

Diversity of Arbuscular mycorrhizal (AM) fungi in *Moringa oleifera* Lam. from Goa.

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Abstract

A total of eighteen AM fungal species were identified and documented from the rhizosphere soils of *Moringa oleifera* Lam. Maximum AM root colonization was recorded at site Majorda (65%) while highest spore density was recorded in Old Goa site (919.67%). The species richness of AM fungi was more in rhizosphere soils of Old Goa (10) and least in Dhargal soils (4). Genus *Glomus* (9) was dominant followed by *Acaulospora* (6), *Gigaspora* (2) and *Scutellospora* (1). *Glomus fasciculatum* was common in all four sites. This study records the predominance of *Glomus* and *Acaulospora* species in the rhizosphere soils of *Moringa oleifera*.

Key words: AM root colonization, dominant, rhizosphere soil sample, species richness, spore density.

Introduction

Moringa oleifera Lam. (Drumstick) is an important tree vegetable commonly grown in Goa. Its immature pods as well as leaves are commonly consumed and included in Goan diet for its high nutritive values such as vitamin C, vitamin B₆, provitamin A as betacarotene, phosphorus, potassium, magnesium and proteins (Peter 2008). It is known to form association with a large number of soil microbiota including arbuscular mycorrhizal (AM) fungi that belong to phylum Glomeromycota (Wang and Qiu, 2006). Arbuscular mycorrhizal (AM) fungi are ubiquitous and obligate symbiotic soil fungi forming association with 80% of terrestrial plant species (Ezawa et al., 2003), including vegetable crop plants and agronomically important species (Harrier and Watson, 2004). Arbuscular mycorrhizae promote growth of the host plant through enhanced nutrient uptake, particularly the immobile macro-nutrient P and other nutrients such as K, Fe, Cu, Ca, Mg and Zn (George, 2000), improved water relations, pest and disease resistance and in exchange they are provided with fixed carbon by the host plants (Rezaee et al., 2007). These fungi are known to increase the

productivity of several cereals, pulses, oilseeds crops, vegetable crops, medicinal plants and also ornamental plants (Dessai and Rodrigues, 2012).

Variation in AM fungal diversity has been reported with the change in the type of plant species and family (Blaszkowski, 1994). However, there may be considerable variation in AM fungal species colonizing the same plant in different geographical locations. The spore count, root colonization, species diversity and dominance varies with region and soil nutrient conditions (Varalaxmi et al., 2009). Hence the objective of this work was to identify and document the diversity of indigenous AM fungal species associated with *M. oleifera* in selected sites from Goa.

Material and Methods

The rhizosphere soils and root samples of *M. oleifera* belonging to family Moringaceae were collected from four selected sites of Goa viz., Dhargal, Majorda, Old Goa and Shiroda. The AM fungal propagules from soil samples were isolated by wet sieving and decanting method (Gerdemann and Nicolson, 1963) and identification of AM fungal spores was carried out based on morphotaxonomic criteria using available manuals (Schenck and Perez, 1990; Rodrigues and Muthukumar, 2009). Root samples were processed for AM fungal colonization using the method of Koske and Gemma (1989). The stained roots were examined using an Olympus research microscope BX 41 (100X - 1000X) for AM fungal structures and percent root colonization was estimated by using slide method (Giovannetti and Mosse, 1980). Physico-chemical characters of soils such as pH, P, K, B were analyzed using the standard methods of soil analysis (Bray and Kurtz, 1945; Hanway and Heidal, 1952; Lindsay and Norwell, 1978).

Table 1: Chemical analysis of rhizosphere soils in selected sites of Goa.

Sites	pH	Available P (kg/ha)	Available K (kg/ha)	B (ppm)
Dhargal	6.9	46.2	873.6	0.40
Majorda	6.1	126.2	219.4	0.35
OldGoa	5.7	35.6	784.6	0.49
Shiroda	4.4	105.4	410.2	0.52

Results and Discussion:

A total of 18 AM fungal species belonging to four genera were recorded in *M. oleifera* from four different sites of Goa. AM root colonization was maximum at site Majorda (65%)

and minimum in site Shiroda (37.33%). The highest spore density was recorded in Old Goa (919.67 spores 100g⁻¹soil) and least in Shiroda (119 spores 100g⁻¹soil). Arbuscular, hyphal and vesicular colonization was recorded (**Table 2**). The study revealed variations in AM root colonization and spore density. Such variations have been reported earlier in *Sida cordifolia* (Chetan et al., 2008). Species richness of AM fungi was more in rhizosphere soil sample at Old Goa (10) and least in Dhargal (4). *Glomus fasciculatum* was common in all the four sites. Genus *Glomus* (9) was dominant followed by *Acaulospora* (6), *Gigaspora* (2) and *Scutellospora* (1).

This study records the predominance of genus *Glomus* and *Acaulospora* in the rhizosphere soils of *M. oleifera*. The data of physicochemical characteristics of the rhizosphere soil samples from selected sites is presented in **Table 1**. Though pH varied greatly in all the four sites (4.4-6.9), it did not exhibit any significant impact on the distribution of AM fungi. Maximum AM fungal propagules were recovered at Old Goa site where available P was found to be low. Several biotic, edaphic and environmental factors influence the occurrence and distribution of AM fungi. The greater the diversity, the more benefits are conferred to the plants, as the mycorrhizal community will span a broader range of functions (Koide, 2000).

Table 2: AM fungal root colonization, spore density and species diversity in *Moringa oleifera* at selected sites of Goa.

AM species	Dhargal	Majorda	Old Goa	Shiroda
<i>A. delicata</i>	+	-	+	-
<i>A. dilatata</i>	+	-	-	-
<i>A. elegans</i>	-	-	-	+
<i>A. foveata</i>	-	-	+	-
<i>A. mellea</i>	-	+	-	-
<i>A. scrobiculata</i>	-	-	+	+
<i>G. clavisporum</i>	-	-	-	+
<i>G. constrictum</i>	-	-	+	-
<i>G. fasciculatum</i>	+	+	+	+
<i>G. geosporum</i>	-	-	-	+

<i>G. maculosum</i>	-	-	+	-
<i>G. macrocarpum</i>		+	-	-
<i>G. multicaule</i>	-	+	+	-
<i>G. rubiformis</i>	-	-	+	-
<i>G. taiwanensis</i>	-	-	+	-
<i>Gi. albida</i>	-	+	+	-
<i>Gi. decipiens</i>	-	+	-	-
<i>S. nigra</i>	+	-	-	-
Spore density/100g soil	175.00 ± 23.06	217.00 ± 36.36	919.67 ± 46.35	119.00 ± 12.76
Root colonization (%)	54.33 ± 12.58 (H, V)	65.00 ± 13.52 (H, V)	64.67 ± 14.01 (Ab, H, V)	37.33 ± 9.07 (H, V)

Legend: H= hyphal colonization, Ab= arbuscular colonization, V= vesicular colonization, A= *Acaulospora*, G = *Glomus*, Gi = *Gigaspora*, S = *Scutellospora*, ± = std.dev. n = 5.

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