http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 4(10): 1251-1252, 2001

Nematicidal Activity of Some Weed Extracts Against *Meloidogyne javanica* (Treub.) Chitwood

S. Shahid Shaukat and [1]Imran Ali Siddiqui
Department of Botany, University of Karachi, Karachi-75270, Pakistan
[1]P.A.F. Intermediate College Korangi Creek Karachi, Karachi-75190, Pakistan

Abstract: Aqueous extract of six weed species including *Argemone mexicana*, *Sonchus asper*, *Abutilon indicum*, *Xanthium strumarium*, *Solanum nigrum* and *Mavastrum coromandelianum* were tested for their activity towards egg hatching and juvenile mortality of *Meloidogyne javanica*, the root-knot nematode. Aqueous extract of *A. mexicana* was most lethal to *M. javanica* juveniles and caused significant inhibition in egg hatching. In general, with an increase in extract concentration and duration for which the juveniles were exposed, mortality increased markedly. Results demonstrated that *A. mexicana* could be exploited for the suppression of root-knot disease in crops.

Key words: Weeds, *Meloidogyne javanica*, juvenile mortality, egg hatching

Introduction

A serious hurdle in nematode control is the prohibitive cost of nematicidal chemicals as well as their residual toxicity in the soil. Use of antagonistic plants offer alternative means for the nematode population management and control because generally they do not leave toxic residues. Recently there has been a growing interest in the suppressive effect of some plant extracts on plant parasitic nematodes (Alam *et al*., 1988; Akhtar *et al*., 1990; Patel, 1991; Dhangar *et al*., 1996; Chandravadana *et al*., 1996; Husan-Bano *et al*., 1999; Ali *et al*., 2001). Plants antagonistic to parasitic nematodes have been recommended as organic amendment, intercropping, or for crop rotation for management of nematode populations (Alam *et al*., 1988; Patel *et al*., 1991). Though a number of weeds occur in cultivated fields often with high density, lesser attention has been paid to exploit the weeds for the control of nematodes.

The present study investigates the activity of six weed species on hatching, larval mortality and penetration of root-knot nematode *Meloidogyne javanica* (Treub.) Chitwood.

Materials and Methods

Six weed species were collected from Karachi and its neighbourhood including Karachi University Campus, Malir, Gadap, and Kathore. The weed species selected were *Argemone mexicana*, *Sonchus asper*, *Abutilon indicum*, *Xanthium strumarium*, *Solanum nigrum* and *Malvastrum coromandelianum*. Shoot material of each weed species was air dried and powdered in an electric grinder. The powdered shoot material (50 g) was soaked in 500 ml sterile distilled water and left for 72 h at room temperature. The extract was filtered through two layers of Whatman No.1 filter paper and kept at 6 °C prior to use. This was called stock solution and from it 50% stock solution was obtained using sterilized distilled water.

To study the effects of the weed extract on egg hatching of *M. javanica*, two medium sized egg masses with 2 ml of the aqueous extract of each weed species were transferred into a 1 cm diameter cavity glass slide. The egg masses placed in sterile distilled water served as controls. Each treatment was replicated three times and the cavity glass slides were arranged in a randomized complete block design. The number of hatched juveniles were counted after 48 h. The egg masses were then transferred into cavity glass slides containing 2 ml sterile distilled water to ascertain whether the egg masses kept in the culture filtrate had been temporarily or permanently inactivated. The juveniles were counted again after a further 48 h period.

To study the effects of aqueous extract of each weed species on mortality of *M. javanica*, two ml of each filtrate were poured in a glass cavity slide and about 30-40 second stage juveniles of *M. javanica* were placed in each glass slide. Juveniles kept in freshly prepared liquid medium served as controls. Treatments were replicated three times and dead nematodes in each cavity slide were counted after 24 and 48 h. The nematodes were considered to be dead when they did not move on probing with a fine needle (Cayrol *et el*., 1989). Data were subjected to factorial analysis of variance followed by least significant differences (LSD) in accordance with Sokal and Rohlf (1995). LSD for nematode mortality data was calculated for species, concentrations and time.

Results

Egg hatching: The results of the effect of weed extracts on egg hatching are presented in Table 1. Weed species had differential effect on egg hatching of *Meloidogyne javanica*

Table 1: Effects of six weed species on egg hatching of *Meloidogyne javanica*

Weed species	Number of eggs hatched		Total no. of eggs hatched	Inhibition % over control
	Extract	Distilled water[a]		
Control	91	108	199	-
Argemone mexicana 100%	57	71	128	35.67
Argemone mexicana 50%	72	96	168	15.57
Sonchus asper 100%	69	88	157	21.10
Sonchus asper 50%	79	99	178	10.55
Abutilon indicum 100%	62	91	153	23.11
Abutilon indicum 50%	78	110	188	5.52
Xanthium strumarium 100%	62	78	140	29.64
Xanthium strumarium 50%	75	103	178	10.55
Solanum nigrum 100%	72	98	170	14.57
Solanum nigrum 50%	81	84	165	17.08
Mavastrum corromendelianum 100%	73	90	163	13.06
Mavastrum corromendelianum 50%	86	114	200	+0.50
$LSD_{0.05}$	13.6	11.8		

[a]After a 48-h hatching period in culture filtrate, the egg masses were transferred to sterile distilled water. + = increase over the control.

Table 2: Effects of aqueous extract of six weed species on mortality of *Meloidogyne javanica*

Weed species	Mortality % Exposure time (hours)	
	24	48
Control	0	2
Argemone mexicana 100%	61	89
Argemone mexicana 50%	42	55
Sonchus asper 100%	28	39
Sonchus asper 50%	18	42
Abutilon indicum 100%	30	51
Abutilon indicum 50%	22	37
Xanthium strumarium 100%	49	75
Xanthium strumarium 50%	32	51
Solanum nigrum 100%	24	34
Solanum nigrum 50%	15	19
Malvastrum corromendelianum 100%	17	31
Malvastrum corromendelianum 50%	11	19
$LSD_{0.05}$		
Species	14.6	
Concentration	11.3	
Time	10.2	

($p < 0.05$). At full strength (stock solution) all species except *S. nigrum* and *M. coromandelianum* significantly inhibited the nematode egg hatching as compared to the controls (p at the most 0.05). At 50% extract substantially lesser hatching was recorded than corresponding full strength extract of a weed species. Highest inhibition of hatching over the controls was recorded for *A. mexicana*, followed by *X. strumarium*. Least inhibition of hatching was caused by *M. coromandelianum* which at 50% extract caused slight increase in egg hatching. Even after transfer to distilled water, the egg hatching was minimal for *A. mexicana* compared to other weed species and the controls. The permanent inactivation of egg hatching ranged between 5.52% (*A. indicum* at 50% concentration) to 35.67% (*A. mexicana* at 100% concentration).

Juvenile mortality: Aqueous weed extracts caused significant ($p<0.05$) mortality of *M. javanica* juveniles (Table 2). Weed species differed significantly in producing juvenile mortality. ($p<0.05$). Significantly greater mortality occurred at full strength extract compared to 50% extract. Also exposure time had a significant influence on juvenile mortality ($p<0.05$). Except for *M. corromendelianum* at 50% concentration, all the plant species at both the concentrations resulted in significantly ($p<0.05$) increased mortality at 48 h compared to 24 h. Again *A. mexicana* caused the highest juvenile mortality. Most (89%) juveniles were killed in aqueous extract of *A. mexicana* at 100% concentration after 48 hours while only a few died in extracts of *S. nigrum* and *M. coromandelianum* (both at 50% concentrations).

Discussion

Results obtained from present study clearly suggest that some weeds specially *Argemone mexicana* and *Xanthium strumarium* have great potential in the inhibition of egg hatching and juvenile viability of *Meloidogyne javanica*. Other weed species used in this study showed low degree of inhibition. Burhan and Shaukat (1999) demonstrated the phytotoxic symptoms by the addition of *A. mexicana* in the soil. These authors suggested that the observed phytotoxicity to be attributed to the presence of allelochemicals especially, the phenolic compounds. We have demonstrated the nematicidal activity following application with phenolics in the soil (Shaukat and Siddiqui, in press). Apart from phenolics, the observed activity of these weeds (*A. mexicana* and *X. strumarium*) could also be ascribed to the presence of compounds other than phenolics, which are yet to be investigated. Observations on the egg hatching activity by *Tagetes patula* and *Commicarpus boissieri*, the cosmopolitan weeds have been reported by Husan-Bano *et al.* (1999). Reduction in egg hatching and nematicidal activity from *Avicennia marina* (mangrove) was also reported by Mehdi *et al.* (1999). Similar to our results, Hussaini *et al.* (1996) showed marked suppression on egg hatching and nematode mortality by the water extract of some plant species including *Argemone mexicana*. Variable effects of the weed extracts on egg hatching and mortality of *M. javanica* observed in present study are possibly due to the varied nature of toxic metabolites produced by different weed species. It is interesting to note that high concentrations of the weed species showed greater effect on egg hatching and produced greater juvenile mortality. This suggests that high concentrations of the weeds are required for the adequate nematode control. Furthermore, the exposure time to the weed extract had a significant effect on juvenile mortality. Though the results of the present study clearly suggest that *A. mexicana* and *X. strumarium* may cause inhibitory effect on root-knot nematode, their application in soil could modify the soil environment resulting in a shift in the microbial community structure. In particular the organisms possessing chitinolytic activity should be monitored as they have the ability of suppress the nematode populations.

Acknowledgment

This investigation was supported by a grant from the office of the Dean Faculty of Science, University of Karachi, which is gratefully acknowledged.

References

Akhtar, M.S., S. Anwar and A. Yadav, 1990. Effect of organic amendments to soil as nematode suppressants. Int. Nematol. Network Newsletter, 7: 21-22.

Alam, M.M., A.M. Khan and S.K. Saxena, 1988. Management of plant parasitic nematodes by different cropping sequences. Ind. J. Pl. Pathol., 6 102-109.

Ali, N.I., I.A. Siddiqui, M. J. Zaki and S.S. Shaukat, 2001. Nematicidal potential of *Lantana camara* against *Meloidogyne javanica* in mungbean. Nematologia Mediterranea, 29: 99-102.

Burhan, N. and S.S. Shaukat, 2000. Effects of atrazine and phenolic compounds on germination and seedling growth of some crop plants. Pak. J. Biol. Sci., 3: 269-274.

Cayrol, J.C., C. Djian and L. Pijarowski, 1989. Study on the nematicidal properties of the culture filtrate of the nematophagous fungus *Paecilomyces lilacinus*. Revue de Nematologie, 12: 331-336.

Chandravadana, M.V., E. Sebastian, J. Nidiary, N.K. Lella, P.P. Reddy, R.M. Khan and M.S. Rao, 1996. Nematicidal activity of some plant extracts. Ind. J. Nematol., 26: 148-151.

Dhangar, D.S., D.C. Gupta and R.K. Jain, 1996. Studies on aqueous extract of different parts of *Tagetes erecta* on hatching, larval mortality and larval penetration of *Meloidogyne javanica*. Ind. J. Nematol., 26: 46-51.

Husan-Bano, I.A. Siddiqui, W. Ahmed and S. Ehteshamul-Haque, 1999. Effect of some medicinal plants on egg hatching of *Meloidogyne javanica*, root-knot nematode. Pak. J. Biol. Sci., 2: 1364-1365.

Hussaini, S.S., R.V.V. Rao and H.K. Pandu, 1996. Toxicity of water soluble leaf extracts against larvae and egg masses of three *Meloidogyne* species. Ind. J. Nematol., 26: 23-31.

Mehdi, F.S., I.A. Siddiqui, S. Erum and R. Ali, 1999. Effect of *Avicennia marina* and *Paecilomyces lilacinus* on root rot-root knot diseases of tomato. Pak. J. Biol. Sci., 2: 1462-1466.

Patel, H.R., D.J. Patel, C.C. Patel and N.A. Thakar, 1991. Management of root-knot nematode by periwinkle. Nematol. Medit., 19: 65-66.

Shaukat, S.S. and I.A. Siddiqui, 2001. Effect of some phenolic compounds on survival, infectivity and population density of *Meloidogyne javanica* in mungbean. Nematol. Medit., 29: (In Press).

Sokal, R.R. and E.J. Rohlf, 1995. Biometry 3rd ed. Freeman, San Francisco.