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Response of *Coleus aromaticus* to *Glomus fasciculatum* and other beneficial soil microflora

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Abstract

Stem cuttings of *Coleus aromaticus* were treated with vesicular arbuscular mycorrhiza (*Glomus fasciculatum*) and beneficial microorganisms viz., *Bacillus coagulans, Pseudomonas fluorescens, Azotobacter chroococcum* and *Trichoderma harzianum* either singly or in combination of organisms. The number of leaves and branches; total biomass, nitrogen and phosphorus contents were higher in plants treated with *G. fasciculatum* alone. Synergistic effect was noticed especially in plants treated with *G. fasciculatum* + *P. fluorescens*. Mycorrhizal colonization in roots was also maximum when VAM was applied alone.

Key words: Beneficial soil microflora, *Coleus aromaticus, Glomus fasciculatum.*

Coleus (*Coleus aromaticus* Benth.) belongs to the family Laminaceae and its leaf and stem are used to cure cough, cold, fever, tonsilities and urinary tract diseases (Brinda *et al.* 1991; Hussian *et al.* 1992). Many active principles (coleons, burbatusin), which are responsible for curing the diseases, have been isolated from different species of coleus (Rastogi & Mehrotra 1991). Cultivation of coleus is gaining importance, since there is a demand from ayurvedic pharmaceutical industries. The occurrence of Vesicular Arbuscular Mycorrhizal (VAM) fungi in the roots of several medicinal plants has been noticed (Govinda Rao *et al.* 1989; Lakshman & Raghavendra 1990). Rapid plant growth due to inoculation of VAM in *Terminalia bellarica* was observed by Lakshman (1992). Similarly, inoculation of VAM and other beneficial soil microflora significantly increased the biomass of different medicinal plants (Sena & Das 1998; Kothari *et al.* 1999). Hence, in the present study we analysed the effect of VAM fungus, *Glomus fasciculatum* and other beneficial microflora on the growth and yield of *C. aromaticus*.

Bacterial cultures of *Pseudomonas fluorescens* and *Bacillus coagulans* in nutrient broth; *Azotobacter chroococcum* on Waksmann No. 77 broth and *Trichoderma harzianum* on potato dextrose broth were grown for 7 days. *G. fasciculatum* was multiplied in the rhizosphere of Rhodes grass (*Chloris gayana*). The pots were filled with a mixture of sand and soil (1:1 ratio v/v). Stem cuttings of *C. aromaticus* (10 cm long) were selected and dipped in the cultures of the test microorganisms for one hour. Ten grams of perlite based *G. fasciculatum* inoculum (19 spores g^{-1}) was added into the planting hole in the pots, and then the treated cuttings were

planted. Growth parameters like, plant height, number of leaves, number of branches and biomass were recorded at the time of harvest (70 days after planting). Colonization of root by mycorrhizal fungus was assessed following the Gridline Intersection method (Giovannetti & Mosse 1980). Phosphorus content was estimated by Vando Molybdate Yellow Colour method and nitrogen content was estimated by Kjeldhal distillation method (Jackson 1973).

The results indicated that the number of leaves and branches were significantly increased in *G. fasciculatum* alone treated plants, followed by *G. fasciculatum* + *P. fluorescens* and *T. harzianum* alone treatments (Table 1). The other treatments were on par with the control. Maximum plant height was found in the treatment *G. fasciculatum* + *P. fluorescens* (58.33 cm) followed by *G. fasciculatum* alone (56.67 cm), *A. chroococcum* alone (56.00 cm) and *T. harzianum* alone (54.33 cm). *G. fasciculatum* alone significantly increased the number of branches and total dry weight too. This shows the efficacy of VAM fungus, *G. fasciculatum* on growth of *C. aromaticus*. Sena & Das (1998) reported similar type of results for other medicinal plants. All the other treatments except *G. fasciculatum* + *B. coagulans* and *G. fasciculatum* + *T. harzianum* showed significantly higher biomass over the control. Thus, the results confirm that the VAM fungi alone could increase the growth of *C. aromaticus* (Gupta & Janardhan 1991; Thomas & Carpenter Boggs 1995). However, synergistic effect of VAM with other microbial agents was observed only in a few treatments (Table 1). *G. fasciculatum* + *P. fluorescens* treatment showed this additive effect with respect to most of the parameters. Total nitrogen and phosphorus contents were highest in plants treated with mycorrhiza alone. The plants treated with *A. chroococcum* alone showed N content next to VAM treatment. Similar interaction effect was observed by Tilak (1990) and Veeraswamy *et al.* (1992). However, the combination of VAM with *T. harzianum* or *B. coagulans* or *A. chroococcum* recorded lesser N or P content when compared to control. Hence, whether the rhizosphere of *C. aromaticus* is congenial for these organisms has to be established. However, there was significantly high content of N and P in plants treated with *G. fasciculatum* + *P. fluorescens* as well as the combination of all microorganisms. This emphasizes the influence of *G. fasciculatum* alone on *C. aromaticus*. Root colonization of VAM was maximum (53.3 %) in VAM inoculation alone. VAM colonization ranged from 35.6 % to 47.8 % in other combined treatments indicating the decreased establishment of VAM in the presence of other microorganisms. Azcon *et al.* (1990) observed in-

Table 1. Effect of VAM and beneficial soil microflora on growth, yield and nutrient contents of *Coleus aromaticus*.

Treatment	Number of leaves plant^{-1}	Number of branches plant^{-1}	Average height of plant (cm)	Total dry wt of plant (g)	Total N (mg plant^{-1})	Total P (mg plant^{-1})
Control (Uninoculated)	43.67	3.33	31.33	5.40	124.43	11.22
Glomus fasciculatum (G.f)	74.67	6.33	56.67	10.48	272.71	25.54
Pseudomonas fluorescens (P.f)	46.66	3.00	40.00	6.56	173.42	16.36
Trichoderma harzianum (T.h)	62.67	5.00	54.33	7.25	185.97	17.41
B. coagulans (B.c)	48.00	3.67	42.00	7.62	206.88	19.53
Azotobacter chroococcum (A.c)	50.00	5.00	56.00	7.45	219.40	18.74
G.f+P.f	66.66	6.00	58.33	7.75	190.87	20.93
G.f+T.h	41.00	3.66	34.33	4.96	117.32	12.79
G.f+B.c	33.33	2.33	32.33	3.75	97.30	8.99
G.f+A.c	48.33	4.00	45.00	7.69	150.54	16.86
G.f+P.f+T.h+B.c+A.c	59.00	4.67	49.33	7.82	198.70	21.70
CD @ 0.05 %	18.83	1.97	14.64	1.19	33.55	2.34

creased colonization of *G. mosseae* and decreased establishment of *G. fasciculatum* which were inoculated alongwith two free living microorganisms. However, it is contrary to the results of Singh *et al.* (1990) and Sekar *et al.* (1995) who observed more colonization in roots of plants inoculated with plant growth promoting rhizobacteria. Thus, the present study revealed positive effect of *G. fasciculatum* on growth and yield of *C. aromaticus.*

References

Azcon R, Rubio R, Morales C & Tobar R 1990 Interaction between rhizosphere free living microorganisms and VAM fungi. Agric. Ecosyst. Environ. 29 : 11-15.

Brinda P, Sasikala E, Pappa M, Bhima R & Kundu R 1991 Pharmacognostic studies on *Coleus aromaticus* Benth . Bulletin of Medico-Ethnobotanical Research 12 : 17-31.

Giovannetti M & Mosse B 1980 Evaluation of techniques for measuring vesicular arbuscular mycorrhizal infection in roots. New Phytol. 84 : 489-500.

Govinda Rao Y S, Suresh C K, Suresh N S, Mallikarjunaiah R R & Bagyaraj D J 1989 Vesicular arbuscular mycorrhiza in medicinal plants. Indian Phytopath. 42 : 476-478.

Gupta M L & Janardhanan K K 1991 Mycorrhizal association of *Glomus aggregatum* with palmarosa enhances growth and biomass. Plant and Soil 131 : 261-264.

Hussain A, Virmani O P, Popli S P, Misra L N, Gupta M M, Srivastava G N, Abrham Z & Singh A K 1992 Dictionary of Indian Medicinal Plants. CIMAP, RSM Nagar, Lucknow.

Jackson M L 1973 Soil Chemical Analysis. Prentice Hall (India) Pvt. Ltd. New Delhi.

Kothari S K, Singh S, Singh U B & Kumar S 1999 Response of bergamot mint (*Mentha citrata*) to vesicular arbuscular mycorrhizal fungi and phosphorus supply. J. Med. Aromatic Plant Sci. 21 : 990-995.

Lakshman H C 1992 Development and response of vesicular arbuscular mycorrhizal fungi in *Terminalia bellarica* Roxb. J. Tropical Forestry 8 : 179-182.

Lakshman H C & Raghavendra S 1990 Occurrence of vesicular arbuscular mycorrhizal fungi in medicinal plants. In: Mycorrhizal Symbiosis and Plant Growth. Proc. Natl. Conf. Mycorrhiza, Univ. Agril. Sci., Bangalore.

Rastogi R P & Mehrotra B N 1991 Coleus: In (R P Rastogi eds) Compendium of Indian Medicinal Plants. Volume 2. Central Drug Research Institute, Lucknow.

Sena M K & Das P K 1998 Influence of microbial inoculants on quality of turmeric. Indian Cocoa Arecanut and Spices Journal 21 : 31-33.

Thomas A L & Carpenter Boggs L A 1995 Mycorrhizal colonization of *Ancistrocladus korupensis*, a new tropical forest species with anti HIV activity. J. Herbs & Medicinal Plants 3 : 51-54.

Tilak K V B R 1990 Interaction of VAM with beneficial soil microorganisms. In: Current Trends in Mycorrhizal Research. Proc. Natl. Conf. on Mycorrhiza. Haryana Agril. Univ. Hissar. India.

Veeraswamy T, Padmavati T & Venkatahwarlu K 1992 Interaction effects of *Glomus intraradices* and *Azospirullum lipoferum* on sorghum. Indian J. Microbiol. 32 : 305-308.