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EVALUATION OF PLANT BASED FORMULATIONS OF *TRICHODERMA HARZIANUM* FOR THE MANAGEMENT OF *MELOIDOGYNE INCOGNITA ON EGG PLANT* [1]

by

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Summary. Aqueous extracts of neem (*Azadirachta indica*), castor (*Ricinus communis*) and pongamia (*Pongamia pinnata*) cakes were evaluated as substrates for mass production of the biological control agent, *Trichoderma harzianum* which was used in the management of *Meloidogyne incognita* in egg plant under field conditions. Castor cake extract at 10% gave maximum growth of mycelial mat and spore production of *T. harzianum* compared with moderate growth in 10% pongamia cake and 5% castor cake extracts. Application of plant based formulations of *T. harzianum* to nursery beds of egg plant was effective in producing vigorous seedlings (increase in plant height and seedling weight) with the least root galling. The above treatments also increased root colonization and parasitization of *M. incognita* females by *T. harzianum*.

Trichoderma harzianum Rifai has been reported to be an effective bioagent for the management of the citrus nematode (Parvatha Reddy *et al.*, 1996). Successful use of any biocontrol agent for the sustainable management of nematodes on crop plants depends on its mass production system (Davis *et al.*, 1991) and availability of a cost effective formulation for its field use (Kerry, 1990). Hence, aqueous extracts of neem (*Azadirachta indica* A. Juss.), castor (*Ricinus communis* L.) and pongamia (*Pongamia pinnata* Merr.) cakes were evaluated for the development of a cost-effective formulation of *T. harzianum*. After confirming that this *T. harzianum* isolate infected females of *Meloidogyne incognita* (Kofoid *et* White) Chitw. (race-1), formulations of it were evaluated as an effective and sustainable management of the nematode on egg plant (*Solanum melongena* L. cv. Pusa Purple Round) in the nursery beds.

Materials and methods

Aqueous extracts of 5 and 10% concentrations of neem, castor and pongamia oil cakes were prepared by soaking appropriate amounts of finely powdered oil cakes in sterile tap water for twelve hours and filtering through a muslin cloth. Five hundred ml of each extract was taken in a 2 l conical flask were autoclaved at 15 lb pressure for 30 minutes. Each conical flask was inoculated with a 4 mm disk of *T. harzianum* (local isolate IIHR-I) cultured on potato dextrose agar medium. Each treatment was replicated five times. The conical flasks were incu-

[1] IIHR Contribution No. 53/9).

bated at 25 °C for 20 and 40 days for recording the weight of mycelial mat and number of spores per ml of suspension, respectively. The mycelial weight of the fungus was ascertained by filtering the suspension on Whatman filter paper No. 1. Spore counts were made using a haemocytometer after making serial dilutions.

The field experiment was conducted at the Indian Institute of Horticultural Research, Bangalore, in raised nursery beds of 1 m x 1 m, infested with *M. incognita* at 127±13 J_2 per 100 g of soil. The formulations of *T. harzianum* grown on oil cake extracts of 10% conc. were used for the management of root-knot nematodes on egg plant seedlings in nursery beds. A 500 ml spore suspension with 0.5 ml teepol (detergent) of each of these plant based formulations of *T. harzianum* was incorporated into the soil in each nursery bed. To evaluate the effect of *T. harzianum* alone, 500 ml of spore suspension (grown on paddy grains containing 9.9×10^3 spores/ml) mixed with 0.5 ml teepol was added to each nursery bed. The control comprised 500 ml of sterile tap water mixed with 0.5 ml teepol added to each nursery bed. Each treatment was replicated five times in a randomized block design. All the nursery beds were sown with the seeds of egg plant in rows. One month after sowing, ten seedlings were pulled at random for recording plant height, weight of seedlings and colonization of *T. harzianum* on roots by following the technique of Papavizas and Lumsden (1982). Further, ten more seedlings (30 day old) were uprooted at random from each bed to record the number of galls on the roots and to estimate the number of females parasitized by *T. harzianum*. Four adult females were teased out from the roots of each seedling and the parasitization by *T. harzianum* was recorded. Ten females from each replicate were surface sterilized with 0.1 per cent sodium hypochlorite solution and were placed on medium developed by Papavizas and Lumsden (1982) to confirm the parasitization of females by the bioagent. Female nematodes from the seedlings of the control treatment were also observed for any parasitization of females by *T. harzianum*.

Results and discussion

The results (Table I) show that the weight of mycelial mat of *T. harzianum* in 10% castor cake extract was significantly greater than the other treatments. Also the number of *T. harzianum* spores in the 10% castor cake extract were significantly greater than in other treatments (Table I). There have been no reports on the ability of these oil cake extracts to support the growth of *T. harzianum*, but in our opinion the preparation of 10% aqueous extracts utilizes little material and is a simple operation. Mass pro-

TABLE I - *Effect of aqueous extracts of oil cakes on the growth and sporulation of* Trichoderma harzianum.

Treatment	*T. harzianum* mycelial mat weight (g)	*T. harzianum* spores/ml of extract (x 1000)
Neem cake extract -5%	2.27	3.45
Neem cake extract -10%	2.68	4.37
Castor cake extract -5%	3.24	7.52
Castor cake extract -10%	4.76	9.74
Pongamia cake extract -5%	2.64	4.28
Pongamia cake extract -10%	3.92	6.36
C.D. at 5%	0.43	1.26

duction system of *T. harzianum* should be economical and holds the prospect of the development of a formulation for field use.

All the treatments were effective in increasing the seedling height and weight (Table II) compared to control, but *T. harzianum* grown on castor cake extract gave the maximum increase in weight. All the plant formulations and oil cake extracts were more effective than *T. harzianum*, grown alone or the control in reducing root galling on the egg plants although differences between the treatments were not statistically significant. Earlier researchers have already established the role of oil cake extracts in increasing the growth of vegetable crops and reducing root-knot nematode development in the roots (Muller and Gooch, 1982; Bhatti and Walia, 1990; Akhtar and Alam, 1990; Sitaramaiah, 1990). Our results (Table III) demonstrate that plant extract-based formulations of *T. harzianum* significantly increased the root colonization and parasitization of nematode females by the bioagent when com-

TABLE II - *Effect of oil cake based* T. harzianum *formulations on the growth of egg plant and management of root-knot nematodes.*

Treatment	Seedling height (cm)	Seedling weight (g)	No. of galls per 100 seedlings
Neem cake extract (NCE) -10%	19.7	2.3	62
Castor cake extract (CEE) -10%	20.5	2.5	58
Pongamia cake extract (PCE) -10%	17.2	2.1	64
NCE (10%) based *T. harzianum* formulation	21.3	2.4	60
CEE (10%) based *T. harzianum* formulation	23.6	2.7	57
PCE (10%) based *T. harzianum* formulation	20.7	2.5	61
T. harzianum alone (grown on paddy grains)	15.4	2.0	89
Control	14.1	1.6	93
C.D. at 5%	3.26	0.38	8.56

TABLE III - *Effect of oil cake based* T. harzianum *formulations on the root colonization and parasitization of root-knot nematode females.*

Treatment	Root colonization by *T. harzianum* (Cfu/g)	Per cent parasitization of females by *T. harzianum*
Neem cake extract (10%) based *T. harzianum* formulation	13,746	43
Castor cake extract (10%) based *T. harzianum* formulation	15,625	51
Pongamia cake extract (10%) based *T. harzianum* formulation	12,242	42
T. harzianum alone (grown on paddy grains)	9,648	30
Control	–	–
C.D. at 5%	94,75	4.26

Cfu - Colony forming units.

pared to *T. harzianum* treatment alone (Table III). Parvatha Reddy *et al.* (1996) reported that the amendment of soil with neem/castor/karanj cakes improved the bio-efficacy of *T. harzianum* for the management of *Tylenchulus semipenetrans* in acid lime. Our results have demonstrated that *T. harzianum* mass produced on neem, castor or pongamia plant extracts can be used as a bioagent for the sustainable management of root-knot nematodes on selected crops and in particular circumstances.

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