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Original Research Paper

Selection of Efficient Arbuscular Mycorrhizal Fungi (AMF) for Inoculation of *Pedilanthes tithymoides* (L.) Poir. Plants Raised Through Stem Cutting

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ABSTRACT

Pedilanthes tithymoides (L.) Poir. stem cuttings were inoculated with different AM fungi viz., *Glomus fasciculatum, Glomus mosseae, Glomus macrocarpum, Glomus intraradices, Glomus etunicatum, Acaulospora laevis* and *Gigaspora margarita*. The observations on plant growth, biomass production, leaf area, mycorrhizal root colonization and P uptake were recorded. The results revealed that the plants inoculated with *Glomus fasciculatum* performed best in improving plant growth, biomass and phosphorus uptake followed by *G. intraradices* and *A. laevis*.

INTRODUCTION

There is an increasing concern for organically grown products, and the use of AM fungi as a bioinoculant for improving crop production is becoming a possibility, especially in transplanted stem cuttings. The beneficial effects of AM fungi have been studied by many workers in a number of crops. Arbuscular mycorrhizal (AM) fungi are a greatly beneficial component of soil microbial biomass. This symbiosis benefits plant growth, practical by enhancing phosphorus, water and mineral nutrient uptake (Pearson & Jackobsent 1993). AM fungi also protect plants against the toxic effect of excess concentration of heavy metals (Arriagada 2007, Lakshman & Hiremath 2009). Besides, AM fungi are important and common components of rhizospheric organic and inorganic compounds released from living roots together with sloughed cell (Dix & Webster 1995). The concept of using mycorrhiza in the cultivation of medicinal plants is of recent origin. Several studies have shown that AM fungi colonize several medicinal plants. It is also found to play an important role in the growth and development of many medicinal plants (Lakshman & Byatanal 2009).

Pedilanthes tithymoides (L.) Poir. is a laticiferous shrub belonging to family Euphorbiaceae grown in hedges and occasionally used medicinally. Latex has emetic irritant and caustic properties used to control external bleeding and skin ailments. No mycorrhizal research has been done on this plant. Hence, the present study was undertaken to select an efficient AM fungus for inoculating *Pedilanthes tithymoides* plants.

MATERIAL AND METHODS

Sand and soil (1:1 by volume) were mixed and sterilized in 70% ethyl alcohol and used to fill pots of 20 × 15 cm size. Planting holes were made at the centre of each pot and planting hole mycorrhizal inoculum containing 4850 infective propagules of AM fungi of 10 g of mixed inoculum were added. Uniformly grown stem cuttings of 8 cm of *Pedilanthes tithymoides* were collected from 90 old plant and planted in each planting hole. The pots were maintained in glass house and watered on alternate day. Six replications were maintained in each treatment. The plants were maintained upto 180 days in the glass house. After 90 days, the fresh weight of shoot and root was recorded. The shoot and root samples were dried in hot air oven at 70°C till they attained constant weight and the dry weight of shoot and root was recorded. Leaf area of the plants was recorded using leaf punch method.

The per cent mycorrhizal root colonization was determined by gridline intersect method (Giovanetti & Mosse 1980). Enumeration of extraradical chlamydospores of AM fungi in the rhizosphere soil was done by wet sieving and decantation method (Gerdemann & Nicolson 1963). Shoot and root phosphorus content was determined by vanadomolybdate yellow colour method. The data obtained were subjected to analysis of variance by CRD and the treatment means were separated by Duncan's Multiple Range test (Little & Hills 1978).

RESULTS AND DISCUSSION

Several types of arbuscular mycorrhizal (AM) occur in natural habitats but only few indigenous fungi influence specific plant species with specificity. These fungi could be benefited from root colonization during plant growth (Sahay & Varma 2000, Lakshman & Aruna 2005). Stem cuttings

Table 1: Effect of different AM fungi on fresh weight, dry weight and leaf area of *Pedilanthes tithymoides*.

Treatments	Fresh weight (g/plant)		Dry weight (g/plant)			Leaf area
	Shoot	Root	Shoot	Root	Total biomass	(dm^3/plant)
Uninoculated control	9.43^{c}	4.12^{f}	2.19^{g}	1.17^{d}	6.00^{d}	2.44^{g}
Glomus intraradices	24.28^{b}	8.30^{a}	8.68^{cd}	2.21^{a}	10.89^{b}	4.99^{c}
Glomus mosseae	2.587^{b}	8.41^{a}	9.37^{bc}	2.59^{a}	12.06^{ab}	5.26^{ab}
Glomus fasciculatum	32.48^{a}	8.43^{a}	10.70^{a}	2.38^{a}	13.08^{a}	5.32^{a}
Glomus macrocarpum	21.49^{c}	5.89^{cde}	6.92^{ef}	1.77^{bcd}	8.30^{c}	4.65^{cde}
Glomus etunicatum	19.42^{cd}	4.15^{f}	7.31^{ef}	1.44^{bce}	8.76^{c}	4.87^{abcd}
Acaulospora laevis	20.65^{cd}	6.94^{bc}	7.14^{f}	1.67^{bc}	8.81^{c}	4.83^{bce}
Gigaspora margarita	20.32^{cd}	4.83^{ef}	7.46^{def}	1.25^{cd}	8.71^{c}	4.51^{cde}

Means followed by the same superscript in each column do not differ significantly at P = 0.05 level by DMRT.

Table 2: Effect of different AM fungi on root colonization and spore number in the root zone soil, and phosphorus content of *Pedilanthes tithymoides*.

Treatments	AM fungal colonization (%)	Spores (avg. No./50g soil)	P-content (mg/plant)	
			Shoot	Root
Uninoculated control	16.78^{j}	133.80^{g}	3.66^{g}	1.34^{e}
Glomus macrocarpum	52.68^{cd}	445.40^{e}	19.75^{cd}	2.65^{jbc}
Glomus mosseae	58.52^{bc}	525.40^{a}	30.65^{bc}	5.25^{a}
Glomus intraradices	61.87^{a}	529.00^{a}	32.26^{a}	5.78^{a}
Glomus fasciculatum	72.00^{dc}	437.80^{c}	25.53^{ef}	1.89^{dc}
Glomus etunicatum	55.73^{g}	371.60^{dc}	14.57^{f}	1.62^{dc}
Acaulospora laevis	58.08^{f}	433.40^{c}	13.07^{f}	2.76^{cd}
Gigaspora margarita	53.54^{b}	363.20^{c}	15.64^{ef}	1.65^{dc}

Means followed by the same superscript in each column do not differ significantly at P = 0.05 level by DMRT.

were prepared by cutting off half of the leaf area of individual leaves to reduce transpiration of *Pedilanthes tithymoides* grown on phosphorus deficient soil.

The growth of *Pedilanthes tithymoides* is influenced by different AM fungi. Among the seven different AM fungi, *Glomus fasciculatum* inoculated plants showed significantly higher shoot and root fresh weight Table 1. The shoot dry weight was found to be high in plants inoculated with *Glomus fasciculatum* and *G. intraradices* while plants inoculated with *G. mosseae* showed the highest root dry weight followed by *G. fasciculatum* and *G. macrocarpum.* The total biomass was highest in *Glomus macrocarpum, G. fasciculatum* and *G. mosseae* inoculated plants. The uninoculated plants showed the least biomass. The leaf area was found to be highest in *Glomus fasciculatum* inoculated plants followed by *G. interadices.* Similar results were reported by Mallesha and Bagyaraj (1995) in two varieties of capsicum inoculated with 7 different AM fungi.

The AM fungi inoculated plants showed increased percent root colonization and spore number in root zone soil of *Pedilanthes tithymoides* plants (Table 2). The plants inoculated with *Glomus fasciculatum* showed the highest percent root colonization and spore count followed by *Glomus intraradices* inoculated plants. The uninoculated plants showed much lower percent mycorrhizal colonization and spore count. This indicates the inefficiency of the native AM fungal spore in colonizing the plants with improved leaf area and dry weight.

Similar observations were recorded by Earanna et al. (1999) on *Coleus barbatus* inoculated with six different AM fungi and by Srihari & Sreenivasa (1997) in chilli inoculated with five different AM fungi. The highest shoot P content was recorded in plants inoculated with *Glomus fasciculatum* and the root P uptake was highest in case of *Glomus intraradices* inoculated plants. It may be concluded that the *Glomus fasciculatum* is the best AM fungi for improving the growth and biomass of *Pedilanthes tithymoides* plants.

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