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Research findings

Populations of arbuscular mycorrhizal fungi associated with rhizosphere of banana (*Musa* sp.) as influenced by seasons

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Introduction

The ubiquitous nature of AMF (arbuscular mycorrhizal fungi) has been confirmed by the information available and the importance of mycorrhizal growth that has been demonstrated overwhelmingly in recent decades. Studies on the seasonal dynamics of AM fungal population in temperate forests (Bakshi 1980), tropical forests (Mohankumar and Mahadevan 1988), and plantation crops (Sutton 1973) have also been reported. However, work on seasonal variation of AM fungal population in the horticultural crops is scarce (Mason 1964; Michelini and Nemec 1993) and not reported in India. Hence the present investigation was undertaken to assess the variation in AM fungal populations associated with rhizosphere of banana (*Musa* sp.) as influenced by seasons.

Materials and methods

The savarbondi variety, one of the popular banana cultivars in Goa, was taken up for study. This variety was sampled for three consecutive seasons viz., pre-monsoon, monsoon, and post-monsoon from Valpoi, situated on the Western Ghats of Goa. Collections of rhizosphere soil samples 10–25 cm deep were carried. Samples were collected in polyethylene bags, labelled, and transported to the laboratory. Hundred grams of air-dried rhizosphere soil samples were employed for isolation of spores/sporocarps. Wet-sieving and decanting proposed by Gerdemann and Nicolson (1963) were followed, and the quantification of spores and sporocarps was carried out using the method of Gaur and Adholeya (1994). Identification of the AMF was carried out using relevant literature (Morton and Benny 1990; Schenck and Perez 1990; Wu 1993).

Results and discussion

Data on spore density of the AMF and species diversity associated with rhizosphere soil of savarbondi variety along with the climatic factors for three consecutive seasons viz. pre-monsoon, monsoon, and post-monsoon were recorded (Table 1).

In the present study it was observed that the spore density of AMF was maximum in pre-monsoon (426 spores per 100 g soil) followed by monsoon (384 spores per 100 g soil) and post-monsoon season (250 spores per 100 g soil), respectively. Thus, the observations support earlier findings that AM spore population exhibits seasonal variation (Kianmeher 1981; Mukherji, Bhattacharjee, and Mohan 1982; Nicolson and Johnston 1979; Sparling and Tinker 1978; Sutton 1973). Our observations are also consistent with those of Hayman (1970) and Saif and Khan (1975) who reported an increase in spore number during summer in field-grown wheat after a period of maximum root growth. Also, lower spore density of AMF in the wet season (monsoon and post-monsoon) as compared to the dry season (pre-monsoon) could be attributed to factors such as water logging (Mohankumar and Mahadevan 1986) and higher moisture levels, which reduce the oxygen tension, thereby affecting the development of the endophyte (Mohankumar and Mahadevan 1988).

A qualitative examination of soil samples revealed the presence of seven species of AMF belonging to three genera viz., *Acaulospora, Glomus,* and *Sclerocystis*. The species richness of AMF was maximum during pre-monsoon (seven species) and minimum during post-monsoon season (four species). Though *Acaulospora nicolsonii* Walker, Reed, and Sanders (Figure 1a) and

Figure 1a Crushed spore of *Acaulospora nicolsonii* Walker, Reed, and Sanders (× 400)

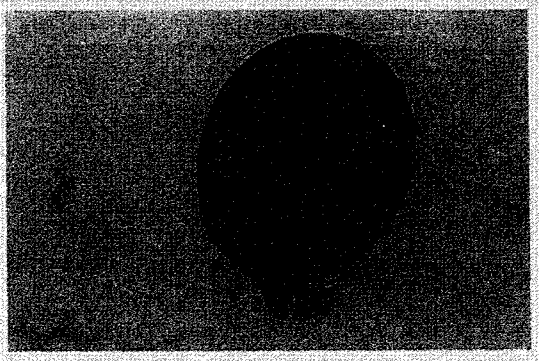

Figure 1b Crushed spore of *Glomus maculosum* Miller and Walker (× 400)

Glomus gerdmanii Rose, Daniel, and Trappe were recovered during the pre-monsoon season only, *Acaulospora scrobiculata* Trappe, *Glomus maculosum* Miller and Walker (Figure 1b), and *Sclerocystis clavispora* Wu and Chen (Figure 1c) were recoverd throughout the study period (Table 1).

According to Hayman (1974), in addition to climatic factors, changes in edaphic factors also

Table 1 An account of spore density and species diversity of arbuscular mycorrhiza fungi associated with banana along with climatic factors recorded during the study period

Season	*Spore density* / 100 gm soil sample*	*Mean temperature* (°C)		*Average humidity* (%)		*Average rainfall* (mm)	*Arbuscular mycorrhiza fungal species*
		Maximum	*Minimum*	*Maximum*	*Minimum*		
Pre-monsoon (May)	426 ± 21.45	34.60	27.90	77.00	67.00	–	*Acaulospora foveata* Trappe and Janos *Acaulospora nicolsonii* Walker, Reed, and Sanders *Acaulospora scrobiculata* Trappe *Glomus gerdmanii* Rose, Daniel, and Trappe *Glomus maculosum* Miller and Walker *Glomus monosporum* Gerdemann and Trappe *Sclerocystis clavispora* Wu and Chen
Monsoon (August)	384 ± 29.40	30.00	24.80	96.00	87.00	549.80	*A. foveata* Trappe and Janos *A. scrobiculata* Trappe *G. maculosum* Miller and Walker *G. monosporum* Gerdemann and Trappe *S. clavispora* Wu and Chen
Post-monsoon (November)	250 ± 20.22	32.20	22.30	22.30	73	44.90	*A. scrobiculata* Trappe *G. maculosum* Miller and Walker *G. monosporum* Gerdemann and Trappe *S. clavispora* Wu and Chen

* Values indicated are the means of five replicates (n = 5 ± 1S.D)

Figure 1c Crushed sporocarp of *Sclerocystis clavispora* Wu and Chen (× 400)

play a key role in the sporulation of AMF in nature, suggesting the need for further studies in this direction.

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