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MANAGEMENT OF DRY ROOT ROT OF BLACKGRAM CAUSED BY *MACROPHOMINA PHASEOLINA* (TASSI) GOID. USING BIO AGENT

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Abstract

Dry root rot caused by *Macrophomina phaseolina* (Tassi.) Goid. is highly destructive in many crops including pulses. In greenhouse, the present study was under taken to mange the dry root rot disease using fungal antagonistic microflora *Trichoderma viride*, significant reduction (upto 60 per cent) in pot inoculated with *T. viride* multiplied in sand maize medium. Shoot and root length were significantly increased due to soil application of *T. viride*.

Key words : Dry root rot, blackgram, *Trichoderma*, *Macrophomina phaseolina*, *T. viride*.

Introduction

Root rot caused by *Macrophomina phaseolina* (Tassi) Goid is economically important disease of many crop plants (Mihail and Taylor, 1995; Srivastava *et al*., 2001 and Jana *et al*., 2005). *M. phaseolina* is an important root soil-inhabiting fungus and causes dry root rot/stem canker, stalk rot or charcoal rot. Its prevalence could be enhanced by different physiological and ecological factors such as low moisture content, high temperature and heat (Dhingra and Sinclair, 1978). *M. phaseolina* is reported to produce charcoal rot disease over 500 species of plants (Sinclair, 1982). Considerable emphasis has been given to develop biological control agents as potential means of disease control and to improve plant health. The use of antagonistic organisms against *Macrophomina* root rot has been well documented in several crops (Lokesha and Benagi, 2007 and Anis *et al*., 2010). Sundravadana (2002) reported that the seed and soil application of *T. viride* significantly controlled the blackgram root rot caused by *M. phaseolina*. Many species of *Trichoderma* have been used as potent biocontrol agents for a variety of phytopathogenic fungi *viz*. *Sclerotium rolfsii*, *Rhizoctonia solani* and *Pythiums* pp. (Harman *et al*., 2004; Sandhya *et al*., 2005 and Spadaro and Gullino, 2005). The response of *Trichoderma* to the presence of a potential host includes production of antibiotic compounds, formation of specialized structures and degradation of the host's cell wall by secretion of hydrolytic enzymes followed by the assimilation of its cellular content (Chet, 1990; Baek *et al*., 1999; Harman, 2000; Mukherjee *et al*., 2003 and Benítez *et al*., 2004). In view of these facts, the present study was under taken to manage the disease using *T. viride*.

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Materials and Methods

Efficacy of antagonistic organism

In vitro evaluation of antagonist aganist *Macrophomina phaseolina*

Trichoderma was isolated from the rhizosphere soil by serial dilution technique and grown on potato dextrose agar (PDA) at 28 ± 2°C. *M. phaseolina* was also isolated from the root rot infected black gram plants. The fungus was isolated and purified by hyphal tip method and maintained on potato dextrose agar slants. The antagonist microflora *Trichoderma* was tested for the management of root rot disease .Seeds were obtained from the National Pulses Research Station (Vamban), Pudukottai and sown in the pots infested with *M. phaseolina*. The pathogen was inoculated into the soil before two days of sowing. The seed treatment and soil application was done with *Trichoderma* commercial formulation as recommended.

Seed treatment

Blackgram seed (Vamban 1) was treated with talc based bio formulation of best two bio agents of *Trichoderma* isolates (TNAU and Thondamuthnur) individually @ 4 g/kg of seeds. Seeds treated with

Table 1 : Effect of bio control agents and their combination against blackgram root rot incidence.

T. no.	Treatments	Disease incidence (%)*	
		45 DAS	60 DAS
T_1	Seed treatment (ST) with TNAU isolate @ 4g/kg	27.77^{abcd} (31.80)	61.09^{bcd} (51.40)
T_2	Seed treatment with Thondamuthur isolate @ 4g/kg	38.87^{abc} (38.57)	88.89^{a} (70.53)
T_3	Seed treatment with combination of both *Trichoderma* sp. @ 4g/kg	11.10^{d} (19.46)	44.40^{d} (41.78)
T_4	Soil application (SA) with TNAU isolate @ 2.5kg/ha	16.67^{cd} (24.09)	44.40^{d} (41.78)
T_5	Soil application with Thondamuthur isolate @ 2.5kg/ha	11.10^{d} (19.46)	55.56^{bcd} (48.19)
T_6	Soil application with combination of both *Trichoderma* sp. @ 2.5kg/ha	44.40^{ab} (41.78)	77.76^{ab} (61.86)
T_7	Seed treatment (4g/kg) + Soil application (2.5kg/ha) with TNAU isolate	22.20^{bcd} (28.11)	44.40^{d} (41.78)
T_8	Seed treatment (4g/kg) + Soil application (2.5kg/ha) with Thondamuthur isolate	49.99^{a} (44.99)	72.20^{abc} (58.18)
T_9	Seed treatment (4g/kg) + Soil application (2.5kg/ha) with combination of both *Trichoderma* sp.	5.60^{d} (13.68)	38.87^{d} (38.57)
T_{10}	Seed treatment with carbendazim @ 2g/kg (control)	38.87^{abc} (38.57)	55.56^{cd} (48.19)
T_{11}	Untreated control	49.99^{a} (44.99)	94.40^{a} (76.31)

* Mean of three replications. DAS- Days after sowing. Values in parentheses are arcsine transformed values.
Means in a column followed by same superscript are not significantly different by Ducan's Multiple Range Test at $P < 0.05$

carbendazim @ 2g/kg served as control.

Soil application

The bio formulation of best two bioagents of *Trichoderma* were applied as soil application individually and in combination before sowing of seeds in pot culture.

Efficacy of bio control agents against root rot of blackgram in pot culture

A pot culture experiment was laid out using *Trichoderma* TNAU and Thondamuthnur isolate and compared with commercial *T. viride* (Tv_1) and carbendazim. Each treatment was replicated three times in a completely randomized block design. Potting soil (red soil: sand: FYM at 1:1:1 w /w) was sterilized at 121^0 C with 15 psi for two consecutive days was filled in uniform (1 × 1 feet) earthen pots. The pathogen was multiplied in sand maize medium and incorporated @ 5g per pot. Seeds were sown after seed treatment as mentioned above in required pots. In each pot, 6 plants were maintain uniformly after thinning on 10 DAS. Pots were irrigated sufficiently. Soil applications of bio agents were done before sowing of seeds as detailed below.

- **Seed treatment with *Trichoderma***

T_1- TNAU isolate of *Trichoderma* @ 4g/kg.

T_2- Thondamuthnur isolate of *Trichoderma* @ 4g/kg.

T_3 (T_1+T_2)- Combination of both *Trichoderma* isolates @ 4 g/kg.

- **Soil application with *Trichoderma***

T_4 - TNAU isolate of *Trichoderma* @ 2.5 kg/ha.

T_5- Thondamuthnur isolate of *Trichoderma* @ 2.5kg/ha.

T_6 (T_4+T_5)- Combination of *Trichoderma isolates* @ 2.5kg/ha.

- **Seed treatment + soil application with *Trichoderma***

T_7- TNAU isolate of *Trichoderma* @4g/kg + 2.5kg/ha.

T_8- Thondamuthnur isolate of *Trichoderma* @ 4g/kg + 2.5kg/ha.

T_9 (T_7+T_8)- Combination of both *Trichoderma spp.* @ 4g/kg + 2.5 kg/ha.

T_{10} - Seed treatment with carbendazim 2g/kg (control).

T_{11}- Untreated control.

Results and Discussion

Biocontrol efficacy of *Trichoderma* was evaluated in the pot culture infested with *M. phaseolina* and inoculated with *Trichoderma*. Among the 11 treatments, the treatment T_9 - seed treatment + soil application with combination of both *T. viride* isolates significantly reduced the per cent disease incidence of 5.60 which accounted 88.79 per cent reduction over control followed by T_3 and

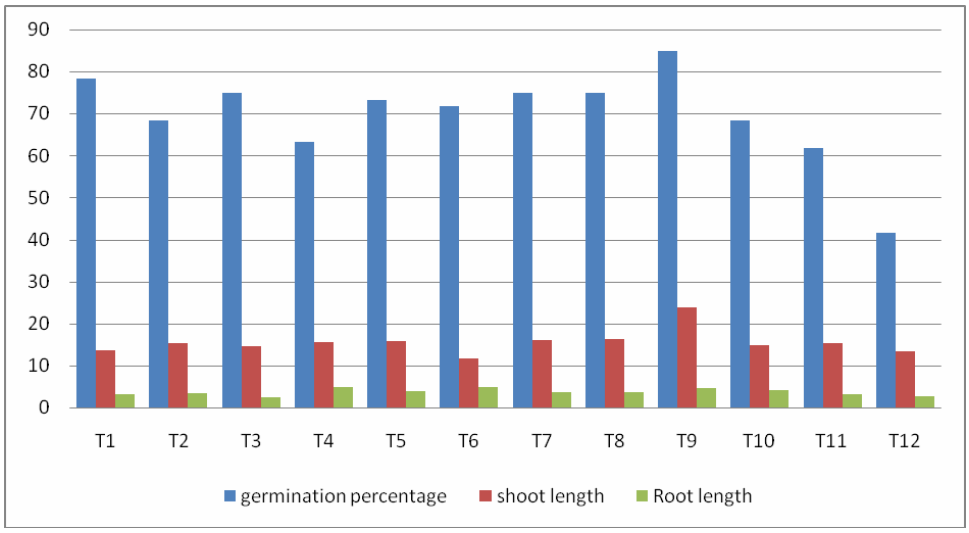

Fig. 1 : Effect of bio control agents and their combination against black gram growth parameters and vigour.

T_5 that recorded 11.10 per cent of root rot incidence (table 1). Growth of blackgram plants were measured 15, 30, 45 and 60 days after the inoculation of *Trichoderma*. A significant (P = 0.05) increase in shoot length was recorded in *Trichoderma* inoculated plants. There was a dramatic increase in the germination percentage of the plant (Combination of both *Trichoderma*). The mean of shoot length was 23.70 cm compared to control is (13.30 cm). The mean root length was 5.30 cm when compared to control is 2.70 cm. Germination percentage of the blackgram was increased to 85 percentage compared to control (49 percentage) (fig. 1).

Soil application of talc based formulation of *T. harzianum*, *T. polysporum* and *T. viride* effectively controlled the root rot (*M. phaseolina*) of eggplant under field condition (Ramezani, 2008). Increased growth response in lettuce bean, cucumber and pepper was demonstrated following application of *Trichoderma* spp. under pot culture or field conditions (Baker, 1989; Ousley *et al*., 1994; Vazquez *et al*., 2000 and Yedida *et al*., 2001). The results presented demonstrated a significant increase in growth of blackgram. The cumulative root length increased to a greater extent. It has been suggested that *Trichoderma* might affect plant growth as a result of its ability to influence plant hormones and vitamins (Harman *et al*., 2004). Such substances could influence the early stages of plant growth with better development of plant roots. Thus, they might be able to sequester more phosphate and other mineral ions liberated as a result of solublization by microorganisms. In most of the earlier studies, *Trichoderma* mediated plant growth promotion has been attributed to indirect mechanisms *viz.*, control of plant pathogens and induced resistance. Though, few of the studies have been focused on the level of minerals and other direct means of growth promotion (Ousley *et al*., 1994). Based on earlier reports (Kredics *et al*., 2001 and Yedidia *et al*., 2001) and findings presented, we concluded that plant growth might be improved by inoculation with *Trichoderma* spp., which helps the plant to obtain 'Phosphorus' and other less available minerals from native soil and also lead to early emergence and increased vigour of plants.

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