Kong. Res. J. 8 (1): 65-68, 2021
Publisher: Kongunadu Arts and Science College, Coimbatore.

https://www.krjournal.com

DOI:10.26524/krj.2021.9

RESEARCH ARTICLE

SYMBIOTIC RELATIONSHIP OF AM FUNGI WITH ROOT OF PHYLLANTHUS AMARUS IN WESTERN GHATS, OF TAMIL NADU

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ABSTRACT

The mutually association between a fungus and root of a higher plants are called as Mycorrhiza, when the fungal hyphae live on root surface is called Ectomycorrhiza and when penetrate the root and grows inside the root tissue is called Endomycorrhiza. The different type of Arbuscular Mycorrhizal fungi (AMF) were evaluated for the symbiotic relationship with *Phyllanthus amarus* in Western Ghats. *Glomus fasciculatum, Gigospora margarita*, etc., are isolated in the forest rhizosphere soil. In the presence of AMF in root tissues generally had greater plant height, biomass, stem diameter, number of leaves and phosphorus content where rich in amount compared to other plant species.

Keywords: Arbuscular Mycorrhizal fungi, *Phyllanthus amarus, Glomus fasciculatum, Gigospora margarita*

1. INTRODUCTION

Mycorrhiza is the most dominant organism among the many microbial community of the rhizosphere. It has been known to form a symbiotic relationship with the fine roots of plants [1] while enhancing plant capabilities to absorb nutrients [2]. The importance of mycorrhiza has been acknowledged in the fields of agriculture forestry and other hand use [3]. AMF are soil fungi colonizing most of the plant roots and forming an association called Endomycorrhiza. More than 90% of plant and 80% of plant families in all terrestrial environment from the association [4] with these obligate fungi belonging to the group Glomeromycota [5]. These fungi are known to improve the nutritional status of host, particularly that of phosphorous and there by enhance their growth, development and yield [6,7].

The current day emphasis is on sustainable agriculture, which uses less of chemical inputs like fertilizer and pesticides having adverse effect on the soil health, fertility and environment. The mycorrhiza plays an important role in sustainable agriculture [7]. The taxon *Phyllanthus* has about eight herbaceous species represented in South India, of which grown in TamilNadu. *Phyllanthus amarus* is a medicinal plant with numerous medicinal properties. It is a small herbal plant grow up to 60-75 cm in the tropical and sub tropical rain fed crop. Every part of *Phyllanthus amarus* has medicinal use and is used for treating anti-viral, hepatitis, jaundice, gonorrhea, frequent menstruation, skin sores, swelling, itchiness, and diabetes. The whole plant (root, stem, leaf area) is used in Ayurvedic formulations [8].

The objective of the study reveal that the status and diversity of AMF on medicinal plants of *Phyllanthus* species.

2. MATERIALS AND METHODS

Study area

The study area of the Western Ghats, which lies between 10˚13' to 10˚33' N in latitude and 76˚ 49' and 77˚ 21' E. The vegetation of this region, harbor may endemic species and is a unique ecological tract rich in biodiversity.

Experimental Soil

The physicochemical characteristics of the exprimental soil used for experiment were tested in Department Soil Science testing laboratories at Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India.

Rhizosphere Effect [9]

The quantitative rhizosphere effect of the plants was calculated using the formula:

$$R/S = \frac{\text{Number of microorganism per gram of rhizosphere soil}}{\text{Number of microorganism per gram of non-rhizosphere soil}}$$

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Arbuscular Mycorrhizal Inoculation

AM fungal spores were isolated from the forest soil, following the wet sieving and decanting method [10]. The spores were identified by using the manual written by Schenck and Perez [11]. The Genera of *Acaulospora*, *Gigaspora*, *Glomus*, *Scutellospora* and *Sclerocystis* were isolated from 100g rhizosphere soil samples. Ten kg of the experimental soil was collected from forest and filled in each pot after sterilization. The AM fungal spore inoculum was added (10g/each pot).

Establishment of test plant and greenhouse experiments

The studies were conducted under greenhouse conditions with temperature ranges from 28-31˚C. AM fungal treatments were given on a layer below the germinated randomized. All the pots are maintained greenhouse condition.

Mycorrhizal Status

Results were processed using Phillips *et al*. [12] technique to study the percent of root colonization.

Phosphorus Content

The phosphorus content in the shoots was determined by the vanado-molybdate phosphoric acid yellow color method outlined by Jackson [13].

3. RESULTS AND DISCUSSION

The different type of Arbuscular Mycorrhizal fungi (AMF) were evaluated for the symbiotic relationship with *Phyllanthus* in Western Ghats of Tamil Nadu. *Glomus vesiculiferum, Glomus fasciculatum, Gigospora margarita, Scutellispora nigra, Acaulospora sporocarpa* etc., are isolated in the forest rhizosphere soil. In the presence of AMF in *Phyllanthus species* root tissues generally had greater plant height, biomass, stem diameter, number of leaves and phosphorus content where rich in amount compared to other plant species. The results are as follows, forest black soil with pH 7.1, Moisture 4.86%. Total organic carbon 1.71, Nitrogen 0.08%, Phosphorus 4.52%, Potassium 7.94%, Magnesium 0.121%, Calcium 0.472%, Copper 0.03 ppm, Zinc 3.86 ppm, Manganese 0.97 ppm and Iron 8.24 ppm (Table 1 and 2). In general, all the recoded parameters showed gradual increase parallel to the increase in plant age as 30, 60, and 90 days of plant growth. Arbuscular Mycorrhizal Fungi species showed a significant increase in plant height, biomass, stem diameter, number of leaves and phosphorus content of *Phyllanthus amarus* Schum. & Thonn. [8] and *Allium cepa* L.

Table 1. Showing the different type of AMF species.

Plant name	Type of infection			AMF Spore density (100g/soil)	AMF species
	Hyphae	Vesicles	Arbuscular		
Phyllanthus amarus Schum. & Thonn	+	+	_	420	*G. deserticola, G. citricola, G. macrocarpum, G. canadenae, A.sporocrpa, A lacunosa,*
Allium cepa L.	_	+	+	450	*Gi.margarita, S.alborosea G. delhiense, G. deserticola G. boreale* and G*. versiculiferum*

Table 2. Showing the root infection of AMF inoculated *Allium cepa* L.

S. No	Number of days	Shoot Length(cm)	Root length (cm)	Type of infection			% of infection
				Hyphae	Vesicles	Arbuscular	
1	30	6.98 ±0.73	5.57 ±0.55	+	_	+	63
2	60	7.6 ±1.01	6.6 ±1.07	+	+	_	82
3	90	8.24 ±0.67	6.85 ±0.55	+	_	+	96

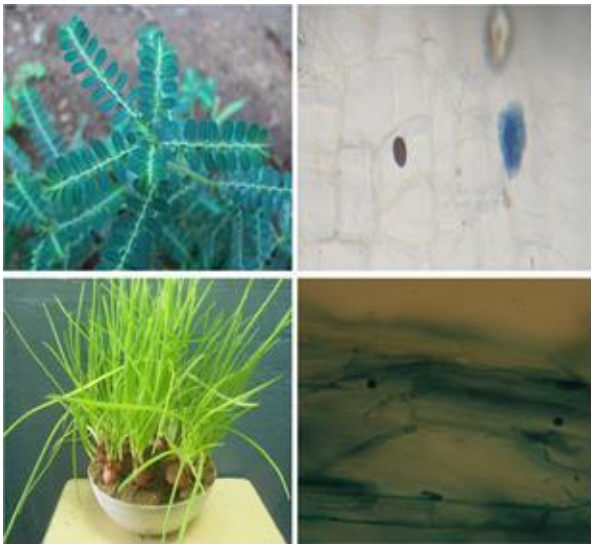

Figure 1. Showing the habit and root infection of *Phyllanthus amarus* Schum. & Thonn and *Allium cepa* L.

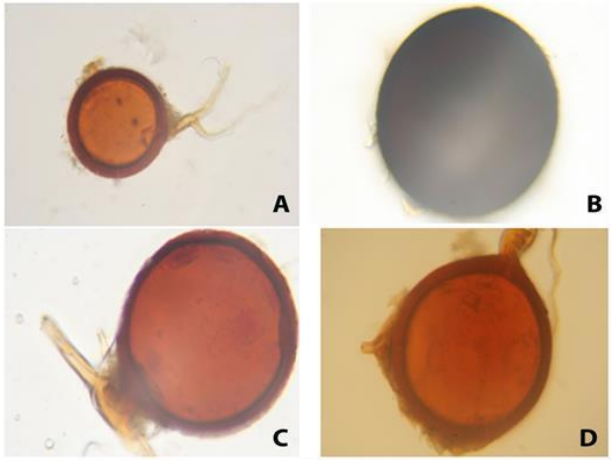

Figure 2. Showing the different type of AMF spore.

A-*Glomus vesiculiferum,* B-*Scutellispora nigra,* C-*Acaulospora sporocarpa,* D-*Gigaspora margarita*

In this study highest mycorrhizal percent colonization was observed in plants treated with *Glomus* species. Highest number of mycorrhizal spores was found in root zone soil. Least number of spores occurred in the uninoculated root zone of plants [14]. Host preference among AM fungi has been reported by earlier workers [15]. The plant biomass (shoot+root) was enhanced due to *Glomus* species inoculation with the *Allium cepa* L. (Figure 1 and 2) has been reported in aromatic plants like *Palmarosa*, *Eucalyptus*, *Bergamot mint* and Sweet basil.

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