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Prevalence of Plant-Parasitic Nematodes in Horticultural Fields of Assam Agricultural University: Jorhat Campus, India

Prerana Bhuyan [a], Gitanjali Devi [a*], Reecha T Das [b] and Sailen Gogoi [b]

[a] Department of Nematology, Assam Agricultural University, Jorhat-785013, Assam, India.
[b] Department of Horticulture, Assam Agricultural University, Jorhat-785013, Assam, India.

Authors' contributions

This work was carried out in collaboration among all authors. Author GD designed the study, wrote the protocol, managed the literature searches and drafted the manuscript. Author PB performed the survey work and statistical analysis. Authors RTD and SG managed the survey and field work. All authors read and approved the final manuscript.

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ABSTRACT

A random survey of the horticultural crops was conducted to assess the nematode community structure in the Experimental field of Department of Horticulture, AAU, Jorhat during Rabi and Kharif season, 2022-2023. Soil and root samples, representing 200 locations were examined. Analysis of 200 soil and root samples collected from the root rhizosphere of different vegetable, fruit and ornamental crops showed the presence of root-knot nematode(*Meloidogyne incognita),* reniform nematode (*Rotylenchulus reniformis*), root-lesion nematode (*Pratylenchus* spp.), lance nematode (*Hoplolaimus* spp.), spiral nematode (*Helicotylenchus* spp.), stunt nematode

**Corresponding author: E-mail: gitanjali.devi@aau.ac.in;*

(*Tylenchorhynchus* spp.) along with *Criconema* spp., *Xiphinema* spp, *Longidorus* spp., free-living nematodes, mycophagous nematodes and predatory nematodes. Among all the isolated plant-parasitic nematodes, root-knot nematode (*Meloidogyne incognita*) was found to be more abundant with prominence value of 136.7, 81.3 and 76.3 in vegetable crops, fruit crops and ornamental crops, followed by *Helicotylenchus* spp. and *Rotylenchulus reniformis*. The prominence value of reniform nematode (*Rotylenchulus reniformis*) was found to be 90.5, 54.1 and 54.1 in vegetable crops, fruit crops and ornamental plants respectively.

Keywords: Plant-parasitic nematode; prevalence; root-knot nematode; reniform nematode; prominence value; horticultural crops.

1. INTRODUCTION

Horticultural crops play a major role in nutritional and food security. Due to global climate change from the past decades, economic yield has been reported. The presence of the plant-parasitic nematodes in horticultural crop may also account for yield suppression [1,2]. Plant parasitic nematodes often interact with fungal, bacterial and viral pathogens to cause disease complexes. In Assam, various plant parasitic nematode has been reported in survey programme in AICRP (Nematodes) [3]. The objective of the study was to identify nematodes associated with horticultural crops in the Experimental field of the Department of Horticulture in AAU, Jorhat, Assam,

2. MATERIALS AND METHODS

The survey was conducted in both Kharif and Rabi season during 2022-2023. A total 200 soil samples along with root samples were collected from the root zone of vegetable, fruits and ornamental crops in the Experimental field of the Department of Horticulture in AAU, Jorhat, Assam. The Geographical location of the survey area is in the Experimental field covering an area of 12.25 ha of the Department of Horticulture in AAU, Jorhat. The area is located at 26047'N latitude and 91012'E longitude at an elevation of 86.8m above mean sea level and under Upper Brahmaputra Valley Agro Climatic Zone of Assam. The samples were collected randomly. Soil samples (1 kg each) including roots (5 g each) were collected. By using a 2.5 cm diameter soil sampling probe, 10-20cm deep soil cores were collected from the rhizosphere of vegetables, fruit and ornamental crops (Fig.1). Each bulk samples was constituted of 10 sub samples. Cores (sub sample) were combined and gently mixed. Roots were collected by gently dislodging soil and placed in a paper bag and transported to the laboratory. Nematodes were extracted from the soil by Cobb's sieving and decanting technique [4]. Microscopic examination were made with an stereoscopic microscope Magnüs at 40x magnification. Community analysis was done with the following formula.

Absolute frequency = (number of samples containing a genus) × 100/ (number of samples collected)

Relative frequency = (frequency of a genus) × 100/ (sum of frequency of all genera);

Absolute density = average population density (nematodes/100 cm 3 soil);

Relative density = average number of individual genus × 100/ average number of all nematode genera;

Prominence value = absolute density × square root (absolute frequency)

Relative prominence = prominence value of a genus × 100/sum of prominence values of all genera [5].

3. RESULTS AND DISCUSSION

The survey results of 200 soil and root samples of vegetable, fruit crops and ornamental crops growing locations in the Experimental field of the Department of Horticulture in AAU, Jorhat, Assam revealed the association of six nematode genera, viz. *Meloidogyne incognita, Rotylenchulus reniformis*, *Pratylenchus* spp., *Hoplolaimus* spp., *Helicotylenchus* spp., *Tylenchorhynchus* spp.(Table1,2,3). Other plant parasitic nematodes,viz., *Criconema* spp., *Xiphinema* spp, *Longidorus* spp., free-living nematodes, mycophagous nematodes and predatory nematodes were also found to be associated with these horticultural crops. Among all the isolated plant-parasitic nematodes, root-knot nematode (*Meloidogyne incognita*) was found to be more abundant with prominence

value of 136.7, 81.3 and 76.3 in vegetable crops, fruit crops and ornamental crops, respectively followed by *Helicotylenchus* spp. and *Rotylenchulus reniformis*.

The frequency of occurrence *Meloidogyne incognita* was found to be 71.4%, 52.8 % and 45.0 % in vegetable crops, fruit crops, and ornamental plants respectively, with population density range 40-340 for vegetable crops (Fig.3), 40-290 for fruit crops and 20-280 for ornamental plants. The frequency of occurrence *Rotylenchulus reniformis* was found to be 54.2%, 40%, 35% in vegetable crops, fruit crops and ornamental plants respectively with population density range 40-220 for vegetable crops, 40-200 for fruit crops and 20-120 for ornamental plants (Fig.2). Low population density of these nematodes in the Experimental field of AAU may be due to intensive plant protection measure taken during experiment of horticultural crops.

Survey conducted in a cotton field in northestern Louisiana revealed that *M. incognita* and R. *reniformis* occurred at population level above threshold level in 21% and 49% of the fields [6]. Das and Gaur [7] conducted a survey on prevalence of *R. reniformis* in cotton growing areas of Punjab, Haryana, and UP. With absolute frequency of *R.reniformis* was 56.5% in Punjab, 30% in Haryana and 42.3% in UP. The mean population densities indicated heavier infestation (178/200 cc soil) in farmers field compared to less infestation (48/200 cc soil) in the research farm in Punjab. Monoculture or poorly planned cropping system with predominance of host crop results in high infestation of plant parasitic nematodes under farmers field condition. A survey in cotton fields from Nuh and Palwal districts of Haryana recorded *M. incognita* with 72.0% frequency of occurrence [8]. A total of 15 plant-parasitic nematodes were recovered throughout the surveyed areas of Nafada, Kaltungo, and Yamaltu Deba of Gombe state, Nigeria. *Meloidogyne* spp., were associated with highest population density and prevalence value followed by *Scutellonema* spp., and *Rotylenchus* spp. in sweet potato. *Nacobbus* spp. *Pratylenchus* spp., *Heterodera* spp., *Xiphinema* spp., *Trichodorus* spp. also found to be associated in sweet potato plantation areas[9]. Adomako et al. [10] carried out a survey of plant-parasitic nematodes in common bean in Ghana and recorded *Meloidogyne*, *Pratylenchus*, *Rotylenchulus*, *Helicotylenchus* and *Trichodorus* were found to be associated with common bean. across all locations. Intensive use of the same area of land by the same crop or crops with similar genetic background increase nematode reproduction.

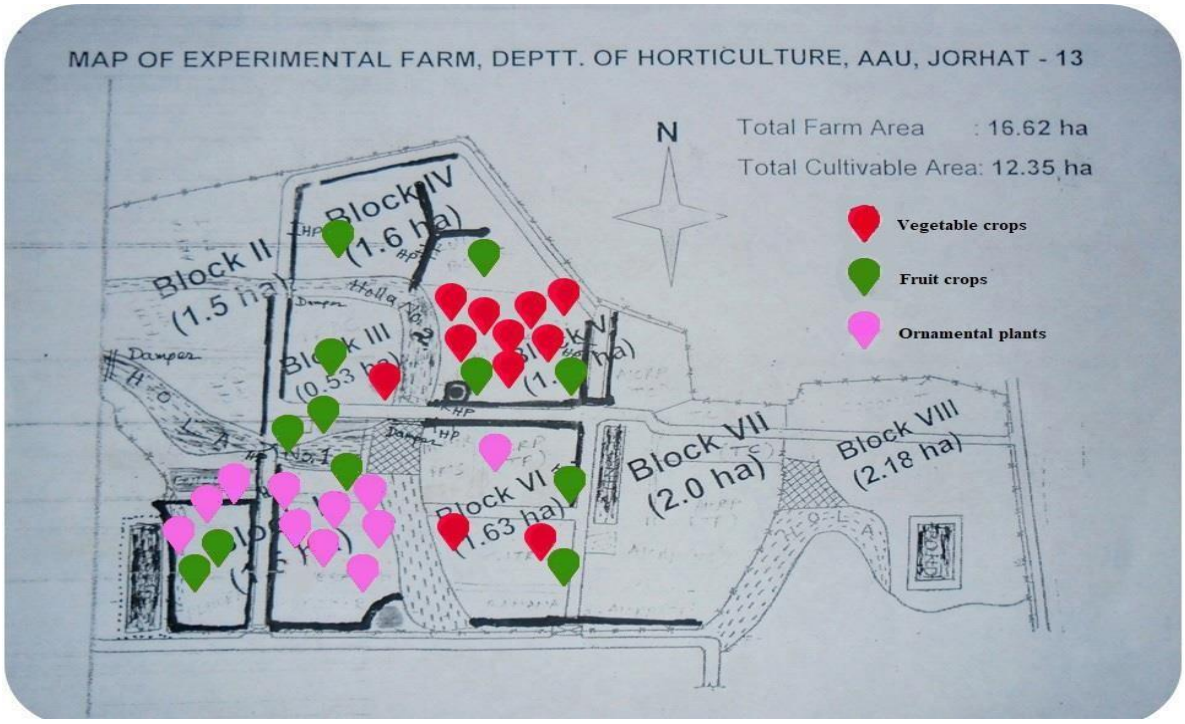

Fig.1. Sample collection from the experimental field

Table 1. Community analysis of plant parasitic nematodes in vegetable crops in the Experimental field of the Department of Horticulture in AAU, Jorhat, Assam

Nematode genus	Total No. of sample collected	No.of +ve samples	Absolute frequency (%)	Relative frequency (%)	Absolute density/250cm^3	Relative density (%)	Prominence value	Relative prominence (%)
Meloidogyne incognita	70	50	71.4	19.6	189(40-340)	31.0	136.7	29.3
Rotylenchulus reniformis		38	54.2	14.8	123(40-220)	20.1	90.5	19.4
Pratylenchus spp.)		18	25.7	7.0	40(20-80)	6.6	20.2	4.3
Hoplolaimus spp.)		46	65.7	18.0	80(30-180)	13.1	64.8	13.8
Helicotylenchus spp.)		59	84.2	23.1	112(40-260)	18.3	102.7	22.0
Tylenchorhynchus spp.		44	62.8	17.2	65(10-180)	10.6	51.4	11.0

(*Number of sample= 70, size of sample= 200 cm3 soil and 5g root)*

Table 2. Community analysis of plant parasitic nematodes in fruit crops in the Experimental field of the Department of Horticulture in AAU, Jorhat, Assam

Nematode genus	Total No. of sample collected	No.of +ve samples	Absolute frequency (%)	Relative frequency (%)	Absolute density/250cm^3	Relative density (%)	Prominence value	Relative prominence (%)
Meloidogyne incognita	70	37	52.8	16.5	112(40-290)	23.2	81.3	23.1
Rotylenchulus reniformis		28	40	12.5	86(40-200)	17.8	54.1	15.4
Pratylenchus spp.)		35	50.0	15.6	38(20-90)	7.8	26.8	7.6
Hoplolaimus spp.)		49	70.0	21.8	95(40-200)	19.7	78.8	22.4
Helicotylenchus spp.)		37	52.8	16.5	100(40-300)	20.7	72.6	20.6
Tylenchorhynchus spp.		38	54.2	16.9	51(20-100)	10.5	37.5	10.6

(Number of sample= 70, size of sample= 200 cm^3 soil and 5g root)

Table 3. Community analysis of plant parasitic nematodes in ornamental crops in the Experimental field of the Department of Horticulture in AAU, Jorhat, Assam

Nematode genus	Total No. of sample collected	No. of +ve samples	Absolute frequency (%)	Relative frequency (%)	Absolute density/250cm^3	Relative density (%)	Prominence value	Relative prominence (%)
Meloidogyne incognita	60	27	45.0	15.3	114(20-280)	27.2	76.3	25.9
Rotylenchulus reniformis		21	35.0	11.9	59(20-120)	14.0	34.8	11.81
Pratylenchus spp.)		21	35.0	11.9	39(20-80)	9.3	23.0	7.8
Hoplolaimus spp.)		36	60.0	20.4	64(20-120)	15.2	49.2	16.7
Helicotylenchus spp.)		46	76.6	26.1	86(20-300)	20.5	74.8	25.3
Tylenchorhynchus spp.		25	41.6	14.1	57(30-90)	13.6	36.4	12.3

(Number of sample= 60, size of sample= 200 cm3 soil and 5g root)

Fig. 2. Reniform nematode

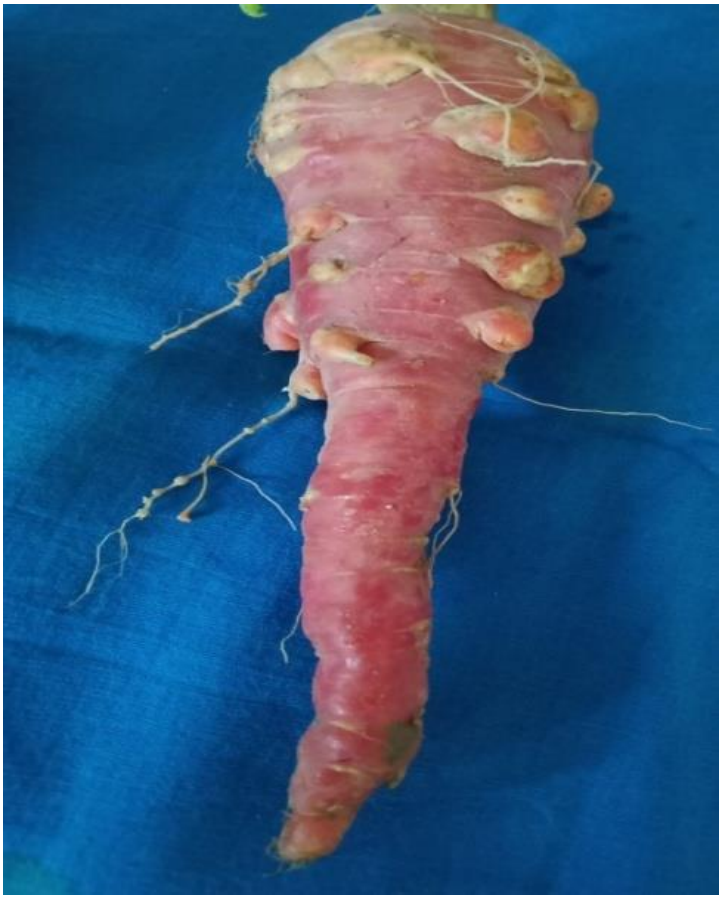

Fig. 3. Root-knot nematode infested carrot

4. CONCLUSION

Survey is providing information on the probability of crop losses due to plant parasitic nematode infestation. Results from this survey will help the researchers with understanding pathogenic nematode population and prioritize research in this area.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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