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SOME PLANT EXTRACTS FOR THE CONTROL OF THE ROOT-KNOT NEMATODE *MELOIDOGYNE JAVANICA*

by
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In many countries commercial nematicides are expensive and therefore plant species exhibiting nematicidal properties have been investigated for nematode control (Nelmes, 1970; Masood and Husain, 1976; Hean and David, 1979; Husain *et al.*, 1984). The use of plant extracts to control plant parasitic nematodes has not previously been investigated in Iraq. The study described here was undertaken with extracts of several locally occurring plant species tested against the root-knot nematode *Meloidogyne javanica* (Treub) Chitw. on tomato.

Second stage juveniles of *M. javanica* were obtained by placing egg masses on gauze supported on screens in a petri dish, with sufficient water just to wet the gauze. Large numbers of juveniles were collected in the water below the screen after 5-7 days at room temperature.

Eleven plant species (Table I) collected from the northern region of Iraq were dried at room temperature and then powdered in a mortar and pestle. A 400 g powdered sample of each species was suspended in 2 litres of 80% aqueous ethyl acetate for 24 hours. The suspensions were filtered with vacuum assistance through a Whatman No. 2 filter and the filtrates concentrated using a rotary vacuum evaporator (Harborne, 1973). Each plant-extract filtrate was diluted in water to give solutions of 100, 500 and 1000 mg/litre.

Three ml of each of the three concentrations of plant extracts were put in 6 mm petri dishes (3 replicates / concentration) and 20 freshly hatched *M. javanica* juveniles were added to each. The petri dishes were kept at 24°C and after 2, 4 and 7 days were examined for dead (immobile)

Table I - Per cent mortality of *Meloidogyne javanica* juveniles immersed in plant extracts of different plant species.

Plant species	Family	Average percentage mortality[1]		
		% concentration		
		1	5	10
Achillea santolinea L.	Compositae	15	57	95
Anthemis pseudoctula Boiss	Compositae	5	15	32
Callingonum comorum (L.) Her	Polygonaceae	0	10	30
C. tetrapterum Jaub	Polygonaceae	7	12	60
Cleome quinqueneriva L.	Cleomaceae	43	83	98
Eryngium thyrsoideum Boiss	Umbelliferae	0	5	38
Euphorbia tinctoria Boiss & Huet	Euphorbiaceae	22	58	97
Heliotropium europaeum L.	Baraginaceae	0	68	100
Lotus langinosus Vent.	Papilionaceae	0	0	0
Serratula cerinthefolia	Compositae	30	57	75
Verbascum sinuatum L.	Scrophuluariaceae	0	0	7
Control (Distilled water)		0	0	0

L.S.D. 5% = 5.98;
1) Each number represents average of 3 replicates.

nematodes. The per cent mortality was calculated according to Abbott's formula (Abbott, 1925).

Over the 7 day period each of the plant extracts at the highest concentration, except *Lotus languinosus* Vent., killed a significantly greater number of nematodes than the other concentrations and compared with the water control (Table I).

The four plant extracts that were found to be the most effective against *M. javanica* in the petri dish tests were further tested in a pot experiment, including oxamyl (Vydate G, Du Pont) as an additional treatment. Three week old tomato plants cv. Super Marimond growing in steam sterilized compost (2 parts soil/1 part peat) in 10 cm clay pots were each inoculated with 1000 freshly hatched *M. javanica* juveniles. Ten ml of each of the three concentrations of the four plant extracts were added to each pot 7 days before planting, at planting, or 7 days after planting. Oxamyl granules (10% a.i.) were dissolved in water and applied to each pot at the rate of 0.106 g/Kg soil at planting and 7 days before and after planting. Each treatment was replicated five times, including a control treatment of water only, and the experiment was randomized in a glasshouse maintained at 26 ± 2°C.

Table II - *Effect of four plant extracts and oxamyl on* M. javanica *root galls and eggs on tomato roots, and on plant height*

Treatment	Dose mg/kg soil	No. Root galls[1]			No. of eggs[1]			Plant height[1] (cm)		
		prep[2]	atp	postp	prep[2]	atp	postp	prep[2]	atp	postp
Control (water+nemas)	—	166	166	166	50938	50938	50938	54	54	54
Control (water only)	—	—	—	—	—	—	—	46	46	46
Oxamyl	0.106	0	7	64	0	931	9118	—	—	—
Achillea santolina	100	69	107	190	3546	31680	41675	57	48	50
	500	38	59	55	1324	8540	32425	48	48	50
	1000	10	44	—	996	2961	—	50	43	—
Euphorbia tinctoria	100	55	218	98	14545	38350	17114	47	44	41
	500	5	133	92	1235	18350	20300	43	48	36
	1000	3	128	29	700	18516	5766	37	58	41
Heliotropium europaeum	100	39	136	246	1334	32981	51674	41	47	35
	500	12	97	138	600	26081	57333	53	59	33
	1000	10	81	32	453	15302	5518	39	45	45
Serratula cerinthefolia	100	5	114	121	844	21121	21817	47	42	48
	500	3	110	101	124	8807	22592	59	59	41
	1000	3	130	62	670	11026	3785	53	50	39
L.S.D. 5%			72.7			5472.8			7.7	

[1] Mean of 5 replicates;
[2] prep=applied before planting; atp=applied at planting; postp=applied after planting

Sixty days after inoculating the pots with nematodes, the plants were removed and measurements made of stem height, numbers of root galls and total numbers of eggs in the mature females. Preplanting applications of the extracts and the oxamyl treatment resulted in fewer galls and eggs/plant root ($P=0.05$) compared with the control (water only) plants (Table II). Extracts of *A. sentolina* at the rate of 500 and 1000 mg/Kg soil at planting or post planting gave similar results.

Preplanting application at the rate of 100 and 500 mg/kg of the plant extracts of *A. santolina* and *S. cerinthefolia*, and of the extracts of *S. cerinthefolia*, *H. europaeum* and *E. tincetoria* at planting date at the rate of 500, 1000 mg/kg respectively, significantly increased plant height compared to other treated and untreated plants.

The four most effective plant extracts against *M. javanica* juveniles when applied as pre-planting applications reduced the penetration of juveniles into the tomato roots and this resulted in less root-galling and egg production by the females (Table II). Applications at planting or post planting were much less effective. In addition to their effects on the *M. javanica* juveniles the plant extracts had some direct effects on plant growth. Sukul *et al.* (1974) indicated that nematode feeding and the presence of toxic compounds in plant extracts caused plant growth retardation.

Chemical analysis of the plants used for the extracts showed that they contained phenols, alkaloids and terpenoids, all of which have been shown to be toxic to plant parasitic nematodes (Hasan and Saxena 1974; Khan 1973; Kaneko, 1971).

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