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COMMUNITY ANALYSES OF NEMATODES ASSOCIATED
WITH BANANA PLANTATIONS IN THE HOOGHLY DISTRICT,
WEST BENGAL, INDIA

by

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While twenty-two plant nematode species are known to be associated with banana plants in India (Sitaramaiah *et al.*, 1971; Rajendran *et al.*, 1979; Mohandas and Prabhoo, 1979) only three species, *Helicotylenchus indicus*, *Tylenchorhynchus zae* and *Xiphinema index*, have been reported from West Bengal (Mukhopadhyaya and Haque, 1974). A further four species, *Helicotylenchus* sp., *Hoplolaimus seinhorsti*, *Rotylenchulus reniformis* and *Caloosia parlona* were reported in another survey (Mukherjee and Dasgupta, 1981). In the present study the frequency of occurrence, population density and prominence values of all the species encountered were determined for a community analysis.

Materials and Methods

Soil and root samples were collected from 20 banana plantations of different age groups in five locations in the Hooghly district during October-November, 1980. Age of plantation was recorded as reported by the farmers. The samples which were taken at 5 km intervals along the main road were from Chandan Nagar (25 samples), Chinsurah

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(18 samples), Hooghly (15 samples), Mankundu (13 samples), and Adisaptagram (9 samples). From each plantation one sample was collected. Each sample consisted of ten subsamples one from each of ten mats randomly selected over 2 ha of a plantation.

Each subsample consisted of about 5 kg of soil and 200 g of fleshy roots taken from a single mat collected up to 30 cm in depth. A subsample was composited and obtained from three equidistant points around the mat with garden shovel and hand trowel. A total of 80 composite samples were processed for nematode assay. Nematodes were extracted from 250 ml aliquots by a modified Baermann funnel method (Schindler, 1961). Roots were washed in running tap water and cut into 2 cm portions which were thoroughly mixed. Twenty g of roots were comminuted in 100 ml tap water for 2 min. with a blender. The suspension was poured over double-layered tissue paper supported by a wire-mesh screen placed in a petri-dish and incubated in 1-3% dilute hydrogen peroxide (Gowen and Edmunds, 1973). After extraction nematodes from soil and root samples were collected separately in homeopathic vials and were killed in a hot water bath, and fixed and stored in TAF. The population data were converted to means of nematodes/100 ml soil. The density frequency and prominence values ($\text{density} \cdot \sqrt{\text{frequency}}$) were calculated for each species at each site and for total samples collected over the total area of the survey.

Results and Discussion

Seventeen species of nematodes within 13 genera were identified (Table I). *Tylenchorhynchus coffeae*, *T. crassicaudatus leviterminalis* n. subsp., *Hoplolaimus columbus*, *Hemicriconemoides mangiferae*, *Scutellonema siamense*, *Pratylenchus brachyurus*, *Cephalenchus leptus*, *Sakia indica* and *Boleodorus* sp. are believed to be associated with banana plants for the first time from India. Since the plantations were not free from weeds it is possible that some of them may be associated with some weeds as well. Fifteen species, viz. *Helicotylenchus multicinctus*, *Hoplolaimus indicus*, *H. columbus*, *Tylenchorhynchus coffeae*, *T. crassicaudatus leviterminalis*, *Pratylenchus coffeae*, *P. brachyurus*, *H. mangiferae*, *S. siamense*, *C. leptus*, *Aphelenchus avenae*, *S. indica*, *Meliodogyne incognita*, *Boleodorus* sp. and *Xiphinema insigne* are suspected to be new records of association with banana plants from West Bengal.

Table I - Ecological variables of plant parasitic nematode community in banana plantations of West Bengal.

Nematode Species (1)	Frequency	Density (2)	Prominence Value (3)
<i>Tylenchorhynchus coffeae</i> Siddiqi et Basir	0.68	123.8	102.1
<i>Rotylenchulus reniformis</i> Linford et Oliveira	0.86	68.4	63.4
<i>Meloidogyne incognita</i> (Kofoid et White) Chitwood	0.71	63.4	53.4
<i>Helicotylenchus multicinctus</i> (Cobb) Golden	0.43	73.0	47.8
<i>Pratylenchus coffeae</i> (Zimmerman) Filipjev et Sch. Stekh.	0.62	54.8	43.1
<i>Helicotylenchus indicus</i> Siddiqi	0.55	39.2	29.1
<i>Hoplolaimus indicus</i> Sher	0.47	35.0	24.0
<i>Hoplolaimus columbus</i> Sher	0.33	36.6	21.0
<i>Tylenchorhynchus crassicaudatus</i> Williams	0.22	36.0	16.9
<i>Scutellonema stamense</i> Timm	0.31	21.2	11.8
<i>Pratylenchus brachyurus</i> (Godfrey) Filipjev et Sch. Stekh.	0.16	27.5	11.0
<i>Hemicriconemoides mangiferae</i> Siddiqi	0.18	23.5	9.9
<i>Xiphinema insigne</i> Loos	0.26	10.2	5.2
<i>Aphelenchus avenae</i> Bastian	0.11	12.5	4.1
<i>Sakia indica</i> Husain et Khan	0.07	14.5	3.8
<i>Cephalenchus leptus</i> (Siddiqi) Golden	0.13	10.0	3.6
<i>Boleodorus</i> sp.	0.08	9.0	2.5

(1) Nematodes are arranged in descending order of their Prominence Values.

(2) Based on 100 ml of soil.

(3) Density $\cdot \sqrt{\text{frequency}}$.

Plant parasitic nematodes which occurred uniformly in all plantations sampled included *Helicotylenchus indicus*, *Hoplolaimus indicus*, *Meloidogyne incognita*, *P. coffeae*, *Rotylenchulus reniformis* and *T. coffeae* whereas *H. multicinctus* was found in three sites and *T. crassicaudatus leviterminalis* and *P. brachyurus* at two sites (Table II).

Helicotylenchus multicinctus is known to cause extensive root necrosis, die-back and disfunction leading eventually to debility of an entire plant (Blake, 1972). In West Bengal, this is widespread in the majority of banana growing areas causing shallow lesions on the roots in the outer layers of the cortex and epidermis only.

The twenty banana plantations surveyed varied greatly with respect to age ranging from 5 to 50 years and to cultivars. *Tylenchorhynchus coffeae* was the most abundant in most of the plantations. Population densities of all species varied widely among sampling sites

Table II - Community analysis parameters of five sites of banana plantations of the Hooghly district in W.B., India.

Nematode Species	CHANDAN NAGAR (1)			CNINSURAH (2)			HOOGHLY (3)			MANKUNDU (4)			ADISAPTAGRAM (5)		
	Fre- quen- cy (Fr.)	Density	Promi- nence Value (P.V.)	Fr.	Density	P.V.	Fr.	Density	P.V.	Fr.	Density	P.V.	Fr.	Density	P.V.
<i>Tylenchorhynchus coffeae</i>	0.72	188	159.5	0.67	156	127.7	0.73	115	98.2	0.69	64	53.1	0.55	96	71.2
<i>Rotylenchulus reniformis</i>	0.92	92	88.2	0.88	70	65.6	0.80	82	73.2	0.84	43	39.4	0.78	55	48.5
<i>Helicotylenchus multincinctus</i>	0.76	105	91.5	0.50	48	33.9	0.46	66	44.7	—	—	—	—	—	—
<i>Pratylenchus coffeae</i>	0.64	96	76.8	0.77	73	64.1	0.60	48	37.2	0.46	22	14.9	0.55	35	25.9
<i>Meloidogyne incognita</i>	0.84	62	56.8	0.55	45	33.4	0.80	93	83.2	0.77	75	65.5	0.44	42	27.85
<i>Helicotylenchus indicus</i>	0.48	37	25.6	0.72	84	71.2	0.53	25	18.2	0.53	36	26.2	0.44	14	9.3
<i>Tylenchorhynchus crassicaudatus</i>	0.36	44	26.4	0.50	28	19.8	—	—	—	—	—	—	—	—	—
<i>Hoplolaimus indicus</i>	0.60	53	41.0	0.38	19	11.7	0.40	46	29.1	0.53	31	22.5	0.33	26	14.9
<i>Pratylenchus brachyurus</i>	0.32	20	11.3	0.28	35	18.5	—	—	—	—	—	—	—	—	—
<i>Hemicriconemoides mangiferae</i>	—	—	—	0.22	20	9.3	0.40	15	9.4	0.23	42	20.1	0.22	17	7.9
<i>Hoplolaimus columbus</i>	—	—	—	0.61	46	35.9	0.66	38	30.8	0.46	26	17.6	—	—	—
<i>Scutellonema siamense</i>	0.28	17	9.0	0.50	23	16.2	0.33	13	7.4	0.30	32	17.5	—	—	—
<i>Cephalenchus leptus</i>	0.20	12	5.3	—	—	—	0.13	7	2.5	0.15	6	2.3	0.22	15	7.0
<i>Sakia indica</i>	—	—	—	—	—	—	0.20	19	8.4	0.23	10	4.8	—	—	—
<i>Xiphinema insigne</i>	0.40	22	13.9	0.33	9	5.1	0.13	4	1.4	—	—	—	0.33	6	3.4
<i>Boleodorus</i> sp.	—	—	—	0.28	13	6.8	—	—	—	0.15	5	1.9	—	—	—
<i>Aphelenchus avenae</i>	—	—	—	0.33	15	8.6	0.20	10	4.4	—	—	—	—	—	—

(1) 40-50, (2) 35-40, (3) 25-30, (4) 20-30, (5) 5-10 years old.

and plantations. But intensity of association was more severe in older cultivations than in newly established plantations.

The characteristic root-knot caused by *Meloidogyne incognita* was common in one plantation at Chandan Nagar but severe galling of roots was generally not observed, even in areas where high population densities of *M. incognita* larvae occurred.

Nematode populations differed quantitatively and qualitatively with sampling sites and age of cultivation (Table I). *Rotylenchulus reniformis* was the most common species, occurring in 86% of the samples examined. Prevalence of other nematodes is indicated in Tables I and II.

The occurrence of *Pratylenchus coffeae*, *P. brachyurus*, *H. multicinctus* and *Meloidogyne incognita* all of which are pathogenic to banana (PANS Manual, 1977) suggest a multiple species infestation in the investigated area.

The number of samples examined, the percentage infected and the number of plantations involved in each locality and maximum population density recorded in soil and root samples are shown in Table I.

Table II enumerates the species in the descending order of their prominence values. *Tylenchorhynchus coffeae* ranked first in mean populations density/site and prominence value, although it was less frequent as compared with other nematode species indicating the use of prominence value (Beals, 1960) in determining the parasitic importance of the nematode in a diverse community. The older cultivations of Chandan Nagar and Chinsurah (40-50 years old) were most diverse in the number of species found. The newly established plantations at Adisaptagram (5-10 years old) were least diverse with only nine nematode species being found. This suggests a trend that with increase in the age of a plantation parasitic species become more abundant and established e. g. *H. multicinctus*, *P. brachyurus*, *P. coffeae* and *R. reniformis*. Their population densities also increased.

The prominence values calculated do not seem to clearly reflect the pathogenic significance of the members of the community. It appears that *R. reniformis* is the most important parasitic species in W. Bengal at present and *H. multicinctus* appears to be posing the most serious threat once it spreads to younger plantations far and wide in this State and others in India.

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S U M M A R Y

Banana-growing tract of the State of West Bengal, India (Hooghly District) has been showing poor productivity. The gradual decline of yield suggested nematode problems and the investigation was undertaken to determine the nature of involvement of parasitic nematodes. Among seventeen species encountered *Rotylenchulus reniformis*, *Helicotylenchus multicinctus*, *Pratylenchus brachyurus* and *P. coffeae* were considered most important from various considerations, although the parameters of community analysis suggested *Tylenchorhynchus coffeae* to rank first, and *Meloidogyne incognita*, *Helicotylenchus indicus*, *Hoplolaimus* spp. and others as prominent members of the community.

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