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Distribution of nematophagous fungi in Pusa Farm Samastipur, India

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ABSTRACT: **Three types of soils sampled, from 80 sites of Pusa farm have shown that nematode destroying fungi exist in all soil habitats. Sixty-one isolates were made consisting of 41 endoparasites and 20 predatory species. A total of nine nematophagous species represented by 7 genera were identified. Most common endoparasites were *Catenaria vermicala* Brichfield (13.75%) followed by *C. anguillulae* Sorokin (8.75%). Amongst the predators, the commonest being *Monacrosporium megalosporum* Drechsler (12.5%) followed by *Stylopage leiohypha* Drechsler (8.75%) and *Cystopage cladospora* Drechsler (2.5%). Rich in organic matter and humus soils were most fruitful source for *Cystopage cladospora* Drechsler and *Harposporium arcuatum* Barron respectively.**

KEY WORDS: Distribution, nematophagous fungi, nematode destroying fungi

Prelimiary survey on occurrence of predacious fungi has been carried out by Duddington (1951) but the study was non-quantitative. It remains the only source of information on the habitat associations of nematophagous fungi from temperate soil. The quantitative studies have been carried out by Gray (1983, 84) in Ireland showing temporary agricultural pasture, coastal vegetation and coniferous leaf litter having the greatest percentage of sites from which nematophagous fungi were isolated. The present investigation was under taken to establish the presence of nematode-destroying fungi in the area and their distribution in cultivated soil. The results of this are compared with surveys of nematode destroying fungi from Delhi soils and elsewhere. Species habitat associations, species diversity, mode of attack of nematodes and factors possibly affecting distribution are examined and discussed.

Owing to the length of time required for samples to be fully processed two separate collections of soil samples were made. The first series during the month of February to March and subsequently during July to September 1996. The detail of each site including date of collection, location and dominant associated plants were recorded (Askary, 1967). Soils poor in organic matter were visibly devoid of any organic matter in the form of fallen litter or plant- decomposing matter while soils rich in organic matter possessed crude leaves and twigs of the vegetation. Humus rich soils were dark in colour and soil particles were mixed amorphous organic particles. While collecting the samples, care has been taken that sample should be from cultivated area or irrigated field and not from barron land. Each sample was placed immediately in a sterile plastic bag and sealed to prevent moisture loss and deterioration of the living organisms.

Isolations

On the same or subsequent day of collection the samples were processed for the isolation of nematophagous fungi present (Srivastava, 1987). Using standard aseptic technique 250g soil samples were unpacked and sprinkled on sterilized Petri-plates having water agar media (2%). Approximately 1-2 g of soil was sprinkled over agar plate, which was then inoculated with one ml of nematode suspension obtained from the same soil sample by Cobb's shifting and gravity method after concentrating nematode suspension in 5 ml water. Nematode suspension was added to the plates within 48h after soil was sprinkled, and allowed to incubate at room temperature (22 to 28°C). Extracted suspension of different species of nematodes used during investigation were *Hoplolaimus indicus*, *Helicotylenchus indicus*, *Tylenchorhynchus mashhoodi*, *Rotylenchus reniformis*, *Tylenchus filiformis* and juveniles of *Meloidogyne* and *Heterodera* spp. amongst phytonematodes whereas *Rhabditis* and *Cephalobus* spp. were common bacterial feeder nematodes. One thousand mixed nematode population per plate (10 cm) was added. Three replicates of soil Petri-plates were prepared for each sample collected and the forceps was sterilized after each operation.

Observation and identification

Soil plates were scanned once a week at X100 magnification for 3 months for trapped or infected nematodes. Identification was made directly at X400 magnification. The fungus was further cultured from the mixed soil plates either by picking up the conidia with sterile agar dipped needle from raised conidiophore above the surface of agar or by cutting agar block under binocular microscope and planted on baited water agar plates for re-culturing the fungus whenever required for further examination. The key (Cooke and Godfrey, 1964) used proved highly satisfactory although original definitive descriptions were always consulted for confirmation of all identifications. Species diversity on various soil habitat types was calculated by Shanon and Wiener index using the formula

$H^1 = \sum^{s} pi \log pi$. Relative frequency values were used for estimation pi of each fungus species, where i=1.

A total of 9 species were isolated and identified, 6 were endoparasite excluding *Myzocytium* which could not be identified up to species level. Among predatory fungi 3 were identified up to species level and one remained unidentified due to lack of spores (Table 1). The presence of nematophagous fungi was 59.09 – 60.71 per cent, the lowest percentage was found in the soil with poor organic matter content while the highest was in humus rich soil. The number

Table 1. Species of endoparasitic and predatory nematophagous fungi recovered and the mode of infection or trapping mechanism employed

Endoparasite / Predator	Mode of infection/ trapping mechanism
Harposporium arcuatum Barron	Spores ingested
Haptoglossa zoospora Barron	Glossoid spores
Haptoglossa heterospora Drechsler	Glossoid spores
Catenaria vermicola Birchfield	Zoospore encystment
Catenaria anguillulae Sorokin	Zoospore encystment
Gonimochaete pyriforme Barron	Adhesive spores
Stylopage leiohypha Drechsler	Adhesive hyphae
Cystopage cladospora Drechsler	Adhesive hyphae
Monacrosporium megalosporum Drechsler	Adhesive hyphae

of records observed from different soil habitats varied between 15-23 (Table 2). The commonest endoparasites in the present survey was the genus *Catenaria* (8.75–13.75%), followed by *Haptoglossa* (7.50–8.75%). Among the total 3 species of predatory nematophagous fungi, *Monacrosporium* showed frequency of 12.5 per cent followed by *Stylopage* (8.75%) and *Cystopage* (2.5%). Of the total endoparasites isolated the frequency of occurrence of fungi with zoospore encystement as a mode of infection was 22.5 per cent and were represented by *Catenaria anguillulae* and *C. vermicola*. *Gonimochaete pyriforme*, a fungus with adhesive spore, showed frequency of 5.0 per cent. Amongst the predatory fungi, *Monacrosporium megalosporum* was the only adhesive net forming type showing a frequency of 12.5 per cent (Table 3). Next to this were *Stylopage* and *Systopage* with adhesive hyphae as a trapping device in that order. Of the total 61 isolates, 41 were endoparasites and 20 were

Table 2. Number of isolates and species diversity of nematophagous fungi from different soil habitat

Soil habitat	No.of sites sampled	No of sites with fungi	Sites & with fungi (%)	Total no. of records	Species diversity index
Poor in organic matter	22	13	59.09	15	0.715
Rich in organic matter	30	18	60.00	23	0.910
Humus rich	28	17	60.71	23	0.860
Total	80	48		61	

Table 3. Percentage frequency of occurrence of endoparasitic and predatory species of nematophagous fungi and their distribution

List of fungi	No. of records in different soil habitats			
	Poor inorganic matter	Rich inorganic matter	Humus rich	Frequency (%)
Endoparasites				
Harposporium arcuatum	0	1	4	6.25
Haptoglossa zoospora	2	2	3	8.75
Haptoglossa heterospora	4	1	1	7.50
Catenaria vermicola	4	4	3	13.75
Catenaria anguillulae	1	3	3	8.75
Gonimochaete pyriforme	0	3	1	5.00
Predators				
Stylopage leiohypha	1	2	4	8.75
Cystopage cladospora	0	2	0	2.50
Monacrosporium megalosporum	2	4	4	12.50

predators.

Certain qualitative data have been generated by Gray (1982) in relation to different habitats. Gray (1984) isolated 9 endoparasites and 8 predatory nematophagous species from maritime Antarctic and a total of 21 fungal species of nematophagous fungi were isolated from Delhi soil (Srivastava, 1986) using the indigenous soil nematodes. The results of Srivastava (1986) indicate that both endoparasites and predators display a small degree of selectivity and any selection is most likely due to the anatomy of the host or prey and mode of infection or trapping mechanism. The present investigation shows that nematophagous fungi, both endozoic and predatory are distributed at Pusa farm area as reported elsewhere. The common predator was *Monacrosporium megalosporum* utilising adhesive nets for capturing nematodes. A total of 9 species representing 7 genera were recorded and identified. By observing the data it appears that predatory species were more frequent during July–September. Most frequent isolations of *Catenaria*, in the present investigation, might be due to the period of sampling as in July–September enough moisture was present in soil samples of the area due to rainy season. In present observations *Cystopage cladospora* was frequently isolated from soil rich in organic matter while *Harposporium arcuatum*, parasitising on *Rhabditis* spp. through spore ingestion was isolated frequently from humus rich soils. Species diversity index showed maximum value in organic matter rich soils followed by that in humus rich soils. Minimum value of species diversity was obtained in the soils poor in organic matter. Obviously, the dead organic matter provided suitable substrate for survival of varied fungal predators and parasites.

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