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Isolation of an indigenous mycorrhizal fungus *Glomus fasciculatum* from Lutunia, Paschim Medinipur, India

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Abstract

The work described in this paper deals with the isolation and identification of an indigenous VAM fungus *Glomus fasciculatum*. Spores were isolated from local soils and inoculated into Sorghum plants to establish a pure culture, which is currently being maintained in the laboratory of Sabang Sajanikanta Mahavidyalaya.

Keywords: Vesicular-arbuscular mycorrhizae, *Glomus fasciculatum*, isolation, identification.

Introduction

In nature, symbiotic mycorrhizal relationships represent a universal standard rather than an anomaly (Gerdemann, 1968), with more than 80% of all terrestrial plant species establishing these fungal bonds (Gianinazzi et al., 1982). Within sustainable farming frameworks, vesicular-arbuscular mycorrhizae (VAM) serve as an indispensable structural component (Bethlenfalvay & Schuepp, 1994; Hooker & Black, 1995; Jeffries & Barea, 1994). However, modern agricultural reliance on synthetic chemical fertilizers actively diminishes and disrupts indigenous VAM communities within the soil matrix (Bagyaraj et al., 1989; Douds et al., 1993; Kabir et al., 1998; Kurle & Pflezer, 1994; Lee et al., 2008; Miller & Jackson, 1998; Oehl et al., 2004; Thingstrup et al., 1998).

The functional importance of VAM fungi escalates sharply in nutrient-depleted environments (Hatch, 1937), where vegetation exhibits a heightened reliance on fungal symbiosis to overcome phosphorus deficiencies (Baylis, 1972). Operating as a biological conduit between the host plant and the surrounding substrate (Jackson et al., 1972), VAM fungi mobilize and transport phosphorus alongside other essential elements from regions well beyond the root's immediate nutrient depletion zone (Liu et al., 2000; Sanders & Tinker, 1973). As obligate symbionts, these fungi deploy vast external hyphal networks to forage, absorb, and translocate vital nutrients back to the host (Jakobsen et al., 1992; Sanders & Tinker, 1973). Beyond nutritional enhancement, the hyphal architecture within the plantation rhizosphere bolsters plant defences by offering cross-protection against pathogens and optimizing soil moisture levels (Baath & Hayman, 1983; Dehne, 1982; Krishna & Bagyaraj, 1983).

The agronomic efficiency of the specific VAM taxon *Glomus fasciculatum* has been widely documented under rain-fed, lateritic soil parameters (Cliquet, 1997; Setua et al., 1999). This particular species demonstrates robust survival across a broad pH spectrum (Abbott &

Robson, 1985) and maintains high persistence in arid soil conditions (Abbott et al., 1987). When paired with optimized, cost-effective phosphorus applications, *G. fasciculatum* yields highly encouraging results in the acidic lateritic zones of West Bengal. Furthermore, research indicates that *Glomus* species constitute the dominant VAM taxa in the acidic soils of the North-Western Himalayas (Suri et al., 2006). Broader biodiversity surveys by Ghosh and Verma (2004) confirmed the regional presence *of Gigaspora, Acaulospora, Glomus*, and *Scutelospor*a, while Sengupta et al. (1998) explored the colonization and infectivity dynamics of various VAM strains native to West Bengal's red lateritic soils.

Driven by the ecological and agricultural significance outlined above, this investigation was designed to extract, isolate, and taxonomically classify indigenous VAM spores occurring naturally within the local soil ecosystems of this zone.

Materials and Methods

VAM fungal spores were extracted from soil samples using the wet sieving and decanting method described by Gerdemann and Nicolson (1963). Spores of individual species were isolated morphologically under a compound microscope. The isolated spores were surface-sterilized using a solution containing 200 µg ml^{-1} streptomycin and 2% (w/v) Chloramine-T (Becard & Fortin, 1988; van Buuren et al., 1999).

For initial culturing, aluminium foil was shaped into a funnel, and its distal end was plugged with cotton. The funnel was filled up to the neck with a sterilized sand-soil mixture, where the surface-sterilized spores were placed. The remaining portion of the funnel was filled with the soil mixture, and surface-sterilized seeds of *Sorghum vulgare* were planted just below the surface. These funnel assemblies were placed inside test tubes filled with distilled water to maintain moisture via the cotton plug. The entire setup was kept in a growth chamber at 25°C and 65% relative humidity for 21 to 30 days.

Once rootlets emerged through the distal end of the funnel, the plants were transferred to pots filled with a sterilized soil mixture and maintained in a net house for up to 90 days. This culturing procedure was repeated through multiple cycles to establish pure pot cultures of single indigenous species. The isolated spores from these pots served as the inoculum source for subsequent pure cultures on Sorghum plants.

Pure cultures of *Glomus fasciculatum* were identified to the species level using standard taxonomic literature, including the manuals of Trappe (1982) and Schenck and Perez (1987, 1990), alongside INVAM voucher specimens (://invam.com). All identification and experimental pot studies were carried out in the Post Graduate Department of Botany, Sabang Sajanikanta Mahavidyalaya, Lutunia, Paschim Medinipur.

Results and Discussion

One species, *Glomus fasciculatum* was identified on the basis of characteristics described in the manual for the identification of VA mycorrhizal fungi by Schenck and Perez (1987, 1990) and INVAM (://invam.com) voucher specimens with descriptions.

Glomus fasciculatum (Thaxter) Gerdemann & Trappe emend. Walker & Koske

Sporocarp: Spores are produced in spongy, loosely coherent masses. The masses are rounded, somewhat elongate, irregular, and somewhat amorphous in shape.
Spores:
Colour: Pale yellow to pale yellow-brown.
Shape: Globose to sub globose.

Size: 66–112 µm in diameter.
Arrangement: Occur in clusters rather than singly.
Subtending Hypha:
Shape: Cylindrical to slightly flared at the point of spore attachment.
Width: 8.50–10.5 µm.
Wall thickness: 1.0–11.0 µm, composite.
Wall layers: Two distinct layers are clearly visible
Spore base: The spore wall may extend into the subtending hypha. More commonly, it curves inward at the spore base to form a septum-like structure.
Diagnostic features: Clustered spongy spore-masses, pale yellow spores, and a septum-like closure at the spore base.
The isolated VAM species identified is *Glomus fasciculatum*.
Ghosh and Verma (2004) reported the presence of *Acaulospora* and *Glomus* species in the lateritic soil in West Bengal. Glomus species have a wide range of occurrence but dominate in low-fertility soils (Khade & Rodrigues, 2007; Suri et al., 2006). *G. fasciculatum* can tolerate a wide pH range (Abbott & Robson, 1985).
The isolated VAM strains are indigenous to the soils of Lutunia, Paschim Medinipur. As native isolates, they are well adapted to the local agro-climatic conditions. Their mass multiplication for use as inoculum in locally cultivated agricultural crops holds significant potential. They can serve as a cost-effective substitute for expensive phosphate fertilizers while also offering the added benefit of being eco-friendly.

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Bio-note

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