

The arbuscular mycorrhizal *Paraglomus majewskii* sp. nov. represents a distinct basal lineage in Glomeromycota

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Abstract: *Paraglomus majewskii* sp. nov. (Glomeromycota) is described and illustrated. It forms single spores, which are hyaline through their life cycle, globose to subglobose, (35–)63(–78) µm diam, sometimes egg-shaped, 50–70 × 65–90 µm, and have an unusually narrow, (3.2–)4.6(–5.9) µm, cylindrical to slightly flared subtending hypha. The spore wall of *P. majewskii* consists of an evanescent, short-lived outermost layer, a laminate middle layer, and a flexible innermost layer, which adheres tightly to the middle layer. None of the spore wall layers stain in Melzer's reagent. In single-species cultures with *Plantago lanceolata* as the host plant *P. majewskii* formed arbuscular mycorrhizae staining violet in trypan blue. *P. majewskii* has been isolated from several, distant geographic regions and from different habitats. In phylogenetic analyses of partial nrDNA SSU and LSU sequences the fungus formed monophyletic group with *Paraglomus* species; however it represents a well separated distinct lineage. Its nrDNA sequences are highly similar to in planta arbuscular mycorrhizal fungal sequences from different habitats in Spain and Ecuador.

Key words: AMF specific PCR primers, ancestral

lineage, arbuscular mycorrhizal fungi, Glomeromycota, mycorrhizae, Paraglomeraceae

INTRODUCTION

The family Paraglomeraceae was erected recently to accommodate the ancestral arbuscular mycorrhizal fungi (AMF) that form small glomoid spores based on rDNA phylogenetic analysis (Morton and Redecker 2001, Schüßler et al. 2001). The species within Paraglomeraceae are the type species *Paraglomus occultum* (C. Walker) J.B. Morton & D. Redecker, *P. brasilianum* (Spain & J. Miranda) J.B. Morton & D. Redecker and *P. laccatum* (Błaszk.) Renker, Błaszk. & Buscot.

The known *Paraglomus* spp. produce glomoid spores (they arise identically to those of *Glomus* spp.) that are colorless or pale and relatively small (mean diameter < 100 µm; Morton and Redecker 2001, Renker et al. 2007). In addition mycorrhizae of *Paraglomus* spp. stain faintly or not at all in trypan blue and probably lack vesicles (Morton and Redecker 2001). However it is evident that spore morphology and even mode of spore formation of many species of Glomeromycota sometimes correlate weakly or not at all with their molecular phylogenies (Redecker and Raab 2006, Schüßler and Walker 2010). Hence to correctly place newly discovered AMF within Glomeromycota both morphological and molecular phylogenetic analyses are needed.

While *P. occultum* has been recorded from numerous regions of the world (Błaszkowski pers obs, Morton and Redecker 2001), *P. brasilianum* has been found only in Brazil and West Virginia, USA (Morton and Redecker 2001, Spain and de Miranda 1996), and *P. laccatum* has been found only in Denmark, Poland (Błaszkowski 1988, unpubl; Renker et al. 2007) and Great Britain (Chris Walker pers comm).

Examination of pot trap cultures inoculated with rhizosphere soil and root fragments of a variety of plant species collected from several locations in Europe, Africa and Asia produced glomoid spores of an undescribed taxon of Glomeromycota. Molecular phylogenetic analyses showed that these isolates formed a new distinct lineage in a monophyletic group with *Paraglomus* species, herein described as *P. majewskii*.

MATERIALS AND METHODS

Establishment of cultures, extraction of spores and staining of mycorrhizae.—Spores examined in this study were derived