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Parasitic fungus: As a tool for the management of root knot nematode, *Meloidogyne incognita* on tomato at north eastern zone

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Abstract

Survey conducted for isolation of nematode parasitic fungus from 21 blocks with 50 villages under five Districts of north eastern region viz., Tiruvannamalai, Cuddalore, Villupuram, Kallakurichi and Vellore. The cultures were identified against nematode, based on the infection structure and capacity for mortality on juveniles of *M. incognita*. Finally, single selected culture (TVMT1) was sent to reputed biotech company for molecular characterization.

Isolation of nematode parasitic fungus from 14 blocks with 43 villages under four districts of northeastern region viz., Cuddalore, Villupuram, Kallakurichi and Vellore and the cultures were identified against nematode, based on the infection structure and capacity for mortality on juveniles of *M. incognita*. Maximum mortality percentage (75.00 percent) was observed in the sample which was collected from Annavalli village, Cuddalore block (Table 1). Soil sample from Villupuram block recorded only mortality of 55.50 percent in Adanur village. The lowest mortality 15.50 and 15.20 percent was observed in the districts viz., Kallakurichi and Vellore. Finally, Single selected culture was sent to Chromous Biotech, Bangalore for molecular characterization.

Keywords: Root knot nematode, tomato, parasitic fungus

Introduction

Efficacy of *Trichoderma reesei* under pot condition

The pot experiment was laid out to evaluate the effects of *T. reesei* on tomato growth and root-knot nematode infection in the glasshouse using a completely randomized design (CRD). Tomato seedlings were planted in pots containing a 5 kg mixture of loam and sandy soil (1:1, w/w). Five tomato seedlings were planted in each pot and they were thinned to three per pot after 6 days of planting. Pots were irrigated regularly, and plants were grown under natural conditions. The experiment consisted of seven treatments, T1- *Purpureocillium lilacinum* (Root dip + soil application 30 DAP), T2-*Trichoderma viride* (Root dip+soil application 30DAP), T3- *P. lilacinum* (root dip)+ *T. viride* (2 kg/ha)soil application 30DAP, T4- *T. reesei* (Root dip+soil application 30 DAP), T5-*P. lilacinum* (root dip)+ *T. reesei* (2 kg/ha), T6- Carbofuran 3G @ 1 kg a.i./ha, T7-Untreated control (Healthy control). Each treatment was performed in five replicates. Plants were harvested 50 days after planting, comparable to the late vegetative stage of tomato growth.

Effect of *Trichoderma reesei* against root knot nematode under field condition

The field experiment was carried out in a field and severely infested with *M. incognita*, located in Agricultural College and Research Institute, Tiruvannamalai, Tamil Nadu in two growing seasons in 2020 and 2021. The four week-old tomato seedlings without infestation with *M. incognita* were transplanted into the field. The 196 mL sterile distilled water was added into 4 mL fermentation broth (106 spores/mL) of strain TVM1 or 4 mL PDB culture medium to obtain the desired concentrations and poured into the planting hole during plant transplantation. The experimental plots were 6 m long, 5.5 m wide and separated by 0.5 m (6 plant rows) and contained 21 transplanted seedlings per row. A randomized complete block design was adopted in this experiment, and each treatment consisted of three replications. The fields were irrigated and fertilized followed as per the schedule. Fifteen plants and rhizosphere soil samples were randomly selected and collected from each treatment, 30 days after transplantation. The population at harvest stage from root and soil samples, root knot index and yield kg per plant were observed as per the procedure.

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Statistical analysis

Data were statistically analyzed using SPSS software 20.0. Duncan's one-way analysis of variance was used to determine the significant differences.

Result and Discussion

Totally 95 samples were collected from various locations from five districts of north eastern region viz., Tiruvannamalai, Cuddalore, Villupuram, Kallakurichi and Vellore. Maximum mortality (75.00%) was observed on juveniles of *M. incognita*. Finally, single selected culture (TVMT1) was sent to Chromous biotech, Bangalore for molecular characterization on 30.03.2021.

The selected virulent culture was sent for identification to reputed company as per the direction of the Director (CPPS), TNAU, Coimbatore and identifies as *Trichoderma reesei*.

Two pot culture experiments were conducted under pot culture conditions to assess the effect of talc formulation of *Trichoderma reesei* on *M. incognita* in tomato cv. PKM. The data from two experiments were pooled and analyzed.

The efficacy of promising bioagents viz., *Purpureocillium*

lilacinum, *Trichoderma viride* and *T. reesei* were tested for the management of root knot nematode infesting tomato cv. PKM 1 under pot culture conditions. Among the isolates tested, *T. reesei* treatments showed significant increase in root length (15.88 cm) and the untreated control plants recorded the least root length (08.12 cm). The isolate *T. reesei* registered the highest Shoot length which attributed for 45.40 cm. The untreated plants recorded the lowest shoot length of 30.11 cm.

All the treatments were found to reduce nematodes population in roots and highest reduction was noticed in *T. reesei* treated plants (141.21) which was (90.02) per cent decrease over control. The untreated plants recorded the highest nematode population of 1415.20 per 200 cc soil (Table 2).

Significant reduction in root lesion index were observed in the treatment *T. reesei* and carbofuran which recorded 1.2 and 1.1. The untreated control plant roots showed highest lesion index of 5.0 per cent (Table 2). The yield increase in the field treated with *T. reesei* was significantly higher than the untreated control (1.2kg/plant).

Table 1: Assessment of morphometric characters, status of galls and egg masses in tomato var. (PKM1) treated with various bioagents against root knot nematodes, *M. incognita* under pot culture condition at farm of AC&RI, VVNR, Tiruvannamalai

Treatments	Root length (cm)	Percent increase over control	Shoot length (cm)	Percent increase over control	Shoot weight (g)	Percent increase over control	No of galls /root system	Percent (-) decrees over control	No of egg masses /gall	Percent (-) decrees over control
T1- <i>Purpureocillium lilacinum</i> (Root dip+soil application 30DAP)	15.21	87.32	42.75	41.98	33.43	18.97	39.43	60.95	35.25	43.44
T2- <i>T. viride</i> (Root dip+soil application 30 DAP)	13.22	62.81	43.55	44.64	42.83	52.42	51.30	40.08	41.72	33.06
T3- <i>P. lilacinum</i> (root dip)+ <i>T. viride</i> (2 kg/ha)soil application 30 DAP)	12.41	52.83	35.21	16.94	34.21	21.74	41.10	51.99	41.91	32.75
T4- <i>T. reesei</i> (Root dip+soil application 30 DAP)	15.88	95.57	45.40	50.78	52.31	86.16	25.41	70.32	25.31	59.39
T5- <i>P. lilacinum</i> (root dip)+ <i>T. reesei</i> (2 kg/ha)	09.21	13.42	40.20	33.51	34.40	22.42	30.31	64.60	30.22	51.51
T6-Carbofuran 3G @ 1 kg a.i./ha	11.52	41.87	35.19	16.87	32.20	14.59	54.91	35.86	41.22	33.86
T7-Untreated control	08.12		30.11		28.10		85.61		62.32	
CD (p=0.05)	3.90		12.69		12.25		15.37		12.48	
SED	1.79		5.82		5.62		7.05		5.73	

Table 2: Assessment of population and yield in tomato var.(PKM1) treated with various bioagents against root knot nematodes, *M. incognita* under pot culture condition at farm of AC&RI,VVNR, Tiruvannamalai

Treatments	Population at harvest (soil 200 cc)	Population at harvest (root 5 g)	Percent decrees (-) over control	Root knot index %	Percent decrees (-) over control	Yield kg/plant	Percent increase over control
T1- <i>Purpureocillium lilacinum</i> (Root dip+soil application 30 DAP)	612.18	511.22	63.88	3.0	40.00	1.1	46.67
T2- <i>T. viride</i> (Root dip+soil application 30 DAP)	401.21	414.12	70.74	3.0	40.00	1	33.33
T3- <i>P. lilacinum</i> (root dip)+ <i>T. viride</i> (2 kg/ha)soil application 30 DAP)	274.16	165.32	88.32	2.0	60.00	1	33.33
T4- <i>T. reesei</i> (Root dip+soil application 30 DAP)	210.66	141.21	90.02	1.0	80.00	1.2	60.00
T5- <i>P. lilacinum</i> (root dip)+ <i>T. reesei</i> (2 kg/ha)	631.44	602.72	57.41	2.0	60.00	1	33.33
T6-Carbofuran 3G @1 kg a.i./ha	265.20	201.22	85.78	4.0	20.00	1.1	46.67
T7-Untreated control	365.20	1415.20		5.0		0.75	
CD (p=0.05)	139.57	202.38		0.92		0.32	
SEd	64.05	92.88		0.42		0.14	

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