J. Biol. Control, 13: 93-99 , 1999

Efficacy of antagonists and carbendazim against dry root rot of mungbean [*Vigna radiata* (L.) Wilczek] incited by *Macrophomina phaseolina* (Tassi.) Goid under glasshouse conditions

B. RAJESWARI*, K. CHANDRASEKHARA RAO and
C. PRAMOD CHANDRA KUMAR
Department of Plant Pathology
Acharya N. G. Ranga Agricultural University
Hyderabad 500 030, A. P., India

ABSTRACT: Bioefficacy of carbendazim tolerant isolate of *Trichoderma harzianum* and exotic isolates of *T. viride* and *T. virens* were evaluated against dry root rot pathogen of mungbean incited by *Macrophomina phaseolina* under glasshouse conditions. *T. harzianum* when applied to the soil besides being effective against the disease, increased seed germination by 96 per cent, plant height by 35.5cm and total biomass by 2.53 g/plant compared to *T. viride* and *T. virens* isolates. In addition, soil application of *T. harzianum* @ 5 g/kg and seed treatment @ 10^8 conidia/ml was found effective against dry root rot pathogen. Integration of *T. harzianum* as soil application (5g/kg) + seed treatment (10^8C/ml) with sub-lethal doses of carbendazim (0.02%) significantly reduced dry root rot incidence (95.3%) over soil treatment (91.5%) and seed treatment alone (86.5%).

KEY WORDS: Antagonists, carbendazim, dry root rot, *Macrophomina phaseolina*, mungbean, *Trichoderma harzianum*

Dry root rot of mungbean caused by *Macrophomina phaseolina* (Tassi.) Goid is the serious disease, which is responsible for a yield loss of up to 25 per cent. The pathogen is both seed and soil borne in nature and having wide host range and extensive environmental adaptability. Owing to its soil borne nature, it is very difficult to manage this pathogen. Integrated approach is the only possible solution for effective management of the pathogen (Chandra and Kheri, 1996). The

* Part of Ph.D. thesis submitted to the Acharya N. G. Ranga Agricultural University, Hyderabad.

ability of *Trichoderma* spp. against *M. phaseolina* under *in vitro* conditions has been proved (Rajeswari *et al.*, 1998). Therefore, the present studies were undertaken to determine the potent strain of antagonist and its use in combination with low doses of fungicide in the management of the pathogen under glasshouse conditions.

MATERIALS AND METHODS

An experiment was conducted using sterilized clay loam soil having pH 6.2 in plastic pots of one- kg capacity in a completely randomized block design. Each treatment was replicated five times. Ten seeds were sown per pot using a susceptible mungbean CV ML-267. *Trichoderma harzianum* was isolated from rhizosphere of mungbean. Carbendazim tolerant isolate of *T. harzianum* (200ppm) was developed under laboratory conditions through successive sub-culturings and used in further studies (Abd-EL - Moity *et al.*, 1982). Exotic isolates of *Trichoderma viride* and *T. virens* were obtained from GBPUAT, Pantnagar. The pathogen, *Macrophomina phaseolina* was grown on autoclaved sorghum grains and seven days old culture was incorporated @ 10g/kg soil and allowed three days for its establishment. The antagonists were multiplied on wheat bran- sawdust medium (3.1:3.5 w/v). These cultures were grown for fourteen days under laboratory conditions and were applied @ 10g/kg soil and mixed thoroughly with upper soil and left for establishment of antagonist for seven days before sowing, following the procedure of Upadhyay and Mukhopadhyay (1986).

The selected three antagonists were evaluated against dry root rot pathogen with the following treatments *viz.*, *T. harzianum* + *M. phaseolina*, *T. viride* + *M. phaseolina*, *T. virens* + *M. phaseolina* and *M. phaseolina* (control). To test the influence of *T. harzianum*, *T. viride* and *T. virens* isolates either alone or with pathogen on growth parameters of the host plant, antagonist alone, antagonist + pathogen, pathogen alone and an un-inoculated control were tested for all isolates.

Efficacy of carbendazim tolerant native isolate of *T. harzianum* as soil application (1, 2.5, 5, 10 g/kg soil) and seed treatment (10^7, 10^8, 10^9 conidia /ml) were tested against *M. phaseolina*. For seed treatment, mungbean seeds were soaked in conidial suspension of different concentrations with addition of carboxy methyl cellulose and allowed to dry overnight at room temperature before sowing.

In another experiment, carbendazim tolerant isolate of *T. harzianum* as soil (5g/kg) and seed treatment (10^8c/ml) in combination with sub-lethal doses of carbendazim (0.02%) was tested against *M. phaseolina* as soil, seed and soil + seed treatments. The treatments were *T. harzianum*, carbendazim, *T. harzianum* + carbendazim and *M. phaseolina* (control). Observations on plant mortality and per cent disease reduction over control were recorded after 60 days of sowing.

RESULTS AND DISCUSSION

The data presented in Table 1 revealed maximum disease reduction (82.76%) by *T. harzianum* followed by *T. viride* (63.14%) and *T. virens* (48.32%) against *M. phaseolina*. The disease reduction in the sterilized soil might be attributed to the suppression of the activity of the pathogen by the antagonists and allowed full expression of the bioagent. Similar results are confirmed by Elad *et al.* (1986) who showed that *T. harzianum* on peat bran preparation reduced dry root rot of beans up to 74 per cent.

Table I. Efficacy of antagonists against dry root rot of mungbean

Treatment	Plant mortality (%)		Disease reduction (%)
T. harzianum + *M. phaseolina*	10.00	(18.43)	82.76
T. viride + *M. phaseolina*	21.38	(27.54)	63.14
T. virens + *M. phaseolina*	29.98	(33.02)	48.32
M. phaseolina (control)	58.01	(49.60)	
SEM±		4.14	
CD (P=0.05)		6.86	

Figures in parentheses are arcsine values.

Application of three antagonists either alone or in combination with pathogen had significant effect on seed germination and plant biometrics (Table 2). Maximum increase in seed germination (96%), plant height (35.49cm) and total biomass (2.53g/pl) was observed in the pots treated with pathogen and native isolate of *T. harzianum* as compared to *T. viride* (87%, 33.1cm, 2.418g/plant) and *T. virens* (82%, 31.4 cm, 2.46 g/plant). Further, native isolate of *T. harzianum* produced profuse green surface growth and proliferation on the surface of potted soil. Such growth was not found in the case of other two antagonists, indicating the detrimental influence of *T. harzianum* on the growth and survival of dry root rot pathogen. Because of its better performance, *T. harzianum* was selected for further studies. The present results are in accordance with Bhaskaran and Seetharaman (1986) who reported enhanced germination in urdbean plants in the presence of *Trichoderma*.

The data presented in Table 3 clearly indicate that the soil application of *T. harzianum* @ 5 g/kg and seed treatment @ 10^8 C/ml were found optimum against *M. phaseolina*, which resulted in the final seedling stands of 98 and 77 per cent over control. Soil application proved better as compared to seed treatment. Similar results were confirmed in chickpea (Parakhia and Vaishnav, 1986) and mungbean (Samiyappan *et al.*, 1987).

Application of *T. harzianum*, carbendazim, *T. harzianum* + carbendazim as soil + seed treatments significantly reduced disease incidence by 90.5, 83.3 and 95.3 per cent as compared to soil

Table 2. Efficacy of bioagents on growth parameters of the host plant

Treatment	*T. harzianum*				*T. viride*				*T. virens*			
	Per cent emergence	Shoot length (cm)	Root length (cm)	Dry weight (g/plant)	Per cent emergence	Shoot length (cm)	Root length (cm)	Dry weight (g/plant)	Per cent emergence	Shoot length (cm)	Root length (cm)	Dry weight (g/plant)
Antagonist	100 (90.0)	27.7	11.46	2.88	100 (90.0)	27.7	11.40	2.70	95 (77.0)	27.3	11.2	2.49
Antagonist + Pathogen	96 (78.5)	25.1	10.39	2.54	87 (68.9)	23.0	10.10	2.42	82.0 (64.8)	21.2	10.2	2.46
Pathogen	52 (46.1)	16.0	7.5	1.52	53 (46.7)	14.6	8.00	1.35	42.0 (40.4)	14.8	7.5	1.40
Unioculated Control	84 (66.4)	21.8	10.2	2.40	80.8 (64.0)	18.8	9.70	2.16	74.0 (59.3)	21.2	9.3	2.00
SEM ±	0.62	0.96	0.30	0.02	0.36	0.86	0.17	0.02	0.63	0.49	0.32	0.04
CD (P=0.05)	1.32	2.03	0.64	0.05	0.77	1.83	0.37	0.04	1.31	1.04	0.67	0.09

Figures in parentheses are arcsine transformed values.

Table 3. Efficacy of *T. harzianum* as soil and seed treatment against dry root rot caused by *M. phaseolina*

Concentration	Plant mortality (%)	Final seedling stand (%)
Soil application (g/kg)		
1	3.8 (11.0)	92.9
2.5	1.6 (7.7)	97.0
5	1.0 (5.7)	98.1
10	5.4 (13.0)	90.0
Seed treatment (C/ml)		
10^7	14 (21.7)	74.0
10^8	12 (20.1)	77.7
10^9	24 (29.2)	55.5
M. phaseolina (control)	54 (47.5)	
SEM ±	2.92	
CD (P=0.05)	5.97	

Figures in parentheses are arcsine transformed values.

Table 4. Integrated control of dry root rot caused by *M. phaseolina* under glasshouse conditions

Treatment	Soil application		Seed treatment		Soil + seed treatment	
	Plant mortality (%)	Disease reduction (%)	Plant mortality (%)	Disease reduction (%)	Plant mortality (%)	Disease reduction (%)
T. harzianum	9.0(17.3)	89.1	12 (20.0)	85.5	7.4(15.2)	90.5
Carbendazim	18.4(25.2)	77.8	21 (27.3)	74.3	13 (20.5)	83.3
T. harzianum + Carbendazim	7.0(14.8)	91.5	11 (18.9)	86.5	3.6 (10.5)	95.3
M. phaseolina (Control)	83.0(65.9)	-	82 (64.9)	-	78 (62.6)	-
SEM ±	2.66		2.23		3.4	
CD (P=0.05)	5.64		4.84		7.2	

Figures in parentheses are arcsine transformed values.

application and seed treatment alone (Table 4).

The present results are in accordance with the findings of Rukmani and Mariappan (1994) who showed that *T. harzianum* + carbendazim recorded least dry root rot incidence in urdbean. The results of this experiment also indicated that addition of sub-lethal doses of carbendazim (0.02%) in combination with *T. harzianum* improved the disease control. Keeping in view the adverse effect of fungicides on the agroecosystem the use of potential bioagents can be exploited as an important component in integrated disease management either alone or in combination with reduced amounts of fungicides.

REFERENCES

Abd-El-Moity, T. H., Papavizas, G. C. and Shatla, M. N. 1982. Induction of new isolates of *Trichoderma harzianum* tolerant to fungicides and their experimental use for control of white rot of onion. *Phytopathology*, **72**: 396-400.

Bhaskaran, R. and Seetharaman, K. 1986. Biological control of pre-emergence damping off of blackgram caused by *Macrophomina phaseolina*. Abstracts of papers presented in seminar on management of soil borne diseases of crop plants, pp. 31-32. Tamil Nadu Agricultural University, Coimbatore.

Chandra, S. and Kheri, H. K. 1996. Diseases due to *M. phaseolina* and their management. IPS, 48th Annual Meeting on Management of threatening plant diseases of National Importance, 8 pp.

Elad, Y., Zvieli, Y. and Chet, I. 1986. Biological control of *Macrophomina phaseolina* (Tassi.) Goid by *Trichoderma harzianum*. *Crop Protection*, **5**: 288-292.

Parakhia, A. M. and Vaishnav, M. U. 1986. Biocontrol of *Rhizoctonia bataticola*. *Indian Phytopathology*, **39**: 439-440.

Rajeswari, B., Chandrasekhara Rao, K. and Pramod Chandra Kumar, C. 1998. Antagonism of *Trichoderma* and *Gliocladium* spp. against *M. phaseolina*. *Journal of Plant Protection*, **26**: 8-10.

Rukmani, S. and Mariappan, V. 1994. Effect of *Trichoderma* spp. on root rot of blackgram caused by *Macrophomina phaseolina*, pp. 217-220. In: Sivaprakasam, K. and Seetharaman, K. (Eds.). *Crop Diseases- Innovative Techniques and Management*. Kalyani Publishers, Ludhiana.

Samiyappan, R., Arjunan, G., Uday Kumar, M., Udayasuriyan, V. and Jeyarajan, R. 1987. Effect of *Trichoderma* spp. on *Macrophomina* root rot disease and *Rhizobium* nodulation in greengram. Abstract of papers presented in the workshop on biological control of plant diseases, Tamil Nadu Agricultural University, Coimbatore.

Upadhyay, J. P. and Mukhopadhyay, A. N. 1986. Biological control of *Sclerotium rolfsii* by *Trichoderma harzianum* in sugarbeet. *Tropical Pest Management*, **32**: 215-220.