Evaluation of Nematicidal properties of some plant materials against root-knot nematode, Meloidogyne incognita on Pueraria phaseoloides.

S. Thankamony, V.T. Jose and R. Kothandaraman

Rubber Reserch Institue of India

Abstract

Pot culture and laboratory studies were conducted to evaluate the nematicidal properties of *Pongamia glabra, Azadira-chta indica, Mucuna brac-teata* and mushroom compost against root-knot nematode *Meloidogyne incognita on Pueraria pha-seoloides.* Among the materials tested, the incorporation of the leaves of *P. glabra* was proved to be effective in reducing the nematode infestation in the host and final soil nematode population followed by that of *A. indica, M. brac-teata* and mushroom compost. In *in vitro* study also *P.glabra* was more effective in increasing the larval mortality followed by *A. indica* and *M.bracteata.* The percent mortality increased with concentration and period of exposure.

Introduction

Nematodes constitute one of the most important group of fauna in the soil around the roots of plants which play a vital role in plant growth. Cultivated soils normally contain a mixed population of parasitic and non-parasitic nematodes. All the plant parasitic nematodes have an oral piercing organ or stylet by which they penetrate the plant cells and suck out the contents. The importance of plant parasitic nematodes in phytopathology derives from the fact that they accelerate the penetration of causative agents of secondary diseases caused by bacteria and fungi.

Economicaly, the plant parasitic nematodes cause considerable losses owing to their damage to cultivated crops. The nematode infestation have been brought down by various control measures. The application of different saprophytic fungi (Chandal & Tabreiz, 1989), Vesicular Arbuscular Mycorrhizae (VAM)(Bhagyaraj *et al.* 1979 and Hussey and Roncadori, 1982) and *Rhizobium* (Sharma *et al.*, 1976) were reported to have some effect to reduce the detrimental effect of plant parasitic nematodes on host plant. However,a complete control can only be achieved by the application of nematicides. (Singh *et al.*, 1973, Amaranatha, *et al.*, 1992, and Poornima *et al.*, 1993). But the chemicals commonly used for controlling nematodes are mostly hazardous and sources of pollution. Organic ammendments, on the other hand, are apparently safe in this respect and more over they

have been found effective in managing plant parasitic nematodes, (Verma, 1996 and Rajeswari, *et al.*,1993). Subramanyan *et al.*, (1988) reported that the leaf extract of some indigenous plants are toxic to many plant parasitic nematodes. Mulching of the green leaves of *Pongamia pinnata* and *A. indica* are reported to have nematicidal properties and are very effective against root-knot nematode, *M. incognita* (Govindaiah *et al.*, 1989). The infestation of plant parasitic nematodes in rubber and associated cover crops was reported by Rajendran *et al.*,1977. The most popular cover crop in rubber plantation, *P. phaseoloides* is found highly susceptible to root-knot nematode, *M. incognita* (Thankamony et al., 1989). Later Nehru *et. al.*, (1991) recorded the incidence of root-knot nematode, *M. incognita* in rubber (*Hevea brasiliensis)* seedlings. In this context, an attempt has been made to evaluate the feasibility of the use of different eco-friendly botanicals for the control of root-knot nematodes in *P. phaseoloides* by conducting pot culture and laboratory studies.

Materials and methods

The experiment was conducted in mud pots (24 cm size) by amending naturally infested soil with the green leaves of test plants at the rate of 6g/kg of soil raised with nematode susceptible host plant *P. phaseoloides.* The pots were irrigated regularly to facilitate the proper decomposition of plant materials. The pretreatment population of nematodes was also recorded (2860 per 200g. soil). For each treatment five replications were maintained and observations such as root galls in the host plant and the final population of nematodes were recorded after 150 days of treatment.

In-vitro studies were conducted with the aqueous extracts of the leaves *P. glabra, A. indica and M. bracteata* at different concentration and exposure periods.

Aqueous extracts were prepared by homogenising 5 g of fresh leaves of each test plants with distilled water in a mortar and pestle. The slurries were strained and the filtrate was concentrated by centrifugation at 6000 rpm for 10 minutes. The supernatents was then diluted with distilled water to get 1:1, 1:5, 1:10, 1:25, 1:50 and 1:100 concentrations. Twenty five second stage juveniles of *M. incognita* were transferred to the cavity block (4x4cm) containing 1 ml of solution. Observations on the mortality of nematodes were recorded under stereoscopic micro-

Table 1. Effect of plant leaves on *M. incognita* on *P.phaseoloides* (Average of 5 replications)

Treatments	No.of galls per plant	Final nematode poulation/250g soil	Percent mortality of nematodes
P. glabra	14.2	730.6	75%
A. indica	21.4	1198.0	58%
M. bracteata	69.4	1398.0	51%
Mushroom compost	175.6	3332.0	—
Control	183.8	5012.0	—
CD.P=0.05	20.3	406	

Table 2. Effect of plant extracts on percent mortality of *M. incognita* larvae (Average of 3 replications)

Treatments (plant extracts)	Dilution	Percentage mortality of nematodes/ exposure period in hrs.				
		3	6	12	24	48
P.glabra	1:1	64	80	84	88	96
	1:5	52	68	76	84	87
	1:10	28	47	56	76	80
	1:25	0	20	44	64	76
	1:50	0	0	32	55	60
	1:100	0	0	0	20	28
A. indica	1:1	56	68	72	80	84
	1:5	40	48	60	72	82
	1:10	20	44	52	64	68
	1:25	0	16	36	48	56
	1:50	0	0	20	28	40
	1:100	0	0	0	12	20
M. bracteata	1:1	32	40	52	68	76
	1:5	20	32	48	56	68
	1:10	12	28	36	44	52
	1:25	0	0	12	20	36
	1:50	0	0	0	8	24
	1:100	0	0	0	0	12

scope at 3, 6, 12, 24 and 48 hrs of incubation. Each treatment was replicated thrice. The nematostatic and nematicidal effect was ascertained by transferring the inactive nematodes into distilled water.

Results and discussion

The results showed that the mulching of the green leaves of *P. glabra* was found to be more effective in reducing the root-knot infection and final nematode population followed by that of *A. indica* and *M. bracteata*. The maximum root-knots was observed in control (183.8/plant) whereas minimum root-knots of 14.2 and 21.4 per plant were recorded from *P. glabra* and *A. indica* mulched pots respectively. The percent mortality of nematodes was also found to be very high in *P. glabra* treated pots (75%) followed by *A. indica* (58%) and *M. bracteata* (51%).

In laboratory test also the toxic effect of *P. glabra* was more than that of *A. indica* and *M. bracteata*. The leaf extract at 1:1 and 1:5 concentrations proved highly toxic to *M. incognita*. Sluggish movement of nematodes was recorded within 3 hrs followed by total immobility with 6 hrs of exposure. Such nematodes failed to revive even after subsequent transfer to distilled water. A similar effect was observed also in 1:10 and 1:25 dilution but after 48 hours. The toxicity of plant extracts are found increased with increase in concentration and period of exposure.

The results clearly indicates the nematicidal properties of test plants and identified *P. glabra* as potentially effective against *M. incognita*.. This may be attributed to the more toxic alkaloids present in *P. glabra* leaves. These results are in confirmity with the findings of Govindaiah *et al.*, (1989). They had shown that amendments of

soil with green leaves increased the growth of plants and reduced the incidence of root-knots. Since the test plants proved very effective against root-knot infection, the decomposed products of these plants can be used in crop management practices. Moreover, the green chopped leaves of these plants can be used as a green manure in highly infested areas such as vegetable nurseries to minimise the nematode incidence.

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References

Amaranatha, B.S. & Krishnappa, K. (1992). Evaluation of certain pesticides to the management of *Meloidogyne incognita* infesting sunflower. *Indian. J. Nematol,* 22 (2): 125-133.

Bhagyaraj, D. J., Manjunath, A & Reddy, D.D.R. (1979) *Plant Soil*, 51:397.

Chandel, Y.S. & Sharma, N.K. (1989). interaction of *Tylenchulus semipenetrans* with *Fusarium solani* on citrus. *Indian J. Nematol,* 19(1):21-24.

Govindaiah, N, Suryanarayano, D. D. Sharma, D.D & Gargi, (1989). Effect of mulching of green leaves for the control of root-knot nematode in mulberry. *Indian J. Nematol* 19(1): 25-28.

Hussey, R.S. & Roncandori : R.W. (1982). *Plant Dis,* 66:9-14.

Kusum Dwidvedi & Upadhyay, K.D. (1992). Management of Root-knot nematode, (*M. javanica*) infesting groundnut with some proming nematicides. *Indian. J. Nematol* 22(1):9-10.

Mohanty, K.C. Mahapatra, S.N. & patnaik, P.R. (1992). Integrated management of root-knot nematode, (*Meloidogyne incognita*) infecting ginger, *Indian J. Nematol,* 22(1):70.

Nehru, C.R, Thankamoniy, S.,& Jayarathnam K. (1991). occurrence of root-knot nematode as a pest of rubber (*Hevea brasiliensis) seedlings. Indian J. Nat. Rubb. Res*, 4(1):77-78.

Patel. D.J., Patel, S.K. & Patel, H.V. (1992). Bioefficacy of six nematicides for the management of root-knot nematodes in tomato nursery. *Indian J. Nematol,* 22(1):1-3.

Poornima, K. & Sivagami Vadivelu. (1992). Comparative efficacy of nematicides, oilcakes and plant extracts in the management of *Meloidogyne incognita Pratylenchus delatteri* and *Rotylenchus reniformis* on bringal. *Indian J. nematol,* 23(2): 170 - 173.

Rajendran, T.P. & Jayarathnam, K. (1977). On the occurrence and effect of nematode infestation on rubber plantations in India. *India J. Nematol,* 7:82-83.

Rajeswari Sundarababu, C.,Sankaranarayana & Sivagami Vadivelu. (1993). Nematode management with plant products. *Indian J. Nematol* 23(2): 177.

Sharma. G.L., & Mathur. B.N. (1989). Control of root-knot nematodes on pea through seed and soil treatment with nematicides. *Indian. J. Nematol,* 2(1):62

Sharma. N.K. & seth, C.L. (1976). Inter-relationship between *Meloidogyne incognita, Heterodera cajani* and *Rhizobium* sp. on cow pea (*Vigna sinensis* (L) Savi). *Indian J. Nematol*, 6:117-123.

Singh, I&Prasad, S.K. (1973). Effect of nematicides on nematodes and soil microorganisms. *Indian. J. Nematol,* 3:109-133.

Subramanian, S.&Selvaraj, P. (1988). Effect of *Tagetes patula* L.Leaf extract on *Radopholus Similis* (Cobb, 1983). Thorne, 1949. *Indian. J. Nematol,* 18(2):337.

Tabreiz Ahmad Khan & Syed Israr Husain. (1989). Effect of culture filtrate of soil fungi on the mortality and hatching of reniform nematode. *Rotylenchulus reniformis Indian J. Nemato,* 19(1):35.

Thankamony, S. Nehru, C.R., and Jayarathnam, K. (1989). Preliminary observati9ns on reaction of leguminous cover crops to root-knot nematode. *Indian Journal of natural rubber research*, 2(1):68-69.

Verma, B.R. (1986). Efficacy of organic amendments against *Meloidogyne incognita* infesting tomato. *Indian J. Nematol,* 16(1):105.