

EFFICACY OF BOTANICALS ON HATCHING AND LARVAL MORTALITY OF *MELOIDOGYNE INCOGNITA*

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Abstract Botanical extracts of *Azadirachta indica*, *Ocimum canum*, *Mentha spicata*, *Aloe barbedenses*, *Vincia rosea*, *Tagetes erecta*, *Calotropis gigantean*, *Humulus lupulus*, *Datura innoxia*, *Rosa damascene* and *Ricinus comunis* were evaluated for their nematicidal effect against *Meloidogyne incognita* juveniles hatching from egg masses. Results were found that all botanical extracts significantly inhibit/ educe the emergence of juveniles (J₂) from egg masses as compared to control. Among the botanical treatments, extracts of *Azadirachta indica* showed maximum inhibition on the emergence of juveniles from egg masses, maximum effect on larval mortality and minimum gall formation as compared to other plant extracts used.

Keywords: Botanical extracts, *Meloidogyne incognita*, Juveniles

INTRODUCTION

Root knot nematode, *Meloidogyne incognita* is a major plant parasitic nematode species affecting the quality and quantity of the crop production in many annual and perennial crops. Several measures have been employed to manage nematode problems worldwide. Notable among these are chemical nematicides. They cause a lot of hazards to both man and livestock cause pollution to the environment. This has prompted research into alternatives that are effective, cheap and compatible with the environment. The use of alternatives to chemicals for the control of plant parasitic nematodes is a response to present and future environmental requirements. One possible alternative is the utilization of nematicides from origin, known as botanical nematicides. They are considered to be non-persistent under field conditions as they are readily transformed by light, oxygen and micro-organisms into less toxic products. Plant extracts containing volatile compounds, especially essential oils, have been found to possess nematicidal activity. Various medicinal and antagonistic plants have been found effective for the control of root knot nematodes (Ahmad *et al.*, 2004; Abraham *et al.*, 2006; Abo-Elyousr *et al.*, 2010; Hussain *et al.*, 2011b). The present investigation was conducted to evaluate the nematicidal properties of some botanicals viz *Azadirachta indica*, *Ocimum canum*, *Mentha spicata*, *Aloe barbedenses*, *Vincia rosea*, *Tagetes erecta*, *Calotropis gigantean*, *Humulus lupulus*, *Datura innoxia*, *Rosa damascene* and *Ricinus comunis* leave extracts for the management of root knot nematode.

MATERIAL AND METHOD

Multiplication of *M. incognita*

Culture of *Meloidogyne incognita* was maintained on tomato variety "Pusa Ruby" raised in pots with

sterilized mixture (2:1:1) sand, loamy soil and farmyard manure respectively.

Extraction of eggs and juveniles

Sixty days after inoculation, the pots were depotted and roots were washed properly under a slow stream of tap water until the roots were free of soil and debris and egg masses were collected from the roots by passing through 60 mesh sieve.

Collection of plant materials

Fresh healthy leaves of *Azadirachta indica*, *Ocimum canum*, *Mentha spicata*, *Aloe barbedenses*, *Vincia rosea*, *Tagetes erecta*, *Calotropis gigantean*, *Humulus lupulus*, *Datura innoxia*, *Rosa damascene* and *Ricinus comunis* were collected from the Horticulture research field of Allahabad Agriculture Institute, washed with tap water and surface sterilized with 2% sodium hypochlorite for 5 minutes and washed thoroughly 2-3 times with sterile distilled water and macerated separately in pestle and mortar. Extracts were squeezed through muslin cloth and thus collected extract were centrifuged at 2000 rpm for 15 min. A stock solution (100%) was maintained and further dilutions of 50% and 25% were prepared.

Assessment of effect of plant extracts on hatching and mortality of *M. incognita*

The dilutions were tested against egg masses of *Meloidogyne incognita* by exposing 10 egg masses of uniform sizes in cavity blocks containing dilutions with three replications and a control with sterile distilled water at 28±1°C. The observations on egg hatched and larval mortality were taken after every 12, 24, 48 and 72 hours.

The percentage (%) of larval mortality was calculated with the following formula:

$$\text{Mortality} = \frac{\text{No. of dead larvae in treatment} - \text{No. of dead larvae in control}}{\text{Total}} \times 100$$

Assessment of effects of plant extracts on *M. incognita* and plants in pot conditions

Effects of standard concentrations of plant extracts were evaluated in the pots by transplanting the 4weeks old tomato seedlings into the pots with sterile soil. One week after transplanting of seedlings, each pot was inoculated with approximately 3000 nematode larva and each pot were irrigated with 300

ml of plant extract after 5days of inoculation. Each treatment was replicated three times and a control was maintained with sterile distilled water. After 30 days the seedlings were carefully brought out of the pots and their roots were washed with tap water. Information on plant height, fresh and dry weight of foliage and roots, the nematode population in the soil were recorded.

Table 1: Efficacy of plant extracts on hatching of *M. incognita* from egg masses.

Treatments/Plant extracts	Exposure time in hours	Concentrations of plant extracts			
		25%	50%	100%	Control
<i>Azadirachta indica</i>	12 hours	03.00	03.00	01.00	13.00
	24 hours	07.00	07.00	03.00	27.00
	48 hours	10.00	07.00	07.00	50.00
	72 hours	10.00	10.00	10.00	71.00
<i>Ocimum canum</i>	12 hours	03.00	03.00	03.00	10.00
	24 hours	10.00	07.00	07.00	17.00
	48 hours	17.00	17.00	13.00	30.00
	72 hours	24.00	20.00	17.00	53.00
<i>Mentha spicata</i>	12 hours	10.00	07.00	07.00	13.00
	24 hours	13.00	13.00	13.00	20.00
	48 hours	17.00	20.00	17.00	50.00
	72 hours	30.00	27.00	23.00	66.00
<i>Aloe barbadenses</i>	12 hours	03.00	03.00	07.00	10.00
	24 hours	10.00	07.00	07.00	20.00
	48 hours	13.00	10.00	10.00	30.00
	72 hours	24.00	20.00	17.00	50.00
<i>Vincia rosea</i>	12 hours	10.00	07.00	07.00	24.00
	24 hours	13.00	13.00	07.00	33.00
	48 hours	20.00	20.00	13.00	53.00
	72 hours	27.00	27.00	17.00	71.00
<i>Tagetes erecta</i>	12 hours	07.00	03.00	00.00	13.00
	24 hours	10.00	07.00	03.00	17.00
	48 hours	13.00	13.00	10.00	37.00
	72 hours	20.00	17.00	17.00	57.00
<i>Calotropis gigantean</i>	12 hours	10.00	10.00	10.00	17.00
	24 hours	24.00	20.00	24.00	27.00
	48 hours	40.00	27.00	40.00	47.00
	72 hours	50.00	47.00	43.00	53.00
<i>Humulus lupulus</i>	12 hours	10.00	10.00	07.00	13.00
	24 hours	24.00	17.00	10.00	24.00
	48 hours	33.00	30.00	17.00	47.00
	72 hours	47.00	40.00	27.00	70.00
<i>Datura innoxia</i>	12 hours	10.00	10.00	13.00	13.00
	24 hours	17.00	13.00	13.00	23.00
	48 hours	24.00	20.00	17.00	40.00
	72 hours	37.00	33.00	27.00	70.00
<i>Rosa damascene</i>	12 hours	10.00	10.00	07.00	20.00
	24 hours	17.00	13.00	10.00	30.00
	48 hours	27.00	24.00	17.00	40.00
	72 hours	30.00	30.00	27.00	67.00
<i>Ricinus communis</i>	12 hours	07.00	03.00	10.00	17.00
	24 hours	20.00	24.00	13.00	30.00
	48 hours	30.00	30.00	30.00	40.00
	72 hours	47.00	40.00	40.00	67.00

Values are mean of three replications.

Table 2: Efficacy of plant extracts on mortality of *M. incognita* juveniles after 48 hours of exposure.

Treatments/Plant extracts	Concentrations of plant extracts			
	25%	50%	100%	Control
<i>Azadirachta indica</i>	42.0	43.7	47.0	11.6
<i>Ocimum canum</i>	21.6	27.7	33.3	14.7
<i>Mentha spicata</i>	34.3	37.7	45.0	23.7
<i>Aloe barbadenses</i>	30.0	39.0	46.7	13.3
<i>Vincia rosea</i>	32.7	36.7	46.0	20.7
<i>Tagetes erecta</i>	35.0	38.3	40.0	17.6
<i>Calotropis gigantean</i>	31.7	33.3	38.7	20.0
<i>Humulus lupulus</i>	26.7	28.3	33.3	15.0
<i>Datura innoxia</i>	23.3	30.0	36.0	10.0
<i>Rosa damascene</i>	23.3	26.7	34.0	26.7
<i>Ricinus communis</i>	30.0	33.3	38.3	19.0

Values are mean of three replications.

Table 3: Efficacy of 300ml/pot of plant extracts on plant height, dry seed weight and galling index of tomato plants inoculated with 3000 juveniles of *M. incognita* /pot.

Treatments/Plant extracts	Plant height (cm)	Dry seed weight (g)	Galling index
<i>Azadirachta indica</i>	28.1	11.8	01.7
<i>Ocimum canum</i>	15.5	07.9	09.0
<i>Mentha spicata</i>	24.5	11.0	02.6
<i>Aloe barbadenses</i>	22.8	10.3	04.0
<i>Vincia rosea</i>	23.6	10.6	03.8
<i>Tagetes erecta</i>	26.4	11.0	01.9
<i>Calotropis gigantean</i>	22.0	09.6	05.3
<i>Humulus lupulus</i>	19.4	08.7	06.4
<i>Datura innoxia</i>	18.0	08.0	07.7
<i>Rosa damascene</i>	17.2	08.0	08.6
<i>Ricinus communis</i>	20.9	09.2	06.5
Control	30.3	12.5	24.1

Values are mean of three replications.

RESULT AND DISCUSSION

The different plant extract treatments and their potentized dose had favourable effect on the hatching of *Meloidogyne incognita* (J₂) from egg masses. All the medicinal plants viz. *Azadirachta indica*, *Ocimum canum*, *Mentha spicata*, *Aloe barbadenses*, *Vincia rosea*, *Tagetes erecta*, *Calotropis gigantean*, *Humulus lupulus*, *Datura innoxia*, *Rosa damascene* and *Ricinus comunis* significantly inhibit the emergence of second stage juveniles (J₂) from egg masses as compared to control. Maximum inhibition of the hatching was observed in treatment with *Azadirachta indica* and *Tagetes erecta* as compared with other treatments including control. Gowda and Setty (1978) reported the hatching of larvae from fresh eggs of *M. incognita* were placed 24 hours into extract of *Azadirachta indica* cake was significantly reduced in all the dilution as compared with control. The efficacy of plant extracts on mortality of *M. incognita* juveniles after 48 hours of exposure to plants extract shows *Azadirachta indica* with 42 % @ 25 ppm, 43.7 % @ 50 ppm and 47% @ 100 ppm. Rajendran and Saritha (2005) used plant extracts of

Arnica montana, *Calendula officinalis*, *Carica papaya* and *Azadirachta indica* for evaluating the nematicidal effect against *M. incognita* infesting tomato, variety PKMI. They reported that all plant extracts tested were found to reduce the root galls and nematode population in soil, further they reported that maximum mortality was recorded in plants treated with *Azadirachta indica* at 30 % dilution.

The result of the study shows maximum effect on plant height, dry seed weight and galling index with leaves extract of *Azadirachta indica* @ 28.1, 11.8 and 1.7 % respectively. Saxena and Gangopadhyay (2005) reported fruits leaves extracts of *Citrus aurantifolia*, *Annona squamosa*, *Psidium guajava*, *Musa species* and *Aegle marmelos* had nematostatic properties and effective against *M. incognita* after exposed to various concentrations viz., 250, 500, 1000 and 2000 ppm for 3,6,24, 48 and 72 hours.

CONCLUSION

The results show that used of botanical plant extracts is successful in reducing the number of juveniles

hatching from egg masses of *Meloidogyne incognita*. The extent of number of hatching reduces depending on qualitative and quantitative application of specific plant extracts and time duration. Therefore use of leaves extract of botanical plants (as in experiment) is more beneficial than the use of chemical treatments. The natural materials are generally non-toxic to plants as well as animals (non-bio hazardous as well as eco- friendly) as compared to chemicals.

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