GLOMUS MORTONII SP. NOV., A PREVIOUSLY UNDESCRIBED
SPECIES IN THE GLOMACEAE ISOLATED FROM THE
TALLGRASS PRAIRIE IN KANSAS

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Introduction

A survey of the Glomales (Morton and Benny, 1990) from native tallgrass prairie soil collected from the Konza Prairie Research Natural Area (KPRNA, Manhattan, KS) revealed spores of an undescribed Glomus species. Soil from the site is a Chase silty clay loam, fine montmorillonitic, mesic Aquic Arguidoll with pH 6.2, 4.5% O.M., and 4.0 mg/kg available P (Bray I). Spores were extracted from soil by wet-sieving and decanting followed by sucrose density gradient centrifugation (Daniels and Skipper, 1982). Descriptions and observations reported in this study are from specimens mounted in polyvinyl alcohol-lactic acid-glycerol (PVLG, Koske and Tessier, 1983) or PVLG and Melzer’s reagent (1:1 v/v). Terminology used follows that of Walker (1983) and Morton (1988). Specimens were observed with brightfield (BF) and Nomarski interference contrast (NI) microscopy using a Leitz Dialux 20 and an Olympus BH-2 photomicroscope, respectively. Spore and wall dimensions, measured with an ocular micrometer, are reported as means (size ranges in parentheses) of at least 200 spores. Sporocarp and spore dimensions are reported as [smallest diameter] x [largest diameter]. Holotypes have been deposited in the Oregon State University Herbarium, and isotypes have been deposited at the Kansas State University Herbarium.

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Description

*Glomus mortonii* Bentivenga et Hetrick, *sp. nov.* (Figures 1-3)

Sporocarpia subglobosa vel irregularia, (90-)290(-450) x (140-)320(-610) μm, sporis 2-10. Sporae tunica (2-)15(-49) μm crassa, sporas adpressa sed tacile separata, hyphis hyalinis, sinuatis, (9-)16(-21) μm in diam, parietaus (3-)5(-8) μm crassis. Sporae globosae, subglobosae, pyriformes, reniformes, vel irregularares, (37-)125(-210) x (44-)149(-275) μm, singulatim vel in sporocarpis efformatae, parietaus tribus (1-3): (1) hyalino, mucilagino, evenescenti, (0.6-)0.8(-1.2) μm crasso, in solutione Melzerti pallide roseo; (2) hyalino, lamelloso, (0.5-)3.0(-6.3) μm crasso; (3) lamellis usque novem, luteo vel spadiceo, (1.1-)2.9(-6.3) μm crasso. Hyphae sustentantes variables, rectae vel interdum curvatae, cylindrica, infundibuliformes vel irregularres, (6.0-)10.8(-13.0) μm in diam.

**Sporocarps** formed in soil, subglobose to irregular, (90-)290(-450) x (140-)320(-610) μm, composed of 2-10 spores. **Mantle** enveloping individual spores, (2-)15(-49) μm thick, appressed to spore proper but easily detached; composed of hyaline, sinuosus hyphae (9-)16(-21) μm thick, with walls (3-)5(-8) μm thick; not reacting with Melzer's solution. Spores globoso to subgloboso, pyriforme, reniforme to irregular, (37-)125(-210) x (44-)149(-275) μm (excluding mantle) produced singly or in sporocarps; yellow to yellow-brown in reflected light. **Spore wall structure** (murograph, Fig. 1) of three walls (1-3) in one group (A). Outer wall (1) hyaline, mucilaginosa, evenescens, often absent from mature spores, (0.6-)0.8(-1.2) μm thick; turning light pink in Melzer's reagent. Wall 2 hyaline in transmitted light, laminated, with laminae imbedded in a gelatinous matrix, (0.5-)3.0(-6.3) μm thick; continuous with hyphal attachment; generally thickest near point of hyphal attachment. Wall 3 laminated with up to 9 laminae, yellow to yellow-brown in transmitted light, (1.1-)2.9(-6.3) μm thick; initially continuous with subtending hypha but tapering to an end 25 to 90 μm from the spore proper. Neither wall 2 or 3 reacting with Melzer's solution. **Hyphal attachment** highly variable, straight or occasionally recurved, cylindrical to flared to irregular; (6.0-)10.8(-13.0) μm wide. Pore at point of hyphal attachment open in immature spores, becoming occluded by innermost laminae of wall 3. Spore lumen contents globular with one to many lipid globules which may coalesce upon crushing. **Subtending hyphae** continuous with mantle, (9.6-)14.1(-24.8) μm wide, with hyaline, unevenly thickened walls (2.4-)4.3(-7.9) μm thick; may be absent from mature spores.

**DISTRIBUTION AND HABITAT:** Known only from a native tallgrass prairie site (KPRNA) near Manhattan, KS (See Introduction for soil characteristics).

**MYCORRHIZAL ASSOCIATIONS:** Unknown. Associated in the field with roots of *Andropogon gerardii* Vitm. and *Sorghastrum nutans* (L.) Nash, however, attempts to pot culture the fungus in the greenhouse with *A. gerardii* and *Schizachyrium scoparium* (Michx.) Nash have failed.

**ETYMOLOGY:** Named after Dr. Joseph B. Morton in recognition of his contributions and innovative approach to the systematics of the Glomales.

Figure 1. Murograph of Glomus mortonii Bentivenga & Hetrick. Walls 1-3 occur in one group (A). Dotted fill = evanescent wall, dashed fill = laminated wall (after Walker, 1983). Note that the evanescent wall may be absent.

Discussion

Spores of G. mortonii form singly or in sporocarps in soil. Spores in sporocarps frequently mature asynchronously with one spore approaching maturity before new spores are initiated. Developmentally, walls 1 and 2 form first, with wall 3 forming after wall 2 has reached its maximum thickness. Wall 2 is generally thicker in small immature spores than in larger mature spores suggesting that the wall may stretch and become thinner as the spore grows and matures. The ontogeny of the mantle is not known, but it seems to arise from the hyaline laminated wall of the subtending hypha (Fig 3C).

The hyaline laminated wall (wall 2) of G. mortonii can easily be mistaken for a unit wall. The laminae are indistinct and difficult to observe without the aid of Nomarski interference contrast. They are most easily seen in immature spores (Fig. 3A) and the thick-walled hyphae (Fig. 3B). The laminae seem to be imbedded in a gelatinous matrix similar to the laminated hyaline wall of G. clarum Nicolson and Schenck (see Morton, 1989). Because of similarities in wall structure, size, and color, single spores of G. mortonii which have had their mantle detached may easily be mistaken for G. clarum. However, the two species are readily distinguished since most spores of G. mortonii retain their distinct mantle even after sucrose gradient centrifugation and by the sporocarpic nature of G. mortonii.

The mantle of G. mortonii closely resembles the peridium of G. sinuosa (Gerdemann & Bakshi) Almeida & Schenck (= Sclerosystis sinuosa). Both are composed of thick-walled, sinuous hyphae. The two species are readily distinguished using a dissecting microscope since spores of G. sinuosa are generally obovate to clavate and are produced radially from a central plexus of hyphae. G. mortonii sporocarps do not display this type of organization.
Figure 3. *Glomus mortonii*. A.) Wall structure (walls 1-2) of immature spore. Note laminae in wall 2. Wall 3 has not yet formed. NI, x 8,600. B.) Subtending hypha with laminated hyaline wall. This wall is contiguous with wall 2 of the spore. Note the unevenly thickened walls. NI, x 6,950. C.) Subtending hypha proliferating to form the spore mantle. NI, x 4,340.
Spores of *G. mortonii* superficially resemble those of *G. mosseae* (Nicol. & Gerd.) Gerdemann & Trappe in having a mantle and in having spores of different sizes occurring in the same sporocarp (Morton, 1989). However, *G. mortonii* differs from *G. mosseae* in several ways. *G. mosseae* possesses a thin (0.5 μm) hyaline outer unit wall, while the hyaline laminated wall (wall 2) of *G. mortonii* is relatively thick (3.0 μm). Also, the peridial hyphae of *G. mosseae* are narrow (2-12 μm) and not sinuous in contrast to the thicker (9-21 μm) and distinctly sinuous mantle hyphae of *G. mortonii*.

*Glomus tortuosum* Schenck and Smith resembles *G. mortonii* in possessing a sinuate hyphal mantle. However, the mantle hyphae of *G. tortuosum* are thin-walled and become pigmented whereas those of *G. mortonii* are thick-walled (5 μm) and remain hyaline. Furthermore, *G. tortuosum* does not produce a hyaline laminated wall or an outer evanescent wall as does *G. mortonii*. *G. mortonii* produces the hyaline laminated wall (wall 2) prior to the formation of the colored laminated wall (wall 3). Since the development of the spore proper is quite different in these two species, we speculate that there is not a strong ancestral relationship between these species and that the possession of a sinuate mantle may instead represent the convergent evolution of these two fungi.

*Glomus globiferum* Koske and Walker also produces a hyphal mantle (called a peridium by Koske and Walker, 1986). The vesiculate swellings of *G. globiferum* could be confused with immature spores in a sporocarp of *G. mortonii*. However, the mantle hyphae of *G. globiferum* are not sinuous and mature spores of *G. globiferum* possess one or two inner membranous walls, which are lacking in *Glomus mortonii*. The vesiculate swellings of *G. globiferum* (which may be secondary spores) have a wall structure similar to immature spores of *G. mortonii*. Koske and Walker (1986) report that the outer hyaline unit wall of the swellings is generally thinner than the inner pigmented laminated wall. The opposite trend is true (wall 2 thicker than wall 3) for immature spores of *G. mortonii*. Furthermore, *G. mortonii* possesses an evanescent mucilagenous layer and its hyaline wall is laminated. Spores of *G. globiferum* are also darker in color than those of *G. mortonii*, the former being orange-brown to red-brown or occasionally black.

**Acknowledgments**

We would like to express our thanks to Dr. R.E. Koske for observing specimens and contributing valuable comments. We also thank Dr. James Trappe for providing the Latin diagnosis and Dr. Steve Upton for assistance in preparing micrographs.

**Literature Cited**


