Efficacy of *Paecilomyces lilacinus* (Thom.) Samson in suppressing nematode infestations in black pepper (*Piper nigrum* L.)[1]

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ABSTRACT

The efficacy of *Paecilomyces lilacinus* in suppressing root-knot nematode (*Meloidogyne incognita*) and burrowing nematode (*Radopholus similis*) infestations in black pepper (*Piper nigrum*) was studied. Though the fungus could not effect absolute control of nematodes, it signficantly suppressed nematode infestation and increased total root mass production. The fungus was more effective in suppressing *M. incognita* than *R. similis*.

Key words : black pepper, *Meloidogyne incognita*, nematodes, *Paecilomyces lilacinus, Piper nigrum, Radopholus similis.*

Introduction

The production and productivity of black pepper (*Piper nigrum* L.) in India is severely affected due to infestation by plant parasitic nematodes viz., *Meloidogyne incognita* (Kofoid & White 1919) Chitwood 1949 and *Radopholus similis* (Cobb 1893) Thorne 1949 leading to 'slow decline'. These two nematode species are widely distributed in all major black pepper growing areas (Kumar, Viswanathan & D'Souza 1971; Venkitesan 1972; Jacob & Kuriyan 1979; Sundararaju, Koshy & Sosamma 1979; Ramana & Mohandas 1987& 1989). Pathogenicity tests conducted under simulated field conditions showed that *M. incognita* and *R. similis* caused significant reduction in growth and productivity of black pepper vines (Mohandas & Ramana 1991).

Though several nematicides are effective in checking nematode infestations in black pepper (Nambiar & Sarma 1977; Venkitesan & Charles 1979; Venkitesan & Setty 1979; Anonymous 1985; Mohandas & Ramana 1987), their usage is limited because of high cost, difficulty in handling, environmental pollution and health hazards due to continuous application. Hence there is need for utilising biocontrol agents which form a major component in integrated nematode managment programmes.

In an earlier effort on biocontrol of nematodes infesting black pepper, four

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species of vesicular arbuscular mycorrhizae were effective in suppressing nematode infestations which was on par with phorate treatment (Anandaraj, Ramana & Sarma 1991). *Paecilomyces lilacinus* (Thom.) Samson, a soil inhabiting hypomycetes fungus was reported highly effective in suppressing root-knot nematodes (Jatala 1985 & 1986; Ibrahim *et al.* 1987; Shahzad & Ghaffar 1987; Cabanillas, Barker & Daykin 1988; Khan & Hussain 1988; Sharma *et al.* 1988), *Tylenchulus semipenetrans* (Reddy 1988), *Rotylenchulus reniformis* (Khan & Hussain 1988; Reddy & Khan 1988 & 1989) and cyst nematodes (Franco & Bocangel 1981; Saifullah & Saeed 1988). Hence a study was conducted to assess the efficacy of *P. lilacinus* in suppressing infestations of *M. incognita* and *R. similis* in black pepper.

Materials and methods

Single node rooted cuttings of black pepper hybrid Panniyur-1 were planted singly in 20 cm dia earthern pots filled with 6.5 kg fumigated soil. Three months after planting, the following treatments were imposed in five replications: 1) Control 2) Phorate 10G 3) *M. incognita* 4) *R. similis* 5) *P. lilacinus* 6) *P. lilacinus* + *M. incognita* 7) *P. lilacinus* + *R. similis* 8) *M. incognita* + *R. similis* 9) *P. lilacinus* + *M. incognita* + *R. similis* 10) *M. incognita* + *R. similis* + Phorate 10G. *P. lilacinus* was mass cultured on rice meal medium in conical flasks. Ten day old culture was blended and made up to 200 ml suspension with sterlie distilled water. This suspension was incorporated into the root zone @ 20 ml/pot. Freshly hatched second stage juveniles of *M. incognita* (2000/pot) from egg masses collected from black pepper roots and *R. similis* (150/pot) were introduced into the root zone 20 days after fungal inoculation. Phorate 10G @ 3g/pot was applied at quarterly intervals. All the plants were arranged in a Randomized Block Design in a net house. Twelve months after planting, the plants were depotted, washed thoroughly and fresh weights of shoot and root were recorded. Root-knot index (RKI) and root lesion index (RLI) of individual plants were recorded.

Results and discussions

Both the nematode species caused significant reductions in biomass production (Table 1). Reduction in fresh weights of shoot and root were 39.2 and 18.1 per cent and 64.8 and 31.6 per cent due to *R. similis* and *M. incognita* inoculations, respectively. Combined inoculation of both the nematodes caused 61.2 and 74.5 per cent reduction in fresh weights of shoot and root, respectively. Fungus inoculation resulted in significant increase in biomass production of shoot and root even though the plants were inoculated with nematodes. Loss in root mass was reduced from 64.8 to 47.3 per cent and 31.6 to 21.2 per cent due to *R. similis* and *M. incognita,* respectively, when these plants were inoculated with the fungus.

RLI was maximum (3.6) in plants inoculated with *R. similis* alone followed by combined inoculation of both nematode species (3.4). When the fungus was incorporated, RLI was significantly reduced. Similarly, RKI was brought down from 4.4 in plants inoculated with *M. incognita* alone to 2.4 in plants treated with the fungus. However, phorate application was also highly effective in supressing nematodes.

The study indicates that though the

fungus could not suppress nematodes completely, it significantly reduced nematode infestation and thereby increased root mass. The fungus showed greater efficacy on *M. incognita* than *R. similis*. The specificity of *P. lilacinus* as an egg parasite of root-knot nematodes might be the reason for reduction in RKI in plants inoculated with *M. incognita* and *P. lilacinus*. The study also further confirmed the efficacy of *P. lilacinus* in suppressing nematodes infesting black pepper. However, the recent report that *P. lilacinus* is a human pathogen (Kerry 1987) indicates the necessity to use the fungus cautiously for nematode management.

Table 1. Efficacy of *Paecilomyces lilacinus* in suppressing nematode infestations in black pepper

Treatment	Fresh weight (g)		RKI	RLI
	Shoot	Root		
Control	267.54	68.22	1.4	1.4
Phorate	296.74 (+10.9)	71.84 (+5.3)	1.0	1.0
Meloidogyne incognita	219.06 (-18.1)	46.64 (-31.6)	4.4	1.0
Radopholus similis	162.66 (-39.2)	23.98 (-64.8)	1.0	3.6
Paecilomyces lilacinus	275.28 (+2.9)	73.84 (+8.2)	1.0	1.0
M. incognita + *P. lilacinus*	230.72 (-13.8)	82.72 (+21.2)	2.4	1.0
R. similis + *P. lilacinus*	(190.04) (-28.9)	35.96 (-47.3)	1.0	2.4
M. incognita + *R. similis*	103.80 (-61.2)	17.40 (-74.5)	2.8	3.4
M. incognita + *R. similis* + *P. lilacinus*	249.64 (-6.7)	60.18 (-11.8)	2.0	2.2
M. incognita + *R. similis* + Phorate	268.78 (+0.5)	64.56 (-5.4)	1.6	1.8
LSD (P=0.05)	38.03	16.63	0.6	0.6

RKI : 1 = No galls; 2 = Mild galling; 3 = Medium galling; 4 = High galling; 5 = Very high galling and root rotting

RLI : 1 = No lesion; 2 = Few isolated lesions; 3 = Many lesions, few coalescing, root tips damaged; 4 = Many lesions, coalescing, encircling the main root, lateral roots damaged; 5 = Whole root system damaged

Figures in parentheses denote percent reduction (-) / increase (+) over control

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