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Diversity of Arbuscular Mycorrhizal Fungal Communities in the Rhizospheric Soil of *Achellea millefolium* Linn.

Chhavi Mangla[1], Aditya Kumar[2], Ashok Aggarwal[3]
[1, 2]*Department of Botany, Dayanand College, Hisar, Haryana-125001, INDIA*
[3]*Department of Botany, Kurukshetra University, Kurukshetra, Haryana-136119, INDIA*

Abstract: ***Arbuscular mycorrhizal fungal (AMF) association constitutes an important component of soil edaphon affecting plant growth and development. Their diversity and composition varies among different habitat. In the present investigation, attempts were made to screen out AMF species from rhizospheric soil of Achellea millefolium- an important medicinal plant. A total of five different species of arbuscular mycorrhizal (AM) spores were screened out from the rhizospheric soil. AM fungi belonging to genus Glomus were found dominant followed by Gigaspora and Acaulospora. Root samples also showed a wide range of variation in terms of AM root colonization. It was found that number of spores in the rhizosphere of plant was not related to the intensity of AM root colonization.***
Keywords: Achellea millefolium, Arbuscular mycorrhizal fungi, Biodiversity, Medicinal plants

I. INTRODUCTION

Medicinal and aromatic plants have long been utilized in traditional system of medicine worldwide. History of medicinal plants is as long as the history of humans being. They treated their illness efficiently by using these medicinal plants. The folk medicines of almost around the world rely chiefly on herbal medicine even today[1]. The demand of medicinal plants has been increasing rapidly with the consumption of herbal drugs. This led to an increase in the cultivation of these plants in order to maintain a steady supply to support the increasing demand due to decline in their natural population.

Knowledge about the presence and diversity of AMF is an essential first step to utilizing these fungi in any application. Wang and Qiu (2006), concluded that the mycorrhizas are present in 92% of plant families (80% of species) and most of these plants are colonized by fungi of the phylum Glomeromycota, which form VAM (Vesicular Arbuscular Mycorrhiza) or AM (Arbuscular Mycorrhiza), the ancestral and predominant form. Keeping in view the above facts, the study of biodiversity on AMF in medicinal plants is, therefore, necessary from efficient utilization and conservation point of view. Considering the importance and status of medicinal plants in Himachal Pradesh, the present investigation was carried out to study the endomycorrhizal status of *Achellea millefolium* and to select the predominant AM fungi for future inoculation studies for production of quality seedling in nurseries and their better survival in adverse conditions.

A. Description of Selected Medicinal Plants: Achillea millefolium Linn.

Figure I: Achillea millefolium: An important medicinal plant

1) *Common Name:* Gandana, Millifoil
2) *Family:* Asteraceae
3) *Part Used:* Whole plant

It is stated to have diuretic, stimulant and haemostatic properties. Decoction of leaves and flower heads is employed as a carminative, tonic and aromatic stimulant. Yarrow tea is good remedy for severe colds, fevers and obstructed perspiration. The plant is also used to treat allergic mucus problems, anti-inflammatory agent and analgesic[3,4]. As a bitter tonic, it is given during convalescence from fevers and a tonic in dyspepsia to promote appetite.

II. MATERIAL AND METHODS

1) *Study site:* The study was undertaken in Solan district of Himachal Pradesh. Solan is located at 30.92^0 N, 77.12^0 E and has a geographical area 1936 sq.km. The climate of the area is generally sub- temperate, semi- humid characterized by cold winter with mild summer and moderate rainfall.
2) *Field Sampling:* The plant grew under natural environmental conditions. The three healthy individuals of medicinal plant species were randomly selected for collection of rhizospheric soil and root samples during course of investigation. The samples of each plant were collected for further processing for the isolation of AM spores and studying mycorrhizal root colonization.
3) *Estimation of AM root colonization:* The mixed soil and roots samples species were packed in polyethylene bags, labeled and brought to the laboratory. The soil samples were air-dried at room temperature. Roots samples were rinsed with water to remove soil particles and processed by 'Rapid Clearing and Staining Method'[5]. Assessment of root colonization was done by estimating total percentage of root colonization by root slide technique[6].
4) *Extraction, Quantification and Identification of AM fungal Spores:* Rhizospheric soil samples were wet sieved for AM spores using the technique of Gerdemann and Nicolson (1963)[7]. The quantification of AM spores was done by Grid Line Intersect Method[8]. The spores were identified by using keys of Walker (1986), Schenk and Perez (1990), Kumar *et al*. (2009)[9-11].

III. RESULTS AND DISCUSSION

To study the biodiversity of endophytic mycorrhizal fungi is the pre requisite or the first step to use these fungi in any kind of application. They play a beneficial role in cultivation and conservation of medicinal important plants. AM fungi are ecologically very important root symbionts in most of the terrestrial plant ecosystems. In the present work seventy four AM fungal spores were wet sieved from the rhizosphere soil of *A. millefolium* of which five species of AM fungi were identified. The identified species of AM fungi belonged to the genera of *Acaulospora* (1 Species), *Glomus* (3 Species) and *Gigaspora* (1 Species). The result indicated (Table-1, Graph-1) that *Glomus* was the dominant genera. Bever *et al* (1996)[12] concluded the dominance *Glomus* and *Acaulospora* species which produces more spore than *Gigaspora* and *Scutellospora.* Moreover, Chaurasia *et al* (2005)[13] reported 15 AMF species from rhizosphere of *Taxus baccata* in Indian Himalayan Region. A total of ten AM fungal taxa were identified in the soil samples of *Spilanthes* acmella and *Glomus* was found dominant[14]. The high spore number in the rhizosphere soils of studied medicinal plants supported the conclusion of Wang *et al*. (2004)[15] in that the host species apparently had direct effects on spore density and colonization of AM fungi. The features favoring the higher population may either be the conductive to edaphic conditions for sporulation like low nutrient status, high aeration and optimum moisture or the undisturbed conditions of the soils which allowed sufficient time for the build up of mycorrhizal spores[16,17]. Spore population is affected by a wide range of soil, climatic, fungal and host factors[18].

Root samples of the plant species showed a wide range of variation in terms of AM root colonization. The mycorrhizal structures present in the roots included mycelium and vesicles. Mycelia of various types like Y-shaped, H-shaped and parallel mycelia were reported in the roots of the plant. The shape of the vesicles was also found variable. Vesicles were present in chain, in groups of two and more. The present results are in conformity with the findings of several workers who reported the dominance of the *Glomus* in various natural ecosystems[14,19]. Wang and Jiang (2015)[20] also study the colonization and diversity of AM fungi on medicinal plants in Southern China and reported the *Glomus* as dominant species. Likewise, Kumar *et al*. (2019)[21] while study the biodiversity of AMF in some medicinal plants of Hamirpur district of Himachal Pradesh, reported five genera of AM fungi and *Glomus* was dominant. . Our results corroborate well with the findings of other investigators, who reported dominance of *Glomus* sp. while studying the biodiversity of AM fungi[22-24]. The dominance of *Glomus* species could be due to the fact that they are widely adaptable to the varied soil conditions and survive in both, acidic as well as in alkaline soils[25].

IV. CONCLUSION

AM fungi are an important component of the soil in all types of environment and are beneficial for plant growth and development. Therefore, in the present study a wide variety of AM fungi have been reported in the vicinity of *A. millefolium*. Medicinal and aromatic plants have a significant role to combat different diseases from the dawn of civilization. The present study was focused to collect spores of AM fungi for identification of indigenous species associated with this important medicinal plant and to establish pot cultures of prominent species. The abundance of *Glomus* sp. in the soil makes it more favoured AM fungi for the mass multiplication and can be utilized for increasing growth and productivity of medicinal plant.

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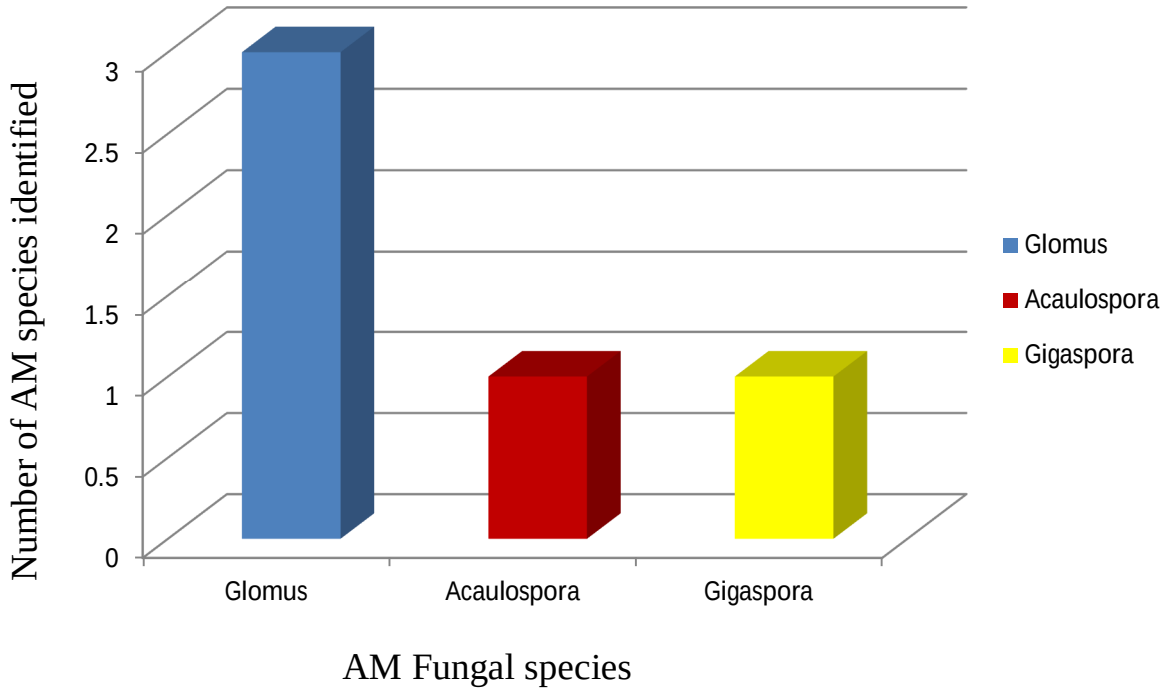
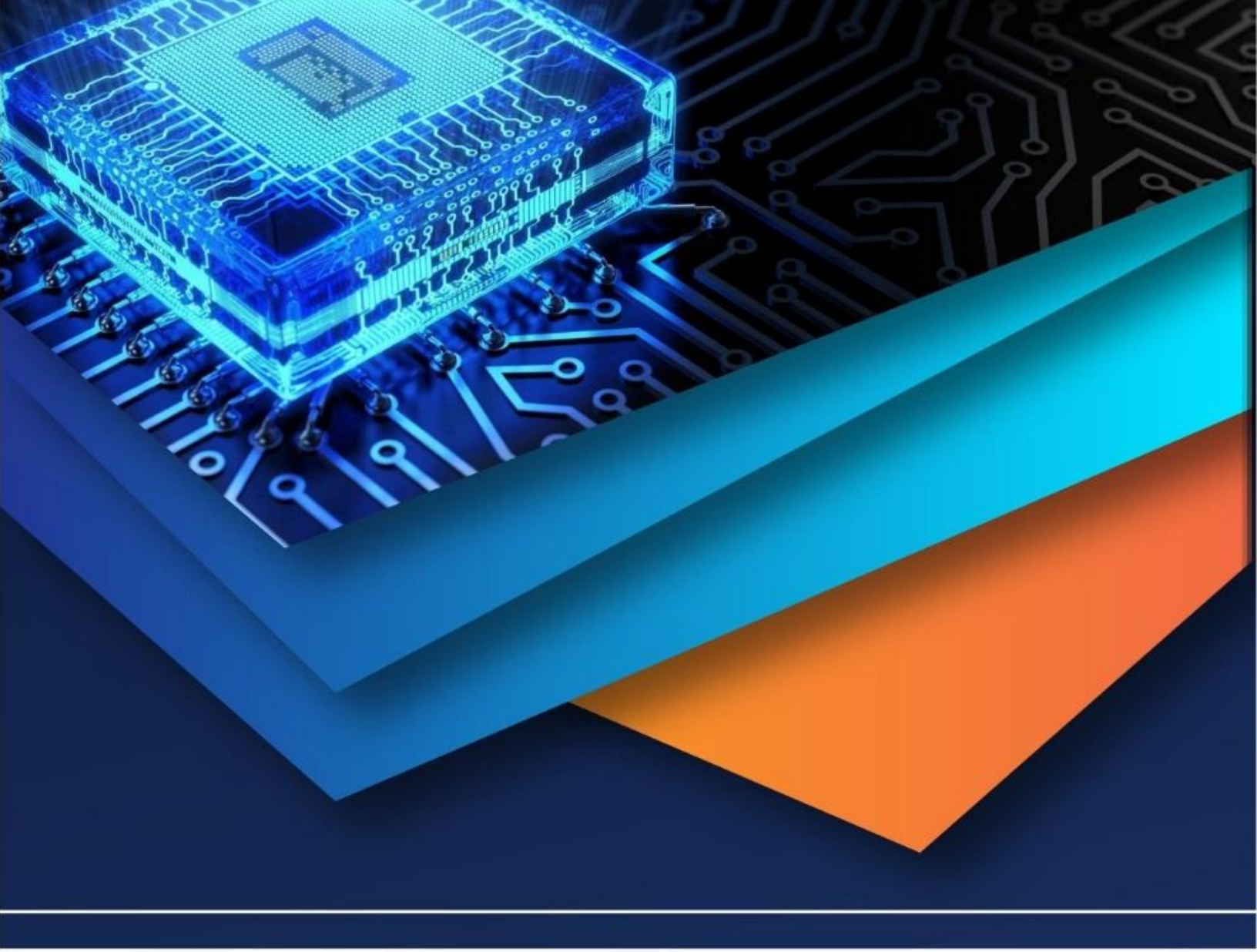
Sr.No.	Name of Plant	AM Fungi
1.	*Achellea millefolium*	*Acaulospora gerdemannii* Schenck & Nicolson
		Glomus clarum Nicolson & Schenck
		G. etunicatum Becker & Gerdemann
		G. gigantea (Nicol. & Gerd.) Gerd. & Trappe
		Gigaspora spp.

Table 1 Natural occurrence of AM fungi associated with *Achellea millefolium*



Graph 1 Number of AM fungi associated with *Achellea millefolium*



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