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ARBUSCULAR MYCORRHIZAL AND DARK SEPTATE ENDOPHYTIC ASSOCIATION IN SOME GRASSES FROM AMRAVATI (M.S.)

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ABSTRACT

Grass family is one of the largest and important families of the plant kingdom and grasses have great role in sustainable development of biodiversity. Present investigation was conducted to study the Arbuscular Mycorrhizal Fungi associated with some of the grasses from three different sites of Amravati region of Maharashtra, India. The physico-chemical characteristics of soil samples of all the study sites were analyzed. The AM Fungal spore count ranged from 130 to 216 and the percent root colonization of AM Fungi varied in the range of 60 to 100%. A total of twenty three fungal species belonging to *Glomus*, *Acaulospora*, *Sclerocystis* and *Scutellispora* were identified from the rhizosphere soil samples of *Eragrostis spectabilis* (Pursh) Steudel., *Eleusine indica* (L) Gaerth., *Dactyloctenium aegyptium* (L)Willd. and *Chloris virgata* Sw. (Olof Swartz). The characteristic features of Dark Septate Endophytic (DSE) fungi were also observed in the investigation. Thus AM Fungi are almost ubiquitous in the grasses studied. Further challenge is to gain more knowledge about range of AMF and DSE tax as and their functional role for grasses.

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INTRODUCTION

Soil, supports an enormous microbial diversity of organisms. Especially rhizospheric region is the most dynamic environment that harbors arbuscular mycorrhizae the most dominant fungal association. The broad distribution and high colonization rates of plant roots by a variety of endophytic fungi suggest that these symbionts have an important role in the function of ecosystems. Mycorrhizal associations are widespread amongst plant families and appear to have evolved and spread with the early land plants. The grasses form a natural homogenous group of plant with remarkable diversity playing a significant role in the lives of human beings and animals. The grass family Poaceae is of a major economic and ecological importance. It is the single most important family of flowering plants for survival of mankind. Grasslands occupy about 25%of earth's vegetation cover. High percentage of grasses is found in the mountainous region. They grow in marshes, deserts, prairies, woodlands, on sands and rocks. Many grasses are known for their fodder value.

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Grasses are good soil binders and moisture conservers and make good tuft and lawns. Some grasses are of medicinal value, certain other yield essential oils, some of which are exploited commercially. Grasses are also used for paper making, for ornamental purposes and miscellaneous use as thatching, matting, musical instruments etc. Thus grass family is one of the largest and important family of the plant kingdom consisting of about 600 genera and over 10,000 species, widely distributed all over the world. Nearly all grassland species form symbiotic relationships with mycorrhizal fungi. These symbiotic relationships often increase grassland vitality and productivity, making it important to understand how they may be altered by rising atmospheric co_2 concentration. The continuing increase in global population coupled with the limitation in the world's supply of natural resources and wide spread degeneration of the environment presents a major challenge to the agriculture scientists today. One must look for sustainable solutions causing least damage to the ecosystem. In order to implement such a plan, the use of nature's own biofertilizers such as arbuscular mycorrhizal fungi (AMF) is one of the suitable alternative to this problem. In the fibrous root system of monocots, the primary root is almost non-existant. The secondary roots are important in absorption, but are not as deep as the primary root of most dicots.

Table 1. Soil Physico- Chemical Analysis

Sr. no	Site	Soil texture			pH	EC dsm^{-1}	$N_{(kg/ha)}$	$P_{(kg/ha)}$	$K_{(kg/ha)}$	Org. C (%)
		Fine sand	Slit sand	Clay						
1.	S1	25.22g	31.66g	11.99g	7.96	0.40	368.5	54.13	399.84	0.55
2.	S2	21.34g	29.40g	24.74g	8.25	0.36	582.9	88.03	362.88	0.86

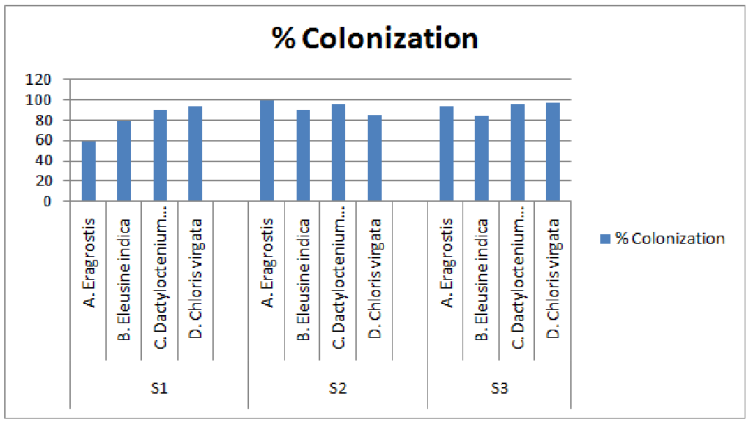


Table 2. AMF status of different site

Sr.no.	Site	Name of the host	% Colonization	Spore/100g
1.	S1	*A. Eragrostis spectabilis*	60	170
		B. Eleusine indica	80	164
		C.Dactyloctenium aegyptium	90	178
		D. Chloris virgata	94	200
2.	S2	*A. Eragrostis spectabilis*	100	136
		B. Eleusine indica	90	184
		C. Dactyloctenium aegyptium	96	130
		D. Chloris virgata	86	216
3.	S3	*A. Eragrostis spectabilis*	94	190
		B. Eleusine indica	84	200
		C. Dactyloctenium aegyptium	96	192
		D. Chloris virgata	98	206

Keeping this view in mind present investigation was conducted to study AMF species associated with some of the grasses from three different sites in Amravati. This information would be useful to develop mass production technology for AM fungi.

MATERIALS AND METHODS

Site selection and sampling: Amravati is located at 20.93°N 77.75°E. It has an average elevation of 343 meters (1125 feet). It lies 156 km (97 mi) west of Nagpur. 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. Three different locations were selected for sample collection. The locations were named as S_1 (V.M.V.), S_2 (Amravati university campus) and S_3 (Shiv wadi in Shri Shivaji Science college campus). Four different grass species were collected from these sites. The grasses namely *Eragrostis spectabilis* (Pursh) Steudel, *Eleusine indica* (L). Gaerth, *Dactyloctenium aegyptium* (L) Willd. and *Chloris virgata* Sw. (olof Swartz)were collected from this region in the month of August and September 2012 along with their fibrous roots and rhizosphere soil.

Processing of Fibrous Roots: 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 fibrous roots were screened for presence of Dark septate hyphae and the intracellular microsclerotia. The extent of their presence was noted.

Processing of Soil Samples

Each labeled rhizosphere soil sample was used for the isolation of spores and the composite soil samples were used for the Physico- Chemical analysis.

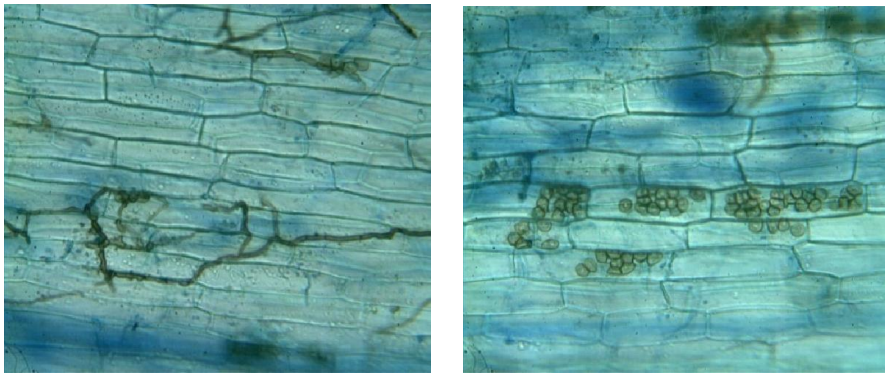
Qualitative and Quantitative Analysis of Am Fungi

The isolation of AM spores was carried out by following method 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).

RESULTS AND DISCUSSION

The results of physico-chemical analysis of the rhizosphere soil samples of three sites are given in Table 1. The spore count /100g of soil samples are given in Table 2. The AM fungal spore count ranged from 130 to 216 in the rhizosphere

Dark septate hyphae

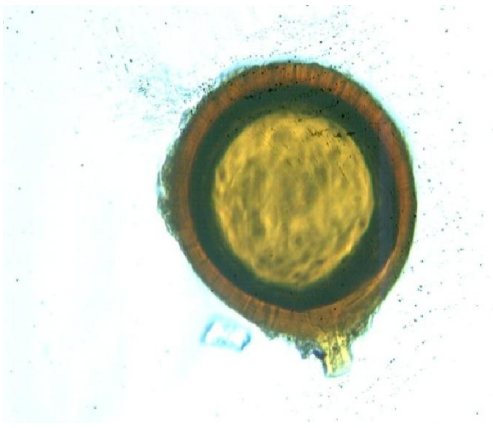


Microsclerotia

Photo Plate I

***Glomus multisubstensum* (LMST)**
(Mukerji,Bhattacharjee & Tewari)

***Glomus leptotichum* (LLPT)**
(Schenck & Smith)



***Glomus geosporum* (LGSP)**
(Nicolson & Gerdemann) Walker

***Glomus heterosporum* (LHTS)**
(Smith & Schenck)

Photo Plate II

soil. The maximum spores are found in the rhizosphere soil sample of *Chloris virgata* Sw. (216) amongst all the three sites. The examination of roots from grasses indicated heavy AMF infection in every sample. The root association was characterized by the presence of hyphae, arbuscular and vesicular characteristic features. The characteristic features of Dark septate Endophytic (DSE) fungi (Photo-plate I) were also observed in the present investigation. The analysis of Arbuscular mycorrhiza (AM) fungal diversity with the help of morphological characters of spores and intra radicular hyphae, arbuscules and vesicles has shown their association with all the grasses studied. Although there is no host-specificity *Chloris virgata* Sw. can be the suitable host for mass multiplication and growth improvement of the grasses studied. The result of the present study also shows that the *Glomus* is the dominant genus in all the study sites (Photo-plate II).

Our study is supported by the earlier reports given by different scientists. The preliminary examination of roots from grasses by Iwan Ho (1987) indicated heavy VA-mycorrhizal infection in every sample with predominance of *Glomus mosseae* and *Glomus macrocarpum*. Koske and Jackson (1997) isolated more than 18 species of AMF. Gollotte *et al*., 2004 have also reported the plant roots of the grass species *Agrostis capillaries* and *Lolium perenne* colonized by Am fungi belonging to the genera *Glomus, Acaulospora* and *Scutellospora.* The co-occurrence of AM and DSE fungi in the present study confirms the earlier findings by Chaudhry *et al*., 2006; Alfaro *et al*., 2008 and Hutchinson *et al*., 2009. They have also reported DSE concurrently with the AMF in the corticle region of the grass species studied. Ruotsalainen *et al*., (2002) reported that the functional relationship between DSE and host may be analogous to that of AM fungi and their host. Haselwander and Read (1982) suggested that colonization with DSE seem to be mutuality rather than parasite. Thus DSE may form the symbiotic association with the roots of their host plants (Jumpponen, 2001).

Conclusion

Arbuscular mycorrhiza are almost ubiquitous in the grasses studied. This study suggested that *Glomus leptotichum* may be the dominant AM fungi which can be used for developing inoculation programme. It will help to maintain native grasses. The presence of DSE is also found to be associated along with AM fungi. The challenge is to gain more complete knowledge about range of AMF and DSE taxas and their functional role for grasses.

REFERENCES

Alfaro, P.A., Herrera, J., Sinsabaugh, L.R., Odenbach, J.K., Lowrey, T. and Natvig, O.D. 2008. Novel root fungal cnsortium association with a domimant desert grass. *Appl Environ Microbial,* May: 74(9):2805-2813.

Chaudhry, M.S., Nasim, F.H. and Khan, G. Abdul. 2006. Mycorrhiza in the perennial grasses of Cholistan Desert, Pakistan. *International Journal of Botany*, 2, 210-218.

Gaur, A. and Adholeya, A. 1994. Estimation of VAM fungal spores in soil. Myco. News 6 (1).

Gerdemann, J. W. and Nicolson, T. H. 1963. Spores of mycorrhizae Endogone species extracted from soil by wet sieving and decanting. Trans. Brit. Mycol. Soc. 46: 235-244.

Giovanneti, M. and Mosse, B. 1980. An evaluation of techniques for measuring VAM infectin in root. New *Phytologist*, 84:489-500.

Gollotte, A., Van Tuinen D. and Atkinson D. 2004. Diversity of Arbuscular mycorrhizal fungicolonising roots of the grass species Agrostis capillaris and Lolium perenne in a field experiment. 14(2): 111-7.

Haselwandter, K. and D.J. Read, 1982. The significance of a root- fungus association in two carex species of high-alpine plant communities. *Oecologia*, 53: 352- 354.

Hutchinson, I., Miriam, Belnap, J., Herrere, J., Sinsabaugh R. and Alfaro, P.A. 2009. Root association fungal communities colonizing two dominant semiarid grasses:Hilaria sp. And Stipa sp. *Nature precedings*.

Iwan Ho, 1987. Vesicular-Arbuscular mycorrhizae of Halophytic Grasses in the Alvord Desert of Oregon. *North West Science,* Vol.61, No.3,.

Jumpponen, A. 2001. Dark septate endophytes are they mycorrhizal. *Mycorrhiza,* 11:207-211.

Koske, R.E. Jackson, N. 1997. Mycorrhizal fungi assciated with three species of turfgrass. *Canadian Journal of Botany,* 75(2):320-332, 10.1139/b97-034.

Philips, J. M. and Hayman, D.S. 1970. Improved procedures for clearing roots and staining parasitic and VAM fungi for rapid assessment of infection. Trans. Brit. Mycol. Soc. 55: 158-161.

Ruotsalainen, A.L., Vare, H. and M. Vesthbeg. 2002. Seasonality of root fungal colonization in low alpine herbs. *Mycorrhiza,* 12: 29-36.

Schenck, N.C. and Perez ,Y.1990. Manual for the identification of VA mycorrhizal fungi in VAM, Gainesville, Florida university.

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