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Original Research Paper

# Effect of Single and Multiple Arbuscular Mycorrhizal Fungal Inoculants on the Growth Parameters of *Bauhinia Varigata L*.

**Krishna H. Waddar and H. C. Lakshman**
Department of Botany, Micro Biology Lab, Karnatak University, Dharwad-580 003, Karnataka, India

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## ABSTRACT

Arbuscular mycorrhizal fungi constitute one of the important components of soil microbiota, and their inoculation directly involved in improving plant growth under the reduced fertilizer input. Green house experiments were undertaken *in Bauhinia varigata* L. plant seedlings were grown in phosphorus deficient sandy loam soil with single, double and triple inoculation with three AM fungi. Single and double inoculation steadily improved plant biomass production and phosphorus content in shoot and roots. However, triple inoculation significantly improved plant growth, biomass production, and phosphorus content in shoot and root, percent root colonization and spore number compared to non-inoculated (control) plants. It may be concluded that triple inoculation of AM fungi for *Bauhinia varigata* at nursery stage considered to be good before transplantation in reforestation programmes.

## INTRODUCTION

Arbuscular mycorrhizal (AM) fungi are important in mobilizing phosphorus nutrition in many soils through hyphal transport to the plant (Jakobsen & Larsen 1994). Nutrient exchange between the two symbionts is at the core of the arbuscular mycorrizal (AM) association and reciprocal transfer is a requirement for a functioning of symbiosis (Fitter 2006). Arbuscular mycorrhiza benefits the plant improving the supply of nutrients, especially phosphorus and other minerals such as Zn, Cu, S, K and Ca (Cooper & Tinker 1978), and the plant supplies the fungus with photosynthetic sugars (Verma & Schuepp 1995). Pure cultures of single species of AM fungus are being assessed for the appreciable plant growth and crop production. AM fungi increased biomass production of sustainable agricultural crops. Multiple inoculation of plants with AM fungi has often yielded increased biomass production, but less emphasis has been paid to exploit their practical utilization (Hepper et al. 1987, Kumar 1990, Lakshman 1996, 2009). The past decade has witnessed a rapid increase of interest in agroforestry and plantation as a land use practice across India. Of the tree species currently being tested for agroforestry or plantation, *Bauhinia varigata* L. is moderately fast growing indigenous tree used for the purpose of timber, fuel, and commonly grown on road side for shade. In the present study, three species of AM fungi, i.e., *Glomus constrictum* Trappe, *Glomus mosseae* (Nicolson, Gerdemann) Gerdemann and Trappe, and *Glomus fasciculatum* (Thaxter Sensu Gerd) Gerdemann and Trappe have been assessed, singly and in combination, for their efficacy as potential AM fungal inoculants for *Bauhinia varigata.*

## MATERIALS AND METHODS

Three species of AM fungi were screened for their efficacy. Pure culture of all the three AM species, which were maintained on *Chloris gayan* (Rhode grass) in 20 × 20 cm pots containing sand loamy soil was used for inoculation. Steam-sterilized sandy loam soil sand mix (1: 1 volume/volume) substrate was dried and potted in 1 kg capacity clay pots. Twenty five grams of single or mixed dry soil inoculum containing 400-450 spores/50 g soil was mixed in the top 6 cm of the soil of each treatment pot. Control plants received 60 g of soil containing non-mycorrhizal root pieces of Rhode grass. Preliminary studies with the standardization of the dose of soil inoculum showed that this quantity of mycorrhizal inoculum was sufficient for the production of a reasonable amount of infection. The amount of AM fungal inoculum for each treatment was so adjusted that equal quantity of soil inoculum could be added to each pot. The different doses of soil inoculum used for each treatment were as follows.

Single endophyte-25 g

Double endophyte-12.5 +12.5 g

Triple endophyte- 10 + 10 + 10 g

Each treatment was replicated seven times, and the following treatments were included in the study.

Soil without inoculation (control)

Soil inoculated with G. *constrictum* (25 g)

Soil inoculated with G. *mosseae* (25 g)

Soil inoculated with G. *fasciculatum* (25 g)

Soil inoculated with G. *constrictum* (12.5 g) and inoculum of *G. mosseae* (12.5 g)

Soil inoculated with G. constrictum (12.5 g) and inoculum of *G. fasciculatum*

Soil inoculated with *G. mosseae* (12.5 g) and inoculum of *G. fasciculatum* (12.5 g)

Soil inoculated with *G. constrictum* (10 g) *G. mosseae* (10 g) and inoculum of *G. fasciculatum* (10 g)

Five surface-sterilized (4% sodium hypochlorite for three minutes) seeds of *Bauhinia varigata* were sown in each pot above the soil inoculum. Seedlings were thinned to one seedling/pot seven days after germination and pots were maintained under greenhouse conditions. Plants were uprooted periodically and per cent colonization of the roots was assessed by methods of Phillips & Hayman (1970). The number of AM fungal spores were extracted from the rhizosphere soil by wet sieving and decanting method (Gerdemann & Nicolson 1963), and spore count was recorded. Biomass production was recorded in the term of fresh and dry weights of shoot and root, and phosphorus content in the shoots and roots (Anderson & Ingram 1989). The data were statistically analysed.

## RESULTS AND DISCUSSION

The results of the study are given in Table 1. All the three AM fungi were tested for their efficacy on *Bauhinia varigata* singly and in various combinations. All the treatments showed improvement in the mycorrhizal colonization, number of chlamydospores recovered from the rhizosphere soil, plant biomass, and P contents of the shoots and roots. However, all the three AM fungi tested behave differently in different combinations and differ from one species to another species. Maximum growth in plants and spore count was observed by the inoculation of *G. mosseae* followed by *G. constrictum* and *G. fasciculatum*. In combination the maximum increase was observed in the plants which received *G. mosseae* and *G. constrictum* followed by *G. constrictum* and *G. fasciculatum* and *G. mosseae* and *G. fasciculatum*. However, highest increase was observed in the shoot biomass, mycorrhizal colonization in P content in the shoots and roots when the plants were inoculated with all the three AM fungi.

These enhancements in the plant growth parameters, mycorrhizal colonization and biomass production may be reflected in higher yield of *Bauhinia varigata* due to multiple inoculation of AM fungi and this deserves due attention and further emphasis to confirm the suitability of multiple inoculum as compared to single inoculum for better crop production. Mycorrhizal symbiosis is an attractive process in agriculture and forest management to enhance crop and wood production in the sense of sustainable agriculture and restoring soil fertility (Verma 1995, Hosmani & Lakshaman 2004).

Many attempts have been made over the years to determine the influence of mixed AM fungal species on root colonization and sporulation. There are numerous reports of increased plant growth from inoculation with non-indigenous AM species even into non-sterile soil containing indigenous species. The competitive ability of *Glomus tenue* was demonstrated (Anderson & Ingram 1989), who observed an increase in plant growth when *Glomus tenue* was added to host pot cultures already colonized by other AM fungi. Further evidence of competition between AM fungal species came from (Ross & Ruttencutter 1977), who found that less colonization occurred in *Glomus macrocarpum* inoculated peanuts and soyabean as compared to hosts inoculated with *Gigaspora gigantean* and *Glomus macrocarpum* together.

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Table 1: Effect of single and multiple inocula of AM fungi on the growth of *Bauhinia varigata* L. in sterilized soil under pot conditions for 90 days.

| Treatment | Shoot fresh wt (g) | Root fresh wt (g) | Shoot dry wt (g) | Root dry wt (g) | Phosporus g/mg | | Colonization (%) | No. of chlamydospores recovered from 20g soil |
|---|---|---|---|---|---|---|---|---|
| | | | | | Shoot | Root | | |
| Control | 19.20 | 1.2 | 3.32 | 0.20 | 1.05 | 0.25 | - | - |
| *G. constrictum* (GC) | 14.5 | 3.0 | 5.85 | 0.68 | 1.23 | 0.17 | 74 | 110 |
| *G. mosseae* (Gm) | 13.3 | 3.2 | 4.85 | 0.62 | 1.2 | 0.30 | 77 | 116 |
| *G. fasciculatum* (Gf) | 11.5 | 3.4 | 3.82 | 0.31 | 1.10 | 0.27 | 71 | 121 |
| Gc + Gm | 19.4 | 7.5 | 9.42 | 1.63 | 1.70 | 0.69 | 69 | 107 |
| Gc + Gf | 15.5 | 6.0 | 8.00 | 1.27 | 1.62 | 0.55 | 72 | 105 |
| Gm + Gf | 13.0 | 3.2 | 6.75 | 0.90 | 1.45 | 0.34 | 62 | 102 |
| Gc + Gm + Gf | 14.3 | 10.8 | 12.00 | 2.00 | 1.95 | 0.90 | 87 | 195 |

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