

Survey and identification of plant parasitic nematodes associated with citrus in Dibrugarh district

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Abstract:

The present investigations were carried out to know the occurrence and distribution of plant parasitic nematodes associated with citrus plants of different citrus orchards in Dibrugarh district. Soil sample were collected from the different citrus orchards of seven blocks from Dibrugarh district. Eight genera of plant parasitic nematodes were found to be associated with citrus plants of Dibrugarh district. Genera of plant parasitic nematodes recorded were namely *Tylenchulus*, *Hoplolaimus*, *Helicotylenchus*, *Tylenchorhynchus*, *Meloidogyne*, *Xiphinema*, *Paratylenchus* and also nematodes genera found under criconematids.

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Community analysis of plant parasitic nematodes revealed that the genus *Hoplolaimus* ranked first in relative frequency, absolute frequency, absolute density, relative density and prominence value. Genus *Helicotylenchus* ranked second in absolute density, relative density and prominence value and genus *Tylenchorhynchus* ranked third in case of absolute density absolute frequency and prominence value. Results shown that *Tylenchulus semipenetrans* ranked second in absolute frequency and relative frequency and fourth in prominence value.

KEY WORDS: Survey, community structure, citrus orchard, nematodes

Introduction

Population densities of plant parasitic nematodes vary greatly in time and space under the influence of a complex of abiotic and biotic factors in their niche. The host growth, temperature, moisture and some physicochemical properties of the soil have been identified as the most important factors responsible for the spatial heterogeneity in nematode population

densities both horizontally and vertically in the soil profile as well as with time (Norton, 1979).

Chona *et al.*(1966) reported that *T.semipenetrans* is widely distributed in India and its association with decline of the tree has been recorded in Punjab, Delhi, Assam,Rajasthan, Orissa, West Bengal, Kerala and Maharashtra. Phukan and Sarmah(1983) recorded high population of *T.semipenetrans* from Dibrugarh district. The high population of nematode was also recorded from Karbi Anglong district (Anon.,1985). Sinha(1986) recorded presence of citrus nematode *T.semipenetrans* in five districts of Assam. (Cachar, Kamrup, Jorhat, Sivasagar, Dibrugarh). Sinha(1986;1988) reported that the citrus nematode, *T. semipenetrans* was as high as 38,000 per 200g and 1842 per 250g of soil respectively in Tinisukia district. Singh (1997) recorded that maximum population of citrus nematode during the month of January in Vidarbha region of Maharashtra. Crozzoliet *al.* (1998) surveyed the main citrus growing areas of Venezuela and collected a total of 1110 soil and root samples and analyzed. They found that thirty four species were associated with citrus and among them *T.semipenetrans* was most economically important and wide spread species. Bark *et al.*(2005) carried out a survey to know the frequency of occurrence of both root-knot nematodes *Meloidogyne* sp., and citrus nematode *T.semipenetrans*(Cobb,1913) in the new reclaimed lands in three different governorates in Egypt. Results revealed that percentage of occurrence of *Meloidogyne* sp., was 96.26% in the surveyed fields while *T.semipenetrans* was 85.18%. Nandwana *et al.*(2005) recorded that five phytonematodes were associated with citrus trees in orchards and nurseries in and around Jhalawar district, and among them *T.semipenetrans* was predominantly and most widely prevalent with highest prominence value followed by *Pratylenchus* sp.; *Helicotylenchus indicus*; *Rotylenchulus reniformis* and *Hoplolaimus indicus* respectively.

Zalpuri *et al.*(2013) surveyed occurrence of important plant-parasitic nematodes associated with citrus crops during 2008-2009 in Jammu Region and they found that *Meloidogyne javanica*, *Hoplolaimus* sp., *Xiphinema* sp., *Pratylenchus* sp., *T.semipenetrans* were mostly associated with the citrus crop. Anon.(2013) surveyed for the plant parasitic nematode associated with citrus growing areas of Tinisukia district. Soil and root samples were collected randomly from the different khasi mandarin orchards. Results revealed that seven species of plant parasitic nematodes were associated with khasi mandarin plants the Ibrahim Said K. *et al.* (2016) reported that the root knot nematode (*Meloidogyne* sp.), *Tylenchulus* sp.,

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Xiphenemasp., *Rotylenchussp.*, *Pratylenchussp.*, *Longidorussp.*, *Tylenchulussp.* and *Radhopholus sp.* were most common on citrus trees in Lebanon.

Very little work has so far been done on citrus crop in Assam, except work done by Phukan and Sarmah (1983) on survey of citrus nematode in Dibrugarh district, Assam. Therefore present investigation is an attempt to study the plant parasitic nematode associated with citrus and to study community structure of soil inhabiting nematodes in citrus orchards of Dibrugarh district of Assam.

Materials and Methods

Roving survey was carried out to know the different plant parasitic nematodes associated with citrus in Dibrugarh district. Soil samples including root were collected from the rhizosphere of various citrus plants. Each bulk sample was constituted of several sub samples. Samples were collected randomly and all relevant information was recorded at the time of collection of samples. The samples were transferred to laboratory and stored in refrigerator at 4°C till the extraction of nematode was made. The extraction of nematode from soil samples were done by modified Cobb's sieving and decanting technique (Christei and Perry 1951) and extraction of nematode from roots by Baermann funnel technique. The killing and fixing of nematodes were done in 8% hot formalin.

3.20. Community analysis of plant parasitic nematode

Community analysis of plant parasitic nematode was done by using the methods given by Norton, (1978).

3.21. Absolute frequency is expressed as a percentage

$$\text{Absolute frequency} = \frac{\text{Number of samples containing a species}}{\text{Number of samples collected}} \times 100$$

Results and Discussion

Eight genera of plant parasitic nematodes were recorded from the rhizosphere of citrus plants in different citrus orchards of Dibrugarh district.

The nematode genera recorded from seven blocks of Dibrugarh district were viz., *Hoplolaimussp.*, *Helicotylenchussp.*, *Tylenchorhynchussp.*, *Paratylenchussp.*, *Tylenchulussemipenetrans*, *Meloidogynesp.*, *Xiphinemasp.* and Criconematids. (Table-1.)

High population of *T. semipenetrans* was recorded from citrus growing areas of Dibrugarh district (Phukon and Sarmah; 1983) and from Karbi Anglong district. (Anon 1985). Sinha (1986) recorded presence of citrus nematode, *T. semipenetrans* in five districts of Assam. Anon. (2013) recorded seven genera of plant parasitic nematodes from the rhizosphere of khasi mandarin in Tinsukia district. Crozzoliet *al.* (1998) surveyed the main citrus growing areas of Venezuela and reported that 34 species were associated with citrus including *Hoplolaimussp.*, *Helicotylenchussp.*, *Tylenchorhynchussp.*, *Paratylenchussp.*, *Tylenchulussemipenetrans*, *Meloidogynesp.*, *Xiphinemasp.* and Criconematids.

5.2 Community analysis of plant parasitic nematodes

In the present investigation, Out of eight genera recorded, *Hoplolaimussp.* found to be the most frequently occurred plant parasitic nematode with an absolute frequency of 59.73 percent, the next most frequently occurring nematode was *Tylenchulussemipenetrans* (51.00%), followed by *Helicotylenchus sp.* (48.32), *Tylenchorhynchus sp.* (42.95%), *Paratylenchussp.* (40.26%), *Meloidogynesp.* (28.85%), *Xiphinemasp.* (26.17%) and Criconematids (21.47%) (Table)

In relative frequency *Hoplolaimus sp.* ranked first with 18.73 per cent followed by *Tylenchulussemipenetrans* (16.00%), *Helicotylenchus sp.* (15.15%), *Tylenchorhynchus sp.* (13.47%), *Paratylenchus sp.* (12.63%). Three nematode species viz. *Meloidogyne sp.*, (9.05), *Xiphinema sp.* (8.21) and Criconematids (6.73) occupied the last position in respect of relative frequency. (Table 2).

It is revealed that *Hoplolaimus sp.* has the highest absolute density and relative density (22.59 and 20.82% respectively) followed by *Helicotylenchus sp.* (18.64 and 17.18%), *Tylenchorhynchus sp.* (17.45 and 16.09%), *Tylenchulussemipenetrans* (15.36 and 14.16%), *Paratylenchus sp.* (14.20 and 13.09%), *Meloidogyne sp.* (8.52 and 7.85%), *Xiphinema sp.* (7.00 and 6.45%) and Criconematids (4.69 and 4.32%). Considering both frequencies and densities, prominence values for all the nematodes were calculated. *Hoplolaimus sp.* was found to be the most prominent with a prominence value of (174.58) followed by *Helicotylenchus sp.* (119.57), *Tylenchorhynchus sp.* (114.36), *Tylenchulussemipenetrans* (109.69), *Paratylenchus sp.* (90.10), *Meloidogyne sp.* (45.76), *Xiphinema sp.* (35.80) and Criconematids (21.73).

Hoplolaimussp. is the most frequently recorded species with relative frequency of 18.73%, absolute density of 22.59 per cent, relative density 20.82 percent. Genus *Helicotylenchus* ranked second in absolute density 18.64 per cent and relative density 17.18 per cent and genus

Tylenchorhynchus ranked third in absolute density 17.45 per cent and relative density 16.09 per cent and *Tylenchulussemipenetrans* ranked fourth in absolute density 15.36 per cent and relative density 14.16 per cent. It is revealed that *Hoplolaimussp.* has the highest prominence value of 174.58 followed by *Helicotylenchussp.*, *Tylenchrhynchussp.* and *Tylenchulussp.* which were recorded as 119.57, 114.36, 109.69 respectively. The highest absolute frequency recorded in *Hoplolaimussp.* which was 59.73 per cent followed by *Tylenchulussemipenetrans* 51.00 per cent, *Helicotylenchussp.* 48.32 per cent and *Tylenchrhynchussp.* 42.95 per cent.

Nandwana *et al.* (2005) recorded that five phytonematodes were associated with citrus trees in orchards and nurseries in and around Jhalawar district, and among them *Tylenchulussemipenetrans* was predominantly and most widely prevalent with highest prominence value followed by *Pratylenchus sp.*; *Helicotylenchusindicus*; *Rotylenchulusreniformis* and *Hoplolaimusindicus* respectively. Rathouret *et al.* (2010) made a study on community structure of plant parasitic and mycetophagous nematodes from different cereals, oilseed, fruit, pulse, cash and medicinal plants in Madhya Pradesh. Among the plant parasitic nematodes, *Meloidogyneincognita* was found to be the most frequently occurring with highest absolute frequency (50), followed by *Rotylenchulusreniformis* (40.38), *Helicotylenchusdihystera* (23). The maximum absolute density was recorded for *R.reniformis* followed by *H. dihystra* and *Tylenchorhynchusindicus*. The highest prominence value was recorded for *M.incognita* (17.12), followed by *H. dihystra* (13.78) and *Hoplolaimus indicus*. Zalpuri *et al.* (2013) recorded the frequency of few plant parasitic nematodes associated with citrus, viz. *Meloidogynejavanica*, *Hoplolaimussp.*, *Xiphinema* *sp.*, *Pratylenchussp.* and *Tylenchulussemipenetrans* in Jammu Region. Among them *Xiphinema* *sp.*, *Pratylenchussp.* and *Hoplolaimussp.* were most abundant and frequently occurring nematodes. They also recorded *Xiphinema* was predominantly and most widely prevalent with highest prominence value i.e. 20, followed by *Hoplolaimussp.*

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Conclusions?

Table -1. Plant parasitic nematodes associated with citrus orchards in Dibrugarh district

Name of	No.	Nematode species	Soil	Root
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1	Tingkhong	8	Korangani	<i>Tylenchulus semipetrans</i>	0-40	17.5	62.5
				<i>Tylenchorhynchus</i> sp.	0-80	46.25	75
				<i>Hoplolaimus</i> sp.	20-60	36.25	100
				Criconematids	0-30	11.25	50
		8	Nemupathar	<i>Tylenchulus semipetrans</i>	0-50	25	62.5
				<i>Tylenchorhynchus</i> sp.	20-70	28.75	75
				<i>Hoplolaimus</i> sp.	20-70	42.5	100
				<i>Helicotylenchus</i> sp.	0-40	15	62.5
				<i>Meloidogynes</i> sp.	0-50	22.5	62.5
		6	Tingkhongchariali	<i>Tylenchulus semipetrans</i>	0-30	18.33	66.66
				<i>Paratylenchus</i> sp.	20-70	45	100
				<i>Xiphinemas</i> sp.	0-40	21.66	66.66
				<i>Meloidogynes</i> sp.	0-30	16.66	66.66
2	Jaipur	8	Powalipathar(1)	<i>Tylenchulus semipetrans</i>	0-50	30	75
				<i>Tylenchorhynchus</i> sp.	30-70	42.5	100
				<i>Xiphinemas</i> sp.	0-50	21.25	62.55
				<i>Helicotylenchus</i> sp.	0-60	36.25	75
				<i>Meloidogynes</i> sp.	0-50	20	62.5
		7	Powalipathar(2)	<i>Tylenchulus semipetrans</i>	0-50	24.28	71.42
				<i>Paratylenchus</i> sp.	0-30	14.28	71.42
				<i>Hoplolaimus</i> sp.	30-60	41.42	100
				<i>Helicotylenchus</i> sp.	0-40	18.57	57.14
		5	Asabam	<i>Helicotylenchus</i> sp.	20-60	42	100
				<i>Hoplolaimus</i> sp.	20-50	38	100
				<i>Meloidogyne</i> sp.	0-30	22	80
				<i>Paratylenchus</i> sp.	0-30	12	60
Sl. No	Block	Total no of sample collected	Citrus orchards	Nematode	Population range in 250 cc soil	Average population	Frequency (%)
		3	Tanti pathar	<i>Tylenchorhynchus</i> sp.	20-40	30	100

				<i>Helicotylenchussp.</i>	0-30	16.66	66.66
				<i>Xiphinemasp.</i>	0-50	33.33	100
				<i>Hoplolaimussp.</i>	0-40	22.5	100
3	Barboruah	5	Dulia	<i>Hoplolaimussp.</i>	20-80	46	100
				<i>Paratylenchussp.</i>	20-50	36	100
				<i>Tylenchorhynchussp.</i>	0-60	24	80
				<i>Meloidogynesp.</i>	0-40	16	60
		7	Dibuwal(1)	<i>Tylenchulussemipenetrans</i>	0-50	27.14	71.42
				<i>Helicotylenchussp.</i>	30-70	42.85	100
				<i>Hoplolaimussp.</i>	0-60	22.85	71.42
				Criconematids	0-30	11.42	42.85
				<i>Xiphinemasp.</i>	0-30	8.57	42.85
		7	Dibuwal(2)	<i>Tylenchulussemipenetrans</i>	0-40	15.71	57.14
				<i>Tylenchorhynchussp.</i>	20-80	42.85	100
				<i>Hoplolaimussp.</i>	20-70	40	100
				<i>Xiphinemasp.</i>	0-40	14.28	57.14
		4	Changmaigo haingaon	<i>Helicotylenchussp.</i>	30-70	45	100
				<i>Paratylenchussp.</i>	20-40	27.5	100
				Criconematids	0-30	15	75
				<i>Meloidogynesp.</i>	0-40	17.5	50
4	Tengkh at	7	Abhaypuriya(1)	<i>Tylenchulussemipenetrans</i>	0-50	21.42	71.42
				<i>Tylenchorhynchussp.</i>	0-60	35.71	85.71
				<i>Hoplolaimussp.</i>	20-80	41.42	100
				<i>Meloidogynesp.</i>	0-50	20	57.14
		7	Abhaypuriya(2)	<i>Tylenchulussemipenetrans</i>	0-40	11.42	57.14
				<i>Tylenchorhynchussp.</i>	Oct-70	40	100

Table-3. Community analysis of different plant parasitic nematodes associated with citrus in Dibrugarh district

Nematodes species	Absolute density	Relative density(%)	Absolute frequency(%)	Relative frequency(%)	Prominence value
<i>Tylenchulus semipenetrans</i>	15.36	14.16	51.00	16	109.69
<i>Hoplolaimus</i> sp.	22.59	20.82	59.73	18.73	174.58
<i>Helicotylenchus</i> sp.	18.64	17.18	48.32	15.15	119.57
<i>Tylenchorhynchus</i> sp.	17.45	16.09	42.95	13.47	114.36
<i>Paratylenchus</i> sp.	14.20	13.09	40.26	12.63	90.10
<i>Meloidogynes</i> sp.	8.52	7.85	28.85	9.05	45.76
<i>Xiphinema</i> sp.	7.00	6.45	26.17	8.21	35.80
Criconematids	4.69	4.32	21.47	6.73	21.73
Total	108.45		318.75		

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Comment [LL6]: Complete with cites on the text: Chona et al. 1966; Bark et al. 2005; Nandwana et al. 2005, Ibrahim Said. K. et al. 2016.

Comment [LL7]: Singh 1997??

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Sinha, A. K. and Chawla, M.L (1985). Plant parasitic nematode associated with trees with reference to citrus nematode. In: *Proc. IVth Nat. Citrus Seminar*, Ranchi, pp.125-131.

Comment [LL8]: Sinha 1988??

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