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Incidence of AM Fungi in Bamboo Species from Wadali, Amravati (M.S.), India

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ABSTRACT

The bamboos are evergreen perennial flowering plants in the subfamily Bambusoideae of the grass family Poaceae. They are of notable economic and cultural significance in South Asia, Southeast Asia and East Asia, being used for building materials, as a food source, and as a versatile raw product. It is an extremely versatile material with countless uses including construction, clothes, food and fuel. Due to its multiple utility and accessibility to common man, it is also known as green gold. There is a need to take efforts for making bamboo a supplementary business for agriculture along with its conservation and nurturing. Bamboo business also will prove financially beneficial for the farmers. The diversified collection of Bamboo plants from different parts of the country is well maintained at Wadali Forest Garden at Amravati. The main motive behind the plantation is to empower the farmer. The farmer who grows oranges and soybeans requires good species of bamboo. They are encouraged to grow bamboo species without having them to purchase it from outside, the bamboo plants are sold to them on the basis of species. Among the microbial communities Mycorrhizae forms symbiotic associations with the roots of most plant species. This symbiosis, that exists in between plant root and Arbuscular Mycorrhizal Fungi (AMF) is of great use and interest to ecologist due to potential influence of it on natural ecosystem processes. As we have the great source of Bamboos in Amravati, it was utilized for the present research work particularly in the field of Mycorrhizal Biotechnology. The main aim of the present study was to investigate the AMF association with three bamboo species i.e. *B. balcooa, B. vulgaris, B. tulda*. All the *Bambusa species* studied exhibited AM fungal association. The root association characterized by the presence of hyphal, arbuscule and vesicles typical of AM fungi were seen. The results indicated that the *Bambusa balcooa* Roxb. exhibited maximum % root colonization. The total number of spores per 100 g of all samples of rhizospere soils found in the range of 60 to 150 (*Bambusa balcooa*), 46 to 56 (*B. vulgaris*) and 40 to 80 (*Bambusa tulda*). *Glomus tortuosum* Schenk and Smith was found to be highly associated with all the three species of Bomboos. The trap culture is maintained to develop monoculture of viable spores. For sustainable development these native most dominant and some more species of AMF can be taken into account in near future as biofertilizers for Bamboos after their mass multiplication.

Key words: Bamboo, Glomus tortuosum, soil trap culture, Wadali.

INTRODUCTION

India has the second largest reserve of bamboos. Bamboos are naturally distributed in all the states of India except in Jammu and Kashmir. Maximum number of genera is reported from West Bengal and Arunachal Pradesh. Bamboos are distributed in the country starting from sea level to an elevation of 3600m above msl. Different species of bamboo have different optimum temperature, humidity, soil types, altitude and physiography for their best performance. (Rao *et al*., 1990). Bamboo has age-old connection with material needs of rural people (Mukherjee *et al*. 2010). They may be able to increase the biocapacity in the future by simultaneously increasing the area of fertile global hectares that is able to supply resourses (Mishra *et al*., 2014).

Plants associate with other life forms (animal, bacteria, or fungi) to complete their life cycle, to fight against pathogens or to thrive in adverse environment. Mycorrhiza is one of the best examples of symbiotic association between plants and fungi. Arbuscular mycorrhizal fungi (AMF) are ubiquitous in soil. In tropics and subtropics 95% of the forest tree species are Arbuscular mycorrhizal. The AMF association promotes growth of plants by improving uptake of macro- and micronutrient, to increasing plant against biotic and abiotic stress, and beneficial alternation of plant regulators (Smith and Read, 2008). The effect of mycorrhiza on its host plant are regularly generalized, however the more recent studies highlighted the differences in the effect shown by different AMF species (Bohrer *et al*., 2004).The understanding of physiological, biochemical and genetic characteristics of AM fungi as well as their practical exploitation is constrained on account of inability to culture under in vitro conditions. Therefore, the AM fungi are grown on a suitable living host root system. The potential utilization of AM fungi greatly depends on the ability to produce suitable inoculum (Singh *et al*., 2012).

The general potential role of AMF in agriculture have been well documented but to understand more of the potential of associated AMF with their host, a better understanding of indigenous AMF species is required. Despite a reasonable amount of information available in the literature on the association of mycorrhiza with many plants, very little is known about such processes in the bamboo species. Furthermore, the information on bamboo mycorrhiza is very limited from India as well as outside. The main aim of the present study was to investigate the AMF association with three bamboo species.

MATERIALS AND METHODS

Amravati district is in Maharashtra, India. It is the seventh most popular metropolitan area in Maharashtra located at 20.93°N 77.75°E. It has an average elevation of 343 meters (1125 feet). It has a tropical wet and dry climate with hot, dry summers and mild to cool winters. The diversified collection of Bamboo plants from different parts of the country is well maintained at Wadali Forest Garden, which is the second largest bamboo nursery of Maharastra, Amravati. Three species mainly *Bambusa balcooa* Roxb, *Bambusa tulda* Roxb, *Bambusa vulgaris* Schrad. ex J.C. Wendl were selected for the present study from this garden. The rhizosphere soil and roots of these species were collected. The roots were carefully washed under tap water and fixed in formalin-acetic acid-70% ethanol (FAA 5:5:90 (v/v)) solution in the separate labelled bottles.

These soil samples were brought to the laboratory and after shade drying the soil was stored in clean polythene bags. The composite soil sample was used for physico- chemical analysis with standard methods by Jackson (1967). The preserved root samples were used for the further analysis by the process given by Phillips and Hayman (1970). The AM percent root colonization was calculated by using the Grid line intersect method (Giovannetti and Mosse, 1980). The isolation of AM spores was carried out by following metod of Gerdemann and Nicolson (1963). The method given by Gaur and Adholeya (1994) was used for counting AMF spores. The isolated spores were given a thorough microscopic examination to record their morpho- taxonomic features. The AM Fungi were identified by using the manual of Schenck and Perez (1990). The method for Soil trap culture given by Rodrigues and Muthukumar, 2009 was followed. All the slides showing characteristic features of AMF along with isolated spores were photographed by using Tucsen Camera.

RESULTS AND DISCUSSION

The result of physico-chemical analysis of the composite rhizosphere soil sample is given in table 1.

Table 1 : Physico – chemical analysis of soil

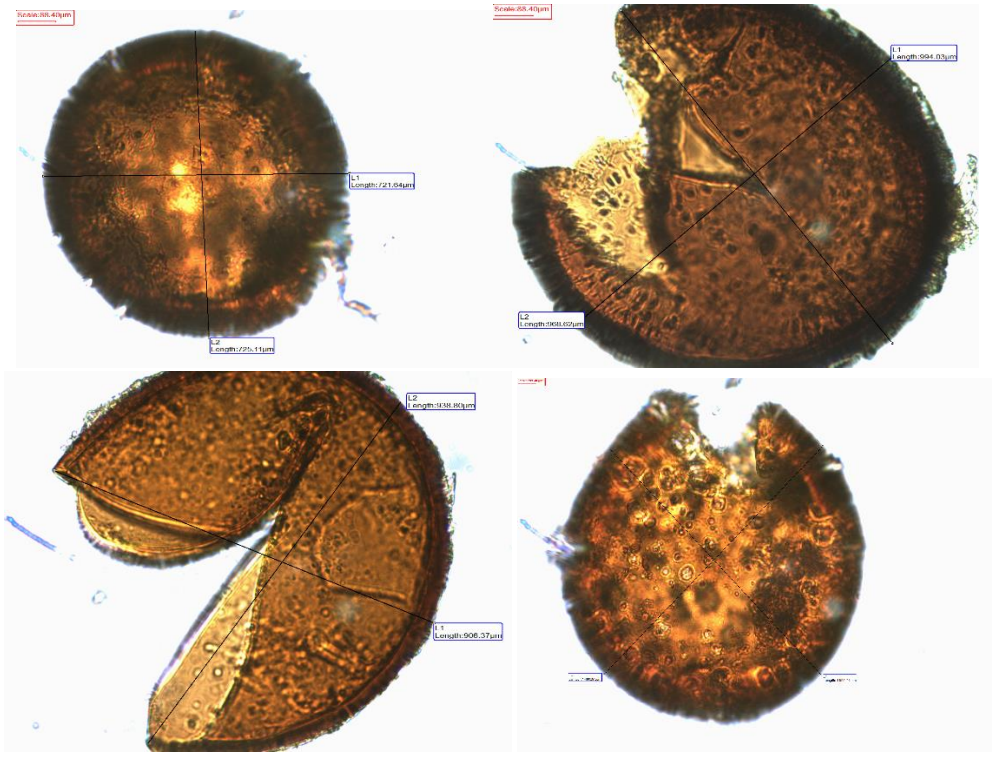
Sr. No.	Sample	pH	Ec $dsem^{-1}$	P Kg/Ha	K Kg/Ha	Org.C %	Cu ppm	Fe ppm	Zn ppm	Mn ppm
1.	Composite rhizosphere soil	7.90	0.31	21.48	464.71	0.60	0.21	2.50	0.41	3.54

Table 2: % Root colonization and spore count

Sr. No	Species	% Root colonization			Spore Count /100g
		S1	S2	S3	
1	*B. balcooa*	150	70	60	58.33
2	*B. tulda*	80	40	70	43%
3	*B. vulgaris*	58	46	56	53%

Table 3: AMF species isolated

Sr. no.	Bambusa species	Sites	Types of spore were observed in rhizospere
1	*Bambusa tulda*	*S1*	*Glomus etunicatum, Glomus tortuosum, Glomus pustulatum, Glomus fasciculatum, Glomus aggreatum*
		S2	*Glomus tortusum, Glomus agrregatum, Glomus fecundisporum, Glomus claroids.*
		S3	*Glomus tortuosum, Glomus reticulatum*
2	***Bambusa vulgaris***	*S1*	*Glomus tortuosum, Glomus leptoticum*
		S2	*Glomus leptoticum, Glomus tortuosum,*
		S3	*Glomus maculosum, Glomus. tortuosum, Glomus. ambisporum.*
3	***Bambusa tulda***	*S1*	*Glomus tortuosum, Glomus maculosum, Glomus fasciculatum, Glomus fistulosum, Glomus aggregatum, Glomus fecundisporum*
		S2	*Glomus tortuosum, Glomus fecundisporum, Glomus clarium, Glomus tortuosum.*
		S3	*Glomus dimorphicum, Glomus pansihalos, Glomus fecundisporum, Glomus tortuosum Glomus pustulatum, Glomus maculosum, Glomus reticulatum, Glomus deserticola, Glomus leptotichum, Glomus australe.*



Photoplate I- *Glomus tortuosum* Schenck and Smith

The whole root system and rhizosphere soils of all the plants of study area were collected and screened for their mycorrhizal status. The young feeder roots are primary sites for initiation and infection of AMF. Hence all those were collected and stored separately and assessed to know the percent root colonization. The observations are recorded in Table 2.

The results indicate that the *Bambusa balcooa* Roxb. exhibited maximum % root colonization. Plant roots showed the typical inter and intracellular coenocytic mycelium, Hyphal, Arbuscules and Vesicles which are the characteristic features and thus confirmation of AM colonization. Similar studies were carried out by Das (2010) for (AMF) distribution and dark septate endophyte (DSE) colonization on four species of bamboo from Northest India and17species were isolated from *Acaulospora, Ambispora* and *Glomus.* Hazarika *et al*., 2015 have observed Arbuscular mycorrhizal fungal (AMF) association in roots of four bamboo species.

Jha *et al*. 2012 have conducted a study to identify suitable arbuscular mycorrhizal (AM) fungi for inoculation of *Bambusa bambos* and *Dendrocalamus strictus* at nursery stage for increasing growth and productivity. Similarly, in the present investigation also an attempt has been made for the trap culture of dominant AMF species. This trap culture will be used to develop monoculture of native dominant AMF species. Even though host specificity is not reported so far with AMF association the genus *Glomus tortuosum* Schenck and Smith was found to be predominant in the present study (Table 3, Photoplate I). The variation which was exhibited in root colonization percentage among different species might be due to the effect of rhizosphere soil that favored the growth of AM fungi.

The soil trap culture is maintained to develop monoculture of viable spores. For sustainable development of agriculture this native most dominant and some more species of AMF can be taken into account in near future as biofertilizers for Bamboos after its mass multiplication.

CONCLUSION

The enhancement of growth and vigour and increase in production of the Bamboo plants is desirable which may be achieved by inoculation of the roots with arbuscular mycorrhizal fungi. These approaches will increase our scope to manipulate the symbiosis in conservation schemes. There is a steady increase in the cultivation of Bamboo plants to maintain a steady supply to support the increasing demand but corresponding researches of AM fungi and their association in *Bambusa* plants are very sporadic, hence a vast research on this field is necessary for a better tomorrow.

Conflict of Interest

The author declares that there is no conflict of interest.

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