NEMATICIDAL PROPERTIES OF SOME LEAF EXTRACTS AGAINST MELOIDOGYNE INCOGNITA

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In Vitro studies were conducted for testing nematicidal properties of some angiosperms and gymnosperms against root-knot nematode, Meloidogyne incognita. It was observed that leaf extract of Malva sylvestris, Chrysanthemum indicum, Calandulla officinalis, Commiphora wightii, Cycas circinalis and Casuarina equisetifolia were nematicidal in nature. Juvenile hatching of M. incognita eggs was greatly inhibited by the extracts. Leaf extract of Eschscholtzia californica, Petunia violacea Phlox paniculata Mesembryanthemum crystallinum and Linum usitatissimum were found nematistatic in nature. Inhibition in the hatching increased with increase in the concentration of leaf extract.

Key words : Meloidogyne incognita; Nematicidal; Nematistatic; Leaf extract; Biological control; Hatching.

Introduction

Nematodes, destroying and causing disease of plants, are of great concern since they lead to the loss of several economically important crop plants, and thus, indirectly harm man by affecting his food supply. A strong movement to determine the potential of biological agents in nematode management has occurred over the past several years. Since many of the most commonly used nematicides are expensive and being taken out of the market because of their harmful effect on humans as well as their persistance in the soil or contamination of the water table, efforts are concentrating on integration of biological control agents into overall nematode management strategies.

Use of phytotherapeutic substances for controlling phytoparasitic nematode is well known. Extracts of large number of cultivated and weed plants have been found toxic to nematodes and the chopped parts of such plants when added to soil have resulted in reduced intensity of root knot. Parts of neem (Azadirachta indica), Melia azadirach, Zinnia, marigold and several other plants have been found effective (Nandal and Bhatti, 1983; Nath et al, 1982; Alam et al., 1976, 1977; Vijayalakshmi et al., 1985; Hammed, 1970; Kaliram and Gupta, 1982). The objective of present study was to assess the

Plant Duration in hours Number of juveniles hatched Name Concentration S/35 S/15 S/100 1 2 3 4 5 6 Malva sylvestris Linn. 24 20.0 21.6 23.3 23.3 As 20.6 21.6 20.6 23.3 35.3 Beckecholizia californica Cham. 24 20.6 23.3 21.3 23.3 72 72 31.1 32.45 31.75 35.3 Beckecholizia californica Cham. 24 20.6 9.3 11.6 12.3 8 7.0 8 20.6 9.3 11.3 12.3 35.3 9 10.45 13.3 32.45 31.75 35.3 35.3 9 10.45 13.3 17.45 18.3 12.0 12.3 4.3 9 7.0 8.3 3.6 6.6 5.3 5.3 5.6 9 10.45 5.3 6.6	ble 1. Effect of Leaf Extract (Observations	Egg Hatching of <i>M. inc.</i> mean of three replicate)	on Egg Hatching of <i>M. incognita</i> (Upto 72 hours) are mean of three replicate)	(Upto 72 hours)	icrs
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72 72 21.6 21.0 21.6 21.7 21.7 21.7 21.7 21.6 21.0 21.6 21.0 21.6 21.7 20.0 10.45 11.45 20.0 11.6 11.45 21.6 21.6 21.6 21.3 21.45 21.6 21.6 21.6 21.6 21.3 21.45 21.3 21.45 21.3 21.45 21.3 21.45 21.6 21.6 21.6 21.6 21.6 21.6 21.3 21.45 21.6 21.6 21.6 21.6 21.3 21.6 21.6 21.6 21.6 21.6	10. 10. 10. 10. 10. 10. 10. 10. 10. 10.	20.6	22.3	21.3	23.3
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48 7.0 8.3 11.6 72 7.3 9.0 12.0 72 7.3 9.0 12.0 Petunia violacea Lindl. 24 3.0 3.6 3.3 Phlox paniculata Linn. 24 3.0 5.0 6.3 8.3 Phlox paniculata Linn. 24 3.0 5.6 6.3 8.3 Phlox paniculata Linn. 24 3.6 5.8 7.25 8.3 Phlox paniculata Linn. 24 3.6 5.0 6.3 8.3 Phlox paniculata Linn. 24 3.6 4.6 5.3 8.0 Chrysanthemum indicum Linn. 24 6.0 6.3 6.6 5.3 5.6 Total % hatched 6.1 7.45 8.1 7.45 8.1 Chrysanthemum indicum Linn. 24 6.0 6.3 6.6 5.3 5.6 725 8.8 7.65 8.3 6.6 5.3 5.6 728 8.8 7.45 8.1 7.45 8.1 728 7.0 7.6 <t< td=""><th>ornica (</th><td>6.6</td><td>9.3</td><td>11.3</td><td>12.0</td></t<>	ornica (6.6	9.3	11.3	12.0
72 7.3 9.0 12.0 Petunia violacea Lindi. 24 3.0 3.5 9.0 17.45 Petunia violacea Lindi. 24 3.0 3.6 3.5 3.3 3.3 Petunia violacea Lindi. 24 3.0 3.6 3.6 5.3 3.3 Phlox paniculata Linn. Total % hatched 5.8 7.25 8.3 8.0 Phlox paniculata Linn. 24 3.6 4.6 5.3 6.6 4.5 5.3 6.6 Chrysanthemum indicum Linn. 24 6.0 6.3 5.3 6.6 5.3 5.6 5.6 Total % hatched 6.1 7.45 8.1 7.75 8.1 7.75 Chrysanthemum indicum Linn. 24 6.0 6.3 5.3 6.6		7.0	8.3	11.6	12.3
Total % hatched 10.45 13.3 17.45 Petunia violacea Lindl. 24 3.0 3.6 3.3 3.3 Petunia violacea Lindl. 24 3.0 3.6 3.6 5.3 3.3 Phlox paniculata Linn. Total % hatched 5.8 7.25 8.0 8.3 Phlox paniculata Linn. 24 3.6 4.6 5.3 6.3 8.3 Chrysanthemun indicum Linn. 24 3.6 6.0 6.3 5.3 6.6 Total % hatched 6.1 7.45 8.1 7.45 8.1 6.0 6.3 5.6 6.6	72	7.3	0.6	12.0	12.3
	Total	10.45	13.3	17.45	18.3
	Petunia violacea Lindl. 24	3.0	3.6	3.3	4.3
72 5.0 6.3 inn. Total % hatched 5.8 7.25 24 3.6 4.6 7.25 48 4.0 5.0 5.0 72 4.0 5.0 5.0 72 4.0 5.0 5.0 72 4.6 5.3 7.45 72 4.6 5.3 7.45 $1cum$ Linn. 24 6.0 6.3 48 2.3 4.0 7.45 72 7.0 7.3 4.0 72 7.0 7.3 8.8 Total % hatched 7.65 8.8		3.6	4.6	5.3	5.3
Iotal $\%$ hatched5.87.25inn.243.64.6243.64.650724.65.0724.65.3724.65.3ficum Linn.246.06.3482.34.0727.07.3727.07.3727.07.3737.68.8		5.0	6.3	8.0	8.6
Jinn. 24 3.6 4.6 48 4.0 5.0 4.6 72 4.6 5.3 5.3 Total % hatched 6.1 7.45 7.45 <i>licum</i> Linn. 24 6.0 6.3 72 7.0 7.3 4.0 72 7.0 7.3 4.0 72 7.0 7.3 4.0 72 7.0 7.3 8.8 Total % hatched 7.65 8.8 8.8	Total %	5.8	7.25	8.3	9.1
48 4.0 5.0 72 4.6 5.3 Total % hatched 6.1 7.45 <i>ticum</i> Linn. 24 6.0 6.3 48 2.3 4.0 7.45 7.45 7.0 7.45 72 7.0 7.45 72 7.0 7.3 72 7.0 7.3 7.0 7.3 8.8	Phlox paniculata Linn. 24	3.6	4.6	4.3	5.0
72 4.6 5.3 Total % hatched 6.1 7.45 <i>itcum</i> Linn. 24 6.0 6.3 48 2.3 4.0 72 7.0 7.3 70al % hatched 7.6 8.8		4.0	5.0	5.3	5.6
Total % hatched 6.1 7.45 <i>licum</i> Linn. 24 6.0 6.3 48 2.3 4.0 72 7.0 7.3 Total % hatched 7.65 8.8		4.6	5.3	6.6	8.0
<i>licum</i> Linn. 24 6.0 6.3 48 2.3 4.0 72 7.0 7.3 Total % hatched 7.65 8.8	Total %	6.1	7.45	8.1	9.3
48 2.3 4.0 72 7.0 7.3 Total % hatched 7.65 8.8	licum Linn.	6.0	6.3	5.6	5.5
72 7.0 7.3 Total % hatched 7.65 8.8		2.3	4.0	3.3	4.3
Total % hatched 7.65 8.8	rest of the local state of the l	7.0	7.3	9.9	8.6
	Total	7.65	8.8	7.75	9.25

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Mesembryanthemum crystallinum Linn. Total Dianthus alpinus Linn. Total Calandulla officinalis Linn.	Linn. 24 48 72 72 72 24 48 48 Total % hatched 24 48	3.6 4.3 5.0 6.45 6.45 7.8 7.8 3.0 3.0	6.0 5.6 8.45 5.6 5.6	4.0 6.0 8.8 7.3	4.3 6.6 8.3
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	 48 72 24 48 72 72 84 73 48 48 48 	4.3 5.0 6.45 5.3 7.8 3.0 3.0	5.6 6.0 5.6	6.0 7.6 8.8 7.3	6.6 8.3
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	% hatched 24 48 72 % hatched 24 88	6.45 5.3 5.3 6.0 7.8 3.0 3.6	8.45 6.0 5.6	8.8 7.3	
	24 48 72 % hatched 24	4.3 5.3 6.0 7.8 3.0 3.6	6.0 5.6 6.6	7.3	۷.0
	48 72 % hatched 48	5.3 6.0 7.8 3.0 3.6	5.6	And the state of t	8.3
	72 % hatched 24 48	6.0 7.8 3.0 3.6	66	7.6	7.3
	% hatched 24 48	7.8 3.0 3.6	0.0	8.0	9.0
	24 48	3.0 3.6	9.1	11.45	12.3
	48	3.6	3.3	4.0	5.3
			4.6	5.3	6.3
	72	4.3	6.0	7.0	7.6
Total	% hatched	5.45	6.95	8.15	9.6
mum Linn.	24	6.3	8.0	9.6	11.6
	48	6.0	8.3	10.3	13.3
	72	6.6	9.3	10.0	140
Total	I % hatched	9.45	12.8	14.95	19.45
	24	0.6	1.0	1.0	1.3
Bhandari	48	0.3	1.3	2.0	2.6
	72	1.0	1.6	2.3	3.0
Correspondence descentioned Frank Total	% hatched	0.95	1.95	2.65	3.45
Endl.	24	0.3	1.0	1.0	1.3
	48	0.6	0.3	1.3	2.0
	72	1.3	0.6	2.0	2.6
Total	Total % hatched	1.1	0.95	2.15	2.95
					Contd.

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1 North Contraction	2	3	4	5	9
Cycas circinalis Linn.	24	0.6	1.0	1.0	1.3
	48	1.6	1.0	1.0	1.6
	72	2.0	2.0	1.3	2.0
Prints insulation Equil.	Total % hatched	2.1	2.0	1.65	2.45
Casuarina equisetifolia Linn.	Jorg 24 patched	2.3	2.6	2.3	3.0
	48	1.3	3.3	1.6	2.6
	72	2.0	3.6	3.0	4.0
Country and might (Arn.)	Total % hatched	2.8	4.75	3.45	4.8
Araucaria cookii Juss.	Loter 24 parched	0.6	1.0	1.3	1.3
	48	1.0	1.3	1.6	2.6
	72	1.3	2.0	23	4.0
Anti- manualtantes man.	Total % hatched	1.45	2.15	2.6	3.95
Thuja orientalis Linn.	Total 24 percented	0.0	0.0	0.3	9.0
	48	0.6	0.3	2.0	3.0
	72	1.0	1.3	2.6	4.3
Calandella officinalia Lina.	Total % hatched	0.8	0.8	2.45	3.55
Control (D.W.)	Intel 24 parched	23.6	1.0	25.11	2 2 3
	48	40.0			
	72	41.1			
Dicathus alpinus Linn.	Total % hatched	52.3			
-		2 2 M . C. 13	21.9117	0.0	
					0.0
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efficacy of aqueous extracts from leaves of some angiospermic and gymnospermic plants on the hatching of *Meloidogyne incognita* eggs, thence controlling the nematode effect on growing plant.

Material and Methods

In the present study leaves of angiospermic plants like Mulva sylvestris Linn (Malvaceae), Eschscholzia californica Cham. (Paparveraceae), Petunia violacea Lindl. (Solanaceae), Phlox paniculata Linn. (Polemoniaceae), Chrysanthemum indicum Linn. (Compositae), Mesembryanthemum crystallinum Linn. (Aizoaceae), Dianthus alpinus Linn. (Caryophyllaceae), Calandulla officinalis Linn. (Compositae), Linum usitatissimum Linn. (Linaceae). Commiphora wightii (Arn.) Bhandari (Burseraceae), Casuarina equisetifolia Linn. (Casuarinaceae) and Gymnosperms like Pinus insularis Endl (Pinaceae) Cycas circinalis Linn. (Cycaceae), Araucaria cookii Juss. (Araucariaceae) and Thuja orientalis Linn. (Cupressaceae) were used. Aqueous leaf extract were prepared by grinding fresh roots (2 gm) with mortar and pestle in distilled water. This was filtered through 4-ply muslincloth and stored in refrigerator for 12 hours (stock solution 'S'). Various concentrations viz., S/25, S/50, S/75 and S/100 were prepared from the stock solution. For hatching experiments special polyvinyl chloride (P.V.C.) tubing (4 cm diam., 0.5 mm high) were cut and 26 µm stainless steel screen was sealed to each ring. Four P.V.C. legs were attached to elevate each ring which allowed the larvae to

pass through and made possible transfer of eggs to fresh test solution. Two hundred eggs of *M. incognita* were used per replicate sample and each treatment was replicated thrice. The experiment was conducted at temperature $30+2^{\circ}$ C. The method described by McClure *et al.* (1973) was followed for obtaining quantities of clean *M. incognita* eggs.

The number of hatched juveniles were counted after 24, 48 and 72 hours of treatment. After every 24 hour period the test solution was discarded after counting the number of hatched larvae and unhatched eggs in the sieve were placed in freshly made test solu-This was done to eliminate the tion effect of bacterial action on the unhatched eggs. After 72 hours, sieves containing the unhatched eggs were removed from the test solution, washed thoroughly with distilled water and left in distilled water for 24 hours to record further hatching.

Results and Discussion

Table 1 and Table 2 shows the effect of various leaf extract on the hatching of *Meloidogyne incognita* eggs. Leaf extract of *Thuja* was most effective followed by *Commiphora Pinus*, *Araucaria*, *Cycas* and *Casuarina*. There was gradual increase in hatching of eggs from higher concentration to lowest concentration. Complete inhibition of hatching was not recorded in any case.

In general, there was gradual decrease in the number of larvae hatched as

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treatment time increased i.e. from 24-72 hours. In Malva, Chrysanthemum, Dianthus, Linum, Commiphora, Pinus and Casuarina latval population was lower after 24 and 48 hours.

The data presented in Table 2 showed that leaf extracts of Malva, Chrysan themum, and Calandulla, Commiphora, Cycas Casuarina showed decreased larval hatching as compared to other. Less per cent of larval hatching in distilled water after resuspension of eggs for 24 hours proved their nematicidal nature. Therefore, it can be inferred that six out of fifteen leaf extracts used checked hatching to varying extent. Nematicidal properties of these six plants suggested that they could be used for the plant based natural nematicides.

Leaf extracts used in higher concentration was successful in inhibiting egg hatch *in vitro* because in all cases at lower concentrations the nematicidal activity started diminishing. These findings support the work of Nandal and Bhatti (1983) and Sayre *et al.* (1964). Prevention of hatching from eggs could be due to toxicity of the leaf extract which prevent egg from undergoing the first moult.

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