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Nematodes Associated with Two Species of *Mentha* (Lamiaceae) in Balochistan, Pakistan

Aly Khan[a]*, Manzoor Hussain Soomro[b], Javaid Akhtar[a], Syed Shahid Shaukat[c]
[a]Crop Diseases Research Institute, PARC, University of Karachi, Karachi-75270, Pakistan
[b]Science Foundation (ECOSF), 1 Constitution Avenue, G-5/2, Islamabad, Pakistan
[c]Institute of Environmental Studies, University of Karachi, Karachi-75270, Pakistan

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Abstract. Nematodes associated with *Mentha spicata* L. and *Mentha longifolia* L. were investigated in Balochistan in various localities so as to assess the variation in density of different nematode species found in the rhizosphere. Ten species of nematodes were found associated with *Mentha spicata* while four species were found in the rhizosphere of *M. longifolia*. Significant differences in nematode density were recorded (p at the most $p < 0.01$). The dominant nematodes associated with *Mentha spicata* were *Pratylenchus projectus* and *Merlinius khuzdarensis* while those associated with *Menthe longifolia* were *Xiphinema americanum* and *Pratylenchus thornei*.

Keywords: mint, Balochistan, plant parasitic nematodes

Introduction

Mint (*Mentha*) is a genus of plants in the family Lamiaceae. Almost 13-18 species exist and exact distinction between the existing species is unclear (Bunsawat *et al*., 2004). It is sub-cosmopolitan distributed across Europe, Australia, Africa, Asia and North America. Although the mint species are widely distributed and can be found in many environments, majority grow better in moist soils and wet environments such as near pools of water, lakes, rivers and cool moist localities in partial shade (Bradley, 1992).

It is cultivated for its aroma, culinary use and medicinal properties. The common diseases associated with mint are leaf blight, *Fusarium* wilt, and stolon rot besides plant parasitic nematodes. Several nematode species have been found to be associated or parasitizing *Mentha* spp. in different countries. Khanzada *et al*. (2012) studied thirteen mint species for the presence of nematodes associated with their rhizosphere. *Tylenchorhynchus* spp. were found to be associated with highest number of mint species which were seven while *Trichodorus* was found associated with only one mint species. The highest population recorded was of *Helicotylenchus* from six species. There were six genera of plant nematodes found associated with *Mentha*, namely *Helicotylenchus* sp., *Hoplolamous* sp., *Longidorus* sp., *Tylenchorhynchus* sp., *Trichodorus* sp. and *Xiphenima* sp. (Vovlas *et al*., 2006) recorded cystoids nematode *Meloidoderita kirjanovae* associated with *Mentha aquotica* from Southern Italy. Hafez *et al*. (2010) reported following nematodes from *Mentha piperita* namely *Helicotylenchus digonicus*, *Mesacriconema ornatum*, *Pratylenchus projectus*, *P. tenuicaudatus*, *P. coffeae*, *P. penetrans*, *P. thornei* and *Tylenchorhynchus clarus* while those associated with *Mentha spicata* were *Aphenenchoides fragariae*, *Pratylenchus lepidus*, *P. projectus*, *P. coffeae*, *P. neglectus* and *P. penetrans* from Idaho, USA.

Sultan *et al*. (2013) conducted intensive survey of plant nematodes associated with *Mentha arvensis*. The results indicated that 19 out of 24 samples in Uttar Pradesh, India had plant nematodes including *Hoplolaimus* spp.; *Meloidogyne incognita*, *Helicotylenchus* spp. and *Tylenchorhynchus* spp. In similar studies Haseeb and Pandey (1989) reported *Meloidogyne javanica* and *Meloidogyne incognita* associated with Japanese mint (*Mentha arvensis*) in Uttar Pradesh, India. The severity of infection of *M. incognita* was more prevalent although it varied from variety to variety.

Plant nematode reduces the yield of *Mentha* spp. causing economic losses. Diverse climatic conditions in Balochistan along with different cropping sequence are considered to be highly conducive for the multiplication of plant nematodes. Information concerning the distribution and occurrence of nematodes in Balochistan is of significant importance to assess their potential to cause economic damage for *Mentha* crop.

*Author for correspondence; E-mail: aly.khan@hotmail.com

In the present investigation nematodes associated with two mint species namely *Mentha spicata* L. and *Mentha longifolia* L. are being reported from different localities of Balochistan.

Materials and Methods

In November 2014 rhizosphere soil from two mint species namely *Mentha spicata* L. and *M. longifolia* L., showing either yellowing, stunted patches or foliar burning system were collected from different localities of Khuzdar and Kalat districts, Balochistan. *M. spicata* samples were collected from Baghbana, Khuzdar, Rahimabad and Wadh while *M. longifolia* were collected from Alizai, Kalat, Kork and Mengalabad.

A total of six samples were taken from each locality from a depth of 0–10 cm. Information on most of the sites was not available but the most common sequence pattern was onion and wheat. Soil type in the region was usually loamy sand (76% sand, 15% silt, 9% clay) and pH for the field soil ranged from 7.7 to 7.9. Samples collected were placed in labeled plastic bags, sealed and brought back to the Nematology Laboratory, PARC where they were stored at 5 °C until processed for nematode extraction (Mckenry and Roberts, 1985). Collected nematode population in petri plates were identified and counted under stereo-binocular microscope. The nematodes were counted in a glass chamber. Identification of nematode species was based on the morphology and measurements (Choi, 2001, Siddiqi, 2000).

One-way analysis of variance (ANOVA) for each species was performed with localities as the factor. Fisher's least significant difference (LSD) was calculated at $p = 0.05$. In addition, standard error (SE) is given against means (Zar, 1996).

Results and Discussion

The nematodes associated with mint (*Mentha spicata*) were *Filenchus* sp.; Andrássy, 1954; *Helicotylenchus digonicus* Perry, 1959; *H. inducus* Siddiqi, 1963; *Longidorus* sp., (Nicol, 1922) Meyl, 1961; *Merlinius khuzdarensis* Handoo *et al*., 2007; *Pratylenchus projectus* Jenkins, 1956; *P. penetrans* (Cobb, 1917) Filipjev and Stekhoven, 1941; *P. thornei* Sher and Allen, 1953; *Tylenchorhynchus* sp., Cobb, 1913 and *Xiphinema basiri* Siddiqi, 1959. *M. spicata* growingin Rahimabad, Balochistan were infected with ten different nematode species (Fig. 1).

While the nematodes associated with mint species (*M. longifolia*) were *Hoplolaimus* sp., von Daday, 1905, *Pratylenchus penetrans*; *P. thornei* and *Xiphinema americanum* Cobb, 1913. *M. Longifolia* growing in Kork were infected with four different nematodes belonging to three genera (Fig. 2).

The results of *Mentha spicata* for differences in density among four localities are given in Table 1. All ten species showed highly significant differences among

Fig. 1. *Mentha spicata* L. growing in Rahimabad, Balochistan infested with ten different nematode species.

Fig. 2. *Mentha longifolia* L. growing in Kork, Balochistan infected with four nematode species.

Table 1. Results of ANOVA of *Mentha spicata* for differences in density of nematodes of 4 localities

Nematodes	Localities				F	LSD
	1	2	3	4		0.05
Filenchus sp.	163 ± 32	28 ± 6.13	415 ± 106	37±11.97	10.56 p<0.001	116.02
Helicotylenchus digonicus	135.66 ± 55.59	0	0	0	21.18 p<0.001	42.75
H. indicus	89.66 ± 13.11	26.5 ± 6.32	16.5 ± 1.65	129.5 ± 1.45	56.13 p<0.001	21.68
Longidorus sp.	358.83 ± 75	0	10 ± 1.46	18 ± 2.51	1970.2 p<0.001	11.64
Merlinius khuzdarensis	362.5 ± 8.61	0	10 ± 1.39	18.66 ± 1.67	1599.13 p<0.001	13.06
Paratylenchus projectus	439.3 ± 28.6	14.33 ± 1.35	36.16 ± 10.24	230.5 ± 57.21	37.67 p<0.001	95.29
P. penetrans	0	43.16 ± 2.62	55.5 ± 4.34	37.83 ± 3.93	55.33 p<0.001	9.48
P. thornei	0	0	107 ± 0.89	101 ± 9.22	13.78 p<0.001	50.3
Tylenchorhynchus sp.	0	0	61.83 ± 0.90	49.16 ± 12.41	27.23 p<0.001	18.54
Xiphinema basiri	160 ± 0.57	0	0	0	768 p<0.001	0.8515

*Localities 1 = Baghbana; 2 = Khuzdar; 3 = Rahimabad; 4 = Wadh.

Table 2. Results of ANOVA of *Mentha longifolia* for differences in density of nematodes of 4 localities

Nematodes	Localities				F	LSD
	1	2	3	4		0.05
Hoplolaimus sp.	0	42.16 ± 0.80	147.16 ± 11.80	8.16 ± 0.47	131.95 p<0.001	17.38
Pratylenchus penetrans	0	14.16 ± 1.70	9.83 ± 2.12	15.5 ± 2.58	13.50 p<0.001	5.63
P. thornei	0	0	203.3 ± 55.47	52.8 ± 13.71	11.80 p<0.001	82.53
Xiphinema americanum	366.66 ± 134.6	47.33 ± 10.97	178.66 ± 3.28	0	5.944 p<0.01	198.56

*1 = Alizai; 2 = Kalat; 3 = Kork; 4 = Mengalabad.

localities ($p < 0.001$). The results of *Mentha longifolia* for density variation in the selected localities are presented in Table 2. Three species including *Hoplolaimus* sp. *P. penetrans* and *P. thornei* showed significant differences ($p < 0.001$) between localities while *X. americanum* showed significant difference at $p < 0.01$.

Some reports suggested that yield losses by different plant parasitic nematodes to mint crop can aggravate if *Verticillium* wilt disease is present in the fields, as the nematode feeding sites may become entry for fungi in the roots (Weller *et al*., 1998). Rhoades (1983) suggested that root weight was significantly reduced by all three nematodes *Belonolaimus longicaudatus*, *Dolichodorus heterocephalus* and *Pratylenchus scribneri* of mint in a pot trial. Rakesh *et al*. (2010) suggested that root-knot nematodes (*Meloidogyne incognita* and *M. javanica*) and root lesion nematode (*Pratylenchus thornei*) affect cultivation of menthal mint in Indo-Gangetic plains.

Johnson and Santo (2001) reported that nematode pathogen cause disease complex between *Pratylenchus penetrans* and *Verticillium dahlia* on mint.

Bergeson and Green (1979) studied association of nematode with 3 cultivars of *M. piperita*, *M. spicata* cv. Native and *M. cardiaca* cv. Scotch in Indiana, USA. Three most frequent nematodes were *Pratylenchus penetrans*, *Longidorus* sp. and *Xiphinema americanum*. They further tested susceptibility of three *M. piperita* cultivars to *P. penetrans* in a pot experiment. In another pot experiment, an inoculum of 5000 nematodes/pot resulted in reduction in root weight of cv. Black Mitcham, Murray Mitcham and Todd's Mitcham by 48, 59 and 41%.

This study on plant parasitic nematodes associated with *Menth* species shall provide important information to extension staffs so that they could create awareness among the growers.

Conflict of Interest. The authors declare no conflict of interest.

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