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BIOLOGICAL CONTROL OF ROOT-KNOT NEMATODE ON BETELVINE, *PIPER BETLE*, BY *PAECILOMYCES LILACINUS*

by
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Summary. Experiments were conducted for two years with *Paecilomyces lilacinus* to control *Meloidogyne incognita* infecting *Piper betle*. Rice grains infected with the fungus were inoculated in different doses per plant and compared with carbofuran as control. Better reduction of nematode population was observed in treating parasitic fungi infested rice grains at 8 g/kg soil. The fungus penetrated the egg masses and the egg masses contained empty egg shells.

Root-knot nematodes are important parasites of Betelvine (*Piper betle* L.). The parasitic fungus *Paecilomyces lilacinus* (Thom.) Samson is reported to control *Meloidogyne* (Jatala *et. al.*, 1979, Hewlett *et al.*, 1990). In the present study *P. lilacinus* grown on rice grain was tried as a control for *Meloidogyne incognita* (Kofoid *et* White) Chitw.

Materials and methods

A pure culture of *P. lilacinus* was obtained from the Indian Agricultural Research Institute, New Delhi, India. Conical flasks were filled with 1 kg of rice grain soaked in water for 12h and steam sterilised. *P. lilacinus* was inoculated to the rice grains and allowed to multiply for 15 days. The flasks were shaken at 48 h interval to accelerate growth.

Uniform sized three hoded cuttings of betelvine cv. Karpoori were planted in pots containing 1 kg sterilised soil and kept in a mist chamber. Thirty days later, the plants were inoculated with 2000 second stage juveniles of *M. incognita* from a culture maintained on tomato. The fungus infected rice grains were added to the rhizosphere of the plant in different doses viz. 2, 4, 6 and 8 g/kg soil, 30 days after planting the vines. The above treatments were also compared with carbofuran at the rate of 1.5 kg ai/ha as control. *P. lilacinus* at 4 g/kg in combination with carbofuran at 0.75 kg ai/ha was also compared with nematode inoculated and uninoculated control. There were five replicates in each treatment.

Plants were uprooted 65 days after the treatments. Measurements were made of shoot lenght and weight, root length and weight. The number of leaves and weight of 100 leaves were also recorded. The root-knot index was estimated on a 0-5 scale basis. Nematodes were extracted from soil using Cobbs' sieving gravity method and Baermann funnel technique to calculate the final soil population.

Results and discussion

Experiments conducted during 1991 and 1992 revealed maximum growth of vines treated with *P. lilacinus* at 8 g/kg of soil. This was equally effective as carbofuran treatment at 1.5 kg ai/ha. These two treatments increased shoot length and weight, root length and weight, number of leaves and weight of 100 leaves.

Nematode infestation was severe on vines grown in nematode inoculated control pots. Reduction in the root-knot index was observed in vines treated with *P. lilacinus* at 8 g and also in the carbofuran treatment.

The parasitic fungus *P. lilacinus* grew profusely on the egg masses and also penetrated the eggs. An abundance of hyphae were present endogenously in the eggs and hatched juveniles. Many workers have reported the efficacy of *P. lilacinus* as an egg parasite (Jatala *et al.*, 1980; Hewlett *et al.*, 1990). The hyphae penetrated the eggs and destroyed the embryo. Hyphae emerging from the egg shells were also observed to produce conidiophores bearing long chains of conidia. Eggs infected with the fungus were swollen when compared with uninfected eggs.

Final nematode population in soil showed a similar trend to the root-knot indices. Low populations were detected in pots treated with *P. lilacinus* at 8 g/kg or with carbofuran at 1.5 kg ai/ha. The data gathered during two years, 1991 and 1992, are exposed in Table I and II respectively.

TABLE I - *Biological control of* Meloidogyne incognita *in betelvine by* Paecilomyces lilacinus in 1991.

Treatments	Shoot		Root		No. of leaves/ plant	Weight of 100 leaves (g)	Final root-knot index (0-5 scale)	Final soil population of nematodes (250 ml soil)
	length (cm)	weight (g)	length (cm)	weight (g)				
P. lilacinus 2g/kg soil	223	112	14	12	141	212	4.0 (2.1)	261 (16.2)
P. lilacinus 4g/kg soil	231	121	27	13	152	214	3.4 (2.0)	193 (13.9)
P. lilacinus 8g/kg soil	253	127	31	15	168	225	2.4 (1.7)	171 (13.1)
Carbofuran 1.5kg a.i./ha	254	127	31	15	170	226	2.2 (1.6)	162 (12.7)
P. lilacinus 4g/kg soil + Carbofuran 0.75kg a.i./ha	230	120	27	14	153	216	3.0 (1.9)	179 (13.4)
Control (nematode inoculated	213	99	20	10	136	189	5.0 (2.4)	289 (17.0)
Control (uninoculated)	256	128	32	16	178	227	0 (0.7)	0 (0.7)
SEM	3.0	1.7	0.6	0.4	1.6	0.9	0.1	0.3
CD at 5%	8.9	4.9	1.5	1.1	4.9	2.9	0.2	0.8

Figures in parentheses are $\sqrt{x + 0.5}$ transformed values: root-knot index 0 = 0 galls, 1 = 1-2 galls, 2 = 3-10 galls, 3 = 11-30 galls, 4 = 31-100 galls, 5 = 100 galls or more per root system.

TABLE II - *Biological control of* M. incognita *in betelvine by* P. lilacinus *in 1992.*

Treatments	Shoot		Root		No. of leaves/ plant	Weight of 100 leaves (g)	Final root-knot index (0-5 scale)	Final soil population of nematodes (250 ml soil)
	length (cm)	weight (g)	weight (g)	weight (g)				
P. lilacinus 2g/kg soil	220	114	27	13	154	210	4.0 (2.1)	247 (15.6)
P. lilacinus 4g/kg soil	218	123	30	14	158	216	3.0 (1.9)	183 (13.5)
P. lilacinus 8g/kg soil	259	138	36	17	196	221	2.2 (1.6)	159 (12.6)
Carbofuran 1.5kg a.i./ha	259	139	35	16	196	222	2.2 (1.7)	157 (12.6)
P. lilacinus 4g/kg soil + Carbofuran 0.75kg a.i./ha	230	122	29	11	173	212	2.6 (1.8)	181 (13.5)
Control (nematode inoculated	210	102	22	12	153	193	5.0 (2.4)	285 (17.0)
Control (uninoculated)	259	139	35	17	195	224	0 (0.7)	0 (0.7)
SEM	2.1	1.3	0.4	0.4	1.9	1.9	0.1	0.1
CD at 5%	6.4	4.0	1.3	1.2	5.6	5.6	0.2	0.4

Figures in parentheses are $\sqrt{x + 0.5}$ transformed values; root-knot index 0 = 0 galls, 1 = 1-2 galls, 2 = 3-10 galls, 3 = 11-30 galls, 4 = 31-100 galls, 5 = 100 galls or more per root system.

It is concluded that the parasitic fungus *P. lilacinus* can be effectively used for the management of *M. incognita* on betelvine where the use of chemical nematicides is not advisable because the leaves are used for chewing.

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