

ANATOMICAL ASPECTS OF SOME HYPOGEOUS FUNGI FROM CATALONIA (NE SPAIN)

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ABSTRACT

During our research on the mycoflora of Catalonia, two species of hypogeous fungi were found as first records in the area surveyed: *Leucogaster tozzianus* (Cav. & Sacc.) Matt. and *Octavianina asterosperma* (Vitt.) O. Kuntze. We have done a macro- and microscopical study of some anatomical features, giving special attention to the peridium and reproductive structures of the species mentioned above. Moreover, a similar study has been done on some other hypogeous fungi which are very infrequent or rare in Catalonia: *Hymenogaster hessei* Soehner, *Hysterangium rickenii* Soehner, *Hysterangium stoloniferum* Tul. var. *rubescens* (Quéf.) Zeller & Dodge and *Wakefieldia macrospora* (Hawker) Hawker.

Key words: *Gasteromycetes*, hypogeous, Catalonia.

Introduction

Six hypogeous *Basidiomycotina* have been studied, including the type material of *Leucogaster tozzianus* (Cav. & Sacc.) Matt.

All the species have been adequately described by different authors, but in this occasion, we want to compare our own observations with theirs, mainly referred to the development of basidia, the development of spores and the morphology of the peridium. The species studied are: *Hymenogaster hessei* Soehner, *Hysterangium rickenii* Soehner, *Hysterangium stoloniferum* Tul. var. *rubescens* (Quéf.) Zeller & Dodge, *Leucogaster tozzianus* (Cav. & Sacc.) Matt., *Octavianina asterosperma* (Vitt.) O. Kuntze and *Wakefieldia macrospora* (Hawker) Hawker.

These species are classified according to JÜLICH (1989), and have been arranged taxonomically here.

The material examined has been deposited in the University of Barcelona Herbarium (BCC).

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Hymenogastrales Cunn. 1944

Hymenogastraceae Vitt. 1831

***Hymenogaster hessei* Soehner 1943**

Specimens examined: Under *Fagus sylvatica*, Montseny (Barcelona), leg. M.P. Martín & D. Sierra, October 1990, BCC-MPM 1352.- Collserola, leg. M. Tabarés, March 1992, BCC-MPM 1547.

Previous records: VIDAL (1991) reported this species from Girona.

Remarks: Our material fits SOEHNER'S (1962) description. In agreement with this autor, the ripe spores are dark brown, oval (19-22 × 11-15 µm), with a more or less distinct apiculum, with coarsely wrinkled or almost reticulate perisporium and with a claw-like basal structure (Fig. 1c, fig. 8 a-b). Basidia are club-shaped (30-35 × 5-8 µm), and bisporic (Fig. 1 a-b).

The peridium has three different layers not always easily separable (Fig. 7a). The outer layer (10-20 µm thick) is formed by brown hyphae, the middle (110-130 µm) is pseudoparenchymatous and the inner (20-30 µm) is composed of hyaline hyphae.

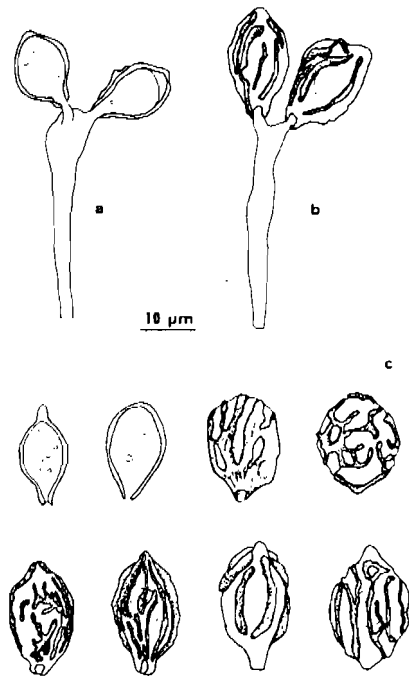


Figure 1. *Hymenogaster hessei* Soehner, BCC-MPM 1547: a, immature basidium; b, mature basidium; c, immature and mature spores showing the ornamentation.

Octavianinaceae Locquin ex Pegler et Young 1979

Octavianina asterosperma (Vitt.) O. Kuntze 1898

Specimen examined: Under *Fagus sylvatica* in Montseny (Barcelona), leg. A. Rocabrana, 27 October 1987, BCC-MPM 794.

Previous records: MORENO & al. (1991) previously recorded this species from Cáceres. CALONGE & PASABAN (1992) reported this species from Navarra.

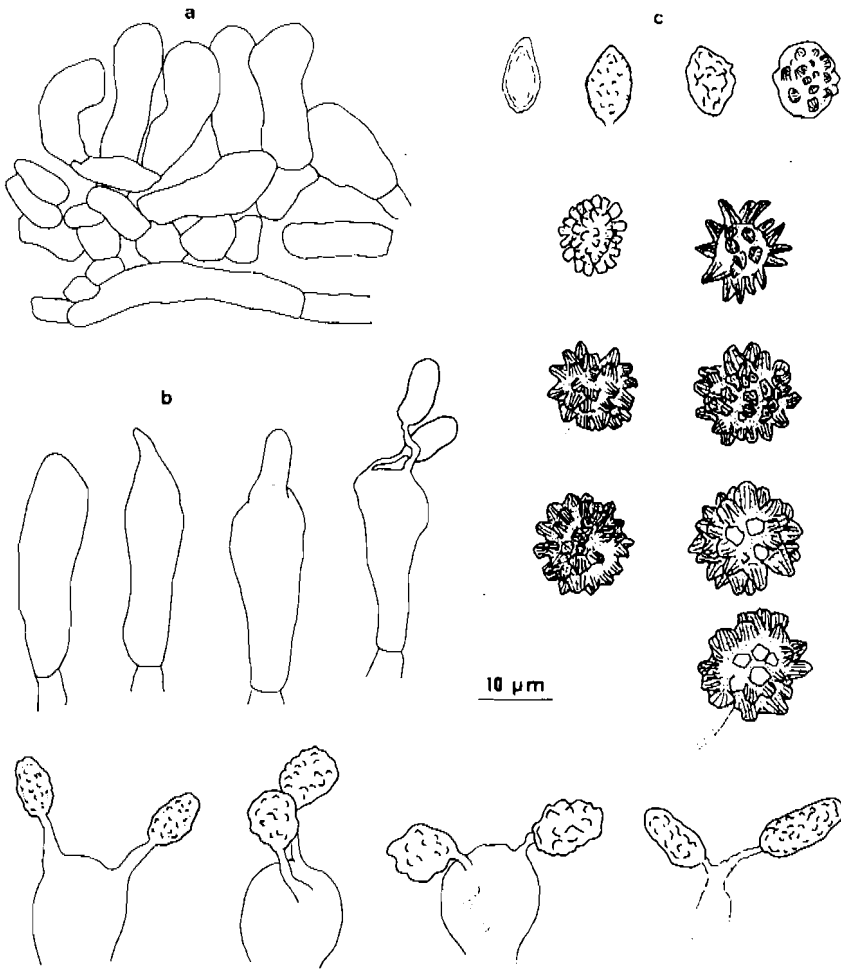


Figure 2. *Octavianina asterosperma* (Vitt.) O. Kuntze, BCC-MPM 794: a, part of the hymenium; b, stages in development of basidia; c, stages in development of the spores.

Remarks: With respect to basidia, we have always seen bisporic ones (Fig. 2b), although according to CORDA (1854), BOUDIER (1905-1910) and LANGE (1956), they can also be tetrasporic.

The young spores are ovate and smooth (LANGE, 1956), but when ripened are globose and ornamented. In the various works we have consulted, the authors' descriptions of spore ornamentation do not agree. In our opinion, this is a result of the diversity of ornamentation that appears during spore development (Fig. 2c). At first, the spores have short, single warts (CORDA, 1854; BOUDIER, 1905-1910; SVRCEK, 1958a). Later, they are strongly echinate-spinose (VELENOVSKY, 1920; LANGE, 1956), and have prominent, pyramidal and acute warts (Fig. 8c), formed as a consequence of the convergence of groups of single spines (MONTECCHI & LAZZARI, 1988; MORENO & al., 1991; CALONGE & PASABAN, 1992). Finally, this fragile ornamentation can easily break, creating obtuse warts, and even cavities (Fig. 8d) on the spore (HAWKER, 1953). Basidia are bisporic (Fig. 8c).

The peridium, which is 100-160 μm thick, is formed by brown hyphae running parallel to the surface (HAWKER, 1953; LANGE, 1956). We disagree with MONTECCHI & LAZZARI (1988), who described the peridium as formed by hyphae and sphaerocysts, instead we found that, between the peridium and the pseudoparenchymatous subhymenial layer, there are hyaline hyphae mixed with short hyphal segments (Fig. 6b), which resemble sphaerocysts (PEGLER & YOUNG, 1979).

Wakefieldia macrospora (Hawker) Hawker 1954

Syn.: *Hymenogaster vacekii* Svrcek 1958

Specimens examined: Under *Quercus* sp., Collserola (Barcelona), leg. M. Tabarés, 1 March 1992, BCC-MPM 1497 and 15 March 1992, BCC-MPM 1556.

Previous records: In Spain, this species has only been reported once (VIDAL, 1991), as *Hymenogaster vacekii* Svrcek.

Remarks: Our material fits well with HAWKER's (1951, 1953) description. The young spores are colourless, subglobose, smooth (PEGLER & YOUNG, 1979) or with short warts (SVRCEK, 1958a, as *Hymenogaster vacekii* Svrcek). The ripe spores are globose (10.5-15 μm), brown, with thick (1-2 μm high), truncate warts (Fig. 3c, fig. 8 f-h). Basidia are club-shaped (30-40 \times 10-13 μm), bisporic (Fig. 3b).

The peridium is not easily separable from the gleba and is formed by hyaline, septate hyphae which do not present clamp connections (Fig. 6a). According to DE VRIES (1988), the peridium hyphae present clamp connections. Therefore, this taxon would be included in the *Hydnangiaceae*. At this moment, until more material is available to confirm the presence or

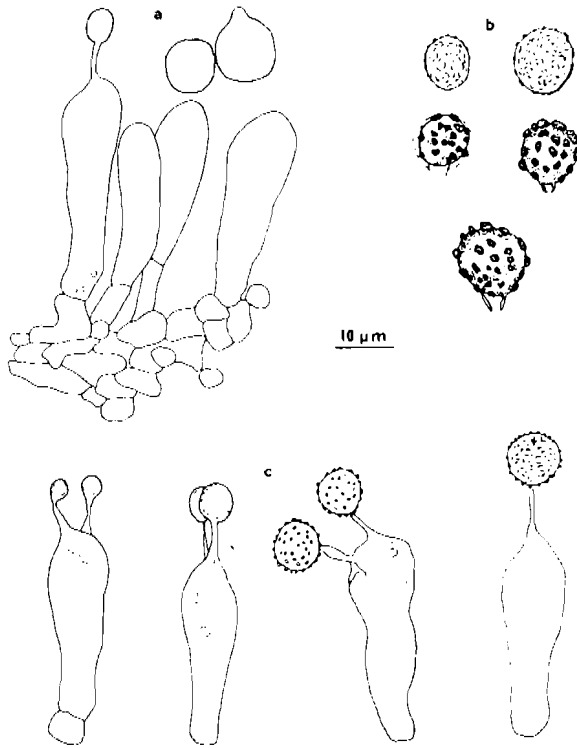


Figure 3. *Wakefieldia macrospora* (Hawker) Hawker, BCC-MPM 1556: a, part of the hymenium; b, spores; c, stages in development of the basidia.

absence of clamp connections, we follow PEGLER & YOUNG (1979), who place *Wakefieldia macrospora* in *Octavianinaceae*.

Hysterangiales Zeller 1943

Hysterangiaceae E. Fischer 1899

***Hysterangium rickenii* Soehner 1921**

Specimen examined: Under *Quercus ilex*, Sant Gervasi, Collserola (Barcelona), leg. M. Tabarés, 27 March 1992, BCC-MPM 1499.

Previous records: This taxon has been found in Alfaguara, Granada (MORENO & al., 1986) and in the province of Girona (VIDAL, 1991), where it is quite frequent.

Remarks: Spores are yellowish, ellipsoid-fusoid ($16-18 \times 6-7 \mu\text{m}$), shortly pedicellate, with rounded or sometimes pointed apices; the young spore has

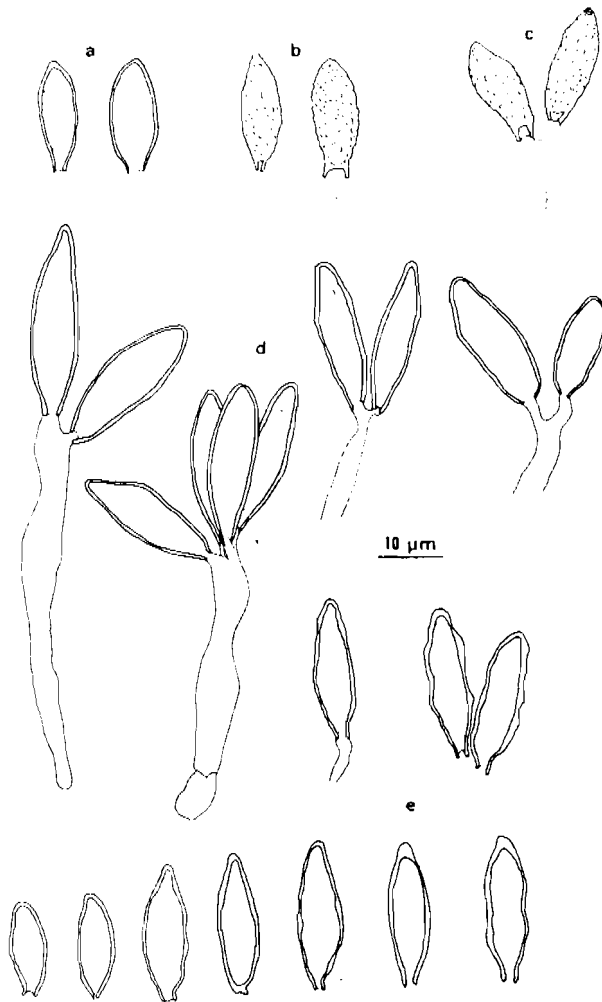


Figure 4. *Hysterangium rickenii* Soehner, BCC-MPM 1499 (a-c): a, immature spores; b, mature spores; c, basidium.- *Hysterangium stoloniferum* Tul. var. *rubescens* (Qué.) Zeller & Dodge, BCC-MPM 1500 (d-c): d, basidia; e, stages in development of the spores.

a smooth perisporium (Fig. 4a, fig. 9a), but then it becomes rugose, giving to the spore a thick and dense verrucose ornamentation (Fig. 4b, fig. 9b). According to MALEÑON (1975), who studied the type material and other samples of Soehner, the spores are minutely asperulate. Basidia are bisporic (Fig. 4c).

We have observed a brown-coloured prosenchymatous peridium (100-200 µm thick), which is formed by interwoven hyphae.

Hysterangium stoloniferum Tul. var. **rubescens** (Quél.) Zeller & Dodge 1929

Specimens examined: Under *Quercus ilex* in Collserola (Barcelona), leg. M. Tabarés, 27 March 1992, BCC-MPM 1500.- Under *Quercus cerrioides* in Sant Just Desvern (Barcelona), leg. J. Llistosella, 13 May 1992, BCC-MPM 1501.

Previous records: This species has been cited from Cáceres and Córdoba (MORENO & al., 1991) and from Girona (VIDAL, 1991).

Remarks: In agreement with MORENO & al. (1991), spores are yellowish, ellipsoid-fusoid ($19-22 \times 6-8 \mu\text{m}$), shortly pedicellate at the base ($2-3 \mu\text{m}$), without apiculum and with a rugose perisporium (Fig. 4e, fig. 9 c-d). Neither these authors nor SVRCEK (1958a) described the basidium, which is club-shaped ($30-50 \times 5-6 \mu\text{m}$), bisporic or tetrasporic, with a short sterigmata $5 \mu\text{m}$ high (Fig. 4d).

The peridium is mainly pseudoparenchymatous ($200-300 \mu\text{m}$ thick), with hyaline cells. In contrast, the external cells are collapsed and brownish. There is also a thin layer ($20-30 \mu\text{m}$) of hyaline hyphae between the pseudoparenchyma and the gleba.

Leucogastrales Fogel 1979

Leucogastraceae Moreau ex Fogel 1979

Leucogaster tozzianus (Cav. & Sacc.) Matt. apud Zeller & Dodge 1924

Syn.: *Leucogaster fragans* Matt. 1990

Specimens examined: In a forest of *Fagus sylvatica* and *Betula pendula*, La Salut (Barcelona), leg. M. Tabarés, 9 October 1990, BCC-MPM 1339.- Under *Pinus pinea*, Punta de la Mora (Tarragona), leg. M. P. Martín & D. Sierra, 16 December 1990, BCC-MPM 1502.

Other materials: S.M. Zeller 2577 (Type), Vallombrosa (Italy), coll. et det. O. Mattiolo, sent by O. Mattiolo, Nov. 23, 1989, NY herbarium.- S.M. Zeller 2577 (cotype), Vallombrosa (Italy), coll. et det. O. Mattiolo, sent by O. Mattiolo, Nov. 23, 1989, NY herbarium.- D. Saccardo 1424, *Mycotheca italica* (*Leucogaster fragans* Matt.), Vallombrosa, Firenze (Italy), in abietinis, A. Fiori, Jun. 1904, NY herbarium.

Previous records: According to the available data, this species does not seem frequent in Europe. It has been found in Italy, living under *Picea* or *Pinus* and in Czechoslovakia living under deciduous trees (SVRCEK, 1958b; JÜLICH, 1984). CALONGE & al. (1992) previously recorded this species from Logroño (Spain).

Description: Basidiocarps subspherical, about 1.5-3 cm diam. Peridium with several protuberances (height 1.5-2 mm), ochraceous, thick (130-160 μm), duplex (Fig. 7b). Outer layer (20-30 μm) constituted of ochraceous or brown collapsed hyphae and the inner layer (110-130 μm) pseudoparenchymatous and hyaline. Gleba composed of subglobose or polygonal chambers which are surrounded by the tramal plates and filled with a gelatinous fluid, producing copious exudation of latex when cut. Trama plates are pseudoparenchymatous and hyaline (Fig. 5a). Hymenium collapsed. We have not seen basidia. Spores spherical (10-13 μm) or subspherical (8-11 \times 9.5-13 μm), heavily reticulate and covered with a thick perisporium (to 3 μm) as in figure 5 b-e and figure 9 e-f.

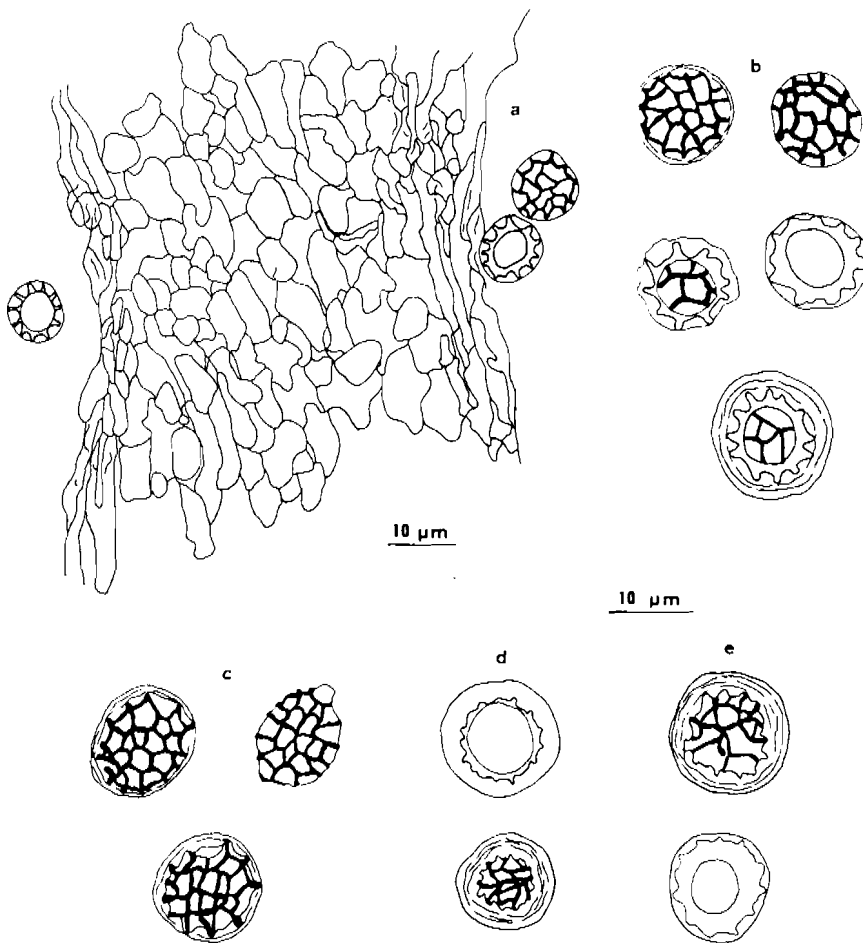


Figure 5. *Leucogaster tozzianus* (Cav. et Sacc.) Matt. apud. Zeller & Dodge: a, part of the gleba BCC-MPM 1339; b, spores BCC-MPM 1339; c, spores BCC-MPM 1502; d, type spores; e, cotype spores.

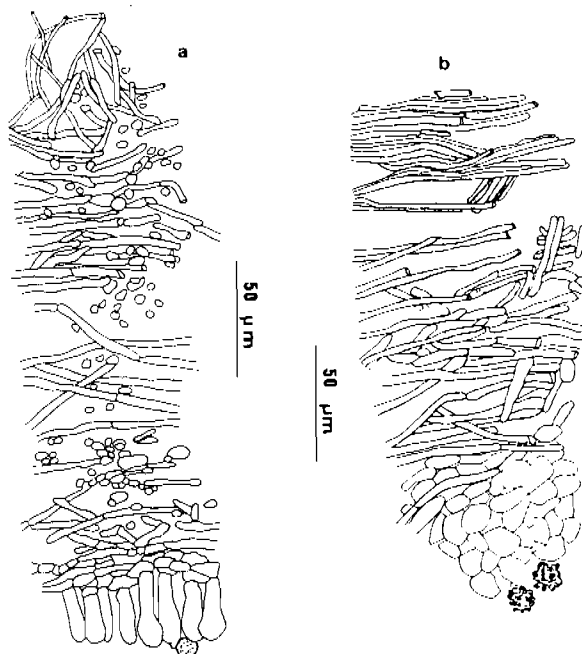


Figure 6. *Wakefieldia macrospora* (Hawker) Hawker, BCC-MPM 1556: a, peridium.-
Octavianina asterosperma (Vitt.) O. Kuntze, BCC-MPM 794: b, peridium.

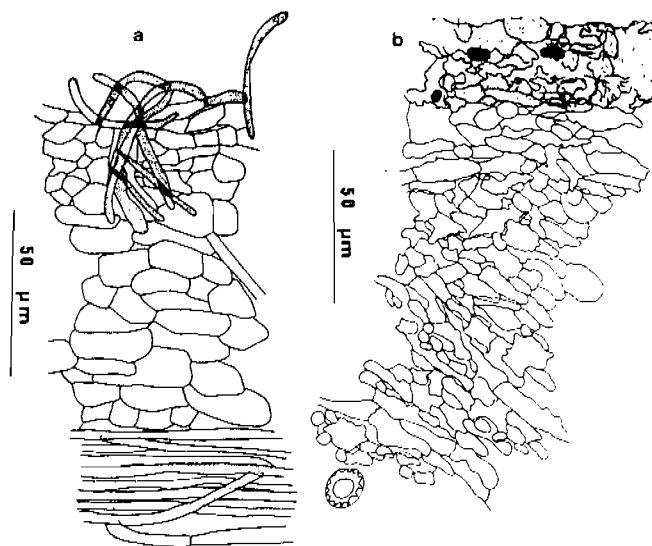


Figure 7. *Hymenogaster hessei* Soehner, BCC-MPM 1547: a, peridium.-
Leucogaster tozzianus (Cav. et Sacc.) Matt. apud. Zeller & Dodge, BCC-MPM 1339: b, peridium.

When first picked, the material did not have a particular odour, but after a few minutes it became pleasant and sweet, like a banana, and gradually changed to a strong smell, like that of an organic solvent.

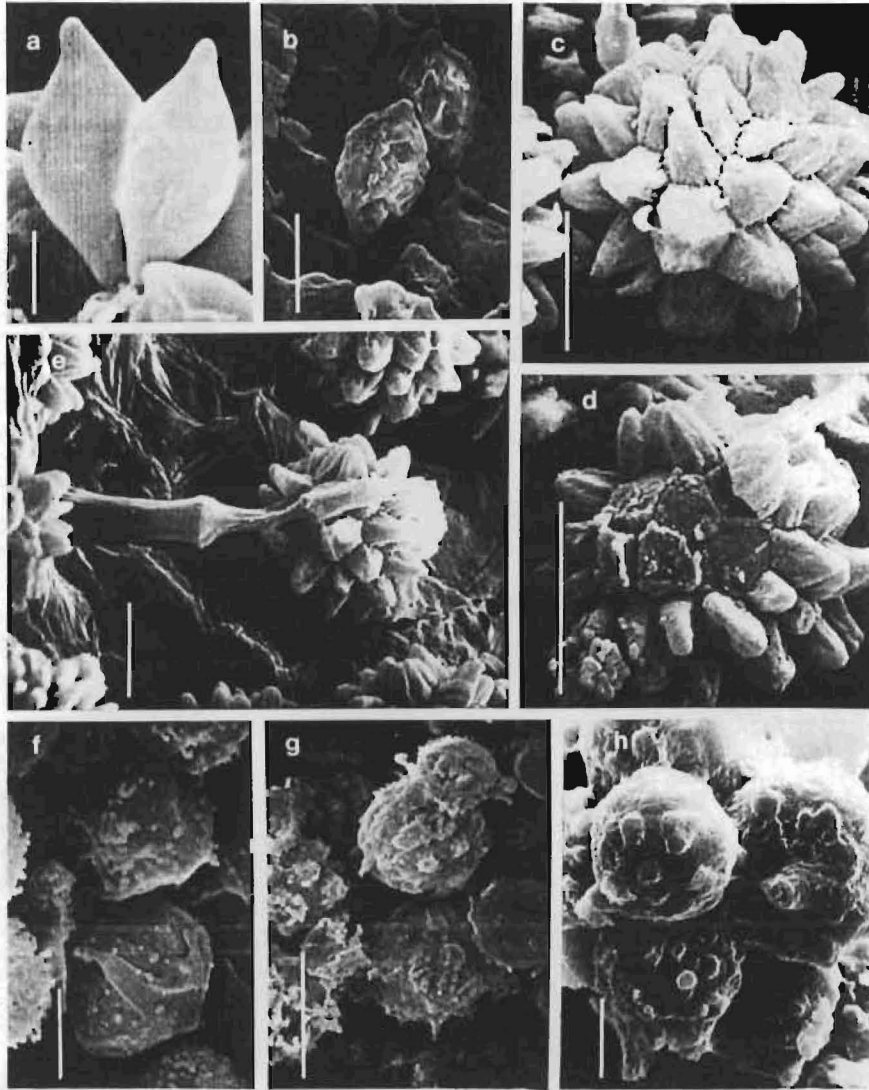


Figure 8. *Hymenogaster hessei* Soehner, BCC-MPM 1547: a, immature spores (bar = 5 μ m); b, mature spores (bar = 10 μ m).- *Octavianina asterosperma* (Vitt.) O. Kuntze, BCC-MPM 794: c, spores (bar = 5 μ m); d, spores (bar = 5 μ m); e, basidium (bar = 5 μ m).- *Wakefieldia macrospora* (Hawker) Hawker, BCC-MPM 1556: f, immature spores ((bar = 5 μ m); g, mature spores (bar = 5 μ m).- *Wakefieldia macrospora* (Hawker) Hawker: h, type spores (bar = 5 μ m).

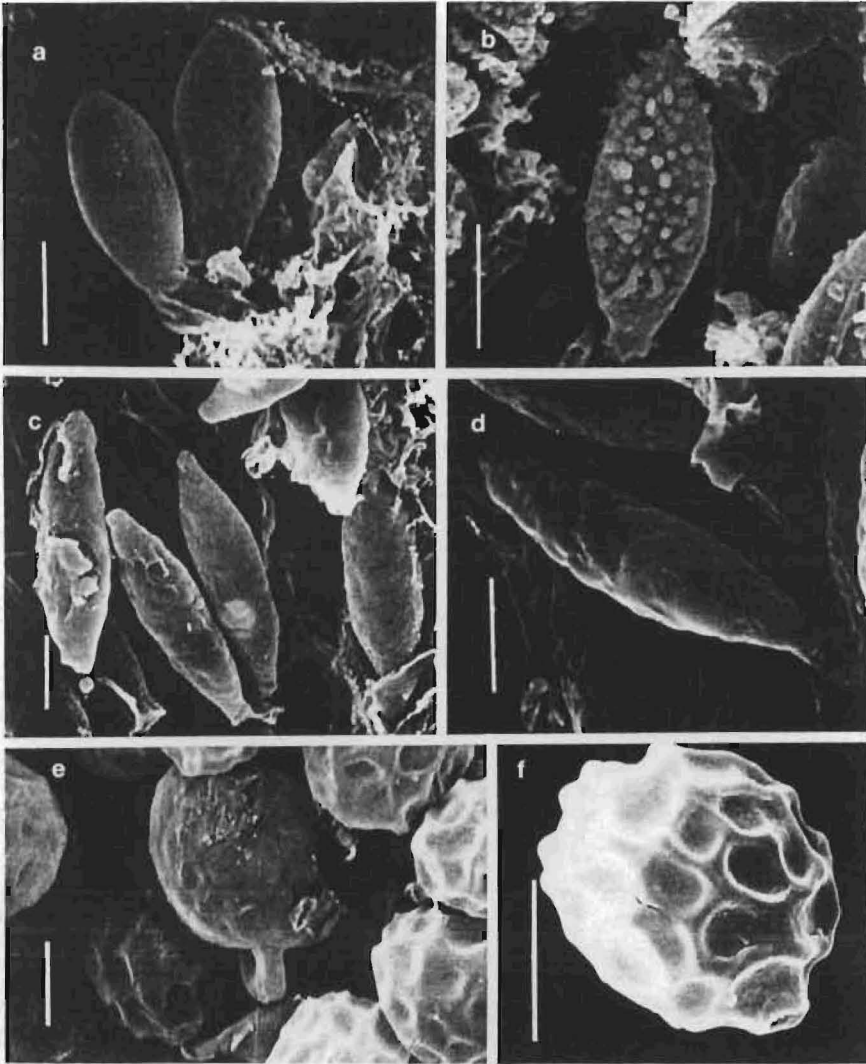


Figure 9. *Hysterangium rickenii* Soehner, BCC-MPM 1499: a, immature spores (bar = 5 μ m); b, mature spores (bar = 5 μ m).- *Hysterangium stoloniferum* Tul. var. *rubescens* (Quél.) Zeller & Dodge, BCC-MPM 1501: c, spores (bar = 5 μ m); d, spores (bar = 5 μ m).- *Leucogaster tozzianus* (Cav. et Sacc.) Matt. apud. Zeller & Dodge, BCC-MPM 1339: e, spores (bar = 5 μ m); f, spores (bar = 5 μ m).

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