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STUDIES ON THE OCCURRENCE, DISTRIBUTION AND COMMUNITY OF THE NEMATODES ASSOCIATED WITH GROUNDNUT FROM HOOGHLY DISTRICT OF WEST BENGAL, INDIA

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ABSTRACT

In a survey of four major groundnut growing blocks of the Hooghly district of West Bengal forty-three samples of soil were sampled for the purpose of studying the occurrence and distribution of rhizospheric nematodes population. Community study revealed presence of six nematode genera *viz*., *Criconemoides*, *Rotylenchulus, Tylenchorhynchus*, *Meloidogyne*, *Hirschmanniella*, and *Pratylenchus* in the rhizosphere of groundnut crop. Most predominant phytonematode in groundnut has been identified as *Criconemoides* sp. which is followed by *Rotylenchulus* and *Tylenchorhynchus*. The species of nematodes such as *Meloidogyne incognita* and *Meloidogyne javanica* were identified. *Criconemoides* sp. and *Tylenchorhynchus mashhoodi* were recorded highest from Chiladangi area of Pursurah block of Hooghly district. *Meloidogyne incognita* was recorded maximum from Haripal block. *Rotylenchulus reniformis* was also recorded in huge number from Samanta Road areas of Pursurah block. Apart from these plant parasitic nematodes, mononchids (especially *Mylonchulus* sp.) the predatory nematodes and saprophytic nematodes have also shown their presence in the population of the wide ranged nematodes associated with groundnut crop.

Introduction

Groundnut (*Arachis hypogaea* L.) is a legume crop which is annual in habit, also known as peanut, earthnut etc. It is the 4th most important oilseed crop and 13th most important food crop of the globe. Groundnut seeds are rich in elements like zinc, iron, riboflavin, thiamine, potassium and many others. Groundnut seeds can be consumed in different ways: raw, roasted or boiled kernels or the oil in culinary purpose. It is also used for feeding animals (oil pressings, seeds, green material and straw) and as industrial raw material (oil cakes and fertilizer). The multipurpose nature of groundnut plant makes it an important cash crop for domestic use as well as for foreign trading (Stigter, 2006).

Groundnut originated in South America (Wiess, 2000). In the tropical countries it is mostly cultivated. Major groundnut cultivating countries are China (40.1%), India (16.4%), Nigeria (8.2%), USA (5.9%) and Indonesia (4.1%) (Stigter, 2006).

Among oilseeds crops in India, groundnut accounts for about 50% of the area and 45% of oil production. In India, about 75% of the groundnut area lies in a low to moderate rainfall zone (parts of peninsular region and western and central regions) with a short period of distribution (90-120 days). Total area of groundnut in West Bengal is 65,826 hectares with an annual production of1, 13,018 tonnes and yield 1717 kg/ha (Anon., 2010).

Major nematode pests of groundnut include dagger nematode (*Xiphinema* spp.), pod lesion nematode (*Tylenchorhynchus brevilineatus*, *Tylenchorhynchus brevicaudatus*), ring nematode (*Criconemoides ornatus*), root-knot nematodes (*Meloidogyne arenaria, Meloidogyne javanica*, *Meloidogyne hapla*), root lesion nematode (*Pratylenchus brachyurus*, *Pratylenchus coffeae*), seed and pod nematode (*Ditylenchus destructor*), spiral nematode (*Scutellonema cavenessi*), sting nematode (*Belonolaimus gracilis, Belonolaimus longicaudatus*) and groundnut testa nematode (*Aphelenchoides arachidis*) (http://en.wikipedia.org).

The most serious nematode pest of peanut is *Meloidogyne arenaria* race 1, the peanut root-knot nematode. It can be expected to occur wherever peanuts are grown. Pod rot, white mold, and other soil-borne diseases may increase when the peanut plant is infected with this root-knot nematode. The lesion nematode, *Pratylenchus brachyurus,* is less troublesome, but it can reduce yields and seriously disfigure the peanut hulls with unattractive brown lesions that lead to pod rotting.

In southern part of India, several studies pertaining to plant parasitic nematode community (Mani and Kumar, 1992; Reddy *et al*.,1993; Senthamizh and Sivakumar, 2004), their pathogenicity (Kalaiarasan *et al.,* 2006) and management (John *et al*, 2006; Kalaiarasan *et al.,* 2006) in groundnut have already been made but still there is hardly any information with regard to the occurrence and

distribution of phytonematodes on groundnut in West Bengal though the crop has been growing since twenty years in some areas of the state.

The present experimentation was hence undertaken to study the occurrence, distribution and community of the nematodes associated with groundnut.

Materials and Methods

This chapter is dealing with survey for collection of nematode populations, counting of the population and preparation of permanent slides for identification.

a. Surveying and collecting samples of nematode populations

Forty-three soil samples (200cc) were collected from the ground nut fields of Hooghly district of West Bengal, India during May, 2012. Survey was conducted in four major groundnut growing blocks (Haripal, Pursurah, Khanakul-I and Jangipara) of the district. GPS (Geographical Positioning System) information for the each area under survey was also recorded during sampling. Soil samples from the groundnut grown fields were collected by making a 'V' shaped core of 20cm depth with the aid of *khurpi* from the rhizospheric region of the crop. Ten such samples were made into a composite sample and were carried in polybags after proper labelling which were brought to the laboratory and kept at 5°C in refrigerator.

b. Extraction of nematode population from soil sample

The extraction method for the processing of the soil samples were decanting and sieving method (Cobb, 1918) followed by Baermann technique (Christie and Perry, 1951).

c. Killing and fixing of nematodes

The hot water bath method was used to kill the nematodes at 60-65°C. Then the suspension of nematode was kept out of hot water to bring the suspension at room temperature as well as to allow the nematode for settling at the bottom of suspension. To concentrate the nematode suspension, excess amount of water was removed gently from the top of suspension by means of dropper without disturbing the whole. Fixing of nematodes are done by the help of formalin glacial acetic acid (4:1). These are kept separately in labelled vials.

d. Nematode population estimation

Nematode suspension was measured in a measuring cylinder to measure the volume of the suspension. Using multi-chambered counting disc nematodes were counted under stereoscopic binocular microscope (Carl Zeiss-Stemi 2000C). The mean of three aliquot was taken from nematode suspension from each location for calculating the population density per 200cc of soil.

e. Statistical analysis

For community study, absolute frequency and relative frequency, absolute density and relative density, and prominence value (absolute and relative) of major rhizospheric nematodes of groundnut were determined according to the formulae given by Norton (1978).

Results and Discussion

a. Occurrence and distribution of rhizospheric nematode population of groundnut in Hooghly district of West Bengal

Forty three soil samples from groundnut fields of Hooghly district were collected to study the occurrence of associated nematode species. Survey was conducted in four major groundnut growing blocks (Haripal, Pursurah, Khanakul-I and Jangipara) of the district. Six genera of plant parasitic nematodes (*Criconemoides*, *Rotylenchulus, Tylenchorhynchus, Meloidogyne, Hirschmanniella* and *Pratylenchus*) were encountered from the soil samples. Of which, *Criconemoides*, *Rotylenchulus, Tylenchorhynchus* and *Meloidogyne* were more frequent over other genera of plant parasitic nematodes (Table 2). *Criconemoides* were recorded in the range of 31-2016/200cc of soil, the highest being from Chiladangi area of Pursurah block of Hooghly district (Table 1).

High population of *Tylenchorhynchus mashhoodi* (906/200cc of soil) and *Meloidogyne* spp. (173.5/200cc of soil) were also recorded from this same locality of Pursurah block. *Rotylenchulus reniformis* was also recorded in huge number (2642/200cc of soil) from Samanta Road areas of Pursurah block.

Presence of *Hirschmanniella* in the soil may be due to the existence of rice based cropping system in the surveyed areas of the district. Saprozoic nematodes were also recorded in huge number from all the soil samples collected from the district.

Table 1: Occurrence and distribution of rhizospheric nematode population of groundnut in Hooghly district of West Bengal

Block (Geographical position)	Locality (No. of sample)	Mean population/200cc of soil								
		Mi	***Mj***	***Tyl***	***Roty***	***Crico***	***Praty***	***Hirsch***	**Mon**	**Sapro**
Haripal (22°49.944´N 88°9.408´E & msl 205ft)	Nalikul (2)	186.3	20.7	89.0	0.0	0.0	0.0	59.0	29.6	1184.0
	Belechonga (2)	0.0	0.0	116.5	0.0	474.0	71.5	43.0	0.0	647.5
Pursurah (22°48.003´-22°51.312´N 88°9.345´-88°9.374´E & msl 59-238ft)	Samanta Road (3)	0.0	0.0	126.7	2642.0	31.0	0.0	10.3	0.0	578.7
	Balarampur (8)	63.6	20.6	408.4	256.1	449.1	33.8	69.9	0.0	1030.4
	Chiladangi (5)	173.5	48.9	906.0	6.4	2016.0	11.0	77.2	0.0	672.6

Khanakul-I (22°43.344´-22°46.163´N 87°55.61´-88°56.129´E & msl 39-63ft)	Balipur (10)	50.3	0.0	201.9	1014.7	402.1	3.2	26.0	9.9	1452.6
	Purba Radhanagar (7)	39.9	0.0	75.9	0.0	307.6	4.1	19.3	3.9	881.6
	Arunda (4)	47.1	11.2	280.3	1929.3	323.3	0.0	0.0	6.1	747.8
Jangipara (22°44.542´N 87°55.838´E & msl 37ft)	Radhanagar (2)	21.0	15.0	477.0	53.0	470.0	0.0	35.0	0.0	1273.0

Note: Mi- Meloidogyne incognita, Mj- M. javanica, Tyl- Tylenchorhynchus mashhoodi, Roty- Rotylenchulus reniformis, Crico- Criconemoides sp., *Praty- Pratylenchus* sp., *Hirsch – Hirschmanniella* spp., Mon- Mononchids, Sapro – Saprozoic nematode including free living dorylaimids and rhabditids

b. Community analysis of rhizospheric nematodes associated with groundnut in Hooghly district of West Bengal

Community analysis of major soil inhabiting plant parasitic nematodes associated with groundnut in Hooghly district of West Bengal is presented in the table-2. Six major plant parasitic nematode genera were identified from the rhizosphere of peanut. These were *Criconemoides* Taylor, 1936, *Rotylenchulus* Linford and Oliviera, 1940 *Tylenchorhynchus* Cobb, 1913, *Meloidogyne* Goeldi, 1892, *Hirschmanniella* Luc and Goodey, 1964 and *Pratylenchus* Filipjev, 1936.

Criconemoides sp. Taylor, 1936 has been identified as most predominant plant parasitic nematode in groundnut. *Rotylenchulus reniformis* Linford and Oliviera, 1940 and *Tylenchorhynchus mashhoodi* Siddiqi and Basir, 1959 were identified as prevalent nematode species under genera *Rotylenchulus* and *Tylenchorhynchus*, respectively. Among root-knot nematodes, two species *viz. Meloidogyne incognita* (Kofoid and White, 1919) Chitwood, 1949 and *Meloidogyne javanica* (Treub, 1885) Chitwood, 1949 were identified.

Table 2: Community analysis of rhizospheric nematodes associated with groundnut in Hooghly district of West Bengal.

Nematode spp.	Absolute frequency	Relative frequency	Absolute density	Relative density	PV	RPV
Criconemoides spp.	97.7	19.1	547.0	20.5	540.6	22.3
Rotylenchulus reniformis	51.2	10.0	674.2	25.3	482.3	19.9
Tylenchorhynchus mashhoodi	93.0	18.2	309.9	11.6	298.9	12.3
Meloidogyne incognita	67.4	13.2	61.0	2.3	50.1	2.1
Hirschmanniella spp.	48.8	9.5	37.5	1.4	26.2	1.1
Pratylenchus sp.	20.9	4.1	12.4	0.5	5.7	0.2
Meloidogyne javanica	20.9	4.1	11.3	0.4	5.2	0.2
Mononchids	11.6	2.3	4.4	0.2	1.5	0.1
Saprozoic nematodes	100.0	19.5	1011.8	37.9	1011.8	41.8

Note: PV=Prominence Value; PV=Absolute density $\sqrt{\text{Absolute Frequency}}$ *, RPV=Relative Prominence value*

Predominance of plant parasitic nematodes associated with peanut in Hooghly district of West Bengal is presented in descending order of their relative prominence value (Table 2).

In reference to the density (absolute & relative) and prominence value *Criconemoides* sp. ranked first followed by *Rotylenchulus reniformis*, *Tylenchorhynchus mashhoodi* and *Meloidogyne incognita*. Considering frequency (absolute & relative) of occurrence *Tylenchorhynchus mashhoodi* ranked second after *Criconemoides* sp. Hence, it is of utmost importance to find out and determine the population and nature of the nematodesin a huge community (Beals, 1960). The value found does not have much significance as per the pathogenicity is concerned among the members of a community. It was reported that *Rotylenchulus reniformis* is one of the key nematode parasite of crops in West Bengal at present (Mukhopadhyay and Haque, 1974; Mukherjee and Dasgupta, 1983; Mukhopadhyay and Roy, 2006; Roy *et al*., 2007; Roy and Mukhopadhyay; 2011). Root lesion nematode, *Pratylenchus* sp. was also recorded as a parasitic nematode in groundnut. Frequency of *Hirschmanniella* spp. was recorded as 48.8%. Farmers of the surveyed area used to follow rice-potato-groundnut cropping sequence. *Hirschmanniella* had been reported to be associated with rice, cabbage, sugarcane, vegetables, weeds and many other crops (Jairajpuri and Baqri, 1991). This finding too corroborates the present observation regarding close association of *Hirschmanniella* spp. with groundnut in West Bengal. Beside phytonematodes, mononchids (especially *Mylonchulus* sp.) the predatory nematodes were also found in a frequency of 11.6%. However, saprozoic nematodes comprising of free living dorylaimids and rhabditids were also observed as very prominent member among soil nematode communities of groundnut.

Conclusion

Six major plant parasitic nematode genera *viz*., *Criconemoides*, *Rotylenchulus*, *Tylenchorhynchus*, *Meloidogyne, Hirschmanniella* and *Pratylenchus* were identified from the rhizosphere of groundnut in the four block of Hooghly district. *Criconemoides* sp. has been identified as most predominant plant parasitic nematode in groundnut followed by *Rotylenchulus* and *Tylenchorhynchus*. *Criconemoides* (2016/200cc soil) and *Tylenchorhynchus mashhoodi* (906/200cc soil) were recorded highest from Chiladangi area of Pursurah block of Hooghly district.

Meloidogyne incognita was recorded maximum (186.5/200cc soil) from Haripal block. *Rotylenchulus reniformis* was also recorded in huge number (2642/200cc of soil) from Samanta Road areas of Pursurah block. Those areas could be treated as hot spot for the respective nematodes.

Rotylenchulus reniformis and *Tylenchorhynchus mashhoodi* were identified as prevalent nematode species under genera *Rotylenchulus* and *Tylenchorhynchus,* respectively.

Among root-knot nematodes, two species *viz. Meloidogyne incognita* and *Meloidogyne javanica* were identified.

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