INTERNATIONAL JOURNAL OF PLANT, ANIMAL AND ENVIRONMENTAL SCIENCES

IJPAES

Volume-3, Issue-2, April-June-2013

ISSN 2231-4490

Coden : IJPAES www.ijpaes.com

Received: 8th Mar-2013 *Revised: 17th Mar-2013* *Accepted: 28th Mar-2013*

Research article

ARBUSCULAR MYCORRHIZAL FUNGI ASSOCIATED WITH SOME PLANTS OF ASTERACEAE IN BHADRA WILDLIFE SANCTUARY

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ABSTRACT: Ten herbaceous plants belonging to Asteraceae were investigated for AM fungal association in Bhadra Wildlife sanctuary. Ten species of AM fungi of the genus *Glomus, Acaulospora* and *Archeospora* were recorded. Among the genera, *Glomus* occurred most frequently. Percentage of root colonization and population of spores of AM fungi were recorded in different plants. The maximum number of AM fungal spore population and root colonization was found in *Parthenium hysterophorus* and *Melampodium* sp. The minimum number of spore population and percentage of colonization was found in *Tridax procumbens*. Host plant influences the AM fungal diversity.

Key words: Arbuscular mycorrhizal fungi, Asteraceae, Bhadra Wildlife Sanctuary**.**

INTRODUCTION

Bhadra wildlife sanctuary which belongs to Western ghats is composed of dry- evergreen to dry deciduous type of vegetation and harbours many endemic, rare and endangered species as well as crores of economically important plant species. Asteraceae is the most dominant family of western ghats. The Asteraceae or compositae also referred as the aster, daisy or sunflower family is the largest family of Vascular plants. Most members of the Asteracese are herbaceous plants which are medically important in areas that don't have access to western medicine. A symbiotic association of a fungus and roots has been discovered by Franciszek Kamienski, a polish mycologist. Later, Frank (1885) coined the term "Mycorrhiza" to the association. Mycorrhiza belonging to most commonly occurring soil microorganisms of the world is considered as a fundamental part of the plant, as 95% of all plant species could not survive in nature without it. Arbuscular mycorrhizal fungi are obligate biotrophs feeding only on the products of photosynthesis of their alive plant hosts. AM fungi consist of intra and extraradical structures. The intraradical structures are arbuscules, vesicles and intraradical hyphae. The extraradical structures are extraradical hyphae, spores and auxillary cells. Haustorium like arbuscules are the main sites of nutrient exchange between a plant host and a fungus.They are formed within the cells of the inner root cortex [10] and are indicators of active mycorrhizae. Association of AM fungi with plants help in increased plant growth [2]. Mycorrhizal diversity is high in forest when compared to other area [14]. A key factor which effects the potential for Mycorrhizae to benefit plants in the particular sites is the supply of phosphate and nitrogen in the soil [1]. Hence, the soil analysis is essential.

MATERIALS AND METHODS

Site description

Bhadra wild life Sanctuary is situated in the midst of Western ghats regions of Chikkamagalore, Narasimharaja pura and Tarikere taluk of Chikkamagalore district and Bhadravathi taluk of Shivamogga district in Karnataka. It covers an area of 492, 46 sq.km. The Sanctuary is situated between 13^0 5' and 13^0 50' northern latitude and 75^0 15' and 75^0 50' eastern longitude. The altitude ranges from 670 to 1,875m MSL.

The temperature in the valley ranges from 10 to 32^0 C. Average rain fall during southwest monsoon between June and September is 500-2500 mm. The annual precipitation is 2,000-2,540 mm and considerably higher than the surrounding plains. The biotic factors and edaphic variations have played a dominant role in determining the forest growth in the sanctuary area.

Soil sampling

Root samples and rhizosphere soils of ten different plants of Asteraceae family from 3 different sites was collected from Bhadra Wildlife Sanctuary and preserved in sterile polythene bags in refrigerator at 4^oC until use. An etal suggested that it is necessary to take soil sample from more than 15 cm surface because some species have been shown to be more abundent deeper in the soil profile. Root samples were cut into 1cm bits and preserved in FAA until use.

Spore extraction

The soil samples were subjected to wet-sieving and decanting technique [6] for the isolation of spores. The isolated spores were picked up with the needle under a dissecting microscope and were mounted in polyvinyl lactoglycerol and observed undre compound microscope. Taxonomic identification of spores up to species level was made using the identification manual [13] and description provided by the International collection of VAM.

Colonization of Am fungi

Root samples were subjected to root clearing and staining technique [11] in which the root samples were cut into 1cm bits and then cleared with 10% KOH for 20min then it was rinsed with distilled water ant cleared with 0.5N HCl for 3min, rinsed with water and stained with 0.05% trypan blue in Lactophenol and percentage of root colonization was calculated. Acaulospora sp segment was counted as infected when hyphae, vesicles or arbuscules are observed.

Soil analysis

Soil samples were collected from *Parthenium hysterophorus* plant which is a member of Astraceae (mycorrhizal) and a brassicaceae plant (non-mycorrhizal) from Bhadra wild life sanctuary and subjected for analysis and results were compared (Table 1).

Table-1: Chemical properties of Rhizosphere soil samples

Soil Sample	Macro nutrients		Micro nutrients (in ppm)			
	pH	Organic compost (%)	Iron (fe)	Manganese (Mn)	Zinc (Zn)	Copper (Cu)
Mycorrhizal	7.4	0.3	14.6	7.02	0.78	1.31
Non Mycorrhizal	7.2	1.05	8.09	7.5	0.15	1.61

Frequency of occurrence of AM fungi

Frequency of occurrence of AM fungi was calculated dividing the number of soil samples that possess spores of particular species with the total number of soil samples screened, and multiplied by 100 (Table 4).

RESULTS AND DISCUSSION

An extensive field investigation was carried out in ten different plants species belonging to Asteraceae family in Bhadra Wildlife Sanctuary to evaluate the percentage of root colonization and spore populations in rhizosphere soils of AM fungi. The association of AM fungi with different plants, their colonization and spore population in the rhizosphere of each plant species are presented in table 2. The spore population and percentage of colonization was high in *Parthenium hysterophorus* and *Melampodium sp*. when compared to the remaining plants. The spore density and root colonization of AM fungi are closely related [15]. About 10 different types of AM fungi were identified in which the Genus *Glomus* was represented by 6 species, *Acaulospora* by 3 species and *Archaeospora* by one. Glomus species were most dominant and made up for more than 50% of the total isolates table 3.

Table-2: Percentage of colonization and spore density of AM fungi.

S.no	Plant species	Colonization (%)				Spore density/ 100g of soil			
		Site 1	Site 2	Site 3	Mean±SD	Site 1	Site 2	Site 3	Mean±SD
1	*Parthenium hysterophorus*	100	100	100	100±0	290	250	280	273.3 ±20
2	*Crassocephalum crepidiodes*	76	72	78	75.3±3	103	90	82	91.6±10
3	*Melampodium sp.*	100	98	96	98±2	200	182	187	189.6±9.2
4	*Melampodium paludosum*	76	80	74	76.6±3	84	94	70	82.6±12
5	*Ageratum conyzoides*	100	98	100	99.3±1.1	146	132	152	143.3±10
6	*Eupatorium odoratum*	80	76	82	79.3±3	196	190	182	189.3±7
7	*Conyza bonariensis*	90	88	92	90±2	98	105	122	108.3±12
8	*Tridax procumbens*	60	62	50	65.5±17	35	40	20	31.6±10
9	*Taraxacum officinale*	60	58	56	66±16	61	60	50	57±6
10	*Cosmos sulphureus*	92	90	86	89.5±2.5	151	103	109	121±26

Table-3: Occurrence of AM Fungi.

S.No	Host plant	AMfungi observed		
		Site 1	Site 2	Site 1
1	*Parthenium hysterophorus*	*Glomus badium, G.deserticola, Acaulospora laevis, A.delicata*	*Glomus badium Acaulospora laevis*	*Glomus badium, G.deserticola, Acaulospora laevis, A.delicata*
2	*Crassocephalum crepidiodes*	*Glomus macrocarpum Acaulospora laevis*	*Glomus macrocarpum*	*Glomus macrocarpum Acaulospora laevis*
3	*Melampodium sp.*	*Glomus microcarpum Archaeospora trappei*	*Glomus mosseae*	*Glomus microcarpum Archaeospora trappei*
4	*Melampodium paludosum*	*Glomus mosseae*	*Glomus microcarpum*	*Glomus mosseae*
5	*Ageratum conyzoides*	*Glomus macrocarpum*	*Acaulospora sp.*	*Glomus macrocarpum*
6	*Eupatorium odoratum*	*Glomus macrocarpum*	*Archaeospora trappei*	*Glomus macrocarpum*
7	*Conyza bonariensis*	*Glomus macrocarpum*	*Glomus macrocarpum*	*Glomus macrocarpum*
8	*Tridax procumbens*	*Glomus macrocarpum*	*Glomus macrocarpum*	*Glomus macrocarpum*
9	*Taraxacum officinale*	*Glomus macrocarpum*	*Glomus macrocarpum*	*Glomus macrocarpum*
10	*Cosmos sulphureus*	*Glomus macrocarpum*	*Glomus macrocarpum*	*Glomus macrocarpum*

More than 102 AM species have so far been reported from India [7]. Members of the genus *Glomus* have been found to be the most common AM species. The widespread occurrence of *Glomus* may be attributed to their reproduction (sporocarp formation), lower host preference and wide range of pH tolerence. It is known that soil factors such as pH restrict the distribution of some taxa [1]. The predominance of *Glomus* sp. and *Acaulospora* sp. supports the observation of [5]. *Glomus* sp. was the most commonly found species in all the plants. Similar results were reported by [5] and [4]. *Acaulospora* sp. were also frequently observed.The host can influence diversity of mycorrhizal fungi under controlled conditions is an important issue as different researchers often use different test plants for studies on AM fungal diversity.Percentage of colonization and spore density varied in different sites. AM fungal colonization and spore density are predominantly regulated by physicochemical properties of soil [12]. Mycotropic relationship may be restored in a previously distributed ecosystem through antural or artificial means once the mycorrhizal status of a plant community is restored study of a plant community is restored study of the amf species compostion and abundance and factors affecting them would be useful in understanding the adaptation of amf species in diverse environmental and stress condition. An understanding of tha amf species richness would be useful in manipulating these fungi for better land and crop management practices and increased agricultural productivity.

Table 4 Frequency of occurrence of AM fungi

S.No	AM fungi	Frequency of occurrence (%)
1	*Glomus badium*	6.6
2	*G.deserticola*	3.3
3	*G.aggregatum*	3.3
4	*Glomus macrocarpum*	60
5	*Glomus microcarpum*	10
6	*Glomus mosseae*	10
7	*Acaulospora laevis*	13.3
8	*A.delicata*	3.3
9	*Acaulospora* sp.	3.3
10	*Archaeospora trappei*	6.6

REFERENCES

[1] Abbott, L.K. and A.D.Robson, 1991. Factors influencing the occurrence of vesicular–arbuscular mycorrhizas. Agri. Ecosyst.Environ, 35:121–150.

[2] Aneesa rani, M. S. and S. Jeeva. 2010. Biofertilizers for enhancing growth of cashew root stocks. Ad.plant sci,23:31-33.

[3] An, Z.Q., J.H, Grove, J.W. Hendrix, D.E. Hershman and G.T.Henson.1990.Vertical distribution of endogonaceous mycorrhizal fungi associated with soyabeen as effected by soil fumigation.soil Boil.Biochem, 22:715-790.

[4] Beena,K.R., N.S.Raviraja, A.B.Arun and K.R.Sridhar. 2000. Diversity of Arbuscular Mycorrhizal fungi on the coastal sand dunes of west coast of India. Current science. 79:1459-1466

[5] Bhuvaneswari, T., R.Chandrasekaran and P.Bhanumathi. 2010. Distribution and occurrence of AM fungi on the coastal saline soils of Tamil nadu. Ad.Plant Sci.23,467-470.

[6] Gerdmann, J. W and T.H. Nicolson. 1963. Spores of mycorrhizal endogone species extracted from soils by Wet- sieving and decanting.Trans.Br.Mucol.Soc.46,235-244.

[7] Manoharachary,C., Sridhar,K Singh reena ,Adholeya,A Suryanarayanan , T.S,Rawat S and B.N Johri .2005.Fungal biodiversity:Distribution conservation and prosespectingh of fungi from india.Current science,89:58-71.

[8] Mehrotra,V.S .1996.Use of revegetated coal mine spoil as a source of arbuscular mycorrhizal inoculam for nursery inoculations.current science 71:73-77.

[9] Morton,J.B., M.Franke and S.P.Bentivenga. 1995. Developmental foundations for morphological diversity among endo mycorrhizal fungi in Glomales (Zygomycetes). in:mycorhiza :structure,function,molecular biology and biotechnology(eds) A Varma and B Hock.Springer and verlag,berlin,pp.669 -683

[10] Mosse, B and C.M. Hepper. 1975. Vesicular – arbuscular mycorrhizal infections in root organ cultures. Physiol. Plant pathol.5, 215-233.

[11] Phillips, J. M. and D. S. Hayman. 1970. Improved procedures for cleaning roots and staining, Parasitic and Vesicular-arbuscular mycorrhizal fungi for the rapid assessment of infecting. Trans.Br.Mycol.Soc.55,158-161.

[12] Sangeetha Hazarika, J.Barukial and D.Hazarika. 2010. Arbuscular mycorrhizal association in Ageratum conyzoides L. in different types of Soil of Golaghat district, Assam, India. Ad.plant sci.23,153-154.

[13] Schenck, N.C. and Y .Perez. 1990. Manual for the identification of VA mycorrhizal fungi.Synergistic Publ., Gainesville, Fl., USA.

[14] Shruti Chaturvedi, C. M.Mehta, Shivom Singh and A.K. Sharma. 2009. Host influences Arbuscular mycorrhizal fungal diversity.J Mycol pl pathol.39,124-129.

[15] Somchit Youpensuk, Sittichai Lordkaew and Benjavan Rerkasem. 2008. Arbuscular mycorrhizal fungi associated with tangerine (Citrus reticulata) in Chiang Mai province, northern Thailand, and their effects on the host plant. ScienceAsia. 34, 259-264.