

# Spatial variations of AM fungi in *Terminalia crenulata* Roth. from the Western Ghat region of Goa, India

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## Introduction

AMF (arbuscular mycorrhizal fungi) is important in influencing the diversity and distribution of plant communities. AMF colonize roots and subsequently provide plants with an increased ability to take up scarce nutrients resulting in increased growth, drought tolerance, and protection against diseases. In return, AMF are dependent on plants for their carbohydrate requirements. Pot experiments show that different species of AMF clearly invoke different growth responses of individuals within a plant species (Mangan, Eom, Adler, *et al.* 2004).

The state of Goa lies in the heart of the Western Ghats, which is one of the hotspots of biodiversity (Khade and Rodrigues 2002). The major portion of the slopes of the Western Ghats belt falls in this region, encompassing luxuriant forests with good diversity (Rao 1985). AM (arbuscular mycorrhizal) association in pteridophytes, medicinal plants, and forest trees from Western Ghat region of Goa have been documented (Khade and Rodrigues 2002). However, studies investigating the ecological importance of beneficial fungi such as AMF are in rudimentary stage (Mangan, Eom, Adler, *et al.* 2004). Therefore, in present paper studies on spatial variations of AMF associated with *Terminalia crenulata* Roth., a timber yielding tree commonly occurring in forest area of Western Ghat region of Goa, was undertaken.

## Material and methods

*T. crenulata* Roth., which belongs to the family Combrataceae and commonly occurs in four forest areas from the Western Ghat region of Goa, was considered for the study (Table 1).

Site no.	Site Name
1	Mollem
2	Collem
3	Dharbandoda
4	Anmod

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Root and rhizosphere soil samples of five trees/site were collected during March 2001. Care was taken to trace back the roots of the selected trees while sampling. Rhizosphere samples were collected upto a depth of 0–25 cm. Samples were packed in polyethylene bags and transported to the laboratory. Root samples were freshly processed, whereas the soil samples were stored at 4 °C until analysed. The roots were cleared and stained in 0.05% trypan in lactoglycerol (Phillips and Hayman 1970) and the degree of colonization was estimated by slide method (Giovannetti and Mosse 1980). Spores of AMF were isolated by wet sieving and decanting method (Gerdemann and Nicolson 1963) and quantification of spore density was carried out (Gaur and Adholeya 1994). AMF were identified to species level using bibliographies provided by Schenck and Perez (1990) and Walker and Vestberg (1998). Taxonomic identification of spores was matched with the descriptions provided by the *International Collection of Vesicular Arbuscular Mycorrhizal Fungi*.<sup>1</sup> Standard deviation was calculated for mean root colonization and mean spore density of AMF.

## Diversity indices

Species richness per site is the mean number of AM fungal species associated with each site (Beena, Raviraja, Arun, *et al.* 2000).

## Frequency of occurrence

Frequency of occurrence of AMF was calculated using the following formula (Beena, Raviraja, Arun, *et al.* 2000).

$$\text{Frequency (\%)} = \frac{\text{Number of soil samples that possess spores of particular species}}{\text{Total number of soil samples screened}} \times 100$$

## Results and discussion

Data on AM status of *T. crenulata* Roth. is presented in Table 2. AM colonization was

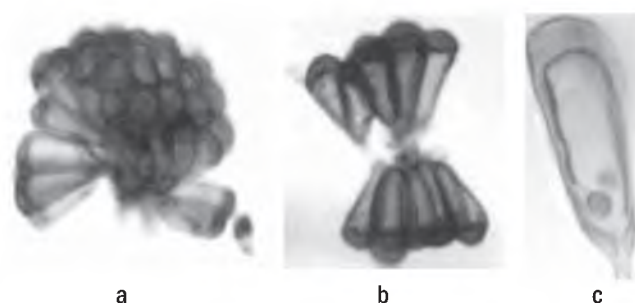
**Table 2** Arbuscular mycorrhizal status of *Terminalia crenulata* Roth. from the Western Ghat region of Goa

AM fungal parameters	Sites			
	1	2	3	4
Type of colonization	HV	HV	HV	HV
Total root colonization (%)	50 ± 4.82	33 ± 6.40	37 ± 2.21	30 ± 1.78
Spore density/100g soil	24 ± 4.8	116 ± 15.42	512 ± 0.76	80 ± 2.4

AM – arbuscular mycorrhizal; H – Hyphal colonization; V – Vesicular colonization

characterized by the presence of hyphae and vesicles. This is in accordance with the findings of Khade and Rodrigues (2003) who reported hyphal and vesicular colonization in *T. crenulata* Roth. collected from Site 1. The lowest and highest root colonization was recorded from Site 4 (30%) and Site 1 (50%) and the minimum and maximum spore density was recorded from Site 1 (20 spore/100 g soil) and Site 3 (512 spore/100 g soil). Similarly, Khade and Rodrigues (2003) reported 84% root colonization and 340 spore/100 g soil in *T. crenulata* Roth. from Site 1.

The diversity of AMF associated with *T. crenulata* Roth. is presented in Table 3. A total of



**Figure 1** (a) A portion of sporocarp of *Glomus taiwanensis* (×100)  
 (b) Cluster of spores of *Glomus taiwanensis* (× 100)  
 (c) A single spore of *Glomus taiwanensis* (× 1000)  
 [Note The thickened spore wall at the apex of the spore]

six species belonging to three genera – *Acaulospora*, *Glomus*, and *Scutellospora* – were recorded in the present study. Similarly, Khade and Rodrigues (2002) reported 16 AM fungal species belonging to four genera – *Acaulospora*, *Glomus*, *Sclerocystis*, and *Scutellospora* – in medicinal plants from the Western Ghats and adjoining region. Further, Khade and Rodrigues (2002) reported 17 AM fungal species belonging to five genera – *Acaulospora*, *Gigaspora*, *Glomus*, *Sclerocystis*, and *Scutellospora* – in commonly occurring pteridophytes from Chorlem and Site 1.

In the present study, the genus *Glomus* was dominant and recovered from all the study sites. The highest frequency of occurrence (100%) was recorded in *Glomus taiwanensis* (Wu and Chen), followed by *G. fasciculatum* (Thaxt.) Gerd. (Almeida and Schenck), and Trappe emend. Walker and Koske (75%) at Site 4. However, AMF belonging to two other genera recovered from Site 4 – *Acaulospora* and *Scutellospora* – recorded a frequency of occurrence of 25% each. In the present study, the minimum species richness (1 species/tree) was recorded at Site 1, while maximum species richness (4 species/tree) was recorded at Site 3 and Site 4 respectively.

Consequently, the present study brings out spatial variability in root colonization, spore population, and species diversity of AMF in *T. crenulata* Roth. from the Western Ghats of Goa.

## Acknowledgement

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## References

- Beena K R, Raviraja N S, Arun A D, Sridhar K R. 2000 **Diversity of arbuscular mycorrhizal fungi on coastal sand dunes of the west coast of India** *Current Science* **79**(10): 1459–1465

**Table 3** Diversity of AM fungi associated with *Terminalia crenulata* Roth. from the Western Ghat region of Goa

AM fungal parameters	Sites				Frequency of occurrence (%)
	1	2	3	4	
<i>Acaulospora scrobiculata</i> Trappe	-	-	-	+	25
<i>Glomus fasciculatum</i> (Thaxt.) Gerd. and Trappe emend. Walker and Koske	-	+	+	+	75
<i>Glomus clariodeum</i> Schenck and Smith emend. Walker and Vestber	-	-	-	+	25
<i>Glomus multicaule</i> Gerd. and Bakshi	-	-	+	-	25
<i>Glomus taiwanensis</i> (Wu and Chen) Almeida and Schenck	+	+	+	+	100
<i>Scutellospora fulgida</i> Koske and Walker	-	-	+	-	25
Species richness	1	2	4	4	-

AM – arbuscular mycorrhizal; + – presence of AMF; - - absence of AMF