

Prevalence of nematodes in different districts of Punjab, Pakistan

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Abstract

During the survey a total 69 soil samples were collected from various agro-ecological areas with different cropping history in six districts comprising Mianwali, Bhakkar, Gujranwala, Sialkot, Gujrat and Mandi Bahauddin of Punjab province, Pakistan and assessed for nematode populations. Analysis of soil samples revealed the presence of eight genera of plant parasitic and soil nematodes. The most frequently isolated nematode population from all the soil samples were *Tylenchorhynchus* sp., *Xiphinema* sp., and *Cephalobus* sp. Prevalence of nematodes were high in districts Mandi Bahauddin and Gujranwala with soil cropping history of maize and rice cultivation.

Keywords: Nematodes, *Tylenchorhynchus*, *Xiphinema*, *Cephalobus*, Punjab

In many aspects of soil processes, soil nematodes have the potential value in relation to collaborative studies with microbiologists and other scientists to understanding the soil process in agricultural soils. The nematodes occurred as the micro fauna in the most numerous component of agricultural soils and are important pests of crop and animals as well as involved in nutrient mineralization, bio-control agents of fungi and insects. The nematode community structure and ecology have focused on semi-natural and natural system (Bongers & Yeates, 1988). These approaches required greater knowledge of biodiversity, massive effort for enumerating of soil nematodes (Lawton *et al.*, 1998).

The nematodes were ubiquitous inhabitant of soil, subsisting on living organisms and contributing their biomass to other soil biota. They were the most abundant soil metazoans and exceeded in species diversity only by the arthropods (Sohlenius, 1980). Soil nematodes can be measured either as microfauna or as mesofauna having significant functions in soil (Freckman & Caswell, 1985; Bongers, 1986).

Soil sample analysis was under taken for the prevalence of nematodes at different crop cultivations in different agro ecological climatic conditions in Punjab province. The nematode populations were assessed with their respect hosts.

Materials and Methods

Survey was conducted to collect samples from different districts including Mianwali, Bhakkar, Gujranwala, Sialkot, Gujrat and Mandi Bahauddin of Punjab Province and collected a total 69 soil samples with different cropping history from various agricultural fields. These soil samples were brought to the Plant Nematology Laboratory (F-241), Crop Diseases Research Program (CDRP), Institute of Plant and Environmental Protection (IPEP), National Agricultural Research Center (NARC), Park Road Islamabad for the isolation and identification of nematodes.

The soil samples were properly arranged according to the provided information as location, collection date, village name, farmer

name, crop history, district and kept in refrigerator for routinely processing. Usually the sieving and decanting techniques (Barker, 1985) were used for the isolation of nematodes from the soil samples. However, nematode populations recovered from the series of sieves were counted in counting dish for the quantitative data collection of each soil sample. According to De Grisse (1969) the nematode were fixed in TAF (Tri-ethanol amine Formaline) for the identification of isolated nematode population, while the slides were prepared by the method described by Hooper (1986). The nematodes were identified up to generic level, based on morphological characteristics of nematode (Mai & Lyon, 1975).

Results and Discussion

Several nematode genera were isolated and identified from different localities (Table 1). The nematode fauna and population variation occurred in these locations, which differed among each other in various districts. From district Mianwali, soil samples collected from 15 villages with different soil ecologies and cropping history. The highest nematode population was recovered from Chack, 8 mile, with cropping history of cultivation of mung followed by Chack 5-6 and Chack 10 mile had soil ecology vegetation were water melon and barseem, respectively, while the least nematodes population recovered from Hafiz Wala, where soil ecology was gourd. The overall population reveals the trend of maximum, moderate and minimum levels in different locations of district Mianwali. Four soil samples were collected from district Bhakkar, where land was cultivated by millet, wheat and sugarbeet. The nematode population was found maximum in location Hattarwali (Shumali) followed by Ghulaman Wala and minimum from Pattiwala location. In district Gujranwala, ten locations were surveyed and the soil samples were collected from rice, wheat, maize and sunflower. Nematode recovered in high densities and population from Rana Village followed by Naeem Colony I, Taliwala I and Patuki II, Wazirabad with crops

as sunflower, rice and maize, respectively. The low population was isolated from Patuki I in maize crop. Only four soil samples were collected from district Sialkot and one from Gujrat had cultivated crops as rice and maize. The nematode population was maximum in Habibpur II village and minimum from Kothiala II from maize. A total 35 soil samples were collected from district Mandi Bahauddin from different locations. From location Chack 38 in maize crop, the highest nematode population was recovered followed by Rato, Dhok Qasib (Mitha Khu), Thata, Saida I and Qaidabad with soil crop history as fallow land, maize, fallow land, rice and maize simultaneously. The decreasing trend in nematode population was observed in locations Karmawala in maize, Mangat and Ajwal from cropping history of rice and maize, respectively.

The nematode populations identified (Table 2) and categorized according to the similarity of crops history in these locations. The identified nematode genera in these soil samples were *Helicotylenchus* sp., *Hoplolaimus* sp., *Trichodorus* sp., *Tylenchorhynchus* sp., *Longidorus* sp., *Xiphinema* sp., *Cephalobus* sp., *Diplogaster* sp., *Mononchus* sp., and *Rhabditis* sp., while the most frequently isolated nematode from all the soil samples were *Tylenchorhynchus* sp., *Xiphinema* sp., and *Cephalobus* sp. However, high prevalence of nematode genera was found at districts Mandi Bahauddin and Gujranwala with crop history of maize and rice. *Helicotylenchus* sp., *Hoplolaimus* sp., *Tylenchorhynchus* sp., and *Xiphinema* sp., were isolated from mung, tobacco, maize, while *Cephalobus* sp., *Diplogaster* sp., *Mononchus* sp., and *Rhabditis* sp., were isolated from maize and rice. In soil nematodes, biodiversity was useful in detection of indicator species (Norton, 1978).

Among the Phylum Nematoda orders Rhaditida, Tylenchida, Aphelenchida and Dorylaimida are particularly common in soil ecologies (Mc Sorley, 2007). However, adequate taxonomic knowledge to identify particular organism efficiently and accurately was essential (Neher *et al.*, 1995).

Table 1. Collection sites of different districts of Punjab, their cropping history and the nematode population isolated from the soil samples.

Sites of soil sample	Cropping history	Nematode population (100 g)
District Mianwali		
Musa Wali, Piplan	Sugarcane (<i>Saccharum officinarum</i> L.)	198
Matta Jae, Piplan	Mung (<i>Vigna radiata</i> (L.) Wilezek)	825
Jhamber, Piplan	Mung (<i>Vigna radiata</i> (L.) Wilezek)	528
Chak, 8 mile, Piplan	Mung (<i>Vigna radiata</i> (L.) Wilezek)	1188
Chak, 10 mile, Piplan	Barseem (<i>Trifolium alexandrinum</i> L.)	1089
Chak, 9 mile, Piplan	Mung (<i>Vigna radiata</i> (L.) Wilezek)	759
Chak, 19 mile, Piplan	Mung (<i>Vigna radiata</i> (L.) Wilezek)	462
Chak, 5 and 6, Piplan	Water melon (<i>Citrullus lanatus</i> (Thunb.) Matsum. & Nakai)	1089
Hafiz Wala, Piplan	Gourd (<i>Lagenaria siceraria</i> (Molina) Standl.)	132
Chak, 11 mile, Piplan	Wheat (<i>Triticum aestivum</i> L.)	165
Jalalpur, Esa Khel	Tobacco (<i>Nicotiana</i> sp.)	891
Kamar Mushani, Esa Khel	Chillies (<i>Capsicum annum</i> L.)	330
Ganda, Mianwali	Tobacco (<i>Nicotiana</i> sp.)	495
Ganda, Mianwali	Tobacco (<i>Nicotiana</i> sp.)	764
Ganda, Mianwali	Tobacco (<i>Nicotiana</i> sp.)	924
District Bhakkar		
Hattarwali, Shumali, Kallur Kot	Millet (<i>Pennisetum glaucum</i> (L.) R. Br.)	660
Muqlian Wala, Kallur Kot	Millet (<i>Pennisetum glaucum</i> (L.) R. Br.)	363
Pattiwala, Kallur Kot	Wheat (<i>Triticum aestivum</i> L.)	132
Ghulaman Wala, Kallur Kot	Sugarbeet (<i>Beta vulgaris</i> L.)	429
District Gujranwala		
Naeem colony I, Wazirabad	Rice (<i>Oryza sativa</i> L.)	2013
Naeem colony II, Wazirabad	Vegetable	396
Raam Gharh I, Wazirabad	Wheat (<i>Triticum aestivum</i> L.)	496
Raam Gharh II, Wazirabad	Rice (<i>Oryza sativa</i> L.)	132
Patuki I, Wazirabad	Maize (<i>Zea mays</i> L.)	66
Patuki II, Wazirabad	Maize (<i>Zea mays</i> L.)	1386
Narkay, Wazirabad	Rice (<i>Oryza sativa</i> L.)	759
Rana, Wazirabad	Sunflower (<i>Helianthus annuus</i> L.)	3135
Taliwala I, Wazirabad	Maize (<i>Zea mays</i> L.)	1584
Taliwala II, Wazirabad	Rice (<i>Oryza sativa</i> L.)	462
District Sialkot		
Kothiala I, Samrial	Rice (<i>Oryza sativa</i> L.)	264
Kothiala II, Samrial	Maize (<i>Zea mays</i> L.)	33
Habibpur I, Samrial	Maize (<i>Zea mays</i> L.)	99
Habibpur II, Samrial	Maize (<i>Zea mays</i> L.)	297

District Gujrat		
Mota, Kalan	Maize (<i>Zea mays</i> L.)	198
District Mandi Bahauddin		
Khytiyala, Mandi Bahauddin	Rice (<i>Oryza sativa</i> L.)	231
Aaki, Mandi Bahauddin	Maize (<i>Zea mays</i> L.)	495
Chak-13, Mandi Bahauddin	Maize (<i>Zea mays</i> L.)	264
Chak-39, Mandi Bahauddin	Rice (<i>Oryza sativa</i> L.)	363
Bachar, Mandi Bahauddin	Maize (<i>Zea mays</i> L.)	957
Eidal, Mandi Bahauddin	Vegetable	297
Chak-5, Malakwal	Maize (<i>Zea mays</i> L.)	990
Shumari, Malakwal	Sugarcane (<i>Saccharum officinarum</i> L.)	330
Wara Alam Shah, Malakwal	Maize (<i>Zea mays</i> L.)	495
Ajwal, Malakwal	Maize (<i>Zea mays</i> L.)	198
Ghor, Malakwal	Maize (<i>Zea mays</i> L.)	627
Burj Aqrah, Phalia	Maize (<i>Zea mays</i> L.)	495
Bherwal, Phalia	Rice (<i>Oryza sativa</i> L.)	231
Chot Khurd, Phalia	Canola (<i>Brassica</i> sp.)	726
Qadarabad, Phalia	Maize (<i>Zea mays</i> L.)	825
Qaidabad, Phalia	Maize (<i>Zea mays</i> L.)	1914
Janewal, Phalia	Rice (<i>Oryza sativa</i> L.)	396
Saida I, Phalia	Rice (<i>Oryza sativa</i> L.)	2112
Saida II, Phalia	Maize (<i>Zea mays</i> L.)	594
Thata, Phalia	Fallow	2178
Dhoke Kalan, Phalia	Maize (<i>Zea mays</i> L.)	957
Kot Hamid Shah, Phalia	Maize (<i>Zea mays</i> L.)	990
Mangat, Phalia	Rice (<i>Oryza sativa</i> L.)	165
Chak-38, Phalia	Maize (<i>Zea mays</i> L.)	4851
Rato, Phalia	Fallow	3861
Raikay, Phalia	Maize (<i>Zea mays</i> L.)	792
Luck, Phalia	Maize (<i>Zea mays</i> L.)	1254
Dala Chak, Phalia	Fallow	1023
Mano Chak, Phalia	Maize (<i>Zea mays</i> L.)	623
Marala, Phalia	Maize (<i>Zea mays</i> L.)	623
Dhok Qasib, Mitha Khu, Phalia	Maize (<i>Zea mays</i> L.)	3564
Makhnawali, Phalia	Maize (<i>Zea mays</i> L.)	1122
Karmawala, Phaila	Maize (<i>Zea mays</i> L.)	66
Draikan, Phalia	Maize (<i>Zea mays</i> L.)	429
Dera Behram, Phalia	Maize (<i>Zea mays</i> L.)	825

Table 2. Nematodes isolated and identified of different villages in the districts of Punjab.

District locations	*Nematode genera									
	<i>Helico.</i>	<i>Hoplo.</i>	<i>Tricho.</i>	<i>Tylencho.</i>	<i>Longi.</i>	<i>Xiphi.</i>	<i>Cepho.</i>	<i>Diplo.</i>	<i>Monon.</i>	<i>Rhabd.</i>
Mianwali										
Sugarcane	-	-	-	-	-	+	-	-	-	-
Mung	+	+	-	+	-	+	+	-	-	-
Barseem	-	+	-	+	-	+	-	-	-	-
Water melon	-	-	-	+	-	+	-	-	-	-
Gourd	-	+	-	+	-	-	-	-	-	-
Wheat	-	-	-	-	-	+	+	-	-	-
Chillies	-	-	-	+	-	-	-	-	-	-
Tobacco	-	+	-	+	+	+	+	-	-	-
Bhakkar										
Millet	+	-	-	+	-	+	+	-	-	-
Wheat	-	-	-	-	-	-	+	-	-	-
Sugarbeet	-	-	-	+	-	-	+	-	-	-
Gujranwala										
Rice	-	+	-	+	-	+	+	+	-	+
Wheat	-	-	-	+	-	+	+	-	-	-
Maize	+	+	+	+	-	+	+	+	-	-
Sunflower	+	-	-	-	-	+	-	+	-	-
Sialkot										
Rice	-	-	-	-	-	+	+	-	-	-
Maize	+	+	-	-	-	+	+	+	-	-
Gujarat										
Maize	-	-	+	-	-	+	+	-	-	-
Mandi Bahauddin										
Rice	-	+	-	+	+	+	+	+	-	+
Maize	+	+	-	+	+	+	+	+	+	+
Sugarcane	-	-	-	+	-	-	+	-	-	-
Canola	-	-	-	+	-	-	+	+	-	-

**Helico.* = *Helicotylenchus* sp., *Hoplo.* = *Hoplolaimus* sp., *Tricho.* = *Trichodorus* sp., *Tylencho.* = *Tylenchorhynchus* sp., *Longi.* = *Longidorus* sp., *Xiphi.* = *Xiphinema* sp., *Cephalo.* = *Cephalobus* sp., *Diplo.* = *Diplogaster* sp., *Monon.* = *Mononchus* sp., *Rhabd.* = *Rhabditis* sp.

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