

SURVEY OF STYLET-BEARING NEMATODES ASSOCIATED WITH DATE-PALM IN KHUZDAR DISTRICT, BALOCHISTAN, PAKISTAN

Aly Khan¹, Shamsul Islam², S.S. Shaukat³ and Z.A. Handoo⁴

¹Crop Diseases Research Institute, PARC, University of Karachi, Karachi-75270, Pakistan.

²Centre of Agriculture and Bioscience, Regional Bioscience Centre, Rawalpindi, Pakistan..

³Department of Botany, University of Karachi, Karachi-75270, Pakistan.

⁴Nematology Laboratory, USDA, ARS, Beltsville, MD-20705, USA.

ABSTRACT

Surveys were conducted during September and October 2002 to identify the stylet-bearing nematodes associated with date-palm in Khuzdar district, Balochistan, Pakistan. The nematodes recorded were namely *Tylenchus* Bastian, 1865 sp.; *Merlinius* Siddiqi, 1970; *Helicotylenchus indicus* Sher, 1963 *Psilenchus hilarulus* Siddiqi, 1963; *Aphelenchoides* Fischer, 1984; *Meloidogyne incognita* (Kofoid and White) 1919, Chitwood, 1949 and *Xiphinema americanum* Cobb, 1913.

The similarity between the localities based on the qualitative (presence/absence) nematode data was calculated using Jaccard's coefficient of similarity. The dendograms derived from hierarchical agglomerative clustering of twelve locations of Khuzdar district showed the largest group with five localities. This group was characterized by high density of *H. indicus*; *X. americanum* and *M. incognita*.

Keywords: Date-palm, Nematodes, Khuzdar, Balochistan, Pakistan

INTRODUCTION

Date-palm (*Phoenix dactylifera* L.) is an important plantation in arid regions of the world including Pakistan. Its fruit being extremely sweet it is a complete instant digestive diet which is high in Vitamin A and B and also contains iron, calcium, potassium and other nutrients (Khan *et al.*, 1987).

A major limiting factor for date-palm production is the toll taken by pest and diseases of which nematodes occupy a prominent place (Al-Yahya *et al.*, 2004; Edongali, 1966; Inscrta *et al.*, 1994; Fernandez *et al.*, 1991; Lamberti *et al.*, 1975, 1977; Khan & Bilqees, 1985; Khan *et al.*, 1987, 2002, 2003, 2004).

In Pakistan, although it is widely domesticated in Sindh, Punjab, lower Balochistan and some areas of NWFP, nearly about 30 percent of production may potentially be lost as a result of diseases and pests (Khusk and Mal, 2005).

The present study was conducted to determine the plant parasitic nematodes associated with date-palm in Khuzdar district, Balochistan prior to conducting more detailed studies on host range, effect on crop growth and interaction between nematodes and soilborne pathogens.

MATERIALS AND METHODS

A total of 288 rhizosphere soil samples were collected during November and December 2003 from 12 locations, namely Alikoh, Bizenjo farm, Khararo, Hafizabad, Kaley Haji Malik Mohd, Khuzdar (Airport Road), Khuzdar (Rabia Road), Ornach, Umerabad, Sonaroo, Wadh farm and Wadh Town. For rhizosphere soil sampling 200 cm³ of soil was removed from an area approximately 30-50 cm away from tree trunk in a zone between 5 to 50 cm below the soil surface. In the laboratory each sample was well mixed and nematodes were extracted through a modified Baermann funnel technique (Cobb, 1918; Schindler, 1961).

Nematodes were collected in sample tubes, heat relaxed and killed at 60°C in a water bath. After fixing in T.A.F. (Hooper, 1986), the samples were thoroughly examined and the stylet-bearing nematodes were removed, processed and mounted on microscope slides using standard technique (Siddiqi, 2000), for identification to species level.

For identification of *Meloidogyne* spp., live egg laying females were dissected from the gall roots and placed into a drop of 45 % lactic acid in a Petri dish and perineal pattern was prepared as described by Eisenback *et al.* (1980).

The similarity between locations based on qualitative (presence/absence) nematode data was calculated on the basis of Jaccard's coefficient of similarity (Mueller-Dumbois and Ellenberg, 1974), as follows:

$$S_{jk} = \frac{a}{a+b+c} \times 100$$

Where S_{jk} is the percentage similarity between localities j and k ; a equals the presence in both localities (j and k) and b and c are the presence in one locality either j or k . In all $n(n-1)/2$ similarities were calculated and the triangular matrix was constructed.

Group structure inherent in the data sets relevant to the localities was exposed using average linkage clustering strategy (Orlaci, 1978). Average linkage is a kind of hierarchical agglomerative clustering strategy which has certain desirable properties such as the extraction of spherical group structure. Euclidean distance was used as the resemblance function.

RESULTS AND DISCUSSION

According to the presence/absence data (Table 1) a total of eight ecto-and endo-parasitic nematodes were recorded viz., *Tylenchus* sp.; *Merlinius* sp.; *Merlinius brevidens*, *Helicotylenchus indicus*, *Psilenchus hilarulus*, *Xiphinema americanum*, *Aphelenchoides* and *Meloidogyne incognita* from twelve localities of Khuzdar district, Balochistan.

Table 1. Presence /absence data of nematode species in various localities of Khuzdar district.

LOCALITIES	NEMATODES								
	<i>Meloidogyne incognita</i>	<i>Tylenchus</i> sp.	<i>Psilenchus hilarulus</i>	<i>Helicotylenchus indicus</i>	<i>Aphelenchoides</i> sp. Larvae	<i>Xiphinema americanum</i>	<i>Merlinius brevidens</i>	<i>Merlinius khuzdarensis</i>	
Alikoh	+	-	+	+	-	-	-	-	
Bizenjo	+	-	+	-	+	-	-	+	
Karao	-	+	+	-	-	+	+	+	
Hafizabad	+	-	-	-	-	-	-	-	
Kaley Haji Malik Mohd.	+	-	+	-	-	+	+	-	
Khuzdar (Air port road)	-	-	-	+	-	+	-	-	
Khuzdar (Rabia road)	+	-	-	-	-	+	-	-	
Ornach	+	-	-	-	-	+	+	+	
Sonaroo	+	-	-	-	-	+	+	+	
Umerabad	-	-	-	+	-	+	+	+	
Wadh Farm	-	+	-	+	-	-	+	+	
Wadh Town	-	-	-	-	-	+	-	-	

Table 2. Similarity matrix of nematode communities associated with twelve localities of Khuzdar district.

	1	2	3	4	5	6	7	8	9	10	11
1											
2	40										
3	28.5	25									
4	33.3	25	0								
5	33.3	50	57.1	20							
6	25	0	33.3	0	16.6						
7	20	40	28.5	33.3	60	25					
8	16.6	33.3	42.8	25	80	20	75				
9	16.6	33.3	42.8	25	80	20	75	100			
10	16.6	14.2	66.6	0	50	50	40	60	60		
11	16.6	14.2	66.6	0	28.5	20	16.6	33.3	33.3	60	
12	0	0	16.6	0	20	50	33.3	25	25	0	

Table 2 presents the similarity matrix of nematode composition of twelve localities of Khuzdar. Similarity value ranged between zero and 100%. Localities 5 (Kaley Haji Mali Mohd.), 7 (Khuzdar Rabia Road) and 8 (Ornach) have high similarity among them and form a large group. Likewise 7 (Khuzdar Rabia Road), 8 (Ornach), 9 (Sonaroo) and 10 (Umerabad) exhibit high mutual similarity in nematode composition. Localities 4 (Hafizabad) and 63 (Khuzdar Airport Road) are dissimilar with most of the localities. The dendrogram derived from hierarchical agglomerative clustering of twelve localities of Khuzdar district is depicted in Fig. 1. At the left side a tight cluster is formed of

five localities including Bizenjo farm, Hafizabad, Khuzdar (Airport Road), Umerabad and Wadh farm. This group is characterized by high density of *H. indicus*; *X. americanum* and *Merlinius* sp. Another small group is constituted by Khuzdar (Rabia Road) and Ornach. This group is characterized by *M. brevidens*, *M. incognita* and *X. americanum*. A small group of two localities Kaley Haji Malik and Wadh town is formed which is characterized by *X. americanum*. Localities Kararo and Sonaro are unique and remain secluded in the dendrogram Kararo is distinguished by presence of *Tylenchus* sp. while Sonaro has high densities of *X. americanum*, *M. brevidens* as well as *M. incognita*. While Alikoh is distinguished by the presence of *M. incognita*; *P. hilarulus* and *H. indicus*.

In the present study presence of *H. indicus* and *M. incognita* are important as reported by Youssef and Eissa (1994) that these two nematodes are well adapted to survive and reproduce under date-palm all the year around and eventually cause yield losses. Attention should be paid to the presence of *X. americanum* as they have caused severe losses to date-palm in Algeria (Lamberti *et al.*, 1975).

This survey was carried out only in one district of the province, for a better assessment of the potential of important nematodes extensive surveys should be conducted in all the date-palm growing districts of the province. Sampling should be carried out to cover different soil types, climatic conditions and cultivation system to get an idea of the influence of ecological factors on the nematode populations and degree of nematode damage.

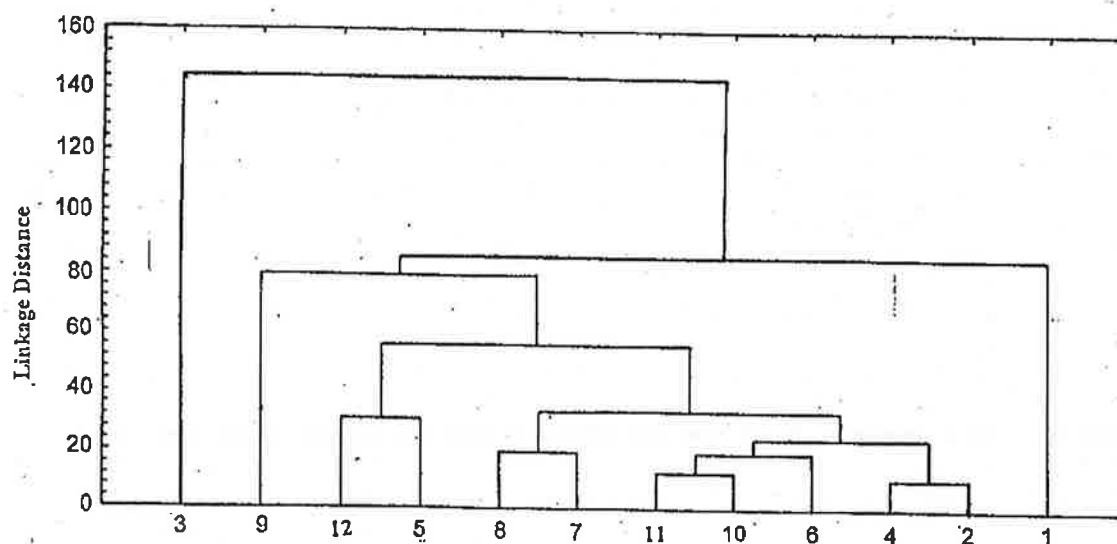


Fig.1. Dendrogram resulting from average linkage of 12 localities of date palm from Khuzdar based on nematode composition (1= Alikoh; 2=Bizenjo farm; 3=Kararo; 4= Hafizabad; 5= Kaley Haji Malik Mohd.; 6= Khuzdar (Airport road); 7= Khuzdar (Road side); 8= Ornach; 9= Umerabad; 11= Wadh farm; 12= Wadh Town).

CONCLUSION

From the survey eight different nematode species were recorded. The dendrograms resulting from hierarchical agglomerative clustering disclosed grouping of localities based upon the degree of similarity in nematode species composition which in turn reflects the similarity in environmental conditions conducive to the survival and prevalence of particular nematode species.

Further work is required to determine the effect of these nematodes on growth and yield of date-palm and the host range among common subsistence crops.

ACKNOWLEDGEMENT

This work was conducted under a Pakistan Science Foundation grant No. PSF/Res/S-PARC/Agr(277) awarded to the senior author.

REFERENCES

Al-Yahya, F.A., A.A.M. Ibrahim and A.A. El-Sherbiny (2001). Frequency and population density of plant parasitic nematode associating date-palm cultivars in Riyadh, Saudi Arabia. *Alexandria J. Agric. Res.*, 46: 127-137.

- Cobb, N.A. (1918). Estimating the nematode populations of soil. U.S. Department of Agriculture, Technical Circular 1.
- Edongali, E.A. (1996). Diseases of date-palm (*Phoenix dactylifera* L.) of Libya. *Arab J. Plant Protection*, 14: 41-43.
- Eisenback, J.D.; H. Hirschmann and A.C. Trianthaphyllou (1980). Morphological comparison of *Meloidogyne* female and structures, pereneal pattern and stylet. *J. Nematol.*, 12: 300-313.
- Fernandez, E.; J. Carrasco, J. Perez and M. Acosta (1991). Susceptibility of various species of flowers and ornamentals to *Meloidogyne incognita* race 2. *Proteccion-de-Plants*, 1: 7-14.
- Hooper, D.J. (1986). Handling, fixing, staining and mounting nematodes. In: *Laboratory methods for work with plant and soil nematodes* (ed. J.F. Southey), pp. 59-68, Her Majesty's Stationery Office, London, U.K.
- Inscrra, R.N., A.A. Dunn and N. Volvas (1994). Host response of ornamental plants to *Rotylenchus reniformis*. *J. Nematology*, 26: 737-743.
- Kaul, R.K. and B.R. Bansali (1990). Association of *Aphelenchoides* sp. with *Botryodiplodia theobromae* on date-palm – a new record. *Indian J. Nematology*, 20: 115-116.
- Khan, A. and F.M. Bilqees (1985). Stylet bearing nematodes associated with date-palm (*Phoenix dactylifera* Linn.) in Thatta district. *Pakistan J. Zoology*, 17: 299-300.
- Khan, A.; F.M. Bilqees, M.A. Samad, N. Khatoon and A.G. Rizwana (2002). Histopathology of date-palm roots infected with *Pratylenchus penetrans* root-lesion nematode. *Pakistan J. Nematology*, 20: 35-40.
- Khan, A. A.K. Khanzada and M. Aslam (1987). Management of plant parasitic nematodes associated with date-palm in Baluchistan. *Pakistan J. Nematology*, 5: 15-17.
- Khan, A.; M.A. Samad and F.M. Bilqees (2004). Histological changes in young date-palm roots following infection by *Meloidogyne incognita*. *Sarhad J. Agriculture*, 20: 149-152.
- Khan, A.; M.A. Samad, F.M. Bilqees, N. Khatoon and M.H. Soomro (2003). Histopathology of date-palm roots infected with root-knot nematode (*Meloidogyne incognita* (Kofoid and White, 1919) Chitwood, 1949). *Bulletin of Pure and Applied Science*, 22: 169-172.
- Khusk, A.M. and Mal. B. (2005). Date production under threat of moth disease. *Dawn Economic and Business Review* (July 3) P.III.
- Lamberti, F.; N. Greco and H. Zaouchi (1975). A nematological survey of date-palms and other major crops in Algeria. *FAO Plant Protection Bulletin*, 23: 156-160.
- Lambergi, F. N. Greco and N. Volvas (1977). Pathogenicity of two species *Meloidogyne* on four varieties of date-palm. *Nematologia Mediterranea*, 5: 159-172.
- Mueller-Dumbois, D. and E. Ellenberg (1974). *Aims and methods of vegetation ecology*. Wiley, New York.
- Orloci, L. (1978). *Multivariate Analysis in Vegetation Research*. W, Junk Publishers, The Hague.
- Schindler, A.F. 1961. A simple substitute for a Baermann funnel. *Plant Disease Reporter*, 45: 747-748.
- Siddiqi, M.R. (1986). *Tylenchida Parasites of Plants and Insects*. Commonwealth Agricultural Bureau, Farnham, Royal, UK. IX + 645 pp.
- Youssef, M.M.A. and Eissa, M.F.M. (1994). Population dynamics of certain nematodes associated with date-palm in Egypt. *Afro-Asian J. Nematology*, 4: 76-78.

(Accepted for publication July 2006)