Madras Agric. J., 98 (4-6): 176-177, June 2011
https://doi.org/10.29321/MAJ.10.100270

Short Note

Pseudomonas fluorescens for the Management of Root-knot Nematode *Meloidogyne incognita* in Tomato

P.G. Kavitha*, E.I. Jonathan and K. Sankari Meena
Department of Nematology
Tamil Nadu Agricultural University, Coimbatore - 641 003

A field experiment was conducted in Coimbatore district to study the efficacy of the biocontrol agent *Pseudomonas fluorescens* for the management of root-knot nematode *Meloidogyne incognita* in tomato. Soil application of the native isolates Pft 20 @ 2.5 kg/ha significantly reduced the nematode infestation in all the bacterized plants both in soil and roots with the least number of adult females, number of egg masses, number of eggs per egg mass and gall index and besides increased the plant growth, total soluble sugars and lycopene content of the fruit.

Key words: *Pseudomonas fluorescens, Meloidogyne incognita*, tomato.

Tomato (*Lycopersicon esculentum* Mill) is one of the important vegetable crops grown in India. It is cultivated in an area of about 4.5 lakh hectares and contributes to total production of 7.5 lakh tonnes and productivity of 16.3 MT/ ha. Root-knot nematodes *(Meloidogyne* spp.) are the major pathogens of tomato throughout the world, affecting both the quantity and quality of marketable yields. The yield loss due to the root-knot nematode in tomato is estimated to be up to 40 percent (Dasgupta, 1998). The plant growth promoting rhizobacterium, *Pseudomonas fluorescens* Migula is reported to be effective in suppressing *M. incognita* in many crops *viz*., tomato (Jonathan *et al*., 2000). Therefore an investigation was undertaken for the management of root knot nematode infesting tomato by the rhizobacterium, *P. fluorescens.*

Materials and Methods

Soil samples were collected from the rhizosphere of healthy tomato plants in Coimbatore district to isolate native strains of *P. fluorescens* by serial dilution agar plate technique. One ml each of 10^{-5} and 10^{-6} dilutions were pipetted out and poured into sterile Petri dishes. King's B medium (King *et al.,* 1954) was poured in Petri dish, rotated and inoculated at room temperature (28 ±1°C) for 24 h. The colonies with raised surface showing fluorescent colour were individually purified and subcultured.

Effective *P. fluorescens* isolates were formulated in purified talc powder (sterilized at 10°5 C for 12 h) with calcium carbonate 15g (to adjust the pH to neutral) and carboxy methyl cellulose (CMC) 10g (adhesive) following the method described by Vidhyasekaran and Muthamilan (1995). At the time of application, the population of bacteria in talc formulation was 2.5 - 3 x 10^8 cfu/g.

A field experiment was conducted in Madampatti village, Coimbatore District to test the bioefficacy of talc based formulations of promising *P. fluorescens* isolates against the natural infestation of *M. incognita* in tomato. The talc based formulation of the promising *P. flourescens* isolates Pft 18, Pft 20 and Pft 25 applied to the soil at two doses viz., 2.5 kg/plot and 3.0 kg/plot. The strain Pf 1 was obtained from the Department of Plant Pathology, Tamilnadu Agricultural University, Coimbatore, India. The effectiveness of these isolates was compared with Pf1 and the chemical carbofuran 3G applied @ 1 kg a.i / plot. An untreated control was also maintained. The plot size of 10 m^2 was maintained for all the treatments. The formulation was applied 30 days after planting of the tomato seedlings of cv. PKM-1. The initial nematode population in the field was 240 juveniles/200 cm^3 which was obtained by taking samples at different locations randomly and the samples were mixed well. A representative sample of volume 200cm^3 was processed as per Cobb (1918) and modified Baermann funnel technique (Schindler, 1961). The study was conducted with 10 treatments by using randomized design with ten treatments each replicated three times.

Observations on fruit yield at the time of harvest; fruit qualitative characters *viz*., total soluble sugar (TSS) and lycopene content were recorded. The plants were carefully uprooted and the observations on gall index, number of females per 5 g of root, number of egg masses per 5 g of root and number of eggs per egg mass were recorded. The soil and roots were processed as per Cobb (1918) and modified Baermann funnel technique (Schindler,

*Corresponding author email: kavitha_nem@yahoo.com

Table 1. Efficacy of talc formulations of *P. fluorescens* isolates on TSS, lycopene and yield of tomato cv. PKM-1 infested with *M. incognita* under field conditions

Treatment	TSS	Lycopene content (%)	Yield/ha (Tonnes)
Pft 18 (2.5kg/ha)	2.9	1.53	2.5
Pft 18(3.0kg/ha)	2.6	1.51	2.7
Pft 20(2.5kg/ha)	4.0	1.84	3.5
Pft 20(3.0kg/ha)	3.4	1.76	3.3
Pft 25(2.5kg/ha)	3.0	1.57	3.0
Pft 25(3.0kg/ha)	3.2	1.56	2.9
Pf 1(2.5kg/ha)	3.6	1.54	3.2
Pf 1(3.0kg/ha)	3.4	1.53	3.1
Carbofuran(1.0kg a.i /ha)	2.8	1.42	3.3
Control	2.5	1.39	2.4
(CD 0.05)	0.04	0.017	0.17

1961). The gall indices were graded on 0 to 5 scales (Taylor and Sasser, 1978). All the data were statistically analyzed and critical differences determined (Gomez and Gomez, 1984).

Results and Discussion

The results showed that Pft 20 treatment @ 2.5kg/ha on tomato recorded significant increase in the total soluble sugar and lycopene content. The maximum fruit yield of 3.5 tonnes/ha was recorded in Pft 20(2.5kg/ha) treated plants compared to the control (Table 1). *P. fluorescens* is capable of surviving and colonizing in rhizosphere of all field crops and they are reported to promote plant growth by secreting auxins, gibberellins and cytokinins. Reduction in the multiplication of *M. incognita* by *P. fluorescens* treatment is also reported in several crops (Jonathan *et al*., 2000).

A significant decrease in the nematode population with the least number of adult females, number of egg masses, number of eggs per egg mass, gall index and population in soil and roots was recorded in the Pft 20 treated plants (Table 2). Several mechanisms were attributed to the

Table 2. Efficacy of talc formulations of *P. fluorescens* isolates on *M. incognita* infestation in tomato under field conditions

Treatment	No. of females / 5 g root	No. of Egg masses/ 5 g root	No. of eggs/ egg mass	Gall Index	Root population (5 g)	Soil population (200 cm^3)
Pft18 (2.5kg/ha)	75.50bc	36.0bc	238.40bc	3.0c	178.60c	265.30c
Pft18(3.0kg/ha)	86.00c	43.7d	241.20bc	3.1c	180.0c	271.00c
Pft20 (2.5kg/ha)	45.70a	21.5a	143.40a	1.4a	92.40a	124.60a
Pft20(3.0kg/ha)	52.30a	29.0a	154.00a	1.5a	97.60a	132.70a
Pft25(2.5kg/ha)	77.30bc	37.5c	198.60c	1.8b	163.50	225.70
Pft25(3.0kg/ha)	75.00bc	45.0	210.40cd	2.6bc	172.50c	263.20c
Pf 1(2.5kg/ha)	48.40a	33.9b	196.60b	1.8b	121.30b	216.50bc
Pf 1(3.0kg/ha)	54.54a	35.8b	185.30b	1.6a	129.60b	198.20b
Carbofuran(1.0kg ai./ha)	64.80b	37.5c	175.70ab	1.5a	108.50ab	193.00b
Control	98.30d	48.0d	263.40d	4.1d	235.80d	298.40c

suppression of phytonematodes by the application of *P. fluorescens* like induced systemic resistance, production of antibiotics and siderophores, competition for nutrients and alteration of specific root exudates such as polysaccharides and aminoacids which modify nematode behaviour (Oostendorp and Sikora, 1990). Although there was not much difference in the application of talc formulation of *P. fluorescens* at two different rates *ie*., 2.5 and 3.0 kg/ha, results reveal that the application at 2.5kg/ha would be more effective for managing the soil pathogens especially the nematodes. It is obvious from the above study that *P. fluorescens* could effectively be used as an alternative for chemicals for managing root knot nematodes in crops.

References

Cobb, N.A. 1918. Estimating the nematode population of soil. U.S. Dep. *Agric. Circ.* 1. 48p.

Dasgupta, M.K. 1998. Nematode problems in India. *Phytonematol*, **14**: 571-756.

Gomez, K.A. and Gomez, A.A. 1984. Statistical Procedures for Agricultural Research. John Wiley and Sons, New York, U.S.A, 680p.

Jonathan, E.I. and Rajendran, G. 2001. Assessment of avoidable yield loss in banana due to root-knot nematode, *Meloidogyne incognita. Indian J. Nematol.,* **30**: 162-164.

Jonathan, E.I., Barker, K.R., Abdel Alim, F.F., Vrain, T.C., and Dickson, D.W. 2000. Biological control of *Meloidogyne incognita* on tomato and banana with rhizobacteria, Actinomyces and *Pasteuria penetrans. Nematropica,* **30**: 231-240.

King, E.O., Ward, M.K. and Raney, D.E. 1954. Two simple media for the demonstration of pyocyanin and fluorescein. *J. Lab. Clin. Med.*, **44**: 301-307.

Oostendorp, M. and Sikora, R.A., 1990. *In vitro* interrelationship between rhizosphere bacteria and *Heterodera schachtii*. *Revue de Nematol.,* **13**: 269-274.

Schindler, A.F. 1961. A simple substitute for a Baermann funnel. *Plant Dis. Reporter,* **45**: 747 - 748.

Taylor, A.L. and Sasser, J.N. 1978. Biology, identification and control of root-knot nematode (*Meloidogyne* spp.) Coop. Pub. Dep. Plant Pathol., North Carolina State Univ. and U. S. Agency Int. Dev. Raleigh, N.C., :111.

Vidhyasekeran, P. and Muthamilan, M. 1995. Development of formulation of *Pseudomonas fluorescens* for control of chick pea wilt. *Plant Dis*., **79**: 782-790.

Received: February 2, 2011; Accepted: May 5, 2011