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Population Dynamics of Root Knot Nematode, *Meloidogyne incognita* (Kofoid and White) Chitwood on Tuberose (*Polianthes tuberosa* L.) under varied irrigation systems

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ABSTRACT : Field experiment was conducted to study the distribution and population dynamics of root knot nematode, *Meloidogyne incognita* in tuberose under surface and drip irrigated conditions during October, 2017 to March, 2018. The highest *M. incognita* population was recorded at 5 cm horizontal distance from the bulb with 10-20 cm vertical depth in surface irrigated condition, whereas it was maximum at 2.5 cm horizontal distance with 0-10 cm depth in drip irrigated condition. This indicated the diverse behaviour of nematode population with difference in horizontal and vertical distances in the crop rhizosphere under varying irrigation systems. Soil population was the highest during October whereas root population was maximum during December, under both the irrigation systems. With reference to the crop stage, soil population was at its peak during the vegetative phase while root population was the highest during flowering phase.

Keywords: tuberose, root knot nematode, *Meloidogyne incognita*, irrigation systems, population dynamics.

INTRODUCTION

Tuberose, *Polianthes tuberosa* L. is a commercially important crop used as cut flowers and loose flowers for its aesthetic value. It plays a major role in perfumery industries, since it fetches high market value. Tuberose is popularly known as Rajanigandha in India. In Tamil Nadu, it is widespread in the areas of Coimbatore, Madurai, Krishnagiri and Trichy districts. The area under cultivation of tuberose in Tamil Nadu is 2,166 ha with production of 36,389 tonnes and productivity of 16.80 t/ha (FloralDaily , 2016). The commercial cultivation of tuberose is seriously limited by root knot nematodes, *Meloidogyne* spp. in Tamil Nadu (Sundarababu and Vadivelu, 1988). It causes a yield loss of 13 - 14 per cent wherein the infected plants show yellowing, stunted growth and moderate to severe galls on roots (Ravichandra, 2008). In the recent years, root knot nematode has become a major threat for tuberose cultivation under drip irrigated conditions. Moreover, information related to the distribution and population dynamics of *M. incognita* in tuberose under different irrigation system is meagre. Hence, the present study was conducted under surface and drip irrigation systems in order to study the distribution pattern and population dynamics of root knot nematode in tuberose, so as to adopt effective management strategies.

MATERIALS AND METHODS

A random survey was conducted at ten places in and around Velliankadu village, Karamadai block, Coimbatore district in order to identify root knot nematode infestation in fields of tuberose. Population dynamics of nematodes in relation to horizontal distance and vertical depth of rhizospheric region of tuberose cv. `Prajwal' were studied at different stages of crop under surface and drip irrigated condition. The experiment was conducted in a heavily root knot nematode infested field at Velliankadu village of Karamadai Block, Coimbatore District, Tamil Nadu which is located at an altitude of 372 m above MSL, 11.14^0 N latitude and 76.94^0 E longitude. The monthly observations of nematode population in soil and root were recorded during October, 2017 to March, 2018 under surface and drip irrigation. The samples were collected from four different horizontal distances and vertical depths, replicated 5 times each, in randomized block design, for assessment of distribution and population dynamics of nematodes.

Collection and Processing of Samples

Soil sample (200 cc) and root samples (5g) were collected randomly from the rhizosphere of tuberose from both surface and drip irrigated field. The samples were stored in polythene bags, labelled properly and sealed

tightly with a rubber band. The collected soil samples were processed by Cobb's decanting and sieving method (Cobb, 1918) followed by modified Baermann's funnel technique (Schindler, 1961). After 36-48 hrs, the petri plates containing nematodes suspension was examined under stereozoom microscope and counted the nematode population by using counting dish. The collected root samples were stained with acid fuchsin lactophenol followed by destaining with plain lactophenol. The numbers of females present in root galls per 5g of roots were counted. The data from the experiments were subjected to statistical analysis. The critical difference was worked out for 5 per cent (0.05) probability (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Distribution of Nematode in rhizosphere

The highest soil (294.40) and root (100.00) population of *M. incognita* was recorded at a distance of 5 cm away from the bulb and at a depth of 10-20 cm and comparatively lowest soil (156.40) and root population (60.00) was recorded at a distance of 2.5 cm and depth of 10-20 cm under surface irrigated conditions.

In case of drip irrigated tuberose, the highest soil and root population of *M. incognita* (300.40) and (139.00), respectively was recorded at a distance of 2.5 cm away from the stem and at a depth of 0-10 cm and the lowest soil (177.60) and root population (61.00) was recorded at a distance of 5 cm and depth of 10-20 cm. This may be due to the confinement of moisture in the rhizosphere under drip irrigated conditions that helps to enhance the production of secondary and tertiary roots have favoured the nematode population indrip irrigated tuberose. Earlier, Jonathan and Rajendran (2003) reported that *M. incognita* associated with banana recorded the highest population at a horizontal distance of 30-60 cm away from corm and at vertical depth of 0-10 cm.

Population dynamics

In surface irrigated tuberose, the highest soil nematode population (294.40) was observed during October when the crop was at vegetative stage whereas the lowest soil nematode population (156.40) was recorded during March at ratoon stage of the crop. With respect to root population, the highest number of females (100.00) was observed during December at flowering stage of crop whereas the lowest population (60.00) was recorded during the month of March when the crop was in ratoon stage under surface irrigation (Table 1).

In drip irrigated tuberose, the highest soil nematode population (300.40) was noticed during the vegetative stage of crop in October while the lowest soil nematode population (177.60) was recorded during March at ratoon stage of the crop. The highest nematode population in root (139.00) was observed during December month at

Table 1. Population dynamics of *M. incognita* in tuberose under surface irrigation

Treatment	Nematode population in soil (200 cc)* and root (5 g)*											
	October 2017		November 2017		December 2017		January 2018		February 2018		March 2018	
	Vegetative stage		Spike emergence stage		Flowering stage		Flower harvest stage		Flower harvest stage		Ratoon stage	
	Soil	Root	Soil	Root	Soil	Root	Soil	Root	Soil	Root	Soil	Root
T_1 - Horizontal distance of 2.5 cm with vertical depth of 0-10 cm	287.40	86.00	273.20	89.00	264.40	97.00	249.20	85.00	208.80	68.00	157.60	62.00
T_2 - Horizontal distance of 2.5 cm with vertical depth of 10-20 cm	286.00	80.00	269.20	87.00	261.00	89.00	247.80	80.00	206.80	63.00	156.40	60.00
T_3 - Horizontal distance of 5 cm with vertical depth of 0-10 cm	290.00	89.00	284.00	91.00	272.40	92.00	266.80	86.00	222.80	73.00	169.60	64.00
T_4 - Horizontal distance of 5 cm with vertical depth of 10-20 cm	294.40	95.00	286.00	96.00	274.80	100.00	268.00	89.00	225.80	78.00	175.00	71.00
S Ed	1.73	0.09	1.19	0.06	1.05	0.07	1.04	0.06	0.97	0.04	1.32	0.08
CD(P=0.05)	3.55	0.21	2.44	0.13	2.13	0.17	2.13	0.15	1.98	0.09	2.70	0.18

*Values are mean of five replications

Table 2. Population dynamics of *M. incognita* in tuberose under drip irrigation

Treatment	Nematode population in soil (200 cc)* and root (5 g)*											
	October 2017		November 2017		December 2017		January 2018		February 2018		March 2018	
	Vegetative stage		Spike emergence stage		Flowering stage		Flower harvest stage		Flower harvest stage		Ratoon stage	
	Soil	Root	Soil	Root	Soil	Root	Soil	Root	Soil	Root	Soil	Root
T_1 - Horizontal distance of 2.5 cm with vertical depth of 0-10 cm	300.4	84.00	292.6	112.00	288.0	139.00	279.6	118.00	231.2	86.00	202.8	77.00
T_2 - Horizontal distance of 2.5 cm with vertical depth of 10-20 cm	296.4	79.00	289.2	109.00	284.8	121.00	278.6	111.00	228.2	82.00	198.2	75.00
T_3 - Horizontal distance of 5 cm with vertical depth of 0-10 cm	269.2	88.00	259.4	99.00	254.0	124.00	246.8	119.00	211.0	73.00	182.0	67.00
T_4 - Horizontal distance of 5 cm with vertical depth of 10-20 cm	256.4	96.00	251.0	91.00	247.2	129.00	249.4	113.00	213.2	67.00	177.6	61.00
S Ed	2.45	0.07	1.69	0.11	1.49	0.06	1.47	0.08	1.37	0.05	1.87	0.08
CD(P=0.05)	5.02	0.15	3.46	0.24	3.02	0.14	3.02	0.18	2.80	0.12	3.82	0.18

*Values are mean of five replications

flowering stage of crop whereas the lowest population (61.00) was recorded during March when the crop was in ratoon stage (Table 3). Browne *et al.* (2002) reported that drip irrigation can maintain a relatively dry soil surface while maintaining crop water requirements would be less conducive to nematodes and higher crop yield can be obtained as compared to conventional system of irrigation. Similar findings were reported by Davis and Bucks (1983).

The drip system of irrigation serves to provide the plants with optimal moisture conditions, thus reducing the influence of phytonematodes stress to the plants (Funt, 1982) which is in contrast with the present investigation where the maximum nematode population was noticed under drip irrigated conditions which may be due to the continuous supply of water that maintains the optimum available soil moisture in the rhizosphere, enhances new root establishment which in turn becomes conducive for the development and reproduction of more number of female nematodes. As a result, more number of galls was observed under drip irrigated tuberose. Similarly, the highest nematode population was recorded during vegetative stage of crop under drip irrigated tuberose since the juvenile stages of nematode preferably feed more upon newly emerged feeder roots, thus the soil nematode population was found to be high during vegetative stage. During flowering stage, the root development gets profuse and succulent, harbours the adult female nematodes that feed upon the vascular stele of roots and continue their reproduction.

In general, drip irrigation system promotes continuous availability of moisture in the rhizosphere which aids in enhanced development of feeder roots where the nematodes get congregated and feed upon and thus it can be inferred that the nematode population is favoured by drip irrigated tuberose.

CONCLUSION

Drip irrigated system harbors more number of root knot nematode, *M. incognita* due to the conducive soil moisture in soil and nutrition which promotes more secondary and tertiary roots development in the crop. Population dynamics of root knot nematode in tuberose gives an idea about the depth at which the application of biocontrol agents and botanicals has to be taken up, for effective management of nematodes.

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