Original Research Article

Effectiveness of talc formulation (TNAUPc001) of egg parasitic fungus, *Pochonia chlamydosporia* on the management of root-knot nematode, *Meloidogyne incognita in* brinjal, (*Solanum melongena*).

ABSTRACT

A pot culture experiment was conducted to evaluate the efficacy of talc formulation of nematode eggparasitic fungus, *Pochonia chlamydosporia* in different method of application *viz.*, seed treatment, nursery application in growth media and soil application at the time of transplanting in brinjal for the management of *Meloidogyne incognita* at Vegetable Research Station, Palur, Tamil Nadu, India during 2020-21. These experiments clearly indicated the effectiveness of a bio-agent *P. chlamydosporia*, TNAU (Pc001) talc formulation were more when applied in combined application *viz.*, seed (8g/kg seed) + nursey (10/kg growth media) + soil application method (5kg/ha). The brinjal yield was significantly high in vegetable yield (880 g/plant) in brinjal (Var PLR 2), Which is 55.3 per cent increase over untreated control and recorded with lowest root-knot nematode, *M. incognita* population (81.66/250 cc soil and 8.33/ 5 g of root) which was more than 60 per cent reduction over control. The colony farming units in the soil also more (75 X10^4) in the above treatments. Through these investigations we could standardize a strategy for the sustainable management of nematode in brinjal.

Keywords: *Brinjal, Meloidogyne incognita, Root knot nematode, Pochonia chlamydosporia*

1. INTRODUCTION

Brinjal is one of the important vegetable crop in India. Most of the vegetable crops are affected by the parasitic nematodes in all stages of the crops. Nematode attack on the root system makes the seedlings weak and also vulnerable to the infection by secondary pathogens (soil borne fungus & bacteria). Nematode damage also break down the resistance against pathogenic fungi and bacteria (Agrios, 2005). Furthermore, nematode infested nursery seedlings facilitate the spread of the nematodes in the main fields making the problem more difficult to manage in a larger area.

Among the plant parasitic nematodes affecting vegetable crops, *Meloidogyne incognita* is an important one. It is a polyphagous nematode pest and has more than 3000 host plants all over the world (Noling, 1999) . Frequent application of chemical nematicides for the control of soil borne plant pests, leads to the pollution of the ecosystem and thereby disturbing the ecological balance. Alternative techniques based on biological methods are needed to solve the problem. The nematode egg parasitic fungus, *Pochonia chlamydosporia* is one of the biocontrol agent against plant parasitic nematodes. The fungus is also a facultative parasite of nematode and mollusk eggs, and a hyperparasite of other fungi (Uddin *et al*. 2019). Plant-fungus-nematode interaction, an interaction that needs to be addressed to ensure the efficient use of *P. chlamydosporia* as a bio-pesticide as part of an integrated pest management approach.

2. MATERIALS AND METHODS

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Department of Nematology, Tamil Nadu Agricultural University, Coimbatore has developed one *P. chlamydosporia bio* product as commercial formulation *viz.*, TNAU (Pc001) talc formulation with the spore load of spore load 10 X 10^8. In the earlier studies we optimized the dose for seed treatment, nursery application in growth media and soil application during transplanting, In this research we studied the different methods of applications *viz.*, seed treatment, nursery application and soil application during transplanting individually and combination of different methods of application were tried and the data were presented.

A pot culture experiment was taken with *P. chlamydosporia* TNAU (Pc001) talc formulation with the following treatments *Viz.*,T1 – P.c (TNAU Pc001) talc formulation as seed treatment @ 8 g/kg seed, T2 - P.c (TNAU Pc001) talc formulation as nursery application @ 10 g/kg growth media, T3 - P.c (TNAU Pc001) talc formulation at the time of transplanting @5 kg/ha, T4 – T1 + T2; T5 – T1 + T3; T6 – T2 + T3; T7 – T1 + T2 + T3; T8 – T a (TV 1) seed treatment @ 4 g/kg + Soil application @ 2.5 kg/ha, T9 – Untreated control. Each treatment was replicated three times. Completely Randomized Design were used for this trial. The brinjal var. PLR2 taken for this study. Plants were maintained properly. Yield was recorded for each picking, Plants were uprooted at the end of the experiment. Observation on various plant growth parameters length (shoot and root) in centimeter, weight (fresh) in grams, root-knot index were recorded. The nematode root population were observed by following root staining method (Byrd *et al.*, 1983) The plant tissues were stained in 0.1% acid fuchsin in lacto phenol at 80ºC for 2-3 minutes . Then after gentle wash, roots were kept in clear lacto phenol for 24 hours the the roots were observed through Stereo zoom microscope

These roots were then examined under the stereo zoom binocular microscope for counting the number of galls, number of egg masses per plant and number of eggs per egg mass and the parasitized egg was calculated through compound microscope. For root gall index evaluating standard scale has been used as described by Taylor and Sasser (1978) shown in Table 1. After removing the plant from each pot, the soil was mixed well and 250cc soil from each pot was processed by Cobb's sieving and decanting technique (Cobb, 1918) followed by modified Baermann's funnel technique for the estimation of nematode population in soil (Christie and Perry, 1951). After termination the one gram of soil samples were collected from each replications and the Colony Forming Units (CFU) were calculated by serial dilution method (Waksman. 1922). The fungal colonies were identified and confirmed with character recorded in number. All the data *viz.*, nematode population, Plant yield, growth parameters were processed by analysis of variance (ANOVA).

Table 1. Standard scale of Root-knot index

Root-knot index	Number of galls / root system
0	0
1	1-2
2	3-10
3	11-30
4	31-100
5	>100

3. RESULT AND DISCUSSION

All the treatments were significantly differ from each other, The treatment contains combination of three method of application *viz.*, P.c (TNAU Pc001) talc formulation as seed treatment @ 8 g/kg seed + nursery application @ 10 g/kg growth media + 5 kg/ha at the time of

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Significantly higher number of *M. incognita* eggs in the egg mass were parasitised by P.*chlamydosporia* and higher Colony Forming Units (75X10^4) were recorded in the combined treatment of P. *chlamydosporia*. which was comparatively less than the slandered check, *T. asperillum* application @ 5kg/ha which was recorded as 85 X 10^3. *P. chlamydosporia* is a multi trophic microorganism because it parasitizes nematodes, colonizes plant roots and has saprophytic ability. These characteristics are desirable in a biological control agent because they allow the fungus to survive in the soil even in the absence of the nematode (Stirling, 2014).

Lloeca *et al.*,2002 also stated that the *P. chlamydosporia* fungus can remain saprophytic in soil in the absence of both plant and nematode hosts. In the rhizosphere, the fungus can colonize the roots of host plants, and several *Pochonia* species have even been reported to show endophytic behavior in some Gramineae and Solanaceae species a growth habit that may result in benefits to the host plant defense against soil-borne pathogens Vicente *et al.* 2009. Crops and plant species that can support more than 200 colony forming units (CFU)/cm^2 of root are considered to be good hosts of the fungus. Good hosts for *P. chlamydosporia* include beans, cabbage, crotalaria, pigeon pea, potato, pumpkin, and tomato. Chili, sweet potato, cowpea, rye, tobacco, and cotton are moderate hosts (100–200 CFU/cm^2 of root), whereas poor hosts (<100 CFU/cm^2 of root), include aubergine, okra, soybean, sorghum, and wheat (Bourne *et al*, 1996).

4. CONCLUSION

The result confirmed that the nematode eggparasitic fungus *P. chlamydosporia as talc based* TNAU Pc001 bio product can be utilized in combined application as seed treatment, nursery application in growth media and soil application during transplanting in brinjal. It will give crop protection from nematodes from seedling to harvest, *P. chlamydosporia* treated nursery and transplanted plants also recorded with more yield.

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Table 2 Effect of different method of application of *P. chlamydosporia* TNAU Pc001 talc formulation on the yield and growth parameters of Brinjal PLR 2 .

Treatment details	Plant growth characters

	Shoot length (cm)	Root Length (cm)	Shoot Weight (g)	Root Weight (g)	No of Fruits/ plant	Yield/ Plant (g)	Yield (t/ha)
T1 – P.c (TNAU Pc001) talc formulation as seed treatment @ 8 g/kg seed	42.66	12.66	63.00	12.33	15.33	616.6 (+8.8)	17.12
T2 - P.c (TNAU Pc001) talc formulation as nursery application @ 10 g/kg growth media	43.66	13.83	76.66	12.50	15.33	620.00 (+9.4)	17.22
T3 - P.c (TNAU Pc001) talc formulation at transplanting@5kg /ha	52.66	16.16	149.33	14.66	16.66	711.66 (+25.6)	19.76
T4 – T1+T2	47.33	15.16	117.33	14.66	15.33	633.33 (+11.6)	17.57
T5 – T1 + T3	62.00	17.16	175.00	22.66	20.66	816.66 (+44.1)	22.68
T6 – T2 + T3	66.66	17.50	198.33	24.00	21.33	841.66 (+48.5)	23.37
T7 – T1 + T2 + T3	82.33	18.00	249.66	25.50	24.00	880.00 (+55.3)	24.44
T8 – T a (TV 1) seed treatment @4 g/kg + Soil application @ 5 kg/ha	63.33	16.66	171.66	20.00	16.00	723.33 (+27.6)	20.08
T9 – Untreated control	26.66	9.00	21.33	4.00	14.66	566.66	15.73
CD (0.05%)	5.19	0.99	15.51	1.70	1.83	34.35	1.42

Note : Value in the parenthesis indicates percent reduction/increase over untreated control

Table 3 Effect of different method of application of *P. chlamydosporia* TNAU Pc001 talc formulation on root-knot nematode population in Brinjal PLR 2 .

Treatment details	Nematode population					CFU of bio agent
	Nematode population / 250 cc soil	Nematode population / 5 g of root	RKN index	Eggs/ mass	No. of eggs parasitized	
T1 – P.c (TNAU Pc001) talc formulation as seed treatment @ 8 g/kg seed	234.67 (-10.2)	22.00 (-13.14)	5	313.33 (-9.4)	12.00	32.66
T2 - P.c (TNAU Pc001) talc formulation as nursery application @ 10 g/kg growth media	228.33 (-12.62)	21.00 (-17.0)	5	303.00 (-12.4)	12.33	33.00
T3 - P.c (TNAU Pc001) talc formulation at transplanting @10 kg/ha	195.00 (-25.41)	17.00 (-32.88)	3	265.33 (-23.3)	13.66	58.00
T4 – T1+T2	211.66 (-19.00)	18.66 (-26.33)	4	240.00 (-30.6)	13.66	38.33
T5 – T1 + T3	161.67 (-38.13)	14.33 (-43.42)	3	158.33 (-54.33)	18.33	68.00
T6 – T2 + T3	128.33 (50.9)	12.33 (-51.32)	3	151.66 (-56.2)	26.00	68.00
T7 – T1 + T2 + T3	81.66 (-68.75)	8.33 (-67.11)	2	134.33 (-61.1)	37.00	73.00
T8 – T a (TV 1) seed treatment @ 4 g/kg + Soil application@5 kg/ha (Standard Check)	196.66 (-25.14)	17.33 (-31.58)	4	255.66 (26.10)	6.66	85.66
T9 – Untreated control	261.33	25.33	5	346.00	0	0
CD (0.05%)	41.29	2.114		15.98	4.45	6.29

Note: value in the parenthesis are percent increase / decreases over control
*value in the parenthesis are percent reduction over standard check

Fig.1

Fig 2

Fig 3

Fig 1,2 & 3, Pot culture trial

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