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SOIL TRAP CULTURE OF AM FUNGI ASSOCIATED IN *DENDROCALAMUS* SPECIES FROM WADALI, AMRAVATI (M.S.)

K. G. Wankhade[1], Dr. R. C. Maggirwar[2]* and S. P. Khodke[3]

[1,2]PG Dept of Botany Shri Shivaji Science College, Amravati (MS) India.
[3]Dept. of Botany Vinayak Vidnyan Mahavidyalay.

Corresponding Author: Dr. R. C. Maggirwar
PG Dept of Botany Shri Shivaji Science College, Amravati (MS) India.

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ABSTRACT

Among the microbial communities Arbuscular Mycorrhizal Fungi (AMF) forms symbiotic association with the roots of most plant species and the major effect of AMF infection on host plants is enhanced nutrient mobilization. Bamboo is called as "Green Gold" because it has endless uses. It is the versatile forest produce, and also one of the most important renewable natural resources which have capability to produce maximum biomass as compared to other forest plants and a vehicle to boost the rural economy in our country. Bamboo resources have considerably dwindled from the natural habitats due to exploitation, shifting cultivation, gregarious flowering and extensive forest fires. Therefore, system cultivation and their scientific management can ensure sustainable production. Hence, there is a need to take efforts for making bamboo a supplementary business for agriculture along with its conservation and nurturing. Most studies on bamboo have evaluated their commercial use but few have investigated their associated mycorrhizal fungi. To address scantiness of the mycorrhizal studies in bamboo, we have investigated Arbuscular Mycorrhizal fungal (AMF) distribution in three species of *Dendrocalamus.* Average AMF spore count was found to be 220 to 290, percent root colonization was 37.66 to 71.33%. The predominant strain of AMF associated with bamboo species was *Glomus fecundisporum* N.C. Schenck and G.S. Smith. The attempt has been made for the soil trap culture of this most dominant AMF species. It may be used to develop the monoculture and on large scale as a bio fertilizer. These results could be of potential interest to growers who wish to cultivate Bamboo species. The native most dominant and some other species of AMF can be taken into account in near future as bio fertilizer after its mass multiplication. Bamboo business will also prove financially beneficial for the farmers of Vidarbha region if it is of better quality and supplied with nature's own bio fertilizer.

KEYWORDS: *Dendrocalamus*, *Glomus fecundisporum*, Soil Trap Culture, Wadali.

INTRODUCTION

Arbuscular Mycorrhizal (AM) fungi form a major component of the soil microbiota in natural ecosystems and play an important role in the mineralization and plant nutrient cycling. In spite of potential for use in agriculture and forestry, AM fungi have received little attention due to their obligate symbiotic nature. They are generally propagated easily using a pot- culture technique. Fungal inocula, usually made of spores and colonized substrate as well as root segments can be used as AM inoculum.[1]

Bamboo, a giant grass, is a member of the family Poaceae and subfamily Bambusoideae. India is the second richest country in bamboo genetic resources following China.[2] It is fast growing plant and widely recognized as cost effective investment due to its very short harvestable maturity.[3] Bamboo forests have ecological and environmental functions in terms of control of soil erosion, land rehabilitation, water conservation and carbon sequestration. Bamboos also play an important role in biodiversity conservation.[4] The root system of bamboos, in general, is superficial and does not grow to more than a meter deep.[5]

The information on bamboo mycorrhiza is very limited from India as well as outside. It includes survey on the AM associations of bamboo in Western Ghats of Kerala,[6] in semiarid tropical grassland[7,8] and field mycorrhizal status of bamboos in Kerala.[9,10] investigated AMF distribution and Dark Septate Endophyte (DSE) colonization on four species of bamboo from northeast India.

To address scantiness of the mycorrhizal studies in bamboo, we have investigated Arbuscular Mycorrhizal fungal (AMF) distribution in three species of *Dendrocalamus* from Wadali, Amravati (M.S.). The

bamboo plantation in Amravati has been taken as a challenge. 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 Maharashtra, Amravati. Spread over 40 hectares, it has got 110 species of bamboo, some locally grown and some imported from countries like China, Malaysia, South America and South Africa. This Bamboo garden has added glory to historic Amravati city. As we have the great source of Bamboos in Amravati we felt that it should be utilized for the research work particularly in the field of Mycorrhizal Biotechnology. Present investigation addresses the bamboo- mycorrhiza symbiosis in terms of root colonization, spore count, AMF spores and soil trap culture.

MATERIAL AND METHODS

Amravati is a city in the state of Maharashtra, India. It is the seventh most populous metropolitan area in Maharashtra. Amravati is located at 20.93°N 77.75°E. It has an average elevation of 343 meters (1125 feet). Amravati has a tropical wet and dry climate with hot, dry summers and mild to cool winters. The study sites are located in Amravati city (Wadali Bamboo Garden).Three different locations in bamboo garden were selected for sample collection. Three different bamboo species were collected for the present study such as *Dendrocalamus strictus* (Roxb.) Nees**,** *Dendrocalamus membranaceus* Munro and *Dendrocalamus giganteus* Munro. These species were collected from this region along with their fibrous roots and rhizosphere soils. The root samples were stored in separate bottles in F:A:A and 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. [11] The preserved root samples were used for the further analysis by the process given by.[12] The AM percent root colonization was calculated by using the Grid line intersect method.[13] The isolation of AM spores was carried out by following metod of.[14] The method given by[15]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.[16] The method for Soil trap culture given by[17] was followed. All the slides showing characteristic features of AMF along with isolated spores were photographed by using Tucsen Camera.

RESULTS AND DISCUSSION

Table 1: Physico – chemical analysis of rhizosphere 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	7.90	0.23	25.69	411.90	0.54	0.22	2.19	0.41	3.54

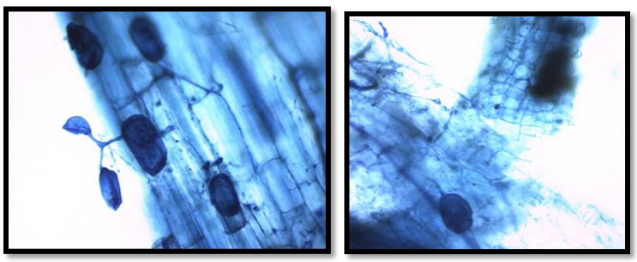
Table 2: AMF %colonization and spore count.

Sr. No.	Species	Spore count	% colonization
1	*D. strictus*	290	37.66
2	*D. membraneceus*	220	69%
3	*D. giganteus*	230	71.33%

The result of physico-chemical analysis of the composite rhizosphere soil sample is given in table No.1.The whole root system and rhizosphere soils of all the plants of study area were screened for their mycorrhizal status. The young feeder roots are primary sites for initiation and infection of AMF hence all those were assessed to know the percent root colonization. The observations are recorded in Table –2.

The results indicated maximum % colonization *in D. giganteus.* The plant roots showed the typical inter and intracellular coenocytic mycelium, Hyphal coils, H-shaped connections, Arbuscules and Vesicles which are the characteristic features and thus confirmation of AM colonization (Photo plate No. I) .

Photoplate I



Vesicles

Density of AM fungal spores in the rhizosphere soils of the host plants from all the sites were studied and *D. strictus* exhibited highest (290) spore count. In all eighteen AMF species of *Glomus* and two species of *Acaulospora* were found to be associated with three Bamboo species. (TableNo.3). *Glomus fecundisporum* N.C. Schenck and G.S. Sm. was the most dominant and found associated in all the three species of Bamboos. In the present investigation an attempt has been made to establish the soil trap culture of the rhizosphere soil with native AMF propagules. This soil trap culture will be used to develop monoculture in future for its mass multiplication and inoculation programme.

Table 3: AM fungal species isolated from rhizosphere soil of *D. strictus, D. membranaceus* and *D. giganteus.*

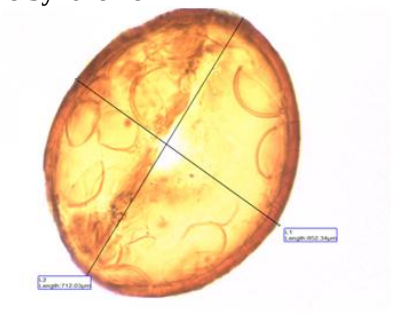
Sr. No.	Name of Species	*D. strictus*			*D. membraneceus*			*D. giganteus*		
		S1	S2	S3	S4	S5	S6	S7	S8	S9
1	*Acaulospora mellea*	-	-	-	1	-	-	-	-	-
2	*Acaulospora nicolsonii*	-	-	-	-	-	-	-	1	1
3	*Glomus aggregatum*	1	-	-	-	1	-	1	-	-
4	*Glomus albidum*	1	-	1	-	-	2	-	-	-
5	*Glomus auntrale*	1	-	-	-	-	3	-	-	--
6	*Glomus ambisporum*	-	-	-	1	-	-	1	-	-
7	*Glomus Clarum*	1	1	2	-	1	-	-	1	-
8	*Glomus claroides*	1	1	1	1	4	1	-	1	-
9	*Glomus deserticola*	-	2	3	-	-	-	-	-	-
10	*Glomus diaphanum*	-	-	-	-	-	-	-	-	1
11	*Glomus etunicatum*	-	-	-	1	-	-	-	-	2
12	*Glomus fistulosum*	4	2	4	1	1	-	-	-	-
13	*Glomus fecundisporum*	3	2	7	8	5	1	2	7	3
14	*Glomus fasciculatum*	1	-	3	1	1	-	1	1	1
15	*Glomus geosporum*	1	1	1	-	2	-	1	-	-
16	*Glomus gerdmannii*	-	-	-	-	-	-	-	2	-
17	*Glomus leptotichum*	1	3	-	2	3	-	1	1	4
18	*Glomus maculosum*	4	1	2	1	1	-	-	1	1
19	*Glomus microggregatum*	-	-	-	-	-	-	-	1	-
20	*Glomus pubescens*	1	-	-	-	-	-	-	-	-
17	*Glomus Palledium*	2	-	-	-	-	-	-	-	-
18	*Glomus reticulatum*	-	1	-	1	1	1	1	-	-
20	*Glomus tenue*	-	1	-	-	-	-	-	-	-

In the present study AMF had good symbiotic association with the roots of *Dendrocalamus membranaceus* Munro and *Dendrocalamus giganteus* Munro. Occurrence of this association was detected microscopically. In early investigations a similar survey was conducted by.[18] for evaluating the mycorhizal status of seven bamboo species, namely, *Bambusa polymorpha, B. multiplex, B.nutans, B. tulda, Cephalostachyum pergracile, Dendrocalamus giganteus* and *Melocanna baccifera* planted in Bambusetum of Forest Research Institute, Dehradun. Composite samples of root and soil from each species were analyzed by for mycorrhizal types, root colonization and spore population, and physico-chemical properties respectively. In all the species of *B. multiplex* and *M. baccifera*, reported the low presence of arbuscules, scanty internal and external mycelium and had a good number of chlamydospores. They have reported the variations in mycorrhization due to the season, soil and host phenology. It has earlier been reported that endomycorrhizal colonization and sporulation may vary in different seasons in a year.[19,20,21]

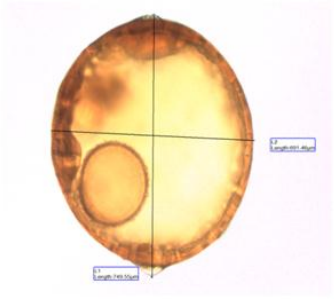
Spore Syndrome

Most species of AM fungal spores occur outside the roots in soil and sometimes inside living roots or plant debris. The saprophytic and pathogenic fungi are known to possess spore-in-spore syndrome. Sometimes their role as mycoparasites, bio-control agents and other related activities are interpreted differently,[22] firstly focused on the AM fungi forming spores inside spores of other AM species and he found that dead spores of at least 10 species of AM fungi, mostly members belonging to the genus *Gigaspora*, were occupied by spores of other Am species. Such interesting observations were also made during this study. Development of many small spores inside the dead spore of other species is called spore syndrome (Photo plate No. II).

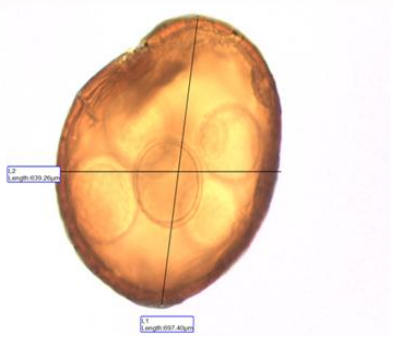
Photoplate II-Spore Syndrome



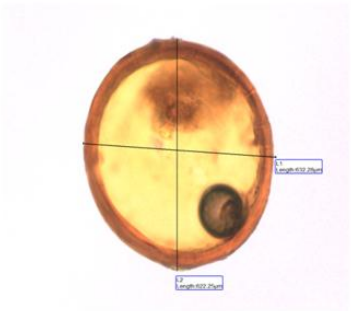
Outer-*Gomus gerdemannii* Rose, Daniels &Trappe
Inner -*Glomus microaggregatumKoske*, Gemma&Olexia



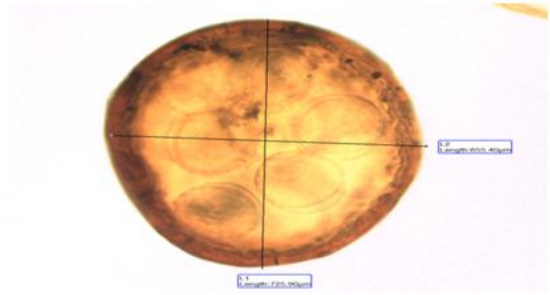
Outer- Glomus Fistulosum Skou &Jakobsen
Inner- Glomus pubescens (Saccardo & Ellis) Trappe & Gerdemann



Outer – *Glomus fistulosum*Skou&Jakobsen
Inner – *Glomus palladium* Hall



Outer – *Glomus fistulosum* Skou&Jakobsen
Inner – *Glomus tenue* (Greenall)Hall



Outer - *Glomus fistulosum* Skou&Jakobsen
Inner -*Glomus palladium* Hall

Most of the spore syndrome was of *Glomus* species. Formation of spore syndrome could be a protective mechanism from the parasitic attack by soil microorganism or predatory larvae. It appears that dead spores of AM fungi provide favorable microhabitats for spore formation in the natural undisturbed ecosystem. The ecological significance of the association of spores within spores and its inoculums potential in the soil or mycoparasitism is unclear at this time.

CONCLUSION

Proper selection of efficient AM fungi is an important step for developing any mycorrhizal inoculation programme. The present study has explored the predominant strain of AMF associated with bamboo species. *Glomus fecundisporum* may be used to develop the monoculture and later on large scale as a biofertilizer. As there is a need to take efforts for making bamboo a supplementary business for agriculture along with its conservation and nurturing. The native most dominant and some more species of AMF can be taken into account in near future as biofertilizer after its mass multiplication. Bamboo business will also prove financially beneficial for the farmers of Vidarbha region if it is of better quality and supplied with nature's own biofertilizer.

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