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RESEARCH ARTICLE

Prevalence and Distribution of Root-Knot Nematode *Meloidogyne Incognita* in Major Tuberose Growing Districts of Tamil Nadu, India

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ABSTRACT

Polianthes tuberosa L., known as tuberose, is a bulbous ornamental plant prized for its fragrant flowers. However, tuberose faces significant cultivation challenges due to root-knot nematode (RKN) infestations, particularly by *Meloidogyne spp.*, which cause root galls, nutrient disruption, stunted growth, and reduced flower yield, severely impacting its commercial value. In this instance, a survey was conducted in Tamil Nadu's tuberose growing districts- Coimbatore, Erode, and Dharmapuri. The study revealed that the widespread root-knot nematode, M. incognita infestations were predominant. Other nematode species such as *Helicotylenchus dihystera*, *Helicotylenchus spp.*, *Pratylenchus spp.*, *Aphelenchus spp.*, and *Filenchus spp.* were also identified. These findings highlight the need for effective management strategies to combat root-knot nematode and support the viability of tuberose cultivation in affected regions.

Keywords: Tuberose, Root-knot nematodes, Survey, other nematode species.

INTRODUCTION

Polianthes tuberosa L., commonly known as tuberose, belongs to the Asparagaceae family. This bulbous plant features pale green leaves and thrives under specific agronomic conditions crucial for its successful cultivation. Tuberose flourishes predominantly in warm, humid climates with temperatures ranging from 16 °C to 30 °C, although it can also be grown in hilly regions at elevations around 1500 meters. Tuberose propagation is typically achieved through seeds and bulbs, with bulb propagation involving the division of bulbs into segments. Root-knot nematode infestation can be a significant issue for tuberose, impacting the health and yield of this ornamental plant. *Meloidogyne* spp. are the most common and damaging nematodes for tuberose. They cause the formation of galls or knots on roots disrupting nutrient uptake and leading to decreased plant growth and lower flower yield. Infected roots may also show reduced branching and appear stubby or Nematode-infected tuberose plants produce fewer and smaller flowers, reducing their commercial value. (Khan 2020) reported that the root-knot nematode*, M. incognita* is one of the critical limiting factors affecting commercial cultivation of Tuberose. It reduces the flower yield of root-knot nematode. It reduces the flower yield by up to 10% (Khan and Reddy 1992). Root-knot nematode problem in Tuberose is widespread root. The majority of the Tuberose growing

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areas in North and South India are heavily damaged by this nematode (Rao *et al.,* 2004).

All commercially grown varieties of Tuberose have been reported to be susceptible to *M. incognita*. Tuberose bulbs procured from root-knot nematode-infested fields, when planted in pots containing sterilized soil, showed the symptoms of root-knot nematode infection with these issues in recent eras, our current study aims to document the nematode infestations in major tuberose growing regions of Tamil Nadu. Also, the study documented the nematode distribution and prevalence in three different regions.

MATERIALS AND METHODS

Survey for root -knot nematode, M. incognita on Tuberose in Tamil Nadu

A comprehensive survey was carried out in diverse locations within the primary Tuberose cultivation districts of Tamil Nadu, specifically Coimbatore, Erode, and Dharmapuri. The objective was to document nematodes associated with tuberose plants prior to harvest. Identification of fields harbouring root-knot nematode infestations was based on observable above-ground symptoms such as stunted growth, daytime-wilting, and chlorosis, complemented by below-ground symptoms like root galling and bulb decay. The tuberose varieties predominantly cultivated by farmers in these districts were identified as Prajwal. Confirmation of the nematode species was established through the observation of adult females, egg masses, and perineal patterns.

Collection of soil and root samples

Soil sampling involved the collection of 250g samples from the rhizosphere region, including feeder roots up to a depth of 15-20 cm, while maintaining a 1m peripheral area as a subsample. Employing a zig-zag pattern, five sub-samples per field were gathered and pooled into a 250 g composite sample, securely

$$\text{RKN incidence} = \frac{\text{Number of samples infested with } \textit{Meloidogyne} \text{ spp.}}{\text{Number of samples cNumber of samples collectedollected}} \times 100$$

placed in a small zip-lock polythene bag, and fastened with a rubber band (one sample per field). Also, roots exhibiting gall formation, decay, or related tissues in tuberose plants were collected. Each collected sample was meticulously labelled with details such as sample number, sampling site, date of sampling, farmer's name, crop stage, and GPS coordinates (Barker and Campbell 1981). The roots were then examined for infestation, with the assessment based on the number of galls, and the incidence of root-knot nematode was subsequently calculated.

Extraction of nematodes from soil

The second stage juveniles (J_2) of the root-knot nematode and other co-existing nematodes were extracted from the soil through the utilization of the decanting and sieving technique (Cobb 1918), coupled with the Baermann's funnel technique as described by (Viggiano *et al.,* 2014).

Extraction of nematodes from roots

The nematode-infected roots were gently washed with water, followed by exposing them to running tap water to remove the adhering soil particles. Then, the washed roots were cut into pieces of 1-3cm in length. The root bits were stained with a mixture of boiling acid fuchsin + lactophenol solution and de-stained with plain lactophenol, overnight. The adult root -knot nematode and egg masses were picked from the roots using forceps and needle under binocular stereo zoom microscope (Bridge and Page 1982).

RESULTS AND DISCUSSION

Findings from the survey

The current study spanned three distinct locations in Tamil Nadu, namely Coimbatore, Erode, and Dharmapuri districts (Table 1a, 1b, 1c). In Erode, observations revealed root-knot nematode (RKN) infestation along with the presence of other nematodes, including *Helicotylenchus dihystera, Helicotylenchus* spp., *Pratylenchus* spp., *Aphelenchus* spp., and *Filenchus* spp. Similarly, the survey in Coimbatore exhibited root-knot nematode infestation and the presence of *Helicotylenchus* spp. (Fig 4). Dharmapuri survey mirrored the same trend, with *M. incognita* identified as the predominant species. The collected samples underwent thorough examination, and nematode populations were assessed. Above-ground symptoms of root-knot nematode infestation, such as gall formation and stunted growth, were evident in the plants.

(Mani 1996) previously demonstrated the efficacy of *Pasteuria penetrans* (Thorne) Sayre and Starr and *Pseudomonas fluorescens* against *Meloidogyne incognita* Chitwood in Grapevine *(Vitis vinifera Linn.),* aligning with the current research utilizing the potential bacterium *Pasteuria penetrans*.

Table 1a. Distribution of plant parasitic nematodes in Tuberose in Erode district

SL. NO	District	Block	Village	Latitude	Longitude	Variety	RKN infestation	H. dihystera	Pratylenchus spp.	Helicotylenchus spp.	Aphelenchus spp.	Filenchus spp.
1	Erode	Sathyamangalam	Varadhampalayam	11.526023	77.237832	Prajwal	MI Yes	15	18	-	14	15
2	Erode	Sathyamangalam	Varadhampalayam	11.52599	77.237831	Prajwal	MI Yes	-	19	-	-	-
3	Erode	Sathyamangalam	Varadhampalayam	11.52599	77.237825	Prajwal	MA Yes	-	12	-	1	1
4	Erode	Sathyamangalam	Varadhampalayam	11.526088	77.237779	Prajwal	MA Yes	8	12	-	9	12
5	Erode	Sathyamangalam	Arasur	11.452748	77.26071	Prajwal	No	-	17	9	13	14
6	Erode	Sathyamangalam	Arasur	11.525982	77.237817	Prajwal	No	7	18	-	12	16
7	Erode	Sathyamangalam	Ayyampalayam	11.440534	77.539732	Prajwal	No	-	13	-	-	-
8	Erode	Sathyamangalam	Ayyampalayam	11.560332	77.559633	Prajwal	No	-	11	-	-	-
9	Erode	Sathyamangalam	Kurumbapalayam	11.112536	77.030345	Prajwal	No	-	13	-	11	-
10	Erode	Sathyamangalam	Kurumbapalayam	11.153140	77.041256	Prajwal	No	9	15	-	-	-
11	Erode	Alathur	Puliampatti	11.330591	77.15308	Prajwal	MI Yes	10	13	-	-	-
12	Erode	Alathur	Puliampatti	11.452748	77.26071	Prajwal	MI Yes	-	-	-	-	-
13	Erode	Alathur	Puliampatti	11.452751	77.26032	Prajwal	MI Yes	-	11	-	-	-
14	Erode	Alathur	Puliampatti	11.475243	77.31069	Prajwal	MI Yes	-	10	-	-	-

Table 1b. Distribution of plant parasitic nematodes in Tuberose in Coimbatore district

SL. NO	District	Block	Village	Latitude	Longitude	Variety	RKN infestation	Helicotylenchus sp.
1	Coimbatore	Annur	Ottarpalayam	11.010512	76.931114	Prajwal	MI Yes	-
2	Coimbatore	Annur	Ottarpalayam	11.011652	76.931123	Prajwal	MI Yes	-
3	Coimbatore	Annur	Ottarpalayam	11.011421	76.932451	Prajwal	MI Yes	-
4	Coimbatore	Annur	Ottarpalayam	11.011341	77.932218	Prajwal	MI Yes	-
5	Coimbatore	Annur	Ottarpalayam	11.013672	77.932889	Prajwal	MI Yes	-
6	Coimbatore	Karamadai	Velliankadu	11.242867	76.958789	Prajwal	MI Yes	10

Table 1c. Distribution of plant parasitic nematodes in Tuberose in Dharmapuri district

SL. NO.	District	Block	Village	Latitude	Longitude	Variety	RKN infestation	H. dihystera	Pratylenchus spp.	Helicotylenchus spp.	Aphelenchus spp.	Filenchus spp.	Psilenchus spp.
1	Dharmapuri	Morappur	Kettureddipatty	12.034196	78.299983	Prajwal	MI Yes	-	4	5	4	8	5
2	Dharmapuri	Morappur	Kettureddipatty	12.03427	78.299759	Prajwal	MI Yes	-	9	-	-	7	2
3	Dharmapuri	Morappur	Nathamedu	12.028552	78.284579	Prajwal	MI Yes	-	-	-	3	2	20
4	Dharmapuri	Morappur	Nathamedu	12.028579	78.284627	Prajwal	MI Yes	-	-	-	-	3	10
5	Dharmapuri	Pappireddipatti	Sunkarahalli	12.027307	78.269693	Prajwal	No	-	10	5	-	-	8
6	Dharmapuri	Pappireddipatti	Sunkarahalli	12.027296	78.269675	Prajwal	No	6	-	5	-	-	9
7	Dharmapuri	Pappireddipatti	Sunkarahalli	12.162464	78.264254	Prajwal	No	-	-	-	-	-	5
8	Dharmapuri	Kambainallur	Mookanur	12.157596	78.26387	Prajwal	MI Yes	-	-	-	-	-	8
9	Dharmapuri	Kambainallur	Mookanur	12.15761	78.263869	Prajwal	MI Yes	5	4	-	-	-	7
10	Dharmapuri	Kambainallur	Mookanur	12.157596	78.26387	Prajwal	MI Yes	-	-	-	-	-	11

(Sumangala 2018) documented the distribution of plant parasitic nematodes on tuberose in four districts, highlighting major nematodes associated with flower crops in different poly houses, and open field conditions. This is consistent with the present research, emphasizing the distribution of nematodes in flower crops across Tamil Nadu.

The current study revealed the prevalence of root-knot nematode, *M. incognita* infestation in tuberose in most surveyed areas. These observations were in accordance with the findings of (Jothi *et al.*, 2018), who reported the population dynamics of root-knot nematode, M. incognita, on tuberose under varied irrigation systems by conducting field experiment. This also helped in the current study to analyze the population and distribution of *M. incognita* in Tamil Nadu and recorded the presence of few plant parasitic nematodes *viz., M. incognita*, *Helicotylenchus* sp, *Pratylenchus* sp, *Filenchus* sp, *Psilenchus* sp, *H. dihystera*, *Aphelenchus* sp.

Fig 1 *Meloidogyne incognita* infested field

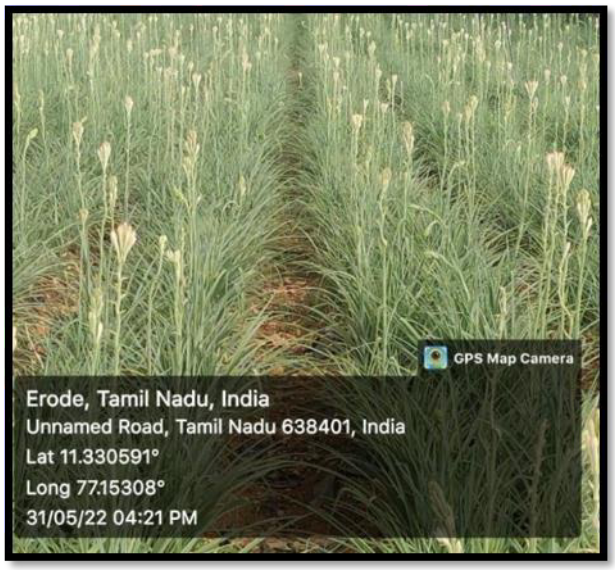

Fig 2. Collection of soil samples

Fig 3 Nematode infested galled roots

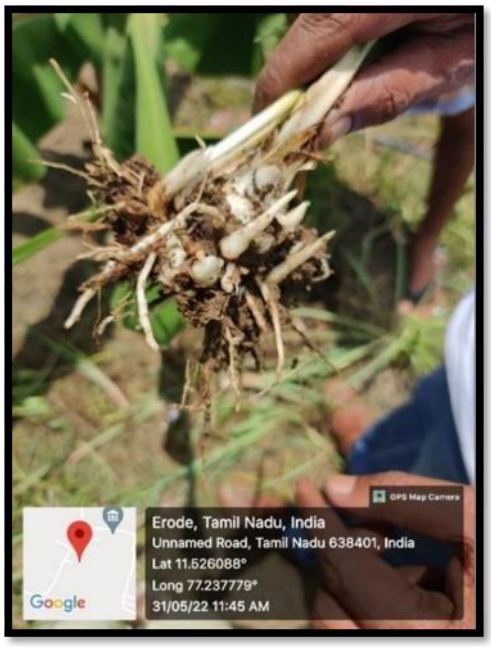

Fig 4. Distribution of various nematodes in major Tuberose growing districts of Tamil Nadu

	Meloidogyne incognita
	Meloidogyne arenaria
	Helicotylenchus spp.
	Helicotylenchus dihystera
	Pratylenchus spp.
	Aphelenchus spp.
	Filenchus spp.
	Psilenchus spp.

CONCLUSION

The survey results across the three major tuberose growing districts in Tamil Nadu have highlighted the widespread prevalence of root-knot nematodes (RKN) particularly *Meloidogyne incognita,* as a significant threat to crops in these regions, and the findings indicate that RKN infestation is consistently accompanied by other nematode species such as *H. dihystera, Helicotylenchus* spp., *Prtaylenchus* spp., *Aphelenchus* spp., and *Filenchus* spp., suggesting a complex nematode community affecting crop plants. A brief conductance of the survey indicated that *M. incognita* was prevalent across the surveyed districts and was the dominant species found in nearly all the tuberose cultivated crops.

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