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GLOMUS PUSTULATUM: A NEW SPECIES IN THE ENDOGONACEAE

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Examination of soil samples from around roots and rhizomes of American beachgrass (Ammophila breviligulata Fern.) growing on the berm and the dunes of Moonstone Beach, Rhode Island, revealed a previously undescribed species of Glomus Tul. & Tul. with a distinctive outer wall. Spores were recovered from soil by the wet-sieving and filtration method (Koske and Walker, 1984). The species was later discovered in the root zones of sea purslane (Honkenya peploides (L.) Erh. (=Arenaria peploides L.)) and sea pea (Lathyrus maritimus Bigel, (=L. japonicus Willd.)) growing in sandy shores in Quebec, Canada. Wall descriptions follow the suggested standardization of Walker (1983, 1986) and are based upon the appearance of freshly collected spores mounted in a polyvinyl alcohol based mountant (PVL or PVLG) (Walker 1983, Koske and Tessier 1983). Specimens preserved in PVLG or 5% formalin have been deposited in the herbaria of Oregon State University (OSC), the Farlow (FH), the Herbarium of the Department of Agriculture, Ottawa, Mycology (DAOM), and Kew (K).

GLOMUS PUSTULATUM Koske, Friese, Walker et Dalpé sp. nov. Figs. 1-3

Sporocarpia ignota. Sporae singulares, flavidae, luteo-brunneae vel aurantiaco-brunneae, globosae ad asymmetricae (43-)86-140 x (60-)

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86-140 µm. Tunica sporae triplici, exteriore flavida, luteo-brunnea vel aurantiaco-brunnea, 1-5 µm crassa usque ad 12 µm crassa propter ciculares usque asymmeticas pustulas; media flavida usque luteo-brunnea lamellosa (3-10 µm crassa); interiore hyalina, membranaceae (<1 µm crassa). Hyphae sustenentes rectae vel recurvae, flavidae usque luteo-brunneae, 6-12 µm crassae. Formans vesicular-arbusculares mycorrhizae.

Sporocarps unknown. Spores formed singly in soil on a thin-walled, hyaline coenocytic to sparsely septate subtending hypha (Fig. 1A); pale yellow to yellow-brown or orange-brown, globose to irregular, (43-)86-140 x (60-)86-140 µm. Spore wall structure (see murograph, Fig. 3) of three walls (walls 1-3) in one group (group A). Wall 1 a yellow-brown to orange-brown unit wall with a basal thickness of 1-5 µm but thickening up to 12 µm in other regions to produce circular to irregular blister-like areas (up to 38 µm across) on the outer surface (Figs. 1B, E-G, 2A,D). Wall 2 pale yellow to yellow-brown, laminated, 3-10 µm thick (Fig. 1E-F). Wall 3 a thin, hyaline, membranous wall (<1 µm thick) which often is adherent to wall 2 (Fig. 1F), but sometimes separates (Fig. 1C-D). Subtending hypha straight or recurved, pale yellow to yellow-brown, continuous with wall 2, 6-12 µm diam at the spore base with walls 0.5-1 µm thick distally. Wall of subtending hypha sometimes slightly thickened at the junction with the spore, but not usually. Wall 1 sometimes continuing distally for up to 37 µm along the subtending hypha. Pore closed by ingrowth of wall 2.

ETYMOLOGY

Latin - pustulatus = having pustules; referring to the blister-like structures (pustules) on the surface of the outer spore wall.

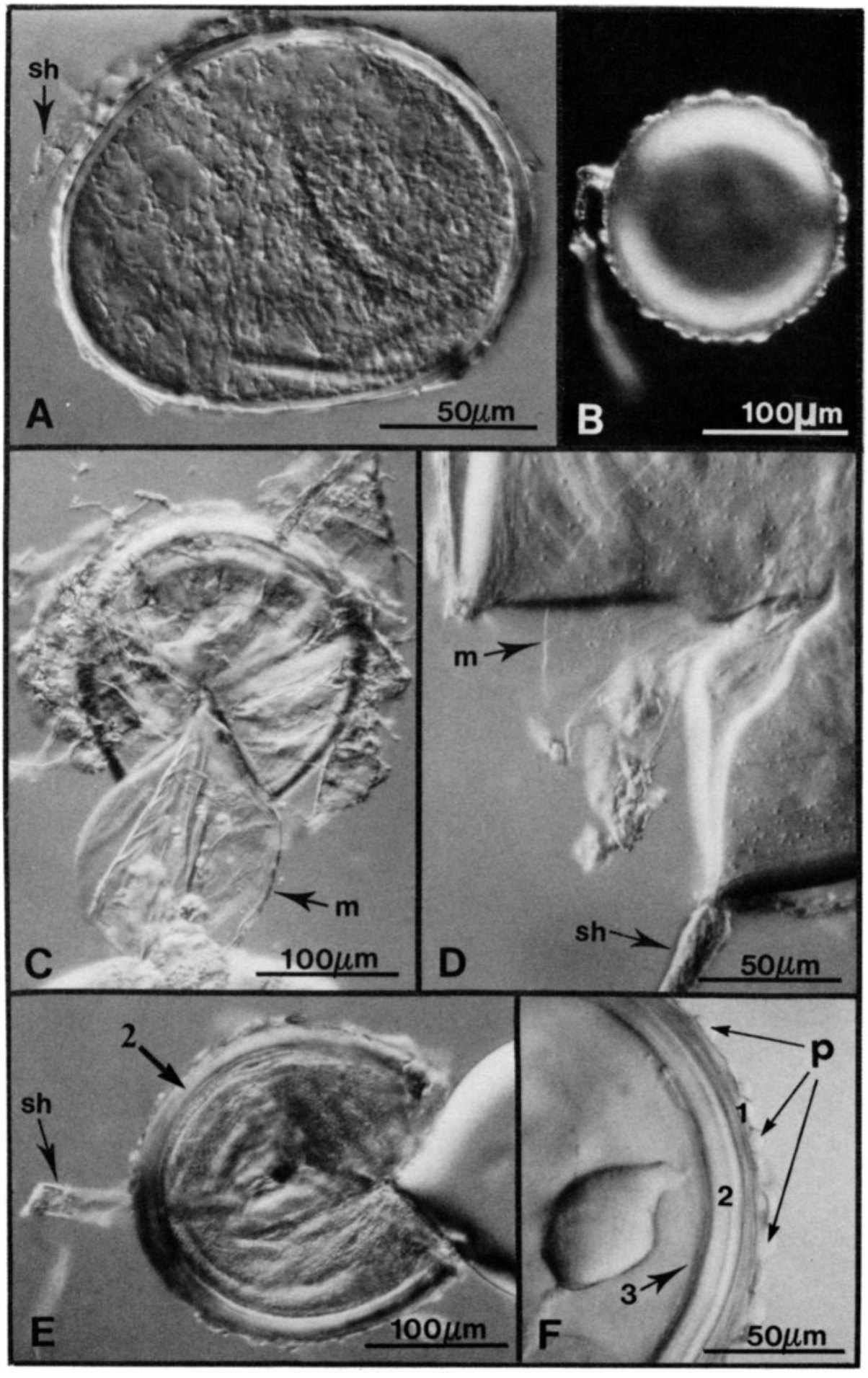
DISTRIBUTION AND HABITAT

The species is known from sand dunes in Rhode Island, U.S.A., and from sandy seashores in Quebec, Canada.

MYCORRHIZAL ASSOCIATIONS

Associated with Ammophila breviligulata and Honkenya peploides. The fungus formed mycorrhizae with vesicles and arbuscules in pot culture with Lathyrus maritimus (Figs. 2B, C,E).

Fig. 1. Glomus pustulatum. A. Whole spore with thin-walled subtending hypha ("sh"). B. Whole spore photographed with dark field optics. Note pustules on outer surface. C. Crushed spore with membranous inner wall extruded. D. Crushed spore illustrating membranous wall ("m") and subtending hypha ("sh"). E. Crushed spore. Note thickness of wall 2. F. Wall structure. Note pustules ("p") of wall 1. Wall 3 is very thin.


sh
A
50µm
B
100µm
C
m
100µm
m
sh
D
50µm
2
sh
E
100µm
p
1
2
3
F
50µm

COLLECTIONS EXAMINED: TYPE: U.S.A., - Rhode Island, Washington Co., Moonstone Beach, in the root zone of A. breviligulata, 11 Jan. 1983 (Walker 1064, Friese 33) OSC, ISOTYPES: FH, K. PARATYPES: CANADA, Québec - Baie-Trinité, Pointe-a-Poulin, in root zones of H. peploides (Dalpé 906, DAOM 193799) and L. maritimus (Dalpé 911, 916, DAOM 193801, 193802) 10 Aug. 1984.

DISCUSSION

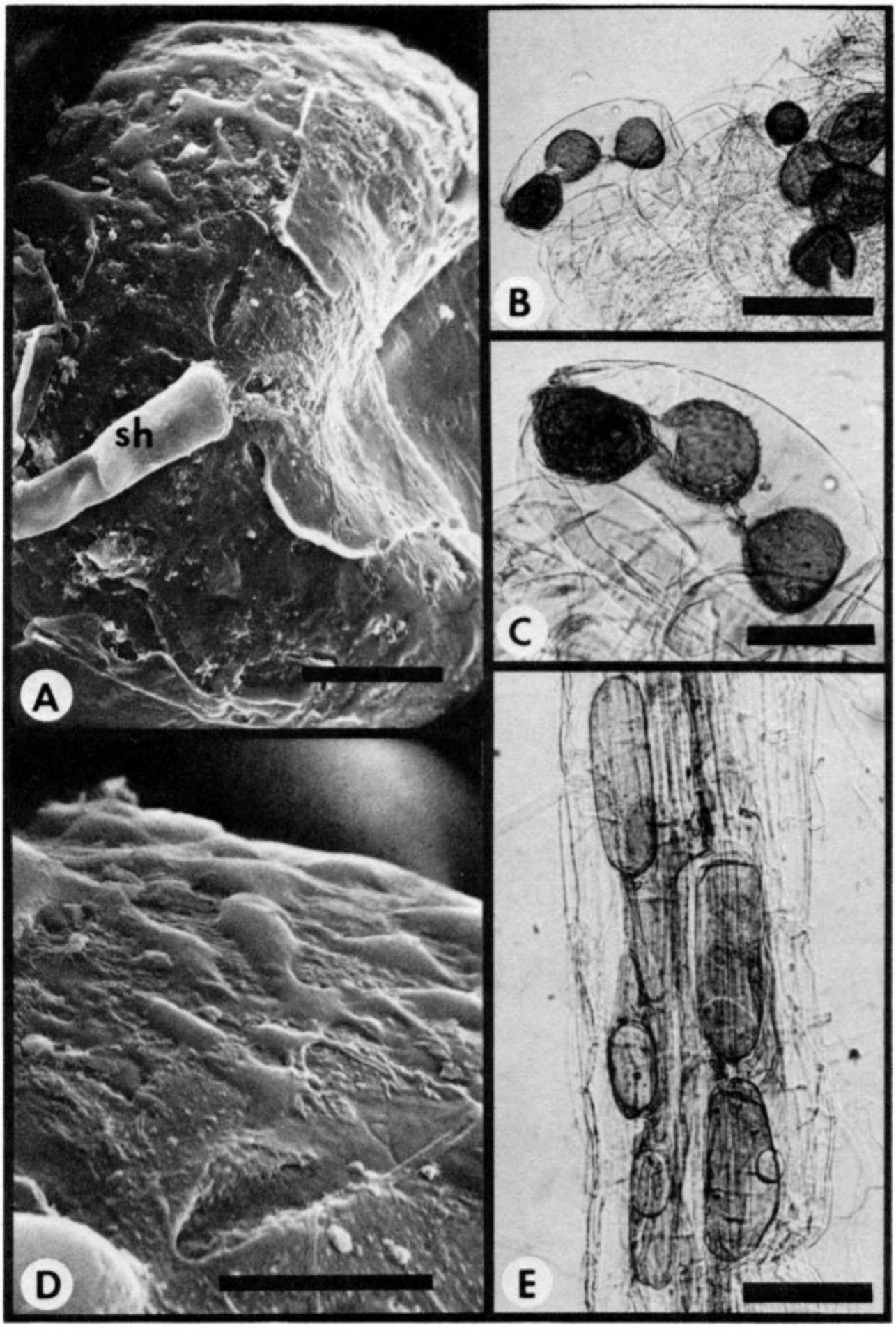
Glomus pustulatum is characterized by the numerous blister-like thickenings on the outermost spore wall (wall 1). These thickenings have the appearance of oil droplets when viewed through a compound microscope. They are not fatty, however, since they remain unstained in Sudan IV. The blister-like areas are circular to irregular in outline, when viewed from directly above but dome shaped in side view (Fig. 1F). The laminations in wall 2 are particularly noticeable in many specimens. Laminae are loose, often separating partially in crushed spores. The innermost laminations are palest in color and may appear almost hyaline. The outer laminations usually are darkest, becoming yellow-brown in some specimens. The membranous wall may be difficult to observe when it is adherent to wall 2, but even under these circumstances, it normally wrinkles a little in the mounting medium. Both the membranous wall and the pustules of wall 1 disappeared almost completely when fresh spores were mounted in 10% KOH or 85% latic acid.

Small spores (48-73 x 60-106 µm) were observed inside nodular tissue of Lathyrus (Figs. 2B,C). Cells in nodules containing spores lacked contents and appeared dead.

Spores of G. pustulatum are similar to young spores of G. etunicatum Becker & Gerd. in color and size (Becker and Gerdemann, 1977). Both species possess an obvious hyaline outer wall, sometimes with a roughened appearance. In G. etunicatum, however, the roughening occurs as this evanescent wall is sloughed, whereas wall 1 of G. pustulatum is a unit wall that remains intact. In addition, wall 1 of G. pustulatum is distinctive, consistently possess the pustules

The outer two walls of G. gerdemannii Rose, Daniels & Trappe flake away as amorphous pieces as spores mature.

Fig.2. Glomus pustulatum. A. Whole spore showing pustulate surface and subtending hypha ("sh") (S.E.M.), scale bar = 20 µm. B, C. Spores in nodules of 6 mo-old Lathyrus maritimus pot culture, scale bar = 200 µm (B), - 100 µm (C). D. Pustulate surface of spores (S.E.M.), scale bar - 10 µm. E. Vesicles in pot cultured L. maritimus, scale bar = 100 µm.


sh
A
B
C
D
E

Some of these flakes are thin and plate-like, and superficially resemble the projections on spores of G. pustulatum. However, the flakes of G. gerdemannii have jagged edges and are angular rather than smooth and rounded. Some spores of G. clarum Nicol. & Schenck may possess a thin outer wall that can develop cerebriform folds up to 9 µm high (Nicolson & Schenck 1979). The projections on G. pustulatum spores differ from such folds in that they do not arise as wrinkles of the outer wall as it breaks down, but are discrete and permanent.

Despite similarities in the morphology of their outer spore walls, G. gerdemannii and G. clarum are easily separated from G. pustulatum. Spores of the former have a more complex inner wall structure and are large. Spores of the latter never become as dark as those of G. pustulatum and do not have brown or orange as a color component.

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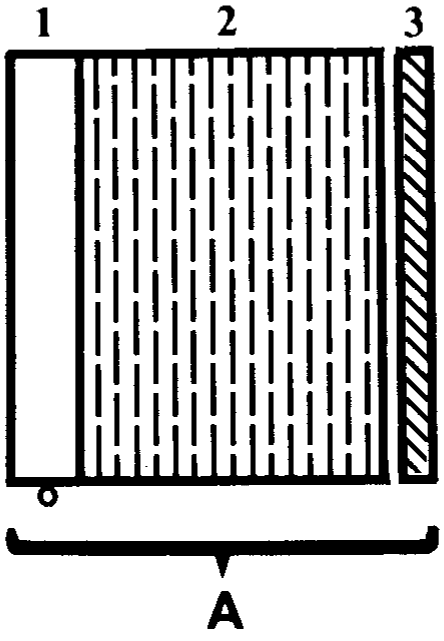

Fig. 3. Murograph of spore wall structure of Glomus pustulatum. See text for explanation. "o" = ornamented (pustules).

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