J. Phytol. Res. 4 (2), 1991

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

Table 1. Effect of Leaf Extract on Egg Hatching of *M. incognita* (Upto 72 hours)
(Observations are mean of three replicate)

Plant	Duration in hours	Number of juveniles hatched			
		Concentration			
		S/25	S/50	S/75	S/100
1	2	3	4	5	6
Malva sylvestris Linn.	24	20.0	21.6	20.6	22.3
	48	20.6	22.3	21.3	23.3
	72	21.6	21.0	21.6	25.0
	Total % hatched	31.1	32.45	31.75	35.3
Eschscholtzia californica Cham.	24	6.6	9.3	11.3	12.0
	48	7.0	8.3	11.6	12.3
	72	7.3	9.0	12.0	12.3
	Total % hatched	10.45	13.3	17.45	18.3
Petunia violacea Lindl.	24	3.0	3.6	3.3	4.3
	48	3.6	4.6	5.3	5.3
	72	5.0	6.3	8.0	8.6
	Total % hatched	5.8	7.25	8.3	9.1
Phlox paniculata Linn.	24	3.6	4.6	4.3	5.0
	48	4.0	5.0	5.3	5.6
	72	4.6	5.3	6.6	8.0
	Total % hatched	6.1	7.45	8.1	9.3
Chrysanthemum indicum Linn.	24	6.0	6.3	5.6	5.5
	48	2.3	4.0	3.3	4.3
	72	7.0	7.3	6.6	8.6
	Total % hatched	7.65	8.8	7.75	9.25

1	2	3	4	5	6
Mesembryanthemum crystallinum Linn.	24	3.6	4.0	4.0	4.3
	48	4.3	5.6	6.0	6.6
	72	5.0	7.3	7.6	8.3
	Total % hatched	6.45	8.45	8.8	9.6
Dianthus alpinus Linn.	24	4.3	6.0	7.3	8.3
	48	5.3	5.6	7.6	7.3
	72	6.0	6.6	8.0	9.0
	Total % hatched	7.8	9.1	11.45	12.3
Calandulla officinalis Linn.	24	3.0	3.3	4.0	5.3
	48	3.6	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
Linum usitatissimum 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	14 0
	Total % hatched	9.45	12.8	14.95	19.45
Commiphora wightit (Arn.) Bhandari	24	0.6	1.0	1.0	1.3
	48	0.3	1.3	2.0	2.6
	72	1.0	1.6	2.3	3.0
	Total % hatched	0.95	1.95	2.65	3.45
Pinus insularis 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 % hatched	1.1	0.95	2.15	2.95

Contd.

1	2	3	4	5	6
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
	Total % hatched	2.1	2.0	1.65	2.45
Casuarina equisetifolia Linn.	24	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
	Total % hatched	2.8	4.75	3.45	4 8
Araucaria cookii Juss.	24	0.6	1.0	1.3	1.3
	48	1.0	1.3	1.6	2.6
	72	1.3	2.0	2 3	4.0
	Total % hatched	1.45	2.15	2.6	3.95
Thuja orientalis Linn.	24	0.0	0.0	0.3	0.6
	48	0.6	0.3	2.0	3.0
	72	1.0	1.3	2.6	4.3
	Total % hatched	0.8	0.8	2.45	3.95
Control (D.W.)	24	23.6			
	48	40 0			
	72	41.1			
	Total % hatched	52.3			

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 muslin-cloth 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°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 solution. This was done to eliminate the 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

Table 2. Number of juveniles hatched (%) after resuspension in water for 24 hours.

Plant	Per cent hatched concentration			
	S/25	S/50	S/75	S/100
Malva sylvestris Linn.	3.5	5.5	9.5	10.5
Eschscholtzia californica Cham.	11.0	12.5	23.5	25.0
Petunia violacea Lindl.	7.0	8.5	11.5	13.0
Phlox paniculata Linn.	7.5	8.0	8.5	10.5
Chrysanthemum indicnm Linn.	2.5	3.5	6.0	6.5
Mesembryanthemum crystallinum Linn.	8.5	10.0	12.5	15.5
Dianthus alpinus Linn.	7.0	8.5	9.0	13.0
Calandulla officinalis Linn.	0.5	2.5	4.0	4.5
Linum usitatissimum Linn.	3.0	4.5	6.0	7.5
Commiphora wightii (Arn.) Bhandari	0.5	1.0	2.0	2.5
Pinus insularis Endl.	1.0	1.5	2.0	2.5
Cycas circinalis Linn.	2.5	2.5	3.0	3.5
Casuarina equisetifolia Linn.	2.0	1.5	2.0	2.5
Araucaria cookii Juss	1.0	2.0	2.5	3.5
Thuja orientalis Linn.	0.5	1.0	4.0	6.5
Control (D.W.)	28.5			

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

The data presented in Table 2 showed that leaf extracts of *Malva*, *Chrysanthemum*, 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.

Acknowledgements

Authors are thankful to U.G.C. New Delhi for financial assistance and Head Department of Botany, for providing facilities during the course of study.

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