MYCORRHIZA NETWORK

MYCORRHIZA NEWS

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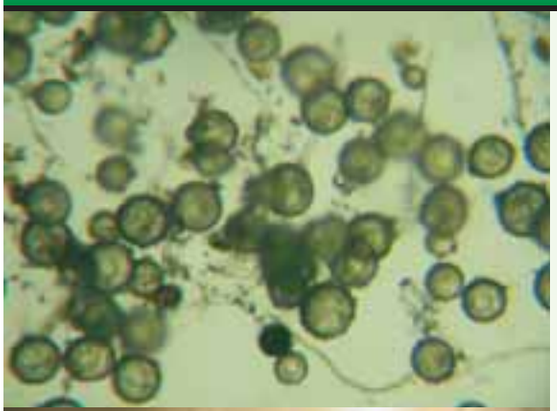

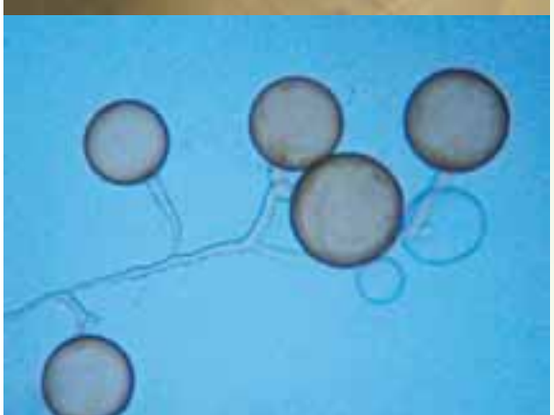

About TERI

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TERI's Mycorrhiza Network

TERI's Mycorrhiza Network is primarily responsible for establishing the MIC (Mycorrhiza Information Centre), the CMCC (Centre for Mycorrhiza Culture Collection), and publishing Mycorrhiza News. The Network helps scientists carry out research in mycorrhiza and promotes communication among mycorrhiza scientists.

Mycorrhiza News

The Mycorrhiza News provides a forum for dissemination of scientific information on mycorrhiza research and activities; publishes state-of-the-art papers from eminent scientists; notes on important breakthroughs; brief accounts of new approaches and techniques; publishes papers complied from its RIZA database; provides information on forthcoming events on mycorrhiza and related subjects; lists important research references published during the quarter; and highlights the activities of the CMCC.

Contents

RESEARCH FINDING PAPERS

Spore-in-spore syndrome in arbuscular mycorrhizal fungi from the agro-based ecosystem of Goa

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Introduction

The saprophytic and pathogenic fungi are known to possess spore-in-spore syndrome. Sometimes, their role as mycoparasites, bio-control agents, and other related activities are interpreted differently. Similarly, the presence of fungi within the spores of AM (arbuscular mycorrhizal) fungi has been reported (Koske 1981). Others have reported the presence of AM fungi inside the exoskeleton of dead oribatid mites in the soil (Rabatin and Rhodes 1982), dead seeds and seed coats (Ferrer and Herrera 1980), in the folds of leaf fragments (Rabatin and Rhodes 1982), nematode eggs, and cysts (Graham and Stone 1975; Tribe 1977), and in the basidiocarps of hypogeous *Melanogaster* (Bakerspigel 1958).

The presence of AM fungal spores within the spores of AM fungi has been reported by Khan (1971). Hall (1977) reported the occurrence of *Glomus pallidus* spores within the spores of *Glomus macrocarpus* var. *macrocarpus*. Koske (1975) reported the presence of yellow punctuate spore of *Acaulospora scrobiculata* inside *Gigaspora* species. Koske (1984) also reported the wide spread occurrence of spore-in-spore syndrome phenomenon the in Atlantic Coast, US, and Great lakes. The present study aims at evaluating the occurrence of AM spores within the spores of AM fungi in the agro-based ecosystem of Goa.

Materials and methods

Extraction of AM fungal spores

Spores of AM fungi associated with *Carica papaya* L. plants were isolated directly from rhizosphere soil samples by wet sieving and decanting method (Gerdemann and Nicolson 1963).

Identification of arbuscular mycorrhizal fungi

Diagnostic slides containing intact and crushed spores of AM fungi were prepared in polyvinyl alcohol lactoglycerol (Koske and Tessier 1983). Spore morphology and wall characteristics were considered for the identification of AM fungi and these characteristics were ascertained using compound microscope, Leica WILD MP 3, and Nikon E 800. AM fungi were identified to the species level using bibliographies by Schenck and Perez (1990). Taxonomic identification of spores was also carried out by matching the descriptions provided by the International Collection of Vesicular Arbuscular Mycorrhizal fungi <http://invam.caf.wvu. edu>. Names and epithets of AM fungi were followed according to the recommendations of Walker and Trappe (1993).

Results

The study recorded the presence of two types of *Glomus microaggregatum* in the dead spores of AM fungi. Fifteen to twenty globose, pale yellow to yellow spores of *G. microaggregatum* Schenck and Smith was recorded in the dead spore of *Scutellospora gregaria* (Schenck and Nicol) Walker and Sanders (Figures 1a, 1b, and 1c), while more than a hundred, loosely aggregated hyaline, globose to pyriform spores of *G. microaggregatum* Schenck and Smith

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emend. Koske was recorded in *Glomus* species (Figure 1d and 1e). A pale yellow, smooth-walled spore of *Scutellospora* species with two distinct wall groups, with the innermost wall consisting of numerous oil globules was present inside the dead spore of *Scutellospora reticulata* (Koske, Miller, and Walker) Walker and Sanders (Figure 1f and 1g). Thus, three types of spores in syndromes such as (1) *Glomus* spores in *Scutellospora* (2) *Glomus* spores in *Glomus* and (3) *Scutellospora* spore in *Scutellospora* were recorded in the present study.

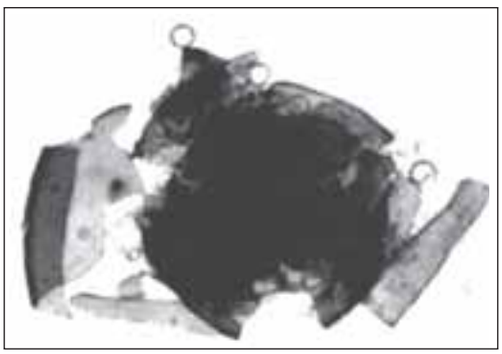

Figure 1(a) Crushed spore of *Scutellospora gregaria* (Schenck and Nicol.) Walker and Sanders with spores of *Glomus microaggregatum* Schenck and Smith (× 100).

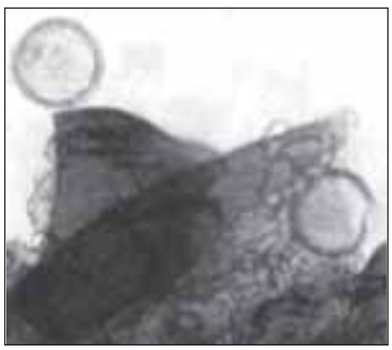

Figure 1(b) Spores of *Glomus microaggregatum* Schenck and Smith (× 400).

Figure 1(c) A single, light yellow spore of *Glomus microaggregatum* Schenck and Smith with curved hyphal attachment (× 1000).

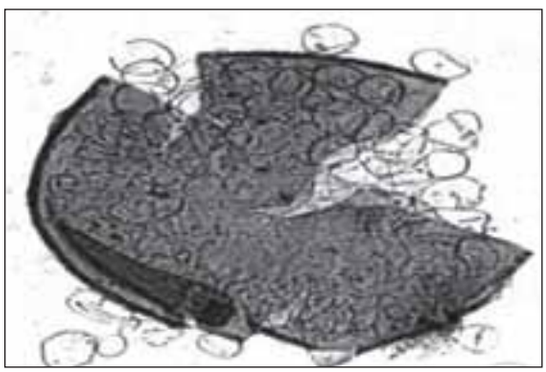

Figure 1(d) Crushed spore of *Glomus* species enclosing clusters of hyaline spores of *Glomus microaggregatum* Schenck and Smith emend. Koske (× 100).

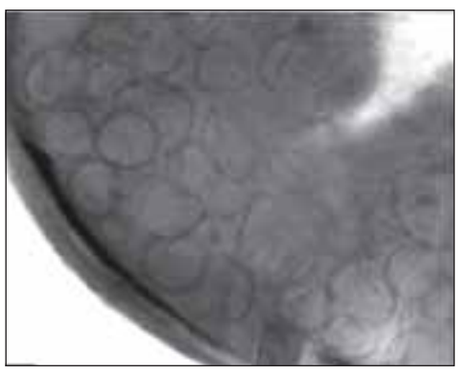

Figure 1(e) A portion of spore of *Glomus* species enclosing clusters of *Glomus microaggregatum* Schenck and Smith emend. Koske (× 400).

Figure 1(f) Crushed spore of *Scutellospora reticulata* (Koske, Miller, and Walker) Walker and Sanders enclosing spore of *Scutellospora* species (x 100).

Figure 1(g) Magnified view of crushed spore of *Scutellospora reticulata* (Koske, Miller, and Walker) Walker and Sanders enclosing spore of *Scutellospora* species (x 400).

Discussion and conclusions

Spore-in-spore syndrome with reference to AM fungi recorded in the present study is in agreement with the findings of Jaiswal (2002) and Bukhari (2002) on the sand dune ecosystem and mine wastelands of Goa, respectively. Jaiswal (2002) reported the occurrence of *Acaulospora spinosa* Walker and Trappe within spores of *S. gregaria* (Schenck and Nicolson) Walkers and Sanders; whereas Bukhari (2002) reported the occurrence of *G. microaggregatum* Koske, Gemma, and Olexia in dead spores of *Glomus macrocarpum* Tulasne and Tulasne and *Glomus sinuosum* (Gerd and Bakshi) Almeida and Schenck. The study supports the findings of Koske (1984) who reported that the number of spores existing within a single spore from the dunes varied from 1 to 100 or more depending on the size of the occupied spore and its habitat. Further, *Gigaspora* spores were found singly in spores, *Acaulospora* members were recorded to be two to six in number, while spores of *Glomus* species occurred in the number of 10 to 100 (Koske 1984). Koske (1984) reported the presence of one to five different species within a single spore. However, in the present study, only one type of species was occupying the spore of AM fungi. The study is in accordance with Koske (1986), who reported the frequent occurrence of *G. microaggregatum* Koske, Gemma, and Olexia inside the spores of other AM fungi and that they seldom occur freely in soil. The study supports the findings of Koske (1984) who brought about the fact that dead spores of AM fungi provide a favourable microhabitat for spore formation. Thus, the further more it is a first report on spore in spore syndrome in the agro-based ecosystem of Goa. However, the significance of spore-in-spore syndrome with reference to AM fungi is not known.

Acknowledgements

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References

Bakerspigel A. 1958
The spore of *Endogone* and *Melanogaster* in digestive tracts of rodents
Mycologia **50**: 440–442

Bukhari M J. 2002
Arbuscular mycorrhizal fungal diversity of degraded iron ore mine-wastelands of Goa
Goa: Goa University, 248 pp.
[PhD Thesis submitted to Goa University]

Ferrer R L and Herrera R A. 1980
El genero *Gigaspora* Gerdemann *et* Trappe (Endogonaceae) en Cuba
Revista Jardín Botánico Nacional University Habana **1**: 43–66

Gerdemann J W and Nicolson T H. 1963
Spores of mycorrhizal *Endogone* species extracted from soil wet sieving and decanting
Transactions of British Mycological Society **46**: 235–244

Graham C W and Stone L E W. 1975
Field experiments on the cereal cyst-nematode (*Heterodera avenae*) in South East England
Association Applied Biologists **80**: 61–73

Hall I R. 1977
Species and mycorrhizal infections of New Zealand Endogonaceae
Transactions of British Mycological Society **68**: 341–356

Jaiswal V. 2002
Studies on arbuscular mycorrhizal fungi in coastal sand dune vegetation of Goa
Goa: Goa University, 171 pp.
[PhD thesis submitted to Goa University]

Khan A G. 1971
Occurrence of *Endogone* spores in West Pakistan soils
Transactions of British Mycological Society **56**: 217–224

Koske R E. 1975
***Endogone* spores in Australian sand dunes**
Canadian Journal of Botany **53**: 668–672

Koske R E. 1981
***Labyrinthula* inside the spores of a vesicular-arbuscular mycorrhizal fungus**
Mycologia **52**: 1175–1180

Koske R E. 1984
Spores of VAM fungi inside spores of VAM fungi
Mycologia **76**: 853–862

Koske R E. 1986
Distribution of vesicular- arbuscular mycorrhizal fungi along latitudinal temperature gradient
Mycologia **78**: 55–68

Koske R E and Tessier B. 1983
A convenient permanent slide mounting medium
Mycological Society of America Newsletter **34**: 59

Rabatin S C and Rhodes L H. 1982
***Acaulospora bireticulata* inside oribatid mites**
Mycologia **74**: 859–861

Schenck N C and Perez Y. 1990
Manual for identification of VA Mycorrhizal fungi
Gainesville: INVAM, University of Florida. 241 pp, edited by N C Schenck and Y Perez.

Tribe H T. 1977
Pathology of cyst nematode
Biological Review (London) **52**: 477–507

Walker C and Trappe J M. 1993
Name and epithets in the Glomales and Endogonales
Mycological Research **97**: 339–344