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CONTROL OF PLANT-PARASITIC NEMATODES WITH 'NIMIN' AND SOME PLANT OILS BY BARE-ROOT DIP TREATMENT

by
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Summary. Bare-root dip treatment with 'Nimin' (contains-neem triterpenes) and some plant oils, viz., neem (*Azadirachta indica*), castor (*Ricinus communis*), rocket-salad (*Eruca sativa*) and mustard (*Brassica juncea*) showed significant inhibition of root-knot development caused by root-knot nematode *Meloidogyne incognita*, and population build-up of commonly occurring plant-parasitic nematodes on tomato (*Lycopersicon esculentum*). 'Nimin' was highly effective in reducing disease incidence. The damage caused by nematodes were recognized in terms of improved plant growth by the root-dip treatment. Root-knot development and nematode densities decreased and plant growth responses increased with increasing concentration of the test products.

A great deal of work has been carried out on the use of organic amendments to the soil for the control of plant-parasitic nematodes (Muller and Gooch, 1982; Akhtar and Alam, 1990a, 1992) particularly with neem oilcake (Alam *et al.*, 1977; Akhtar and Alam, 1991) and castor oilcake (Lear, 1959). It has also been observed that extracts of oil-cakes and leaves of castor have a systemic action against the root-knot nematode *Meloidogyne incognita* (Akhtar and Alam, 1990b). Recently Godrej Soaps Ltd., India has marketed a product 'NIMIN' which contains neem-triterpenes and is recommended as a urea-based coating agent to restrict loss of nitrogen by leaching. However, it is not known to what extent it is effective against nematodes, though in all possibilities because of its origin it can be expected to have nematicidal properties. Also, the nematicidal properties of oils of neem, castor, mustard and rocket-salad are not known. It is therefore considered desirable to test the nematicidal potential by root-dip treatment in 'Nimin' and some plant oils viz., neem (*Azadirachta indica* A. Juss.), castor (*Ricinus communis* L.), rocket-salad (*Eruca sativa* L.) and mustard [*Brassica juncea* (L) Czern. et Coss.] to induce plant resistance against root-knot nematodes and some other plant-parasitic nematodes present in naturally infested soil.

Materials and methods

Ten ml of neem, castor, rocket-salad and mustard oil and 'Nimin' were dissolved in 90 ml of water and kept for an hour. These extracts were arbitrarily termed as standard 'S'; other dilutions, viz., S/2 and S/10 were prepared from the 'S' concentration with distilled water.

Roots of three-week-old seedlings of tomato (*Lycopersicon esclulentum* Mill.) cv. Pusa Ruby grown in sterilized soil, were dipped in different concentrations separately for 30 minutes. Plants without dip treatment served as control. Each treatment had five replications including control. After dip treatment, roots were washed with water and seedlings were transplanted into 15-cm clay pots comprising 1 kg autoclaved soil-manure mixture. Each seedling, after transplantation, was inoculated with 1000 freshly hatched 2nd stage juveniles of root-knot nematode *Meloidogyne incognita* (Kofoid *et* White) Chitw. Two months after inoculation the plants were uprooted, weighed, lengthed and root-knot indices estimated.

For another experiment pots were filled with naturally infested soil containing mixed populations of commonly occurring plant-parasitic nematodes viz., *Hoplolaimus indicus* Sher, *Helicotylenchus indicus* Siddiqi, *Rotylenchulus reniformis* Linford *et* Oliveira, *Tylenchorhynchus brassicae* Siddiqi and juveniles of *M. incognita*. Here also, seedlings were transplanted and treated in the same manner as described above. Two months after inoculation the plants were carefully uprooted, washed and plant growth (fresh weight and length of shoot and root) and root-knot index on 0-5 scale (Sasser *et al.*, 1984) were determined. Nematode populations after termination of experiment was determined by Cobb's sieving and decanting and Baermann's funnel techniques (Southey, 1986).

Results and discussion

Bare-root dip treatment in different concentrations of the extracts of oils and 'Nimin' significantly reduced the incidence of root-knot caused by *M. incognita* (Table I) and population densities of plant-parasitic nematodes (Table II) on tomato plants. Maximum reduction was observed in 'Nimin' followed by neem oil, castor oil, rocket-salad oil and mustard oil. Moreover, the potential of treatments was comparatively more in higher concentrations whereas it decreased with decreasing concentration. Plant weight and length were positively correlated with the degree of reduction in root-knot and suppression in the population levels of plant-parasitic nematodes (Tables I, II).

Results indicate that the extracts tested induce some resistance in tomato against *M. incognita* and other plant-parasitic nematodes. The inhibition in root-knot development and decline in the nematode populations due to root-dip treatment could be attributed to the unfavourable condition causing poor penetration and later retardation in biological activities such as feeding and/or reproduction of the nematode as suggested by Bunt (1975). The efficacy of different extracts varied due to the fact that the chemical(s) present in the test material have some toxic potential against nematodes. Considering the recent report by Kast (1985), induced defence mechanisms may also have some practical relevance. Siddiqui and Alam (1988) have also pointed out that some chemicals are either absorbed by the roots or there might have been some chain reaction which has been triggered due to some factor ('elicitor' / 'activator') present in leaf extracts of neem when bare-root dip treatment was given to tomato seedlings.

These findings with respect to protective action and the direct toxicity of plant derivatives would go a long way to help develop some plant based nematicidal products.

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TABLE I - *Effect of bare-root dip treatment with plant oils and 'Nimin' on root-knot development caused by* Meloidogyne incognita *and related plant growth of tomato cv. Pusa Ruby.*

Treatment	Concentration	Root-knot index (0-5 scale)	Plant weight (g)			Plant length (cm)		
			Shoot	Root	Total	Shoot	Root	Total
'Nimin'	S	0.4	47.4	22.3	69.7	29.1	8.9	38.0
	S/2	0.8	44.3	21.7	65.0	27.9	8.2	36.1
	S/10	1.0	42.3	20.4	62.7	26.5	7.5	34.0
Neem oil	S	0.5	45.3	20.5	65.8	27.2	9.0	36.2
	S/2	1.0	43.2	20.4	63.6	25.1	8.1	33.2
	S/10	1.2	40.3	18.2	58.5	24.2	7.2	31.4
Castor oil	S	0.6	43.7	19.4	63.1	25.2	8.0	33.2
	S/2	1.0	40.3	19.2	59.5	23.1	7.1	30.2
	S/10	1.4	38.5	16.4	54.9	21.5	6.5	28.0
Rocket-salad oil	S	0.7	42.2	17.0	59.2	24.1	7.2	31.3
	S/2	1.0	39.4	15.4	54.8	21.2	6.9	28.1
	S/10	1.5	36.5	14.3	50.8	20.5	6.2	26.7
Mustard oil	S	0.8	39.7	16.8	56.5	22.1	7.2	29.3
	S/2	1.0	37.9	14.3	52.2	20.4	6.1	26.5
	S/10	1.5	35.1	13.4	48.5	19.2	5.7	24.9
Undipped-inoculated		4.0	15.3	7.5	22.8	10.0	4.9	14.9
Undipped-Uninoculated		–	52.2	24.5	76.7	51.5	10.5	62.0
C.D. (P = 0.05)		0.69			5.09			4.88
C.D. (P = 0.01)		0.91			6.76			6.49

TABLE II - *Effect of bare-root dip treatment with plant oils and 'Nimin' on the population of plant-parasitic nematodes and related plant growth of tomato cv. Pusa Ruby.*

Treatment	Concentration	Nematode population/250 g soil							Plant weight (g)			Plant length (cm)		
		Hop	Hel	Tyl	Trh	Rot	Mel	Total	Shoot	Root	Total	Shoot	Root	Total
'Nimin'	S	74	39	31	75	78	81	378	46.7	24.0	70.7	35.4	10.2	45.6
	S/2	89	62	51	39	81	79	401	44.3	22.0	66.5	32.2	9.8	33.0
	S/10	100	90	70	61	133	205	659	41.5	20.9	62.4	30.1	8.1	38.2
Neem oil	S	77	41	44	85	90	122	461	44.5	21.4	65.9	33.5	9.4	42.9
	S/2	95	67	55	44	95	141	497	41.2	20.2	61.4	30.2	8.2	38.4
	S/10	105	94	74	63	140	225	701	40.0	19.8	59.8	28.5	8.0	36.5
Castor oil	S	85	55	50	90	94	90	464	43.4	22.5	65.9	30.2	9.2	39.4
	S/2	102	68	67	105	100	110	552	40.0	20.0	60.0	27.5	8.0	35.5
	S/10	111	99	78	67	145	233	733	39.4	18.5	57.9	25.4	7.2	32.6
Rocket-salad oil	S	90	60	55	95	100	95	495	41.4	20.2	61.6	28.4	8.2	36.6
	S/2	102	80	70	61	140	120	573	39.2	19.4	58.6	26.2	7.4	33.6
	S/10	125	105	80	74	165	250	799	38.4	18.0	56.4	23.9	6.4	30.3
Mustard oil	S	95	65	62	103	114	100	539	40.5	20.0	60.5	25.4	8.0	33.4
	S/2	115	90	80	163	145	130	723	38.2	18.9	57.1	22.4	7.2	29.6
	S/10	140	110	90	170	160	280	950	37.4	18.8	56.2	20.5	7.0	27.5
Undipped-infested soil		210	195	105	275	290	575	1650	14.3	7.5	21.8	15.2	4.9	20.1
Undipped-sterilized soil		–	–	–	–	–	–	–	52.2	24.5	76.7	51.5	10.5	62.0
C.D. (P = 0.05)								35.01			2.78			1.91
C.D. (P = 0.01)								46.56			3.69			2.54

Hop = *Hoplolaimus indicus*, Hel = *Helicotylenchus indicus*, Tyl = *Tylenchus filiformis*, Trh = *Tylenchorhynchus brassicae*, Rot = *Rotylenchulus reniformis*, Mel = *Meloidogyne incognita*.

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