J. Phytol. Res. 2 (1)

ECOLOGY OF NEMATOPHAGOUS FUNGI : DISTRIBUTION IN DELHI

Neelima Mittal, Geeta Saxena and K.G. Mukerji
Mycology Laboratory, Botany Department, University of Delhi,
Delhi-110007, India.

An account of the occurrence of nematophagous fungi in different parts of Delhi is given. An analysis of 81 soil samples showed that these fungi are particularly abundant in cultivated soil and moss cushions. During the present investigation, ten species of nematophagous fungi were recorded out of which seven are predators and three endoparasites. Adhesive nets were more abundant than other trapping mechanisms.

Keywords : Nematophagous fungi; Nematodes; predatory fungi; Endoparasites.

Introduction

The nematophagous fungi are a group of microorganisms capable of destroying nematodes either by predation or parasitism. They are an important component of the soil microflora which are widespread and common in different habitats like decomposed organic matter, partially decayed wood, decomposed leaves and grasses, wood and cultivated land. Mosses, manure and fresh dung of horses, donkeys, cattle and other farm animals also provide a good substrate for the occurrence of numerous nematode-trapping fungi.

In India numerous surveys of nematophagous fungi have been undertaken by Dayal and Nand (1973a, b); Dayal and Gupta (1975); Dayal and Singh (1975); Patil and Pendse (1976, 1981); Srivastava and Dayal (1982, 1984); Prasad *et al.* (1984a, b)and Prasad and Dayal (1985, 1986a, b). But studies on their ecology and factors affecting distribution are virtually absent. Laboratory studies on the group have been almost entirely non-ecological in nature (Barron, 1977) except for the pioneer work on the ecology of these fungi by Cooke (1962, 1963a, b). The present investigation was carried out in order to study the distribution of these fungi in various habitats. Their species diversity, mode of capturing nematodes, habitat associations and factors affecting distribution have been examined and discussed in this paper.

Materials and Methods

Sample Collection—Samples were collected from various sites of Delhi, viz. Pitampura, India gate, Bank of river Yamuna, Delhi ridge, Alipur, University garden, Janakpuri, Patel Nagar, Vasant Vihar and many other places. Collections were made from a variety of habitats, such as leaf mould, partly decayed plant materials, doung, mosses, old compost piles, cultivated soils near rivers, disturbed and undisturbed places and rhizosphere soils of certain plants. Samples were placed directly in sterilized polythene bags and sealed in the field.

Isolation of Nematophagous Fungi—For the isolation of predatory fungi, sprinkling technique (Drechsler, 1941a) and baited plate technique (Barron, 1977) were used. After incubating for a week at 25°C, the plates were examined regularly. Endoparasitic fungi were isolated by Baermann funnel technique (Giuma and Cooke, 1972).

Examination and Identification of Plates—The soil plates were scanned at x100 and x400 magnifications for the presence of both endoparasites predators. The nematophagous fungi were identified using pertinent literature (Karling, 1938; Drechsler, 1941b; Cooke and Godfrey, 1964; Cooke and Dickinson, 1965; Cooke, 1967a, b; Haard, 1968; Barron, 1976).

Results and Discussion

During the present investigation, ten species of nematophagous fungi were obtained of which seven are predators and three endoparasites. Soil samples, collected from cultivated lands yielded for nematophagous fungi viz. *M. gephyrophagum*, *M. megalosporum*, *M. salinum* and *S. hadra*. Three fungi namely *M. cystosporum*, *M. papillatum* and *S. leiohypha* were recorded from moss cushions (Table 1). Presence of large number of nematophagous fungi in mosses may be due to high moisture in them. Overgaard (1948) stated that nematodes follow the movement of water held in the moss cushions. Mosses serve as a rich source of nematophagous fungi Gimingham and Smith 1971; Duddington *et al.*, 1973; Gray *et al.*, 1982). Two fungi each were recorded from undisturbed, disturbed and river soils. *M. megalosporum* and *S. hadra* were harboured from horse dung. Many workers have reported earlier several species of nematophagous fungi from dung (Zwirn-Hirsch, 1947; Juniper, 1957).

Soil samples collected from cultivated places showed maximum frequency of occurrence of these fungi with four isolations. Habitats, namely undisturbed soil, disturbed soil and dung showed low frequency

occurrence of these fungi with only two isolations each. *S. hadra* was found to be most abundant in these habitats as it was isolated from 3.70% of the samples. Other species namely *M. gephyrophugum*, *M. megalosporum*, *M. salinum* and *Myzocytium papillatum* were found to be less abundant being isolated from 2.46% of the samples. Other five species viz. *Acrostalagmum obovatus*, *A. conoides*. *Harposporium anguillulae*, *M. cystosporum* and *S. leiohypha* were least abundant being isolated from 1.23% of the samples.

Of the predators isolated, one species of *Arthrobotrys*, three species of *Manacrosporium* and two species of *Stylopage* have been obtained. One third of the population is endoparasites. This shows that predators, are more abundant than the endoparasites. Amongst the predators, *Monacrosporium* species are the most abundant. The most abundant endoparasite recorded was *Myzocytium papillatum*.

As the plant and soil types varied widely, all the samples were classified into one of the six major habitat groups (Table 2). This table also shows number of isolates and species diversity of nematophagous fungi from each habitat. The habitat group dominated by cultivated soil had the greatest records of these fungi at four isolations Three isolations were obtained from mosses. Most of the habitats had mean species diversity of 1.0.

Table 3 shows number of species of nematophagous fungi isolated from each habitat elassified by their trapping mechanism. Of the predators isolated, six individuals captured nematodes by adhesive hyphae and two by adhesive branches. Of the endoparasites isolated, mode of infection in two individuals was found to be encysted zoospores, in one individual adhesive conidia and another one individual palatable conidia. This clearly shows that in predators the adhesive net and in endoparasites the encysted zoospores are the most abundant and the most successful mode of trapping/infection in nematophagous fungi. Other trapping mechanisms like constricting rings, nonconstricting rings and adhesive knobs were not encountered in these soil samples. This shows that these soil conditions may not be favourable for such types of trapping mechanisms.

It is evident from these findings that nematophagous fungi are widespread in Delhi. Further field surveys are required on the factors affecting distribution of nematophagous fungi and also on the role of these fungi.

Accepted March, 1989

Table-1 Analysis of sample sites and species of nematophagous fungi recorded with their % frequency, and trapping mechanism/mode of infection.

Sample Number	Location	Habitat detail	Nematophagous fungi recorded	Frequency (% samples)	Trapping mechanism/ mode of infection
79	South Delhi ridge	*Cleome gynandra*	*Acrosialagmus obovaius*	1.23	Adhesive conidia
34	Vasant Vihar	*Cassia occidentalis*	*Arthrobotrys conoides*	1.23	Adhesive net
39	Kamla Nehru ridge	*Adhntoda vasica*	*Harposporium anguillulae*	1.23	Aalatable conidia
67	D.R. College Delhi Univ.	*Physcometrium cyathicarpum*	*Monacrosporium cystosporam*	1.23	Adhesive net
25 & 44	Yamuna bank	*Euphorbia hirta*	*Monacrosporum gephyrophagum*	2.46	Adhesive branches
	Janak Puri	*Rosa indica*			
55 & 71	Moti Bagh	*Abelmoschus esculentum*	*Monacrosporium mngalosporum*	2.46	Adhesive net
	Patel Nagar	Horse dung			
49 & 74	Alipur	*Trifolium subterraneum*	*Monacrosporium salinum*	2.46	Adhesive net
	Indraprastha power station	*Chenopodium album*			

(Continued)

(*Table 1 contd.*)

Sample Number	Location	Habitat detail	Nematophagous fungi recorded	Frequency (% samples)	Trapping mechanism/ mode of infection
3 & 21	Yamuna bank	*Croton bonplandianum*	*Myzocytium Popillatum*	2 46	Encystment of motile zoospores
	Botanical garden Delhi Univ.	*Funaria* sp.			
12, 56 & 62	Maharani Bagh	*Impatiens balsamina*	*Stylopage hadra*	3.70	Adhesive hyphae
	Pitampura India gate	Horse dung *Eugenia jambolana*			
65	North Delhi ridge	*Barbula* sp.	*Stylopage leiohypha*	1.23	Adhesive-hyphae

Teble-2 Number of records and species diversity of nematophagous fungi from each habitat

Habitat	No. of sites sampled	No. of sites with fungi	% of sites with fungi	Total no. of records	Mean species dlversity
A	25	5	20.00	4	0.80
B	18	2	11.11	2	1.0
C	13	2	15.38	2	1.0
D	3	2	66.67	2	1.0
E	16	2	12.50	2	1.0
F	6	3	50.00	3	1.0
Total	81	16	—	15	—

A — Cultivated soil; B — Undisturbed soil; C — Disturbed soil; D — Dung; E — River soil; F — Moss cushions.

Table-3 Number of species of nematophagous fungi isolated from each habitat classified on the basis of their trapping mechanism

Habi-tat	Adhe-sive hyphe	Adhe-sive branches	Adhe-sive nets	Adhe-sive conidia	Pala-table conidia	Encystment of motile zoospores	Total
A	2	1	2	0	0	0	5
B	0	0	0	1	1	0	2
C	0	0	2	0	0	0	2
D	1	0	1	0	0	0	2
E	0	1	0	0	0	1	2
F	0	0	1	0	0	1	2
Total	3	2	6	1	1	2	15

References

Barron G L 1976, *Can J. Microbiol.* **22** 752

Barron G L 1977, *The nematode - destroying fungi—Topics in Mycobiology* : 1 Canadian Biological Publications Ltd, Guelph, Canada, p 140

Cooke R C 1962, *Ann. Appl. Biol.* **50** 507

Cooke R C 1963a, *Ann. Appl. Biol.* **51** 295

Cooke R C 1963b, *Ann. Appl. Biol.* **52** 431

Cooke R C 1967a *Trans. Br. Mocol. Soc.* **50** 315

Cooke R C 1967b, *Trans. Br. Mycol. Soc.* **50** 515

Cooke R C and Dickinson C H 1965 *Trans. Br. mycol. Soc* **48** 621

Cooke R C and Godfrey B E S 1964 *Trans. Br. mycol. Soc.* **47** 61

Dayal R and Gupta R N 1975, Some members of Hyphomycetes. *Proc. Nat. Acad. Sci., India* **45** 237

Dayal R Nand R 1973a, *Proc. Nat. Acad. Sci,, India* **43** 87

Dayal R Nand and R 1973b, *Proc. Nat. Acad. Sci., India* **43** 249

Dayal R and Singh V K 1975, *Proc. Nat. Acad. Sci.. India* **45** 89

Drechsler C 1941a, *Biol. Rev.* **16** 265

Drechsler C 1941b *Phytopathology* **31** 77

Duddington C L, Wyborn C H E and Smith R I L 1973, *Bull. Br. Antarct. Surv.* **35** 87

Gimingham C H and Smith R I L 1971, *Bull. Br. Antarct. Surv.* **25** 1

Gray N F, Wyborn C H E and Smith R I L 1982, *Oikos* **38** 194

Haard K 1968, *Mycologia* **50** 1140

Juniper A J 1957, *Trans. Br. mycol. Soc.* **40** 346

Karling J S 1938, *Mycologia* **30** 512

Overgaard C 1948, *Publications de la Societe des Sciences et des Lettres d' Aarheis* **2** 1

Patil S D and Pendse M A 1976 *MVM Patrika* **11** 27

Patil S D Pendse M A 1981, *J. Univ. Poona, Sci. Tech.* **54** 197

Prasad G and Dayal R 1985, *Curr. Sci.* **54** 286

Prasad G and Dayal R 1986a, *Nat. Acad Sci.* **56** 46

Prasad G and Dayal R 1986b, *Curr. Sci.* **55** 321

Prasad G, Singh P R and Dayal R 1984a, *Nat. Acad. Sci Letters* **7** 363

Prasad G, Singh P R and Dayal R 1984b, *Proc. Nat. Acad. Sci., India* **54** 163

Srivastava S S and Dayal R 1982, *Indian Phytopath*, **35** 650

Srivastava S S and Dayal R 1984, *Indian Phytopath.* **37** 691

Zwirn-Hirsch H E 1947, *Polest. F. Bot. Jerusalem Ser.* **4** 56