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Short Communication

Prevalence of Plant Nematodes Associated with Maize in Balochistan, Pakistan

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ABSTRACT

A survey of maize (*Zea mays* L.) of eight localities, namely Anjira, Kalat, Khazeena, Khuzdar, Mangochar, Rodeni, Surab and Zehri was conducted in Balochistan. A total of 13 plant nematodes were recorded. Out of these seven nematodes were encountered in only one locality. Most common species in maize fields was found to be *Pratylenchus zeae* that occurred in 5 out of eight localities, one-way of variance was performed for those nematodes that occurred in two or more localities. With one exception, the density differed significantly among the localities.

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Authors' Contributions
AK did identification and wrote the manuscript. KAK did the survey while SSS performed statistical analysis.

Key words
Nematodes, Plant, Maize, Prevalence, Balochistan.

Maize (*Zea mays* L.) is an important cereal crop used in human diet. It is also an important feed component for livestock and poultry (Adegbile, 2011). Its production in Pakistan is greatly affected by several biotic factors including insect, bacteria, fungi and plant parasitic nematodes are the most important pests associated with maize. The nematodes cause losses to the yield by direct feeding on roots besides this, they interact in roots with other disease causing agents and thus cause losses to yield qualitatively and quantitatively.

Nematodes can be a source of extensive damage to maize. Over 120 nematode species parasitize maize and some of these species are considered to be economically important pathogens (Norton, 1983; Windham, 1998; Riggs, 1982; Tylka *et al*., 2011; Karuri *et al*., 2017). However, a number of organic and inorganic nematicides are used to curtail the population (Khan *et al*., 1985, 1989, 2003, 2009; Qamar *et al*., 1993).

Symptoms of nematode damage on maize due to nematodes include stunting, yellowing of leaves, wilting, lack of fine roots and swelling or browning of roots. The only way nematode infestation is confirmed is by proper investigation of root and soil samples for which the best time is in the middle of growing season to determine whether the plant nematodes have exceeded damage threshold as often when the crop starts maturing the frequency of nematodes decline. The plant nematodes withdraw the contents of plant cells thus killing them. During this feeding process damage is caused to root system which reduces the plant capability to absorb nutrients and water.

McSorley and Dickson (1998) studied relationship between nematode population and yield in experimental plots in Florida. They observed preplant levels and final levels at time of harvest and suggested that the final densities of most nematode species were linearly related to densities measured at planting or earlier. Mokhel (2014) recorded the following species associated with maize namely *Criconemella* sp., *Helicotylenchus* sp., *Heterodera* sp. and *Meloidogyne* spp. grown in Abu-Arish governorate, Jizan province, Southwest, Saudi Arabia. Jordaan *et al*. (1989) recovered endoparasitic nematodes *Meloidogyne incognita*, *M. javanica*, *Pratylenchus brachyurus*, *P. zeae*, *P. neglectus, P. penetrans*, *P. crenatus* and *Rotylenchulus parvus,* associated with maize root samples in western Transval, South Africa. De Silva (2010) suggested that there was a significant effect on maize root health in the presence of *Fusarium* spp. and *Pratylenchus* sp. The present study provides information about nematodes associated with maize.

Materials and methods

Samples were collected from eight maize growing areas namely Anjira, Kalat, Khazeena, Khuzdar, Mangochar, Rodeni, Surab and Zehri of Balochistan, Pakistan in the middle of the crop growing period which was first week of November, 2016. Different nematicides are commonly applied at planting but in these eight localities no nematicide was used prior to sowing. Soil in

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Table I.- Plant nematodes associated with maize (*Zea mays* L.) in eight localities of Balochistan.

Localities	Plant Nematodes in 100 ml of soil (Population range)
Anjira	*Longidorus* sp. (4-10); *Scutellonema brachyurum* (60-105).
Kalat	*Bitylenchus goffarti* (10-25); *Meloidogyne incognita* larvae (8-18); *Tylenchorhynchus mashhoodi* (50-65); *Scutellonema brachyurum* (2-14).
Khazeena	*Bitylenchus goffarti* (6-7); *Pratylenchus zeae* (120-185); *Helicotylenchus dihystera* (15-36).
Khuzdar	*Aphelenchus avenae* (10-12); *Hoplolaimus pararobustus* (5-115).
Mangochar	*Meloidogyne incognita* larvae (10-68); *Pratylenchus zeae* (60-62); *Pratylenchus penetrans* (10-14).
Rodeni	*Pratylenchus zeae* (70-250); *Pratylenchus penetrans* (10-14).
Surab	*Pratylenchus zeae* (120-178); *Longidorus* sp. (4-17).
Zehri	*Bitylenchus goffarti* (7-10); *Tylenchorhynchus mashoodi* (3-45); *Pratylenchus thornei* (4-40); *Pratylenchus zeae* (100-164); *Pratylenchus goodeyi* (4-8); *Aglenchus* sp. (4-18); *Pratylenchus penetrans* (9-26); *Helicotylenchus dihystera* (4-60); *Meloidogyne incognita* (4-10).

the region contained 44-52% sand. Six plants were arbitrarily selected in each field. Rhizosphere soil collected from six plants was pooled together to obtain 100 ml sample (Table 1). For root-knot nematodes 5g of root from each sample was macerated in water in a kitchen blender (De Wade *et al*., 1998). The females of root-knot nematodes were cleaned in lactic acid (45%) and mounted in pure anhydrous glycerol (Taylor and Netscher, 1974). The rhizosphere soil samples were processed according to Cobb's modified decanting and sieving method (S'Jacob and Van Bezooyen, 1984). Nematodes were killed with hot formalin-propionic acid (FP 4:1), processed using Seinhorti's (1959) rapid glycerol-ethanol method, and mounted in pure glycerin. Most nematodes were identified up to species level.

For statistical analysis the differences in the density of nematode species among localities were analyzed using one-way ANOVA, least significant test (L.S.D.) at p-level of 0.05 and Duncan's multiple range test (DMART) (Zar, 2008).

Results and discussion

The nematodes recorded were *Aglenchus* (Andrássy (Mcyl) sp., *Aphelenchus avenae* Bastian, *Longidorus* Micoletzky sp., *Hoplolaimus pararobustus* (Schuurmans Stekhoven and Teunissen) Sher; *Helicotylenchus dihystera* (Cobb) Sher; *Meloidogyne incognita* (Kofoid and White) Golden; *Pratylenchus zeae* Graham; *P. penetrans* (Cobb) Filipjev & Schuuvmans Stekhoven; *P. thornei* Sher and Allen; *P. goodeyi* Sher and Allen; *Scutellonema brachyurum* (Steiner) Andrássy; *Bitylenchus goffarti* (Sturhan) and *T. mashhoodi* Siddiqi and Basir. For the plant nematode *Bitylenchus goffarti* there was a significant difference in density ($F = 17.53$; $p < 0.001$) among localities. *Meloidogyne incognita* larvae also showed significant difference among the localities ($F = 10.16$; $p < 0.001$) with the highest density in Mangochar. *Tylenchorhynchus mashhodi* was recorded only from Kalat. *Pratylenchus thornei* had a significant difference in density ($F = 11.302$; $p < 0.001$). *Longidorus* sp. was recorded in one locality Anjira with a mean value of 2.4. *Scutellonema brachyurum* was only recorded in Kalat with mean value of 7.5. Similarly, *Aphelenchus avenae* was also recorded only in Khuzdar with an average density of 11 and *Hoplolaimus pararobustus* was also present in one locality Khuzdar with an average density of 57.5. For *Helicotylenchus dihystera* the difference in mean density for Khazeena and Zehri was non-significant. *Pratylenchus goodeyi* was prevalent only in one locality with a mean density of 6. *Pratylenchus zeae* occurred in most localities namely Khazeena Mangochar, Rodeni, Surab and Zehri with a maximum density in locality Rodeni (density = 171.4) and minimum in locality Mangochar (density = 56.3). The overall difference among mean densities was significant ($p < 0.001$). *Aglenchus* sp. was found in one locality Zehri with an average mean density of 13 and finally *Pratylenchus penetrans* was recovered in three localities namely Mangochar, Rodeni and Zehri with a mean density of 17.5 and the difference between localities was significant ($F = 4.05$; $p < 0.05$). Norton (1983) suggested that *Hoplolaimus* sp. and *Pratylenchus* sp. presence in the rhizosphere soil of maize can be extremely low while several thousand of nematodes may be present in a single gram of root tissue thus for proper results maize root tissue by proper macerating can give accurate results. Since *Meloidogyne* sp., *Pratylenchus* spp. and *Longidorus* sp. were encountered in the present survey. Their feeding and migrating destructively through root tissue or acting as vector of virus can be extremely harmful to maize crop. As suggested by Kayani *et al*. (2018) early diagnosis of root-

knot nematode can abate heavy losses.

The culture methods for management of nematode are very successful besides being environment friendly. As far as the chemicals are concerned they require applications of large amounts of chemicals using specialized equipment. Moreover, besides being costly, chemicals can be extremely harmful to humans and other non-target organisms. The most successful approach to plant nematode control could be only in conjunction with other management tactics including cultural practices (non-host crop, rotations or growing cover crops that could be nematode antagonists and if necessary chemical treatment of soil provide efficient control. Cover crops such as marigold (*Tagetes erecta*) and rattlepods (*Crotalaria*) can be employed.

Statement of conflict of interest

The authors declare no conflict of interest.

References

Adegbile, A.A., 2011. *Afr. J. Pl. Sci.*, **5**: 162-167.

De Silva, M.P., 2010. *Interactions between lesion nematodes and corn pathogens*. Iowa State University Digital Repository Graduate Theses and Dissertations, pp. 109. https://doi.org/10.31274/etd-180810-2912

De Wade, D., McDonald, A.H., Jordan, E.M., Orion, D., Van dén Berg, E. and Loots, G.C., 1998. *Afr. Pl. Protect.*, **4**: 113-118.

Jordaan, E.M., De Weele, D. and Van Rooyen, P.J., 1989. *J. Nematol.*, **21**: 356-360.

Kayani, M.Z., Mukhtar, T. and Hussain, M.A., 2018. *Pakistan J. Zool.*, **50**: 897-902. http://dx.doi.org/10.17582/journal.pjz/2018.50.3.897-902

Karuri, H.W., Olago, D., Neilson, R., Maroro, E. and Villinger, J., 2017. *Crop Protect.*, **92**: 114-121. https://doi.org/10.1016/j.cropro.2016.10.020

Khan, A., Rajput, T. and Fatima, H., 1985. *Pakistan J. Zool.*, **17**: 101-103.

Khan, A., Saeed, M. and Khanzada, A.K., 1989. *Pakistan J. Scient. Indust. Res.*, **32**: 408-409.

Khan, A., Qamar, F., Bilqees, F.M., Shaikh, S.A. and Hakro, A.A., 2003. *Biosci. Res. Bull.*, **20**: 69-74.

Khan, A., Qamar, F., Shaukat, S.S. and Rizki, Y.M., 2004. *Biosci. Res. Bull.*, **20**: 69-73.

Khan, A., Shaukat, S.S., Nawab, B., Khanzada, K.A. and Solangi, M.S., 2009. *Pakistan J. agric. Res.*, **22**: 165-167.

McSorley, R. and Dickson, D.W., 1989. *J. Nematol.*, **21**: 462-471.

Mokhel, A.A., 2014. *Egypt. J. exp. Biol. (Zool.)*, **10**: 35-39.

Norton, D.C., 1983. *Pl. Dis.*, **67**: 253-256. https://doi.org/10.1094/PD-67-253

Qamar, F., Husain, S.S., Khan, A., Seema, N. and Badar, Y., 1993. *Pakistan J. agric. Sci.*, **30**: 272-274.

Riggs, R.D. (ed.), 1982. Nematodes in the southern region of United States. *South. Coop. Ser. Bull.*, 276. Arkansas Agricultural Experimental Station, University of Arkansas, Fayetteville.

Seinhorsti, J.W., 1959. *Nematologica*, **4**: 58-67.

S'Jacob, R.A. and Van Bezooyen, J., 1984. *A manual for practical work in nematology*. International Course on Plant Protection, Wageningen, The Netherlands, IAC, pp. 76.

Taylor, D.P. and Netscher, C., 1974. *Nematologica*, **20**: 268-269. https://doi.org/10.1163/187529274X00285

Tylka, G.L., Todd, T.C., Niblack, T.L., MacGuidwin, A.E. and Jackson, T., 2011. *Pl. Hlth. Progr.*, **12**: 1-18. https://doi.org/10.1094/PHP-2011-0901-01-DG

Windham, G.L., 1998. In: *Plant and insect nematodes*, (ed. W.R. Nickle). Marcel Dekker, New York, pp. 335-357.

Zar, J.H., 2008. *Biostatistical analysis*. Prentice-Hall, New Jersey, USA.