ISSN 0258-7122
Bangladesh J. Agril. Res. 35(1) : 11-16, March 2010

EFFICACY OF MAHAPANCHA GAVYA (MPG) IN CONTROLLING DAMPING-OFF IN TOMATO CAUSED BY *Pythium aphanidermatum*

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Abstract

Maha Pancha Gavya (MPG), a concoction made from five cow products was tested for its toxicity against *Pythium aphanidermatum (Edson) Fitz.* and its antagonists at 5, 10, 25, and 50% concentration in *in vitro* to find out if it can be used in integration for the control of damping-off in tomato in nursery beds. MPG was very effective inihibiting the growth of *P. aphanidermatum.* At the highest concentration, the growth of the pathogen was negligible. Isolates of *Trichoderma viride, T harzianum,* and *T. virens* were also sensitive to MPG at all the concentrations. Their radial growth decreased, but it was fluffy in nature and sporulated profusely. MPG was not toxic against two bacterial antagonists i.e., *Bacillus subtilis* and *Pseudomonas fluorescens.* Soil application of 10% MPG to nursery beds improved seedling stand and gave upto 48.27% tlisease control, which was more than that given by individual antagonists. However, MPG improved disease control efficacy of all the antagonists when it was used in combination with them. Integrated treatment with MPG and *B. subtilis* gave maximum disease control (65.33%). MPG enhanced seedling growth and it was more in combination with *T. viride* and *B. subtilis.* MPG in integration with neem cake and neem leaf extract gave complete control of damping-off and maxium increase in height of the tomato seedlings.

Keywords : Maha Panch Gavya (MPG), *Trichoderma, Pythium aphanidermatum,* integrated control, neem products, tomato, damping-off.

Introduction

There are evidences that the activities of soil borne pathogens and their antagonists are markedly influenced by the presence of various plant and animal products present in soil. These products not only change the physiochemical characteristics of the soil and improve the plant health but also increase the inoculum density of antagonists by serving as substrate media for their growth (Neelamagam and Govindarajalu, 2002; Chatmpawat and Sharma, 2003). This increase in inoculum density helps in overall reduction in disease. Contrary to these reports, some other workers have reported that urine and feaces of animals like cow, buffalo, sheep, and goat, etc. inhibit the growth of soil borne fungi (Raja and Kurucheve, 1998, 1999; Purushothaman *et al.,* 2003). Even in 17th and 18th centuries, numerous abnoxious concentrations made of cow dung and urine were used for the treatment of canker disease of apple (Austen, 1657). Reddy and

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Padmodaya (1996) reported Maha Pancha Gavya (MPG) an organic formulation made from five cow products to be highly effective in controlling wilt of tomato. In integration with neem cake, it was better than carbendazim in controlling the disease and in increasing the plant vigour. Jahagirdhar *et al.* (2001) reported MPG to be effective in suppressing panama disease of banana caused by *Fusarium oxysporum* f. sp. *cubense.* Sugha (2005) found MPG to be toxic to five soil borne fungi in *in vitro* and effective in reducing damping-off of cauliflower seedlings caused by *R. solani.* Therefore, in the present study an effort was made to develop effective strategies for the management of damping-off of tomato caused by *P. aphanidermatum* with MPG in integration with biocontrol agents and neem products in nursery beds.

Materials and Method

The pathogen *P. aphanidermatum* was isolated from diseased tomato seedlings on Potato Dextrose Agar (PDA) medium. Antagonists of pathogen which included 7 isolates of *Trichoderma* spp. *(T. viride-I, T viride-II, T viride-III, T viride-IV, T. harzianum-I, T harzianum-II,* and *T virens), Bacillus subtilis* and *Pseudomonas fluroscence* were obtaied from the culture collection of the Department of Plant Pathology, CCS Haryana Agricultural University, Hisar. Tomato CV. S-7 was used as the host plant. Maha Pancha Gavya (MPG) was prepared by mixing 20 ml of cow ghee, 50 ml each of cow milk and curd, 480 ml of cow urine, 400 g of cow dung, 20 g common salt and 10 g Baker's yeast. All the ingredients were put in closed plastic bucket, thoroughly stirred with wooden stick and allowed to ferment for 15 days with twice stirring daily. Then the fermented concoction was filtered through muslin cloth and its total volume was made to 1 litre. This was 100% MPG and kept for use.

***In vitro* tests:** MPG was evaluated in *in vitro* for its toxicity against P. *aphanidermatum* and its antagonists by poisoned food technique given by Grover and Moore (1962). MPG was incorporated into PDA before sterilization to obtain 5, 10, 20, and 50% concentration and poured into sterilized Petri plates in triplicate. After solidification of the medium, the plates were inoculated with 5mm mycelial discs of pathogen and antagonists taken from the periphery of 5 days old actively growing cultures. Each treatment had three replications and suitable controls were maintained simultaneously. Inoculated plates were incubated at 28±1°C for 3-7 days and linear growth of various fungi was measured. Percent inhibition of mycelial growth was calculated on the basis of growth in control treatments.

In case of bacterial antagonists, 2 days old cultures were just streaked on PDA impregnated with different concentrations of MPG. Observations on bacterial growth were taken visually and the growth was categorized as -- = Nil

growth, + = scanty growth, + + = moderate growth, + + + = profuse growth, + + + + = highly profuse growth.

Table 1. Effect of Maha Pancha Gavya (MPG) on the mycelial growth of *Pythium aphanidermatum* and its antagonists in culture at different concentrations.

Treatment	Percent inhibition at			
	5%	10%	25%	50%
T. viride-I	5.56	57.78	88.89	88.89
T.. viride-ll	0.0	0.0	61.11	72.22
T..viride-III	5.56	11.11	38.88	72.22
T.. viride-IV	22.22	72.22	88.89	100.00
T. harzianum-I	0.00	11.11	44.44	72.22
T. harzianum-11	0.00	38.88	72.22	88.9
T. virens	27.78	44.99	55.56	88.33
P. aphanidermatum	5.56	16.66	22.22	77.78

Disease control studies: Small sized nursery beds of 1 m^2 were made in green house from field soil. There were 18 treatments each with 3 replications laid out in a randomized block design. All the nursery beds except in two treatments were inoculated with *P. aphanidermatum* multiplied on sand-maize meal medium @ 500g/m^2. After three days of stabilization of the pathogen, the beds in 27 treatments were drenched with 10% MPG @ 3 litres/rn^2. In four different treatments, the powdered neem cake @ 250 g/m^2 and 10% fresh neem leaf extract @ 3 1/rn^2 were added to nursery beds amended and unamended with MPG. In rest of the treatments, various antagonists viz., *T. viride-I, T. harzianum-II, T. virens, B. subtilis* and *P. fluorescens* were applied to soil @ 250 g/m^2. After 3 days of application of antagonists and various amendments, 5 furrows were made in each bed, and in each furrow 15 tomato seeds were sown. Observations on pre-emergence and post- emergence damping - off were taken 10 and 30 days after sowing. Percent seedling mortality and disease control were calculated on the basis of seedling stand in uninoculated and inoculated control, respectively.

Table 2. Effect of Maha Pancha Gavya (MPG) on the growth of bacterial antagonists of *Pythium aphanidermatum* in cultre.

Treatment	Concentration (%)	*B. subtilis*	*P. fluorescens*
MPG	0	+++	+++
	5.0	+++	++++
	10.0	+++	+++
	25.0	+++	+++
	50.0	++	++

+ + = Moderate growth
+ + + = Profuse growth
+ + + + = Highly profuse growth

Results and Discussion

MPG was moderately effective in inhibiting the mycelial growth of *P. aphanidermatum in vitro* (Table 1). It inhibited the pathogen's growth by 5.56% at the lowest concentration i.e., 5% after 2 days of incubation. Mycelial growth at 25 and 50% concentrations was nil upto 2 days of incubation and it was only after 2 days that some membranous type of growth appeared on the surface of the medium. Sugha (2005) also found MPG to be highly toxic to 5 soil borne pathogens i.e., *Rhizoctonia solani, Scierotium rolfsii, Fusarium solani, Scierotinia scierotiorum, Phytophthora colocasiae in vitro* and very effective in controlling damping-off of cauliflower seedlings in nursery bed. In the present studies, the radial growth of various isolates of *Trichoderma* spp. was affected even at the lowest concentration of MPG, but it was fluffy and sporulated profusely. *T viride-IV* exhibited maximum inhibition at 50% concentration of MPG.

Table 3. Effect of Maha Pancha Gavya (MPG) in integration with antagonists and neem products in controlling damping off of tomato caused by *Pyihium aphanidermatum.*

Treatments	Seedling stand	Seedling mortality (%)	Disease control (%)	Seedling height (cm)	Increase in height over control (%)
T.viride-I	44.00	29.03	37.93	28.60	9.16
T. viride-I+MPG	49.00	20.96	55.18	32.61	24.42
T. harzianum-II	43.33	30.64	34.48	26.60	1.52
T. harzianum-II+MPG	48.00	22.58	51.72	29.02	10.68
T. virens	42.33	32.25	31.04	29.42	12.21
*T.*virens+MPG	47.00	24.19	48.27	30.21	15.26
B. subtilis	46.00	25.80	44.83	27.10	3.43
B. subtilis+MPG	52.00	16.12	65.33	33.10	26.33
P.fluorescens	43.33	30.64	34.48	27.51	4.96
P.fluorescens+ MPG	49.00	20.96	55.18	31.21	17.93
Neemcake	41.33	33.87	27.58	29.20	11.45
MPG+Neem Cake	62.00	0.00	100.00	33.30	27.09
Neem leaf extract	37.00	40.32	13.79	28.01	6.87
MPG + Neem leaf extract	63 00	0 00	100 00	32 80	25 19
Control -l (Inoculated)	33.00	46.77	-	24.50	-
Control -I (Inoculated +MPG)	47.00	24.19	48.27	29.00	10.68
Contro-III (Uninoculated)	62 00	-	-	26.21	-
Contro-III (Uninoculated +MPG)	58 00	-	-	30.40	16.03
C.D.(P0.05)		181		1.12	

• Neem cake added @ 250g1m^2 of nursery bed
• Neem leaf extract (10%) was applied @ 31/rn^2 of nursery beds
• MPG (10%) applied @ 31/rn^2 of nursery bed
• Antagonists applied @ 250g/m^2 of nursery bed

MPG was not toxic against bacterial antagonists. At the lowest concentration, maximum growth of *P. fluorescens* was observed (Table 2). At the highest concentration of MPG, the growth of *B. subtilis* and *P. fluorescens* was decreased.

Soil application of MPG in nursery beds improved seedling stand and decreased percent seedling mortality in inoculated soil. Disease control given by MPG was better than that obtained with individual antagonist (Table 3). In integration with antagonists, the disease control was significantly increased in all the treatments. Among the various integrated treatments, *B. subtilis* + MPG treatment gave maximum disease control (65.33%). When MPG was used in integration with neem cake and neem extract, 100% disease control was achieved. This may be due to the additive effect of both the neem products and the MPG on the multiplication of antagonists. Many workers have reported that organic amendments stimulate antagonistic microorganisms in soil (Arjunan *et al.*, 1987; Rao and Sitaramaiah, 2000; Champawat and Sharma, 2003). MPG also enhanced seedling length more so in the presence of antagonists (Table 3). The increase in seedling length was probably due to the presence of hormones in MPG (Padmodaya, 1994). It was maximum when MPG was applied in integration with neem products. Although there is no information available on the efficacy of MPG in controlling damping-off tomato by *Pythium* spp. Reddy and Padmodaya (1996) found it to be highly effective both alone and in integration with neem cake and *T. viride* against *Fusarium* wilt of tomato. Further, they reported that it increased the vigour as well as the yield in tomato. Jahagirdhar *et al.* (2000) reported it to be effective in suppressing panama disease of banana caused by *F. oxysporum* f. sp. *cubense.* Thus, the present results revealed the antifungal potential of MPG and it can be one of the major components in the management of plant diseases, especially soil borne one's in "Organic Agriculture".

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