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BARE-ROOT DIP OF BRINJAL SEEDLINGS IN PHYTOCHEMICALS FOR THE MANAGEMENT OF ROOT-KNOT NEMATODE (*MELOIDOGYNE INCOGNITA)*

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Abstract: Aqueous neem leaf extract, neem oil and marotti oil at different concentrations were tested as bare-root dip treatments for their efficacy in containing root-knot nematode *[Meloidogyne incognita* (Kofoid and White, 1919) Chitwood, 1949] infestation in brinjal. Root-dip in neem leaf extract for 1 h resulted in significantly better height and number of leaves in the treated plants than neem oil and marotti oil. Among the different concentrations of neem leaf extract tested, 6.25 and 25 per cent extracts proved more effective. Significant reduction in gall index was also seen in neem leaf extract treated plants. Higher concentrations of the extract (50 and 25 per cent) significantly reduced the number of egg masses produced. But none of the phytochemicals had any adverse effect on the hatching of the egg masses. All the three phytochemicals irrespective of the doses reduced population of the nematode in the soil. An overall assessment of the result established the superiority of neem leaf extract (25%) among the different phytochemicals in checking nematode infestation.

Key words: Bare-root dip, brinjal, phytochemicals, root-knot nematode

INTRODUCTION

Among the factors for the low productivity of brinjal (*Solanum melongena* L.) or the egg-plant, nematodes, especially the root-knot nematode *Meloidogyne incognita* (Kofoid and White, 1919) Chitwood, 1949 play a major role. Spurred by the ecocidal effects of chemical based management tools, pest management strategists have now shifted their focus to eco-friendly practices, which maintain soil health. Among the options available for nematologists, use of botanicals is gaining momentum. Though botanicals are generally used as soil amendments for controlling nematodes, bare-root dip of seedlings of transplanted crops like brinjal, tomato and chilly at the time of transplanting in the extracts of oils of pesticidal plants is an attractive proposition. Not only are these less costly and non-environment-polluting, but also they impart sufficient protection to the plant at a crucial period of its growth. Different organic oils (Devakumar, 1985; Pradhan *et al.*, 1989) and leaf extracts (Husain *et al.*, 1984; Nandal and Bhatti, 1986; Vats and Nandal, 1994) have shown promise as bare-root dip of brinjal against *M. incognita.* The present investigation was taken up with a view to identify phytochemicals suitable for bare-root dip treatment of brinjal seedlings to counter nematode invasion.

MATERIALS AND METHODS

Seeds of brinjal (Var. Surya) were sown in denematised pot mixture (soil, sand and farm yard manure in the ratio of 2:1:1) and maintained till transplanting. The phytochemicals used in the experiment included neem *(Azadirachta indica* A. Juss) leaf extract, neem oil and marotti (*Hydnocarpuslaurifolia* [Dennst.] Sleumner) oil. Neem leaf extract was prepared by macerating 25 g of leaves in 100 ml water. It was kept undisturbed for 24 hours and then filtered through thin muslin cloth and Whatman No. 1 filter paper to obtain stock solution. The stock solution was further diluted to concentrations of 50, 25, 12.5 and 6.25 per cent. The oils were emulsified with one per cent teepol and four concentrations viz., 50, 25, 12.5 and 6.25 per cent were prepared.

Four-weeks old healthy brinjal seedlings were selected for the experiment. The seedlings were uprooted, washed well and dipped in neem leaf extract for 1 h and in the oils for 15 minutes. These were then planted in pots containing sterile pot mixture. The experiment was laid out in completely randomized design with 13 treatments replicated thrice.

Newly hatched second stage larvae of M. *incognita* were inoculated to the root zone of the transplanted seedlings at the rate of one larva per gram of soil. Inoculation was done as per the method suggested by Venkitesan and Setty (1977). The pots were irrigated daily to keep the soil moist. Sixty days after transplanting the plants were uprooted. Observations on height of the plants and number of leaves per plant were taken at planting, 30, 45 and 60 days after planting. At uprooting,

observations on gall index, number of egg masses per plant, number of larvae per egg mass and nematode population in 200 g soil and 5 g root were taken. Population of nematodes in soil was determined by the modified method of Christie and Perry (1951) and root population was estimated by modified Baermann funnel technique.

RESULTS AND DISCUSSION

Effect on biometric characters

The height and number of leaves of brinjal plants dipped in the phytochemicals viz., aqueous neem leaf extract, neem oil and marotti oil are presented in Table 1. No significant difference was observed in the height of plants when observed 30 days after transplanting. At 45 and 60 days after transplanting, a significant increase in height was observed in plants dipped in different concentrations of neem leaf extract (34.3 cm and 44.3 cm). Though there was no significant difference among the different concentrations of neem leaf extract, the lowest dose 6.25 per cent (36.3 cm and 48.0 cm) resulted in maximum increase in height, closely followed by 25 per cent (34.0 cm and 45.0 cm) concentration. Evidently, lower doses were more effective than the highest dose (50 per cent). Though statistically not significant, root-dip in oils (neem and marotti) generally resulted in reduced height. This may be due to the mild phytotoxic effect of the phytochemicals. Similar suppression of plant stature due to phyto-toxicity of plant products was reported by Mahapatra and Swain (1993) in tomato dipped in higher concentrations of citronella leaf extracts.

Table 1. Effect of bare-root dip of brinjal seedlings in phytochemicals on plant height and number of leaves per plant

Treatments	Height (cm)			Number of leaves / plant		
	30 DAT	45 DAT	60 DAT	30 DAT	45 DAT	60 DAT
Neem leaf extract 50 %	20.3	34.0	41.3	4.7	7.3	10.7
Neem leaf extract 25 %	19.7	34.0	45.0	6.3	9.3	12.3
Neem leaf extract 12.5 %	20.3	32.7	42.7	5.3	7.3	10.3
Neem leaf extract 6.25 %	20.7	36.3	48.0	5.3	10.3	15.7
Mean	20.3	34.3	44.3	5.4	8.5	12.3
Neem oil 50 %	18.3	24.7	30.7	5.7	5.3	8.3
Neem oil 25 %	17.7	27.3	353	6.0	7.3	10.3
Neem oil 12.5 %	18.0	27.0	34.3	5.0	7.3	10.7
Neem oil 6.25 %	17.3	25.3	33.3	5.3	7.7	10.0
Mean	17.8	26.1	33.3	5.5	6.9	9.8
Marotti oil 50 %	14.0	21.7	39.0	4.0	5.3	8.7
Marotti oil 25 %	18.0	28.3	39.7	4.3	6.0	0.0
Marotti oil 12.5 %	17.3	25.3	33.7	4.7	6.3	9.7
Marotti oil 6.25 %	18.3	29.0	39.3	5.3	7.3	10.7
Mean	16.9	26.1	37.9	4.6	6.3	9.8
Untreated control	16.7	28.3	40.3	6.3	8.7	10.3
CD (0.05) for phytochemicals		2.49	3.66	—	0.82	0.94
CD (0.05) for treatments		4.99	7.32	—	1.65	1.88

DAT = Days after transplanting

Root-dip of brinjal seedlings in neem leaf extract resulted in significantly more number of leaves than root-dip treatments in neem oil and marotti oil. The ineffectiveness of root-dip treatments in these oils may probably be due to slight phytotoxic effect. Of the different doses of neem leaf extract tested, the lowest dose (6.25%) was best, closely followed by 25 per cent extract. Earlier workers have also recorded significant improvement in plant growth due to bare-root dip treatments in different phytochemicals like water extracts of leaves of eucalyptus and neem in tomato (Vats and Nandal, 1994) and neem and its dif-

ferent formulations in tomato (Vats and Nandal, 1994; Pannu and Paruthi, 1995).

Effect on nematode infestation

The pronounced effect on plant growth due to the suppressive effect of the extract on the nematode is evident from Table 2. Effectiveness of root-dip of brinjal plants in phytochemicals in reducing root-knot development has been observed by Husain *et al.* (1984). Though Pradhan *et al.* (1989) reported that root-dip of tomato seedlings in oil of neem and karanj was highly effective in preventing gall formation, the results of the present study showed that neem leaf extract was better than neem oil in reducing root-knot development in brinjal.

Table 2. Effect of bare-root dip of brinjal seedlings in phytochemicals on the population of root-knot nematode

Treatments	Gall index	No. of egg mass per plant	No. of larvae per egg mass	Percentage increase / decrease	Nematode population	
					Soil (200 g)	Root (1 g)
Neem leaf extract 50 %	1.0	3.9 (2.2)	180	-16.3	92.2 (9.7)	36.9 (6.2)
Neem leaf extract 25 %	1.0	6.6 (2.8)	205	-4.7	43.6 (6.7)	35.5 (6.1)
Neem leaf extract 12.5 %	1.3	10.3 (3.4)	160	-25.6	39.7 (6.4)	50.3 (7.2)
Neem leaf extract 6.25 %	2.0	12.3 (3.6)	240	11.6	31.7 (5,7)	...53.4 (7.4)
Mean	1.3	7.9 (2.9)			62.8 (7.1)	46.3 (6.9)
Neem oil 50 %	1.3	9.2 (3.2)	190	-11.6	228.6 (15.2)	51.8 (7.3)
Neem oil 25 %	2.0	9.9 (3.3)	210	-2.3	211.1 (14.6)	46.1 (6.9)
Neem oil 12.5 %	2.3	10.9 (3.5)	200	-6.9	193.2 (13.9)	53.3 (7.4)
Neem oil 6.25 %	2.3	10.8 (3.4)	185	-13.9	163.2 (12.8)	39.6 (6.4)
Mean	1.9	10.2 (3.4)			198.4 (14.1)	47.6 (6.9)
Marotli oil 50 %	1.7	5.6 (2.6)	210	-2.3	304.4 (17.5)	38.0 (6.2)
Marotti oil 25 %	2.0	6.9 (2.8)	240	11.6	283.9 (16.9)	43.8 (6.7)
Marotti oil 12.5 %	2.0	5.6 (2.6)	160	-25.6	234.1 (15.3)	52.6 (7.3)
Marotti oil 6.25 %	2.3	5.7 (2.6)	180	-16.3	211.1 (14.6)	55.2 (7.5)
Mean	2.0	5.9 (2.6)			256.9 (16.1)	47.2 (6.9)
Untreated control	2.7	11.5 (3.4)	215		338.0 (18.4)	92.7 (9.6)
CD (0.05) for phytochemical	—		NA		(1.25)	
CD (0.05) for treatments	—	(0.566)			(2.50)	(0.86)

Figures in parentheses are $\sqrt{(x+1)}$ transformed values; NA = not analysed

The fecundity of the nematode was significantly impaired by root-dip in neem leaf extract and to some extent by neem (10.2) and marotti oils (5.9) as evidenced by the number of egg masses in the treated plants. The higher concentrations of water extract of neem leaves significantly reduced the number of the egg masses produced. Though the lowest concentration (6.25%) resulted in significantly better plant growth, gall index (2.0) and number of egg masses per plant (12.3) were higher in this treatment indicating the possibility of build-up of the nematode population to economic injury levels subsequently. Considering the effect of the phytochemicals on the hatchability of the egg masses, no significant adverse effect was observed, though a slight decrease was seen in the different treatments. Contrary to the present findings on the hatchability, inhibitory effect of several phytochemicals on the hatching of root-knot nematode has been reported by several workers (Alain *et al.*, 1978; Patel *et al.*, 1985).

The population of the root-knot nematode in the rhizosphere of the treated plants was significantly reduced in all the three phytochemical treated plants. Higher dose of the botanicals had higher population density in the soil, the lowest being in neem leaf extract treatment (62.8), which was below economic threshold level. Such observations have been recorded by earlier workers (Mahapatra and Swain, 1993; Vats and Nandal, 1994).

The nematode population in the roots of the treated plants was also significantly low compared to the untreated plants. However, among them, there was no significant difference. The results confirmed the findings of Pradhan *et al.* (1989) and Mahapatra and Swain (1993).

An overall assessment of the results indicated that root-dip in neem leaf extract for 1 h resulted in significantly better height and number of leaves in brinjal. Of the phytochemicals tested, neem leaf extract 25 per cent was more effective in suppressing the nematode infestation.

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