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CONTROL OF ROOT-KNOT NEMATODES ON *TRIGONELLA FOENUM-GRAECUM* BY *PAECILOMYCES LILACINUS*

by
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Summary. An experiment was conducted to control *Meloidogyne incognita* infecting *Trigonella foenum-graecum* using *Paecilomyces lilacinus* raised on goat dung and sesame oil cake. Of the four treatments used, relatively better reduction in nematode population was observed on substrate + fungus + nematode treatment compared with substrate + nematode alone. The fungus penetrated the eggs and fed upon their contents leaving empty shell. Invaded eggs were swollen in coparison with uncolonized ones.

Root-knot nematodes are important parasites of fenugreek (*Trigonella foenum-graecum L.).* Various biological control measures have been tried, including the use of dung (Yousif and Badra, 1981) and oil cakes (Mankau and Minteer, 1962) as soil amendments. The fungus *Paecilomyces lilacinus* (Thom.) Samson has been used as a biocontrol agent against *Meloidogyne incognita* (Kofoid *et* White) Chitw. (Jatala, 1983). In the present study *P. lilacinus* grown on goat dung and sesame (*Sesamum indicum L.*) oil cake was tried as a control of *M. incognita* on fenugreek.

Materials and methods

A pure culture of *P. lilacinus* was obtained from the International *Meloidogyne* Project, Raleigh, U.S.A. It was initially multiplied on rice but for the control experiments sesame oil cake and goat dung were used as substrates. The sesame oil cake was obtained from a local oil mill as waste product.

One kg of oil cake or dung was steam sterilized in a flask and then inoculated with 2 ml spore - water suspension of *P. lilacinus*. The flasks were shaked to accelerate growth.

Surfage sterilized seeds of fenugreek treated with specific *Rhizobium* culture were sown singly in 15 cm pots containing 1 kg sterilized soil. Two week old seedlings were inoculated with a suspension of 1000 second stage juvenile of *M. incognita* from a culture maintained on brinjal. Two dosages of substrates were used viz., 5 g and 10g per kg soil. The substrates containing *P. lilacinus* were added to the soil when the seedlings were two week old, giving the combination of treatments shown in Tables I and II.

Plants were uprooted sixty days after treatments. Measurements were made of root and shoot length and weight. The number of bacterial nodules were counted and a root-knot index estimated on a 1-5 basis. Nematodes were extracted from the soil using Cobb's sieving, gravity method and Baermann funnel technique to calculate the final population.

Results and discussion

Maximum growth was observed in plants grown in the higher dose (10 g) or the substrates alone. This was followed by plants grown in substrate + fungus + nematode. Root-shoot length and fresh weight were more in substrate + nematode compared with nematode alone. Parvatha Reddy and Khan (1988) observed an increase in root length of tomato with *P. lilacinus* at 2 g per plant. Plant growth was more in oil cake amended soil compared with goat dung amended soil.

Disease intensity was greatest in plants with nematodes alone and this was evident in the yellowing of the leaves. Root-knot index was less in substrate + fungus + nematode as compared to substrate + nematode or nematode alone. In oil cake + fungus + nematode combination root-knot index was less (1.7 and 1.5 for 5 and 10 g dose respectively, Table II) compared with dung + fungus + nematode combination (2 and 1.7 for 5 g and 10 g dose respectively, Table I).

The fungus *P. lilacinus* was observed to grow profusely on the egg masses and to penetrate the eggs. Infected eggs and hatched juveniles showed an abundance of hyphae present endogenously. *P. lilacinus* as an egg parasite has been reported in tomatoes (Jatala *et al.*, 1980). The fungal

TABLE I - *Control of* Meloidogyne incognita *infecting* Trigonella foenum-graecum *by* Paecilomyces lilacinus *grown on goat dung (observations are mean of five replicates).*

Dose	Treatment	Length (cm)		Fresh weight (g)		Root-knot index*	Number of nodules	Final nematode population per pot
		Root	Shoot	Root	Shoot			
5 g	Dung + fungus + nematode	22.4	33.1	2.4	6.3	2.0	44.0	1210
	Dung + nematode	18.1	33.5	2.3	6.4	4.0	29.7	3625
	Dung alone	24.5	36.3	3.4	6.4	–	53.0	–
	Nematode alone	21.2	31.1	2.5	6.8	5.0	10.5	4892
10 g	Dung + fungus + nematode	29.2	36.5	4.0	6.9	1.7	55.5	896
	Dung + nematode	24.9	35.6	2.3	4.8	3.0	30.2	2220
	Dung alone	27.5	39.6	4.2	7.7	–	61.0	–
	Nematode alone	21.1	31.1	2.5	6.8	5.0	10.5	4892
	SEM ±	1.0	2.7	0.1	0.9	1.1	5.5	175.2
	CD at 5%	2.2	5.8	0.3	1.9	2.3	11.6	364.5
	CD at 1%	3.0	7.9	0.4	2.6	3.1	15.8	495.9

* Root-knot index: 0 = 0 galls; 1 = 1-20 galls; 2 = 21-40 galls; 3 = 41-60 galls; 5 = 81 galls or more.

TABLE II - *Control of* Meloidogyne incognita *infecting* Trigonella foenum-graecum *by* Paecilomyces lilacinus *grown on sesame oil cake (observations are mean of five replicates).*

Dose	Treatment	Length (cm)		Fresh weight (g)		Root-knot index*	Number of nodules	Final nematode population per pot
		Root	Shoot	Root	Shoot			
5 g	Oil cake + fungus + nematode	18.9	28.0	2.2	6.8	1.7	47.2	825
	Oil cake + nematode	21.9	32.2	2.4	4.4	3.2	27.2	2415
	Oil cake alone	26.4	37.4	3.7	6.2	–	52.2	–
	Nematode alone	21.1	26.3	2.2	5.9	5.0	12.0	4795
10 g	Oil cake + fungus + nematode	23.4	27.0	3.3	6.5	1.5	53.5	790
	Oil cake + nematode	26.7	31.7	2.6	4.8	3.0	33.5	2200
	Oil cake alone	28.9	38.6	4.3	7.2	–	55.7	–
	Nematode alone	21.1	26.3	2.2	5.9	5.0	12.0	4795
	SEM ±	1.3	3.7	0.1	0.2	1.6	2.4	96.9
	CD at 5%	2.8	7.8	0.3	0.5	3.4	5.1	201.7
	CD at 1%	3.9	10.6	0.4	0.7	4.7	7.0	274.4

* Root-knot index: 0 = 0 galls; 1 = 1-20 galls; 2 = 21-40 galls; 3 = 41-60 galls; 5 = 81 galls or more.

hypae penetrate the eggs and destroy the embryo. Hyphae emerging from the egg shells were also observed to produce conidiophores bearing long chains of conidia. Invaded eggs were swollen compared with uncolonized ones.

Final nematode populations showed a similar trend to the root-knot indices. They were less in oil cake + fungus + nematode (825 and 790 for 5 g and 10 g dose respectively, Table II) compared with dung + fungus + nematode where it was 1210 and 896 for 5 g and 10 g dose respectively. Ten g of the substrate was found to be better in reducing root-knot index and the final number of nematodes compared with 5 g dose (Tables I, II). The number of nodules was maximum in substrate alone, followed by substrate + fungus + nematode, and was minimum in nematode alone.

We conclude from our results that cheap and locally available material could be used to multiply *P. lilacinus* on a large scale and use this for nematode control under tropical conditions like India.

Ten g dose of oil cake or dung infected with the fungus is recommended for Indian farmers for checking multiplication of *M. incognita*.

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