EFFECT OF SOME PLANT EXTRACTS ON THE MORTALITY AND HATCHING OF *MELOIDOGYNE INCOGNITA* AND *HETERODERA CAJANI* INFESTING PIGEONPEA

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Summary. Water extracts of several plants killed juveniles of *Meloidogyne incognita* and *Heterodera cajani* and suppressed egg hatch of both species. The nematicidal effect of the extracts was concentration dependent and, in some cases, species specific. Furthermore, the adverse effect on juveniles was not always accompanied by a suppression of egg hatch in the same species.

Various plant extracts exhibit nematicidal activity against plant-parasitic nematodes (Hussain and Masood, 1975; Dutt and Bhatti, 1986 a,b; Bhatti *et al.,* 1997).

Because of the importance of pigeon pea as a key pulse crop and its vulnerability to severe damage by the root knot nematode (*Meloidogyne incognita*) and a cyst nematode (*Heterodera cajani*), a study was undertaken to evaluate the possibility of using plant extracts for their control.

MATERIALS AND METHODS

After a preliminary screening, selected plants were tested *in vitro* for their efficacy on mortality and hatching of *M. incognita* (Kofoid *et* White) Chitw. and *H. cajani* Koshy. Leaf extracts of the plants listed in table I-IV were prepared by grinding 5 g fresh leaves, fruits or seeds in 10 ml distilled water with a pestle and mortar. Extracts thus prepared were filtered through What-

Table I. Effect of various plant extracts on mortality of *Meloidogyne incognita.*

Plant Species (organ)	Per cent juvenile mortality after 48 hrs at various dilutions						
	0.0	1:5	1:10	1:20	1:40	1:80	C.D.5%
Achyranthus aspera L. (leaf)	1.6	86	76	68	60	38	3.4
Ageratum conyzoides L. (leaf)	1.0	40	29	21	18	6	3.9
Acasia arabica Willd. (leaf)	1.3	20	11	9	7	7	2.6
Allium cepa L. (leaf)	2.0	100	63	35	19	10	5.8
Allium sativum L. (leaf)	2.0	80	60	27	22	20	5.7
Amaranthus viridis L. (leaf)	0.0	32	17	15	10	7	3.6
Azadirachta indica A.Juss. (leaf)	0.0	89	70	40	30	28	4.1
Azadirachta indica A.Juss.(seed))	1.6	100	100	90	50	30	5.5
Bougainvillea glabra Choisy(leaf)	1.3	70	67	60	42	38	6.1
Calotropis gigantia(L) R.Br.(leaf)	0.0	16	13	11	8	6	3.1
Cassia tora L. (leaf)	1.6	72	62	52	40	24	5.2
Chenopodium album L. (leaf)	1.3	19	17	10	05	3	2.7
Camelia bengalensis L. (leaf)	0.0	17	13	9	05	3	3.2
Datura fastuosa L. (leaf)	1.6	14	11	9	06	4	2.9
Datura fastuosa (fruit)	0.0	100	96	90	90	70	5.8
Datura fastuosa (seed)	1.3	96	90	76	74	68	5.1
Digeri arvensis L. (leaf)	1.0	60	41	22	20	10	4.8
Eclipta alba (L.) Hass K. (leaf)	0.0	59	40	27	20	17	4.3
Euphorbia hirta L. (leaf)	2.0	81	43	40	32	30	4.2
Ipomoea reptance Lam. (leaf)	1.0	45	38	38	30	23	5.1
Launea asplentifolia Hook (leaf)	0.0	17	13	11	5	3	2.7
Laggera aurita L. (leaf)	1.6	75	70	68	60	32	4.6
Mentha arvensis L. (leaf)	0.0	80	74	20	7	7	4.5
Ocimum sanactum L. (leaf)	1.3	96	50	10	7	3	3.0
Ricinus communis L. (leaf)	1.0	70	68	23	20	14	3.6
Ricinus communis L. (seed)	0.0	94	76	70	56	36	3.6
Solanum nigrum L. (leaf)	0.0	100	100	43	29	17	3.5

Table II. Effect of various plant leaf extracts on mortality of *Heterodera cajani.*

Plant Species	Per cent juvenile mortality after 48 hrs at various dilutions						
	0:0	1:5	1:10	1:20	1:40	1:80	C.D. at 5%
Achyranthus aspera	1.6	88.0	81.6	75.0	63.6	50.0	1.7
Allium cepa	0.0	15.0	8.0	1.8	1.4	0.9	2.9
Amaranthus viridis	0.8	52.3	33.6	30.0	25.0	11.0	2.0
Azadirachta indica	1.5	97.6	91.6	82.3	21.6	7.6	5.5
Bougainvillea glabra	4.0	97.6	93.6	77.6	70.0	52.6	5.3
Chenopodium album	5.1	97.6	95.0	87.6	72.3	53.6	7.5
Camelia bengalensis	1.3	21.0	19.0	17.0	13.6	9.0	1.6
Datura fastuosa	4.5	96.6	77.6	73.6	69.0	55.0	3.1
Digeri arvensis	2.0	96.3	89.3	87.0	83.0	72.0	3.3
Eclipta alba	2.0	66.6	60.5	41.6	35.5	20.5	4.3
Euphorbia hirta	2.1	65.0	51.0	45.0	28.0	19.0	1.0
Mentha arvensis	0.7	0.9	0.8	0.7	0.7	0.6	0.6
Ocimum sanactum	0.6	98.0	94.8	23.3	19.0	9.0	2.1
Solanum nigrum	1.3	98.3	86.3	85.6	36.6	16.0	4.7

Table III. Effect of various plant leaf extracts on hatching of *M. incognita.*

Plant Species	Dilution	Average number of (3 replications) second stage juveniles hatched from 5 egg masses/after hrs				
		48	96	144	Total	% reduction compared to control
Azadirachta indica	1:5	3.3(0.5)	1.6(0.2)	1.6(0.2)	6.5(0.9)	99.7
	1:20	99.6(1.9)	87.0(1.9)	43.0(1.6)	299.6(5.5)	88.8
Allium cepa	1:5	11.6(1.0)	5.3(0.7)	2.6(0.4)	19.5 (2.2)	99.0
	1:20	20.0(1.3)	13.0(1.1)	9.0(0.9)	42.0(3..3)	98.0
Allium sativum	1:5	17.0(1.2)	10.0(0.9)	6.6(0.8)	33.3(3.0)	98.4
	1:20	45.0(1.6)	23.0(1.3)	10.0(0.9)	78.0(4.0)	96.2
Bougainvillea glabra	1:5	190.0(2.2)	130.0(2.1)	112.0(2.0)	432.0(6.4)	79.0
	1:20	650.3(2.8)	426.6(2.6)	117.6(2.0)	1192.6(7.5)	42.1
Datura fastuosa	1:5	6.0(0.7)	4.6(0.6)	1.0(0.0)	11.6(1.4)	99.5
	1:20	37.0(1.5)	14.3(1.1)	2.0(0.2)	53.3(2.98)	97.4
Euphorbia hirta	1:5	190.3(2.2)	21.0(1.3)	11.0(1.0)	222.3(4.6)	89.2
	1:20	299.3(2.4)	88.0(1.9)	80.0(1.9)	467.3(6.3)	77.3
Mentha arvensis	1:5	115.0(2.0)	97.0 (1.9)	70.0 (1.8)	288.0(5.8)	86.3
	1:20	790.3(2.9)	540.0(2.7)	140.0(2.1)	1473.3(7.7)	28.5
Ocimum sanactum	1:5	212.6(2.3)	32.0(1.5)	28.0(1.4)	272.6(5.2)	86.8
	1:20	290.3(2.9)	43.0(1.6)	79.0(1.9)	412.3(5.9)	80.0
Ricinus communis	1:5	4.3(0.6)	1.0(0.0)	1.0(0.0)	6.3(0.6)	99.7
	1:20	50.6(1.7)	34.6(1.5)	21.0(1.3)	106.3(4.5)	94.9
Solanum nigrum	1:5	23.0(1.3)	11.0(1.0)	6.3(0.7)	40.3(3.2)	98.0
	1:20	43.0(1.6)	23.0(1.3)	170(1.2)	85.0(4.2)	95.9
Control		920.3(2.9)	701.0(2.85)	439.0(2.6)	2060.3	
C.D. at 5%		0.29	0.12	0.17		

Data are $\log_{10}$ (x+1) transformed for analysis. Figures in parentheses are log value.

man's filter paper No. 1. The extracts obtained were used as stock solutions for the preparation of different concentrations 1:5, 1:10, 1:20, 1:40, and 1:80. Ten ml water suspensions of twenty juveniles of each nematode species were poured into 10 ml of each plant extract. Their mortality rate was ascertained after 48 hours by counting the dead juveniles using a microscope. For hatching studies, ten plant extracts found to be effective in the first experiment were tested *in vitro*, at two dilutions (1:5 and 1:20; Table III), against eggs of *M. incognita* (five egg masses/replicate).

Table IV. Effect of various plant leaf extracts on hatching of *H.cajani.*

Plant Species	Dilution	Average number of (3 replications) second stage juveniles hatched from 5 egg masses/after hrs				
		48	96	144	Total	% reduction compared to control
Camellia bengalensis	1:5	2.63	4.52	4.99	12.14	61.77
	1:20	4.70	5.78	7.22	17.70	44.27
Chenopodium album	1:5	1.00	1.00	1.99	3.99	87.43
	1:20	2.44	8.72	5.09	16.25	48.83
Bougainvillea glabra	1:5	1.00	1.00	1.64	3.64	88.53
	1:20	1.00	2.99	3.05	7.04	77.83
Datura fastuosa	1:5	1.00	1.14	1.53	3.67	88.44
	1:20	1.26	1.40	1.72	4.38	86.20
Digera arvensis	1:5	1.62	2.83	3.16	7.61	76.03
	1:20	3.42	3.75	4.01	11.18	64.79
Euphorbia hirta	1:5	1.00	1.00	1.48	1.48	89.04
	1:20	1.62	2.63	4.79	9.04	71.54
Eclipta alba	1:5	1.14	1.41	1.72	4.27	86.55
	1:2 0	6.03	6.82	6.41	19.26	39.36
Ocimum sanactum	1:5	1.00	4.57	8.42	13.99	55.95
	1:20	2.22	7.80	12.30	22.30	29.78
Ricinus communis	1:5	1.00	1.86	3.40	5.26	83.43
	1:20	1.00	3.48	5.11	9.59	69.80
Solanum nigrum	1:5	2.43	6.51	7.15	16.07	49.40
	1:20	3.45	6.55	7.31	17.11	45.50
Control		8.44	11.30	12.02		
C.D. at 5%		0.27	2.17	2.32		

Data are $\log_{10}$

RESULTS AND DISCUSSION

Data in Table I and II indicate that extracts of leaves of *Allium cepa* L. and *Solanum nigrum* L. and of seeds of *Azadirachta indica* A. Juss. caused 100% mortality of *M. incognita* at 1: 5 dilution while extracts of other plants such as *Euphorbia hirta* L., *Laggera aurita* L., *Mentha arvensis* L., *Ocimum sanactum* L., *Ricinus communis* L., *Cassia tora* L., *Achyranthus aspera* L., *Allium sativum* L., and *Bougainvillea glabra* Choisy caused 90% mortality at 1:10 and 1:20 dilution after 48 hrs. Fruit and seed extracts of *Datura fastuosa* L. caused 70% juvenile mortality even at 1:80 dilution without any significant difference amongst the two. With *H. cajani, Chenopodium album* L. *O. sanactum, D. fastuosa, Digera arvensis* L., *S. nigrum* and *A. indica* caused 90% mortality at 1:5 dilution which was slowly reduced with increase in dilution of plant extracts. All the plant extracts selected to evaluate their effect on hatching of *M. incognita* eggs suppressed hatching at 1:5 dilution in comparison to the control. *Ricinus communis, A. sativum, S. nigrum, A. indica,* and *A. cepa* caused up to 90% reduction in hatching compared to the control. Also with *H. cajani* all the tested plant extracts suppressed hatching at both concentrations but the effect was more pronounced at 1:5 dilution (Table IV). *E. hirta, C. album* and *Eclipta alba* L. caused more than 80% reduction in hatching at 1:5 dilution. Little reduction in hatching was recorded at 48, 96, and 144 hrs time intervals in *B.glabra, D fastuosa, A. cepa, E. alba, E.hirta* and *C. album.*

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