Curcuma bhatii (R.M. Sm.) Skornickova & M. Sabu (Zingiberaceae) and its mycorrhizal association

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Curcuma bhatii (R.M. Sm.) Skornickova & M. Sabu (*Paracautleya bhatii* R.M. Sm.) (Zingiberaceae) is an endemic, threatened plant (Nayar & Sastry 1988). It is the smallest southern Indian Zingiberaceae with a height of 12–15 cm (Sabu 2006) (Image 1a), having short rhizomes. It grows in the crevices of laterite rocks. It is found in a few scattered populations in Udupi District, Karnataka State, which is its type locality. The plant goes under dormancy for about six months by withering its aerial portion. Since, it is difficult to establish it in ex situ, it prompted us to study its microbial association which plays an important role in the nutrition of the plants. This plant was collected from its natural habitat for the mycorrhizal study and the voucher specimen is deposited in TBGRI (Mathew Dan no. 67521).

Methods: The rhizosphere soil sample of the plant was collected for isolation of arbuscular mycorrhizal spore by wet sieving and decanting method (Gerdemann & Nicolson 1963). Root hairs were cut into small pieces (ca. 1cm), decolourised by boiling them in 10% KOH for one hour, cooled to room temperature, washed thoroughly in distilled water, stained with Lactophenol-cotton-blue to study the presence of vesicles and arbuscules (Philips & Hayman 1970).

The percentage of mycorrhizal colonization was calculated as: (No. of mycorrhizal root segments / Total no. of root segments observed) x 100

The relative frequency of spores was calculated as: (No. of isolate for each species / Total no. of isolates) x 100

Fungal spores were identified on the basis of spore morphology (Schenk & Perez 1990).

Result: Root colonization and AM spore count were determined. *Curcuma bhatii* revealed 95% infection (based on the above formula) and showed about 290 spores per 100g soil. Vesicles and hyphae were present in the roots. The mycorrhizal infection restricted to the epidermis and did not penetrate in to endodermis. Hyphae 2–7 µm broad. Vesicles globose to elongate, 25–50 x 17–20 µm, present in both intercellular and intracellular layer of cortical cells. Spores isolated from the rhizosphere soil belonged to *Glomus aggregatum, G. glomerulatum, G. multicaule* and *Sclerocystis pachycaulis*. The spores of *Glomus aggregatum* and *Sclerocystis pachycaulis* showed maximum relative frequency (Table 1).

***Glomus aggregatum* Schenck & Smith, 1982**
Mycologia 74 (1): 80, 1982. (Image 1 b,c)

Material examined: 24.vii.2010, spores isolated from the rhizosphere soil of *Curcuma bhatii* (R.M. Sm.) Skornickova & M. Sabu (Zingiberaceae), Udupi District, Karnataka, coll. P.P. Rajeshkumar, Slide no. TBGT 141.

Table 1. Relative frequency of spores

Species name	Relative frequency
Glomus aggregatum	33%
G. glomerulatum	10%
G. multicaule	23%
Sclerocystis pachycaulis	32%

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Chlamydospores formed in loose clusters or in sporocarps without peridium. Sporocarps are of variable size ranging from 800–1000 µm, hyaline to light yellow with a greenish tint in transmitted light. Chlamydospores globose, subglobose, obovate, irregular, 40–50 x 40–50 µm, hyaline to yellow; wall yellow to yellowish-brown, 1–3µm thick, outer wall slightly thicker and lighter in colour than the inner wall. Hyphae at the point of attachment to spore up to 8µm wide. Spore contents continuous with hyphal contents in young spores but get separated from the hyphal content in older spores by the inner spore wall; pore not occluded by hyphal wall thickening. Hyphal attachment straight to recurved sharply at the base of the spores.

***Glomus glomerulatum* Sieverding**
Mycotaxon 29: 74, 1987 (Image 1d)

Material examined: 24.vii.2010, spores isolated from the Rhizosphere soil of *Curcuma bhatii* (R.M. Sm.) Skornickova & M. Sabu (Zingiberaceae), Udupi District, Karnataka, coll. P.P. Rajeshkumar, Slide no. TBGT 144.

Chlamydospores globose, yellowish-brown, up to 64µm in diam. Composite spore wall composed of two wall layers (wall 1 & 2) in one group (group A); wall 1 is yellow to brown, laminate and up to 3µm thick, on the surface of this wall a layer of hyphae is adherent but normally the spore surface is smooth; wall 2 is hyaline, membranous, up to 0.5µm thick and normally adherent to wall 1. Chlamydospores have two attached hyphae, yellow, straight to recurved. The pore of the hyphal attachment 1.6µm in diam. The pore is closed by second wall. Spore content hyaline, oily.

***Glomus multicaule* Gerdmann & Bakshi, 1976**
Trans. Brit Mycol. Soc. 66 (2): 340, 1976 (Image 1e)

Material examined: 24.vii.2010, spores isolated from the Rhizosphere soil of *Curcuma bhatii* (R.M. Sm.) Skornickova& M. Sabu (Zingiberaceae), Udupi District, Karnataka, coll. P.P. Rajeshkumar, Slide no. TBGT 142.

Sporocarps not seen. Chlamydospores dark brown, 167–200 µm in diam., subglobose with four hyphal attachments, attachments generally occur at opposite ends of the spore. Spore wall up to 15µm thick, thickest at the point of hyphal attachments, rounded projections up to 1.6µm, regularly distributed over the wall surface.

***Sclerocystis pachycaulis* Wu & Chen, 1985**
Taiwania 31: 74, 1986 (Image 1f)

Material examined: 24.vii.2010, spores isolated from the Rhizosphere soil of *Curcuma bhatii* (R.M. Sm.) Skornickova & M. Sabu (Zingiberaceae), Udupi District, Karnataka, coll. P.P. Rajeshkumar Slide no. TBGT 143.

Sporocarp yellowish-brown, globose, 200–280 µm, consisting of terminal chlamydospore arranged on a central plexus of hyphae. Peridium not seen. Chlamydospores yellow to yellowish-brown, ovoid to ellipsoid, 32–40 x 22–27 µm, wall yellowish-brown, up to 3µm thick, with hyaline, separable outer layer, <1µm thick, usually chlamydospore content separated by 1–2 adventure septa below the spore attachment of attached hyphae. Attached hyphae up to 6.5µm with thick wall. Wall thickness of attached hyphae extending down for some distance, usually thicker than the chlamydospore wall.

Discussion

The plants grow on the shallow deep soil on rocks and crevices where the soil appears to be poor in nutrients, a condition which favours mycorrhizal fungi. Soil analysis study may prove this statement. Presence of characteristic mycorrhizal association points out the habitat specificity of this narrowly endemic species.

REFERENCES

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

Nayar, M.P. & A.R.K. Sastry (1988). *Red Data Book of Indian Plants.* BSI, Calcutta, 250-251pp.

Phillips, J.M. & D.S. Hayman (1970). Improved procedures for clearing roots and staining parasitic and vesicular-arbuscular mycorrhizal fungi for rapid assessment of infection. *Transactions of the British Mycological Society* 55: 158–161.

Sabu, M. (2006). *Zingiberaceae and Costaceae of South India*. Indian Association for Angiosperm Taxonomy, Calicut

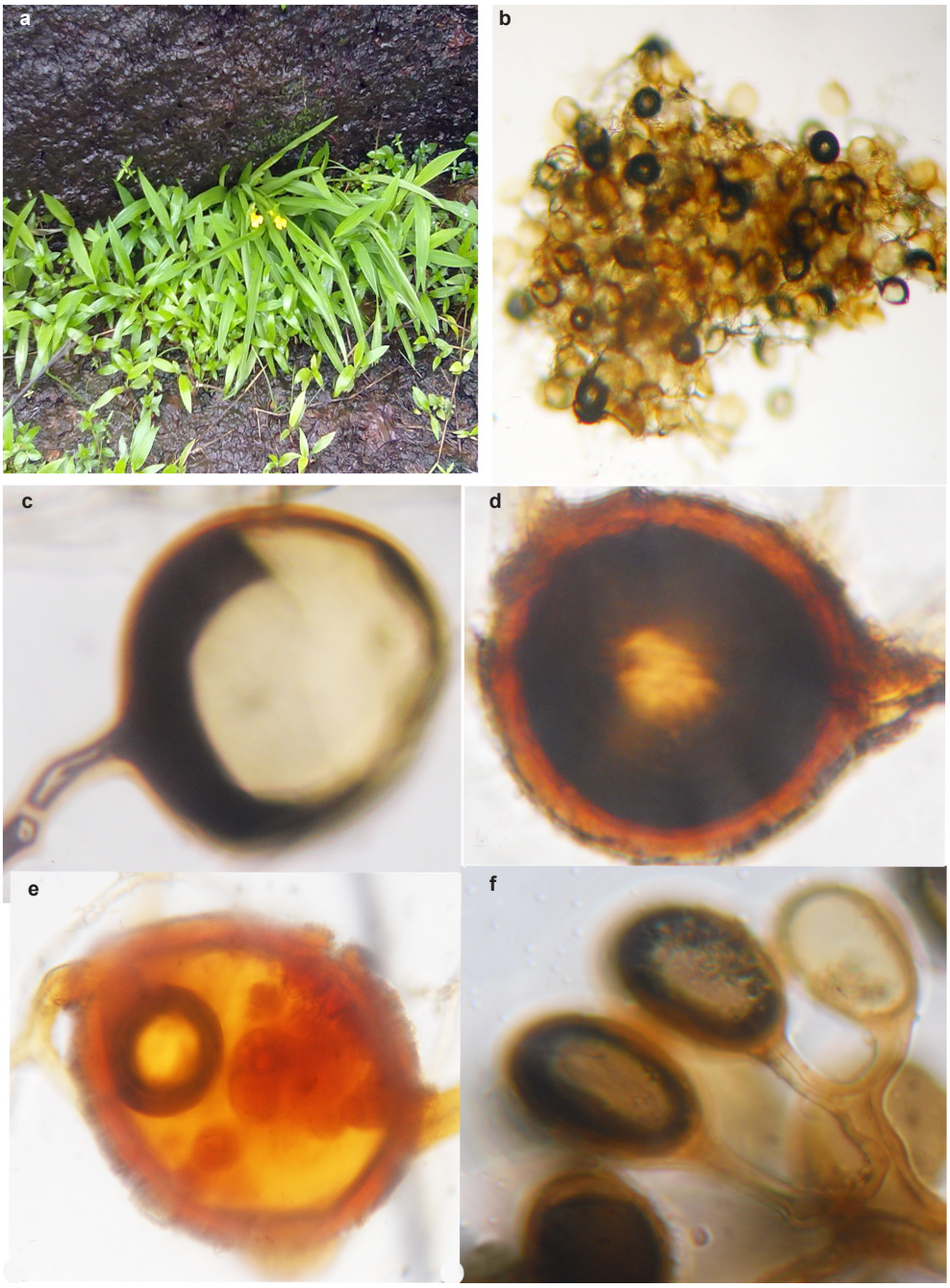

Image 1. a - Habitat of *Curcuma bhatti* (R.M. Sm.) Skomickova & M. Sabu; b - Sporocarp of *Glomus aggregatum* Schenck & Smith; c - Chalmydospore of *Glomus aggregatum* Schenck & Smith; d - Chalmydospore of *Glomus glomerulatum* Sieverding; e - Chlamydospore of *Glomus multicaule* Gerdmann & Bakshi; f - Chalmydospores of *Sclerocystis pachycaulis* Wu & Chen.

University, India, 144pp.

Schenk, N.C. & Y. Perez (1990). *Manual for the Identification of VA Mycorrhizal Fungi*. Synergistic Publications, USA, 1–286pp.