

***In vitro* Studies of the Effectiveness of Medicinal Plants Extract Compared to Carbofuran in Controlling the Root Knot Nematode *Meloidogyne incognita* in Tomato**

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Abstract The crude aqueous extracts of five plants, turmeric (*Curcuma longa*), marwatulsi (*Origanum majorana*), mentha (*Mentha arvensis*), aonla (*Phyllanthus emblica*) and jatropa (*Jatropha curcas*) and a synthetic nematicide. Carbofuran were studied *in-vitro* for their efficacy in controlling the root knot nematode, *Meloidogyne incognita*. The extracts were applied at 50 ml and 75 ml per pot while carbofuran was applied at 0.1 g per pot. One thousand (1000) freshly hatched juveniles were inoculated. Efficacy of treatments improved with increase in their concentration. Aqueous extract of mentha @ 75 ml/pot followed by extract of turmeric @ 75 ml/pot was found effective in enhancing plant growth parameters and reducing nematode reproduction factors.

Keywords Plants extract, Root knot, Carbofuran, *Meloidogyne incognita*, Tomato.

Introduction

Root-knot nematode (*Meloidogyne* spp.), is an im-

portant pest of vegetables. Overall, 5% global yield losses are guessed to be due to root-knot nematode only, which may be much higher in tropics and subtropics. Management of root-knot nematodes with chemicals, under field condition is cost prohibitive, hazardous and cause serious environmental pollution. So efforts are being made these days to shift from the conventional use of chemicals to the use of eco-friendly botanicals for the management of plant parasitic nematodes. In recent years, so many plants and their parts are being screened and identified with promises of nematicidal and nematostatic effects. This is necessary because of the negative side effects of synthetic nematicides on the environment and agricultural produce as well as the high cost of such nematicides. Several researchers [1—3] have reported earlier on the inhibitory effects of some plant extracts on nematode egg hatch and juvenile survival. However, the list of plant materials with ovicidal and larvicidal potentials seems to be inexhaustible. Botanical pesticides are readily available in many places, often cheaper than their synthetic counter parts and their crude extracts are easy to prepare even by farmers. These are also less likely or slow down the development of resistance or resurgence in pests. The benefits of natural pesticides have aroused interest in protection of crop plants. The aim of this research was to investigate the laboratory toxicities of crude aqueous extracts of turmeric, marwatulsi, mentha, aonla and jatropa. It was also intended to compare the toxicities of the test plants with that of a proven synthetic nematicide, carbofuran (furadan).

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Table 1. Effect of aqueous extracts of medicinal plants on growth parameters of tomato (cv Sel-7) infested with *M. incognita* under screen house. Figures in parentheses are \sqrt{n} transformed values.

Treatments (Extract/pot)	Shoot length (cm)	Root length (cm)	Fresh shoot weight (g)	Fresh root weight (g)	Dry shoot weight (g)	Dry root weight (g)	Num- ber of galls/ plant	Num- ber of egg masses plant	Final nema- tode popula- tion/ 200cc soil
T ₁ Turmeric @ 50 ml	40.72	21.50	22.32	10.75	5.30	1.15	(11.04)	38 (6.20)	609 (24.70)
T ₂ Turmeric @ 75 ml	42.32	24.07	24.90	11.60	5.55	1.29	93.74 (9.73)	28 (5.40)	559.2 (23.66)
T ₃ Marwa @ 50 ml	39.62	21.19	21.92	10.77	4.81	0.92	137.8 (11.77)	46 (6.82)	698.2 (26.44)
T ₄ Marwa @ 75 ml	41.85	23.60	23.67	11.92	5.11	1.24	125.8 (11.25)	37 (6.01)	671.2 (25.92)
T ₅ Mentha @ 50 ml	41.97	25.17	25.42	11.70	5.68	1.34	86.5 (9.35)	31 (5.65)	479.28 (21.91)
T ₆ Mentha @ 75 ml	44.37	26.60	27.57	12.07	5.83	1.47	67 (8.24)	24 (4.94)	410 (20.27)
T ₇ Aonla @ 50 ml	37.97	20.93	22.90	10.57	4.57	0.94	189 (13.7)	56 (7.51)	990.2 (31.48)
T ₈ Aonla @ 75 ml	39.62	21.92	23.92	11.00	5.03	1.11	154.2 (12.39)	44 (6.68)	885 (29.76)
T ₉ Jatropha @ 50 ml	38.27	21.32	21.75	10.40	4.69	1.05	171.8 (13.14)	500 (7.14)	940.5 (30.68)
T ₁₀ Jatropha @ 75 ml	40.90	22.72	23.97	11.02	5.01	1.13	152.8 (12.39)	40 (6.36)	844.5 (29.07)
T ₁₁ Carbofuran @ 0.1 g/pot	45.77	28.42	28.75	12.87	5.78	1.38	49 (7.06)	18 (4.28)	393.2 (19.85)
T ₁₂ Untreated inocu- lated (check)	34.300	17.20	16.67	8.55	3.41	0.83	289.8 (17.05)	75 (8.73)	1337.2 (36.58)
T ₁₃ Untreated uninoc- ulated (check)	37.57	19.80	21.10	9.67	4.22	1.01	0.5 (1.22)	0.5 (1.22)	0.5 (1.22)
CD at 5%	1.70	1.67	1.87	1.18	0.52	0.11	(0.35)	(0.24)	(0.13)

Materials and Methods

The experiment was carried out in the screen house of Department of Nematology, CCHAU, Hisar. The aqueous extract of turmeric, mar watulsi, mentha, aonla and jatropha were prepared separately by grinding and dissolving 2 g of ground leaves and delicate stem in 5 ml of distilled water with the help of pestle and mortar. In order to obtain a clear and transparent extract, free of all plant debris, the water extracts were filtered through a four ply muslin cloth and then centrifuged for five minutes at 4000 rpm and then filtered through a Whatman's filter paper. The aqueous extracts thus prepared were kept in a covered flasks in refrigerator and were taken as stock solution. Four week old seedlings of tomato cv Sel-7 (Hisar Arun)

were transplanted in each pot and after three days of transplanting one healthy seedling in each pot was maintained and other was uprooted carefully. The aqueous extracts of different plants @ 50 ml and 75 ml per pot and 1000 juveniles of root-knot nematodes simultaneously were added to the pots three days after transplanting. Untreated and chemical check with carbofuran @ 0.1 g per pot were maintained for comparison. The pots were watered regularly as and when required.

Results and Discussion

Effect of aqueous extracts of medicinal plants on plant growth parameters of tomato and multiplication of root-knot nematode was evaluated under screen con-

ditions and results (Table 1) showed that aqueous extracts of all the plants were found effective to enhanced growth parameters of tomato and reducing the reproduction factor of root-knot nematode significantly in comparison with untreated control. Gall-ing and egg masses formation on tomato was significantly reduced by carbofuran and mentha extracts followed by turmeric extracts. Plant growth parameters (shoot length, root length, fresh shoot weight, fresh root weight, dry shoot weight, dry root weight) were found higher in the plants treated with carbofuran @ 0.1 g/kg soil followed by mentha and turmeric @ 75 ml/pot respectively. This might be due to that nematotoxic effect of plant extracts and carbofuran, which prevent the juveniles of *M. incognita* to penetrate into roots. The similar type of results were obtained by Ramanpreet et al. [4] who reported that aqueous extracts of fresh leaves of neem (*Azadirachta indica*), aak (*Calotropis procera*), and dek (*Melia azaderach*) and oil cakes of mustard and cotton significantly inhibited the penetration of second stage juveniles of *M. incognita* into the roots of sunflower Saravanpriya and Sivakumar [5] reported that root dip treatment of tomato seedlings in extracts of *Calotropis gigantea* significantly increases seedlings establishment as well as reducing the nematode reproduction factors Joyamati et al. [6] observed the nematicidal property of essential oil extracted from various medicinal plants against *M. graminicola* infesting rice in pots and found that oil from *Jatropha curcas* showed significantly improvement in plant growth parameters and reduction in disease incidence when compared with untreated control.

Conclusion

It has been concluded from present research that certain plant extracts are a source of cheap and effective

nematicides of root knot nematodes. The extracts of turmeric, mar watulsi, mentha, aonla and jatropha were found to have nematicidal properties. This finding is important from the point of view of controlling root-knot nematodes affecting tomato without the use of nematicides in view of the environmental pollution likely to cause. The future looks bright for identifying new classes of pesticides from natural plants to replace the synthetic dangerous and expensive chemicals used at present. The cooperation of nematologists, breeders, chemists, ecologists and others in the field of agriculture is necessary to achieve maximum progress in this important field of research.

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