A SURVEY OF NEMATODES OF POMEGRANATE ORCHARDS IN BALOCHISTAN PROVINCE, PAKISTAN

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Summary. A survey of nematodes associated with pomegranate was conducted in the orchards in Balochistan province. The survey was restricted to 18 localities. In all, twelve nematode genera were recorded from the rhizosphere of pomegranate. The most dominant species was *Scutylenchus rugosus* followed by *Xiphinema basiri* and *Meloidogyne incognita*. Species diversity (H′) varied and was highest in Piromal and lowest in Surab.

Pomegranate (*Punica granatum* L.) is commonly grown in Balochistan Province of Pakistan. The crop requires a long hot summer to mature the fruit, yet can withstand low temperatures of -8 to -10 ºC in the winter and is extremely drought-tolerant. Many species of plant parasitic nematodes are present in the major pomegranate growing regions of India (Chadha and Pareek, 1993; Darekar *et al*., 1990; Salalia *et al*., 2002) and some of these species are highly damaging to pomegranate production (Darekar *et al*., 1990; Shelke and Darekar, 2001).

However, there is a lack of information on the distribution and abundance of plant parasitic nematodes in the major pomegranate growing regions of Balochistan Province, Pakistan, therefore the present survey was conducted to fill this gap in our knowledge.

MATERIALS AND METHODS

Surveys were conducted in the major pomegranate growing localities of Balochistan in March and April, 2003. The eighteen localities that were chosen for the survey included Azeemabad, Bencha, Badrang, Baghbana, Bizenjo farm, Kalat, Khudh, Khuzdar, Langoabad, Mastung, Mangchar, Nawab Post, Piromal, Podengo, Surab, Umarabad, Uthal and Wadh.

The soil types in these localities were sandy loam, loamy sand or loamy sand with gravel. The ranges of temperature that they experience vary considerably. The maximum temperature varies from 38 ºC to 43 ºC in Lasbela, Uthal and Khudh while; the minimum temperature reaches below -10 ºC in Kalat and Mastung. Soil and root samples were collected at ten random locations within each field from the rhizosphere of trees in the eighteen localities. Soil samples were collected from 5-30 cm depth using small soil corers and shovels. The soil samples from each locality were pooled to obtain composite samples.

Nematodes were extracted from the samples using the Baermann funnel technique (Southey, 1970). Root-knot nematodes females (*Meloidogyne* spp.) were extracted from the galls present on the roots and species identification was based on perineal pattern morphology. Other nematode species were also identified and their numbers recorded using a binocular microscope.

Soil texture was determined manually. The pH of soil was measured in soil paste (1:5 soil/dist. water) while water holding capacity was determined in accordance with USDA (1951) protocol. The soil was saturated in tin cans with a hole in the bottom. The soil was then oven-dried (100 °C for 24 h). The water holding capacity was calculated as loss in weight (saturated soil - oven-dried soil) and expressed as a percentage of oven-dry soil. Grass cover around the trees was noted. Species diversity of nematodes was estimated using the Shannon-Wiener information theory function (H′) as given in Magurran (1988). Equitability $J' = H'/H_{max.}$ was calculated in accordance with Pielou (1969) and species richness as $d' = S/\sqrt{N}$ as suggested by Menhinick (1964).

RESULTS AND DISCUSSION

Twelve genera were recorded from the eighteen different localities (Table I). Galling intensity of the roots was observed and, on dissection of the galls, females with numerous eggs were observed. *Meloidogyne incognita* (Kofoid *et* White) Chitw. was recorded from six localities, while *M. javanica* (Treub) Chitw. from only two.

The number of second stage juveniles of *M. incognita* ranged from 40 to 168 while that of *M. javanica* from 20 to 34 per 200-cm^3 soil.

The highest number of nematode species was recorded from Piromal, namely *Tylenchorhynchus* sp., *Scutylenchus rugosus* (Siddiqi) Siddiqi, *Ditylenchus* sp., *Merlinius brevidens* (Allen) Siddiqi, *Tylenchorhynchus brassicae* Siddiqi, *M. incognita, Psilenchus* sp., *P. hilarulus* de

Table I. Nematode density in 200 cm^3 soils in the rhizosfere of pomegranate of the eighteen localities surveyed.

Site	*Aphelenchus avenae*	*Ditylenchus sp.*	*Helicotylenchus digonicus*	*Hoplolaimus indicus*	*Longidorus sp.*	*Meloidogyne incognita*	*M. javanica*	*Merlinius brevidens*	*Psilenchus sp.*	*Psilenchus hilarulus*	*Scutylenchus rugosus*	*Tylencborbynchus sp.*	*T. brassicae*	*Tylenchus sp.*	*Xiphinema basiri*
Azeemabad	-	-	17	46	8	-	34	-	-	-	69	-	-	58	108
Bencha	-	-	18	40	8	-	-	-	-	-	68	-	-	40	85
Badrang	-	-	-	-	-	-	-	56	-	-	117	-	-	-	80
Baghbana	-	-	-	-	-	-	-	80	-	-	-	-	47	-	70
Bizenjo farm	-	-	-	-	-	70	-	-	-	-	-	10	-	-	-
Kalat	-	-	-	-	-	84	-	-	-	-	-	7	-	-	-
Khudh	-	-	-	-	-	168	-	-	5	-	106	-	-	-	-
Khuzdar	-	10	-	-	8	-	-	-	4	-	114	6	47	-	81
Langoabad	-	-	-	-	-	-	-	-	-	-	80	-	-	-	-
Mastung	-	-	-	-	-	-	20	-	-	-	84	-	-	-	-
Mangohar	-	32	-	-	-	-	-	-	-	13	-	-	-	-	110
Nawab Post	-	12	15	40	-	-	-	-	-	-	-	-	40	-	-
Piromal	-	17	15	44	-	40	-	50	3	10	116	10	48	60	104
Podengo	-	-	-	-	-	-	-	-	-	13	87	-	-	-	-
Surab	-	-	-	-	-	-	-	-	12	-	80	-	-	-	-
Umarabad	-	-	-	-	-	-	-	-	-	-	106	-	-	-	-
Uthal	10	-	17	40	-	50	-	-	-	-	-	-	-	-	76
Wadh	30	-	18	42	10	98	-	-	-	-	-	-	-	-	78

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

Site	Soil texture	Soil pH	Max. water holding capacity (%)	Grass cover	Species diversity H′	Equitability J′	Richness d′
Azeemabad	Loamy sand	8.1	26.2	Low	1.77	0.896	0.406
Bencha	Loam sand	8.0	28.7	Low	1.586	0.885	0.364
Badrang	Sandy loam	7.8	37.8	Medium	1.06	0.972	0.189
Baghbana	Sandy loam	7.9	36.5	Low	1.07	0.975	0.214
Bizenjo farm	Loamy sand	8.2	27.6	High	0.76	0.697	0.229
Kalat	Loamy sand (with gravel)	8.2	27.2	Low	0.304	0.439	0.190
Khad	Sandy loam	7.9	34.7	Medium	0.656	0.946	0.145
Khuzdar	Sandy loam	8.0	36.0	Medium	1.757	0.845	0.458
Langoabad	Loamy sand	8.1	27.5	Low	0.223	0.322	0.416
Mastung	Sandy loam	7.8	38.2	Low	0.525	0.757	0.176
Mangchar	Sandy loam	7.7	37.6	Low	1.134	0.818	0.317
Nawab Post	Sandy loam (with gravel)	7.9	26.3	None	1.218	0.878	0.414
Piromal	Sandy loam	7.8	28.0	Medium	2.048	0.854	0.488
Podengo	Loamy sand	8.0	28.6	Low	0.319	0.460	0.188
Surab	Loamy sand	8.1	29.1	Low	0.325	0.468	0.200
Umerabad	Loamy sand	8.1	27.4	Low	-	-	0.091
Uthal	Sandy loam	7.8	32.3	High	1.099	0.793	0.253
Wadh	Sandy loam	8.0	35.6	Medium	1.610	0.827	0.418

Man, *Xiphinema basiri* Siddiqi, *Tylenchus* sp. and *Helicotylenchus digonicus* Perry, Darling *et* Thorne.

The average populations of *M. incognita, S. rugosus* and *X. basiri* were high while *Psilenchus* sp., *Longidorus* and *Tylenchorhynchus* populations were low. The nematode recorded from the highest number of localities (eleven) was *S. rugosus*, followed by *X. basiri*, which was found in nine localities.

Species diversity (H′) was highest in Piromal, followed by Azeemabad and Khuzdar while minimal diversity was recorded in Surab, Longoabad and Kalat (Table II). Equitability component of diversity was highest in Baghbana and lowest in Longoabad. Species richness was highest in Piromal and lowest in Umerabad. Diversity (H′) seems to be mainly a function of species richness.

The three most common nematode genera found associated with pomegranate in India were *Helicotylenchus, Xiphinema* and *Meloidogyne* (Darekar *et al.*, 1990). These genera were also recorded in the present survey though they were not necessarily abundant. With the exception of *Meloidogyne* spp., the rest do not seem to produce pathogenic symptoms in pomegranate. However, detailed studies should be undertaken to determine their pathogenicity.

The dominant grasses were: *Cynodon dactylon* (L.) Pers. and *Cenchrus biflorus* Roxb. Since grass cover was present from low to high in all the surveyed pomegranate fields, there is a possibility that the non-endoparasitic nematodes were feeding on the grass cover, suggesting that grass cover should be removed from time to time in order to minimise the population of stylet-bearing nematodes.

The study clearly showed that the roots of pomegranate were infected by sizeable populations of parasitic nematodes, particularly root-knot nematodes which can adversely affect the growth and yield of pomegranate. However, the control of these nematodes can readily be achieved using several methods, including organic soil amendments that have shown promise against phytonematodes of other fruit crops (Khan *et al.*, 1997, 2004).

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Accepted for publication on 8 February 2005.