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# Community analysis of plant parasitic nematodes in turmeric (*Curcuma longa* L.)

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**Abstract**
The present investigation was conducted on Aug to Dec'2014 to study the community structure of phytonematodes associated with turmeric under conventional and drip irrigation methods. Species were identified on the basis of perineal patterns of females. The predominant nematode species were *Meloidogyne incognita, Pratylenchus delattrei, Radopholus similis, Longidorus elongatus, Xiphinema elongatum, Hoplolaimus seinhorstii, Helicotylenchus multicinctus, Tylenchorhynchus martini* and *Rotylenchulus reniformis* were encountered from the rhizosphere soil of turmeric grown under both system of irrigations. This is the first record of various species of phytonematodes associated with turmeric crops cultivated under conventional and drip irrigation system.

**Keywords:** Conventional irrigation, Drip irrigation, turmeric, *Meloidogyne incognita*, community analysis

## 1. Introduction
Turmeric (*Curcuma longa* L.) belonging to the family Zingiberaceae is an important spice as well as medicinal plant and contribute a major share in foreign exchange. Indian turmeric is regarded as best quality in the world market because of its high curcumin content [1]. The rhizomes of turmeric and its powder have been used extensively in the Indian systems of medicine (Ayurveda, Unani and Siddha) besides as a culinary spice, in cosmetic preparation, as food preservative, colouring agent and also in drug industries for its pharmaceutical properties. Dried rhizome of lucrative yellow colour noted as the aromatic pungent, bitter and flavoured sacred spice in India [15]. In the recent past, its colouring principle "Curcumin" (chemically diferulolylmethane) has been established to have wide spectrum of biological and pharmacological activities including antioxidant, anti-inflammatory, hypoglycemic, antimicrobial, antiviral and anticancerous properties [4].
The crop is widely cultivated in many states *viz.,* Andhra Pradesh, Tamil Nadu, Orissa, Karnataka, Kerala, Maharashtra and West Bengal of India [2]. In Tamil Nadu turmeric is being cultivated both under conventional and drip irrigated system. Several biotic and abiotic stresses hamper the sustainable cultivation of turmeric. One of the major pests of high valued agricultural crops are the phytonematodes which are highly diversified organisms exhibiting variations in distribution patterns. The degree of damage done depends upon the pathogenic potential of population growth of nematodes which are greatly influenced by the initial population densities [3, 17]. The abundance and distribution of plant parasitic nematodes are influenced by the soil texture, crop cycle and anthropogenic factors [6]. Thus the community analysis of phytonematodes is important, not only to assess the pathogenic potential of the nematodes in a particular region, but it also an important criteria for identification of hotspot of nematode infestations [13]. Therefore, the present experiment was conducted on community analysis of the phytonematodes associated with turmeric in the Comibatore District of Tamil Nadu.

## 2. Materials and Methods
### 2.1 Random Survey
A rowing survey was made on Aug to Dec'2014 for the community of nematodes in turmeric grown in Coimbatore district in Tamil Nadu. Diseased field were selected based on the above ground symptoms such as wilting, stunting, slow growth and yellowing of leaves. Soil samples (250 g) collected from the rhizosphere region at a depth of 15 cm @ ten samples per ha were pooled and a composite sample of 250 g was taken using shovel and packed in polythene bag with proper labelling for analysis.

Similarly, new feeder root samples (10 g) were collected randomly from 10 plants/ha pooled to derive a composite sample of 10 g and subjected for nematode analysis. Nematodes The extraction of nematodes from soil samples were made by Cobb's decanting and wet sieving method [7] followed by Modified Baermann's funnel method [16]. Roots samples were macerated using a waring blender and the nematodes were separated by Modified Baermann's funnel method. The adult nematode population in roots was counted by staining the roots with acid fuchsin lactophenol [11].

**2.2 Community analysis**

The data collected on nematode population in turmeric grown under conventional and drip irrigated method was subjected to community analysis *viz.,* Absolute and Relative frequency, Absolute and Relative density and Prominence value using the following formulae [12].

$$\text{Absolute frequency} = \frac{\text{Number of samples containing a species}}{\text{Number of samples collected}} \times 100$$

$$\text{Relative frequency} = \frac{\text{Frequency of a species}}{\text{Sum of frequencies of all species}} \times 100$$

$$\text{Relative density} = \frac{\text{Number of individuals of a species in a sample}}{\text{Total of all individuals in a sample}} \times 100$$

$$\text{Absolute density} = \frac{\text{Number of individuals of a species in a sample}}{\text{Volume or mass or units of the sample}} \times 100$$

$$\text{Prominence value} = \frac{\text{Absolute density} \times \sqrt{\text{Absolute frequency}}}{100}$$

**2.3 Statistical analysis**

The data on nematode infestations values were duly averaged and entered through ECONEM software tool to analysis the community structure of nematode populations/infestations.

**3. Results and Discussion**

**3.1 Absolute frequency**

The root knot nematode *M. incognita* was identified as most frequently occurred nematode and *T. martini* as less frequently occurred nematode in soil with absolute frequency of 72.3 and 4.0 respectively in conventional method of flood irrigated turmeric and it was highest for *M. incognita* (20.1) and lowest for *R. reniformis* (4.5) in root samples (Table 1and 2). Similarly the highest absolute frequency of occurrence was recorded with *M. incognita* in both soil (51.3) and root (15.1) in conventional flood irrigated turmeric and the lowest absolute frequency of occurrence was noticed with *R. reniformis* in both soil (5.0) and root (6.3) in drip irrigated turmeric (Table 3 and 4).

**3.2 Relative frequency**

The relative frequency of occurrence of *M. incognita* was highest both in soil (29.6) and root (5.6). Whereas it was lowest with *T. martini* in soil (5.3) and *R. reniformis* in roots (4.5) of conventional method of flood irrigated turmeric (Table 1 and 2). The trend was similar in drip irrigated turmeric also with highest relative frequency in soil (20.1) and root (4.3) for *M. incognita*. The relative frequency was absolutely nil for *R. reniformis* in soil and for *R. reniformis* and *R. similis* in root (Table 3 and 4).

**3.3 Absolute density**

The absolute density of *M. incognita* was highest in both soil (475) and root (125) in turmeric grown under conventional method. Similar trend of highest absolute density in soil (309) and root (98) was recorded with *M. incognita* in drip irrigated turmeric (Table 1, 2, 3 and 4).

**3.4 Relative density**

The relative density of *M. incognita* was highest in both soil (39.1) and root (36.1) of all the nematodes encountered in turmeric grown under conventional method. Similarly the *M. incognita* registered the highest relative density in soil (32.4) and roots (35.9) of turmeric grown under drip irrigated turmeric (Table 1, 2, 3 and 4).

**3.5 Prominence value**

As above the prominence value was also highest in respect of *M. incognita* in the range of 0 to 47.5 and 0 to 30.9 computed irrespective of nematodes/blocks in soil and root of conventional and drip irrigated turmeric grown in Coimbatore district respectively (Table 1, 2, 3 and 4). The root knot nematode, *M. incognita* ranked first in respect of Absolute and Relative Frequency/Density with regard to community analysis as the population of root knot nematode was highest of all the nematodes recorded both in soil and root irrespective of conventional and drip irrigated method in all the blocks surveyed in Coimbatore district and it fall in line with the finding [14]. The other nematodes *viz.,* lesion nematode *Pratylenchus delattrei* and burrowing nematode *Radopholus similis* ranked next to *M. incognita* in their occurrence based on population and distribution in turmeric. It is confirmed with the documentation of literature made by several authors as *M. incognita*, *P. delettrei* and *R. similis* are the key nematode pest of turmeric [5, 8, 10, 9, 14].

**Table 1:** Community analysis of nematodes (250 g soil) in turmeric grown under conventional method in Coimbatore district.

| Absolute frequency (%) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nematodes species | | | | | | | | | |
| **Blocks** | ***M. i*** | ***P. d*** | ***R. s*** | ***L. e*** | ***X. e*** | ***H. s*** | ***H. m*** | ***T. m*** | ***R. r*** |
| Anamalai | 25.0 | 15.2 | 16.7 | 13.2 | 8.6 | 8.0 | 3.5 | 3.0 | 1.0 |
| Annur | 49.6 | 11.0 | 12.6 | 18.9 | 11.0 | 10.7 | 6.1 | 3.5 | 4.3 |
| Karamadai | 20.0 | 13.0 | 14.3 | 10.1 | 6.3 | 7.8 | 2.5 | 2.0 | 4.3 |
| Kinathukadavu | 16.8 | 11.1 | 12.3 | 6.4 | 5.0 | 6.5 | 2.3 | 1.2 | 2.2 |
| Madukkarai | 26.1 | 18.0 | 20.0 | 15.2 | 9.0 | 8.5 | 4.0 | - | 1.0 |
| PN Palayam | 30.5 | 21.0 | 30.1 | 17.6 | 9.8 | 10.0 | 6.0 | 2.4 | 4.0 |
| Pollachi(N) | 14.0 | 7.0 | 6.1 | 4.2 | 3.5 | 3.0 | - | - | - |
| Pollachi(S) | 12.0 | 5.0 | 4.1 | 3.6 | 3.0 | 2.1 | 1.0 | - | - |
| S.S Kulam | 23.2 | 14.1 | 15.9 | 12.1 | 7.6 | 8.1 | 3.0 | 2.9 | 5.0 |
| Sulur | 28.4 | 19.6 | 28.3 | 16.1 | 8.6 | 9.2 | 5.7 | 2.0 | 3.6 |
| Sultanpettai | 18.1 | 12.6 | 13.1 | 9.8 | 5.6 | 7.0 | 2.0 | 1.6 | 2.0 |
| Thondamuthur | 72.3 | 12.3 | 22.9 | 36.4 | 19.7 | 12.3 | 7.3 | 4.0 | 4.5 |
| **Relative frequency (%)** | | | | | | | | | |
| Anamalai | 15.1 | 14.0 | 10.0 | 9.6 | 8.3 | 7.2 | 6.0 | 5.1 | 1.0 |
| Annur | 29.0 | 12.4 | 15.0 | 11.2 | 10.0 | 10.0 | 8.4 | 7.2 | - |
| Karamadai | 14.1 | 11.2 | 9.6 | 8.9 | 8.0 | 7.3 | 5.5 | 3.2 | 2.0 |
| Kinathukadavu | 14.1 | 12.1 | 9.5 | 8.3 | 7.1 | 7.0 | 5.1 | 3.2 | 1.6 |
| Madukkarai | 20.0 | 11.3 | 12.1 | 9.6 | 8.3 | 7.3 | 6.1 | 5.3 | 2.0 |
| PN Palayam | 26.0 | 10.1 | 14.1 | 10.6 | 9.8 | 9.8 | 8.1 | 6.2 | 2.1 |
| Pollachi(N) | 12.6 | 11.0 | 8.5 | 8.0 | 7.7 | 6.5 | 4.1 | 3.0 | 1.1 |
| Pollachi(S) | 12.6 | 11.0 | 7.2 | 7.6 | 7.4 | 6.0 | 2.9 | 1.6 | - |
| S.S Kulam | 14.1 | 13.0 | 9.8 | 9.0 | 8.0 | 7.0 | 5.6 | 4.0 | - |
| Sulur | 25.2 | 10.5 | 13.3 | 9.6 | 8.2 | 9.0 | 8.8 | 6.1 | - |
| Sultanpettai | 14.1 | 13.2 | 9.6 | 8.5 | 7.8 | 7.0 | 5.3 | 3.1 | 1.6 |
| Thondamuthur | 29.6 | 12.5 | 16.0 | 19.2 | 12.7 | 12.5 | 9.7 | 5.3 | 6.5 |
| **Relative density (%)** | | | | | | | | | |
| Anamalai | 117.0 | 32.0 | 42.0 | 48.0 | 40.0 | 32.0 | 17.0 | 13.0 | 2.3 |
| Annur | 294.0 | 51.0 | 63.0 | 92.0 | 34.0 | 50.0 | 45.0 | 10.0 | 5.0 |
| Karamadai | 68.0 | 40.0 | 33.0 | 25.0 | 18.0 | 9.0 | 7.0 | 2.0 | 0.0 |
| Kinathukadavu | 24.0 | 12.0 | 14.0 | 9.0 | 11.0 | 7.0 | 5.0 | 0.0 | 1.0 |
| Madukkarai | 120.0 | 35.0 | 43.0 | 22.0 | 26.0 | 7.0 | 14.0 | 17.0 | 2.0 |
| PN Palayam | 167.0 | 23.0 | 52.0 | 95.0 | 47.0 | 31.0 | 23.0 | 11.0 | 7.0 |
| Pollachi(N) | 23.0 | 17.0 | 13.0 | 10.0 | 7.0 | 5.0 | 4.0 | 0.0 | 0.0 |
| Pollachi(S) | 18.0 | 13.0 | 9.0 | 6.0 | 11.0 | 14.0 | 16.0 | 0.0 | 0.0 |
| S.S Kulam | 109.0 | 39.0 | 25.0 | 56.0 | 43.0 | 30.0 | 22.0 | 8.0 | 1.0 |
| Sulur | 152.0 | 27.0 | 64.0 | 42.0 | 31.0 | 13.0 | 11.0 | 9.0 | 4.0 |
| Sultanpettai | 64.0 | 51.0 | 42.0 | 23.0 | 12.0 | 11.0 | 7.0 | 5.0 | 2.0 |
| Thondamuthur | 475.0 | 49.0 | 70.0 | 95.0 | 53.0 | 48.0 | 31.0 | 10.0 | 12.0 |
| **Relative density (%)** | | | | | | | | | |
| Anamalai | 27.0 | 11.1 | 9.7 | 23.5 | 13.8 | 7.4 | 3.9 | 0.7 | 3.0 |
| Annur | 35.3 | 11.0 | 12.4 | 18.1 | 10.1 | 6.0 | 5.4 | 0.6 | 1.2 |
| Karamadai | 32.2 | 11.8 | 15.6 | 23.2 | 8.5 | 4.3 | 3.3 | - | 0.9 |
| Kinathukadavu | 28.9 | 10.8 | 16.9 | 14.5 | 13.3 | 8.4 | 6.0 | 1.2 | - |
| Madukkarai | 39.2 | 7.2 | 14.1 | 18.0 | 8.5 | 2.3 | 4.6 | 0.7 | 5.6 |
| PN Palayam | 28.5 | 13.2 | 14.0 | 21.0 | 8.0 | 5.3 | 3.9 | 1.2 | 1.9 |
| Pollachi(N) | 29.1 | 12.7 | 16.5 | 21.5 | 8.9 | 6.3 | 5.1 | - | - |
| Pollachi(S) | 23.7 | 7.9 | 17.1 | 18.4 | 11.8 | 13.1 | 9.1 | - | - |
| S.S Kulam | 28.5 | 14.6 | 26.5 | 15.4 | 19.1 | 7.8 | 5.7 | 0.3 | 2.1 |
| Sulur | 33.6 | 9.3 | 14.1 | 28.0 | 6.8 | 2.9 | 2.4 | 0.9 | 2.0 |
| Sultanpettai | 29.5 | 10.6 | 19.4 | 23.5 | 5.5 | 5.1 | 3.2 | 0.9 | 2.3 |
| Thondamuthur | 39.1 | 14.0 | 19.6 | 29.4 | 7.8 | 4.9 | 2.6 | 0.8 | 1.6 |
| **Prominence value** | | | | | | | | | |
| Anamalai | 11.7 | 3.1 | 1.7 | 10.2 | 4.2 | 4.7 | 6.0 | 1.0 | 0.1 |
| Annur | 29.4 | 5.0 | 4.4 | 15.1 | 10.3 | 9.2 | 8.2 | 0.6 | 0.2 |
| Karamadai | 6.8 | 0.5 | 0.3 | 4.9 | 3.3 | 2.4 | 1.1 | 0.1 | - |
| Kinathukadavu | 2.4 | 0.4 | 0.2 | 0.8 | 0.9 | 0.4 | 0.8 | - | - |
| Madukkarai | 12.0 | 0.4 | 1.0 | 5.5 | 4.3 | 2.0 | 2.6 | 1.5 | 0.1 |
| PN Palayam | 16.7 | 3.1 | 2.1 | 12.3 | 8.2 | 9.5 | 4.7 | 0.8 | 0.5 |
| Pollachi(N) | 2.3 | 0.4 | 0.2 | 1.5 | 0.9 | 0.7 | 0.4 | - | - |
| Pollachi(S) | 1.3 | 1.4 | 1.6 | 1.3 | 0.9 | 0.6 | 1.1 | - | - |
| S.S Kulam | 10.9 | 3.0 | 2.0 | 5.9 | 2.5 | 5.6 | 7.3 | 0.4 | - |
| Sulur | 15.2 | 0.8 | 0.8 | 12.7 | 6.4 | 4.2 | 3.1 | 0.4 | 0.3 |
| Sultanpettai | 6.4 | 0.7 | 0.3 | 5.1 | 4.2 | 2.1 | 0.8 | 0.2 | 0.1 |
| Thondamuthur | 47.5 | 5.9 | 3.1 | 25.5 | 10.1 | 17.0 | 9.5 | 1.2 | 0.6 |

**Note:** *M. i- Meloidogyne incognita, P. d- Pratylenchus delattrei, R. s-Radopholus similis, L. e-Longidorus elongatus, X. e-Xiphinema elongatum, H. s-Hoplolaimus seinhorstii, H. m- Helicotylenchus multicinctus, T. m-Tylenchorhynchus martini* and *R. r- Rotylenchulus reniformis.*

**Table 2:** Community analysis of nematodes (10 g root) in turmeric grown under conventional method in Coimbatore district.

| **Absolute frequency (%)** | | | | | **Relative frequency (%)** | | | |
|---|---|---|---|---|---|---|---|---|
| | **Nematodes** | | | | **Nematodes** | | | |
| **Blocks** | ***M. i*** | ***P. d*** | ***R. s*** | ***R. r*** | ***M. i*** | ***P. d*** | ***R. s*** | ***R. r*** |
| Anamalai | 12.6 | 11.3 | 8.4 | 6.3 | 3.4 | 2.4 | 2.6 | 1.0 |
| Annur | 18.1 | 15.2 | 12.1 | 3.4 | 4.9 | 4.0 | 3.2 | 1.9 |
| Karamadai | 10.2 | 9.8 | 6.3 | 5.2 | 2.0 | 1.2 | 2.1 | 1.2 |
| Kinathukadavu | 8.8 | 7.9 | 5.2 | 4.6 | 1.5 | 1.1 | 1.5 | 1.3 |
| Madukkarai | 13.2 | 11.3 | 8.7 | 5.3 | 3.2 | 2.6 | 2.5 | - |
| PN Palayam | 15.4 | 14.3 | 11.1 | 2.6 | 3.1 | 3.2 | 3.0 | 1.4 |
| Pollachi(N) | 5.5 | 4.3 | 3.6 | - | 1.1 | 2.0 | 1.1 | - |
| Pollachi(S) | 4.2 | 3.6 | 2.1 | - | 1.1 | 2.1 | 1.1 | - |
| S.S Kulam | 11.8 | 10.6 | 7.4 | 6.1 | 2.2 | 1.4 | 2.3 | - |
| Sulur | 14.3 | 12.6 | 9.1 | - | 3.0 | 2.8 | 2.6 | 1.2 |
| Sultanpettai | 9.8 | 8.1 | 5.4 | 4.8 | 1.6 | 1.2 | 1.9 | 1.0 |
| Thondamuthur | 20.1 | 15.1 | 18.6 | 4.5 | 5.6 | 3.8 | 4.9 | 2.1 |
| **Absolute density (%)** | | | | | **Relative density (%)** | | | |
| Anamalai | 25.0 | 14.0 | 13.0 | 7.0 | 42.4 | 23.7 | 22.0 | 11.9 |
| Annur | 31.0 | 24.0 | 19.0 | 8.0 | 37.8 | 29.3 | 23.2 | 9.8 |
| Karamadai | 15.0 | 13.0 | 9.0 | - | 40.5 | 35.1 | 24.3 | - |
| Kinathukadavu | 11.0 | 8.0 | 5.0 | - | 45.8 | 33.3 | 20.8 | - |
| Madukkarai | 27.0 | 20.0 | 18.0 | 7.0 | 37.5 | 27.8 | 25.0 | 9.7 |
| PN Palayam | 30.0 | 25.0 | 22.0 | 10.0 | 34.5 | 28.7 | 25.3 | 11.5 |
| Pollachi(N) | 10.0 | 6.0 | 5.0 | - | 47.6 | 28.6 | 23.8 | - |
| Pollachi(S) | 11.0 | 5.0 | 3.0 | 1.0 | 55.0 | 25.0 | 15.0 | 5.0 |
| S.S Kulam | 36.0 | 30.0 | 17.0 | 3.0 | 41.9 | 34.9 | 19.8 | 3.5 |
| Sulur | 45.0 | 58.0 | 37.0 | 6.0 | 30.8 | 39.7 | 25.3 | 4.1 |
| Sultanpettai | 29.0 | 36.0 | 14.0 | 2.0 | 35.8 | 44.4 | 17.3 | 2.5 |
| Thondamuthur | 125.0 | 101.0 | 113.0 | 7.0 | 36.1 | 29.2 | 32.7 | 2.0 |
| **Prominence value** | | | | | | | | |
| Anamalai | 2.5 | 1.0 | 0.9 | 0.4 | | | | |
| Annur | 3.1 | 2.4 | 1.3 | 0.4 | | | | |
| Karamadai | 1.1 | 0.9 | 0.4 | - | | | | |
| Kinathukadavu | 0.8 | 0.4 | 0.2 | 0.0 | | | | |
| Madukkarai | 2.7 | 2.0 | 1.6 | 0.4 | | | | |
| PN Palayam | 3.0 | 2.5 | 2.2 | 0.7 | | | | |
| Pollachi(N) | 0.7 | 0.3 | 0.2 | - | | | | |
| Pollachi(S) | 0.8 | 0.4 | 0.1 | - | | | | |
| S.S Kulam | 3.6 | 3.0 | 1.2 | 0.1 | | | | |
| Sulur | 4.5 | 5.8 | 3.7 | 0.3 | | | | |
| Sultanpettai | 2.9 | 3.6 | 1.2 | 0.1 | | | | |
| Thondamuthur | 12.5 | 10.1 | 11.3 | 0.4 | | | | |

**Note:** *M. i- Meloidogyne incognita, P. d- Pratylenchus delattrei, R. s-Radopholus similis, R. r- Rotylenchulus reniformi*

**Table 3:** Community analysis of nematodes (250 g soil) in turmeric grown under drip irrigation in Coimbatore district

| Absolute frequency (%) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Nematode species | | | | | | | | |
| **Blocks** | ***M. i*** | ***P. d*** | ***R. s*** | ***L. e*** | ***X. e*** | ***H. s*** | ***H. m*** | ***T. m*** | ***R. r*** |
| Anamalai | 36.1 | 20.2 | 14.3 | 9.8 | 11.6 | 8.1 | 6.0 | 2.4 | 1.0 |
| Annur | 54.2 | 26.3 | 20.3 | 16.1 | 15.3 | 10.0 | 9.6 | 5.3 | 4.1 |
| Karamadai | 22.4 | 15.3 | 11.1 | 7.6 | 9.1 | 6.2 | 5.1 | 1.0 | - |
| Kinathukadavu | 18.1 | 12.3 | 9.4 | 5.6 | 7.8 | 4.1 | 3.1 | 0.0 | 1.0 |
| Madukkarai | 40.6 | 21.6 | 15.4 | 10.1 | 12.0 | 8.3 | 6.4 | 2.1 | 2.0 |
| PN Palayam | 50.8 | 24.1 | 18.6 | 12.3 | 13.0 | 9.8 | 8.1 | 4.3 | 3.0 |
| Pollachi (N) | 14.0 | 11.0 | 8.0 | 4.1 | 6.2 | 3.6 | 2.1 | 1.0 | - |
| Pollachi (S) | 10.0 | 8.9 | 6.4 | 2.1 | 3.4 | 2.0 | 2.3 | - | - |
| S.S Kulam | 30.3 | 18.6 | 12.4 | 8.1 | 10.1 | 7.8 | 5.9 | 1.2 | 1.4 |
| Sulur | 46.3 | 23.0 | 17.1 | 11.1 | 12.6 | 9.2 | 7.9 | 3.6 | 2.8 |
| Sultanpettai | 20.1 | 14.2 | 10.0 | 6.1 | 8.2 | 5.3 | 4.9 | 1.0 | - |
| Thondamuthur | 61.3 | 18.6 | 26.4 | 30.1 | 19.1 | 11.1 | 11.0 | 6.0 | 5.0 |
| **Relative frequency (%)** | | | | | | | | | |
| Anamalai | 14.9 | 12.6 | 10.1 | 9.8 | 7.3 | 6.4 | 3.3 | 1.4 | 1.0 |
| Annur | 18.1 | 15.1 | 13.2 | 12.6 | 10.0 | 9.0 | 4.0 | 1.0 | - |
| Karamadai | 11.1 | 9.6 | 8.0 | 7.6 | 5.1 | 4.9 | 1.2 | 1.1 | - |
| Kinathukadavu | 9.2 | 7.8 | 6.2 | 6.0 | 5.1 | 4.1 | 1.2 | 1.0 | - |
| Madukkarai | 15.1 | 13.0 | 11.2 | 10.1 | 8.1 | 7.3 | 3.1 | 1.1 | 1.0 |
| PN Palayam | 17.1 | 15.1 | 12.3 | 11.8 | 9.6 | 8.5 | 3.3 | 1.4 | 1.0 |
| Pollachi (N) | 8.1 | 6.4 | 3.1 | 5.8 | 4.8 | 3.9 | 2.0 | 1.0 | - |
| Pollachi (S) | 5.8 | 2.3 | 1.1 | 3.1 | 2.4 | 2.8 | 1.1 | - | - |
| S.S Kulam | 12.6 | 11.3 | 9.8 | 8.1 | 6.4 | 5.1 | 2.9 | 1.2 | 1.0 |
| Sulur | 16.1 | 16.0 | 11.6 | 11.0 | 9.0 | 8.0 | 3.0 | 1.0 | - |
| Sultanpettai | 10.8 | 8.3 | 7.4 | 6.8 | 5.2 | 4.3 | 1.3 | 1.0 | - |
| Thondamuthur | 20.1 | 17.6 | 15.1 | 12.3 | 11.1 | 9.6 | 4.3 | 1.4 | 1.1 |
| **Absolute density (%)** | | | | | | | | | |
| Anamalai | 102.0 | 97.0 | 31.0 | 32.0 | 51.0 | 15.0 | 16.0 | 10.0 | 3.0 |
| Annur | 185.0 | 128.0 | 93.0 | 47.0 | 65.0 | 32.0 | 32.0 | 17.0 | 6.0 |
| Karamadai | 56.0 | 35.0 | 27.0 | 15.0 | 17.0 | 7.0 | 17.0 | 1.0 | 1.0 |
| Kinathukadavu | 24.0 | 12.0 | 14.0 | 9.0 | 11.0 | 5.0 | 7.0 | 3.0 | 1.0 |
| Madukkarai | 98.0 | 47.0 | 43.0 | 22.0 | 18.0 | 14.0 | 18.0 | 17.0 | 5.0 |
| PN Palayam | 89.0 | 68.0 | 71.0 | 64.0 | 39.0 | 21.0 | 30.0 | 10.0 | 8.0 |
| Pollachi (N) | 17.0 | 15.0 | 11.0 | 10.0 | 6.0 | 3.0 | 4.0 | - | - |
| Pollachi (S) | 15.0 | 14.0 | 15.0 | 11.0 | 8.0 | 7.0 | - | - | 1.0 |
| S.S Kulam | 106.0 | 47.0 | 25.0 | 56.0 | 45.0 | 20.0 | 27.0 | 10.0 | 5.0 |
| Sulur | 145.0 | 114.0 | 62.0 | 41.0 | 29.0 | 9.0 | 10.0 | 29.0 | 7.0 |
| Sultanpettai | 55.0 | 31.0 | 30.0 | 20.0 | 9.0 | 10.0 | 8.0 | 5.0 | 1.0 |
| Thondamuthur | 309.0 | 150.0 | 156.0 | 151.0 | 87.0 | 29.0 | 53.0 | 10.0 | 9.0 |
| **Relative density (%)** | | | | | | | | | |
| Anamalai | 28.6 | 27.2 | 8.7 | 9.0 | 14.3 | 4.2 | 4.5 | 2.8 | 0.8 |
| Annur | 28.4 | 19.6 | 14.3 | 7.2 | 10.0 | 4.9 | 4.9 | 2.6 | 0.9 |
| Karamadai | 31.8 | 19.9 | 15.3 | 8.5 | 9.7 | 4.0 | 9.7 | 0.6 | 0.6 |
| Kinathukadavu | 27.9 | 14.0 | 16.3 | 10.5 | 12.8 | 5.8 | 8.1 | 3.5 | 1.2 |
| Madukkarai | 34.8 | 16.7 | 15.2 | 7.8 | 6.4 | 5.0 | 6.4 | 6.0 | 1.8 |
| PN Palayam | 22.2 | 17.0 | 17.8 | 16.0 | 9.8 | 5.2 | 7.5 | 2.5 | 2.0 |
| Pollachi (N) | 25.8 | 22.7 | 16.7 | 15.2 | 9.1 | 4.5 | 6.1 | 25.8 | 22.7 |
| Pollachi (S) | 21.1 | 19.7 | 21.1 | 15.5 | 11.3 | 9.9 | - | - | 1.4 |
| S.S Kulam | 28.9 | 12.8 | 6.8 | 15.3 | 19.3 | 5.4 | 7.4 | 2.7 | 1.4 |
| Sulur | 31.7 | 24.9 | 13.6 | 9.0 | 12.4 | 6.3 | 2.2 | 6.3 | 5.3 |
| Sultanpettai | 32.5 | 18.3 | 17.8 | 11.8 | 5.3 | 5.9 | 4.7 | 3.0 | 0.6 |
| Thondamuthur | 32.4 | 15.7 | 16.4 | 15.8 | 9.1 | 3.0 | 5.6 | 1.0 | 0.9 |
| **Prominence value** | | | | | | | | | |
| Anamalai | 10.2 | 9.7 | 3.1 | 1.2 | 1.2 | 3.2 | 5.1 | 0.6 | 0.1 |
| Annur | 18.5 | 12.8 | 9.3 | 3.2 | 3.2 | 4.7 | 6.5 | 1.3 | 0.3 |
| Karamadai | 5.6 | 3.5 | 2.7 | 0.3 | 1.1 | 1.2 | 1.3 | - | - |
| Kinathukadavu | 2.4 | 0.8 | 0.9 | 0.2 | 0.3 | 0.4 | 0.7 | 0.1 | - |
| Madukkarai | 9.8 | 4.7 | 4.3 | 0.9 | 1.5 | 2.0 | 1.4 | 1.3 | 0.2 |
| PN Palayam | 8.9 | 6.8 | 7.1 | 1.9 | 3.0 | 6.4 | 3.9 | 0.6 | 0.4 |
| Pollachi (N) | 1.3 | 0.9 | 0.7 | 0.1 | 0.2 | 0.6 | 0.3 | - | - |
| Pollachi (S) | 1.2 | 0.9 | 0.9 | 0.3 | 0.0 | 0.7 | 0.4 | - | - |
| S.S Kulam | 10.6 | 4.7 | 2.5 | 1.8 | 2.7 | 5.6 | 7.1 | 0.6 | 0.2 |
| Sulur | 14.5 | 11.4 | 6.2 | 2.9 | 0.6 | 4.1 | 2.9 | 2.9 | 0.3 |
| Sultanpettai | 5.5 | 3.1 | 3.0 | 0.6 | 0.4 | 1.8 | 0.4 | 0.2 | - |
| Thondamuthur | 30.9 | 15.0 | 15.6 | 2.9 | 5.3 | 15.1 | 8.7 | 0.6 | 0.5 |

**Note:** *M. i- Meloidogyne incognita, P. d- Pratylenchus delattrei, R. s-Radopholus similis, L. e-Longidorus elongatus, X. e-Xiphinema elongatum, H. s-Hoplolaimus seinhorstii, H. m- Helicotylenchus multicinctus, T. m-Tylenchorhynchus martini* and *R. r- Rotylenchulus reniformis.*

**Table 4:** Community analysis of nematodes (10 g root) in turmeric grown under drip irrigation in Coimbatore district.

| Absolute frequency (%) | | | | | Relative frequency (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | Nematodes | | | | Nematodes | | | |
| **Blocks** | ***M. i*** | ***P. d*** | ***R. s*** | ***R. r*** | ***M. i*** | ***P. d*** | ***R. s*** | ***R. r*** |
| Anamalai | 8.4 | 7.0 | 6.3 | - | 1.3 | 1.0 | - | - |
| Annur | 13.9 | 10.1 | 9.8 | 5.0 | 3.1 | 2.8 | 2.0 | 1.9 |
| Karamadai | 6.5 | 6.0 | 5.8 | - | 1.3 | 1.0 | - | - |
| Kinathukadavu | 5.5 | 4.3 | 4.0 | 1.1 | 1.3 | 1.0 | 1.2 | - |
| Madukkarai | 9.2 | 8.4 | 7.2 | 2.1 | 1.9 | 1.3 | 1.0 | 1.0 |
| PN Palayam | 12.1 | 9.8 | 9.4 | 4.8 | 2.9 | 2.5 | 2.2 | 1.5 |
| Pollachi(N) | 4.3 | 4.0 | 3.5 | - | 0.9 | 0.4 | 0.8 | 0.5 |
| Pollachi(S) | 3.1 | 2.9 | 2.6 | - | 0.8 | 0.4 | 0.5 | - |
| S.S Kulam | 7.2 | 6.5 | 6.0 | 1.1 | 1.3 | 1.0 | 1.1 | - |
| Sulur | 11.0 | 8.1 | 9.0 | 3.4 | 1.8 | 1.4 | 1.0 | - |
| Sultanpettai | 6.0 | 5.5 | 5.3 | 2.1 | 1.3 | 1.2 | - | - |
| Thondamuthur | 15.1 | 11.2 | 12.8 | 6.3 | 4.3 | 3.1 | 2.8 | 2.1 |
| **Absolute density (%)** | | | | | **Relative density (%)** | | | |
| Anamalai | 20.0 | 14.0 | 11.0 | 5.0 | 40.0 | 28.0 | 22.0 | 10.0 |
| Annur | 35.0 | 27.0 | 36.0 | 9.0 | 32.7 | 25.2 | 33.6 | 8.4 |
| Karamadai | 13.0 | 10.0 | 12.0 | - | 27.1 | 47.9 | 25.0 | - |
| Kinathukadavu | 11.0 | 8.0 | 5.0 | - | 45.8 | 33.3 | 20.8 | - |
| Madukkarai | 57.0 | 21.0 | 16.0 | 2.0 | 56.4 | 20.8 | 16.8 | 2.0 |
| PN Palayam | 25.0 | 18.0 | 12.0 | 10.0 | 38.5 | 27.7 | 18.5 | 15.4 |
| Pollachi(N) | 11.0 | 12.0 | 13.0 | - | 9.0 | 5.0 | 7.0 | - |
| Pollachi(S) | 10.0 | 4.0 | 5.0 | - | 52.6 | 21.1 | 26.3 | - |
| S.S Kulam | 39.0 | 30.0 | 17.0 | 3.0 | 45.3 | 34.9 | 19.8 | 5.9 |
| Sulur | 40.0 | 31.0 | 35.0 | 5.0 | 29.0 | 42.0 | 25.4 | 3.6 |
| Sultanpettai | 27.0 | 26.0 | 12.0 | 1.0 | 40.9 | 39.4 | 18.2 | 1.5 |
| Thondamuthur | 98.0 | 81.0 | 83.0 | 11.0 | 35.9 | 29.7 | 30.4 | 4.0 |
| **Prominence value** | | | | | | | | |
| Anamalai | 2.0 | 1.2 | 0.8 | 0.2 | | | | |
| Annur | 3.5 | 2.7 | 3.6 | 0.4 | | | | |
| Karamadai | 7.5 | 1.0 | 6.4 | - | | | | |
| Kinathukadavu | 0.8 | 0.6 | 0.2 | - | | | | |
| Madukkarai | 5.7 | 2.1 | 2.1 | 0.1 | | | | |
| PN Palayam | 2.5 | 1.6 | 0.8 | 0.5 | | | | |
| Pollachi(N) | 0.4 | 0.2 | 0.4 | - | | | | |
| Pollachi(S) | 0.7 | 0.2 | 0.2 | - | | | | |
| S.S Kulam | 3.9 | 3.0 | 1.5 | 0.3 | | | | |
| Sulur | 4.0 | 5.8 | 3.5 | 0.2 | | | | |
| Sultanpettai | 2.7 | 2.6 | 0.8 | - | | | | |
| Thondamuthur | 11.8 | 8.1 | 8.3 | 0.8 | | | | |

**Note:** *M. i- Meloidogyne incognita, P. d- Pratylenchus delattrei, R. s-Radopholus similis, R. r- Rotylenchulus reniformis*

## 4. Conclusion

Among the nine nematodes associated with turmeric, the root knot nematode registered the highest absolute/relative frequency and density was considered as predominant nematode of turmeric grown in twelve blocks of Coimbatore district. Out of twelve blocks, the Thondamuthur was found to be more affected with the above nematodes and monocropping of turmeric is reasoned for the same. The above nematode population was found to be in higher side in conventional method of flood irrigated turmeric compared to drip irrigated turmeric.

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