* genus the author tried to fulfill the Koch's posutulate in the case of the "Phloem necrosis" of coffee. He did not succeed but the results he obtained in his research program were of sufficient magnitude to closely associate *Ph. leptovasorum* to the phloem necrosis of coffee in Suriname.

210. VICKERMAN, K. Observations on the life cycle of *Phytomonas elmassiani* (Migone) in East Africa. Journal of Protozoology 9:26-33. 1962.

In dealing with flagellated protozoans of the *Phytomonas* genus, the author reports the presence of giant and small forms of *Phytomonas* sp. in *Oncopeltus famelicus*. The giant forms (50 um) and the small ones (110-20 um) were found mixed in the salivary glands of the insect vector; giant forms were found alone only in the mid-gut of the insect.

211. WALLACE, F.G. *et al.* Guidelines for the description of new species of lower Trypanosomatids. Journal of Protozoology 30 (2):308-313. 1983.

There are specialized comments on several criteria to follow in the description of Trypanosomatids among which the *Phytomonas* genus is included. Morphological, cultural and biochemical parameters are discussed. The differentiation of species of lower Trypanosomatids should include Kinetoplast structure, carbohydrate utilization, electrophoretic mobilities of isoenzymes and KDNA fingerprinting. Temperature, pH and osmolarity tolerance are useful growth indices and the determination of nitrogenous excretion metabolites, as well as the ornithine-arginine cycle enzymes, are recommended for generic placement of the organisms.

The differentiation of flagellates from different host plant species is difficult because of so many natural variations, the authors say.

212. WATERS, H. Wilt disease of coconut in Trinidad. *In* Meeting of the International Council on Lethal Yellowing, 3rd., Palm Beach County, Fla., U.S.A. 1977. Proceedings. Fort Lauderdale, Fla., U.S.A. Agricultural Research Center Institute of Food and Agricultural Sciences. University of Florida. Publication FL-78-2. p.37. 1978.

Reports that protozoan flagellates of the *Phytomonas* genus were found in tissue samples from inflorescences stem, leaf, spear and cabbage of coconut palms showing symptoms of a wilt disease in Trinidad. Affected palms were found in all major coconut growing areas in Trinidad but none was detected in Western Tobago.

There are figures of lost trees in the Cedros area.

The symptoms and the disease pattern, along with the description of the presumed pathogen are given. There is also the report that similar organisms were found in the root system of an adjacent diseased coffee plant.

213. WATERS, H. A wilt disease of coconuts from Trinidad associated with *Phytomonas* sp. a sieve tube restricted protozoan flagellate. Annals of Applied Biology 90:293-302. 1978.

There is a symptom description of the disease and some economic figures for Trinidad-Tobago. He reports also that samples from 10 diseased palms contained flagellates that were classified as trypanosomatid protozoans of the *Phytomonas* genus. There is a technique described and suggested to prepare tissue samples for microscopic examination. There is a morphological description of the pathogen associated with the coconut wilt in Trinidad, including sizes of the cell and the flagellum. The author reports that sections of the inflorescence rachillae from diseased coconut palms revealed that the pathogen was restricted to the sieve tubes of diseased palms; it was not found in healthy plants. A brief ultrastructural description of the organism is provided.

214. ZENNER DE POLANIA, I. y LOPEZ, A., A. Apuntes sobre la biologia y habitos del *Aplaxius pallidus* transmisor de la "Marchitez sorpresiva" en la palma africana. Revista Colombiana de Entomologia 3 (1, 2):49-62. 1977.

This paper presents the results of a detailed study on the life history and habits of the Cixiid *Haplaxius pallidus* Caldwell (*Myndus crudus* Van Duzee). The insect was described by J.S. Caldwell in 1946 from specimen collected at Miami. In 1975 it was found living on the grass *Panicum maximum*, in Colombia, in an oil palm plantation affected by "Marchitez sorpresiva" (Sudden Wither). The studies here reported were carried out at the "Oleaginosas Risaralda" oil palm plantation, in the North East of Colombia and at the Tibaitata Experiment Station, near Bogota, during a 15 month period.

The authors report the eggs are inserted in groups in the underside of the leaves of the grass plant. They are about 0.56 m.m. in length and 0.18 m.m. wide; they are creamy white in color and cylindrical in shape. The nymphs, which are dirty white in color, live near the soil surface feeding on the root crown. In the last instar they measure about 3.41 m.m. in length. The adults, are found on the basal leaves of the young oil palms; the female adults measure 4.8 m.m. in length and the males 4.5 m.m. The adults are greenish in color with transparent wings with small black tubercles on the veins.

The authors report 5 instars stages for the nymphs, following the so called Dyar's rule with a growth ratio of 1:34. Other monocotyledoneous plants are reported as nymphal host plants; no dicotyledoneous plants are reported for nymphal host plants. *Cocos nucifera* L, *Heliconia biahi* L, *Aiphanes carytifolia* (H.B.K.) Wendl and *Carludovica palmata* R et P., besides *Elaeis guineensis* Jacq., are reported as adult host plants.

215. ZULETA, E. Enfermedades de importancia economica en palma africana en Colombia. Palmas Monterrey Ltda. Puerto Wilches, 1972. Manuscript 12pp.

"Marchitez sorpresiva" (Sudden Wither) of the oil palm is included within the list of the economically important diseases of the oil palm in Colombia. There is an appropriate description of the disease, some information on historical accounts and economic implications and particularized comments on the different hypotheses about the causal entity of the disease. Reports of the results achieved in the technical attempts to uncover the cause of the pathological disturbance are provided in a summarized presentation. The disease is still considered as of uncertain origin.

216. ZULETA, E. La marchitez sorpresiva de la palma de aceite (*Elaeis guineensis* Jacq.) en la plantacion Oleaginosas Risaralda S.A. Cucuta, Oleaginosas Risaralda S.A., 1971. 41p. (Unpublished Report).

This is an updated report on the "Marchitez sorpresiva" (Sudden Wither) disease of the oil palm. There is general information in which the author reports the hypotheses and actions taken to uncover the causes of the disease, since it was first found in 1963. The author presents a rather complete description of the distinctive characteristics of the disease, including an economic evaluation of the losses; he reports that 56.6% of the plants were killed between 1961 and 1969, and up to 82% by 1971.

The report includes the results of the experimental works performed to discard or to prove the role of many suspected causes such as soil characteristics, soil drainage, soil compaction, plant nutrition, potassium deficiency, role of the chinch bug *Scaptocoris divergens*, and many fungal, bacterial and viral organisms. All results were negative and the applications of insecticides were unable to control the disease or inconsistent in the observed results.

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