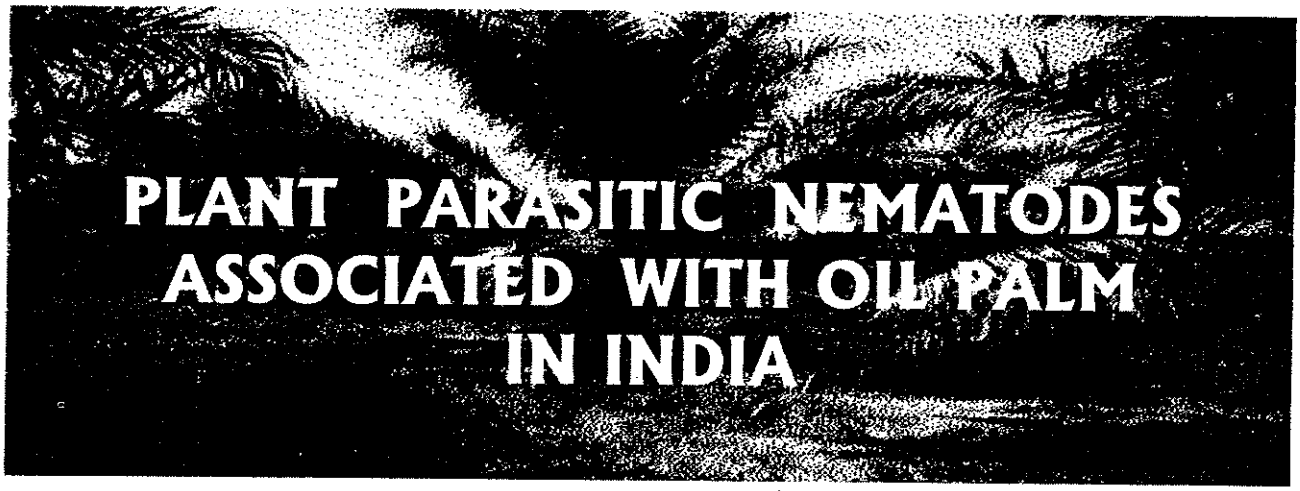


PLANT PARASITIC NEMATODES ASSOCIATED WITH OIL PALM IN INDIA

* by P. Sundararaju, P.K. Koshy, K. Rathnakaran, J. Gulsar Banu & V. K. Sosamma

A total of 620 each of soil and root samples collected from Oil Palm plantations in eight states of India indicated the presence of 21 genera of plant parasitic nematodes. The root lesion nematode, Pratylenchus coffeae was the predominant species recorded from the root samples of Oil Palm in all the eight states of India, whereas the burrowing nematode, Radopholus similis was recorded only from Kerala, Karnataka, Andhra Pradesh and Assam. The other major nematode species encountered from the rhizosphere of Oil Palm with high frequency and density were Rotylenchulus reinformis, Helicotylenchus sp. and Aphlenchoide sp. Maximum percentage occurrence of different nematodes were recorded from red loam soil followed by gravely loam soil.

The first plant parasitic nematodes reported on Oil Palm is Rhadinaphelenchus cocophilus from Trinidad

The Oil Palm is affected by large number of insects, fungi and nematodes. c (Nowell, 1919). In India, the burrowing nematode, Radopholus similis was recorded on Oil Palm seedlings in Karnataka (Anonymous, 1990). Though Oil Palm is the most important oilseed crop grown in large areas in Kerala, Karnataka, Tamil Nadu and Andhra Pradesh, detailed survey has not been carried out so far to identify the plant parasitic nematodes associated with the crop. Hence, the present investigation was carried out and the results are presented herein.

MATERIALS AND METHOD

The survey was undertaken in Oil Palm nurseries as well as adult plantations in the States of Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Goa, Maharashtra, West Bengal and Assam during 1989-94. The survey covered Oil Palm plantations at CPCRI Research Centre, Palode; Oil Palm India Ltd., Chithara, Kulathupuzha, Yeroor and Thodupuzha in Kerala; Oil Palm demonstration plots in Charmudi and Karkala of South Kanara district, Bhadra, Tunga, Honnali, Chennagiri, Bhadravathy and Kalenahalli in Shimoga district; K.R. Sagar in Mandya district, Nanjangud in Mysore district, Siddapur and Mundagod in Uttara Kannada district, Bellapur in Chitradurga district, Navalgund in Dharwad district, Munirabad and Odderahatti in Raichur district, Bukkasagara and Nagasthi basappura in Bellary district of Karnataka; Pethenampatty in Trichirappally district, Aduthurai and Veppankulam in Thanjavur district of Tamil Nadu; Oil Palm Plantations of M/s. Navabharat Enterprises at Lakshmipuram,

* Section of Nematology, Central Plantation Crops Research Institute, Kasaragod-671 124, Kerala

Jengareddigudam and Borrempalam in West Godavari district, Muram village of East Godavari district of Andhra Pradesh; M/s. Godrej Oil Palm plantations at Valpoi of Goa state; Mulde, Sangave, Assalde, Kankavalli and Darum village of Maharashtra; CPCRI, Research Centre, Mohitnagar in West Bengal and CPCRI Research Centre, Kahikuchi in Assam. A total of 620 each of soil and root samples were collected from different soil types such as gravely loam, red loam, laterite red sandy, laterite clay and black alluvial.

Frequency and density are the two important and conventional parameters of population studies in nematodes.

Soil samples alone were collected from 30 seedlings of primary nursery. Soil and root samples were collected at a distance of one metre away from the bole region to the depth of 25 to 75 cm. with a 75 mm. soil auger. Three such samples were taken within the basin at 120^0 to each other, mixed well and 250 CC. samples drawn. In addition to the root bits collected through auger, 25 to 50g. tender portion of the main roots was also collected wherever possible from the base of the palm. In the case of nursery, samples were collected around the base of the seedlings which were raised in polybags. Soil samples were processed by Cobb's sieving and sifting method. Root populations were extracted by the method reported by Koshy *et al* (1975) and the nematode population was estimated under a stereoscopic microscope. The absolute frequency, density and prominence value of the nematodes were calculated using methodology of Norton (1978) as indicated below:

$$\text{Absolute frequency} = \frac{\text{No. of samples containing nematodes}}{\text{No. of samples collected}} \times 100$$

$$\text{Absolute density} = \frac{\text{No. of nematodes in all samples}}{\text{No. of samples collected}}$$

$$\text{Prominence value} = \text{Absolute density} \times \sqrt{\text{Absolute frequency}}$$

RESULTS

Eight genera of plant parasitic nematodes were recorded from root samples of Oil Palm. Among these, the genera viz. *Aphelenchus sp., Aphelenchoides sp. and Pratylenchus coffeae* are the predominant species recorded from root samples in almost all the Oil Palm growing areas in the eight states of India surveyed, whereas the burrowing nematode, *Radopholus similis* was recorded only in four states of India. *P. coffeae* was the most important pathogen of Oil Palm and the percentage occurrence of this nematode was 13.1, 19.4, 26.7, 14,5, 12.5, 7.9, 26.0 and 33.3 with respect to Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Goa, Maharashtra, West Bengal and Assam. The burrowing nematode, *Radopholus similis* was the other important pathogen recorded from the root samples of Oil Palm in Kerala, Karnataka, Andhra Pradesh and Assam and the percentage occurrence of the nematode was 9.0, 13.9, 12.7 and 66.6 respectively. The other genera recorded from root samples of Oil Palm were *Helicotylenchus Rotylenchulus reniformis, Ditylenchus and Meloidogyne.Though R.reniformis and Meloidogyne sp.* were recorded in most of the root samples in Oil Palm, no female could be observed from the root.

Primary Nursery

Seven genera of plant parasitic nematodes were recorded from soil samples collected from Oil palm seedlings of primary nursery at CPCRI Research Centre, Palode. Among these the genera *Helicotylenchus* and *Xiphinema* were found to occur in maximum absolute frequency, absolute density and prominence value in the soil samples. Frequency and density are the two important and conventional parameters of population studies in nematodes. As they individually convey only limited meaning, prominence value (Beals, 1960) which relates these two parameters, is of significant importance.

Secondary Nursery

Ten genera of plant parasitic nematodes were recorded from the secondary nursery of Oil Palm at CPCRI Research Centre, Palode. The genera Xiphinema was found to occur in

maximum absolute frequency (84.6%), absolute density (710) and prominence value (6530.4) from the soil samples. Four nematode genera namely *R. similis, P. coffeae, Aphelenchoides sp. and Ditylenchus sp.* were recorded from root samples of secondary nursery and the percentage occurrence was 23.1, 7.7, 15.4 and 7.7 respectively.

Oil Palm plantations in Kerala State

The results revealed that nineteen genera of plant parasitic nematodes were recorded from the rhizosphere of Oil Palm. Among them, the genera *Aphelenchus, Aphelenchoides, R.reniformis, Tylenchorhynchus and Tylenchus* were the dominant genera found to occur in maximum absolute frequency, absolute density and prominence value. Eight genera of plant parasitic nematodes were recorded from root samples of Oil Palm.

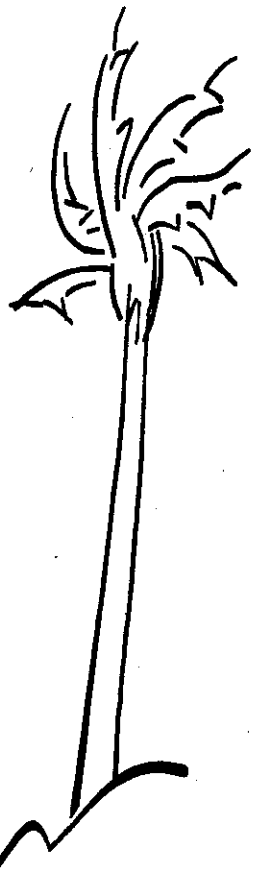
Oil Palm plantations in Karnataka State

Eighteen genera of plant parasitic nematodes were found to occur in the rhizosphere of Oil Palm. The genera *R.reniformis, Helicotylenchus sp., Tylenchorhynchus sp. and P. coffeae* were recorded in maximum frequency and density with the prominence value in the soil samples. Seven genera of plant parasitic nematodes were recorded from the root sample of Oil Palm.

Oil Palm plantations in Tamil Nadu

Soil samples collected from Oil Palm plantations from Tamil Nadu revealed the presence of fourteen genera of plant parasitic nematodes. The genera *R. reniformis* was found to occur in maximum absolute frequency (57.7%) and absolute density (455) with the prominence value of 3456.2 followed by *Helicotylenchus sp., Tylenchorhynchus sp and P.coffeae*. Six genera of plant parasitic nematodes were recorded from root samples of Oil Palm and the maximum percentage occurrence of *P. coffeae* was 26.6 followed by *Aphelenchoides sp.*

Oil Palm plantations in Andhra Pradesh



Analysis of the soil samples collected from Oil Palm plantations in Andhra Pradesh indicated the presence of fifteen genera of plant parasitic nematodes. The genera *Helicotylenchus sp., Meloidogyne sp., Hoplolaimus sp., and Tylenchorhynchus sp.* were recorded in maximum frequency and density with the higher prominence value from the soil samples. Six genera of plant parasitic nematodes were recorded from root samples of Oil Palm.

Oil Palm plantations in Goa

Nine genera of plant parasitic nematodes were recorded from the soil samples collected from Oil Palms in Goa. Among these, the reniform nematode *R. reniformis* was recorded in maximum frequency (50%) and absolute density (112) with the prominence value of 791.9 followed by *P. coffeae*. Four genera of plant parasitic nematodes were recorded from the root samples of Oil Palm but the frequency of occurrence was very low.

Oil Palm plantations in Maharashtra

The soil samples collected from Oil Palm plantations in Maharashtra yielded fifteen genera of plant parasitic nematodes. Among them the genera *Helicotylenchus, Tylenchorhynchus and Tylenchus* were the dominant genera recorded maximum in absolute frequency, density and prominence value, from the soil samples. Out of five genera, the root lesion nematode, *P. coffeae and Aphelenchus sp.* were the predominant nematodes recorded from root samples of Oil Palm.

Survey of Nematodes from Oil Palm at CPCRI, RC Mohitnagar and Kahikuchi

Twentythree soil samples collected from Oil Palm experiment at CPCRI Research Centre, Mohitnagar and three from Kahikuchi were assessed for nematodes. Six genera of plant parasitic nematodes were recorded from the samples collected from Oil Palm in Mohitnagar. The genera, *Helicotylenchus* was the dominant one found to occur in maximum absolute frequency (30.45%), absolute density (263) with the prominence value of 1452.5. Six genera of plant parasitic nematodes were also recorded from the root samples of Oil Palm. None of the soil samples collected from Oil Palm in Kahikuchi yielded any nematodes. However, the nematode species viz; *R. similis, P. coffeae, Aphelenchoides and Aphelenchus* were recorded from the root samples of Oil Palm. None of the samples collected from Oil Palm plantations in Tamil Nadu, Maharashtra, Goa and West Bengal yielded any *R. similis*. A total of 21 genera plant parasitic nematodes were recorded from the rhizosphere of Oil Palm.

Maximum percentage occurrence of different nematodes was recorded from red loam soil, closely followed by gravely loam and laterite. With reference to different soil types, the percentage occurrence of *Helicotylenchus* was found to occur maximum in red loam soil (55.8%) followed by gravely loam (53.7%), laterite (39.8%), *clayey*(34.7%) and alluvial (29.0%). The second highest percentage of occurrence was seen in the case of *Rotylenchulus reniformis* by recording 46% in red loam soil followed by alluvial (40.6%), laterite (36.9%), gravely loam (35.8%) and clayey (22.2%). Similarly the frequency of occurrence of the root lesion nematode. *P.coffeae* was recorded maximum in red loam soil (35.4%) followed by gravely loam (23.9%), clayey (16.6%), laterite (12.5%) and alluvial (10.9%). The number of nematodes recorded from clayey soil was found to be less compared to other soil types.

From the available literature, it appeared that caloosia longicandata (Loos, 1948) Siddiqi and Goodey, 1964; Rotylenchulus reniformis Linford and Oliveira, 1940; Pratylenchus coffeae (Zimmerman, 1898) Filipjev and Schuurmans Stekhoven, 1941); Helicotylenchus multicinctus; Helicotylenchus of indicus Siddiqi, 1963; Tylenchorhynchus coffeae; Hopholaimus seinhorsti(Luc, 1958) Shamsi, 1979 were recorded for the first time in association with Oil Palm in India.

A total of 21 genera plant parasitic nematodes were recorded from the rhizosphere of Oil Palm.

Discussion

Survey conducted in Oil Palm plantations in the eight states of India revealed the presence of 21 genera of plant parasitic nematodes. Among them, the root lesion nematode, Pratylenchus coffeae was the most economically important nematodes occuring in almost all the eight states of India surveyed from Oil Palm. The other economically important nematode pathogens are the burrowing nematode, *Radopholus similis* occuring in Kerala, Karnataka, Andhra Pradesh and Assam. Kumar *et al* (1971) also reported that both *P. coffeae and R. similis* are the major pest and widely distributed in coffee tracts of South India.

The root lesion nematode, Pratylenchus coffeae was the most economically important nematodes occuring in almost all the eight states of India surveyed from Oil Palm.

The root lesion nematode has a very wide host range attacking more than 200 species of plants (Goodey *et al.* 1965), most important cultivated crops being coffee, banana, apples and strawberry (Thorne, 1961). The burrowing nematode has been reported from coconut palm in association with lethal yellowing in Florida and Jamaica and leaf scorch decline in SriLanka and from Western Samoa of Pacific Ocean Islands (Van Weerdt *et al.* 1959; Latta, 1966; Ekanayake, 1964; and Orton Williams,

1980). In India, the burrowing nematode was reported for the first time from roots of banana (Nair *et al.* 1966) and later from coconut (Weischer, 1967). Extensive survey conducted by Koshy *et al* (1978) revealed the wide spread occurrence of *R. similis* on coconut, arecanut, banana and black pepper in South India.

The present investigations show a variation in the population density occuring from state to state as explained by the absolute density, absolute frequency and prominence value factors. Majority of the nematodes were found to occur maximum in red loam soil followed by gravelly loam soil which obviously indicates the nematodes preference for loose, well drained soil (Sundararaju, 1984). Among the 21 genera of plant parasitic nematodes, the genera *Helicotylenchus* was the dominant one found to occur maximum in red loam soil (55.8%) followed by gravely loam soil (53.7%).

Majority of the nematodes were found to occur maximum in red loam soil followed by gravelly loam soil which obviously indicates the nematodes preference for loose, well drained soil

Rotylenchulus reniformis was the second predominant species and obtained the maximum percentage occurrence in red loam soil (46.6%) and widely distributed in Oil Palms in all the eight states of India. The other two economically important nematode species viz. *P. coffeae and R. similis* were also found to occur maximum in red loam soil (35.4% and 23.9%) and followed by gravely loam soil (23.9% and 14.9%). The occurrence of *P.coffeae and R.similis* was numerically inferior to *Helicotylenchus sp. and Rotylenchulus reniformis,* but the greater damage caused by *P. coffeae and the R. similis* would make it the most important of the nematodes discovered. These two nematodes feed endoparasitically on the roots and causes elongate red to dark brown lesions in the epidermis. These lesions very often extend throughout the cortex to the vascular bundles. They feed and reproduce within the root and only migrate into the soil when food becomes a limiting factor. The extensive lesions caused by these nematodes facilitate a secondary invasion by pathogenic fungi and bacteria and eventually an infected root becomes completely necrotic. In general, the nematode population was less in clayey soil compared to other soil types.

The most important means by which *R. similis and P. coffeae* are introduced into new geographical areas are through the infested planting materials, as these two nematodes are migratory endoparasitic habits in nature.

The number of samples collected was not only inadequate but did not represent all the soil types. However, the information obtained from this survey do indicate the need for an extensive as well as intensive survey especially from Oil Palm plantations in North East region, since the samples collected were limited and unseasonal. The most important means by which *R. similis and P. coffeae* are introduced into new geographical areas are through the infested planting materials, as these two nematodes are migratory endoparasitic habits in nature.

The present investigations have clearly revealed that the association of plant parasitic nematodes especially the most economically important species like *Pratylenchus coffeae* and *Radopholus similis* would cause severe damage to the Oil Palm plantations if the management practices are not being governed to keep the population abate.

Notable Maxim

If you drink milk under a palm tree, people will think you are drinking toddy !