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Evaluation of Ecofriendly Management Technique against Root Knot Nematode *Meloidogyne incognita* in Tuberose

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ABSTRACT: Plant parasitic nematodes are one of the major limiting factors in the production of tuberose. Among the nematodes, root knot nematode *Meloidogyne incognita* is serious and important nematode, which causes flower yield loss about 40 per cent. Limited chemical nematicides are available for nematode management and farmers are not used these nematicide due to environmental concern. Alternatively ecofriendly bionematicides are gaining much important for nematode management among the farmers. Hence, a field experiment was conducted to study the potential of bionematicide on root knot nematode management using commercially available talc formulation of *Paecilomyces lilacinus, Pochonia chlamydosporia,* growing of marigold and neem cake along with chemical check Carbofuran 3G and compared with untreated control under root knot nematode sick field. The above said biocontrol agents were applied as seed treatment (bulbs) and soil application as per the treatment schedule. The biometrical observation, nematode population and flower yield were recorded at the time of termination of experiment. The results revealed that the combined application of soil (2.5 kg/ha) and bulb (1 kg/ha) of *Pochonia chlamydosporia* significantly reduced the nematode population in soil (47.3 %) and root (49.1 %) compared to other treatments. The application of *Pochonia chlamydosporia* in soil (2.5 kg/ha) and bulb (1 kg/ha) recorded the highest flower yield (43.5%) and spike length (63.7 cm) when compared to untreated control.

Keywords: Tuberose, root knot nematode, biocontrol agents, *Meloidogyne incognita.*

INTRODUCTION

Tuberose (*Polianthes tuberosa* L) is an important flower crops cultivated in Tamil Nadu. Tuberose mainly propagated by bulbs and bulblets. This form of vegetative propagation favors the spread of many diseases such as fungi, bacteria, virus and nematodes. Among the nematodes, root knot nematode *Meloidogyne incognita* causes 40 per cent of flower yield loss (Ramakrishnan, 1995; Elgawad, 2014) in tuberose. The nematode infested tuberose plants exhibit yellowing, drying of leaves and retarded growth. In severe condition nematode suppresses the spike production and side shoots emergence resulting in total loss of flower yield and reduction of bulbs number, weight and size. Even though chemical nematicides are effective for nematode management, nowadays use of chemical nematicide decreased due to awareness on residues, environmental pollution and health hazards. So as to avoid these problems, biological agents are used to manage root knot nematode by sustainable manner (Mitchell *et al.* 1987; Kiewnick and Sikora, 2004; Elgawad, 2016; Senthilkumar and Ananthan, 2018; Baron *et al.,* 2019). Hence the present study was undertaken to evaluate the bionematicide *Pochonia chlamydosporia* and *Paecilomyces lilacinus* on root knot nematode in tuberose.

MATERIALS AND METHODS

A field experiment for the management of root knot nematode in tuberose was conducted during 2014-2015 at ADAC&RI, Trichy. Application of *Paecilomyces lilacinus, Pochonia chlamydosporia* , marigold and neem cake along with carbofuran 3G @ (33 kg/ha) as standard check was taken up in a nematode sick field. Schedule of treatments were followed as T1 - Bulb application of *Paecilomyces lilacinus* (1 kg/ha), T2 - Soil application of *Paecilomyces lilacinus* (2.5 kg/ha), T3 - Bulb application of *Pochonia chlamydosporia* (1 kg/ha), T4 - Soil application of *Pochonia chlamydosporia* (2.5 kg/ha), T5 - Combined application of *Paecilomyces lilacinus* (bulb @1 kg/ha & soil @ 2.5 kg/ha), T6 - Combined application of *Pochonia chlamydosporia* (bulb @1 kg/ha & soil @ 2.5 kg/ha), T7 - Growing of marigold (10:1 ratio), T8 - Neem cake (500 kg/ha), T9 - Carbofuran (33kg/ha), T10 - Untreated control maintained during the planting of tuberose bulbs. Observations on tuberose yield parameters *viz.*, number of flowers/spike, average weight of 10 flowers (g), spike length and flower yield during the study period were recorded. After flower harvest the soil and root samples were collected from the tuberose and processed in laboratory. Nematode population was assessed in soil and root. The number of egg masses present per gram of root was found out and root gall indies were recorded. Galls on the root system indexed based on a scale of 0 to 5 (Hussey and Janssen, 2002). Collected data were analyzed statistically and tabulated.

RESULT AND DISCUSSION

All the data were analyzed and tabulated. The results revealed that in all the treatments from the Table (1 and 2) it was observed that biocontrol efficacy on biometric characters were increased and nematode population was decreased in soil as well as root when compared to untreated control. The combined treatment of soil (2.5 kg/ha) and bulb (1 kg/ha) of *Pochonia chlamydosporia* effectively reduced the nematode population in soil and root. The application of *Pochonia chlamydosporia* in soil (2.5 kg/ha) and bulb (1 kg/ha) recorded the highest flower yield (43.5 %) and spike length (14.1 %) when compared with untreated control. Similarly the maximum number of flowers per plant (46.7 %) was recorded in above said treatment followed by combined application of *P. lilacinus* (bulb @1 kg/ha & soil @ 2.5 kg/ha) compared with untreated control. Similarly *P. chlamydosporia* in soil (2.5 kg/ha) and bulb (1 kg/ha) treated plants were recorded lowest number of root knot nematode population (167.7) and adult female nematode population was also recorded as 9.3 per g of root with gall index o 2.7 when compared to untreated control.

Table 1: Evaluation of eco-friendly management tactics against root knot nematode *Meloidogyne incognita* in tuberose under field conditions.

Treatments		Root knot nematode (250g soil)	Per cent decrease over control	No. of nematode /g of root	Per cent decrease over control	No. of egg mass/g of root	Per cent decrease over control	Gall Index
T_1	Bulb application of *Paecilomyces lilacinus* (1 kg/ha)	178.7	43.9	12.7	30.9	8.7	48.0	3.3
T_2	Soil application of *Paecilomyces lilacinus* (2.5 kg/ha)	181.7	42.9	13.7	25.5	9.7	42.0	3.7
T_3	Bulb application of *Pochonia chlamydosporia* (1 kg/ha)	174.7	45.1	12.0	34.5	8.3	50.0	3.3
T_4	Soil application of *Pochonia chlamydosporia* (2.5 kg/ha)	183.0	42.5	13.0	29.1	8.7	48.0	3.3
T_5	Combined application of *Paecilomyces lilacinus* (bulb @1 kg/ha & soil @ 2.5 kg/ha)	176.0	44.7	10.0	45.5	7.0	58.0	3.7
T_6	Combined application of *Pochonia chlamydosporia* (bulb @1 kg/ha & soil @ 2.5 kg/ha)	167.7	47.3	9.3	49.1	6.3	62.0	2.7
T_7	Growing of marigold (10:1 ratio)	186.0	41.6	12.0	34.5	9.3	44.0	3.0
T_8	Neem cake (500 kg/ha)	193.3	39.3	13.7	25.5	10.0	40.0	3.3
T_9	Carbofuran (33kg/ha)	162.3	49.0	7.0	61.8	4.3	74.0	2.0
T_{10}	Untreated control	318.3		18.3		16.7		5.0
CD		13.36		1.47		1.32		-

Table 2: Effect of eco-friendly management tactics against root knot nematode *Meloidogyne incognita* on yield of tuberose.

Treatments		No. flowers/ spike	Per cent increases over control	weight of 10 flower (g)	Per cent increases over control	Spike length (cm)	Per cent increases over control	Flower yield (g)	Per cent increases over control
T_1	Bulb application of *Paecilomyces lilacinus* (1 kg/ha)	23.3	30.0	13.7	24.4	63.0	13.2	41.0	15.4
T_2	Soil application of *Paecilomyces lilacinus* (2.5 kg/ha)	24.7	33.8	13.3	22.5	61.0	10.4	40.7	14.8
T_3	Bulb application of *Pochonia chlamydosporia* (1 kg/ha)	26.3	38.0	14.0	26.2	62.0	11.8	43.3	20.0
T_4	Soil application of *Pochonia chlamydosporia* (2.5 kg/ha)	25.7	36.4	14.7	29.5	61.3	10.9	47.0	26.2
T_5	Combined application of *Paecilomyces lilacinus* (bulb @1 kg/ha & soil @ 2.5 kg/ha)	27.7	41.0	14.7	29.5	63.3	13.7	56.3	38.5
T_6	Combined application of *Pochonia chlamydosporia* (bulb @1 kg/ha & soil @ 2.5 kg/ha)	30.7	46.7	15.7	34.0	63.7	14.1	61.3	43.5
T_7	Growing of marigold (10:1 ratio)	25.7	36.4	12.7	18.4	60.7	9.9	51.7	32.9
T_8	Neem cake (500 kg/ha)	23.0	29.0	13.3	22.5	61.0	10.4	44.3	21.8
T_9	Carbofuran (33kg/ha)	22.0	25.8	12.0	13.9	59.7	8.4	50.3	31.1
T_{10}	Untreated control	16.3		10.3		54.7		34.7	
CD		1.59		1.61		2.41		4.19	

From this experiment it is observed that all the formulation of bio-control agents was effectively reduced the *M. incognita* population in soil as well as root. Suppression of root knot nematode population by *P. chlamydosporia* was due to its egg parasitic nature and can also colonise the rhizosphere of healthy plants (Larriba *et al.,* 2015). The fungus proliferates in the rhizosphere and parasitizes the egg masses of root-knot nematodes as they mature and rupture the root cortex and those egg masses exposed on the root surface (Cannayane and Jonathan, 2008; Mahfouz *et al*. 2018) which affects the extent of galling and the reproduction of root-knot nematodes (Anita and Samiyappan, 2012; Mahfouz *et al*., 2018). This significantly decreased the number of galling in the following generations of nematodes, finally nematode population we reduced simultaneously increase the plant growth (Santhi and Sivakumar, 1995; Milani *et al*., 2019; Baron *et al.,* 2020). It is evidenced with the findings of Jonathan and Rajendran (2000), the population of *M. incogntia* significantly reduced in soil with the application of that *P. lilacinus* in banana. In this study it is observed that the bio-control potential of egg parasitic fungus on nematode management is effective (Cannayane and Rajendran, 2001; Senthilkumar and Ananthan, 2018; Goffré and Folgarait, 2015). From this research

experiment it is concluded that the bio-control agents effectively inhibit the nematode egg hatching and increase the plant growth positively.

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