Nematol. medit. (1994), 22: 265-26

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A METHOD FOR CONVEYING *PAECILOMYCES LILACINUS TO* SOIL FOR THE MANAGEMENT OF ROOT KNOT NEMATODES ON EGG-PLANT

by
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Summary. An experiment was conducted to convey the spores of *Paecilomyces lilacinus* to the soil by mixing the spores of this bio-control agent in neem cake (*Azadirachta indica*) extracts (5 and 10%). The results of the experiments indicated that neem extracts are very useful for carrying biocontrol agent to the root rhizosphere of egg plant (*Solanum melongena*) planted in pots. This method of application of spores facilitates rational integration of biocontrol agent and botanical leading to the exploitation of beneficial effects of both components in the management of *Meloidogyne incognita*. Addition of neem cake extracts (5 and 10%) mixed with spores of *P. lilacinus* to the soil was effective in the management of *M. incognita* on egg plant. Results also indicated that the neem cake extracts (5 and 10%) support the growth of *P. lilacinus*.

Delivery of *Paecilomyces lilacinus* (Thoms.) Samson. into soil has been through application of infested grain or aqueous spore suspension (Jatala, 1986) or through certain carriers such as granules of diatomaceous earth (Backman and Kabana, 1975), bark pellets (Sundheim, 1977), laponite gel with germinated seedlings (Conway *et al.*, 1982). This study explores the possibility of utilising neem (*Azadirachta indica* Juss.) cake extract to convey this biocontrol agent to the soil and for the management of *Meloidogyne incognita* (Kofoid *et* White) Chitw. attacking egg plant, *Solanum melongena* L. (Cv. Pusa Purple Long).

Materials and methods

Five and 10% acqueous extracts of neem cake were prepared by dissolving 50 and 100 grams of powdered oil cake separately in distilled water (made up to 1 litre) for 16 hours and filtering through Whatman filter paper No. 1. A 15 day old culture of *P. lilacinus* (Peruvian isolate) obtained from P. Jatala International Potato Center, Apartado 5969, LIMA, Peru), grown on standard potato dextrose agar medium was comminuted in distilled water with 0.01% Triton X-100 in a Waring blender and the spore concentration was adjusted to $2x10^6$ spores/ml of water. Equal quantities of spore suspension and extract were thoroughly mixed and ajusted to provide a spore load of $1x10^6$ spores/ml. The experiments were conducted in a glasshouse at 27 ± 2 °C. Four week old egg plant seedlings raised in sterilised soil were transplanted singly into pots each containing 2 kg sterilised soil. Five days after transplanting, 20 ml of neem cake extract of 5% or 10% with or without *P. lilacinus* spores were added to the pots in holes made around each seedling. Seedlings in a few pots were inoculated with 20 ml of distilled water containing spores of *P. lilacinus* ($2x10^6$ spores/ml) in the above manner for comparison. Control plants received no inoculum. After three days all the seedlings were inoculated with 2500 J_2 of *M. incognita* per seedling. Each treatment was replicated 5 times. Sixty days after inoculation observations on plant growth parameters, gall index (1-5 scale), per cent egg masses infected by bio-control agent *P. lilacinus* were recorded. Ten egg masses collected at random from infected roots were observed for the presence of fungal mycelium as an indication of infection. Fungus was re-isolated from egg mass, soil and root and density of spores in soil was estimated. Fungus was identified on the basis of conidiophore morphology, conidial colour, colony colour characteristic to *P. lilacinus*.

Another experiment was conducted to confirm the ability of the extracts to support the growth of *P. lilacinus*. Twenty ml of fresh neem cake extracts (5 and 10%) were taken separately in conical flasks and autoclaved at 15 lb pressure for 30 min. Extracts in flasks were inoculated with a piece of culture of *P. lilacinus* grown on potato dextrose agar medium and were incubated at 26 ± 1 °C for 20 days at which the spore loads were recorded.

IIHR Contribution N. 66/92.

Results and discussion

Addition of 5 or 10% neem cake extracts to the soil in pots has significantly increased shoot height and weight of egg plant and reduced the root gall index in comparison to that of the control (Tables I and II). Absorption of neem cake extract appeared to have given protection against nematodes to some extent. Systemic action of neem compounds was reported earlier by Gill (1971). The extracts at these concentrations have proved safe and were not phytotoxic. Increased per cents of infected egg masses in neem cake extracts 5% or 10% + *P. lilacinus* treatment could be due to increased multiplication of this biocontrol agent. There was significantly higher density of *P. lilacinus* spores in the soil in these treatments (Table II) suggesting acqueous neem cake extracts stimulated the growth of *P. lilacinus*. Agar media mixed with neem cake extract was reported to enhance growth of *P. lilacinus* (Mani and Anandam, 1989). Integration of neem cake and *P. lilacinus* was found to be effective in the management of *Tylenchulus semipenetrans* (Reddy *et al.*, 1991).

The experiemnt conducted to study the interaction of biocontrol agent with cake extracts (where neem cake extracts in the flasks were inoculated with *P. lilacinus*) resulted in the spore production to the tune of 16.4×10^6 and 19.8×10^6 spores/ml of 5% and 10% neem cake extracts, respectively after 20 days of incubation at 26 ± 1 °C. With the results of this experiments we maintain that neem cake acqueous extracts support the growth of *P. lilacinus* and these results confirm the findings on increased multiplication of this bio-control agent in soil when applied along with neem cake acqueous extracts.

Acknowledgement: Authors thank the Director, Indian Institute of Horticultural Research, Bangalore, for providing facilities.

TABLE I - *Effect of application of* Paecilomyces lilacinus *(PL) along with neem cake extract (NCE) on the growth of egg plant infected with* Meloidogyne incognita.

Treatments	Shoot length (cm)	Fresh shoot weight (g)	Root length (cm)	Fresh root weight (g)
NCE - 5%	26.2 c	14.3 c	8.7 b	1.5 d
NCE - 10%	28.5 cb	15.4 c	9.2 ab	1.8 c
PL alone	25.7 c	14.6 c	8.4 b	2.2 b
NCE - 5% + PL	32.3 ab	19.4 b	9.8 ab	2.4 b
NCE - 10% + PL	35.1 b	23.8 a	10.5 a	2.9 a
Control	20.4 d	11.2 d	5.3 c	2.2 b
C.D. at 5%	4.00	3.13	1.54	0.37

* Figures in a column followed by a common letter do not differ significantly according to Duncan's multiple range test.

TABLE II - *Effect of application of* P. lilacinus *(PL) along with neem cake extract (NCE) on* M. incognita *infecting egg plant.*

Treatments	Gall index	Final population	% Egg masses parasitised	Spore density (Cfu/g of soil)
NCE - 5%	2.9 b	2549 b	–	–
NCE - 10%	2.7 b	2348 b	–	–
PL alone	2.6 b	2249 b	51.5 b	4200 c
NCE - 5% + PL	1.9 c	1894 c	58.2 a	6100 b
NCE - 10% + PL	1.5 d	1685 d	61.9 a	7400 a
Control	4.5 a	6438 a	–	–
C.D. at 5%	0.50	390.93	3.4	672

* Figures in a column followed by a common letter do not differ significantly according Duncan's multiple range test.

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Accepted for publication on 10 September 1994.