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# Distribution of Plant Parasitic Nematodes Associated with Millets

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**A B S T R A C T**

A survey was conducted to explore the existence of plant parasitic nematodes associated with millet crops in Tiruvannamalai District. In this study, nine genera of plant-parasitic nematodes were recognized. The analysis of nematode communities revealed that the *Tylenchorynchus* sp. was the most frequently occurring nematode having an absolute frequency of 46.6% followed by *Helicotylenchus* sp. (38.8%) and *Meloidogyne* sp. (25.9%). These were followed by *Pratylenchus* sp. (23.3%), *Hoplolaimus* sp. (20.7%), *Criconemoides* sp. (6.0%), *Heterodera* sp. (4.3%) and *Rotylenchulus* sp. (3.4%). *Trichodorus* sp. was least frequently occuring species (2.6%). The maximum absolute density was recorded for *Tylenchorynchus* sp. followed by *Meloidogyne* sp. and *Helicotylenchus* sp. with 300, 225 and 122 individuals per 200cc soil respectively. Considering both frequencies and densities, the highest prominence value of 52.0 was recorded for *Tylenchorhynchus* sp. followed by *Meloidogyne* sp. (33.8), *Helicotylenchus* sp. (13.5) and *Pratylenchus* sp. (10.1). These were followed by *Heterodera* sp. (7.3), *Hoplolaimus* sp. (5.1), *Trichodorus* sp. (4.1), *Criconemoides* sp. (1.0) and *Rotylenchulus* sp. (0.3).Of these, root-knot nematode (*Meloidogyne*spp.) in little millet at Jamunamarathur and Tiruvannamalai blocks and cyst nematode (*Heterodera* sp.) in kodo millet at Tiruvannamalai block were very important genera.

## Introduction

Millets are a group of eight crops comprising of sorghum, pearl millet, finger millet, kodo millet, little millet, foxtail millet, barnyard millet and proso millet. They are deliberated as nutri cereals since 3-5 times nutritionally greater to rice and wheat in terms of protein, minerals and vitamins. They are grown in a variety of agro-ecological situations *viz*., plains, coast and hills as well as in diverse soils and varying rainfall. Plant-parasitic nematodes (PPN) are widely spread in millet growing areas of the world. The estimated annual yield loss based on the International survey of crop losses due to nematodes in millet was assessed as 11.8%. Incidence of the plant parasitic nematodes associated with millets was reported from different part of the world including southern part of India (Seshadri, 1970 and Bridge, 1978) by several workers. However, no work

has yet been reported on the community structure of the phytonematodes associated with millet crops of Tamil Nadu.

Hence, this investigation on the community structure of the phytonematodes associated with millet crops in Tiruvannamalai district of Tamil Nadu may be considered to be the first documentation of Tamil Nadu, India.

## Materials and Methods

### Collection of soil samples

A survey was conducted to investigate the occurrence of plant parasitic nematodes associated with millet crops *viz*., sorghum, pearl millet, finger millet, foxtail millet, kodo millet, little millet and proso millet in Tiruvannamalai District.

Altogether 116 soil samples were collected from Jamunamarathur, Chetpet, Polur, Jawadhu Hills, Kalasapakkam, Tiruvannamalai, Peranamallur and Vembakkam blocks of Tiruvannamalai District.

Soil samples were collected from the vicinity of millet crops to a depth of 10-15 cm at the rate of 5 composite samples obtained from four corners and centre of the field per field.

The soil samples were collected in polythene bags labelled properly and stored at 5°C in a refrigerator for not more than 7 days.

### Processing soil samples

Nematodes were extracted from 200 $cm^3$ soil by using Cobb's sieving and decanting method, followed by modified Baermann's funnel technique (Southey, 1986). The nematodes present in the suspension were identified up to generic level.

### Community analysis plant parasitic nematodes

It was done in order to find out their Absolute Frequency (AF), Relative Frequency (RF), Absolute density (AD), Relative Density (RD) and Prominence Value (PV) by following the methods of Norton (1978).

Absolute frequency

$$= \frac{\text{no.of samples containing species}}{\text{no.of samples collected}} \text{x100}$$

Relative frequency

$$= \frac{\text{Absolute frequency of a species}}{\text{Sum of absolute frequency of all species}} \text{x100}$$

Relative density

$$= \frac{\text{No.of indivuals of a species in a sample}}{\text{Total of all indivuals in a sample}} \text{x100}$$

Absolute density

$$= \frac{\text{No.of indivuals of a species in a sample}}{\text{Volume or mass or units of a sample}} \text{x100}$$

Prominence value (PV)

$$= \frac{\text{absolute density x } \sqrt{\text{absolute frequency}}}{100}$$

## Results and Discussion

### Sorghum

In this crop, two genera of parasitic nematodes were encountered. Among them, *Tylenchorynchus* was more frequent and abundant than *Pratylenchus* (Table 1).

### Cumbu

Five genera of plant parasitic nematodes were encountered in the rhizosphere of cumbu crop *viz., Helicotylenchus, Hoplolaimus, Rotylenchulus, Criconemoides* and *Tylenchorynchus*.

Among them, *Tylenchorhynchus* was more frequent and abundant. All other genera were neither frequent not abundant (Table 2).

## Ragi

Six genera of parasitic nematodes, *Helicotylenchus, Hoplolaimus, Pratylenchus, Criconemoides, Trichodorus* and *Tylenchorynchus* were found in ragi crop. Only *Tylenchorynchus* and *Helicotylenchus* genera were both frequent and abundant. *Pratylenchus and Criconemoides* were common but not abundant. *Hoplolaimus* and *Trichodorus* were neither frequent not abundant (Table 2).

## Tenai

Only three genera were encountered (Table 1) in tenai crop. Two of them, *Hoplolaimus* and *Helicotylenchus* were neither frequent nor abundant while, *Tylenchorynchus* was abundant but not frequent (Table 2).

## Samai

Five genera of plant parasitic nematodes were encountered in soil samples taken from samai crop (Table 1).

Only *Meloidogyne* was both frequent and abundant. *Helicotylenchus* and *Tylenchorynchus* were frequent but not abundant while *Hoplolaimus* and *Criconemoides* neither frequent not abundant (Table 2).

## Varagu

Only two genera were encountered (Table 1) in the rhizospere of varagu crop. One of them, *Heterodera* was abundant but not frequent. while, *Tylenchorynchus* was neither frequent not abundant (Table 2).

## Kuthiraivali

The only nematode genus, *Hoplolaimus* was encountered in soil samples taken from kuthiraivali crop. It was abundant but not frequent (Table 2).

## Panivaragu

None of the parasitic nematode genera was recorded in panivaragu crop (Table 1). The analysis of nematode communities revealed the presence of 9 genera of plant parasitic nematodes. *Tylenchorynchus* sp. was the most frequently occurring nematode having an absolute frequency of 46.6% followed by *Helicotylenchus* sp. (38.8%) and *Meloidogyne* sp. (25.9%).

These were followed by *Pratylenchus* sp. (23.3%), *Hoplolaimus* sp. (20.7%), *Criconemoides* sp. (6.0%), *Heterodera* sp. (4.3%) and *Rotylenchulus* sp. (3.4%). *Trichodorus* sp. was least frequently occuring species (2.6%). The maximum absolute density was recorded for *Tylenchorynchus* sp. followed by *Meloidogyne* sp. and *Helicotylenchus* sp. with 300, 225 and 122 individuals per 200cc soil respectively.

Considering both frequencies and densities, the highest prominence value of 52.0 was recorded for *Tylenchorhynchus* sp. followed by *Meloidogyne* sp. (33.8), *Helicotylenchus* sp. (13.5) and *Pratylenchus* sp. (10.1). These were followed by *Heterodera* sp. (7.3), *Hoplolaimus* sp. (5.1), *Trichodorus* sp. (4.1), *Criconemoides* sp. (1.0) and *Rotylenchulus* sp. (0.3) (Table 2).

**Table.1** Distribution of nematode genera associated with Millets in Tiruvannamalai District

| Nematode genera (in 200 g soil) | Block | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | | | | 2 | | 3 | | | | | 4 | | | 5 | | | | 6 | | | | | | | 7 | 8 |
| | S | P | F | L | S | F | S | P | F | L | T | P | R | L | S | P | F | K | S | R | Fo | K | L | Fo | B | F | F |
| ***Meloidogyne*** | - | - | - | 48.3 | - | - | - | - | - | - | - | - | - | 98.5 | - | - | - | - | - | - | - | - | 108 | - | - | - | - |
| ***Heterodera*** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 162 | - | - | - | - | - |
| ***Pratylenchus*** | 27 | - | - | - | - | 12 | 21 | - | 14 | - | - | - | - | - | 22 | - | 16 | - | - | - | - | - | - | - | - | 42.0 | 23.5 |
| ***Helicotylenchus*** | - | - | 43 | 18 | - | 13 | - | - | 3.5 | 9 | - | 3.0 | - | - | - | - | 9.0 | - | - | 32 | 12 | - | 17.0 | - | - | 26.5 | 12 |
| ***Hoplolaimus*** | - | - | - | - | - | 22 | - | - | - | - | 18 | 5.0 | - | - | - | - | - | - | - | - | 8 | - | 14.0 | - | 61 | - | - |
| ***Rotylenchulus*** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 21 | - | - | - | - | - | - | - | - | - | - | - |
| ***Criconemoides*** | - | - | 9.0 | - | - | 6.5 | - | - | 4 | - | - | - | 8 | - | - | - | 1 | - | - | - | - | - | 8.0 | - | - | - | - |
| ***Tylenchorynchus*** | 14 | 25.5 | 29 | - | 41 | 16 | 18 | 21 | 14 | 12 | - | 19 | 20 | - | 13 | 19 | 7 | 4 | 14 | 28 | - | - | 12.0 | 37 | - | 29.5 | 40 |
| ***Trichodorus*** | - | - | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 41.0 | 29 |

The numbers denotes the name of the block where soil sample was taken (1 – Jamunamarathur; 2 – Chetpet; 3 – Polur; 4 – Jawadhu Hills; 5 – Kalasapakkam; 6 – Tiruvannamalai; 7 – Peranamallur; 8 – Vembakkam).
The letters denotes the name of the crop where soil sample was taken. Abbreviations used (S – Sorghum; P – Pearl millet; F – Finger millet; L – Little millet; Fo. – Foxtail millet; K – kodomillet; B – Barnyard millet)

**Table.2** Community analysis of plant parasitic nematodes associated with millets

| Nematode Genera | Average no. of nematodes/200cc soil | Absolute frequency | Relative frequency | Relative density | Absolute density | Prominence value |
|---|---|---|---|---|---|---|
| *Meloidogyne* | 450 | 25.9 | 15.1 | 23.0 | 225 | 33.8 |
| *Heterodera* | 162 | 4.3 | 2.5 | 8.3 | 81 | 7.3 |
| *Pratylenchus* | 201 | 23.3 | 13.6 | 10.3 | 101 | 10.1 |
| *Helicotylenchus* | 244 | 38.8 | 22.6 | 12.4 | 122 | 13.5 |
| *Hoplolaimus* | 128 | 20.7 | 12.1 | 6.5 | 64 | 5.1 |
| *Rotylenchulus* | 21 | 3.4 | 2.0 | 1.1 | 11 | 0.3 |
| *Criconemoides* | 43 | 6.0 | 3.5 | 2.2 | 22 | 1.0 |
| *Tylenchorhynchus* | 600 | 46.6 | 27.1 | 30.6 | 300 | 52.0 |
| *Trichodorus* | 111 | 2.6 | 1.5 | 5.7 | 56 | 4.1 |

Among the nine nematode genera associated with millets, the stunt nematode, *Tylenchorhynchus* spp. registered the highest absolute, relative frequency and density was considered as predominant nematode of millets grown in eight blocks of Tiruvannamalai district. Of these, root-knot nematode (*Meloidogyne* spp.) in little millet at Jamunamarathur and Tiruvannamalai blocks and cyst nematode (*Heterodera* sp.) in kodo millet at Tiruvannamalai block were very important genera and monocropping of millet is coherent for the same.

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