

Community Structure of Plant Parasitic Nematodes in Banana Plantations of Andhra Pradesh, India

P. SUNDARARAJU

*Crop Protection Laboratory, National Research Centre for Banana (ICAR),
Thogamalai Road, Thayanur Post, Tiruchirapalli – 620102, Tamil Nadu*

ABSTRACT : A total of 42 soil and root samples collected from different cultivars of banana grown in West Godavari, East Godavari, Guntur and Nellore districts of Andhra Pradesh during July, 2005 covering various soil types viz., alluvial, sandy loam, clay and black soils were processed and nematode populations were assessed. Analysis of the soil samples revealed the presence of 13 genera of plant parasitic nematodes. Root-knot nematode (*Meloidogyne incognita*) was the most predominant species having the highest prominence value, followed by root-lesion nematode (*Pratylenchus coffeae*) and spiral nematode (*Helicotylenchus multicinctus*). *M. incognita* was also recorded as a predominant species from all the cultivars surveyed, whereas the burrowing nematode, *Radopholus similis* was recorded only from cv. Robusta (100%). Cent per cent occurrence of *M. incognita* was recorded from alluvial soil followed by sandy loam soil (80%). *P. coffeae* was also recorded maximum in alluvial soil (83.3%) followed by sandy loam (80%).

Key words: Survey, community analysis, plant parasitic nematodes, banana varieties, soil types, Andhra Pradesh.

Banana (*Musa* spp.) is one of the most important fruit crops widely grown in Indian sub-continent. Plant parasitic nematodes have been recognized as a major constraint in banana production and are responsible for serious yield losses. Though banana is the most important fruit crop grown in Andhra Pradesh, but detailed survey for nematodes has not been carried out except for some sporadic reports on the occurrence of nematodes in banana from Andhra Pradesh (Koshy *et al.*, 1978 & Singh *et al.*, 1979). Hence, an extensive survey was undertaken to know the plant parasitic nematode species associated with banana in Andhra Pradesh.

MATERIALS AND METHODS

An extensive survey of plant parasitic nematodes affecting banana plants was conducted from the main banana growing districts of West Godavari, East Godavari, Guntur and Nellore in Andhra Pradesh during July, 2005. A total of 42 each of soil and root samples were collected from different cultivars of banana viz., Martaman (19), Karpuravalli (8), Karpurachakrakeli (7), Thellachakrakeli (4), Robusta (2) and Monthan (2) grown in various soil types viz., clay, black soil, alluvial and sandy loam. The survey was done mainly from the fusarium wilt affected banana gardens located in Kovvur,

Vadapalli and Maddur Puroshothapalli of West Godavari district; Peravaram, Velicheru, Vaddipur, Ravalpalam and Ampajipet of East Godavari district; Jagarlamudi and Angalakuthiroo of Guntur district and Padukupadu, Devispet, Kothoor and Jegadevapetta of Nellore district in Andhra Pradesh. The samples were collected at 25-50 cm away from the bole of the plant to a depth of 10-50 cm with the help of a GI pipe (diameter 75mm). Three such samples were taken within the basin, mixed well and an aliquot of 250cc samples were drawn. Soil samples were processed for nematode assay by decanting and sieving, followed by the modified Baermann funnel technique. Five grams of root samples were stained in acid fuchsin lactophenol method, and the nematode population in roots was estimated by extraction through maceration by using a kitchen blender. Nematodes collected from soil samples were killed in hot water and fixed in 4% formaldehyde solution. Plant parasitic nematodes were identified upto genus/species level, and their densities were recorded.

RESULTS AND DISCUSSION

A total of thirteen genera of plant parasitic nematodes were found in the rhizosphere of banana plants. Community analysis showed that *M. incognita* was the most predominant species having highest prominence

values of 1255.7, 1156.4, 1020.1 and 941.1 in Nellore, East Godavari, Guntur and West Godavari districts of Andhra Pradesh, respectively. The root-lesion nematode, *P. coffeae* was the second dominant species having the prominence values of 777.8, 775.2, 636.4 and 632.7 in East Godavari, Guntur, Nellore and West Godavari districts, respectively. The other species of root-knot nematode, *M. javanica* was recorded only from Nellore districts with the minimum prominence value (160). The burrowing nematode, *Radopholus similis* the most destructive pest on banana was recorded from banana

grown in West Godavari district only, whereas the other nematodes viz., *H. multicinctus*, *R. reniformis*, *Hoplolaimus* sp. and *Tylenchorhynchus* sp. were recorded from all the four districts of Andhra Pradesh. (Table 1). The other nematode genera viz., *Aphelenchoides* sp., *Aphelenchus* sp., *Tylenchus* sp., *Hemicriconemoides* sp., *Ditylenchus* sp. and *Xiphinema* sp. were recorded in low densities. Data from Table 2 indicated that all the six cultivars of banana namely Martaman (AAB), Karpuravalli (ABB), Karpurachakrakeli (AAB), Thellachakrakeli (AAA),

Table 1. Community analysis of plant parasitic nematodes associated with banana plantations of Andhra Pradesh (No. of samples collected = 42).

District	Nematodes recorded	Absolute frequency (%)	Absolute density (%)	Prominence value
West Godavari (13)	<i>Meloidogyne incognita</i>	61.5	120.0	941.1
	<i>Pratylenchus coffeae</i>	30.8	114.0	632.7
	<i>Radopholus similis</i>	23.0	26.0	124.7
	<i>Helicotylenchus multicinctus</i>	46.1	32.0	217.3
	<i>Hoplolaimus</i> sp.	30.8	10.0	55.5
	<i>Rotylenchulus reniformis</i>	23.0	48.0	230.2
	<i>Tylenchorhynchus</i> sp.	38.5	30.0	186.1
East Godavari (11)	<i>M. incognita</i>	63.6	145.0	1156.4
	<i>P. coffeae</i>	54.5	105.0	775.2
	<i>H. multicinctus</i>	27.3	45.0	235.1
	<i>Hoplolaimus</i> sp.	27.3	25.0	130.6
	<i>R. reniformis</i>	27.3	85.0	444.1
	<i>Tylenchorhynchus</i> sp.	27.3	60.0	313.5
Guntur (6)	<i>M. incognita</i>	66.6	125.0	1020.1
	<i>P. coffeae</i>	50.0	110.0	777.8
	<i>H. multicinctus</i>	16.6	30.0	122.2
	<i>Hoplolaimus</i> sp.	16.6	25.0	101.8
	<i>R. reniformis</i>	50.0	75.0	530.3
	<i>Tylenchorhynchus</i> sp.	16.6	20.0	81.5
Nellore (12)	<i>M. incognita</i>	75.0	145.0	1255.7
	<i>M. javanica</i>	25.0	32.0	160.0
	<i>P. coffeae</i>	50.0	90.0	636.4
	<i>H. multicinctus</i>	33.3	45.0	259.7
	<i>Hoplolaimus</i> sp.	33.3	20.0	115.4
	<i>R. reniformis</i>	16.6	50.0	203.7
	<i>Tylenchorhynchus</i> sp.	33.3	25.0	144.3

Figures in parentheses are the number of samples collected from each district

Robusta (AAA) and Monthan (ABB) were found susceptible to either one or all the five major nematode pests which infect banana. Among them, *M. incognita* was predominant on all the cultivars surveyed, whereas, *Radopholus similis* was recorded only from cv. Robusta (100%). The root lesion nematode, *P. coffeae* the second predominant species recorded from all the cultivars except cv. Robusta. Like *M. incognita*, *H. multicinctus* was also recorded from all the cultivars whereas *R. reniformis* was recorded only from four cultivars viz. Karpurachakrakeli, Karpuravalli, Thellachakrakeli and Martaman.

Maximum percentage occurrence of different nematodes was recorded from alluvial soil followed by sandy loam soil (Table 3). Cent per cent occurrence of *M. incognita* was recorded from alluvial soil followed by sandy loam (80%), clay (66.6%) and black soil (52%).

The second highest percentage of occurrence was seen in the case of *P. coffeae* by recording 83.3% in alluvial soil followed by sandy loam (80%), black (40%) and clay (33.3%) soils. Similarly the frequency of occurrence of *H. multicinctus* was recorded maximum in sandy loam soil (60%) followed by alluvial and minimum in black soil (20%). The 33% occurrence of *R. similis* was in clay soil (33%).

The widespread occurrence of *M. incognita* and its high densities associated with all six cultivars of banana suggested that it might be playing a key role in limiting banana production. Most of the banana plantations exhibited stunted growth and yellowing of leaves accompanied by poor, necrotic and galled root system in those areas where very high population of plant parasitic nematodes were present. The maximum frequency, absolute frequency, absolute density and prominence

Table 2. Occurrence of predominant nematodes in association with different varieties of banana in Andhra Pradesh.

No. of samples collected = 42

Name of varieties	Genome	Percentage occurrence (%)				
		<i>M. incognita</i>	<i>P. coffeae</i>	<i>H. multicinctus</i>	<i>R. similis</i>	<i>R. reniformis</i>
Martaman (19)	AAB	52.6	42.1	31.6	0.0	21.0
Karpuravalli (8)	ABB	75.0	50.0	37.5	0.0	25.0
Karpurachakrakeli (7)	AAB	57.1	57.1	28.6	0.0	57.1
Thellachakrakeli (4)	AAA	75.0	75.0	25.0	0.0	25.0
Robusta (2)	AAA	100.0	0.0	25.0	100.0	0.0
Monthan (2)	ABB	50.0	50.0	50.0	0.0	0.0

Figures in parentheses are the number of samples collected from each variety

Table 3. Occurrence and distribution of predominant nematodes from the rhizosphere of banana grown in different soil types in Andhra Pradesh.

Soil types	Percentage occurrence (%)				
	<i>M. incognita</i>	<i>P. coffeae</i>	<i>H. multicinctus</i>	<i>R. similis</i>	<i>R. reniformis</i>
Alluvial (6)	100.0	83.3	50.0	0.0	50.0
Black soil (25)	66.6	33.3	50.0	33.3	16.6
Clay (6)	52.0	40.0	20.0	0.0	16.0
Sandy loam (5)	80.0	80.0	60.0	0.0	20.0

Figures in parenthesis are the total number of samples collected from each soil type

value were recorded in *M. incognita* followed by *P. coffeae*, which was in accordance with the earlier reports of nematodes in banana plantations (Koshy *et al.*, 1978; and Sudha & Sundararaju, 2002) and on oil palm (Sundararaju & Ratnakaran, 2002) supports the present findings.

Both *M. incognita* and *P. coffeae* were recorded from all the six cultivars of banana surveyed, whereas *R. similis* was confined only to cv. Robusta. It is quite interesting to note that cent per cent occurrence of *M. incognita* and *R. similis* was recorded in cv. Robusta which suggests the need for controlling the nematode using either chemical nematicides or bio control agents. Maximum occurrence of different nematodes was recorded in alluvial and sandy loam soil which was in conformity with the earlier finding of Sundararaju & Jeyabhaskaran (2003) on multiplication of *P. coffeae* and growth of banana seedlings var. Nendran, in different soils.

Thus, the present investigations have clearly indicated that the association of plant parasitic nematodes especially the most economically important nematode species like *M. incognita* and *P. coffeae* would cause severe economic yield loss to banana plantations in Andhra Pradesh if the management practices are not being governed to keep the nematode populations abate.

ACKNOWLEDGEMENT

The author is thankful to Dr. S. Sathiamoorthy, Director, NRC for Banana, Tiruchirapalli for providing necessary facilities and to Mr. T. Sekar, Technician

(Nematology), NRC for Banana, Trichy, for the technical assistance rendered in carrying out the work.

REFERENCES

- Jonathan, E.I. & Rajendran, G.** (1998). Interaction of *Meloidogyne incognita* and *Fusarium oxysporum* f. sp. *cubense* on banana. *Nematologia Mediterranea* **26**: 9-11.
- Koshy, P.K., Sundararaju, P. & Sosamma, V.K.** (1978). Occurrence and distribution of *Radopholus similis* (Cobb, 1983) Thorne, 1949 in South India. *Indian Journal of Nematology* **8**: 49-58.
- Norton, D.C.** (1978). Ecology of plant parasitic nematodes. A Wiley Interscience publication. John Wiley and Sons. New York, 268 pp.
- Singh, D.B., Rao, V.R. & Reddy, P.P.** (1979). Plant parasitic nematodes associated with horticultural crops in South India. *Indian Journal Nematology* **9**: 183-186.
- Sudha, S. & Sundararaju, P.** (2002). Occurrence and distribution of *Radopholus similis* (Cobb, 1893) Thorne, 1949 and other plant parasitic nematodes in arecanut-based cropping system in Kerala. *Indian Journal of Nematology* **32**: 219.
- Sundararaju, P. & Ratnakaran.** (2002). Factors influencing the prevalence of the root-knot nematode, *Pratylenchus coffeae* on oil palm (*Elaeis guineensis* Jacq.). *Indian Journal of Nematology* **32**: 16-19.
- Sundararaju, P. & Jeyabhaskaran, K.J.** (2003). Evaluation of different soil types on multiplication of *Pratylenchus coffeae* and growth of banana seedlings var. Nendran. *Nematologia Mediterranea* **31**: 151-153.