

## Trophic groups of nematodes associated with banana plantation in Paschim Medinipur district of West Bengal, India

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**Abstract:** During a faunal survey from March 2004 to February 2006 in 29 blocks of Paschim Medinipur district of West Bengal, India, 46 species of soil and plant parasitic nematodes, associated with banana (*Musa paradisiaca* L. cv. Kanthali) plantations were recorded. Amongst 46 species, 29 belong to the order Dorylaimida and 17 species are under the order Tylenchida. The species are categorized into five different trophic groups viz., plant feeders, bacteria feeders, hyphal feeders, predators and omnivores. The number of plant feeders was maximum (17 species), followed by omnivores (16 spp.), predators (8 spp.), bacteria feeders (3 spp.) and hyphal feeders (2 spp.). Present study indicates that phytophagous nematodes dominated other trophic groups of nematodes in banana plantations in Paschim Medinipur district of West Bengal.

**Resumen:** Durante un reconocimiento faunístico realizado de marzo de 2004 a febrero de 2006 en 29 bloques del distrito Paschim Medinipur, Bengala Occidental, India, se registraron 46 especies de nemátodos del suelo y parásitos de plantas, asociados con plantaciones de plátano o banano (*Musa paradisiaca* L. cv. Kanthali). Entre las 46 especies, 29 especies pertenecen al orden Dorylaimida y 17 al orden Tylenchida. Las especies se clasificaron en cinco grupos tróficos diferentes: consumidores de plantas, consumidores de bacterias, consumidores de hifas, depredadores y omnívoros. El número de consumidores de plantas fue el más grande (17 especies), seguido de los omnívoros (16 especies), los depredadores (8 especies), los consumidores de bacterias (3 especies) y consumidores de hifas (2 especies). El presente estudio indica que los nemátodos fitófagos dominaron sobre los otros grupos tróficos de nemátodos en las plantaciones de plátano en el distrito Paschim Medinipur de Bengala Occidental.

**Resumo:** Durante o inventário realizado entre Março 2004 e Fevereiro 2006 em 29 blocos no distrito de Paschim Medinipur em Bengala Ocidental, Índia, registaram-se 46 espécies de nemátodos do solo e nemátodos parasitas de plantas associados com as plantações de bananeira (*Musa paradisiaca* L. cv. Kanthali). Entre as 46 espécies, 29 pertenciam à ordem Dorylaimida e 17 espécies pertenciam à ordem Tylenchida. As espécies foram categorizadas em cinco grupos tróficos diferentes: os fitófagos, bacteriófagos, os micófagos, os predadores e os omnívoros. O número de fitófagos era o mais frequente (17 espécies), seguida pelos omnívoros (16 spp.), predadores (8 spp.), bacteriófagos (3 spp.) e os micófagos (2 spp.). Este estudo indicou que os nemátodos fitófagos dominavam os outros grupos tróficos nas plantações de bananeiras no distrito de Paschim Medinipur na Bengala Ocidental.

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Banana is one of the major fruit crops of tropics and subtropics forming an important item in the diet of millions across the globe. India is the largest banana producing country in the world (FAO 2005). In India, banana is grown in an area of 332.2 thousand ha with an annual production of 3633 thousand tons (Jonathan & Rajendran 2003). West Bengal is the second largest banana producing state in the country. Banana plantation covers 25.73 thousand ha with a total production of 502.11 thousand tons per annum in the state and Paschim Medinipur district is one of the major banana-growing districts, 'Kanthali' being the major cultivar.

Soil and plant parasitic nematodes belonging to the orders Dorylaimida and Tylenchida have considerable direct and indirect effects on banana. Tylenchids have been recognized as a major constraint in banana production and are responsible for serious yield losses (Sundararaju 2006). Dorylaimids act as vectors of various fungal and bacterial diseases of this important crop affecting the Gross National Product of India. Studies on the pathogenic nematodes and development of appropriate management tools would greatly benefit the banana growers. Such studies are grossly lacking in the country. An investigation regarding different trophic groups of soil and plant parasitic nematodes belonging to these two orders, associated with banana plantations in Paschim Medinipur district of West Bengal was done during 2004 - 2006. This paper deals with the significant findings of the survey along with management implications.

Present investigation was carried out in Paschim Medinipur district (22° 57' 10"-21° 36' 35" N; 88° 12' 80" - 86° 35' 50" E) of West Bengal, India, during March 2004 to February 2006. Soil samples as well as root samples were collected randomly from banana fields covering all the 29 blocks of the district. The samples were collected twice a year, i.e., once in rainy season (July - August) and again in dry season (December - January). During each season, 4 soil and 4 root samples were taken from 4 different plots from each of the 29 blocks of the district. Thus, a total of 464 soil samples and 464 root samples were collected from the rhizosphere of banana orchards. Each soil sample (250 g) was taken with the help of scooping hand-shovel up to a depth of 20 cm, at a distance of 25 cm from the

base of banana plants. Root samples (5 g each) were taken from the rhizome of the plants. Nematodes were extracted from soil by Cobb's sieving technique (Cobb 1918) and from root by Mechanical maceration technique (Reddy 1983), decanting method followed by Modified Baermann's funnel technique (Christie & Perry 1951), processed by Seinhorst's slow dehydration method (Seinhorst 1959). Dehydrated nematodes were mounted permanently on glass slides and identified up to species level following the keys of Jairajpuri & Ahmad (1992) for the order Dorylaimida and of Siddiqi (2000) for the order Tylenchida. All the specimens were deposited in the National Zoological Collections of Zoological Survey of India, Kolkata, West Bengal for future reference.

In all, 46 species of soil and plant parasitic nematodes belonging to 32 genera and 15 families of the orders Dorylaimida and Tylenchida were collected and identified (Table 1). The order Dorylaimida includes 29 species belonging to 21 genera under 8 families. Amongst dorylaims, 8 species turned out to be new to science, of which 6 species have already been described and remaining 2 are yet to be published. Tylenchida includes 17 species belonging to 11 genera under 7 families. Among these, 4 species are recorded as new to science, of which 3 species have been described and one is yet to be published. The nematodes, encountered in the present study are categorized into five trophic groups (Table 1) following the classification by Yeates *et al.* (1993). These are plant feeders, bacteria feeders, hyphal feeders, predators and omnivores. Among these, the plant feeders represented maximum number of species (17), followed by omnivores (16 spp.), predators (8 spp.), bacteria feeders (3 spp.) and hyphal feeders (2 spp.).

Present study reveals that the phytophagous nematodes dominated other trophic groups of nematodes in the rhizosphere of banana plantations in the district. Preponderance of phytophagous nematodes in banana fields has also been observed in Andhra Pradesh (Sundararaju 2006). Similar findings have been reported from the agriculture fields in China (Bilgrami *et al.* 2003). The phytophagous nematodes are among the best known soil organisms because of the damage they cause to agricultural crops leading to decreased plant production, disrupting plant nutrient and

**Table 1.** Nematode species recorded from banana plantations of Paschim Medinipur district and their trophic groups.

Family	Species	Trophic groups
Dorylaimidae	<i>Dorylaimus innovatus</i> Jana & Baqri	Omnivore
	<i>D. neominimus</i> Gantait <i>et al.</i>	
	<i>Mesodorylaimus sushili</i> Gantait <i>et al.</i>	
	<i>Prodorylaimus jihuai</i> Ahmad & Ahmad	
	<i>P. sukuli</i> Baksi & Baqri	
	<i>Laimydorus minutus</i> sp. nov.	
	<i>L. siddiqii</i> Baqri & Jana	
	<i>Thornenema garhwalicum</i> Srivastava <i>et al.</i>	
Aporcelaimidae	<i>Aporcelaimellus conicaudatus</i> (Altherr) Monteiro	Predator
	<i>A. heynsi</i> Baqri & Jairajpuri	
	<i>A. subhasi</i> Gantait <i>et al.</i>	
	<i>Makatinus siddiqii</i> sp. nov.	
Qudsianematidae	<i>Sectonema procta</i> Jairajpuri & Baqri	Omnivore
	<i>Labronema glandosum</i> Rahaman <i>et al.</i>	
	<i>Thonus garhwaliensis</i> Ahmad <i>et al.</i>	
	<i>Discolaimus dhanachandi</i> Gantait <i>et al.</i>	
Nordiidae	<i>Discolaimium parweiji</i> Siddiqi	Predator
	<i>Discolaimoides teres</i> Khan & Laha	
	<i>Oriverutus lobatus</i> Siddiqi	
Actinolaimidae	<i>O. parangulatus</i> Baqri	Bacteria feeder
	<i>Paractinolaimus aruprus</i> Khan <i>et al.</i>	
Tylencholaimidae	<i>P. shamimi</i> Gantait <i>et al.</i>	Predator
	<i>Tylencholaimus (Tylencholaimus) obscurus</i> Jairajpuri	
	<i>T. (Opisthotylencholaimus) pakistanensis</i> Timm	
Mydonomidae	<i>Promuntazium elongatum</i> Ahmad & Jairajpuri	Bacteria feeder
	<i>Dorylaimoides (Longidorylaimoides) filicaudatus</i> Jana & Baqri	
Nygolaimidae	<i>Aquatides aquaticus</i> (Thorne) Thorne	Omnivore
	<i>Laevides laevis</i> (Thorne) Thorne	
Tylenchidae	<i>Polenchus shamimi</i> Baqri	Plant feeder
Anguinidae	<i>Nothotylenchus hexaglyphus</i> Khan & Siddiqi	
Hoplolaimidae	<i>Hoplolaimus indicus</i> Sher	
	<i>Helicotylenchus crenacauda</i> Sher	
	<i>H. dihystra</i> (Cobb) Sher	
	<i>H. hydrophilus</i> Sher	
	<i>H. medinipurensis</i> Gantait <i>et al.</i>	
	<i>H. wasimi</i> Gantait <i>et al.</i>	
	<i>Rotylenchus (Rotylenchus) alii</i> Maqbool & Shahina	
	<i>Varotylus musae</i> sp. nov.	
Rotylenchulidae	<i>Rotylenchulus reniformis</i> Linford & Oliveira	

Contd...

**Table 1.** Continued.

Family	Species	Trophic groups
Pratylenchidae	<i>Pratylenchus coffeae</i> (Zimmermann) Filipjev & Stekhoven	Plant feeder
	<i>Hirschmanniella gracilis</i> (De man) Luc & Goodey	
	<i>H. mannai</i> Gantait <i>et al.</i>	
Meloidogynidae	<i>Meloidogyne incognita</i> (Kofoid & White) Chitwood	
Telotylenchidae	<i>Tylenchorhynchus coffeae</i> Siddiqi & Basir	
	<i>T. mashhoodi</i> Siddiqi & Basir	

water transfer, besides decreasing the quantity and quality of the produce (Yeates & Coleman 1982). The bacteriophagous nematodes act as an important constituent particularly in an ecosystem rich in organic matter such as banana plantation.

Banana plantation is unique compared to other agricultural and horticultural crops in the sense that even though plants are perennial, the fruiting stock dies after maturation of fruits. Subsequently the basal portion of fruiting stock, part of rhizome and roots undergo necrosis. As a consequence, a considerable organic matter is added to the soil. Such situations provide an excellent habitat for the lush growth of bacteria, fungi and other microorganisms. Moreover, banana plantations with very broad and long type of foliage produce a dense canopy, which in turn creates a moist and humus rich soil environment, a condition ideal to support a variety of bacteriophagous and fungivorous nematodes and also other soil biota in addition to the usual phytoparasitic nematodes. These three trophic groups in turn support predatory and omnivorous nematodes. Although field experiments using nematodes have shown a significant enhancement of nutrient return (Ingham *et al.* 1985) the role of phytophagous nematodes deserve more attention in view of their high species richness and as potential pests. Role of predatory and omnivorous feeding groups, which are next to phytophagous group in species diversity, need to be explored in view of their probable role in biological control of nematode pests. Such studies could open up a new vista in minimizing or eradicating the nematode problem associated with banana plantations and enhance fruit production.

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