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Effect of plant products on egg hatch and larval mortality of *Meloidogyne incognita*

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Abstract. Thirteen leaves, 4 oilcake extracts and 4 root exudates were tested against root-knot nematode, *Meloidogyne incognita* to study their effect on egg hatch and larval mortality. Aqueous leaf extracts of *Datura stramonium*, *Parthenium hysterophorus* and *Tagetes erecta* and oilcake extracts of karanj and neem were the most potent treatments and they not only inhibited egg hatch but also killed the larvae significantly. The root exudates of *Brassica campestris* and *Tagetes erecta* also killed the second stage larvae of *Meloidogyne incognita*.

Keywords. Plant products; toxicity; *Meloidogyne incognita*.

1. Introduction

In vitro experiments carried out earlier revealed that certain aqueous extracts of dried leaves and oilcakes inhibited egg hatch and larval mobility of *Meloidogyne incognita* (Kofoid and White 1919), Chitwood 1949 (Gowda and Setty 1972; Khan *et al* 1975; Mishra and Prasad 1975; Nath *et al* 1982). The effect of root exudates of marigold, *Tagetes* spp., in reducing populations of *Pratylenchus penetrans* and *Tylenchorhynchus* spp. had been reported by Oostenbrink (1961). There is potential scope for the use of plant products in nematode control as they are cheap, easily available and non-toxic to mammals. An attempt was made to test the effect of aqueous extracts of a few dried plant leaves, oil cakes and root-exudates on egg hatch and larval mortality of *M. incognita*.

2. Materials and methods

Leaves of 13 plant species and 4 non-edible oil cakes were collected, dried under shade and powdered well. Standard extract was prepared by grinding 10 g of powdered leaf or oil cake with 50 ml of distilled water using pestle and mortar and passing through double layer of muslin cloth. The standard extract was diluted to 5% and it was transferred into 5 cm diameter petri dishes at 5 ml per dish. Five uniform size egg masses of *M. incognita*, handpicked from infected brinjal roots, were kept in each petri dish for hatching. Tap water served as check and each treatment was replicated 3 times. All the petri dishes were maintained at $26 \pm 2°C$ in BOD incubator. Observation on egg hatch was recorded at 3 days interval and egg masses from all the treatments were transferred to tap water after 15 days of exposure in extracts. Hatch in water was recorded upto 30 days.

The effect of leaf and oil cake extracts on larval mortality was tested at two concentrations viz 1 and 5% prepared from the standard extracts. Five ml of the

extract was pippetted out into 5 cm diameter petri dishes and 100 freshly hatched second stage larvae were suspended in each dish. Observation on larval mortality was recorded after 12, 24 and 48 hr of exposure. The mortality of larvae was confirmed by gently touching them with a fine needle.

Four test plants viz marigold (*Tagetes erecta*) periwinkle (*Vinca rosea*), gingelly (*Sesamum orientale*) and mustard (*Brassica campestris*) were grown separately in earthen pots at 5–7 plants per pot. Root exudates were collected from 60 days old test plants (Southey 1970), filtered using Whatman No. 42 filter paper and tested against second-stage larvae of *M. incognita* as mentioned earlier.

The per cent larval mortality recorded in treatment was calculated and corrected according to Abbott's (1925) formula to eliminate the mortality observed in check. Data were analysed following standard procedures for analysis of variance. Differences between means were evaluated for significance according to Duncan's multiple range test (Steel and Torrie 1960). All differences referred to in the text were significant at 5% level of probability.

3. Results and discussion

A marked reduction in hatching of *M. incognita* eggs was observed in all the leaf extracts tested (table 1). The inhibition of egg hatch in leaf extracts of *Parthenium hysterophorus*, *T. erecta* and *Datura stramonium* was higher than in other extracts

Table 1. Effect of leaf and oil cake extracts on hatching of *M. incognita* eggs*.

Treatments	Egg hatch in extract (15 days)	Total hatch (15 days in extract + 15 days in water)	Inhibition of hatch over check (%)
Leaf extracts			
Check (water)	1248 i	1538 e	—
A. indica	753 de	968 c	37·06
Calotropis gigantea	908 d	1461 e	5·00
D. stramonium	291 b	691 b	55·07
Eucalyptus globulus	1156 hi	1486 e	3·38
Glyricidia maculata	339 c	817 c	46·87
Ipomea cornea	962 fg	1524 e	0·91
Leucaemea leucophyla	645 cd	1394 de	9·36
Nerium indicum	509 c	959 c	37·64
Pongamia glabra	717 d	1509 e	1·88
Prosopis juliflora	961 fgh	1437 de	6·56
P. hysterophorus	110 a	457 a	70·28
Sapindus emerginatus	1154 ghi	1490 e	3·12
T. erecta	326 b	690 b	55·13
Oil cake extracts			
Castor cake	1104 ghi	1496 e	2·73
Gingelly cake	889 ef	1536 e	0·13
Karanj cake	510 c	1015 c	34·00
Neem cake	565 c	1176 cd	23·53

Mean of 3 replications

*Data in columns followed by a common letter were not statistically different ($P = 0·05$) according to Duncan's multiple range test.

and the inhibition was 70·28, 55·13 and 55·07%, respectively. However, the leaf extract of *P. hysterophorus* was the most effective treatment wherein the highest inhibition was recorded. Hussain and Masood (1976) reported complete inhibition of hatching of *M. incognita* eggs in certain leaf extracts like *Azadirachta indica* and *Chenopodium anthelminticum*. Among oil cake extracts, karanj and neem cake extracts inhibited egg hatch to the extent of 34·00 and 23·53%, respectively. Similarly Khan *et al* (1975) reported that egg hatch of *M. incognita* was suppressed by aqueous extracts of mahua and neem cakes. But in the present study it was observed that in extracts of castor and gingelly cakes, egg hatch was almost normal. This is in variance with the findings of Khan *et al* (1975) which could be due to the difference in the method of preparation of the extracts as well as the concentration used.

With regard to larval mortality, all the leaf and oil cake extracts were toxic to the second stage larvae (tables 2 and 3). An increase in the concentration of extracts as well as the exposure period resulted in a corresponding increase in larval mortality. However, a high rate of larval mortality was recorded at 5% concentration after 48 hr of exposure. The extract of *P. hysterophorus* was the most potent among leaf extracts and was on par with the extracts of *D. stramonium* and *T. erecta*. The larval mortality was maximum in neem cake extract followed by those of karanj, gingelly and castor cakes. Mishra and Prasad (1975) reported that 1% solution of neem cake extract was highly toxic to larvae of *M. incognita*. The adverse effect of plant products in suppressing nematode activities like egg hatch and larval mobility could be due to the presence of toxic principles like alkaloids, cyanogenic glycosides, glycosides, phenols, terpenoids etc.

Present investigations further revealed that all the 4 root exudates significantly increased the larval mortality with increase in observation period (table 4). The highest larval mortality of 59·32% was recorded after 48 hr of exposure in the root exudate of

Table 2. Effect of leaf extracts on larval mortality of *M. incognita*.*

	1% Extract			5% Extract		
	Mortality at different time intervals (hr) (%)			Mortality at different time intervals (hr) (%)		
Treatments	12	24	48	12	24	48
A. indica	8·63 b	11·54 cdef	15·48 cde	17·60 cdefg	23·02 de	32·31 cd
C. gigantea	15·99 a	24·16 ab	29·14 ab	25·16 abcd	33·17 bcd	46·45 b
D. stramonium	21·22 a	23·08 ab	33·49 a	25·37 abc	38·91 ab	59·60 a
E. globulus	3·62 cdef	1·19 g	10·57 e	6·05 hij	10·68 f	17·72 f
G. maculata	3·05 ef	9·07 cfg	12·79 cde	5·05 ij	19·34 ef	20·02 ef
I. cornea	15·38 a	15·97 bc	20·93 bcd	15·85 defgh	23·05 de	24·80 def
L. leucophyla	3·05 ef	3·81 fg	9·62 e	11·46 fghi	22·89 e	28·52 cdef
N. indicum	8·59 bc	12·95 cd	22·55 bc	20·65 bcde	24·24 cde	33·37 cd
P. glabra	3·95 bcdef	10·07 defg	14·82 cde	13·92 efghi	26·90 cd	36·05 c
P. juliflora	5·92 bcd	11·08 cdef	22·90 bc	9·47 ghij	18·79 ef	30·32 cde
P. hysterophorus	20·14 a	27·18 a	36·76 a	32·46 a	45·85 a	65·00 a
S. emerginatus	4·65 bcde	11·79 cde	18·56 cde	17·93 bcdef	23·38 de	34·18 cd
T. erecta	20·48 a	21·89 ab	28·97 ab	25·95 ab	34·78 bc	59·50 a

Mean of 3 replications

*Data in columns followed by a common letter were not statistically different ($P=0·05$) according to Duncan's multiple range test.

Table 3. Effect of oil cakes extracts on larval mortality of *M. incognita*.*

	1% Extract			5% Extract		
	Mortality at different time intervals (hr) (%)			Mortality at different time intervals (hr) (%)		
Treatments	12	24	48	12	24	48
Castor cake	12·11 a	13·95 ab	13·64 b	18·60 b	20·75 b	21·60 b
Gingelly cake	2·93 a	17·60 ab	19·14 ab	12·68 b	18·64 b	22·14 b
Karanj cake	3·57 a	7·27 b	13·74 ab	18·33 b	21·26 b	25·33 b
Neem cake	15·89 a	21·90 a	23·64 a	32·99 a	53·52 a	57·00 a

Mean of 3 replications

*Data in columns followed by a common letter were not statistically different ($P=0·05$) according to Duncan's multiple range test.

Table 4. Effect of root exudates on larval mortality of *M. incognita**.

	Mortality at different time intervals (hr) (%)		
Treatment	12	24	48
B. campestris	16·07 a	24·48 b	42·80 b
S. orientale	9·55 a	19·36 b	27·07 c
V. rosea	16·52 a	24·77 b	36·17 bc
T. erecta	18·88 a	53·56 a	59·32 a

Mean of 3 replications

*Data in columns followed by a common letter were not statistically different ($P=0·05$) according to Duncan's multiple range test.

T. erecta followed by 42·80, 36·17 and 27·07% in root exudates of *B. campestris*, *V. rosea* and *S. orientale*, respectively. Oostenbrink *et al* (1961) reported similar effect of root exudate of *Tagetes* spp. on *P. penetrans* and *Tylenchorhynchus* spp. The toxic effect could be due to the release of certain toxic metabolites from roots. Bakker and Gommers (1978) reported that the root exudate of *Tagetes* spp. contained compounds like α-terthienyl which could have affected nematode activities.

4. Conclusions

Application of organic amendments such as plant leaves and oil cakes is a common practice for nematode management (Singh and Sitaramaiah 1973; Khan *et al* 1974). The present investigations reveal that there is potential scope for utilizing several plant products in nematode control. However, further research should be carried out to determine the efficacy of such plant products in controlling various plant parasitic nematodes. Likewise, plants which release toxic root exudates may be grown as intercrops or mixed crops and they can also be included in crop rotation depending on the regional cropping pattern for nematode management.

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