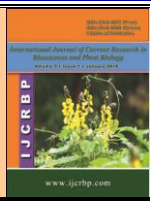
Int. J. Curr. Res. Biosci. Plant Biol. 2016, 3(1): 62-65

EXCELLENT PUBLISHERS

International Journal of Current Research in Biosciences and Plant Biology

ISSN: 2349-8080 (Online) • Volume 3 • Number 1 (January-2016)

Journal homepage: www.ijcrbp.com



Original Research Article

doi: http://dx.doi.org/10.20546/ijcrbp.2016.301.008

The Vesicular Arbuscular Mycorrhizal Associations with Two Medicinal Plant Species in Telangana University Campus, Nizamabad (T.S.), India

S. Prsanthi, V. Jalander* and M. Mamatha

Department of Botany, Telangana University, Dichpally, Nizamabad, Telangana State, India

Corresponding author.

Abstract

Various types of microorganisms are present in soil, play vital roles in numerous physiological activities. These dynamic activities are mediated by association of microorganisms participating in saprophytic, pathogenic and symbiotic association with root. Mycorrhizal fungi are ubiquitous, occurring in all natural ecosystems in most climatic zones throughout the world. An investigation has been made about the vesicular arbuscular mycorrhizal fungi colonization in two locally available medicinal plants such as *Cassia auriculata* and *Calotropis procera* were screened for the occurrence and association of VAM fungi. Both the plants screened in the study harbored VAM fungi. Of the two plants *Calotropis procera* supported maximum number (9) of VAM fungi. VA mycorrhizal fungi isolated from the two medicinal plants belong to 4 different genera *viz. Acaulospora, Entrophspora, Glomus* and *Scutellospora*. From these four different genera *Glomus* was more abundant than the others.

Article Info

Accepted: 17 December 2015
Available Online: 06 January 2016

Keywords

Calotropis procera
Cassia auriculata
Medicinal plants
VAM fungi

Introduction

Vesicular arbuscular mycorrhizae (VAM) are present in the roots of all most all vascular plants. These are common, soil borne fungi belongs to the family Endogonaceae (Zygomycotina) and produces fungal structures in the cortex of the roots. Mycorrhiza is a mutualistic association between zones surrounding the root. The symbiotic association between fungi and the roots of higher plants is called mycorrhiza. Of the different types, arbuscular mycorrhizae (AM) are ubiquitous in their distribution and occur abundantly (Gabor, 1991; Miller, 1995).

VAM fungi play a crucial role in the mineral nutrition of plants by transferring phosphors and other minerals from the soil to the plant. They are organisms that form an interface between soils and plant roots, and are sensitive to changes in soil and plant conditions. They are known to improve the plant growth through, better uptake of nutrients (Lambert et al., 1979; Brundrett, 2009) and water, resistance to drought and increased resistance to root pathogens. They also improve the activity of N fixing organisms in the root zone (Brundrett, 2009).

The association of VA mycorrhizal fungi has been recorded in almost all plant types like legumes, cereals, forage crops, oil seeds, forest plants, plantation crops and medicinal plants (Bloss, 1930; Gianinazzi et al., 1980; Mohan Kumar and Mahadevan, 1988; Sharma and Roy, 19891; Mukerji and Ardery, 1985; Manjunath and Bhagyaraj, 1984, 1986; Manoharachary et al., 1988; Thaper and Khan, 1985; Vijayalaxmi and Rao, 1987; Jalander and Mamatha, 2015). There are reports on beneficial effects of VAM on other crops plants, only a few reports on the VAM association with medicinal plants. The present work deals with the association of VAM fungi in locally available two medicinal plants in the University campus.

Materials and methods

Collection of soil samples

The rhizosphere soil samples of locally available two medicinal plants such as *Cassia uriculata, Calotropis procera* were collected from the different localities of University Campus, Telangana University, Dichpally, Nizamabad (T.S.) India during November, 2014 to October, 2015. The samples were brought to the laboratory and air dried in the shade at room temperature for spore isolation.

Isolation of VAM fungal propagules

VAM fungal propagules were isolated from soils samples by wet-sieving and decanting method (Gerdemann and Nicolson, 1963). This technique is used to remove the clay and sand fractions of soil while retaining spore and other similar sized soil and organic matter particles on sieves of various decimeters. The VAM fungal spores are analyzed qualitatively by identifying them for their genera and species. The VAM fungal spores collected on filter paper (What man's filter paper No.1) after wet sieving and decanting technique were observed under Binocular microscope. These spores were picked through needle and mounted in glycerin on slide. All slides with spores on mounting medium were observed and VAM spores were identified using standard monographs (Walker, 1981; Trappe, 1982; Berch and Trappe, 1987; Schenck and Perz, 1987; Raman and Mohan Kumar, 1988).

Assessment of vesicular-arbuscular infection in roots

Assessment of the amount of VA mycorrhizal infection and colonization in roots studies by the method of Giovannetti and Mosses (1980) was employed for root staining to find root root colonization. The roots were examined under the microscope to observe vesicles and arbuscules under light microscope. The small pieces were mounted on the glass slide temporarily in lacto phenol solution. The cover slip was pressed gently to make the roots flattened and sealed with nail polish. The percentage of root colonization is obtained by applying following formula.

$$\% \text{ of VA infection} = \frac{\text{No. of infected segments}}{\text{Total no. of segmentsexamined}} \text{X } 100$$

Results

Periodically rhizosphere soil sample were collected from locally available two medicinal plants such as *Cassia auriculata and Calotropis procera* were screened for the occurrence and association of VA mycorrhizal fungi. VA mycorrhizal fungi were identified to the species level and the results are presented in Table 1.

Table 1. Occurrence of VAM fungi in two locally available medicinal plants.

S. No.	Name of VAM fungus	Name of the plant					
		Cassia auriculata			*Calotropis procera*		
		1	2	3	1	2	3
01	*Acaulospora dilatata* (Mortan)	+	-	+	+	-	+
02	*Entrophospora colombinana* (Spain and Schenck)	-	-	+	-	-	+
03	*Glomus dimorphicum* (Boye tchko and Tewari)	+	-	-	+	-	+
04	*G. fasiculatum* (Gerd and Trappe emend walker)	+	+	+	+	+	+
05	*G. fuegianum* (Spegazzini)	-	-	+	-	-	+
06	*G. gerdemanni* (Rose, Daniels and Trappe)	-	-	-	-	+	+
07	*G. macrocarpam* (Tul and Tul)	-	-	-	+	-	+
08	*G. maculosam* (Miller and walker)	-	-	+	-	-	+
09	*Scutellospora persica* (Koske and walker)	-	-	+	-	-	+
	Total	**03**	**01**	**06**	**04**	**02**	**09**

Note: + = Presen; - = Absent; 1. November to February (Winter Season); 2. March to June (Summer Season) and 3. July to October (Rainy Season).

The VAM species identified were *Acaulospora dilatata, Entrophospora colombinana, Glomus gerdemanni, G. fuegianum, G. dimorphicum, G. fasiculatum, G. dimorphicum, G. maculosam, G. macrocarpam, Scutellospora persica.* Both the two plants screened harbored VAM fungi. From these two plants *Calotropis procera* supported more number (9) of VAM fungi. Vesicular arbuscular mycorrhizal fungi identified from both plants belong to 4 different genera *i.e. Acaulospora, Entrophspora, Glomus* and *Scutellospora.* Among the isolated genera of VAM fungi, *Glomus* was the most dominant VAM genus isolated during the present

investigation. More number of VAM fungi were isolated at the time of rainy season (July to October) in both the plants and it was very low in summer season (March to June). The similar results were observed by Sharma et al. (2005). They isolated the VAM fungi in more number at the time of rainy season in case of *Tectona grandis* and *Dendrocalamus strictus* and Dhritiman et al. (2014) isolated AM fungi from soil contaminated with paper mill effluents. The VAM associations were more in rainy season because roots showed better growth during this season and active root growth provided more entry points to VAM fungi (Bhaskaran and Selvaraj, 1997; Allen et al., 1998).

Two locally available medicinal plants were screened in the present study were found to be infected by VAM fungi. Percentage mycorrhizal infection was abundant in *Calotropis procera*. The percentage of vesicles and arbuscules were more in *Calotropis procera* and less number was recorded in other plant (Table 2). Early reports are available on the occurrence of VAM fungi. The root system of many medicinal and aromatic plants possesses secondary substances (Abbott and Robson, 1982; Taber and Trappe, 1982). Mohan Kumar and Mahadevan (1984) examined 28 medicinal plants from 20 families for the presence of VA mycorrhizal fungi. They reported the absence of mycorrhizal association in all the plants containing a spectrum of secondary substances like alkaloids, phenolics, terpenoids and tannins. Lakshman and Raghavendra (1990) have also screened 40 species of medicinal plants for mycorrhizal association. They reported that all the species were susceptible to colonization by VA M fungi.

Table 2. Incidence of VAM infection in two locally available medicinal plants.

Name of Plant		% of colonization			% of infection
		Hyphae	Arbuscules	Vesicles	
Cassia auriculata	1	66	10	60	70
	2	50	06	52	64
	3	72	16	64	80
Calotropis procera	1	70	14	66	84
	2	58	08	60	76
	3	86	20	74	92

Note : 1. November to February (Winter Season); 2.March to June (Summer Season) and 3. July to October (Rainy Season).

Conflict of interest statement

Authors declare that they have no conflict of interest.

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How to cite this article:

Prsanthi, S., Jalander, V., Mamatha, M., 2016. The vesicular arbuscular mycorrhizal associations with two medicinal plant species in Telangana University campus, Nizamabad (T.S.), India. Int. J. Curr. Res. Biosci. Plant Biol. 3(1), 62-65. doi: http://dx.doi.org/10.20546/ijcrbp.2016.301.008