

TULOSTOMA PSEUDOPULCHELLUM SP. NOV. (*TULOSTOMATALES*,
GASTEROMYCETES) AND ALLIED SPECIES

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Abstract: *Tulostoma pseudopulchellum* sp. nov. is fully described and compared with *T. pulchellum* Sacc., *T. poculatum* White and *T. minutum* White. *T. hollosii* Moravec is made a synonym of *T. subfuscum* White, and the new combination *T. pulchellum* var. *subfuscum* (White) is proposed. Macro- and microscopic features are illustrated with photographs.

Key words: Taxonomy, chorology, *Tulostoma pseudopulchellum*,
T. pulchellum, *T. subfuscum*, *T. hollosii*, *T. poculatum*, *T. minutum*,
Gasteromycetes.

Tulostoma is a very attractive genus of *Gasteromycetes* since its more than 100 species distributed throughout most of the world, presents a great taxonomic complexity. All efforts to elucidate this problem are specially interesting. In this regard, WRIGHT'S (1987) monograph paved the way for future studies.

The present paper is included in the line of research that the authors are currently pursuing, viz. the comparative study of the species of *Tulostoma* from the chalky-gypsum communities of Madrid (Spain) with those fruiting in desertic and semidesertic zones of Baja California (Mexico). The studies concerning Mexico have been published by MORENO et al. (1991), and those corresponding to Spain begin with this contribution.

MATERIAL AND METHODS

The material of *T. pseudopulchellum* studied is deposited in the Herbarium of the Departamento de Biología Vegetal (Botánica), Universidad de Alcalá de Henares, Spain (AH); the remaining collections are from the Herbarium of the National Museum, Prague, Czechoslovakia (PRM), from the Universidad de Baja California, Mexico (BCMEX), from the University of Tel-Aviv, Israel (TELA), and from the New York Botanical Garden, U.S.A. (NY).

Photomicrographs of spores were made with a Zeiss-DSM 950 S.E.M., and those of the capillitia with a Labophot Nikon photomicroscope. The procedure followed for the preparation of samples has been described by MORENO et al. (loc. cit.).

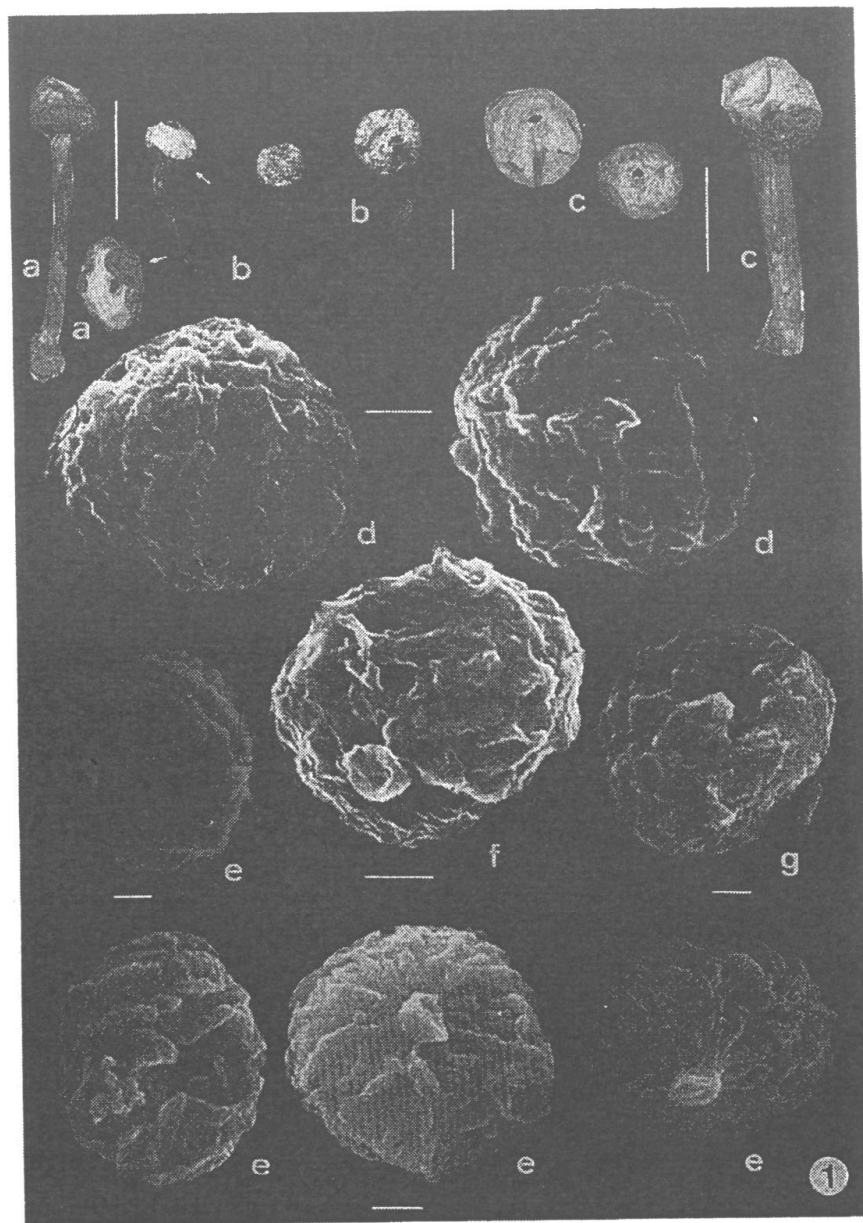


Fig. 1. *Tulostoma pseudopulchellum*; fruit-bodies and spores (a, AH 11975; b, AH 11603; c, f, AH 11699; d, AH 11822; e, AH 11605 -holotypus-; g, AH 13106).

Tulostoma pseudopulchellum Moreno, Altés & Wright sp. nov.

(Figs. 1-13)

Material studied: España; Finca La Oruga, Alcalá de Henares, Madrid, in loamy gypsum soil with *Stipa tenacissima*, 15-X-1986, leg. C. Illana, AH 11644; *ibid.*, 21-X-1987, leg. G. Moreno, C. Illana, M. Heykoop & F. Esteve, AH 12956; near Cerro Malvecino, Alcalá de Henares, in loamy gypsum soil with *Salsola vermiculata* and *Kochia prostrata*, 2-XI-1986, leg. M. Heykoop, AH 12957; *ibid.*, III-1989, AH 11603 and 11605 (holotypus); *ibid.*, 3-XI-1989, leg. G. Moreno, J. L. Manjón & A. Altés, AH 11699, 11703 and 11758; *ibid.*, 5-XII-1989, leg. A. Altés, J. L. Manjón & G. Moreno, AH 11749, 11821 and 11822; *ibid.*, 2-II-1990, leg. G. Moreno & A. Altés, AH 11965, 11968, 11975 and 11977; *ibid.*, 1-III-1991, leg. Dpto. de Botánica (Univ. Alcalá), AH 13106, 13107 and 13108.

Sacculo sporifero 5-10 mm diam., globoso vel subgloboso. Exoperidio valde membranoso, in squamulis secedentes, ad basim persistentes. Endoperidio laevi, albo. Ore fimbriato, haud prominente. Collo inconspicuo. Gleba ferruginea. Stipite (11-)14-20(-25) x 1.5-2.5(-3) mm, albo cremeo vel dilute brunneo, fibroso, longitudinaliter sulcato, basis cylindracea vel leniter bulbosa.

Sporis globosis, 4-5.7(-6.2) µm diam., flavis, sublaevis vel parce verrucosis sub lente; sub microscopio electronico collapsantes, foedentibus, sculptura indefinita, superficie rugosa verrucis interdum sejunctis, cristis irregularis efformantibus. Capillitio hyalino vel flavo, usque ad 5.5 µm diam., parietibus tenui vel crassitunicatis, leviter incrassatis ad septis brunneis usque 7 µm diam.

Holotypus: Cerro Malvecino, Alcalá de Henares, Madrid, Spain, in AH 11605 conservatus est.

Paratypus in MA-fungi et BAFC.

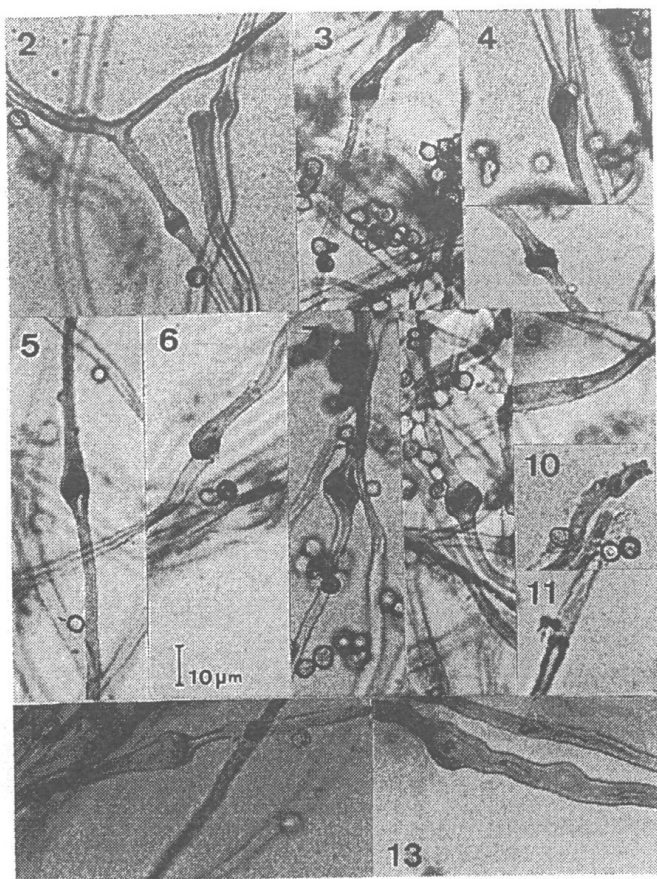
Spore-sac globose to subglobose, 5-10 mm diam. Exoperidium distinctly membranous covered by a layer of soil, whitish to greyish, sloughing off in patches of variable size, persisting in the lower third. Endoperidium smooth, white to dirty white, often soiled by clay particles. Mouth fimbriate, not conspicuous. Socket obscured by the soil that covers it. Gleba ferruginous. Stipe (11-)14-20(-25) x 1.5-2.5(-3) mm, whitish cream to light brown, fibrous, longitudinally sulcate, with a cylindric or only very slightly bulbous base.

Spores globose, 4-5.7(-6.2) µm diam., yellowish, subsmooth or only very slightly verrucose when viewed under the L.M.; under S.E.M. they appear ugly through collapsation and by exhibiting an indistinct, usually wrinkled surface which may appear at times covered by some plates; however, more or less independent verrucae may occasionally be seen, as well as very irregularly arranged cristae. Capillitium hyaline to slightly yellowish, up to 5.5 µm diam., walls of varied thickness, branched, with brownish slightly thickened septa, which may reach 7 µm broad. Endoperidium formed by hyphae similar to those of the capillitium, 1.5-4.5 µm diam., not much broadened at the uncolored septa.

Remarks: *T. pseudopulchellum* is characterized by a correlation of features such as its small size, practically plane fimbriate mouth,

stem hardly bulbous at the base, spores with an ill-defined ornamentation under S.E.M. as seen in all the collections studied in different stages of development, and the habit among steppe hills with loam-clayish soil with some gypsum, growing somewhat isolated together with *Chenopodiaceae* (mainly *Salsola vermiculata* and *Kochia prostrata*).

It is close to *T. pulchellum* which it resembles macroscopically to the point of confusing it with that species on first sight; they differ, however, by *T. pulchellum* exhibiting a distinct and well delimited, mammosc mouth, stem frequently enlarged towards the base, and spores with a well defined and very characteristic spore ornamentation under S.E.M., formed by wide and plane verrucae (fig.14).



Figs.2-13, *Tulostoma pseudopulchellum*; capillitium, capillitial septa and spores (2-8, AH 11605 -holotypus-; 9-11, AH 11603; 12-13, AH 11758).

In addition, we have compared the proposed species with the types of *T. poculatum* and *T. minutum* (fig.14c,d). The result shows that they are very similar to *T. pulchellum* regarding their main features, and so they are considered synonymous with the latter. This has been already pointed out in WRIGHT (loc.cit.). The type of *T. poculatum* belongs to the collection Bates 462, Long Pine, Nebraska, U.S.A., as it was published in WHITE (1901). We must remark that this type collection consists of 8½ fruit bodies and one of them belongs to *T. striatum* indeed; the rest of the fruit bodies fit the original description (WHITE, loc.cit.).

Regarding *T. hollosii* Moravec, on the basis of the study of the holotype (WRIGHT, 1987) as well as other collections at PRM, it exhibits macroscopic features coincident with those of *T. pulchellum* and *T. subfuscum* White. Under S.E.M., the spore ornamentation of *T. hollosii* has narrower and not so flat verrucae as in *T. pulchellum* but rather more prominent and forming frequent cristae of variable length (fig.15c). This type of spore ornamentation is similar to that observed in some collections of *T. subfuscum* studied from Israel and Mexico (figs.15d,e). However, WRIGHT (loc.cit.; pl.XVII.5) has observed spores with an ornamentation intermediate between *T. subfuscum* and *T. pulchellum* with flattened verrucae and cristae. We have not observed any important differences in the capillitia.

For these reasons we believe it is best to treat *T. hollosii* as a synonym of *T. subfuscum*, and the latter as a mere variety of *T. pulchellum*, possibility which was pointed out by WRIGHT (loc.cit.). In a previous paper, MORENO et al. (loc.cit.) admitted a wider concept of *T. pulchellum*, with greater variability of spore ornamentation.

In short, the taxonomic conclusions concerning *T. hollosii* and *T. subfuscum* are as follows:

- 1.- *Tulostoma pulchellum* Sacc., Bull.Soc.Mycol.France 5:118, tab.XIV, fig.4 (1889).
- 2.- *Tulostoma pulchellum* Sacc. var. *subfuscum* (White) Wright, Moreno & Altés comb.nov.
= *T. subfuscum* White, Bull.Torrey bot.Cl. 28(8):433, pl.34, figs.10-12 (1901).
= *T. hollosii* Moravec, Preslia 28:36-37 (1956).

Material studied: EUROPE, Czechoslovakia; Záhorí, Malacky, *T. pulchellum* var. *subfuscum* PRM 583339 (as *T. hollosii*), NORTH AMERICA, Mexico; Baja California, *T. pulchellum* BCMEX 1794 and 1802; *ibid.*, *T. pulchellum* var. *subfuscum* AH 12967 (as *T. pulchellum*), U.S.A.; Nebraska, Long Pine, *T. poculatum* Herb.Bates 462 (NY); Colorado, *T. minutum* NY, ASIA, Israel; Ramat Hasharon, *T. pulchellum* var. *subfuscum* TELA 77g38 (as *T. subfuscum*); Rehovot, *T. pulchellum* var. *subfuscum* BAFC ex LG (as *T. pulchellum*).

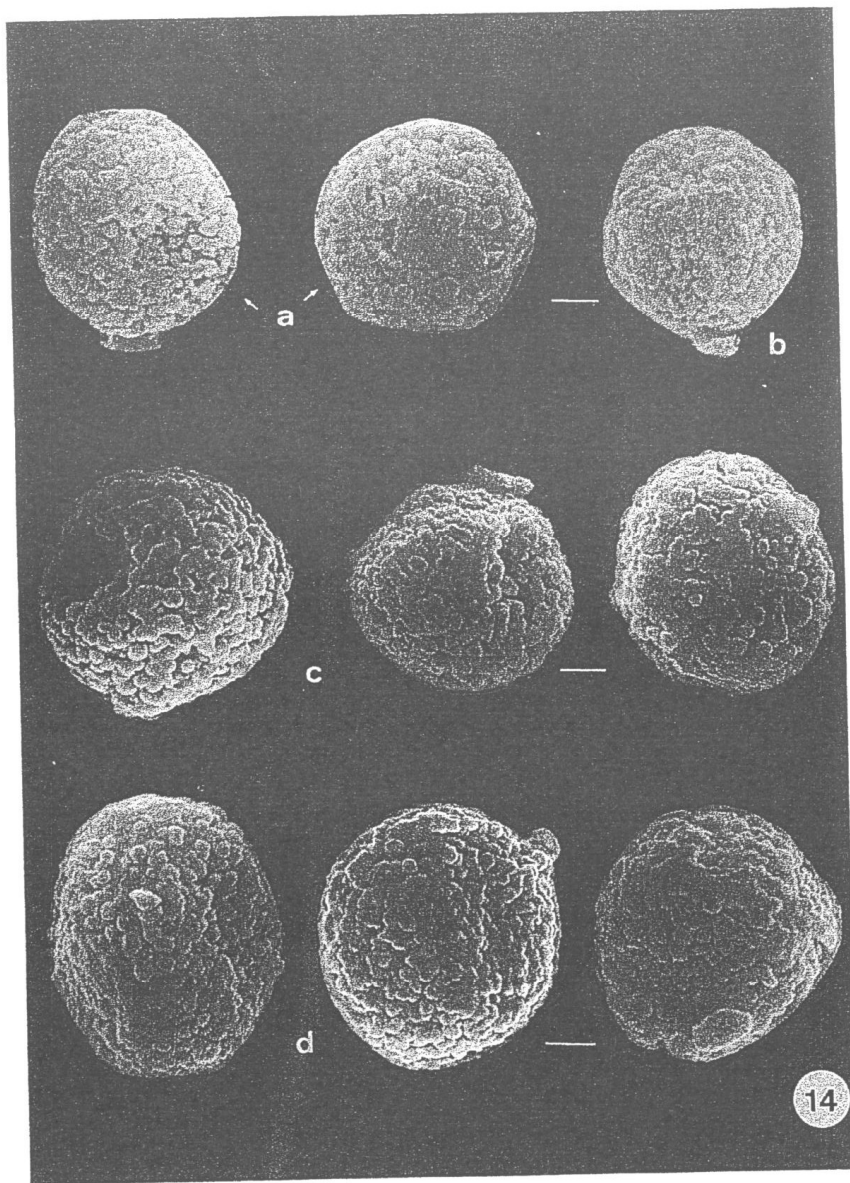


Fig.14. *Tulostoma pulchellum*; spores (a, BCMEX 1794; b, BCMEX 1802; c, Herb.Bates 462 [NY] -typus of *T.poculatum*; d, NY -typus of *T.minutum*).

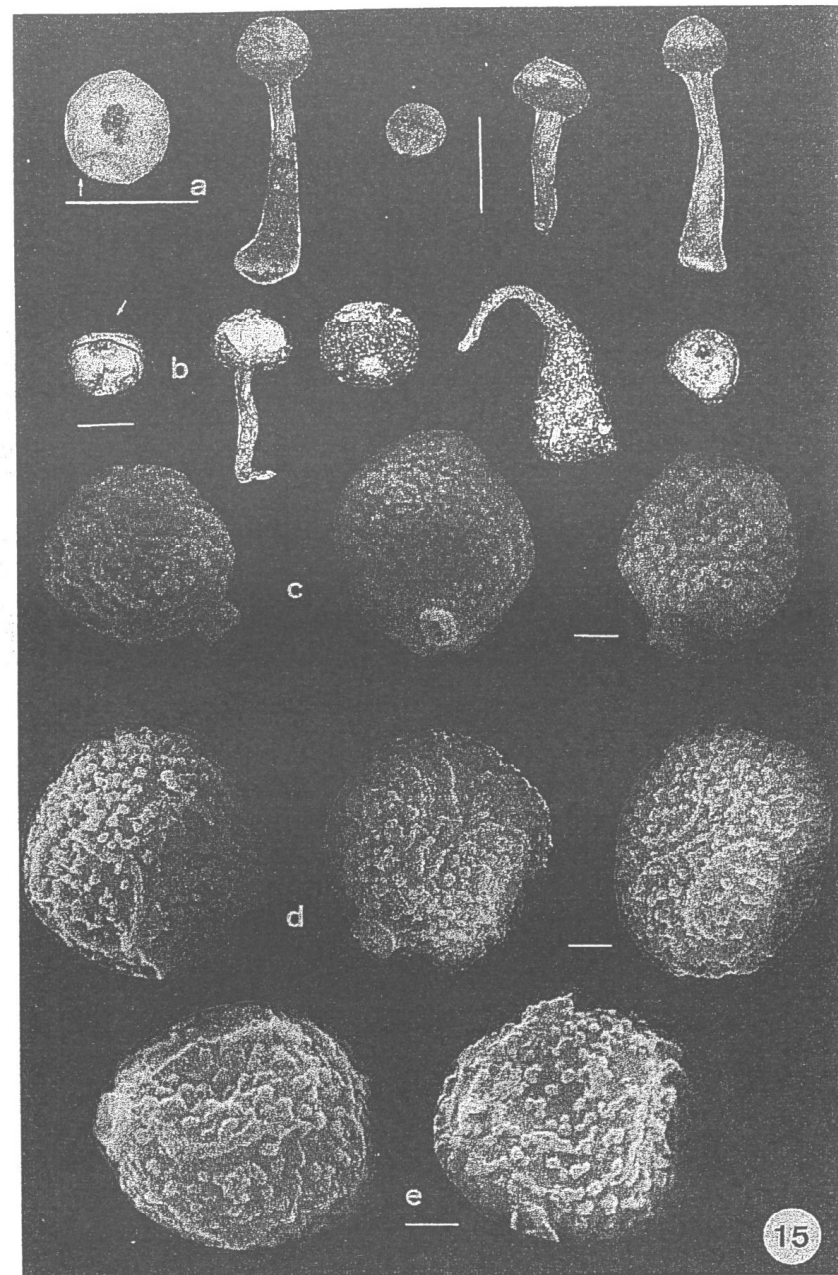


Fig.15. *Tulostoma pulchellum* var. *subfuscum*; fruit-bodies and spores (a,c, PRM 583339 as *T.hollosii*; b,e, AH 12967 as *T.pulchellum*; d, TELA 77g38 as *T.subfuscum*).

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LITERATURE

- Moreno, G., A. Altés, C. Ochoa, N. Ayala & J. E. Wright (1991). The genus *Tulostoma* in Baja California, Mexico. *Mycologia* (in press).
- White, V. S. (1901). The *Tylostomaceae* of North America. *Bull. Torrey Bot. Club* 28: 421-444.
- Wright, J. E. (1987). *The genus Tulostoma (Gasteromycetes). A world monograph.* Biblioth. Mycol. 113, J. Cramer, 338 pp.

