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Community study of soil nematodes in the rhizosphere of solanaceous vegetable crops in West Bengal, India

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ABSTRACT

Community analysis of soil nematodes associated with solanaceous vegetable crops (Solanum melongena L., Lycopersicon esculentum Mill. and Capsicum annum L.) in West Bengal revealed prevalence of eight major genera of phytonematodes viz., Meloidogyne, Rotylenchulus, Tylenchorhynchus, Hoplolaimus, Pratylenchus, Helicotylenchus, Hirschmanniella and Criconemoides. Frequency of occurrence of Meloidogyne spp. were 83.1 per cent as compared to 59.15 per cent in case of R. reniformis. Here, M. incognita, M. javanica and R. reniformis were identified as dominant pathogenic nematodes, causing crop damage in the state. Saprozoic nematodes were also encountered in huge number from soil samples collected from different areas of the state.

Key words: Community analysis, phytonematodes, *Meloidogyne*, *Rotylenchulus*, solanaceous vegetable crops

Medium and upland agricultural fields of West Bengal are mostly occupied by vegetable based cropping sequence. West Bengal is a highest producer of vegetables in India, having approximately 2.6 lakh hectares area under solanaceous vegetable crops (Anon, 2010). Several soil and plant inhabiting parasitic nematodes have been known to be associated with vegetable crops. Plant nematodes and free living nematodes are the important members of the soil nematode community. Nematode community in an agro-ecosystem is greatly influenced by cropping system, intercultural operations, irrigation, use of agrochemicals, crop variety etc. (Barker and Koenning, 1998). Information about the association of plant parasitic nematodes with solanaceous vegetable crops has ample use in crop production and pest management system, if agriculture is to meet the increasing demand of food. Therefore, an investigation on the community of soil nematodes around the rhizosphere of solanaceous vegetable crops was carried out.

MATERIALS AND METHODS

All together, 213 soil samples were collected from different vegetable growing areas of 24 Parganas (South and North), Nadia, Burdwan, Hooghly, Midnapore (East and West), Murshidabad, Malda, South Dinajpur and Purulia districts of West Bengal. The soil samples measuring 200cc were collected from the rhizosphere of solanaceous vegetable crops (*Solanum melongena* L., *Lycopersicon esculentum* Mill. and *Capsicum annum* L.). Several cores of sample to a depth of 15 cm were taken in a zigzag fashion from each site to make a composite sample. Nematodes were extracted from composite soil samples by Cobb's decanting and sieving technique (Cobb, 1918) followed by modified Baermann's funnel method (Christie and Perry, 1951). They were killed in a hot water at 65°C and fixed in formalin glacial acetic acid (4:1) solution. Nematodes were then processed by Seinhorst's glycerol-ethanol method (Seinhorst, 1959) and mounted in anhydrous glycerin on glass slide. The taxonomic key for different genera of plant parasitic nematodes (Siddiqi, 1986) and free living nematodes (Jairajpuri and Ahmed, 1992) was used for identification. The estimation of nematode population was done by multi-chambered counting dish under stereoscopic binocular microscope (Olympus SZ-11). Data obtained were subjected to the nematode community analysis as proposed by Norton (1978).

RESULTS AND DISCUSSION

Twelve species of plant parasitic nematodes belonging to eight genera were identified from the rhizosphere of solanaceous vegetable crops. Those were *Meloidogyne incognita*, *M. javanica*, *Rotylenchulus reniformis*, *Tylenchorhynchus mashoodi*, *Tylenchorhynchus* sp., *Hoplolaimus indicus*, *Pratylenchus* sp., *Helicotylenchus dihystera*, *Helicotylenchus* sp., *Hirschmanniella oryzae*, *H. mucronata* and *Criconemoides onoensis*. Frequency of occurrence of *Meloidogyne* spp. was 83.1 per cent as compared to 59.15 per cent in *R. reniformis*. Frequency of a particular nematode species does not always signify its parasitic importance. So, Beals (1960) suggested using the prominence value which is more pertinent for determining the parasitic importance of nematodes in a diverse community. In respect of absolute and relative density, *Meloidogyne* spp. was found most abundant in the rhizosphere of solanaceous vegetable crops. *R. reniformis* and *Tylenchorhynchus* spp. were followed there after with regard to the absolute and relative density. Predominance of plant parasitic nematodes associated with solanaceous vegetable crops in different tracts of West Bengal is presented in descending order of their prominence value (Table 1). In observance of

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prominence value *Meloidogyne* spp. (*M. incognita* and *M. javanica*) was placed first, which was followed by *R. reniformis*. *Tylenchorhynchus* spp. and *H. indicus* were also found predominant here with ranking 3rd and 4th, respectively. *M. incognita, M. javanica* and *R. reniformis* were the leading and pathogenic nematodes among plant parasitic soil nematode community and causing damage to solanaceous vegetable crops in the state. They are the most important plant parasitic nematode species of vegetable crops in eastern and north eastern India (Mukhopadhyay and Roy, 2006; Roy *et al.*, 2007). Saprozoic nematodes were also observed as the well-known member of the soil dwelling nematodes. The saprozoic nematodes include rhabtitids, dorylaimids and mononchids which were mostly bacterial feeders, fungal feeders, omnivorous and predatory in nature. Their definite role in crop production system is yet to find out; however, they may take part in essential biological processes in soil (Beare, 1997). The information cited in the present article regarding the association of key nematode pests (*M. incognita, M. javanica* and *R. reniformis*) of solanaceous vegetable crops will have an ample use in planning of pest management programme of crop production system.

Table 1: Community analysis of major soil inhabiting plant parasitic nematodes associated with solanaceous vegetable crops

Nematode genera	Nematode species	Absolute frequency (%)	Relative frequency (%)	Absolute density	Relative density (%)	PV
Meloidogyne	*M. incognita* *M. javanica*	83.10	19.37	426.64	24.99	388.92
Rotylenchulus	*R. reniformis*	59.15	13.79	372.34	21.81	286.37
Tylenchorhynchus	*T. mashhodi* *Tylenchorhynchus* sp.	53.05	12.36	73.29	4.29	53.38
Hoplolaimus	*H. indicus*	43.19	10.07	37.17	2.18	24.43
Pratylenchus	*Pratylenchus* sp.	37.56	8.75	32.47	1.90	19.90
Helicotylenchus	*H. dihystera* *Helicotylenchus* sp.	33.33	7.77	16.33	0.96	9.43
Hirschmanniella	*H. oryzae* *H. mucronata*	7.98	1.86	10.08	0.59	2.85
Criconemoides	*C. onoensis*	11.74	2.74	3.67	0.21	1.26
	Saprozoic nematodes	100.00	23.30	735.40	43.07	735.40

Note: # Based on 213 samples, PV=Prominence Value; PV=Absolute density $\sqrt{\text{Absolute Frequency}}$

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