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Biological control of Dry Root Rot of chickpea caused by *Rhizoctonia bataticola* Taub

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Two biocontrol agents were evaluated individually and in combinations and in integration with carbendazim seed treatment and hexaconazole seed soaking for management of dry root rot of chickpea. Seed and soil application with bioagents was effective for the maximum germination with less root rot incidence as against seed treatment with carbendazim alone and seed soaking in hexaconazole alone. Integration of seed and soil application of biocontrol agents resulted in higher germination and reduced mortality due to disease as against check. The application of biocontrol agents individually either soil application or seed treatment also showed good germination with reduced mortality due to dry root rot as compared to treatments imposed with fungicides.

Key words: Chickpea, *Rhizoctonia bataticola,* Integrated management, Biocontrol agent, fungicides

INTRODUCTION

Dry root rot of chickpea (*Cicer auritinum* L.) caused by *Rhizoctonia bataticola* is quite destructive and reduces the yield considerably. The disease is of recent occurrence in Karnataka (Veerendra Kumar, 2004). *Rhizoctonia* is seed as well as soil borne pathogen (Surekha *et al*, 1986). Attempts for its control with fungicides as seed or soil application, or cultural practices have not been much effective as its propagules are randomly distributed in the soil and are often not in reach of the fungicides. While fungicidal seed treatment may not persist in effective concentration for sufficiently long time, soil application of fungicides is also deleterious for associated soil micro flora.

There are some reports of use of biocontrol agents alone or in combination with fungicides for controlling root rot caused by *Rhizoctonia solani* in other crops (Naik and Sen, 1995). The present work has been aimed at developing an integrated management strategy with emphasis on use of local or native biocontrol agents in integration with fungicidal seed treatment to combat dry root rot of chickpea.

MATERIALS AND METHODS

Biocontroi agentsy

Six isolates of *Trichoderma* were collected from Agriculture College, Raichur and Directorate of Oilseed Research, Hyderabad and eight isolates of *Pseudomonas fluorescens* are collected from Agriculture College, Raichur and they were maintained on specific media namely *Trichoderma* specific media for *Trichoderma* and King's B media for *P. fluorescens.*

Isolation of the fungal pathogen

The isolation of the fungus was done by following standard tissue isolation method under aseptic condition. The infected tissues of the chickpea root were cut into small bits of size 1-2 mm and surface steril-

ized in 1:1000 mercuric chloride solution for a minute and then washed repeatedly thrice in sterile distilled water to remove the traces of mercuric chloride before transferring them to sterile Potato Dextrose Agar [PDA] slants under aseptic conditions and incubated at 30 ±1° C.

Dual culture test

Six isolates of *Trichoderma* were evaluated for their efficacy through dual culture technique. *Trichoderma* isolates and the test fungus were placed side by side on a single Petri-dish containing solidified Potato dextrose agar (PDA). There were three replications for each isolate with one control that consisted of the pathogen or bioagent. They were incubated for 6-7 days. The diameter of the colony of both bioagent and the pathogen was measured in two directions and the average was calculated. Per cent inhibition of growth of the test pathogen was calculated by using the formula given by Naik *et al.* (2009) : I = C-T/CX 100 where; I = Per cent inhibition; C= Radial growth of the pathogen in control; T = Radial growth of pathogen in treatment

Evaluation of biocontrol agents under field condition

One each of potential isolate of *Trichoderma viride* and *P. fluorescens* was selected for filed study based on initial screening. The experiment was conducted for two seasons during *rabi* at RARS, farm, Raichur (Karnataka). All recommended agronomic practices were followed to raise a good crop. Chickpea seeds (cv. JG-11) were treated with *Trichoderma* and *Pseudomonas* (4 g/kg seed and 5 g/kg seed respectively). Soil application was carried out by mixing of FYM enriched with *Trichoderma viride* @ 8 ton/ha 10 days in advance of planting chickpea. The enrichment of bioagent was done under shade for a period of 15 days. A care was taken to maintain the optimum moisture content by sprinkling water on the enriched heap. Seed treatment with carbendazim @ 4 g/kg seed and seed soaking in hexaconazole @ 2 ml/kg seed were also the treatments along with other bioagents. The experiment was conducted in Randomized Block Design (RBD) having three replications of seven treatments each with a plot size of 2.5 x 2.5 m. The germination percentage was calculated 15 days after sowing and incidence of root rot was recorded throughout the crop period. The data were statistically analyzed.

RESULTS AND DISCUSSION

Dual culture test

Six fungal (Table 1) and eight bacterial (Table 2) antagonists were tested against *Rhizoctonia bataticola*, the incitant of dry root rot of chickpea under dual culture.

Among the fungal bioagents tested, *Trichoderma viride* (Tv-R) isolate showed maximum inhibition of mycelial growth by recording 78.50 per cent followed by *T. viride* (Tv-32) with inhibition of 74.92 per cent and the least was 73.83 per cent inhibition by T. *viride* (Tv-16) isolate. However, among two isolates of T. *harzianum*, Th-10 isolate was found to have higher (75.56%) inhibition of mycelial growth of *Rhizoctonia bataticola* than *T. harzianum* (Th-R) isolate with inhibition of 71.63 per cent. These findings are similar to that of Sachin Upamanya *et al.* (2002) and Suriaachandraselvan *et al.* (2004).

Among bacterial (*Pseudomonas*) isolates, *Pseudomonas fluorescens* (Pf4) isolate inhibited to

Table 1 : In *vitro* evaluation of fungal bioagents against *Rhizoctonia bataticola* dual culture.

Bioagent	Per cent inhibition
Trichoderma viride (Tv-R)	78.50 (62.37)*
Trichoderma viride (Th 16)	73.83 (59.23)
Trichoderma viride (Tv 32)	74.92 (59.94)
Trichoderma viride (Tv 41)	73.97 (59.32)
Trichoderma harzianum (Th R)	71.63 (57.86)
Trichoderma harzianum (Th 10)	75.56 (60.32)
SEm±	0.70
CD @1%	2.15

*Are sine transformed values

Table 2 : In *vitro* evaluation of bacterial bioagents *Rhizoctonia bataticola* dual culture

Bioagent	Inhibition (%)
Pseudomonas fluorescens (Pf1)	75.14 (60.09)*
Pseudomonas fluorescens (Pf2)	74.51 (59.68)
Pseudomonas fluorescens (Pf3)	65.17 (53.83)
Pseudomonas fluorescens (Pf4)	82.12 (64.98)
Pseudomonas fluorescens (Pf5)	71.26 (57.58)
Pseudomonas fluorescens (Pf6)	72.19 (58.17)
Pseudomonas fluorescens (Pf7)	74.28 (59.53)
Pseudomonas fluorescens (Pf8)	79.10 (62.80)
SEm±	0.68
CD @1%	2.87

*Are sine transformed values

the extent of 82.12 per cent mycelial growth of *Rhizoctonia bataticola* which was followed by Pf8 and Pfl isolates with an inhibition of 79.10 and 75.14 per cent mycelial growth respectively and the lowest inhibition (65.17%) was observed in Pf3 isolate. These findings are similar to that of Anand *et al.* (2009).

Evaluation of biocontrol agents under field condition

Seed germination and root rot incidence

The data in Table 3 revealed that germination percentage was highest (97.60 %) with seed treatment and soil application of *T. viride* followed by *P. fluorescens* (96.27%). However, the seed treatment with bioagent alone also recorded considerable percentage of germination (94.23 %) but seed treatment with carbendazim showed 94.67 per cent germination only when compared to check (84.20%). Ramesh and Korikanthimath (2006) reported that application of bioagents combination of seed treatments and soil application was more useful in getting a better crop stand and survival of groundnut plants. Though, the germination percentage of seeds treated and soil application with biocontrol agents was higher than the treatments with bioagents alone. This could be attributed to growth promoting ability and rapid buildup of population in the rhizosphere of plant by the biocontrol agents (Muthamilan and Jeyarajan, 1996). Ray and Mukherjee (2002) reported that the antagonistic *Bacillus* sp. reduced seedling mortality in groundnut caused by *Sclerotium rolfsii* by both the seed treatment and soil drenching.

The least root rot incidence (2.67 %) was noticed in the treatment of seeds as well as soil application of *T.viride* followed by *P.fluorescens* seed treatment of seeds with bioagents also recorded considerable reduction in root rot incidence against check (19.68 %). Among two fungicides, seed treatment with carbendazim (2 g/kg seed) recorded 4.09 per cent incidence as against check.

Ramesh and Korikanthimath (2006) in their experimental findings revealed that application of bioagents by seed treatment and soil application drastically reduced the root rot incidence in groundnut. The root rot incidence was less in the treatments imposed with seed treatment and soil application with bioagents than the treatment of seeds with bioagents alone. This could be attributed to the well establishment of bioagents and their rapid build up in the soil and adoption of more than one mechanism by the bioagent which might be responsible for suppression of the pathogen (Rini and Sulochana, 2007). Meena (2001) reported the reduction of groundnut root rot significantly in field experiments by seed treatment with powder formulations of *P. fluorescens* and suggested that more than one mechanism by the bacteria might be responsible for suppression of the pathogen. Suriachandraselvan *et al* (2004) reported that the rhizosphere population of *Rhizoctonia* is significantly reduced due to seed treatment with antagonists. This could be due to significant increase in the rhizosphere population of *Trichoderma.* as reported in other crops (Devika Rani *et al.*, 2009)

Since chickpea is grown under rain fed condition in Karnataka, the crop is highly prone to *Rhizoctonia* infection. *Rhizoctonia* being a soil borne fungus, is capable of surviving in soil for several years. Use of fungicides for drenching to decontaminate *Rhizocto-*

Table 3: Influence of bioagents on germination and root rot incidence of chickpea under field condition.

Treatments	Germination percentage	% Root rot incidence
Control	84.20 (66.57)*	19.68 (26.3)
Trichoderma viride seed treatment + soil application through FYM at 4 kg/plot	97.60 (81.08)	2.67 (9.40)
Pseudomonas fluorescens seed treatment + soil application through FYM at 4 kg/plot	96.27 (78.80)	2.93 (9.9)
Carbendazim seed treatment before sowing @ 2.0 g/kg seed	94.67 (76.65)	4.09 (11.66)
Hexaconazole seed soaking before sowing @ 2 ml/kg seed	88.27 (69.97)	4.32 (11.75)
Trichoderma viride seed treatment @ 4 g/kg seed	94.23 (76.10)	3.15 (10.22)
Pseudomonas fluorescens seed treatment @ 5 g/kg seed	93.63 (75.38)	3.38 (10.59)
SEm±	1.05	0.47
CD @ 5%	3.23	2.35

nia from soil is next to impossible task. The resistant chickpea cultivars against dry root rot are also not available. Under the present circumstances, application of bioagents such as *Trichoderma* and *P. fluorescens* through FYM enrichment is very feasible method. Hence, this method is recommended as eco-friendly and cost effective technology for sustainable management of chickpea dry root rot.

REFERENCES

Anand, M., Naik, M.K.; Ramegowda, G. and Devika Rani, G.S. 2009. Biocontorl and PGPR of *Pseudomonas fluorescens* isolates. *J. Mycopathological Res.*, **46** (Under print).

Devika Rani, G.S.; Naik M. K., Patil M.B. and Prasad P.S. 2009, Biological control of *Fusarium solani* causing wilt of chilli. *Indian Phytopath.*, **62** (2): 190-198.

Meena, B.; Marimuthu, T.; Vidyasekaran, P. and Velazhan, R. 2001, Biological control of root rot of groundnut with antagonistic *P. fluorescens* strains. *Zeitschrift fur planzenkrankeiten und Planzenschutz* **108:** 369-381.

Muthamilan, M. and Jeyarajan, R. 1996. Integrated management of *Sclerotium* root rot of groundnut involving *Trichoderma harzianum, Rhizobium* and carbendazim. *Indian J. Mycol. Pl. Pathol*, **26:** 204-209.

Naik, M.K. and Sen, B., 1995, Biocontrol of plant disease caused by *Fusarium* spp. p.32 In: K.G., Mukherjee, (Ed) *Recent Developments in Biocontrol of Pl ant Diseases.* Aditya Publishing House, New Delhi, India.

Naik, M.K.; Madhukar, H.M and Devika Rani, G.S., 2009, Evaluation of biocontrol efficacy of *Trichoderma* isolates and methods of its applications against wilt of chilli caused by *Fusarium solani. J. Biol. Control.* **23:** 31-36.

Ramesh, R. and Korikantimath, V.S., 2006, Management of groundnut root rot by *Trichoderma viride* and *Pseudomonas fluorescens* under rain fed conditions. *Indian J. Pl. Prot.*, **34**(2): 239-241.

Ray, S.K. and Mukerjee, N. 2002, Supression of *Sclerotium rolfsii* causing foot rot of groundnut by *Bacillus* sp. *J. Mycopathol. Res.*, **40:** 89-92

Rini, C.R. and Sulochana, K.K., 2007, Usefulness of *Trichoderma* and *Pseudomonas* against *Rhizoctonia solani* and *Fusarium oxysporum* infecting tomato. *J. Tropical Agric.* **45**(1-2): 21-28.

Sachin Upmanyu; Gupta, S.K. and Shyam, K.R., 2002, Innovative approaches for the management of root rot and web blight (*R.solani*) of French bean. *J. Mycol. Pl. Pathol*, **32**(3): 317-331.

Surekha, C; Smgh T. and Singh B.,1986, *Rhizoctonia solani* in chilli seeds of Rajasthan. *Indian Phytopath.*, 39: 565-567.

Suriachandraselvan, M.; Salarajan, F.; Aiyanathan, K.E.A and Seetharaman, K., 2004, Inhibition of sunflower charcoal rot paihogen, *Macrophomina phaseolina* by fungal antagonists. *J. Mycol. Pl. Pathol*, **34**(2): 364-366.

Veerendra Kumar, K.V., 2004, *Studies on dry root rot disease of chickpea caused by R. bataticola.* (M. Sc. (Agri) Thesis Uni.AgricTSci, Dharwad (India).