



BIODIVERSITY OF PLANT PARASITIC NEMATODES ASSOCIATED WITH BANANA IN THANJAVUR DISTRICT OF TAMIL NADU.

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ABSTRACT : Banana is one of the most important fruits crops among the different fruit crops in the agricultural and its intensively cultivated in all over the parts of India especially in middle part of Tamilnadu. A total number of 80 each soil and root samples were collected from various part of Tamilnadu in Tiruchirapalli. Thiruvaiyaru, Thiruvudaimarudur, Kumbakonam, Papanasam, Thanjavur, Orathanadu, Pattukottai and Peravurani, Talkus of Thanjavur districts of Tamilnadu during December 2006 to March 2007. Covering a range of soil types such as clay (32) sandy (23), alluvial (17), sandy loam (4), red soil (3), Black soil (1), were processed and nematodes populations were assessed. In the present study revealed that the all talkus of root lesion nematodes (*Pratylenchus coffeae*) was the predominant species found to occur in maximum number of root samples (42/80) and it has the highest prominence value of 48785.9, 20261.2, 54529.2, 127421.7, 53622, 49900.3, 30695.1 and 44569.3 with admiration to 8 talkus Thanjavur followed by spiral nematodes (*Helicotylenchus multicintus*) root knot nematode (*Meloidogyne incognita*). *P. coffeae* was also recorded as a predominant species from all the cultivars surveyed and the occurrence percentage rate were, 42.5, 73, 33.3, 50, 100 and 100 with respect with cultivars Poovan, Monthan, Karpuravalli, Pacchnadan, Red banana, and Robusta, maximum percentage occurrence of *P. coffeae* was recorded from red soil (66.60%) followed by sandy loam soil (50.00%). Analysis of the soil sample revealed the presence of 12 genera of plant parasitic nematode.

Key words: Biodiversity, community, nematodes, banana varieties, soil, Thanjavur district, Tamilnadu.

INTRODUCTION

In India covering an area of 4.9 lakhs banana fruits per hacter with total production 16.9 million tones per annum [1]. It is one of the non-commercial plant for cultivated is one of the backyard plantings and also commercial cultivation by private growers, and allover country local consumption for prayer some people, and traditional poojas prilecrime as temple. In addition to this fruits as have higher potential medical and pharmaceutical per potassium because of cultivation of banana plant. The plant parasitic nematodes as pests of different horticultural and field crops are responsible for an annual monetary loss of Rs. 300 cores/annum in Tamilnadu alone. Namely 50 species of plant parasitic nematodes have been reported in association with banana root systems [2] and are mainly responsible for controlling the banana production to greater extend. [3, 4, 5, 6]. Keeping in view of the disturbing nature of this pest, the present study was undertaken to examine the biodiversity of plant parasitic nematodes associated with banana intensively grown in Thanjavur district of Tamilnadu.

MATERIAL AND METHODS

During the month of December 2006 to March 2007 an intensive survey of plant parasitic nematodes affecting banana plant was conducted from the banana growing areas of Thiruvaiyaru, Thiruvaidaimarudur, Kumbakonam, Papanasam, Thanjavur, Orathanadu, Pattukottai and Peravurani taluks of Thanjavur district of Tamilnadu. A total of 80 each of soil and root samples were collected from different cultivars of banana viz., Poovan (40), Monthan (26), Karpuravalli (6), Pachanadan (4), Rasthali (2), Red banana (1), Robusta (1), in various soil types such as clay, sandy, alluvial, sandy loam, red soil and black soil in and around the middle part of Tamilnadu. Survey work was conducted mainly from the banana garden in different places of Thanjavur district. At each place a random of soil and root samples were collected from banana plants at 25-50cm away from the bole of the plant to a depth of 10-50 cm with the help of a G1 pipe diameter 75mm. Collected samples were taken within the basin, mixed well and an aliquot 250cc samples were drawn in addition to the root bits collected through auger, 10-20g at tender, white to orange colored semi hard portion of the main roots wherever possible from the base of the plants. Number of sample collected from different moieties of banana covering differed soil types are net large and inform due to the non-availability of plants at the respective place. Soil samples more processed for nematode assay by decanting and sieving followed by the modified Baermann funnel technique [7]. The root sample more thoroughly washed in running tap water finely chopped and thoroughly mixed. Five grams of these composite samples were stained in acid fuchsine and lacto phenol method, and the nematode population in root was estimated by traction through maceration by using a kitchen blender. Nematodes collected from soil samples were killed in hot water and later fixed in 4% formaldehyde solution. Nematode population as estimated by using a stereoscope microscope. Plant parasitic nematodes were identified up to genus/species level by using standard monograph. The species of root knot nematode were identified by their perennial pattern male and juvenile character. The absolute frequency absolute density and prominence value of the nematodes calculated using methodology of [8] as given below.

$$\text{Absolute frequency} = \frac{\text{Number of samples containing nematodes}}{\text{Number of samples collected}} \times 100$$

$$\text{Absolute density} = \frac{\text{Number of nematodes in all samples}}{\text{Number of sample collected}} \times 100$$

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

RESULTS AND DISCUSSION

Community analysis of plant parasitic nematodes associated with banana root showed that *Pratylenchus coffeae* had the highest prominence values 48785.9, 20261.2, 54529.2, 127421.7, 53622, 49900.3, 30695.1 and 44569.3 with respect to eight taluks of Thanjavur District in middle Tamilnadu. The other species otherwise called as *Helicotylenchus multicintus* and *Meloidogyne incognita* six taluks of Thanjavur Districts. With various intensity of nematodes populations (Table 1). The Burrowing nematodes *Radopholus similis* was recorded from Thiruvaiyaru and Eachangudi of Thiruvaiyaru and Papanasam talukus Thanjavur District is the first report of this nematode.

Present study revealed that the presence of genera of plant parasitic nematodes similar to soil samples maximum occurrence of *Hoplolamius sp.* population was recorded in soil samples all taluks. Surveyed and had the highest prominence Value of 3003.6, 3923.4, 11077.5, 6366.8, 5000.8, 1591.5, 13700.1, and 2692.5, with respect to Thiruvaiyaru, Thiruvidaimarudur, Kumbakonam, Papanasam, Thanjavur, Orathanadu, Pattukkottai, and Peravurani respectively. Further prominence value was *P.coffeae*, *M.incognita*, *R.simillis* and *H.multicinctus*. The other nematodes genera viz., *Hetroderaoruzicola sp*, *Tylenchorhynchus sp*, *Paratylenchus sp*, *Rotylenchus sp*, *Longiderus sp*, *Peralongidorus sp*, were recorded in minimum number and does not cause much damage to banana plantation (Table 2).

Table 1. Community analysis of plant parasitic nematodes from 80 root samples of banana grown in Thanjavur district.

Samples collected Area	Name of the Nematodes	Frequency Distribution	Total no of Nematodes	Absolute Frequency Distribution (%)	Absolute Density (%)	Prominence Value
Thiruvaiyaru (15)	<i>Radopholus similis</i> .	1	158	06.6	1053.3	2705.9
	<i>Pratylenchus coffeae</i> .	7	1072	46.6	7146.6	48785.6
	<i>Helicotylenchus multicinctus</i>	6	634	40.0	4226.6	26731.3
	<i>Meloidogyne incognita</i>	4	629	26.6	4193.3	21627.0
	<i>Tylenchorhynchus sp.</i>	1	130	06.6	866.6	2226.3
Thiruvidai marudur (9)	<i>Pratylenchus coffeae</i>	3	316	33.3	3511.1	20261.2
	<i>Meloidogyne incognita</i>	3	374	33.3	4155.5	23979.7
Kumbakonam (12)	<i>Pratylenchus coffeae</i>	7	857	58.3	7141.6	54529.2
	<i>Helicotylenchus multicinctus</i>	1	137	8.3	1141.6	3288.9
	<i>Meloidogyne incognita</i>	2	348	16.6	2900	11815.5
	<i>Tylenchorhynchus sp.</i>	1	030	08.3	250	720.2
Papanasam (9)	<i>Pratylenchus coffeae</i>	7	1301	77.7	1455.5	127421.7
	<i>Helicotylenchus multicinctus</i>	2	174	22.2	1933.3	9109.1
	<i>Radopholus similis</i>	1	180	11.1	2000.0	2016.6
Thanjavur (12)	<i>Pratylenchus coffeae</i>	6	910	50.0	7583.3	53622.0
	<i>Helicotylenchus multicinctus</i>	3	305	25.0	2541.6	12708.0
	<i>Tylenchorhynchus sp.</i>	1	084	08.3	700.0	2016.6
Orathanadu (9)	<i>Pratylenchus coffeae</i>	4	674	44.4	7488.8	49900.3
	<i>Helicotylenchus multicinctus</i>	5	344	55.5	3822.2	28474.7
	<i>Meloidogyne incognita</i>	4	277	44.4	3077.7	20507.7
	<i>Tylenchorhynchus sp.</i>	2	119	22.2	1322.2	6229.7
Pattukkottai (8)	<i>Pratylenchus coffeae</i>	3	401	37.5	5012.5	30695.1
	<i>Helicotylenchus multicinctus</i>	1	174	12.5	2175	7689.7
	<i>Meloidogyne incognita</i>	3	403	37.5	5037.5	30848.2
Peravurani (6)	<i>Pratylenchus coffeae</i>	5	293	83.3	4883.3	44569.3
	<i>Meloidogyne incognita</i>	1	070	16.6	1166.6	4753.0

Note: Tables in parenthesis are the total number of samples collected from each taluks

Table 2. Community analyses of plant parasitic nematodes from 80 soil samples of banana grown in Thanjavur district.

Samples collected Area	Name of the Nematodes	Frequency Distribution	Total no of Nematodes	Absolute Frequency Distribution (%)	Absolute Density (%)	Prominence Value
Thiruvaiyaru (15)	<i>Radopholus similis</i>	1	85	06.6	566.6	14550.6
	<i>Paratylenchus sp.</i>	1	340	06.6	2266.6	5823.0
	<i>Helicotylenchus multicinctus</i>	3	180	20.0	1200.0	5366.5
	<i>Meloidogyne incognita</i>	1	74	06.6	493.3	1267.3
	<i>Rotylenchus sp.</i>	1	29	06.6	193.3	496.5
	<i>Heteroderaoryzicola sp.</i>	1	19	06.6	126.6	325.2
	<i>Tylenchorhynchus sp.</i>	9	925	60.0	6166.6	47765.2
	<i>Hoplolaimus sp.</i>	7	66	46.6	440.0	3003.6
Thiruvidai marudur (9)	<i>Pratylenchus coffeae</i>	6	535	40.0	3566.6	22557.1
	<i>Pratylenchus coffeae</i>	3	197	33.3	2188.8	12626.1
	<i>Meloidogyne incognita</i>	3	311	33.3	3455.5	19940.4
	<i>Tylenchorhynchus sp.</i>	5	685	55.5	7611.1	1241.1
Kumbakonam (12)	<i>Hoplolaimus sp.</i>	4	53	44.4	588.8	3923.4
	<i>Pratylenchus coffeae</i>	2	224	16.6	1866.6	7605.1
	<i>Helicotylenchus multicinctus</i>	2	262	16.6	2183.3	8895.4
	<i>Meloidogyne incognita</i>	3	380	25.0	3166.6	15883.0
	<i>Rotylenchus sp.</i>	1	17	08.3	141.6	407.9
	<i>Tylenchorhynchus sp.</i>	6	746	50.0	6216.6	43958.0
	<i>Hoplolaimus sp.</i>	6	188	50.0	1566.6	11077.5
Papanasam (9)	<i>ParaLongidorus sp.</i>	2	20	16.6	166.6	678.7
	<i>Radopholus similis</i>	1	65	11.1	722.2	2406.1
	<i>Pratylenchus coffeae</i>	4	351	44.4	3900.0	25986.9
	<i>Helicotylenchus multicinctus</i>	1	97	11.1	1077.7	3590.5
	<i>Rotylenchus sp.</i>	2	62	22.2	688.8	3245.4
	<i>Tylenchorhynchus sp.</i>	3	184	33.3	2044.4	11797.4
	<i>Hoplolaimus sp.</i>	4	086	44.4	955.5	6366.8
Thanjavur (12)	<i>Pratylenchus coffeae</i>	6	611	50.0	5091.6	36003.0
	<i>Helicotylenchus multicinctus</i>	4	373	33.3	3108.3	17936.8
	<i>Longidorus sp.</i>	1	08	08.3	66.6	191.8
	<i>Rotylenchus sp.</i>	4	161	33.3	1341.6	7741.8
	<i>Heteroderaoryzicola sp.</i>	1	29	08.3	241.6	696.0
	<i>Tylenchorhynchus sp.</i>	6	533	50.0	4441.6	31406.8
	<i>Hoplolaimus sp.</i>	4	104	33.3	866.6	5000.8
	<i>Paratylenchus sp.</i>	1	540	08.3	4500.0	12964.4
Orathanadu (9)	<i>Pratylenchus coffeae</i>	1	35	11.1	388.8	1295.3
	<i>Helicotylenchus multicinctus</i>	3	315	33.3	3500.0	20197.1
	<i>Tylenchorhynchus sp.</i>	6	476	66.6	5288.8	43161.2
	<i>Meloidogyne incognita</i>	1	113	11.1	1255.5	4182.9
	<i>Hoplolaimus sp.</i>	1	43	11.1	477.7	1591.5
Pattukkottai (8)	<i>Pratylenchus coffeae</i>	1	27	12.5	337.5	1193.2
	<i>Helicotylenchus multicinctus</i>	1	44	12.5	550.0	1944.5
	<i>Tylenchorhynchus sp.</i>	5	278	62.5	3475.0	27472.2
	<i>Meloidogyne incognita</i>	2	203	25.0	2537.5	12687.5
	<i>Hoplolaimus sp.</i>	4	155	50.0	1937.5	13700.1
	<i>Heteroderaoryzicola sp.</i>	3	76	37.5	950.0	5817.5
Peravurani (6)	<i>Tylenchorhynchus sp.</i>	4	199	66.6	3316.6	27066.3
	<i>Heteroderaoryzicola sp.</i>	3	58	50.0	966.6	6834.8
	<i>Hoplolaimus sp.</i>	2	28	33.3	466.6	2692.5
	<i>Rotylenchus sp.</i>	1	42	16.6	700.0	2852.0

Note: Tables in parenthesis are the total number of samples collected from each taluks

All the 7 cultivars of banana, viz., Poovan (AAB) Montan (ABB), Karpuravalli (ABB), Pachanadan (AAB), Resthali (AAB), Red banana (AAA) and Robusta (AAB), were found infested with either one or all the five major nematodes pests. Among the root lesion nematodes *P. coffeae* was the predominant species recorded from all the cultivars. Surveyed and the percentage occurrence was 100, 100, 73, 50, 42.5, and 33.3, with respect to cultivars. Red banana, Robusta, Montan, Pachanadan, Poovan, and Karpuravalli (Table 3). The root knot nematode *M. incognita* the second predominant recorded for four varieties the cultivars and percentage occurrences of 50, 33.3, 25 and 23 Rasthali, Karpuravalli, Poovan, Monthan (Table 3) The spiral nematodes *Helicotylenchus mylticintus* the four varieties the cultivars and percentage. 33.3, 27.5, 25, 19.2, Karpuravalli, Poovan, Patchanadan, Monthan, similar to *M. incognita* and *H. multicitis*. Was also recorded from the cultivars except in cultivars. Resthali and the percentage occurrence of *P. coffeae* recorded was 100, 100, 73, 50, 42.5, 33.3, Red banana, Robusta, Monthan, Pachanadan, Poovan, and Karpuravalli where as the percentage occurrence of *R. similes* was recorded only from two cultivars Viz. Pachanadan (25%). Monthan (3.8%) (Table 3).

Table: 3 Occurrence of major nematodes in 80 roots samples of different varieties of banana grown in Thanjavur district.

Name of Varieties	Genome	Percentage occurrence (%)				
		<i>Radopholus similis</i>	<i>Pratylenchus coffeae</i>	<i>Helicotylenchus multincinctus</i>	<i>Meloidogyne incognita</i>	<i>Tylenchorhynchus sp</i>
Poovan (40)	AAB	-	42.5	27.5	25	2.5
Monthan (26)	ABB	3.8	73	19.2	23	11.5
Karpuravalli (6)	ABB	-	33.3	33.3	33.3	16.6
Pachanadan (4)	AAB	25	50	25	-	-
Rasthali (2)	AAB	-	-	-	50	-
Red Banana (1)	AAA	-	100	-	-	-
Robusta(1)	AAA	-	100	-	-	-

(-) Denotes did not yield any nematodes

Note: Tables in the parenthesis are the total number of samples collected.

The maximum percentage of different nematodes was recorder from clay soil, sandy soil, alluvial soil, sandy loam soil, red soil and black soil. Maximum percentage of *Tylenchorhynchus sp.* was recorded from red soil 100%, black soil 100%, sandy loam 100%, sandy 65.2%, alluvial soil 52.9%, clay soil 34.4, the second highest percentage of occurrence was seen in the case of *P. coffeae* by recording red soil 66.6%, sandy loam soil 50%, alluvial soil 35.2%, clay soil 28.1% and sandy 17.3%. Similar result was obtained in *R. Similis* 6.3% (Table 4). This may be due to the minimum number of samples collected from thus three soil types.

Table 4. Occurrence and distribution of major nematodes from 80 samples the rhizosphere of banana grown in different soil type in Thanjavur district.

Soil types	Percentage occurrence (%)				
	<i>Pratylenchus coffeae</i>	<i>Meloidogyne incognita</i>	<i>Helicotylenchus multincinctus</i>	<i>Radopholus similis</i>	<i>Tylenchorhynchus sp</i>
Claysoil (32)	34.3	15.6	15.6	6.2	34.3
Sandy (23)	17.3	4.3	13	-	65.2
Alluvial (17)	35.2	17.6	11.7	-	52.9
Sandy loam(4)	50	25	25	-	100
Red soil (3)	66.6	-	-	-	100
Black soil (1)	-	-	100	-	100

(-) Denotes did not yield any nematodes

Note: Tables in the parenthesis are the total number of samples collected from each soil types.

The widespread occurs of *P. coffeae* was recorded in most of the areas surveyed and recovery of there higher number from banana in all seven cultivars of banana suggests that the nematode plays a key role in limiting banana production. They survey result showed that in most of the banana plantation grown in this area exhibited standard growth and yellowing leaves accompanied by poor necrotic root system in those plantations where high population of plant parasitic nematodes were present. Among the nematodes maximum frequency density and prominence value was recorded in *R. similis*, *P. coffeae*, *H. multicinctus*, *M. incognita* and *Tylenchaorhynchus sp.* Earlier report on the wide spread occur of *M. incognita*, *R. similis*, and *P. coffeae* in banana plantations [9, 10, 11, 12, 4, 3] and on oil plan [6] supports the present findings. The root-lesion nematode *P.coffeae* was the dominant species found to occurred maximum in all the six cultivars of banana surveyed followed by *H.multicinctus* and *M.incognita* was recorded in four cultivars of banana. It is quite intensity to note that all the cultivars were found infested with either one or more nematodes wrong either chemical nematicides or control agents. Maximum occurrence of nematodes was recorded in clay soil, sandy soil and alluvial soil. Among nematodes *Tylenchorhynchus sp.* and *Hoplolaimus sp.* was found to occur maximum in sandy soil followed by alluvial soil. The present in agreement with the earlier. Finding of [12] who studied the effect of different soil on multiplication of *P.coffeae* and growth of banana seedlings ware monthan.

Conclusion

Present investigation have clearly indicated that the association of plant parasitic nematodes especially the most an important nematodes species like *P.coffeae*, *H. multicinetus*, *M. incognita* and *Tylenchorhynchus sp.* would cause severe economic yield loss to banana plantation in Thanjavur district of Tamilnadu, if the management practices are not being government to kept the nematodes population under check. In order overcome these problems, integrated nematode management schedule be adopted at the earliest for greater yield of bananas in those areas.

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