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Occurrence of nematophagous fungi (Hyphomycetes) and their predaceous ability in Tamil Nadu

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ABSTRACT: Soil samples collected from different regions of Tamil Nadu revealed the occurrence of five different nematode-trapping fungi *viz.*, *Arthrobotrys cladodes* var. *macroides* (Drechsler), *A. oligospora* (Fresinius), *Arthrobotrys* sp., *Dactylella brochopaga* (Drechsler) and *Dactylaria thaumasia* (Drechsler). An *in vitro* test against *Ditylenchus phyllobia* (Thorne) Filipjev indicated that both the species of *Arthrobotrys* were spontaneous trap formers, while *D. brochopaga* and *D. thaumasia* were induced trap former. *Arthrobotrys cladodes* var. *macroides* was the most prolific trap former followed by *A. oligospora*. Among the five fungi, *A. cladodes* var. *macroides* was widely prevalent in gardenland soils and most efficient predator compared to *A. oligospora*, *D. brochopaga* and *D. thaumasia*.

KEY WORDS: *Ditylenchus phyllobia*, nematophagous fungi, occurrence, predaceous activity

Nematophagous fungi comprise those fungi that attack living nematodes or their eggs and utilize them as a source of nutrients. These fungi have been categorised as predaceous and endoparasitic depending upon their mode of attack. The predaceous fungi have an extensive hyphal development on the substratum and capture nematodes by producing trapping organs. Hyphae are usually sparse and radiate out from the original point of primary capture with each hypha producing trapping devices at intervals along its length. Victims are captured either by adhesive or non-adhesive devices. Adhesive organs of capture have been categorized as hyphae, branches, knobs and nets (Sachidananda, 1964).

Several workers (Duddington, 1954; Mankau and Clark, 1959; Pramer, 1964) have investigated the occurrence of nematophagous fungi in soil elsewhere. However, in India such an interesting group is still almost unnoticed. Hence, an attempt was made to find out the occurrence of predaceous fungi in gardenland soils of Tamil Nadu and its predaceous ability against *Ditylenchus* phyllobia under *in vitro* condition.

MATERIALS AND METHODS

Soil samples from rhizosphere numbering 297 were collected from four districts (Coimbatore, Dharmapuri, Salem and the Nilgiris) of Tamil Nadu and examined for nematode trapping fungi. The samples were examined by baiting with nematodes on water agar medium (Duddington, 1955). Approximately one g of soil sample was placed in solidified water agar media (2%) and baiting the plates with *Ditylenchus phyllobia* (Thorne) Filipjev. This nematode was obtained from infected *Solanum elagnifolium* (Cav.) leaves and approximately 1500 nematodes were inoculated/plate. The plates were incubated at room temperature (25°C) and observed for a period of one month.

The nematode trapping fungi produce conidiophores and conidia in a characteristic manner such as perpendicular to the substratum. Hence, isolation was made by just touching the conidia with a needle dipped in the melted water agar medium. Water agar with conidia adhered on the needle was inoculated on the plates poured with potato dextrose agar (PDA) and the fungus colony from these spores was sub-cultured in PDA and maintained.

The trapping activity of the observed fungi was assessed following the method described by Galper *et al.* (1995). Sterile water was added to sporulating cultures of the four fungi on PDA and a conidial suspension was obtained by rubbing the agar surface with a sterile glass rod. A drop of this suspension was then spread on the surface of the water agar in 60mm diam Petri-plates and incubated at 27±2°C for 24h to allow spores to germinate and juveniles of *D. phyllobia*. (Ca 2500 juveniles/plate) were inoculated after 24h. Petri-plates without nematodes served as control. Plates were examined at an interval of 24h at a magnification of 10x with a compound microscope and the number of traps present in five different microscopic fields was recorded. In the case of three dimensional net work traps, each individual component of the trap was counted. The hours on which more than 90 per cent of the nematodes had trapped was recorded for assay the trapping activity.

RESULTS AND DISCUSSION

Five nematode trapping fungi *viz.*, *Arthrobotrys cladodes* var. macroides (Drechsler), *A. oligospora* (Fresinius), *Arthrobotrys* sp., *Dactylella brochopaga* (Drechsler) and *Dactylaria thaumasia* (Drechsler) were found occurring in 12.86 to 62.59, 22.85, 20.00, 1.45 and 1.45 per cent of the samples surveyed (Table 1).

Table 1. Occurrence of nematode trapping fungi in different regions of Tamil Nadu

Locality/typed cultivation	Sample no.	Frequency of occurrence (%)	Fungus identified
Coimbatore (Gardenland)	139	62.59 1.45 1.45	*Arthrobotrys cladodes var.* macroides *Dactylella brochopaga* *Dactylaria thaumasia*
Burliar & Kallar of Coimbatore (Rainfed hilly region)	23	0.00	Nil
Salem (Rainfed gardenland)	25	20.00	Unidentified
Dharmapuri (Rainfed gardenland)	40	0.00	Nil
Nilgiris (Hilly region)	70	12.86 20.00 22.85	*A. cladodes var.* macroides *Arthrobotrys* sp. *A. oligospora*

An *in vitro* test resulted that the fungus *A. cladodes* var. macroides is a spontaneous trap former, produced large number of adhesive hyphae (traps), quickly eliminated (16h) most of the nematodes in plates. Between the two adhesive network trap formers, *A. oligospora* is a spontaneous trap former and *D. thaumasia* is an induced trap former. Both took 40h to eliminate >90 per cent of nematodes. *Dactylella brochopaga* is also an induced trap former, produced constricting rings, and took 64h to trap >90per cent of nematodes (Table 2). Galper *et al.* (1995) stated that the network formers took 1-2 days to trap >90 per cent of *Caenorhabditis elegans* (Maupas) and *Meloidogyne incognita* (Kofoid & White) Chitwood and constricting ring formers took 2-3 days to trap >90per cent of *C. elegans* and *M. incognita* respectively. The present findings agree with these observations.

Due to their wide distribution and relatively dense population, nematophagous fungi probably play an important role in natural suppression of nematodes in gardenland soils. The gardenland soils of Tamil Nadu are under crops throughout the year and so there is sufficient soil moisture and prey population in the soil, for activity of nematophagous fungi. Hence augmenting the predator population with addition of organic matter would definitely help in the management of plant-parasitic nematodes in gardenlands.

Table 2. Predaceous efficiency of four native hyphomycetes against *D. phyllobia* under *in vitro* condition

Fungus	1 day			II day			III day		
	Traps/ m^2	Sporu-lation	Time to trap> 90% nemato des	Traps/ m^2	Sporu-lation	Time to trap> 90% nemato des	Traps/ m^2	Sporu-lation	Time to trap> 90% nemato-des
A. cladodes var. *macroides* I	30	-	16h	62	+	16h	77	+	16h
C	27	-	-	68	+	-	79	+	-
A. oligospora I	9	-	-	49	-	40h	54	+	40h
C	-	-	-	42	-	-	58	+	-
D. brochopaga I	-	-	-	8	-	-	11	+	64h
C	-	-	-	-	-	-	-	+	-
D. thaumasia- I	-	-	-	31	+	40h	45	+	40h
C	-	-	-	-	+	-	-	+	-

\+ Sporulated, - No sporulation

I Nematode inoculated, C Uninoculated

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