WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 7.523
Volume 7, Issue 10, 391-398. Research Article ISSN 2277– 7105

DIVERSITY OF ARBUSCULAR MYCORRHIZAL FUNGI ASSOCIATED WITH SOME PLANTS FROM JABALPUR REGION OF MADHYAPRADESH INDIA

Jitendra Nagpure[1]*, Akhlesh Kumar Pandey[2] and Sajad Ahmad Mir[3]

*[1]Research scholar at Mycological research lab RDVV Jabalpur state Madhyapradesh India.

[2]Professor at Mycological Research lab RDVV Jabalpur state Madhyapradesh India.

[3]Research scholar at Mycological research lab RDVV Jabalpur state Madhyapradesh India.

Article Received on
29 March 2018,

Revised on 19 April 2018,
Accepted on 09 May 2018,

DOI: 10.20959/wjpr201810-11625

***Corresponding Author**
Dr. Jitendra Nagpure
Research scholar at Mycological research lab RDVV Jabalpur state Madhyapradesh India.

ABSTRACT

An investigation was carried out to study AM fungi association with five different plant species viz, *Euphorbia hirta, Lantana camara, Achyranthes aspera, Datura metel and Xanthium strumarium* collected fom different sites of Jabalpur. Fungal species extracted from the roots of these plants assessed for identification of these spores, extracted from the sediments of the root region of these plants. All the five species of AM fungi viz, Glomus mosseae, Acaulospora laevis, Acaulospora scrobiculata, Sclerocystis spp., Glomus fasciculatum and some unknown species were found frequently attached to these plants. Two of the five AM fungi Glomus mosseae and Acaulospora laevis, were identified from Xanthium strumarium, three AM fungi viz., Glomus mosseae, Acaulospora laevis, and Sclerocystis spp., were associated with Lantana camara and Achyranthes aspera. AM fungi in % colonization in roots were studied in which highest % colonization were associated with Lantana camara species that accounts to 83% and lowest % colonization in Achyranthes aspera 34%. Glomus species was dominant in all the species of plants studied.

KEYWORDS: AM fungi, Plant species, Root colonization and Jabalpur region.

INTRODUCTION

Arbuscular mycorrhizae fungi are coming to study in the phylum Glomeromycota.[1] They are obligate symbionts that are forming interactions with about 80% of plant species.[2] AM associations one of the most frequent symbiosis found having broad association and are

frequently occurred having cosmopolitan distribution.[3,4] Arbuscular mycorrhizal fungi improves the plant to access the limited soil minerals like nitrogen, phosphorus and potassium in exchange for the photosynthetic products. Mycorrhiza enhances soil structure[6] and promote plant growth[5] which allow ecosystem to be in stable state.[7] Lantana camara proved to be beneficial and are reported, having high content of N and P, which is mineralized rapidly from the organic material. Colonization of mycorrhizal fungi is very important in the region were soil is degraded because of having low nutrient availability. Furthermore, AM fungi produce extraradical hyphae that release glomalin, that is a glycoprotein, helps in improving soil structure.[8] Studies on the activity and association of AM fungi help in understanding the ecological importance of AM fungal association. Moreover, there is growing evidence that the diversity and distribution of AM fungi is related to plant community structure and ecosystem function.[9]

MATERIALS AND METHODS

Collection of soils and root samples

Roots and soil samples were collected from the rhizosphere of plants growing in that area. From different sites plants were selected. Samples to be collected randomly and pooled and then homogenised. Before processing, the samples were allowed to remove stones, coarse roots and other litter, collected from each sample. Soil samples were air dried and stored at 4°C for further experiments.

Preparation of roots and assessment of AM fungi

Roots were collected and washed with tap water and were allowed to cut approximately one centimeter. Roots were then cleaned with ten percent NaOH at ninety degree centigrade for many hours depending on the charracteristics of root. These roots were again cleaned with tap water and then bleached in drops of alkaline H2O2 before acidification for 2 to 4 times. After acidification they are then stained with 1% HCl, and were then stained with Black Faber Castell stamp pad ink.[10] After some time roots were mounted on the slide for observation under microscope to identify AM fungal structures. The estimation of AM and fungal colonization were done by the magnified intersection method.[11]

Spore analysis

For analysis of spore twenty five gram of soil was taken and extracted by the method of wet sieving and decanting,[13] The spores that were isolated are then picked out with the help of needle and then to be added 1-2 drops of polyvinyl alcohol-lactoglycerol and then identified

under microscope.[12] The taxonomic identification of spores was based upon colour, size and ornamentation.

Determination of soil characters

Soil charracteristics were determined by taking 10 g of soil and then dissolved in 50 ml distilled water and stirred for 30 min. after that kept for 10-15 hours. Measurement of the electrical conductivity, soil pH were determined using conductivity meter and a digital Ph meter. The Organic Carbon was estimated by using Walkley-Black method[14] The soil available Nitrogen was estimated by Black (1982).[15] Available Phosphorus of soil was determined using Jackson (1978) method.[16]

RESULTS

Physico-chemical characteristics of the 5 different sites of Jabalpur

The pH of all the samples was approximately acidic and significantly higher in soils from Bhedaghat and Gaurighat region. The electrical conductivity was significantly higher in the soil collected from shaktinagar area. The organic Carbon (%) was significantly higher in Gaurighat soil. Available Nitrogen was higher in Bhedaghat soil and available Phosphorus was highest in soil collected from Madanmahl area.

Table No. 1: Physico-chemical characteristics of the 5 different sites of Jabalpur.

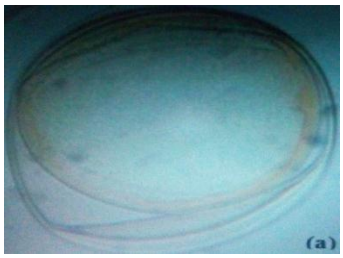
Plant species	Different sites of Jabalpur	Ph	Electrical conductivity	Organic carbon	Nitrogen Kg/Ha	Phosphorus Kg/Ha	Potasium Kg/Ha	Percentage Root infection
Euphorbia hirta	Bhedaghat	7.10	0.32	0.66	303	9.40	143	71%
Lantana camara	Gaurighat	7.10	0.45	0.86	132	7.68	162	83%
Achyranthes aspera	Tilwara ghat	6.85	0.42	0.43	229	5.9	157	34%
Datura metel	Madan mahal	6.90	0.55	0.55	307	12.28	232	60%
Xanthium strumarium	Shaktinagar	6.92	0.71	0.71	210	5.8	230	39.10%

The extent of colonisation was highest in Gaurighat site ranged to 83% followed by Bhedaghat 71%, Madanmahal site 60% and lowest root infect colonisation was in Tilwara ghat site that acccounts to 34%.

In the roots fungal hyphae pentrate that are charracterised by the presence of an appressorium. The different AM fungal structures *viz.*, intra radical hyphae, hyphal coils, micro-sclerotia and inter or intra cellular vesicles were observed.

AM Fungal Diversity

An investigation was carried out to study AM fungi association with five different plant species viz, *Euphorbia hirta, Lantana camara, Achyranthes aspera, Datura metel and Xanthium strumarium* collected fom different sites of Jabalpur. A total of five different AM fungal spore morphotypes were identified based on their spore morphology. They included two species in *Acaulospora* (*Acaulospora leaves* and *A. scrobiculata*), one species in Sclerocystis spp., and two species in *Glomus* (*Glomus mosseae* and *Glomus fasciculatum*) and some unknown species.

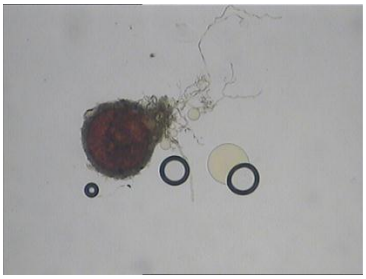


(a) *Acaulospora laevis*

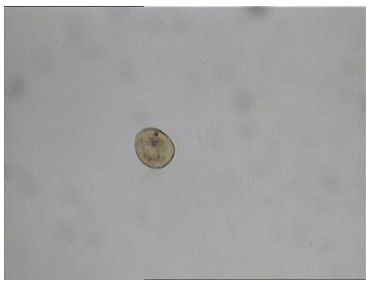
(b) *Glomus diaphanum*

(c) *Glomus fasciculatum*

(d) *Sclerocystis*



(e) Unknown species



(f) *Glomus mosseae*

(g) Unknown species

(h) *A. scrobiculata*

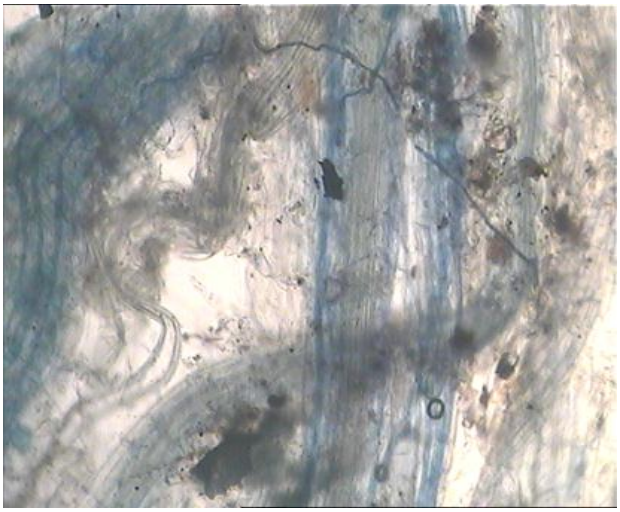
(a) *Acaulospora laevis* (b) *Glomus diaphanum* (c) *Glomus fasciculatum* (d) *Sclerocystis* (e) Unknown species (f) *Glomus mosseae* (g) Unknown species (h) *A. scrobiculata*

Figure No. 1: Arbscular mycorrhizal fungal spores isolated from the rhizosphere soils of the study area.

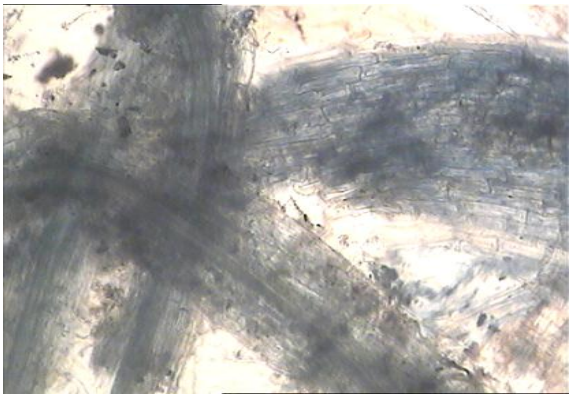
Table No. 2: Arbuscular mycorrhizal association in the angiospermic plants of the study area.

Family	Plant name	Habit	AM fungal species
Euphorbiaceae	Euphorbia hirta	Herb	*Glomus mosseae, Acaulospora laevis, A.scrobiculata,Sclerocystis spp., Glomus fasciculatum*
Verbenaceae	Lantana camara	Herb	*Glomus mosseae, Acaulospora laevis, Sclerocystis spp*
Amaranthaceae	Achyranthes aspera	Herb	*Glomus mosseae, Acaulospora laevis, Sclerocystis spp*
Solanaceae	Datura metel	Herb	*Glomus mosseae, Acaulospora laevis, A.scrobiculata,Sclerocystis spp., Glomus fasciculatum,* Unknown species
Asteraceae	Xanthium strumarium	Herb	*Glomus mosseae, Acaulospora laevis*

Fungal colonization in the roots of *Euphorbia hirta.*

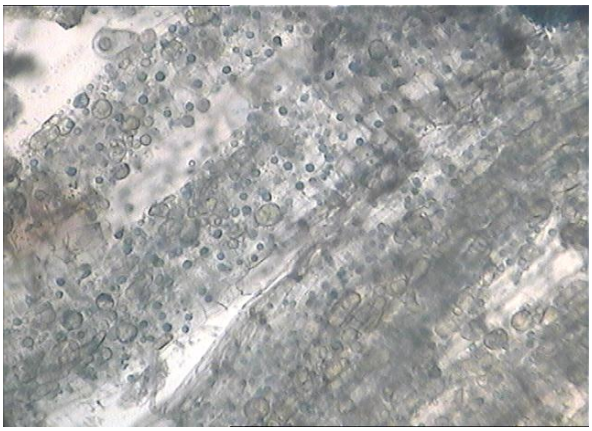


Lantana camara



Datura metel.

Fungal colonization in the roots of *Xanthium strumarium*



Achyranthes aspera

Figure No. 2: Arbuscular mycorrhizal fungal colonization in the roots of the plants in the study area.

DISCUSSIONS

The level of AM infection differed among the plants to be studied. Heavy root Infection was recorded in *Lantana camara* (83%), *Euphorbia hirta* (71%) and lowest root infection by these AM fungal species were studied in *Achyranthes aspera* collected from the site of

Tilwara ghat. *Glomus* was the dominant genus with two species namely *Glomus mosseae* and *Glomus fasciculatum* followed by *Acaulospora* (*Acaulospora* laevis, *Acaulospora scrobiculata).*The results are found in accordance with the previous results of many researchers.[17,18,19] Pattern of spores of *Glomus* might cause the dominancy of this genus. Spores of *Glomus* are borne in clusters and hence they sporulate more frequently.

CONCLUSION

From the study, it can be concluded that the studied plants survive due to the AM fungal associations. *Glomus* was the dominant genus found in the study area.

ACKNOWLEDGEMENT

We are thankful to Prof. A.K. Pandey for their kind support, HOD Department of biological sciences for permitting me to work in central Lab whenever needed for my research. I am thankful to central university of Bilaspur for doing part of research work in the university.

REFERENCES

1. Schubler A, Schwarzott D and Walker C. A new fungal phylum, the Glomeromycota: phylogeny and evolution. Mycological Research 2001; 105: 1413–1421.
2. Trappe JM. Phylogenetic and ecologic aspects of mycotrophy in the angiosperms from an evolutionary standpoint. In: Safir GR, ed. Ecophysiology of Vesicular Arbscular mycorrhizal plants. Boca Raton, Florida, United States of Ameica., 1987; 2–25.
3. Verma RK. Change in microbial diversity under tree plantation on degraded land of Bilaspur (Chhattisgarh). In: Sustainable Rehablitation of Degraded Ecosystem. 2010; 177-181.
4. Harley JL and Smith SE. Mycorrhizal symbiosis.Edition illustrated publisher London, United Kingdom: Academic Press. 1983; 483.
5. Chen B, Roos P, Zhu Y and Jakobsen I. Arbuscular mycorrhizas contribute to phytostabilization of uranium in uranium mining tailings, Journal Environmental Radioactivity, 2008; 801-810 .
6. Rillig M C, and Steinberg P D. Glomalin production by an arbuscular mycorrhizal fungus a mechanism of habitat modification, Soil Biology and Biochemstry. 2002; 34: 1371-1374
7. Koide RT and Dickie IA. Effects of mycorrhizal fungi on plant populations, Plant and Soil, Kluwer Academic Publishers Netherlands, 2002; 244: 307-317.

8. Tisdall JM and Oades JM. Organic matter and water-stable aggregates in soils. Journal of soil Science. 1982; 33: 141-163.
9. van der Heijden MGA, Sanders IR. Mycorrhizal ecology: synthesis and perspectives, In: van der Heijden MGA and Sanders IR (ed) Mycorrhizal ecology. Ecological studies 157. Springer-Verlag, Berlin Heildelberg, Germany. 2002; 441–456.
10. Das P, Kayang H. Arbuscular mycorrhizal fungi and dark septate endophyte colonization in bamboo from Northeast India. Frontiers of Agriculture in China 2010; 4(3): 375–382.
11. McGonigle TP, Miller MH, Evans DG, Fairchild GL, Swan JA. A new method which gives an objective measure of colonization of roots by vesicular arbuscular mycorrhizal fungi. New Phytologist 1990; 115: 495–501.
12. Koske RE, Gemma JN, Flynn T. Mycorrhizae in Hawaiian Angiosperms: A Survey with Implications for the origin of the native flora. American Journal of Botany 1992; 79: 853–862.
13. Muthukumar T, Senthilkumar M, Rajangam M, Udaiyan K. Arbuscular mycorrhizal morphology and dark septate fungal associations in medicinal and aromatic plants of Western Ghats, Southern India. Mycorrhiza 2006; 17: 11– 24.
14. Walkley A, Black IA. An examination of the Degtjareff method for determining organic carbon in soils: Effect of variations in digestion conditions and of inorganic soil constituents. Soil Science 1934; 63: 251–263.
15. Walkley CA, and Black IA. An examination of the Degtjareff method for determining available nitrogen in soils: Effect of variations in digestion conditions and of inorganic soil constituents. Soil Science 1934; 63: 251–263.
16. Jackson ML. Soil chemical analysis. Prentice Hall. New Delhi, India 1978.
17. Muthukumar T and Udaiyan K. Influence of organic manures of arbuscular mycorrhizal fungi associated with *Vigna unguiculata* (L.) Walp in relation to tissue nutrients and soluble carbohydrate in roots under field condition, Biological Fertility of Soils., 2000a; 114-120.
18. Klironomos JN, Hart MM, Gurney JE and Moutoglis P. Interspecific differences in the tolerance of arbuscular mycorrhizal fungi to freezing and drying, Can. J. Bot., 2001; 1161-1166.
19. Boyer RL, Grzyb I, and Jeferies P. Shifting the balance from qualitative to quantitative analysis of arbuscular mycorrhizal communities in field soils, Fungal Ecology, 2009; 1-9.