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# Species diversity of phytophagous nematodes in selected agroecosystems of Telangana State

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**Abstract**
Survey of plant-parasitic nematodes was conducted in different cropping areas of Telangana state during 2009-2012. Different genera of plant-parasitic nematodes were found in association with economically important crops causing great damage to agricultural production. We recorded the presence of ten genera of plant-parasitic nematode occurring in the different cropping areas showing much species diversity. In our present investigation, we aimed to know the Relative frequencies and Absolute frequencies of plant-parasitic nematodes. *Meloidogyne* species were more pre-dominant and recorded with highest relative frequency and absolute frequency in our survey.

**Keywords:** plant-parasitic nematodes, species diversity, *meloidogyne* species

## Introduction
Crop production of Warangal is effected by biotic and abiotic stress. Major crops are subjected to severe infection with pests and facing disease problems. It is difficult to identify nematode infections in the economically important crops and attribute the corresponding pathological changes. The plant-parasitic nematodes are eel-like round worms of which some are root endo-parasites and few are ectoparasites living in the soil.
Hence, a nematological survey was undertaken in order to determine the most pathogenic species of scientific and economic importance. These phytopathogenic nematodes distribution differs from place to place and so research has been carried to reveal the species diversity of these nematodes. Recently John Sudheer *et al*., 2007 [7] have studied the biodiversity of plant- parasitic nematodes in selected districts of Andhra Pradesh.

## Research Methodology
A nematological survey was conducted in the eight villages in Warangal district of Telangana state based on crop intensity to assess the distribution and species diversity of plant-parasitic nematodes in major crops. Nearly, 135 soil samples were collected from the major cropping areas of surveyed villages randomly from of one acre field. Soil sampling is done in the rhizospere region at a depth of 10-20 cm and collected samples were stored at 10-15°C to avoid the decay and drying of specimens. These samples were processed by Cobb's sieving and decanting method followed by modified Baermann's funnel method (Cobb, 1918). These nematodes obtained were fixed in 4% formalin and stored in a glass vials. Root bits were stained with acid-fuschin lactophenol to observe the presence of endoparasites and semi endoparasites. The no. of samples positive to the nematode infection and % of infection is calculated. nematodes were counted genera wise and absolute and relative frequencies were calculated according to Nortan (1978) [12]. Plant-parasitic nematodes can be easily differentiated from free-living saprophytic nematodes with the presence of stylet in the head region. The nematode identification were mainly based on the morphology of adults and second stage juveniles (j2) (Eisenback, 1985) [5]. The fixed specimens were identified by making temporary mounts.

## Results and Discussion
In order to assess species diversity of nematodes several approaches has been used. One of them is soil sample analysis for nematode extraction. Eight crops from commercial fields were sampled for three consecutive years from 2009-2012. The study reported the presence of ten nematode genera *Meloidogyne, Heterodera, Helicotylenchus, Hoplolaimus, Pratylenchus, Xiphinema, Hirshamanniella, criconema, Tylenchorhynchus, Rotylenchus. Meloidogyne* species was predominant and recorded in majority of villages associated with tomato, brinjal, chilli, ladiesfinger, cotton, turmeric, paddy, maize. It is found to associate with these crops in the form of visible galls on root system. Ladies finger is an excellent host for root-knot nematode in the different regions of world (Nadakal, 1966) [13].
The soil communities are so diverse in both size and the numbers of species. The study has revealed that a single soil sample contained ten different genera of nematodes. The mean number of nematodes per sample, highest individual counts and frequency are summarized in Table N0.1 to 6 and histogram. *Meloidogyne* species has greatest distribution in warm temperature to tropical agroecosystems (Carter, 1985) [14]. This species was common in Pegadapalli, Venkatapuram, Vanchanagiri and Dugondhi areas where vegetable crops are in major cultivation. Root-Knot caused by *Meloidogyne* spp is a major constraint in sustainable tomato cultivation (Kumari and Siva kumar 2005) [9] and this malady is difficult to manage by Pesticides

**Table 1:** Major plant parasitic nematodes associated with different crops in Warangal district during 2009-2010.

| Crop | Total no. of samples | Meloidogyne sp. | Heterodera sp. | Helicotylenchus sp. | Hoplolaimus sp. | Pratylenchus sp. | Xiphinema sp. | Hirshamannie--llasp. | Criconema sp. | Tylenchor-hynchus sp. | Rotylenchussp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tomato | 20 | 13 | - | 3 | 1 | 1 | 1 | - | - | 1 | - |
| Brinjal | 15 | 10 | - | 2 | 1 | 2 | - | - | - | - | - |
| Chilli | 15 | - | - | 2 | 1 | - | - | - | - | - | 12 |
| Ladiesfinger | 20 | 12 | - | 1 | 1 | 2 | 2 | - | - | 2 | - |
| Cotton | 10 | - | - | 2 | - | - | - | - | - | - | 8 |
| Turmeric | 10 | 6 | - | 2 | - | - | - | - | 1 | - | 1 |
| Paddy | 10 | - | - | 3 | - | - | - | 5 | - | 2 | - |
| Maize | 15 | - | 8 | 5 | - | - | - | - | - | - | 2 |

**Table 2:** Major plant parasitic nematodes associated with different crops in Warangal district during 2010-2011.

| Crop | Total no. of samples | Meloidogyne sp. | Heterodera sp. | Helicotylenchus sp. | Hoplolaimus sp. | Pratylenchus sp. | Xiphinema sp. | Hirshamanniella sp. | Criconema sp. | Tylenchor-hynchus sp. | Rotylenchus sp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tomato | 30 | 17 | - | 4 | 2 | 2 | 2 | - | - | 1 | - |
| Brinjal | 20 | 12 | - | 4 | 1 | 1 | - | - | - | - | - |
| Chilli | 30 | 5 | - | 6 | 2 | - | - | - | - | - | 12 |
| Ladiesfinger | 20 | 13 | - | 2 | 2 | 1 | 1 | - | - | 1 | - |
| Cotton | 20 | - | - | 5 | - | - | - | - | - | - | 12 |
| Turmeric | 10 | 5 | - | 1 | - | - | - | - | 1 | - | 1 |
| Paddy | 10 | - | - | 1 | - | - | - | 6 | - | 1 | - |
| Maize | 10 | | 6 | 3 | - | - | - | - | - | - | - |

**Table 3:** Major plant parasitic nematodes associated with different crops in Warangal district during 2011-2012.

| Crop | Total no. of samples | Meloidogyne sp. | Heterodera sp. | Helicotylenchus sp. | Hoplolaimus sp. | Pratylenchus sp. | Xiphinema sp. | Hirshamannie-lla sp. | Criconema sp. | Tylenchor-hynchus sp. | Rotylenchus sp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tomato | 30 | 16 | - | 5 | 2 | 4 | 3 | - | - | 2 | - |
| Brinjal | 10 | 4 | - | 3 | 1 | 1 | - | - | - | - | - |
| Chilli | 40 | 9 | - | 7 | 2 | - | - | - | - | - | 18 |
| Ladies finger | 10 | 4 | - | 1 | 2 | 1 | 1 | - | - | 1 | - |
| Cotton | 15 | - | - | 2 | - | - | - | - | - | - | 8 |
| Turmeric | 10 | 3 | - | 1 | - | - | - | - | 2 | - | 2 |
| Paddy | 10 | - | - | 1 | - | - | - | 5 | - | 3 | - |
| Maize | 20 | - | 5 | 2 | - | - | - | - | - | - | 2 |
| Total | 135 | 36 | 5 | 22 | 7 | 6 | 4 | 5 | 2 | 6 | 28 |

**Table 4:** Community analysis of plant-parasitic nematodes in selected agroecosystems of Warangal district during 2009-2010.

| Genera | No. of positive samples | Absolute frequency (AF) | Relative frequency (RF) |
|---|---|---|---|
| Meloidogyne sp. | 41 | 35.65 | 39.07 |
| Heterodera sp. | 8 | 6.95 | 7.61 |
| Helicotylenchus sp. | 20 | 17.39 | 19.05 |
| Hoplolaimus sp. | 4 | 3.47 | 3.80 |
| Pratylenchus sp. | 5 | 4.34 | 4.75 |
| Xiphinema sp. | 3 | 2.60 | 2.84 |
| Hirshmanniella sp. | 5 | 4.34 | 4.75 |
| Criconema sp. | 1 | 0.86 | 0.94 |
| Tylenchorhynchus sp. | 5 | 4.34 | 4.74 |
| Rotylenchus sp. | 13 | 11.30 | 12.38 |

**Table 5:** Community analysis of plant-parasitic nematodes in selected agroecosystems of Warangal district during 2010-2011.

| Genera | No. of positive samples | Absolute frequency (AF) | Relative frequency (RF) |
|---|---|---|---|
| Meloidogyne sp. | 52 | 34.66 | 39.10 |
| Heterodera sp. | 6 | 4.0 | 4.51 |
| Helicotylenchus sp. | 26 | 17.33 | 19.05 |
| Hoplolaimus sp. | 7 | 4.66 | 5.25 |
| Pratylenchus sp. | 4 | 2.66 | 3.00 |
| Xiphinema sp. | 3 | 2.0 | 2.25 |
| Hirshmanniella sp. | 6 | 4.0 | 4.51 |
| Criconema sp. | 1 | 0.66 | 0.74 |
| Tylenchorhynchus sp. | 3 | 2.0 | 2.25 |
| Rotylenchus sp. | 25 | 16.66 | 18.79 |

**Table 6:** Community analysis of plant-parasitic nematodes in selected agroecosystems of Warangal district during 2011-2012

| Genera | No. of positive samples | Absolute frequency (AF) | Relative frequency (RF) |
|---|---|---|---|
| Meloidgyne sp. | 36 | 26.6 | 29.71 |
| Heterodera sp. | 5 | 3.70 | 4.13 |
| Helicotylenchus sp. | 22 | 16.29 | 18.19 |
| Hoplolaimus sp. | 7 | 5.18 | 5.78 |
| Pratylenchus sp. | 6 | 4.44 | 4.95 |
| Xiphinema sp. | 4 | 2.96 | 3.3 |
| Hirshmanniella sp. | 5 | 3.70 | 4.13 |
| Criconema sp. | 2 | 1.48 | 1.65 |
| Tylenchorhynchus sp. | 6 | 4.44 | 4.95 |
| Rotylenchus sp. | 28 | 20.74 | 23.16 |

**Parasitic plant – nematode incidence overtime in the sample sites: (A) Histogram showing the fluctuations in soil infestations; (B) Stacked line chart showing the variation in the nematode dynamics for the period of study.**

*Heterodera* species was common in the soil where corn is raised especially in Mucharla area. Several other species were detected at very low frequencies. It effects the Graminaceae members and attacks the root system and resulting in poor root development, stunting narrow leaves.

*Helicotylenchus* species was identified in highest population with the crops like maize, cotton, tomato, paddy and ladies finger. It was most frequent one due to their parasitism and plant tolerance to infection. *Helicotylenchus* species was the dominant species in Dugondhi, Bheemaram, Mucharla, Pegadapalli and Devannapeta villages where vegetable and paddy cultivation is common. *Hoplolaimus* species was common dominant species in Devannapeta village where brinjal cultivation is raised frequently. *Pratylenchus* species was the abundant in Dugondhi, Devannapeta, Pegadapalli, Venkatapuram and Vanchanagiri areas where the vegetable crops and leguminous crops are often grown. *Xiphinema species was abundant in crops like tomato and ladies finger especially in Dugondhi and Pegadapalli areas. Hirschmanniela* species was common dominant species mainly in Bheemaram village where paddy cultivation was raised frequently. Tylenchorhynchus species was also observed with less frequency especially in tomato planted villages. In turmeric crop, Criconema species was abundant followed by Meloidogyne species and Heterodera species.

*Rotylenchus* species is widely distributed in turmeric fields (Mani & Prakash, 1992) [11]. Because of galling and rotting, turmeric rhizomes lose their bright yellow colour (Mani, Naidu & Madhavachari, 1987) [10].

This study has revealed that nematodes are abundant in sandy loam soils harbouring larger populations of plant-parasitic nematodes than clay soil where there is more aeration and easy movement. The penetrating capacity of nematodes was more in sandy loam soils. (Nadakal. A.M, 1966) [13]. Increase in nematode numbers could be due to multiplication of the nematode as a result of continous presence of susceptible crops (Kratochil *et al*., 2004) [8]. Loss of plant growth vigour coupled with competition among the nematodes for limited reserves could explain the decline (Akhtar and Malik, 2000) [1]

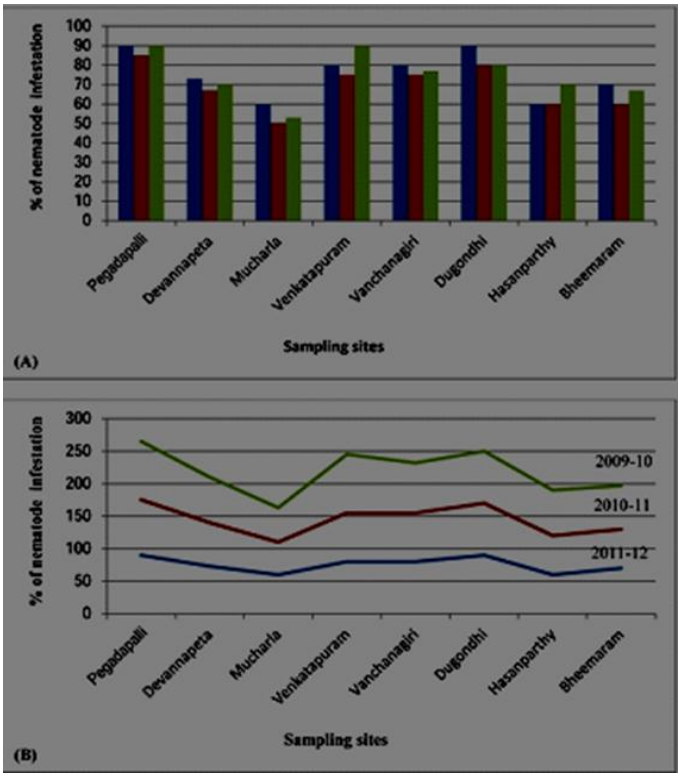


**Fig 1**

## Conclusion

Various surveys have indicated that nematodes are common pest of vegetable crops and are key constraints to vegetable production; the results discussed here have identified key nematodes. Pathogenecity studies are required to quantify damages caused by individual nematode genera. There is need for continued research in order to come up with cheap yet effective nematode management techniques. This may include screening various cultivars for resistance to various PPN with an aim of designing a proper nematode management strategy.

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