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Comparative Study of Community Analysis of Plant Parasitic and Free-living Nemic Fauna around Root Zones of Mango (*Mangifera indica*) Plant in Hapur Region

Shashi Bala [a++*]

[a] *Department of Zoology, Raghunath Girls Post Graduate College, Meerut- 250001, India.*

Author's contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

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ABSTRACT

Nematodes are tiny rounded body, unsegmented worms. They occupy any niche of the environment, like soil, freshwater, and terrestrial (free-living and parasitic). They constitute a large group of all metazoans in the world: Plant-parasitic and free-living nematodes are well-recognized factors in soil productivity. Phytonematodes feed upon the cell sap of plants with the help of stylet. It causes many abnormalities in plants like gall formation on roots, stunting growth, wilting of plants, and serious damage to crop yield. In the present study, soil samples were collected from (0-30 cm)

[++] *Associate Professor;*
**Corresponding author: Email: shashiverma1580@gmail.com;*

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vertical depth and (30-60 cm) horizontal depth from around the root of the mango plant in the Hapur region from July to November. Nematodes samples were extracted by decanting and sieving Techniques (Cobb1918) were applied. Under the microscope examination nematodes were identified as free-living with minimum percentages of 14.2% and8.88% at both vertical and horizontal depth while plant parasitic nematodes were recorded as a higher percentage(53.90% vertical depth)and(64.91% horizontal depth) away from the host plant. This was variation in communities of plant nematodes at both depths due to seasonal changes, various other edaphic factors such as PH, temperature, moisture emergence of secondary rootlets, and availability on set of monsoon season and unavailability of various food resources.

Keywords: Plant parasitic nematode; free-living; community; edaphic factors.

1. INTRODUCTION

Plant nematodes are rounded bodies, small size microscopic, ubiquitous and worm like organism. In any agroecosystem and under the ground communities, they form the most prominent group. Mango (*Mangifera indica* L.) belongs to the family Anarcardiaceae. It is a rich source of various dietary fibres, lipids protein, and carbs, with different phytochemicals elements, This fruit has various elements and amino acids' leucine, valine, lysine methione, cysteine, arginine and phenylalanine [1], Nematode infestation is constrained to mango production and export. They attack all parts of plants including leaves, stems, roots even flowers and seeds which cause tremendous damage and loss of annual crop yield. Due to their root infestation including gall formation stunting growth, foliar wilting, and leaf chlorosis. Root infestation of plant nematodes having worldwide negative physiological and economic dimension, nematode infestation causes tremendous crop damage [2] community of plant nematodes depends upon so many factors such as trophic level, food web, ecological niche, and life history .of plant nematodes are the best indicators of the environment and quality of the soil. (Ferris et al. [3], Yeates [4], Bonger [5], Liang et al. [6]. Nematodes were placed into five different groups according to feeding habits [7] viz., omnivores, herbivores, bacteriovores, fungivores, and predators. The distribution of free-living plant nematodes depends upon many *factors* in ecological processessuch as the decaying of organic matter and nutrient cycle [8]. Phytonematodes attack the stem root and leaf of various cultivated crops. They are highly diversified organisms. Their distribution and abundance depend upon the texture of the soil crop cycle and other anthropogenic factors. Chirchirt et al. [9]. The diversity and structure generally affect the stability of a greater number of any species means more interaction among them is possible. Many intrinsic forces acting on stability determine the size of the population, Some internal forces like environmental like PH the chemical composition of soil disturb the stability of community structure. Plant parasitic nematodes are well recognized in soil productivity because they are more sensitive to environmental factors and are used as bioindicators for monitoring soil health.They have agricultural significance for those who live in the soil and act as a variety of plant diseases and adversely affect agricultural production by acting as major pests that cause different diseases. The economic consequence of crop losses due to pests and disease to farmers, consumers, state, and country. The estimated annual yield loss of the world's major crop to plant nematodes has been reported to the extent of 12.3 percent. Plant nematodes are silent enemies they lose up to 80 % of vegetable crops [10], Kaskvalk, [11] and similar to the Indian forest decline day by day [12] due to this pathogenic microorganism. According to Kumar Khan [13] nematode infestation in mangoes has worldwide negative physiological and economic dimensions through a survey in India eight genera were associated with Mango with having *Hemicricomoides magniferae* was most populated while *Meliodogyne incognita* in the lower segment.

2. MATERIALS AND METHODS

In the present study, soil samples were collected from the rhizospheric root of the mango plant (*Mangifera Indica*) in the Hapur region from July to November. 250 gm. soil samples were taken from(0-30cmvertical) and (30-60 horizontal) depth away from the host plant. All the collected samples were extracted by decanting and sieving Technique by Cobb1918. Extraction of nematode population per 10 gm root samples was taken from 250gm soil samples. Soil samples were done in a multi chambered counting disc under the binocular microscope and each group of

nematodes were picked up manually with help of a needle then placed into the cavity block. Prepared slides were observed under microscope especially feeding apparatus of each group and for study of nematode community from samples were calculated by following formulae.

2.1 Community Analysis

Community analysis of both plant-parasitic and free-living nematodes was calculated as Absolute Frequency, Absolute density, Relative density, and Prominence value by using following formulae.

Absolute Frequency(A.F)= $\frac{no.of\ samples\ containing}{no.of\ samples\ collected}$x100

Relative Frequency (R.F)= $\frac{Frequency\ of\ species}{sum\ of\ frequency\ of\ all\ species}$x100

Relative densities(R.D)= $\frac{no.of\ individuals\ of\ sp\ in\ samples}{total\ no.of\ individual\ samples}$ x100

Prominence value (P.V) = Density $\sqrt{}$ Frequency

3. RESULTS

In the present investigation, community of plant nematodes was identified as in the form of free-living; plant parasitic and sluggish forms at both vertical depth (0-30cm) and (30-60 cm) horizontal depth from the host plant. During the study major segments of plant parasitic nematodes were identified (53.9%) and (64.9%) from whole endemic fauna while free-living forms were constituted in the lower segment as 14.2%and 8.88% of whole plant nematode fauna at both vertical depth as well horizontal and third segment was constituted sluggish form as 31.7% and26.2% of total Nemic fauna at both depths vertical and horizontal. These results showed that the parasitic form had a higher percentage in comparison to other forms of free-living and parasitic forms. Tables 1 & 2 Figs. 1&2.

Table 1. Community analysis of plant parasitic as well as free-living nematodes at different depths

Nemic Community	Nematode / 250gm, Soil	A.F%	R.F%	R.D%	P.V
Parasitic	681	100	36.3	53.9	539
Free LIVING	180	85	30.9	14.2	130

A.F=Absolute Frequency, R.F=Relative Frequency, RD=Relative Density, PV= Prominence Value

Table 2. Community analysis of plant parasitic and free-living plant-parasitic nematodes at different horizontal depths

Community Nemic	Nematode/250gm Soil	A.F%	R.F%	R.D%	P.V%
Parasitic Form	1023	100	37.0	64.9	64.9
Free Living Form	140	80	29.6	8.80	79.3

A.F=Absolute Frequency, R.F=Relative Frequency, RD=Relative Density, PV= Prominence Value

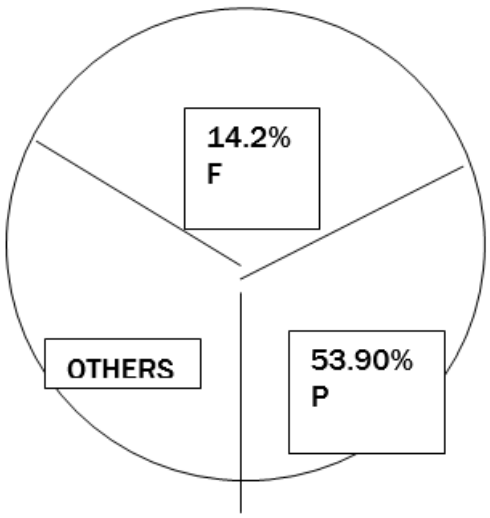

Fig. 1. Distribution of plant parasitic and free living plant nematodes at different depths Vertical depths (0-30) and30 cm horizontal distance around root zones *of Mangifera indica*

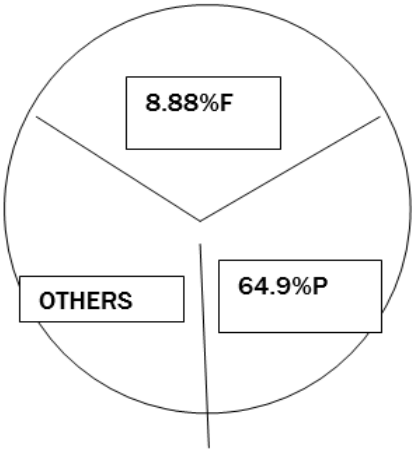

Fig. 2. Distribution of plant parasitic and free living plant nematodes at different depths (30-60) vertical and 30 cm horizontal distance around root system of *Mangifera indica*

4. DISCUSSION

The distribution of plant nematodes around the root zone of *Mangifera indica* was not uniform. The population of parasitic nematodes was high at 30 -60 cm due to enough food material seen as sec. Rootlets plant nematodes were identified, such as *Helicotylenchus sp. , Hemicriconemoides* sp. , *Tylenchorhynchus sp. , and Longidorus sp.* while a lower percentage of free-living nematodes *Pangrolaimus sp ,Acrobeloider sp Saprorhabditis spand Seinura sp Rhabditis sp* in the soil at 30-60 cm depth due to this endemic fauna present in upper strata as well as lower strata of soil and exhibit the close relationship between free-living nematodes and food material present in low amount and various edaphic factors like temperature PH. The temperature of soil the free-living nematodes are bacteriophages as well as fungivores central to many bacteria, fungi through grazing but also central fungi by affecting the outcome of fungal bacterial competition [7].

The species variation of nematode identification can be attributed to differences in soil, and mango varieties present at different locations and stages of growth. Porazinska [14] also indicated that the nematode population or diversity in topics (including Ghana)is higher than the temperate zones e.g.(Pakistan, Brazil, and Florida) due to factors such as light temperature, moisture, and types of soil and other nutritional factors in Pakistan eleven nematode genera were identified after conduction of survey on plant parasitic nematode and fungal communities associated . Mango decline of southern Punjab (Anwar 2012) our present result reveal nematode diversity and population density, however, nematode associated with mango in soil are more diverse as compared to root samples. Reducing nematode infestation in mango field demand and integrated pest management of nematodes [15-17].

5. CONCLUSION

In present study in all the nemic community population of parasitic form was so high in comparatively free living and other forms .free living form occurs upper strata followed by deeper strata because they directly feed upon bacterial and fungal colonies while parasitic form occurs at deep level and influenced by other factors and availability of food resources. (organic carbon and emergence of secondary rootlets).

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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