NEMATODES ASSOCIATED WITH JUJUBE, *ZIZYPHUS MAURITANIA*, IN THE LOWER SINDH PROVINCE OF PAKISTAN

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Summary. Soil nematodes are reported in association with jujube in Pakistan. Nine genera are reported from fourteen localities. They include both ecto- and endo-parasites. The abundance of nematodes varied with the individual localities. Predominant plant parasitic nematodes were *Xiphinema elongatum* and juveniles of *Meloidogyne* sp.

Jujube (*Zizyphus mauritiana* Lam., syn. *Z. jujuba*) is commonly grown in the Sindh Province of Pakistan. The occurrence of plant parasitic nematodes associated with jujube has been investigated by Darekar and Khan (1981), Dwivedi *et al.* (1985, 1988, 1993), Dwivedi (1987, 1988), Siddiqui *et al.* (1988), Padhi *et al.* (2000) and Verma *et al.* (2000). These investigations were limited to India.

The aim of this work was to investigate the occurrence of nematodes associated with jujube trees in the lower Sindh Province, Pakistan.

MATERIALS AND METHODS

Soil samples, 1 kg each, were collected from the rhizosphere of 6 different jujube trees at fourteen locations in the lower Sindh Province, Pakistan. Nematodes were extracted from 500 cm^3 aliquots of thoroughly mixed composite sample by Cobb's decanting and sieving technique as modified by Brown and Boag (1988), killed by gentle heat, fixed in FAA and mounted in anhydrous glycerine. Nematodes were identified from each locality. Soil texture was determined manually, pH of soil was measured in soil paste (1:5 soil/dist. water), while water holding capacity was determined in accordance with USDA (1951). Grass cover was noted. Species diversity of nematodes was estimated using Shannon-Wiener information theory function (H') as given in Magurran (1988).

RESULTS AND DISCUSSION

The nematode densities for the fourteen sites are given in Table I, while the soil characteristics, the ground cover and nematode diversity are given in Table II.

The nematodes recorded from the soil samples of jujube were *Aphelenchus avenae* Bastian, *Helicotylenchus indicus* Siddiqi, *H. pseudorobustus* (Steiner) Golden, *Meloidogyne* spp. juveniles, *Merlinius brevidens* (Allen) Siddiqi, *Paratylenchus* sp. juveniles, *Pratylenchus thornei* Sher *et* Allen, *Tylenchorhynchus brassicae* Siddiqi, *Tylenchus* sp. juveniles and *Xiphinema elongatum* Schuurmans Stekhoven *et* Teunissen.

The nematodes recorded from the greatest number of sites (seven out of fourteen sites) were *Xiphinema elongatum* and *Meloidogyne* juveniles. The maximum population of *X. elongatum* was 282 per 500 cm^3 soil, while that of *Meloidogyne* juveniles was 170 per 500 cm^3 soil.

Tylenchus sp. juveniles were recorded from five out of fourteen sites (maximum population, 48 per 500 cm^3 soil), followed by *H. pseudorobustus* and *A. avenae* from four out of fourteen sites (maximum population sizes of 196 and 60 per 500 cm^3 soil, respectively). *Helicotylenchus indicus*, *M. brevidens* and *Paratylenchus* sp. juveniles were recorded from only two sites, with maximum populations of 108, 40 and 40 per 500 cm^3 soil.

It was observed that *Helicotylenchus* spp. prevailed in sites having medium to high grass cover.

The damage caused by most nematode species associated with jujube has not yet been properly assessed but preliminary investigations have shown heavy root damage caused by nematodes, particularly at the Gulshan-e-Iqbal, Sohrab Goth and University of Karachi sites. Species diversity (H') was mostly low because of low species richness. Gharo showed the greatest diversity of 1.362 while Sikhat had the lowest diversity (only one species).

The nematodes associated with jujube in India include *Hoplolaimus indicus*, *Tylenchorhynchus brassicae*, *Tylenchus filliformis*, *Meloidogyne incognita* and *Hemicycliophora* spp. Amongst these *Tylenchorhynchus brassicae* and *Meloidogyne* sp. were also encountered in our survey.

Our study has highlighted the presence of both endo- and ecto-parasitic nematode species associated with jujube in lower Sindh Province, Pakistan. The survey provides the basic data to prioritise and initiate research programmes to assess the economic importance of nematodes on this crop and develop options for their management.

Table I. Nematode density in the soils of the fourteen sites studied. Nematode density is given as average number of nematodes/500 cm^3 soil in the six samples.

No.	Sites	*Aphelenchus avenae*	*Helicotylenchus indicus*	*Helicotylenchus pseudorobustus*	*Meloidogyne* spp. juveniles	*Merlinius brevidens*	*Paratylenchus* sp. juveniles	*Pratylenchus thornei*	*Tylenchorhynchus brassicae*	*Tylenchus* sp. juveniles	*Xiphinema elongatum*
1	Oderolal	32	108	-	40	-	-	-	-	20	-
2	Sikhat	-	-	-	70	-	-	-	-	-	-
3	Mirpurkhas	40	-	-	170	-	-	-	-	-	-
4	Nasrpur	60	-	-	-	-	-	-	-	48	-
5	Paligani	24	-	-	50	-	-	32	-	-	-
6	Khaiber	-	-	-	110	-	-	-	-	40	-
7	Matiari	-	70	-	128	-	-	-	-	-	-
8	Liaquatabad (Karachi)	-	-	162	-	22	-	-	-	-	270
9	Shaheed-e-Millat (Karachi)	-	-	160	-	40	-	-	-	-	260
10	Gulshan-e-Iqbal	-	-	196	-	-	-	-	-	-	282
11	Sohrab Goth	-	-	-	-	-	-	-	36	-	140
12	University of Karachi	-	-	100	-	-	-	-	-	-	164
13	Gharo	-	-	-	58	-	40	-	-	32	40
14	Malir	-	-	-	-	-	32	-	-	26	36

Table II. Soil characteristics and nematode diversity of the fourteen sites. Average of six samples from each locality.

No.	Sites	Soil texture	Soil pH	Max. water holding capacity	Grass cover*	Nematode diversity (H')
1	Oderolal	Sandy loam	8.1	37.6	Medium	1.178
2	Sikhat	Loamy sand	8.3	28.8	Absent	0
3	Mirpurkhas	Sandy loam	7.8	38.2	Low	0.486
4	Nasrpur	Sandy loam	8.2	37.9	Low	0.686
5	Paligani	Loamy sand	8.4	30.3	Absent	1.052
6	Khaiber	Loamy sand	8.0	29.2	Absent	0.579
7	Matiari	Loamy sand	8.3	28.6	Medium	0.595
8	Liaquatabad (Karachi)	Sandy loam	7.9	36.8	Medium	0.823
9	Shaheed-e-Millat (Karachi)	Sandy loam	8.3	38.3	High	0.902
10	Gulshan-e-Iqbal	Loamy sand	8.2	29.2	Medium	0.676
11	Sohrab Goth	Loamy sand	8.4	27.4	Absent	0.691
12	University of Karachi	Sandy loam	7.9	38.6	High	0.663
13	Gharo	Loamy sand	8.2	28.7	Low	1.362
14	Malir	Sandy loam	8.0	39.4	Medium	1.089

* Grass cover was mostly *Cynodon dactylon*.

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Accepted for publication on 3 May 2004.