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Research Article

FIRST REPORT ON OCCURRENCE OF SPIRAL NEMATODE, *Helicotylenchus* sp. IN FALLOW REGIONS OF TAMIL NADU

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Abstract: Community analysis plays a vital role in assessing the population of plant parasitic nematodes in a region and helps in identifying the major areas of nematode attack. This investigation involves a study of community structure of phytonematodes in fallow soil in different zones of Tamil Nadu. A random survey was conducted in five zones of Tamil Nadu *viz*., East, west, north, south and centre for important plant parasitic nematodes having desiccation tolerance and their survival under host free condition. Collections of soil samples were done at the fallow areas and total numbers of samples were restricted to 10 per location at the depth of 15-20 cm depth. Extraction of nematodes was done by Cobb's decanting and sieving method followed by modified Baermann's funnel technique. Estimation of nematode population was done in a multichambered counting dish under stereo zoom microscope and the nematode genera were identified by comparing the characters. Four major nematode species *viz*., *Helicotylenchus incisus, Hoplolaimus seinhorsti, Meloidogyne incognita and Rotylenchulus reniformis* besides *Tylenchorhynchus* sp*., Pratylenchus* sp*., Radopholus similis* and *Aphlenchus avenae* were encountered in the survey. *Helicotylenchus incisus* was the predominant nematode species in all the zones with high frequency and density and could tolerate desiccation upto 12 months of host free condition. This is the first record of various species of phytonematodes associated with fallow regions of Tamil Nadu.

Keywords: *Community analysis, Prominence value, Population density, Fallow soil, Desiccation, Plant parasitic nematodes*

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Introduction

Plant parasitic nematodes are vermiform and microscopic in nature that infect plants and causes major yield loss in agricultural and fruit crops. These organisms employ a combination of behavioural and physiological survival strategies to conquer its environment and can tolerate abiotic stress conditions. To overcome these obstacles, some plant parasitic nematodes which are ectoparasites could spend most of their time in the soil to avoid perishing with the plant host while others are endoparasites and spend most of their time within plant tissue to escape predators. Plant-parasitic nematodes appear to be well adapted for surviving extremes of temperature, moisture stress and carbon dioxide concentration. These strategies enable nematodes to persist in soil, where their activity is limited for specific periods by extreme temperature and or desiccation. Desiccation tolerance can be defined as the ability of organisms to maintain its internal water potential with that of moderately dry air and after rehydration it could retain its normal function [1]. Plant parasitic nematodes (PPN) are known to survive periods of desiccation, an ability that increases the risk of them surviving unintentional transport between countries [2. The ability to overcome this desiccated condition is an inevitable example for adaptation of certain plant parasitic nematodes to changing environmental conditions. These ecological considerations were taken into account for formulating any nematode control strategy with these objectives as the focus. Information on desiccation survival plays a vital role in effective management and control measures for plant parasitic nematodes. The present investigations were made to study the desiccation tolerance of nematodes and their longevity under host free condition.

Materials and Methods

Survey of important plant parasitic nematodes were carried out during the year 2014-2015 for the assessment of population of important plant parasitic nematodes. Soil samples were collected randomly from fallow areas of all over Tamil Nadu which was divided into five zones *viz*., East, West, North, South and Central Tamil Nadu. Soil samples from each zone were collected separately. The sampling was done in the fallow areas and the total number of samples was restricted to 10 per location. Samples from each zone at 15-20 cm depth were collected using a hand shovel. Each sample consisted of 200cc sample was also collected and packed in polythene bag sealed tightly with a rubber band. For extraction of nematodes from the soil, Cobb's decanting and sieving followed by Baermann's funnel technique [3] was followed by using a series of sieves (20, 60, 150 and 350 mesh). The nematode genera were identified by comparing the characters [4]. The total population was estimated by converting the counts of sample to total volume with regard to nematode population encountered from soil samples. The population densities of nematode species in the samples were calculated using the formulae [5].

$$Absolute\ frequency = \frac{No.of\ samples\ containing\ a\ species}{No.of\ samples\ collected}\ X\ 100$$

$$Relative\ frequency = \frac{Frequency\ of\ a\ species}{Sum\ of\ frequency\ of\ all\ species}\ X\ 100$$

$$Relative\ density = \frac{No.of\ individuals\ of\ a\ species\ in\ a\ sample}{Total\ of\ all\ individuals\ in\ a\ sample}\ X\ 100$$

$$Absolute\ density = \frac{No.of\ individuals\ of\ a\ species\ in\ a\ sample}{Volume\ or\ mass\ or\ units\ of\ the\ sample}\ X\ 100$$

$$Prominence\ value = \frac{Absolute\ density\ X\ \sqrt{absolute\ frequency}}{100}$$

Results and Discussion

Occurrence and community structure of nematodes in fallow soil: The nematode population occurring in fallow soil in different zones of Tamil Nadu are shown in [Table-1]. Four major nematode species *viz*., *Helicotylenchus incisus, Hoplolaimus seinhorsti, Meloidogyne incognita* and *Rotylenchulus reniformis* with high occurrence besides these *Tylenchorhynchus* sp., *Pratylenchus penetrans, Radopholus similis* and *A. avenae* were also encountered. A community analysis of [Table-2] revealed the presence of *Helicotylenchus* sp. in all zones.

Table-1 Occurrence of nematode population per 200 cc fallow soil in different zones of Tamil Nadu

Nematode species	Nematode population per 200cc soil at 10 locations in each zone					Total
	East	west	North	South	Centre	
H. incisus	1140	140	460	266	340	2346*
H. seinhorsti	100	80	220	120	80	600
M. incognita	600	-	280	200	-	1080
R. reniformis	200	290	300	730	-	1520
P. penetrans	100	-	-	470	60	630
T. mashoodi	260	-	120	400	-	780
R. similis	-	120	-	-	1230	1350
A. avenae	-	-	-	160	-	160**

*High population *, Low population **.*

Table-2 Community analysis of *Helicotylenchus* sp. in fallow soil at different zones of Tamil Nadu

SN	ZONES	AF	RF	AD	RD	PV
1	EASTERN	80.0	34.8	1140.0	47.5	102.0
2	WESTERN	40.0	28.6	140.0	22.2	8.9
3	NORTHERN	60.0	37.5	460.0	33.3	35.6
4	SOUTHERN	30	14.3	266	11.3	14.6
5	CENTRAL	50	38.5	340	19.9	24.0

Discussion

The spiral nematode *Helicotylenchus incisus* was the most predominant species which has highest densities in all the five zones *viz*., east, west, north, south and central Tamil Nadu. The survival of the spiral nematode in host free soil was upto 12 months. The present finding on the survival seems to be new under Indian conditions as no studies indicated the survival of *Helicotylenchus* sp. in host free soil. Not much of the studies indicated the survival in desiccated conditions except the survival of *H. dihystera* increases when dehydration is lengthened and found that *H. dihystera* could survive in dry soil for about 250 days [6,7].

Conclusion

The results clearly show that the population of nematodes in the soil varied from location to location and was reduced as fallow period progressed but could tolerate the dry period and retrieve once the host is planted. So, fallowing as the management practice does not control plant parasitic nematodes and the assessment of nematode population in the particular fallow soil before planting plays a major role in controlling the infestation.

Application of research: The present study suggests that the phytonematodes can tolerate moisture stress by reducing its metabolic activity. So, further research on the metabolic activities will reveal more.

Research Category: Desiccation tolerance.

Abbreviations:

Sp Species
Cm Centimetre
Cc Cubic centimetre
AF Absolute frequency
RF Relative frequency
AD Absolute density
RD Relative density
PV Prominence value

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