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CONTROL OF PLANT PARASITIC NEMATODES BY INTERCROPPING WITH *TAGETES MINUTA*

by
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Several studies have shown the nematode-suppressant effects of *Tagetes* spp. (Oostenbrink, 1960; Daulton and Curtis, 1963; Hackney and Dickerson, 1975; Alam *et al.*, 1977). In India farmers sometimes grow marigold plants in land bordering vegetable crops or in between the rows. The work reported here is an investigation of the effect of this practice on *Meloidogyne incognita* (Kofoid *et* White) Chitw., *Rotylenchulus reniformis* Linford *et* Oliveira and *Tylenchorhynchus brassicae* Siddiqi.

Materials and Methods

Three week old seedlings of tomato (*Lycopersicon esculentum* Mill. cv. Pusa Ruby), eggplant (*Solanum melongena* L. cv. Pusa Purple Long), cabbage (*Brassica oleracea capitata* L. cv. Pride of India) and cauliflower (*B. oleracea botrytis* L. cv. Maghi) were transplanted singly into the centre of 15 cm clay pots containing 1 kg autoclaved mixture of soil, sand and compost (in 7:2:1 ratio). In some of the pots 5 seedlings of marigold (*Tagetes minuta* L.) of the same age were transplanted equidistantly around the periphery as per the treatments listed in Tables I - III. Two days after transplanting the pots were inoculated in the rhizosphere of the central seedling with 1000 specimens of one of the three test nematodes, viz., *M. incognita, R. reniformis,* or *T. brassicae*. Uninoculated plants served as the control. There were three replicates for each set. Sixty days after inoculation the plants were uprooted and washed gently and plant growth

and root-knot index (on 0-4 scale) were determined. Final soil populations of the nematodes were determined by Cobb's sieving and decanting method and modified Baermann funnel technique.

Root-exudates of *T. minuta* were obtained by dipping the roots of ten seedlings of the same age in 50 ml sterilized distilled water. The exudate was collected after 5 days and the volume made up to 50 ml with distilled water. This exudate was arbitrarily termed as the standard (S).

Mortality of the test nematodes in different dilutions of root-exudates was determined by transferring 2nd stage juveniles of *M. incognita* and different free stages (soil phase) of *R. reniformis* and *T. brassicae* to 40 mm petri plates containing 10 ml of different dilutions of the root-exudates (Alam, 1985). Petri dishes containing distilled water only served as the control. There were three replicates for each treatment including the control. The number of dead and living nematodes were counted after 12, 24 and 48 hr, death being ascertained after transferring them to water for 1 hr.

For studying the effect of the root-exudates on the juvenile hatch of *M. incognita*, five average sized healthy and freshly picked eggmasses were transferred to petri dishes (40 mm diameter) containing 10 ml of different dilutions of the root-exudates. There were three replicates for each treatment including the control. The total number of hatched juveniles was counted after 5 days and per cent inhibition of the juvenile hatching in relation to the control was calculated.

Results and Discussion

Results presented in Tables I - III indicate that all the three test species of nematodes were highly pathogenic on their respective hosts as they multiplied freely on control plants. The nematode multiplication was, however, significantly retarded when these crops were grown with marigolds. The root-knot indices on tomato and eggplant were 1.8 and 1.5 respectively when marigolds were grown with tomato and eggplant, compared with 4.0 without marigolds (Table I). *R. reniformis* had a reproduction factor of 2.1 on tomato and 1.9 on eggplant which in the presence of marigolds were reduced to 0.8 and 0.7 respectively (Table II). The reproduction factor of *T. brassicae* was 2.4 on tomato, 2.2 on eggplant, 1.9 on cabbage and 1.6 on cauliflower. It was reduced to 0.7, 0.8, 0.7 and 0.8 on these crops respectively in the presence of marigolds (Table III). As a consequence of reduction in nematode multiplication the plant growth in all cases was enhanced significantly (Tables I - III).

The root-exudate of *T. minuta* was found most toxic to *R. reniformis* followed by *T. brassicae* and *M. incognita* (Table IV). Nematode mortality increased with increase in concentration of the root-exudate and the exposure period (Table IV). The inhibition of juvenile hatching from eggmasses of *M. incognita* exposed to the root-exudate for 5 days was 80% at the full concentration (S), 74.5% at S/2, 51.0% at S/10 and 20.4% at S/100.

The present findings indicate that the practice of growing marigolds intermixed with vegetables crops suppresses some plant parasitic nematodes. This kind of nematode control is of special significance as it is devoid of environmental pollution hazards.

The present findings confirm and extend the findings of Alam *et al.* (1975), who reported the nematicidal nature of root-exudates of *T. erecta*, and those of Stessel and Sakkinen (1961) who found strong nematicidal action of root sap of *T. lucida* against *Panagrellus redivivus*.

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Table I - *Effect of interculture of* Tagetes minuta *on root-knot development of* Meloidogyne incognita *and growth of tomato and eggplant.*

Crops	Inoculation with the nematode	Weight[1] (g)			Root-knot index[1]
		Shoot	Root	Total	
Tomato alone	Uninoculated	27.2	11.2	38.4	—
Tomato alone	Inoculated	11.2	7.5	18.7 (51.3)[2]	4.0
Tomato and Tagetes	Inoculated	23.3	10.0	33.3 (13.1)	1.8
	C.D. (P=0.05)			5.91	0.86
Eggplant alone	Uninoculated	26.0	10.0	36.0	—
Eggplant alone	Inoculated	8.5	3.5	12.0 (66.7)	4.0
Eggplant and Tagetes	Inoculated	24.0	6.3	30.3 (15.8)	1.5
	C.D. (P=0.05)			3.11	0.64

[1] Each value is an average of three replicates.

[2] Values for per cent reduction in plant weight over uninoculated control are given in parenthesis.

Table II - *Effect of interculture of* Tagetes minuta *on the population of* Rotylenchulus reniformis *and plant growth of tomato and eggplant.*

Crops	Inoculation with the nematode	Weight[1] (g)			Final Population[1]	$R=\frac{P_f}{P_i}$
		Shoot	Root	Total		
Tomato alone	Uninoculated	27.2	11.2	38.4	—	—
Tomato alone	Inoculated	9.5	6.8	16.3 (57.4)[2]	2133	2.1
Tomato and Tagetes	Inoculated	16.3	9.0	25.3 (34.0)	820	0.8
	C.D. (P=0.05)			3.42	70.97	
Eggplant alone	Uninoculated	26.0	10.0	36.0	—	—
Eggplant alone	Inoculated	11.0	9.8	20.8 (42.1)	1883	1.9
Eggplant and Tagetes	Inoculated	19.3	8.3	27.6 (23.3)	730	0.7
	C.D. (P=0.05)			5.91	64.15	

[1] Each value is an average of three replicates.

[2] Values for per cent reduction in plant weight over uninoculated control are given in parenthesis.

Table III - *Effect of interculture of* Tagetes minuta *on the population of* Tylenchorhynchus brassicae *and plant growth of selected crops.*

Crops	Inoculation with the nematode	Weight[1] (g)			Final Population[1]	$R=\frac{P_f}{P_i}$
		Shoot	Root	Total		
Tomato alone	Uninoculated	27.2	11.2	38.4	—	—
Tomato alone	Inoculated	10.2	5.5	15.7 (59.2)[2]	2400	2.4
Tomato and Tagetes	Inoculated	21.3	8.4	29.7 (22.5)	740	0.7
	C.D. (P=0.05)			5.21	55.02	
Eggplant alone	Uninoculated	26.0	10.0	36.0	—	—
Eggplant alone	Inoculated	11.0	5.5	16.5 (54.2)	2176	2.2
Eggplant and Tagetes	Inoculated	19.9	9.2	29.1 (19.2)	820	0.8
	C.D. (P=0.05)			2.75	61.68	
Cabbage alone	Uninoculated	31.0	7.3	38.3	—	—
Cabbage alone	Inoculated	21.0	4.2	25.2 (34.3)	1916	1.9
Cabbage and Tagetes	Inoculated	24.4	7.2	31.6 (17.6)	720	0.7
	C.D. (P=0.05)			6.78	76.14	
Cauliflower alone	Uninoculated	51.2	11.7	62.9	—	—
Cauliflower alone	Inoculated	27.0	7.0	34.0 (45.9)	1600	1.6
Cauliflower and Tagetes	Inoculated	30.0	8.0	38.0 (39.5)	810	0.8
	C.D. (P=0.05)			8.92	58.60	

[1] Each value is an average of three replicates.

[2] In parenthesis are given per cent reduction in plant weight over uninoculated control.

Table IV - *Mortality of plant parasitic nematodes in root-exudates of marigold,* Tagetes minuta.

Exposure period (hr)	% mortality in different concentrations[1]			
	S	S/2	S/10	S/100
Meloidogyne incognita				
12	30	20	11	0
24	50	25	15	0
48	60	39	25	9
Rotylenchulus reniformis				
12	60	21	0	0
24	69	19	10	0
48	79	50	25	5
Tylenchorhynchus brassicae				
12	44	20	7	0
24	62	43	16	0
48	73	56	19	5

[1] Each value is an average of three replicates. No mortality occurred in distilled water (control).

SUMMARY

Marigold, *Tagetes minuta*, in mix-culture, significantly inhibited the root-knot development caused by *Meloidogyne incognita* on tomato and eggplant and reduced the multiplication of *Rotylenchulus reniformis* and *Tylenchorhynchus brassicae* on tomato, eggplant, cabbage and cauliflower. The growth of all the test plants was improved when marigolds were present. The root-exudates of *T. minuta* also exhibited strong nematicidal action.

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