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Effect of Leaf Extract on Stylet Bearing Nematodes and on Growth Parameters of Two Wheat Varieties

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Leaf extracts from *Azadirachta indica, Nicotiana tabacum* and *Eucalyptus citriodora* were tested for their nematicidal effect on *Helicotylenchus indicus, Bitylenchus goffarti* and *Pratylenchus thornei* and on growth and yield of Pavon-76 and Mehran wheat varieties in microplots. All the amendments significantly reduced the population of the nematodes. Average weight of shoot, root and yield were increased by *A. indica* treatment. *Nicotiana tabacum* increased the yield in variety Pavon-76.

Key words: Leaf extracts, Nematode, Wheat.

Introduction

Control of plant parasitic nematodes using antagonistic plant extracts offers an alternate strategy to prevent use of synthetic nematicides (Devakumar 1993). Due to health hazards and environmental pollution potential of synthetics, more and more farmers are attracted towards the concept of using plant extracts with no or minimum application of synthetic chemicals. Jeyarajan *et al* (1987) observed, reduction in nematode population associated with *Piper betle* by the use of neem cake. Siddiqui and Alam (1989) observed in a laboratory experiment that root exudate of *Azadirachta indica* (L.) A. Juss, caused considerable mortality of *Hoplolaimus indicus, Helicotylenchus indicus, Tylenchus filiformis, Tylenchorhynchus brassicae, Rotylenchulus reniformis* and *Meloidogyne incognita* of some fresh plants as well as oilseed cakes and found it toxic to juveniles of *Meloidogyne incognita* in laboratory experiment. Qamar *et al* (1989) observed that dry weight of roots, fresh and dry weight of shoots were greater and average yield was also higher in wheat plants treated with *Azadirachta indica.* Mishra *et al* (1989) used aqueous extract of some toxic fresh plants as well as oilseeds cakes and found toxic to juveniles of *Meloidogyne incognita.*

Mohammad *et al* (1981) reported that extracts of leaves of *Delphinum ajacis, Urtica urens* and *Eminium intortum* showed nematicidal properties against *Tylenchulus semipenetrans* when treated in vitro. Khan and Shaukat (1991); Khan *et al* (1991); Khan and Shaukat (1993) performed a series of experiments on control of nematodes associated with wheat varieites. They used conventional nematicides in comparison with neem. Khan (1992) studied the effect of coarsely crushed neem leaves on *Pratylenchus thornei,* an endoparasitic nematode that penetrates the parenchyma and forms cavities in the cortex causing extensive damage to root system, associated with Sarhad-82, Faisalabad-85 and Khyber-87 wheat varieties. Gnanapragasam (1991) controlled Tea nematode using extract of *A. indica.* Gul *et al* (1991) reported that *Nicotiana tabacum* dust significantly reduced root galling in Okra and Tobacco.

Mojunder *et al* (1989) used the plant extract of wild plants against *Heterodera cajani* and found them to be highly toxic. Mojunder and Mishra (1991) tested the nematicidal efficacy of plant extracts against *M. incognita* in pulses.

According to Sasanella and Addabbo (1992) aqueous extracts from leaves of *Ruta graveolens* had a high nematicidal effect against *Xiphinema indica* in vitro, nematode mortality increased with the increase in concentration and exposure time. Sasanella and Addabbo (1993) observed the effect of *Cineraria manitemia, Ruta graveolens* and *Tagetes erecta* on the hatching of *Heterodera schachtii* and the populations of *Meloidogyne* species. They noted that emergence of juveniles from egg masses was suppressed in all the aqueous extracts during the first four weeks. Khan *et al* (1994) observed the effect of three plant extracts on nematode population and on growth parameter of wheat variety (Pirsabak-85). In the present experiment the authors have used leaf extracts of *A. indica, N. tabacum* and *E. citriodora* for control of nematodes associated with two wheat varieties, namely Pavon-76 and Mehran.

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Materials and Methods

Leaves of the test plant species viz., *Azadirachta indica, Nicotiana tabacum* and *Eucalyptus citriodora* were air dried, ground to a course powder and 300 g/litre of this powder was extracted three times with ethanol at room temperature. The filtrate, after removal of ethanol under vacuum, was concentrated to dryness and then 2% solution in water was prepared for field application. The nematicidal efficacy of extracts was evaluated against *Helicotylenchus indicus, Bitylenchus goffarti* and *Pratylenchus thornei* associated with wheat varieties, Pavon-76 and Mehran in microplots located at Crop Diseases Research Institute (CDRI), Pakistan Agricultural Research Council (PARC), Karachi and each microplot measured 1 m^2. The experiment was done in a randomized complete block design (RCBD). Four replicates were taken for each treatment. Preplantation soil samples were taken from each microplot. Nematodes were isolated from 100 cc soil sample using improved Baerman's funnel technique. Nematodes were counted using binocular microscope. Permanent slides were prepared for nematodes identification. Sowing in microplots was done in rows each row had 50 healthy seeds. Extracts were applied at a rate of 100 ml/row. Irrigation was done once a week and fertilizer (40 kg/acre) was applied as needed. Experiment was terminated after 4 months. Plant growth parameter including fresh shoot weight, root weight and yield (grain weight) were determined at the time of harvest and final nematode population noted. Two-way analysis of variance (ANOVA) was conducted in order to observe the effect of amendments on population, plant gowoth and yield.

$$Y_{ijr} = \mu + T_i + B_j + (T\beta)_{ij} + e_{ijr}$$

Where,

Y_{ijr} is the response.
μ is the overall mean effect.
T_i is the effect of treatment.
β_j is the effect of nematode.
$(T\beta)_{ij}$ is the effect of interaction between treatment and nematode.

Results and Discussion

Effect on nematode population. All the amendments significantly reduced the population density of the nematodes ($F=3.65$, $p<0.05$). The interaction of nematode species and amendments (treatments) was also found significant ($F=3.49$, $p<0.05$). The population of *H. indicus* was reduced in the order *A. indica* > *N. tabacum* > *E. citriodora* in variety Mehran (Fig. 1a) while in variety Pavon-76 population was reduced in the order *A. indica* > *N. tabacum* > *E. citriodora* (Fig. 2a).

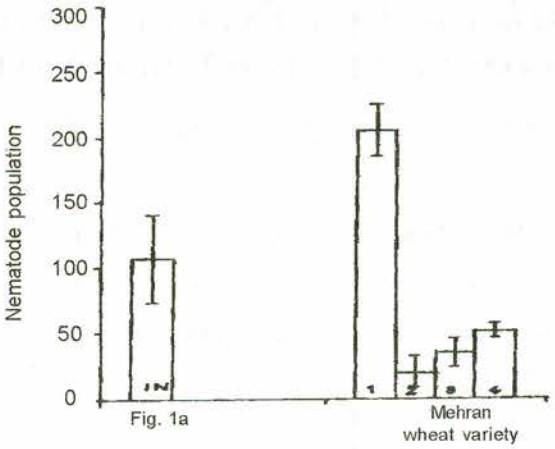

Fig 1a. Initial and final population of *Helicotylenchus indicus* associated with wheat variety Mehran (1N = initial; 1 = control; 2 = *A. indica*; 3 = *N. tabacum*; 4 = *E. citriodora*).

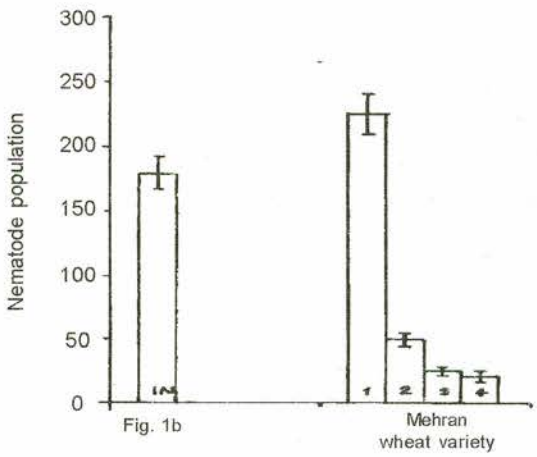

Fig 1b. Initial and final population of *Bitylenchus goffarti* associated with wheat variety Mehran (symbols as in Fig. 1a).

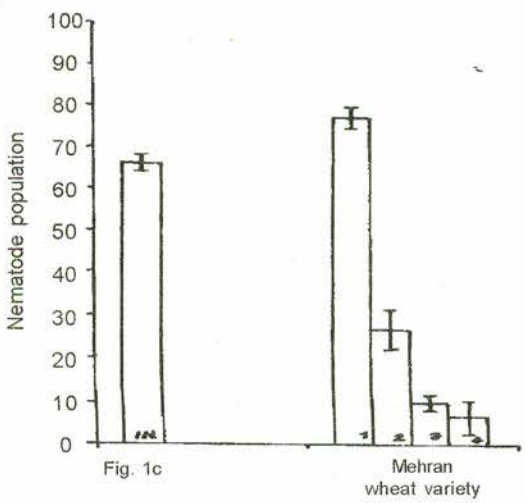

Fig 1c. Initial and final population of *Pratylenchus thornei* associated with wheat variety Mehran (symbols as in Fig. 1a).

The population of *B. goffarti* was abated in the order *E. citriodora* > *N. tabacum* > *A. indica* in variety Mehran (Fig. Ib) while in Pavon-76 population was abated in the order *N. tabacum* > *A. indica* > *E. citriodora* (Fig. 2b). The population of *P. thornei* was reduced in the order *E. citriodora* > *N. tabacum* > *A. indica* in variety Mehran (Fig. 1c), while in Pavon-76 population was reduced in the order *E. citriodora* > *N. tabacum* > *A. indica* (Fig. 2c).

Effect on growth parameters of wheat. Average weights of shoot and root as well as the yield of both varieties (Mehran and Pavon-76) were significantly ($p<0.05$) increased in *A. indica* (neem) extract treatment (Table 1). In *N. tabacum* treatment yield was significantly elevated over the controls in variety Pavon-76 ($p<0.05$). *E. citriodora* had no significant effect.

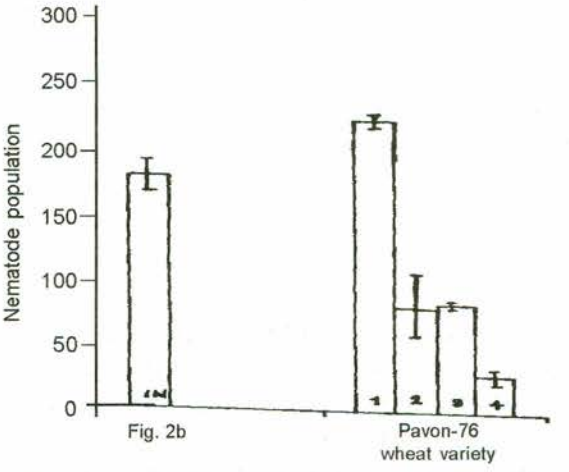

Fig 2b. Initial and final population of *B. goffarti* associated with wheat variety Pavon-76 (symbols as in Fig. 1a).

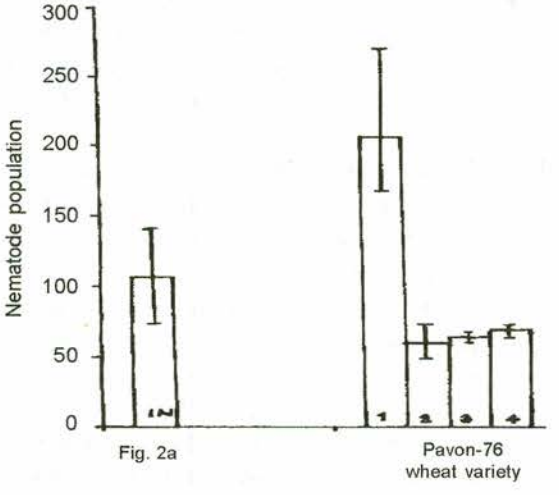

Fig 2a. Initial and final population of *H. indicus* associated with wheat variety Pavon-76 (symbols as in Fig. 1a).

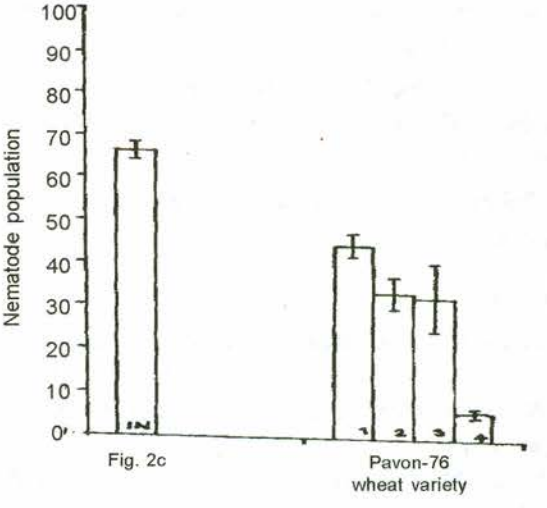

Fig 2c. Initial and final population of *P. thornei* associated with wheat variety Pavon-76 (symbols as in Fig. 1a).

Table 1
Effect of leaf extracts on mean growth and yield of two wheat varieties

	Control		*A. indica*		*N. tabacum*		*E. citriodora*	
	Mehran	Pavon-76	Mehran	Pavon-76	Mehran	Pavon-76	Mehran	Pavon-76
Average weight shoot/plant	25±2.67	20±1.6	55.6±2	35±0.40	27±0.70	21±0.70	25±2.67	20±1.60
Mehran $LSD_{0.05}=7.65$								
Pavon-76 $LSD_{0.05}=3.24$								
Average weight root/plant	8±0.40	4±0.8	22±0.91	6±0.40	9.5±3.30	5.25±0.25	8±0.40	4±0.8
Mehran $LSD_{0.05}=3.17$								
Pavon-76 $LSD_{0.05}=1.77$								
Average yield/plant	74±2.04	20±1.58	100±2.48	75±1.77	80±4.63	40±2.12	74±2.04	20±1.58
Mehran $LSD_{0.05}=11.71$								
Pavon-76 $LSD_{0.05}=6.06$								

Mean followed by ± standard error

The three leaf extracts tested viz, *A. indica and N. tabacum* may be categorised as having nematicidal and soil conditioning properties while *E. citriodora* appeared to be only nematicidal. Addition of these extracts into soil results in improvement of soil texture and increase in water holding capacity of the soil which may result in the plant root development and absorption of minerals in the soil at the same time toxic effect of these extracts results in the mortality of the nematodes.

In previous studies Khan (1992) suggested that *A. indica* leaves were even more effective than a chemical nematicide carbofuran in reducing population of *Pratylenchus thornei*. In wheat trials conducted by Qamar *et al* (1989) successful control of Anguinosis was obtained by using extracts of *Azadirachta indica* and *Vinca rosea*, the number of cockles was zero in these two treatments whereas in the plants treated with *Jatropha curcas* the number of cockles were 10/plant.

Improvement in the plant growth parameters was also seen by the addition of the leaf extracts similar to the results recorded by Jasy and Koshy (1992).

This experiment further substantiates toxic effect of the leaves against nematodes.

References

Devakumar C 1993 Nematicidal principles of plant origin. In: *Nematode Pest Management in Crop.* eds Bhatti D S & Walia R K. CBS Publishers & Distributors, Delhi India pp 165-189.

Gul A, Saeed M, Saifullah 1991 A mode of action of different substances used for control of *Meloidogyne javanica* on Tobacco and Okra in NWFP. *Afro Asian J Nematol* **1**(1) 23-29.

Gnanapragasam N C 1991 Influence of soil amendments in reducing pathogenicity to tea by the root lesion nematode, *Pratylenchus lossi* In: *Proceedings of International Symposium on Tea Science.* August 26-29 Shizuoka Japan, pp 684-688.

Jasy T, Koshy P K 1992 Effect of carbofuran leaf extracts and leaves of *Glyricidia maculata* (HB & K) Steud. as green manure on *Radopholus similis. Indian J Nematol* **22** (2) 117-121.

Jeyarajan J. Sabitha D, Bhaskaran R, Jeyaraj S 1987 Effect of neem (*Azadirachta indica)* and other plant products in the management to plant diseases in India. In: *Natural Pesticides from the Neem* (*Azadirachta indica* A. Juss) and other tropical plants, ed. Eschborn S. German Federal Republic pp 635-644.

Khan A 1992 Effect of neem leaves and carbofuran on *Pratylenchus thornei* associated with three wheat varieties. *Pak J Sci Ind Res* **35** (11) 459-460.

Khan A, Shaukat S S 1991 Effect of nematicides against population of two ectoparasitic nematodes associated with wheat varieties. *Current Nematol* **2** (2) 140-150.

Khan A, Shaukat S S 1993 Effect of neem and carbofuran against population of three nematodes associated with wheat varieties. *Sarhad J Agric* **11** (2) 157-163.

Khan A, Shaukat S S, Hakro A A, Khanzada A K 1991 Comparative efficacy of nematicides against population of Lance and Lesion nematodes associated with wheat varieties. *Sarhad J Agric* **7** (5) 643-648.

Khan A, Shaukat S S, Qamar F, Jaffry A H, Hakro A A 1994 Effect of three plant extracts on nematode population and on the growth parameter of wheat variety Pirsabak-85. *Sarhad J Agric* **10** (4) 415-418.

Mohammad H Y, Hussain S I, Al-Zarari A J 1981 Effect of plant extracts of some poisonous plants in Iraq on mortality of citrus nematode, *Tylenchus semipenetrans* Cobh. *Acta Botanica Indica* **9** (1) 198-200.

Mishra S D, Haque M M, Mojunder V, Goswami B K 1989 Efficacy of aqueous extracts of neem seed cake on egg hatching and penetration of *Meloidogyne incognita. Neem newsletter* **6** (1) 6-7.

Mojunder V, Mishra S D 1991 Nematicidal efficacy of some plant products and management of *Meloidogyne incognita* in pulse crop by soaking seeds in their aqueous extracts. *Current Nematol* **2** (1) 27-32.

Mojunder V, Mishra S D, Haque M M, Goswami B K 1989 Nematicidal efficacy of some wild plants against pigeon pea cyst nematode, *Heterodera cajani. Int Nematol Network Newsletter* **6** (2) 21-24.

Qamar F, Saeed M, Khan A, Seema N 1989. Control of Anguinosis of wheat using plant extracts. *Pak J Sci Ind Res* **32** (4) 260-261.

Sasanella N D, Addabbo T 1992 The effect of *Cineraria martina, Ruta graveolens* and *Tagetes erecta* extracts on hatching of *Heterodera schochtii. Nematol Medit* **20** (1) 49-51.

Sasanella N D, Addabbo T 1993 Effect of *Cineraria martina, Ruta graveolens* and *Tageta erecta* leaf extracts and root extracts on Italian population of *Meloidogyne* species. *Nematol Medit* **21** (1) 21-25.

Siddiqui M A, Alam M M 1989 Effect of root-exudates of neem and Persian lilac on plant parasitic nematodes. *Anzeiger fur Schadlingskunde, Pflanzenschutz, Umweltschulz* **62** (2) 33-35.