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NEMATODES ASSOCIATED WITH THE COCONUT PALM (*COCOS NUCIFERA* L.)

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INTRODUCTION

Increasing human concern to improve world food supply to cope up with the unprecedented population growth has aroused considerable attention towards coconut as one of the sources of plant protein. Although coconut is regarded by many as a conventional edible oil crop, it is among the most useful plants known to man. Coconut palms flourish well along the sea coasts of over 80 tropical countries between latitudes 28°N and 23°S. Unfortunately coconut production is hampered by several problems. Surveys organised by agencies like the FAO have revealed that in many coconut growing countries the palms are plagued by several pests and diseases of undetermined etiology (cf. Maramorosch, 1964 and the references therein). A recent article highlighted the situation India in particular is facing (Govindankutty, 1978). The present effort is to bring together information scattered in literature on the record of nematodes associated with coconut (see Table 1) with a view to caution against the possibility of accidental introduction of potentially dangerous pests and pathogens of agricultural crops. Literature pertaining to nematode associations with the coconut, and nematode disease problems of the palm on which considerable researches were carried out is included in the bibliography.

BACKGROUND

Plant parasitic nematodes are implicated by some workers as direct causative factor or vectors of the pathogenic agents associated with some of these diseases. One of the well known nematode problems of plants is the red ring disease of coconut caused by

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Rhadinaphelenchus cocophilus (Cobb, 1919) Goodey, 1960 and is reported to occur in Barbados, Belize, Brazil, Colombia, Costa Rica, Dominican Republic, El Salvador, Ecuador, Grenada, Guyana, Honduras, Mexico, Nicaragua, Panama, St. Vincent, Surinam, Tobago, Trinidad and Venezuela (Blair, 1968; Harries, 1971, 1977). The importance of this disease, transmitted by a palm weevil, Rhynchophorus palmarum L. to the economy of these countries, epidemiology, symptomatology, pathogenicity, transmission, available control measures etc. were reviewed by Fenwick (1957, 1959 a,b) and Blair (1964, 1968, 1976).

The possibility of ecto-and endoparasitic nematodes being involved in other coconut diseases of obscure origin was investigated by several investigators from time to time. The works of van Weerdt et al. (1959b) in Florida, Latta (1964, 1966) and Dixon and Latta (1965) in Jamaica in relation to the lethal yellowing disease; Luc (1957, 1958) and Luc & Hoestra (1960) on Kaincope disease of Togo in West Africa; Palo (1964, 1966), Pizarro (1967, 1969), Pizarro and Santamaria (1974) on cadang cadang, a malady prevalent in the Philippines; Reinking & Radewald (1961) on Tinangaja or Guam disease in the Pacific Island of Guam; Ekanayake (1964), Ekanayake & Wickramaratne (1964) and Robertson (1965) on the leaf scorch decline of Sri Lanka; Weischer (1967), Mathen (1969); Mathen et al. (1970) and Koshy et al. (1975, 1977) in connection with the root (wilt) disease of South India; and Maramorosch & Golden (1967) following a world wide survey on some of these diseases have brought out that a number of nematodes are found in the tissues and soil around roots of the declining palms.

DISCUSSION

Information presented in this review could help plant quarantine programmes which are aimed to intercept alien and harmful organisms, or to contain and eradicate them (Hewitt & Chiarappa, 1977). Johnston (1963) referred to the regulations pertaining to coconut and Harries (1977) had pointed out the limitations of present quarantine regulations for coconut and stressed the need for regional

post entry quarantine centres, pathogen surveillence and international support. The occurrence of nematodes in the vicinity of coconut palms does not necessarily mean that they are parasitic on the palms and actually feed on them. Similarly a list of nematodes based on information from analysis of limited samples need not hold any guarantee that these are pathogenic to the coconut trees. The consideration that other crops are common in coconut groves and presumably influence the microorganisms and nematodes present and their relative abundance is significant. Several of the nematological surveys and correlation studies are not intensive or extensive, and have been unable to establish any positive correlation between populations of the various genera of nematodes and specific type of coconut decline, except red ring disease, but the possibility of nematodes acting as vectors or aggravators is not ruled out.

Generally a predominant nematode species at any particular site has to be recovered during subsequent sampling. Damage to crops is related to the number of parasites or pathogens and their control means bringing down the population until yield is economically acceptable. With diseases like red ring, so far none of the control measures have provided a practical and effective method of combating the disease, but by integrating some of them and improving plantation hygiene the disease incidence could be reduced (Dumo, 1959; Blair, 1964, 1969; Fenwick, 1968a, 1969a; Maharaj, 1968; Carr, 1970; Griffith, 1971, 1974; Hoyle, 1971, Jorge & Victoria, 1971; Banguera and Potes, 1972; Oostenbrink, 1972).

Red ring disease is not prevalent in Jamaica but in inoculation tests on six tall coconut varieties carried out in Aracaju, Colombia for the Coconut Industry Board, Jamaica no variety showed resistance (Harries, 1971). Today Asia and Oceania are believed to be free from red ring infestation and only strict quarantine measures can ensure that these areas remain void of the problem. Certain countries have a reasonable embargo against import of coconuts from red ring and other disease prevalent areas. Regulatory measures are inadequate or nil for oil palm, date palm or ornamental palms

(Malagutti, 1953; Franco, 1964; Kraayenga & den Ouden; 1966; Dao & Oostenbrink, 1967; Blair & Darling, 1968). Today many ornamental palms are exchanged between countries without ascertaining their role as secondary hosts or symptomless carriers of many of the palm diseases of obscure origin. Over twenty ornamental palms are known to be hosts for the lethal yellowing pathogen (Thomas, 1974), and cadang-cadang symptoms are believed to be exhibited by certain other palms also (Pizarro & Santamaria, 1974; Bigornia, 1977). It has been reported that oil palm is a natural host of the root (wilt) disease pathogen (Shanta et al., 1970). A recent survey of ornamental and wild palms in Kerala recorded a number of nematode species associated with the roots and soil around these palms (Govindankutty & Koshy, in preparation). Van Hoof & Seinhorst (1962) reported Rhadinaphelenchus cocophilus consistently associated with 'little leaf' disease symptoms of coconut and oil palms in Surinam and Guyana, where nematodes were generally retarding the development of the young leaves in which they occurred. It is probable that the same pathogenic organism may produce dissimilar symptoms in different hosts or identical disease syndrome may be induced by unrelated agents.

Though coconuts are seldom exchanged as seedlings, it is important to caution importers and growers that the roots and adhering soil are likely to carry nematodes which may or may not be principally a problem in receiving areas. Artificial infection trials of Fenwick & Mohammed (1964) on seednuts showed that red ring eelworms are capable of colonizing the nut tissues and seedlings although infections disappeared about 48 weeks afterwards. If the diseases and disorders of the coconut palms continue to persist unchecked the coconut industry may gradually decline and result in a totally different tropical scene.

TABLE 1 RECORD OF NEMATODES ASSOCIATED WITH THE COCONUT PALM

* Nematodes recorded from roots, @ Nematodes isolated from aerial parts

(1) NEMATODE	(2) LOCALITY	(3) CONTEXT OF INVESTIGATION	(4) REFERENCE
Anguillulina sp.	Florida, USA	General survey	Crossman & Christie (1957)
Aphelenchoides cocophilus	Trinidad	Red ring disease	Fenwick & Maharaj (1960)
A. cocophilus	Florida, USA	General survey	van Weerdt et al. (1959a)
Aphelenchoides sp.	Guam	Guam disease	Reinking & Radewald (1961)
Aphelenchoides sp.	Florida, USA	General survey	van Weerdt et al. (1959a)
Aphelenchus cocophilus	Trinidad	Red ring disease.	Cobb (1919)
@Aphelenchus sp.	Jamaica	Lethal yellowing disease	Latta (1964, 1966)
Basirioptyleptus nemoralis	India	General survey	Siddiqi (1970)
Belonolaimus longicaudatus	Florida, USA	General survey	van Weerdt et al. (1959a)
Boleodorus thalactus	El Salvador	General survey	Abrego & Tarjan (1972)
Cacopaurus sp.	Jamaica	Lethal yellowing disease	Latta (1964, 1966)
Cacopaurus sp.	Florida, USA	General survey	van Weerdt et al (1959a)
Caloosia longicaudatus	Sri Lanka	Leaf scorch decline	Ekanayake (1964)
Criconema sp.	Kerala, India	Root (wilt) disease	Nathen et al. (1970)
Criconema sp.	Kerala, India	Root (wilt) disease	Weischer (1967)
Criconemoides citri	Florida, USA	General survey	van Weerdt et al. (1959a)
C. discolabium	Philippines	General survey	Diab & Jenkins (1966)

(1)	(2)	(3)	(4)
Criconemoides mutabile	Florida, USA	General survey	vanWeerdt et al. (1959a)
Criconemoides sp.	El Salvador	General survey	Abrego & Tarjan (1972)
Criconemoides sp.	Jamaica	Lethal yellowing disease	Latta (1964, 1966)
Criconemoides sp.	Golden Grove, Trinidad	Coconut decline	Maramorosch & Golden (1967)
Criconemoides sp.	Kerala, India	Root (wilt) disease	Mathen et al. (1970)
Criconemoides sp.	Philippines	Cadang cadang disease	Pizarro (1969)
Criconemoides sp.	Kerala, India	Root (wilt) disease	Weischer (1967)
Criconemoides spp.	Florida, USA	Lethal yellowing disease	van Weerdt et al. (1959b)
Discocriconemella racensi	Kerala, India	Root (wilt) disease	Khan et al. (1971)
Ditylenchus sp.	Venezuela	General survey	Torrealba (1969)
Dolichodorus profundus	Togo, West Africa	Kaincope disease	Luc & Hoestra (1960)
D. profundus	Togo, West Africa	Kaincope disease	Maramorosch & Golden (1967)
D. pulvinus	Kerala, India	Root (wilt) disease	Mathen et al. (1970)
Dolichodorus sp.	Kerala, India	Root (wilt) disease	Weischer (1967)
Dorylaimus sp.	Kerala, India	Root (wilt) disease	Maramorosch & Golden (1967)
Encholaimus taurus	Trinidad	General survey	Golden & Murphy (1967)
E. taurus	Golden Grove, Trinidad	Coconut decline	Maramorosch & Golden (1967)
Helicotylenchus dihystera	San Antonio, Jamaica	Lethal yellowing disease	Maramorosch & Golden (1967)

(1)	(2)	(3)	(4)
Helicotylenchus dilystera	Golden Grove, Trinidad	Coconut decline	Maramorosch & Golden (1967)
*H. erythrinae	Florida, USA	General survey	van Weerdt et al. (1959a)
H. erythrinae	Florida, USA; Jamaica	Lethal yellowing disease	van Weerdt et al. (1959b)
H. multicinctus	Jamaica	Lethal yellowing disease	Latta (1966, 1966)
H. nannus	Jamaica	Lethal yellowing disease	Latta (1964, 1966)
H. nannus	Guam	Guam disease	Reinking & Radewald (1961)
Helicotylenchus sp.	El Salvador	General survey	Abrego & Tarjan (1972)
@*Helicotylenchus sp.	Jamaica	Lethal yellowing disease	Latta (1964, 1966)
Helicotylenchus sp.	Kerala, India	Root (wilt) disease	Mathen et al. (1970)
Heliootylenchus sp.	Philippines	Cadang cadang disease	Pizarro (1969)
Helicotylenchus sp.	Venezuela	General survey	Torrealba (1969)
Helicotylenchus sp.	Kerala, India	Root (wilt) disease	Weischer (1967)
Helicotylenchus sp.	Florida, USA	General survey	van Weerdt et al. (1959a)
*Helicotylenchus spp.	Florida, USA	Lethal yellowing disease	van Weerdt et al. (1959b)
Hemiriconemoides cocophilus	El Salvador	General survey	Abrego & Tarjan (1972)
H. cocophilus	Florida, USA	General survey	van Weerdt et al. (1959a)
H. strictathecatus	Florida, USA	General survey	van Weerdt et al. (1959a)
H. wessoni	Florida, USA	General survey	van Weerdt et al. (1959a)

(1)	(2)	(3)	(4)
Hemicriconemoides cp.	El Salvador	General, survey	Abrego & Tarjan (1972)
Hemicriconemoides sp.	Jamaica	Lethal yellowing disease	Latta (1964,1966)
Hemicriconemoides sp.	Kerala, India	Root (wilt) disease	Mathen et al. (1970)
Hemicriconemoides sp.	Kerala, India	Root (wilt) disease	Weischer (1967)
Hemicriconemoides spp.	Florida, USA	Lethal yellowing disease	van Weerdt et al. (1959b)
*Hemicycliophora longicaudata	Sri Lanka	Leaf scorch decline	Ekanayake & Wickramaratne (1964)
H. longicaudata	Sri Lanka	Leaf scorch decline	Robertson (1965)
H. pauciannulata	Togo, West Africa	Kaincope disease	Luc & Hoestra (1960)
Hemicyliophora sp.	Sri Lanka	Leaf scorch decline	Ekanayake (1964)
Hemicycliophora sp.	Togo, West Africa	Kaincope disease	Maramorosch & Golden (1967)
Hemicycliophora sp.	Florida, USA	General survey	van Weerdt et al. (1959a)
Hemicycliophora sp.	Florida, USA	Lethal yellowing disease	van Weerdt et al. (1959b)
Hemicycliophora spp.	Florida, USA	Lethal yellowing disease	Latta (1964,1966)
Heterodera sp.	Jamaica	Lethal yellowing disease	van Weerdt et al. (1959b)
*Heterodera spp.	Jamaica	Lethal yellowing disease	Latta (1964,1966)
Hodronchus andamanicus	Andamans, India	General survey	Jairajpuri (1969)
Hoplolaimus seinhorsti	Gonapinnowela, Sri Lanka	Leaf scorch decline	Maramorosch & Golden (1967)

(1)	(2)	(3)	(4)
Hoplolaimus tylenchiformis	Florida, USA	General survey	van Weerdt et al. (1959a)
Hoplolaimus sp.	Kerala, India	Root (wilt) disease	Mathen et al. (1970)
Hoplolaimus sp.	Kerala, India	Root (wilt) disease	Weischer (1967)
Hoplolaimus spp.	Florida, USA, Jamaica	Lethal yellowing Disease	van Weerdt et al. (1959b)
Iotonchus basrii	India	General survey	Jairajpuri (1969)
Leptonchus baccatus	India	General survey	Siddiqi (1970)
Longidorus laevicapitatus	Golden Grove, Trinidad	Coconut decline	Maramorosch & Golden (1967)
L. saginus	Kerala, India	Root (wilt) disease	Khan et al. (1971)
Longidorus sp.	Kerala, India	Root (wilt) disease	Mathen et al (1970)
Longidorus sp.	Kerala, India	Root (wilt) disease	Weischer (1967)
Macroposthonia oachirai	Kerala, India	Root (wilt) disease	Khan et al (1971)
Macroposthonia sp.	French West Indies	General survey	Maesese, Scotto La (1969)
Meloidogyne incognita acrita	Gonapinnuwela, Sri Lanka	Leaf scorch decline	Maramorosch & Golden (1967)
Meloidogyne sp.	El Salvador	General survey	Abrego & Tarjan (1972)
*Meloidogyne sp.	Jamaica	Lethal yellowing disease	Latta (1964, 1966)
Meloidogyne sp.	Kerala India	Root (wilt) disease	Mathen et al (1970)
Meloidogyne sp.	Guam	Guam disease	Reinking & Ludowald (1961)
Meloidogyne sp.	Kerala, India	Root (wilt) disease	Weischer (1967).
*Meloidogyne sp.	Florida, USA	Lethal yellowing disease	van Weerdt et al. (1959b)

(1)	(2)	(3)	(4)
*Metacrobeles togoensis	Togo, West Africa	Kaincope disease	Loof (1962)
M. togoensis	Togo, West Africa	Kaincope disease	Luc & Hoestra (1960)
Mononchus sp.	Kerala, India	Root (wilt) disease	Maramorosch & Golden (1967)
Neoncilenchus sp.	El Salvador	General survey	Abrego & Tarjan (1972)
Panagrolaimus rigidus	Kerala, India	General survey	Nadakkal (1965)
Panagrolaimus sp.	Kerala, India	General survey	Nadakkal (1965)
Paralongidorus flexus	Kerala, India	Root (wilt) disease	Khan et al (1971)
Paratylenchus sp.	Surinam	Coconut decline	Anonymous (1975)
Paratylenchus sp.	El Salvador	General survey	Abrego & Tarjan (1972)
*Paratylenchus sp.	Togo, West Africa	Kaincope disease	Luc & Hoestra (1960)
Paratylenchus sp.	Kerala, India	Root (wilt) disease	Mathen et al. (1970)
*Paratylenchus sp.	Florida, USA	Lethal yellowing disease	van Weerdt et al. (1959 b)
Paratylenchus sp.	Kerala, India	Root (wilt) disease	Weischer (1967)
Peltamigratus luci	Golden Grove, Trinidad	Coconut decline	Maramorosch & Golden (1967).
P. thornei	British Honduras	General survey	Knobloch (1969)
Pratylenchus brachyrus	Togo, West Africa	Kaincope disease	Luc & Hoestra (1960).
P. brachurus	Florida, USA	General survey	van Weerdt et al. (1959 a)
P. hexincisus	Florida, USA	General survey	van Weerdt et al. (1959a)
P. minutus	Florida, USA	General survey	van Weerdt et al. (1959a)

(1)	(2)	(3)	(4)
Pratylenchus sp.	El Salvador	General survey	Abrego & Tarjan (1972)
*Pratylenchus sp.	Jamaica	Lethal yellowing disease	Latta (1964, 1966)
Pratylenchus sp.	Togo, West Africa	Kaincope disease	Luc & Hoestra (1960)
*Pratylenchus sp.	Kerala, India	Root (wilt) disease	Mathen et al. (1970)
Pratylenchus sp.	Mysore, India	General survey	Swamy & Govindu (1966)
*Pratylenchus sp.	Florida, USA	Lethal yellowing disease	van Weerdt et al. (1959b)
Pratylenchus sp.	Kerala, India	Root (wilt) disease	Weischer (1967)
*Radopholus similis	Kerala, India	Root (wilt) disease. ~~Kerala, India~~	Koshy et al. (1975)
*R. similis	Jamaica	Lethal yellowing disease	Latta (1966)
*R. similis	Kerala, India	Root (wilt) disease	Mathen et al. (1970)
R. similis	Florida, USA	General survey	van Weerdt et al (1959a)
R. similis	Florida, USA, Jamaica	Lethal yellowing disease	van Weerdt et al (1959b)
*R. similis	Kerala, India	Root (wilt) disease	Weischer (1967)
*Radopholus sp.	Sri Lanka	Leaf scorch decline	Ekanayake (1964)
Radopholus sp.	Sri Lanka	Leaf scorch decline	Robertson (1966)
*Rhadinaphelenchus cocophilus	El Salvador	General survey	Abrego & Tarjan (1972)
*R. cocophilus	Trinidad	Red ring disease	Blair (1963, 1968)
*R. cocophilus	Trinidad	Red ring disease	Cobb (1919)
R. cocophilus	St. Vincent	General survey	Edmunds (1969)

(1)	(2)	(3)	(4)
@* Rhadinaphelenchus cocophilus	Trinidad	Red ring disease	Fenwick (1958, 1962b, 1963)
@* R. cocophilus	Trinidad	Red ring disease	Fenwick & Maharaj (1960, 1963c.)
R. cocophilus	Brazil	Red ring disease	Franco (1964)
R. cocophilus	Colombia	Red ring disease	Harris (1971)
R. cocophilus	Surinam	Red ring disease	Kravenga & Ouden den (1966)
R. cocophilus	Golden Grove, Trinidad	Coconut decline	Maramorosch & Golden (1967)
R. cocophilus	Mexico	Red ring disease	Marban Mendoza (1973)
R. cocophilus	Bogota, Colombia.	Little leaf disease	Messa-Bernal (1951).
R. cocophilus	Ceara, Brazil	Red ring disease	Ponte et al (1971)
R. cocophilus	Tumaco and Narino, Colombia	Red ring disease	Potes (1967)
@ R. cocophilus	Surinam	Little leaf disease	VanHoof and Seinhorst (1962)
R. cocophilus	Pomeroon, Guyana	Red ring disease	Singh (1971)
R. cocophilus	Grenada, West Indies	Red ring disease	Singh (1972)
R. cocophilus	Dominican Republic	Red ring disease	Schieber (1970)
Rotylenchulus reniformis	Guam	Guam disease	Reinking & Radewald (1961)
* R. reniformis	Jamaica	Lethal Yellowing Disease	Dixon & Latta (1965)
R. reniformis	Togo, West Africa	Kaincope disease	Luc & Hoestra (1960)
* R. reniformis	Jamaica	Lethal yellowing Disease	Latta (1966)

(1)	(2)	(3)	(4)
Rotylenchulus sp.	El Salvador	General survey	Abrego & Tarjan (1972)
*Rotylenchulus sp.	Jamaica	Lethal yellowing disease	Latta (1964, 1966)
Rotylenchulus sp.	Florida, USA	Lethal yellowing disease	Oliaginier & Westeteign (1963)
Rotylenchulus sp.	Kerala, India	Root (wilt) disease	Mathen et al (1970).
Rotylenchulus sp.	Venezuela	General survey	Torrealba (1969)
*Rotylenchulus sp.	Florida, USA	Lethal yellowing disease	van Weerdt et al (1959 b)
Rotylenchulus sp.	Kerala, India	Root (wilt) disease	Weischer (1967)
Rotylenchus sp.	Trinidad	Red ring disease	Fenwick & Maharaj (1962)
Rotylenchus sp.	Guam	Guam disease	Reinking & Radewald (1961)
Scutellonema bradys	Togo, West Africa	Kaincope disease	Luc & Hoestra (1960)
Scutellonema sp.	Jamaica	Lethal yellowing disease	van Weerdt et al (1959b)
Sphaeronema (?)	Jamaica	Lethal yellowing disease	Latta (1966)
Trichodorus christei	Florida, USA	General survey	van Weerdt et al (1959a)
T. proximus	Florida, USA	General survey	van Weerdt et al (1959a)
Trichodorus sp.	Togo, West Africa	Kaincope disease	Luc & Hoestra (1960)
Trichodorus sp.	Florida, USA; Jamaica	Lethal yellowing disease	van Weerdt et al (1959b)
Trichotylenchus actriatus	Mysore, India	General survey	Khan & Nanjappa (1971)
Trophonema sp.	Golden Grove, Trinidad	Coconut decline	Maramorosch & Golden (1967)

(1)	(2)	(3)	(4)
Trophurus similis	Mycore, India	General survey	Khan & Nanjappa (1971)
Trophurus sp.	Jamaica	Lethal yellowing	Latta (1966)
Tylenchorhynchus nudus	Sri Lanka	Leaf Scorch decline	Ekanayake (1964)
Tylenchorhynchus sp.	El Salvador	General Survey	Abrego & Tarjan (1972)
Tylenchorhynchus sp.	Jamaica	Lethal yellowing disease	Latta (1964, 1966)
Tylenchorhynchus sp.	Kerala, India	Root (wilt) disease	Mathen et al. (1970)
Tylenchorhynchus sp.	Venezuela	General survey	Torrealba (1969)
Tylenchorhynchus sp.	Florida, USA	Lethal yellowing	van Weerdt et al. (1959b)
Tylenchorhynchus sp.	Kerala, India	Root (wilt) disease	Weischer (1967)
Tylenchulus semipenetrans	Florida, USA	General sruvey	van Weerdt et al. (1959a)
Tylenchus sp.	Jamaica	Lethal yellowing disease	Latta (1964, 1966)
Tylenchus sp.	Venezuela	General survey	Torrealba (1969)
Tylenchus sp.	French, West Indies	General survey	Maccese, Scotto La (1969)
Xiphinema americanum	Guam	Guam disease	Reinking & Badewall (1961)
X. americanum	Florida, USA	General survey	van Weerdt et al (1959a)
X. attoroderum	Togo, West Africa	Kaincope disease	Luc & Hoestra (1960)
X. brasiliense	Golden Grove, Trinidad	General survey	Maramorosch & Golden (1967)
X. campinense	Togo, West Africa	General survey	Luc (1958)
X. diversicaudatum	Guam	Guam disease	Reinking & Badewald (1961)

(1)	(2)	(3)	(4)
Trophurus similis	Mysore, India	General survey	Khan & Nanjappa (1971)
Trophurus sp.	Jamaica	Lethal yellowing	Latta (1966)
Tylenchorhynchus nudus	Sri Lanka	Leaf Scorch decline	Ekanayake (1964)
Tylenchorhynchus sp.	El Salvador	General Survey	Abrego & Tarjan (1972)
Tylenchorhynchus sp.	Jamaica	Lethal yellowing disease	Latta (1964, 1966)
Tylenchorhynchus sp.	Kerala, India	Root (wilt) disease	Mathen et al. (1970)
Tylenchorhynchus sp.	Venezuela	General survey	Torrealba (1969)
Tylenchorhynchus sp.	Florida, USA	Lethal yellowing	van Weerdt et al. (1959b)
Tylenchorhynchus sp.	Kerala, India	Root (wilt) disease	Weischer (1967)
Tylenchulus semipenetrans	Florida, USA	General sruvey	van Weerdt et al. (1959a)
Tylenchus sp.	Jamaica	Lethal yellowing disease	Latta (1964, 1966)
Tylenchus sp.	Venezuela	General survey	Torrealba (1969)
Tylenchus sp.	French, West Indies	General survey	Massese, Scotto La (1969)
Xiphinema americanum	Guam	Guam disease	Reinking & Radewald (1961)
X. americanum	Florida, USA	General survey	van Weerdt et al (1959a)
X. attoroderum	Togo, West Africa	Kaincope disease	Luc & Hoestra (1963)
X. brasiliense	Golden Grove, Trinidad	General survey	Maramorosch & Golden (1967)
X. campinense	Togo, West Africa	General survey	Luc (1958)
X. diversicaudatum	Guam	Guam disease	Reinking & Radewald (1961)

(1)	(2)	(3)	(4)
Xiphinema infacolum	Guam	Pencil point disease	Maramorosch & Golden (1967)
X. setariae	Togo, West Africa	Kaincope disease	Luc & Hoestra (1960)
X. vulgare	French, West Indies	General survey	Macsaco, Sectto La (1969)
Xiphinema sp.	El Salvador	General survey	Abrego & Tarjan (1972)
Xiphinema sp.	Jamaica	Lethal yellowing disease	Latta (1964, 1966)
Xiphinema sp.	Sarawak, North Borneo (Semetan)	Pencil point disease	Maramorosch & Golden (1967)
Xiphinema sp.	Kerala, India	Root (wilt) disease	Mathen *et al*. (1970)
Xiphinema sp.	Venezuela	General survey	Torrealba (1969)
* *Xiphinema* sp.	Florida, USA; Jamaica	Lethal Yellowing Disease	van Weerdt *et al* (1959b)
Xiphinema sp.	Kerala, India	Root (wilt) disease	Weischer (1967)

Note:- Undetermined species from different localities have been repeatedly listed in the table as their identity has not been indicated in the literature.

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