

# SEM studies of the Myxomycetes from the Peninsula of Baja California (Mexico), I. *Arcyria* to *Fuligo*

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In two papers, of which this is the first, the authors present a macro- and microscopic study of 45 Myxomycetes collected on the Peninsula of Baja California, Mexico. This part treats 24 species, in alphabetical order, from *Arcyria affinis* Rostaf. to *Fuligo septica* (L.) F. H. Wigg. SEM photographs of spores and capillitial threads are provided. The following taxa are reported as new to Mexico: *Arcyria affinis* Rostaf., *A. minuta* Buchet, *Craterium scyphoides* (Cooke & Balf) Lizárraga, Illana & G. Moreno, and *Dictydiaethalium plumbeum* var. *cinnabarinum* (Berk. & Br.) Shirai & Hara. We propose the following new combination: *Craterium scyphoides* (Cooke & Balf) Lizárraga, Illana & G. Moreno.

**Key words:** Baja California, chorology, Mexico, Myxomycetes, scanning electron microscopy, taxonomy

## INTRODUCTION

The Baja California Peninsula stretches 1 300 km from the northern frontier of Mexico and the United States (32°30'N) to the Cape of San Lucas (22°30'N), separating the Pacific Ocean, to the west, from the Californian Gulf (Sea of Cortes), on the east side of the peninsula. The territory is about 144 000 km<sup>2</sup> and divided into two states: Baja California and Baja California Sur, whose border follows the 28° parallel.

The floristic richness of Baja California has long been known and a recent analysis of its flora (Delgadillo 1992, 1995, Peinado *et al.* 1994) brings the number of native vascular plants to almost 3 000, of which 725 are endemic. The num-

ber of endemic genera increases to 22. The higher floristic richness is concentrated in the small north-western quadrant which has a Mediterranean type climate, in which around 1 322 native vascular plants occur (Raven & Axelrod 1978), 902 of which do not exist elsewhere in the peninsula, and 633 genera, of which 292 do not exist elsewhere in the peninsula. Thus, in this zone, which represents just 17% of the total area of the peninsula, 71% of the genera and almost half the species (44%) can be found. This richness is not surprising since this territory forms part of the Californian phytogeographic region, recognised worldwide as one of the the most floristically rich areas in the world (Raven 1988).

For these reasons we feel that it is important

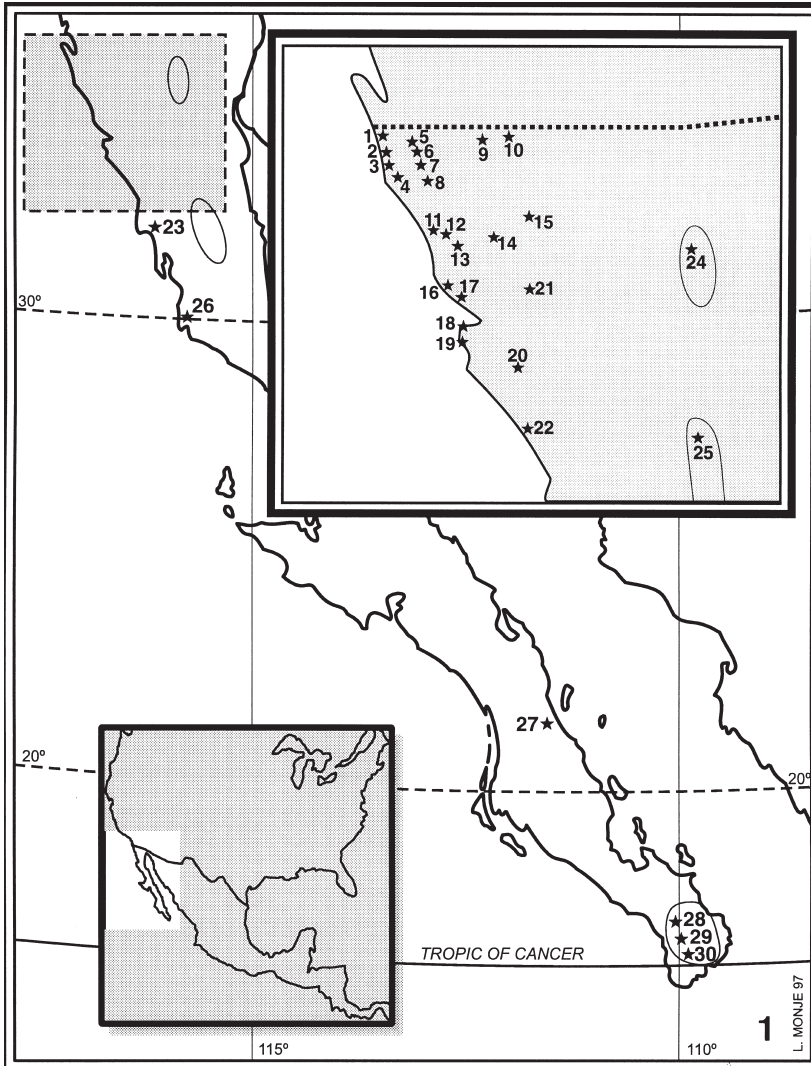


Fig. 1. Distribution map of the collection sites in Baja California.

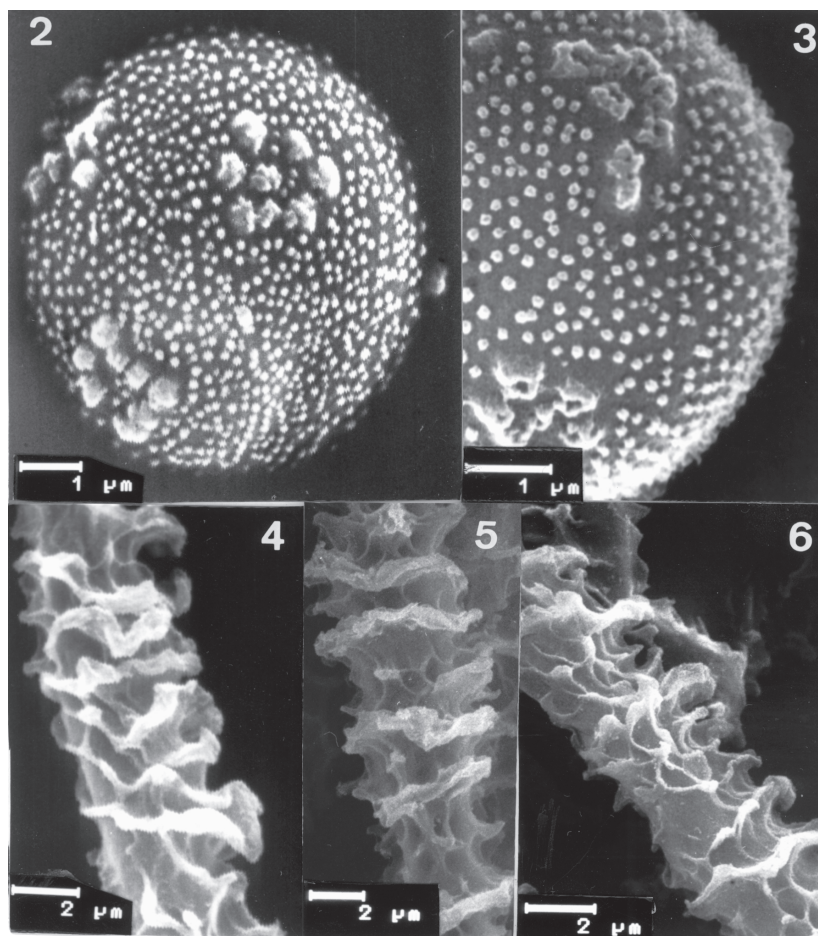
to study the Myxomycete flora of the Baja California peninsula. At the present time 16 taxa of Myxomycetes have been collected in the peninsula by Villarreal (1990), Lizárraga *et al.* (1996, 1997a, 1997b) and Moreno *et al.* (1997).

## MATERIAL AND METHODS

The material studied comes from different places situated on the Baja California peninsula (states of Baja California and Baja California Sur). We have numbered the collection sites, all of which are shown on the map (Fig. 1). The chorology of the species is based mainly on the paper by Ogata *et al.* (1994) and subsequent papers which are noted, where appropriate.

Localities studied of Baja California Peninsula: 1. Tijuana beach–Rosarito toll highway. 2. 14 km of the Tijuana beach–Rosarito toll highway. 3. La Joya, Tijuana. 4. Ejido Mazatlan, Rosarito. 5. Zona Río, Tijuana. 6. Colonia Lomas Taurinas, Tijuana. 7. Colonia Buenavista, Tijuana. 8. La Presa, Tijuana. 9. Cañón Billy, Tecate. 10. Cañada Verde, Tecate–Mexicali road. 11. Las Chichihuas, Ensenada. 12. Santa Rosa, Ensenada. 13. San Antonio de las Minas, Ensenada. 14. San José de la Zorra, Valle de Guadalupe, Ensenada. 15. Ejido Ignacio Zaragoza, 65 km from Tecate–Ensenada road. 16. Garden of the Facultad de Ciencias, Ensenada. 17. Playa Hermosa, Ensenada. 18. Punta Banda, Ensenada. 19. La Bufadora, Ensenada. 20. Ensenada–Santo Tomás Mexico highway 1 (Rancho Las Jacarandas, Cañón de las Ánimas). 21. 24 km of the Ensenada–Ojos Negros road. 22. Cerro Solo, way Erendira–San Vicente, Ensenada. 23. San Telmo stream, San Quintín. 24. Sierra de Juárez, Laguna Hanson. 25. Mikes Sky Ranch, Sierra de San Pedro Mártir.





Figs. 2–6. *Arcyria affinis* Rostaf. (AH 18482). — 2 and 3: Spore and detail of ornamentation. — 4–6: Capillitial threads.

26. Bocana stream, El Rosario. 27. Mexico highway 1 (near Loreto). 28. Sierra de la Laguna (to 28 km of East of San Juan del Aserradero). 29. Sierra de La Laguna, Mesa Verde (La Candelaria). 30. Sierra de la Laguna, San Felipe.

SEM images were prepared using a Zeiss DSM-950 microscope. Spore samples were rehydrated with 100%  $\text{NH}_4\text{OH}$  for 30 minutes, then dehydrated in aqueous ethanol solutions (70%) for 1–1.5 h, before fixation in pure ethylene glycol dimethyl ether (1,2 dimethoxy-methane) and immersion in acetone for at least 2 h. The spores were subsequently critical-point dried, mounted onto an aluminium stub, and coated with gold-palladium in a Polaron E-5000 sputter coater for 12 minutes at 1.4 kV and 18 mA (argon atmosphere), creating a metal coating approximately 500 Å thick. Samples for light microscopy were mounted in Hoyer's medium.

The spore wall ornamentation as seen in the SEM is described according to the terminology proposed by Rameloo (1974, 1975).

The collected specimens are deposited in the Herbarium of the Departamento de Biología Vegetal (Botánica), Universidad de Alcalá, Madrid, Spain (AH) and Herbarium of the Universidad Autónoma de Baja California, Ensenada,

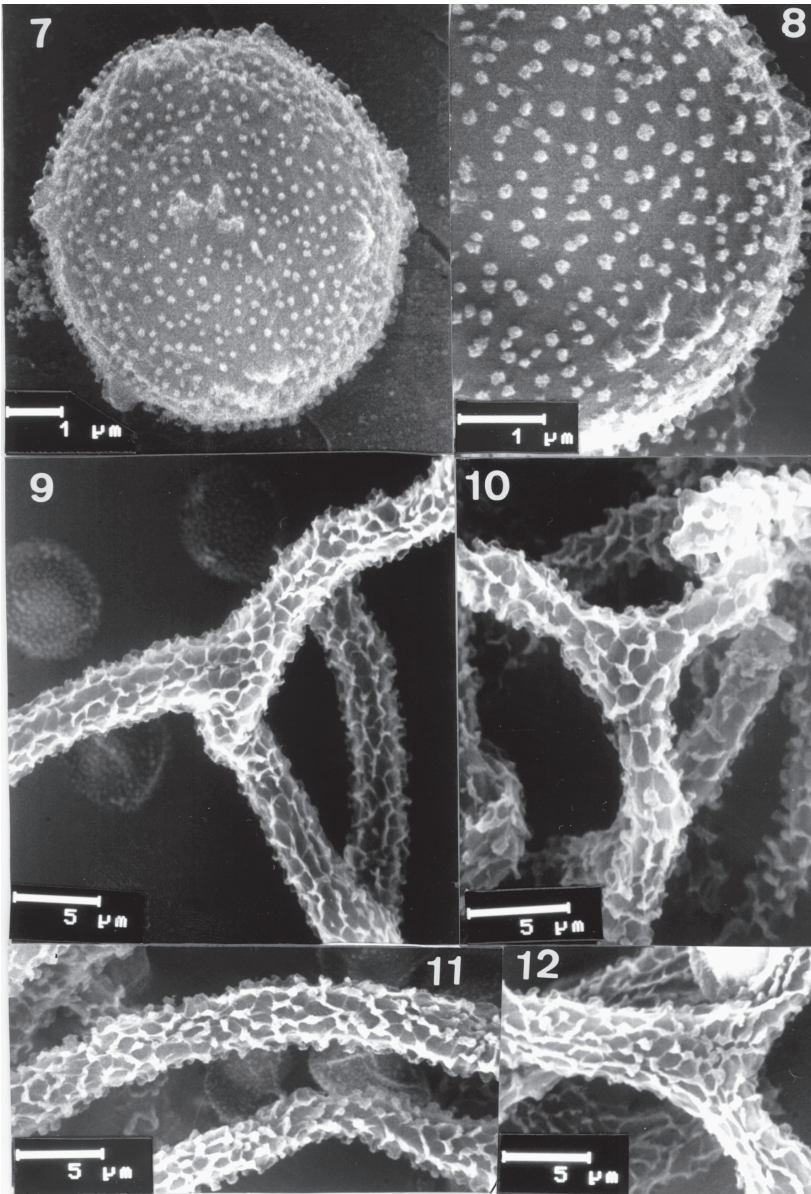
Mexico (BCMEX). Voucher specimens are cited for new records for Mexico. A list of all examined specimens is available on request from the author Moreno.

#### LIST OF SPECIES

*Arcyria affinis* Rostaf. (Figs. 2–6)

Sluzowce Monogr. 276. 1875.

Sporocarps crowded, stalked, 1.2–1.6 mm in total height, subglobose to cylindrical after the expansion of the capillitium, reddish. Stalk cylindrical, erect, 0.4–0.8 mm long, longitudinally striate, dark brown. Hypothallus common to a group of sporocarps, colourless. Peridium evanescent, remaining as a basal deep calyculus, translucent, the inner surface ornamented with a faint reticulum. Capillitium tubular, elastic, 3–5 µm diam., scantily attached to the calyculus, branched and



Figs. 7–12. *Arcyria cinerea* (Bull.) Pers. (AH 17092). — 7 and 8: Spore and detail of ornamentation. — 9–12: Capillitial threads.

anastomosed, ornamented with half rings and rings, yellowish by transmitted light. Spores 6–8 µm diam., globose, reddish in mass, pale yellow by transmitted light, slightly warted with groups of more prominent warts. With SEM the capillitium has half rings and rings combined with a reticulum, the spore ornamentation with small and larger warts, some of which coalesce.

We follow for this species the concept of Robbrecht (1974). The present record is the first for Mexico.

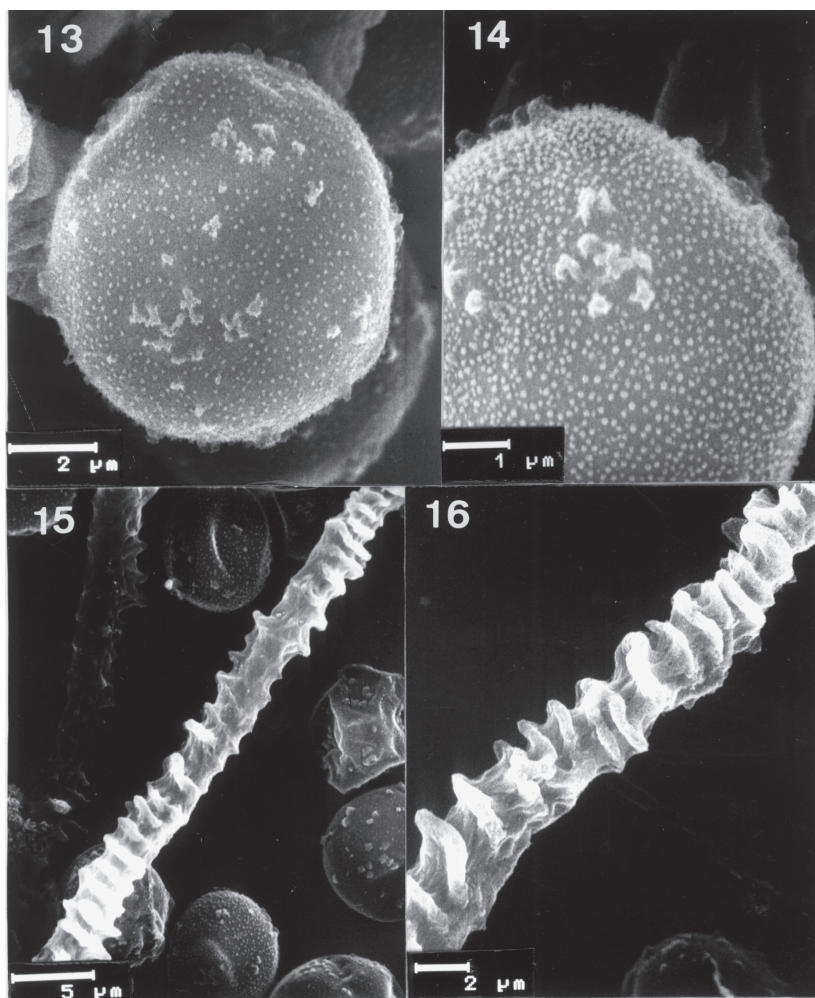
*Mexican specimen studied.* — Baja California: On stems of *Rhus laurina*, the Tijuana beach-Rosario toll highway, 11.XI.1994, M. Lizárraga (AH 18482).

***Arcyria cinerea* (Bull.) Pers. (Figs. 7–12)**

Syn. Meth. Fung. 84. 1801.

*Arcyria cinerea* is characterized by its subcylindrical sporocarps, in groups or solitary, yellowish grey to yellow ochraceous, capillitium tubular, slightly elastic, strongly attached to the calycu-





Figs. 13–16. *Arcyria incarnata* (J. F. Gmelin) Pers. (AH 18479). — 13 and 14: Spore and detail of ornamentation. — 15 and 16: Capillitial threads.

lus, tubes ornamented with spines sometimes connected by a reticulum. With SEM the capillitium is reticulated with nodules, the spores are ornamented with small warts, and larger coalescent warts.

*Arcyria pomiformis* (Leers) Rostaf. may be mistaken macroscopically for old specimens of *A. cinerea*. For differences between these two species, see the observations of Farr (1962). *Arcyria cinerea* is a common species both in the peninsula of Baja California and in Mexico.

Localities: 9, 11, 13, 17, 18, 23, 27.

***Arcyria incarnata* (J. F. Gmelin) Pers. (Figs. 13–16)**

Observ. Mycol. 1: 58. 1796.

*Arcyria incarnata*, a common species in the

study area, is easily recognized by its pinkish sporocarps which turn brown with age, shallow saucer-shaped calyculus, short stalk, and elastic capillitium, loosely attached to the calyculus and easily blown away. With SEM the capillitium has half rings and rings, the spores are ornamented with small warts, and larger coalescent warts.

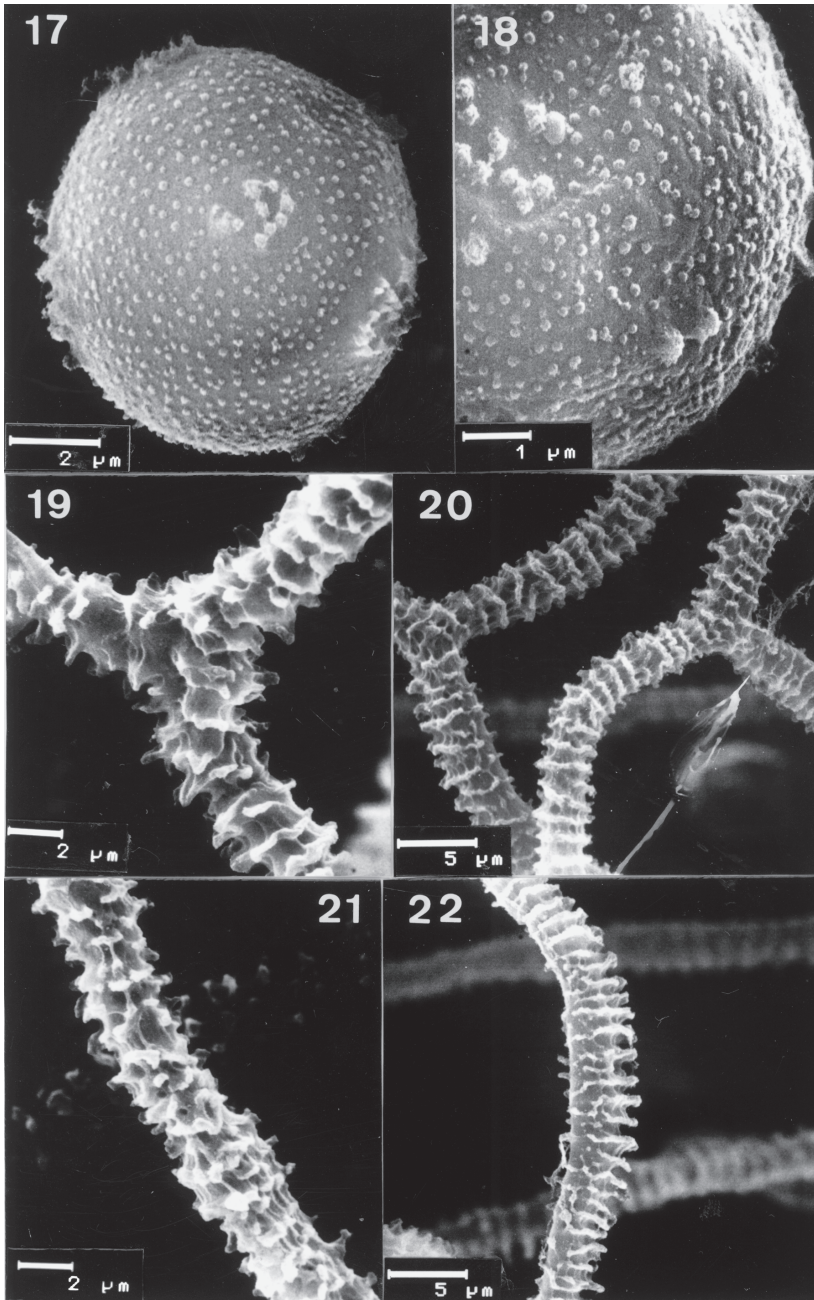
Localities: 2, 9, 11, 13, 15, 20, 21.

***Arcyria minuta* Buchet in Pat. (Figs. 17–22)**

Mém. Acad. Malgache 6: 42. 1927.

*Arcyria gulielmae* Nann.-Brem., Proc. Kon. Ned. Akad. Wetensch., Ser. C, 74: 358. 1971.

Sporocarps crowded to scattered, stalked, 1–2 mm in total height, cylindrical after expansion

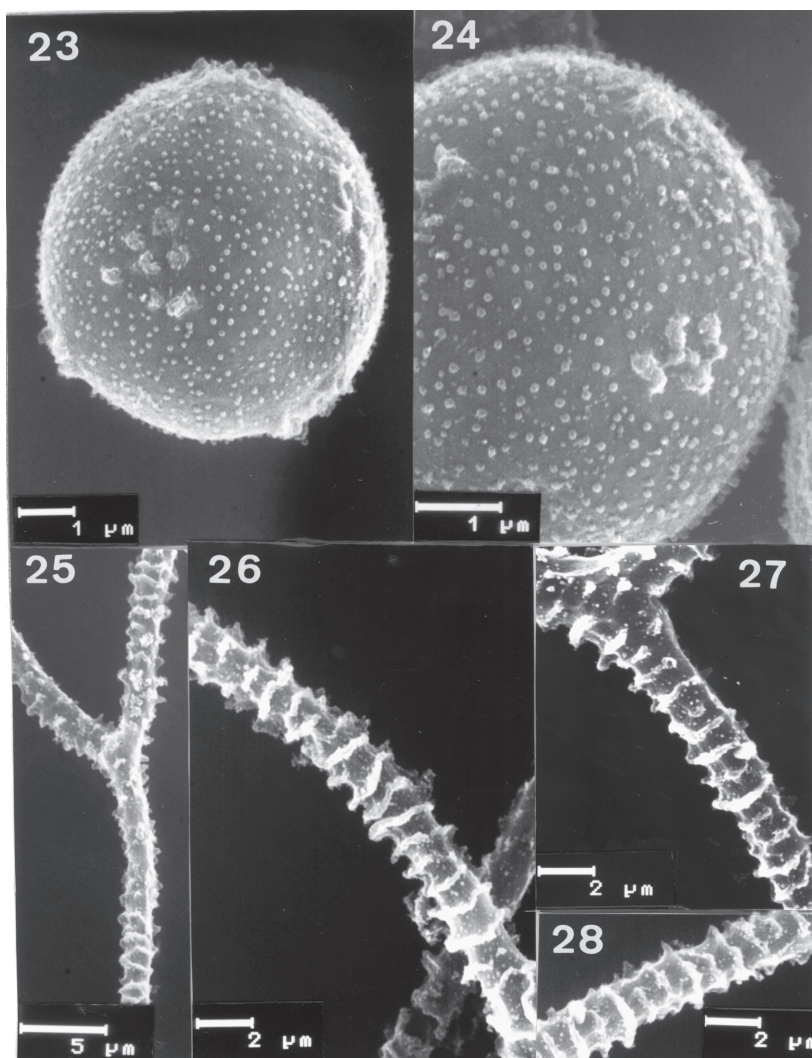


Figs. 17–22. *Arcyria minuta* Buchet. — 17 and 18: Spore and detail of ornamentation (AH 15955). — 19–22: Capillitial threads (19 and 21 from AH 15955; 20 and 22 from AH 16028).

of the capillitium, red, pink to pale ochraceous. Stalk cylindrical, erect, 0.1–0.3 mm long, longitudinally striate, pallid reddish. Hypothallus common to a group of sporocarps, colourless. Peridium evanescent, remaining as a basal flat calyculus, translucent, the inner surface ornamented with papillae. Capillitium tubular, elastic, 3–4 µm diam., firmly attached to the calyculus, branched and anastomo-

sed, ornamented with cogs, warts, half rings and rings, yellowish by transmitted light. Spores (7–)8–10 µm diam., globoses, pallid reddish in mass, colourless by transmitted light, slightly warted with groups of more prominent warts. With SEM the capillitium is ornamented with rings, half rings and an inner reticulum, the spores with small warts and larger and coalescent warts.





Figs. 23–28. *Arcyria obvelata* (Oeder) Onsberg (AH 20058). — 23 and 24: Spore and detail of ornamentation. — 25–28: Capillitial threads.

This species is easily recognised by its pink to ochraceous (in older specimens) sporocarps and capillitium firmly connected to calyculus and densely warted with cogs, half-rings, ridges and an interrupted reticulum. First record for Mexico.

*Mexican specimens examined.* — Baja California: On stem of *Pluchea sericea*, Punta banda, Ensenada, 12.II.1993, M. Lizárraga (AH 16028). On stem of *Rhus laurina* and *R. integrifolia*, 14 km of the Tijuana beach-Rosarito toll highway, Tijuana, 18.II.1996, M. Lizárraga (AH 20286).

*Arcyria obvelata* (Oeder) Onsberg (Figs. 23–28)

Mycologia 70: 1286. 1979. = *A. nutans* (Bull.) Grev., Fl. Edin. 455. 1824.

*Arcyria obvelata* is easy to recognize macro-

scopically by its large yellow to ochraceous sporocarps and capillitium which expands into very long cylindrical plumes, with few attachments to the calyculus. With SEM the capillitium has half rings and rings, the spores are ornamented with small warts and larger and coalescent warts. The species is widely distributed in Mexico.

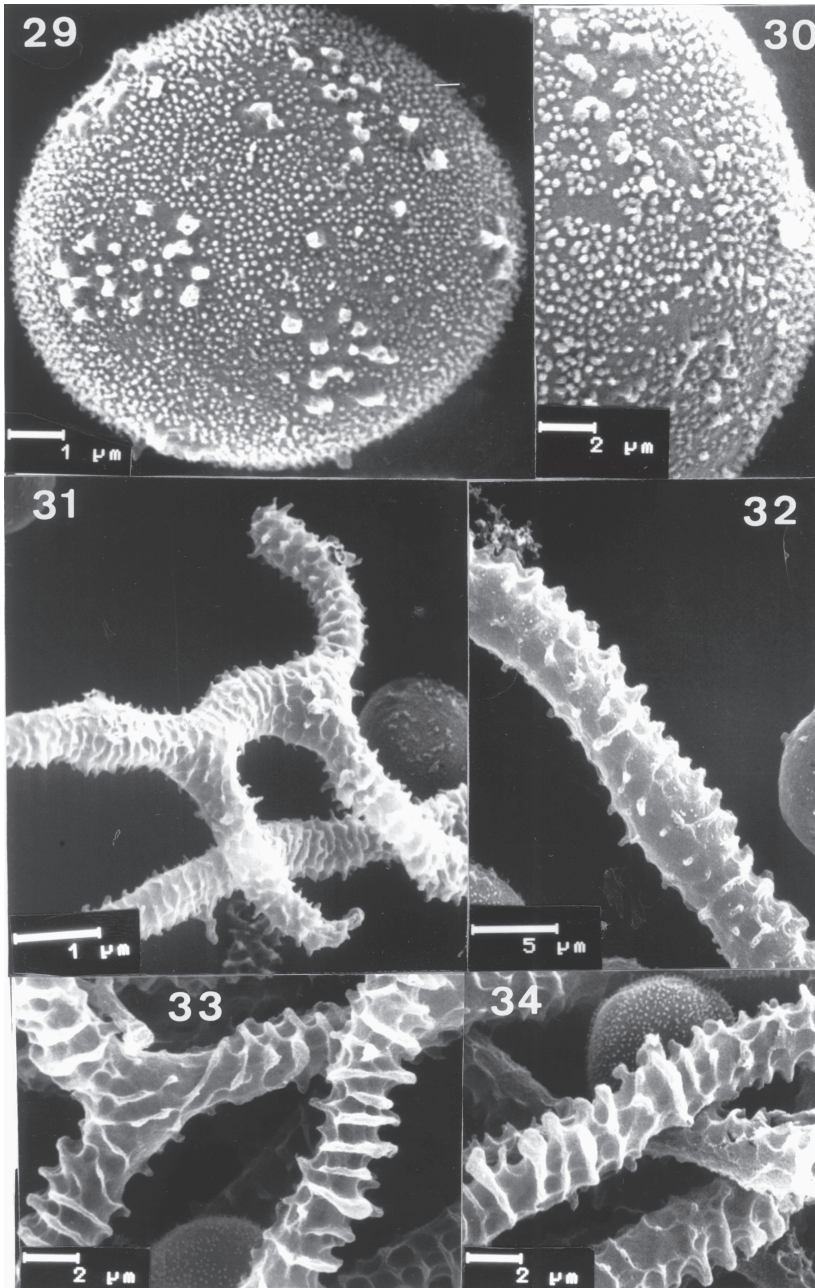
Localities: 15, 25, 27.

*Arcyria pomiformis* (Leers) Rostaf. (Figs. 29–38)

Sluzowce Monogr. 271. 1875.

The main characteristics of *Arcyria pomiformis* are its small, subglobose sporocarps, yellow





Figs. 29–34. *Arcyria pomiformis* (Leers) Rostaf. — 29 and 30: Spore and detail of ornamentation (AH 15815). — 31–34: Capillitial threads (31 and 32 from AH 15815; 33 and 34 from AH 15968).

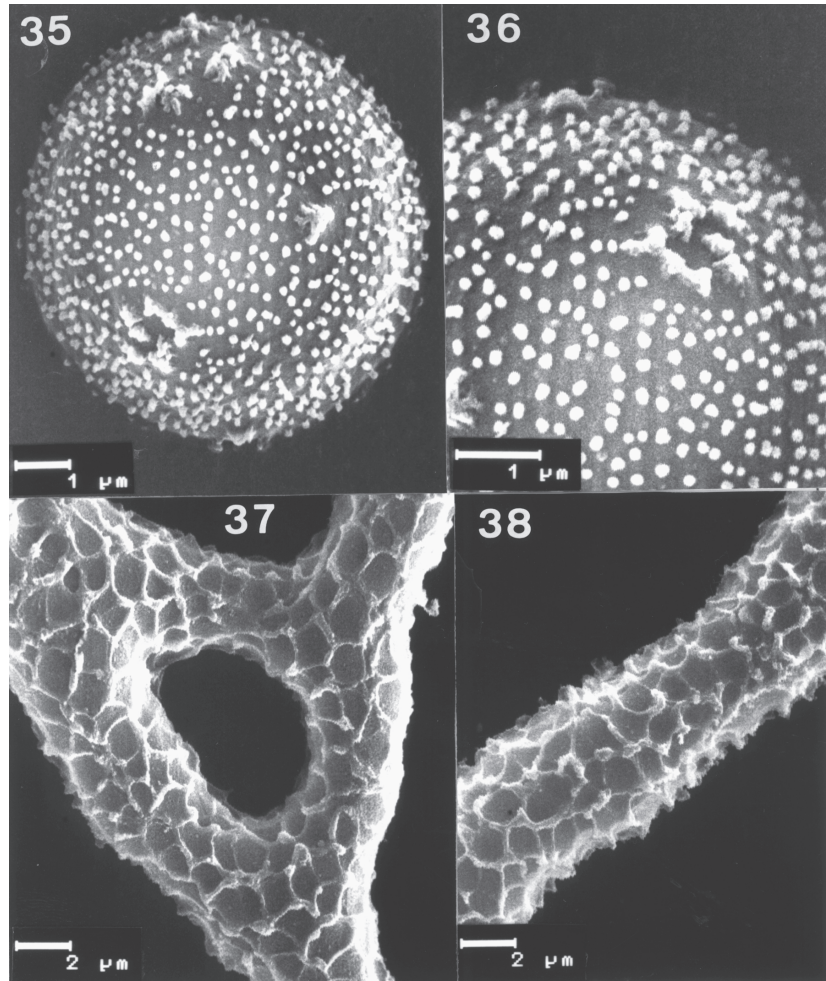
to yellowish brown and slightly elastic capillitium which is firmly attached to the calyculus. With SEM the capillitium has half rings and a marked reticulum, the spores are ornamented with small warts and larger and coalescent warts. Sometimes *A. pomiformis* presents a capillitium with complete rings or half rings, that could be interpreted as *Arcyria annulifera* Torrend (Liu 1983). However, a study of the type of the last species has

been done by Rammeloo (1983a).

As Farr (1962) indicated, some discoloured forms of small-sized sporocarps of *Arcyria cinerea* may be confused with *A. pomiformis*.

We believe that *Arcyria pomiformis* must be a common species in Mexico yet there is only one previous record, from the state of Veracruz (Villarreal 1985).

Localities: 2, 20, 24, 27.



Figs. 35–38. *Arcyria pomiformis* (Leers) Rostaf. (AH 15815). — 35 and 36: Spore and detail of ornamentation. — 37 and 38: Capillitial threads.

***Badhamia foliicola*** G. Lister (Figs. 39–40)

J. Bot. 35: 209. 1897.

*Badhamia foliicola* is a highly variable species. With SEM the spore ornamentation is baculate. This species was previously reported from Mexico from the state of Coahuila (Villarreal 1990).

Localities: 2, 11, 15.

***Ceratiomyxa fruticulosa*** (O. F. Müller) T. Macbr. (Figs. 41–43)

N. Amer. Slime-Moulds 18. 1899.

*Ceratiomyxa fruticulosa* is a widely distributed species in Mexico. With SEM the spores are smooth, though appearing wrinkled despite the

use of critical point drying. Recently Alexopoulos *et al.* (1996) also provided SEM for this species.

Locality: 30.

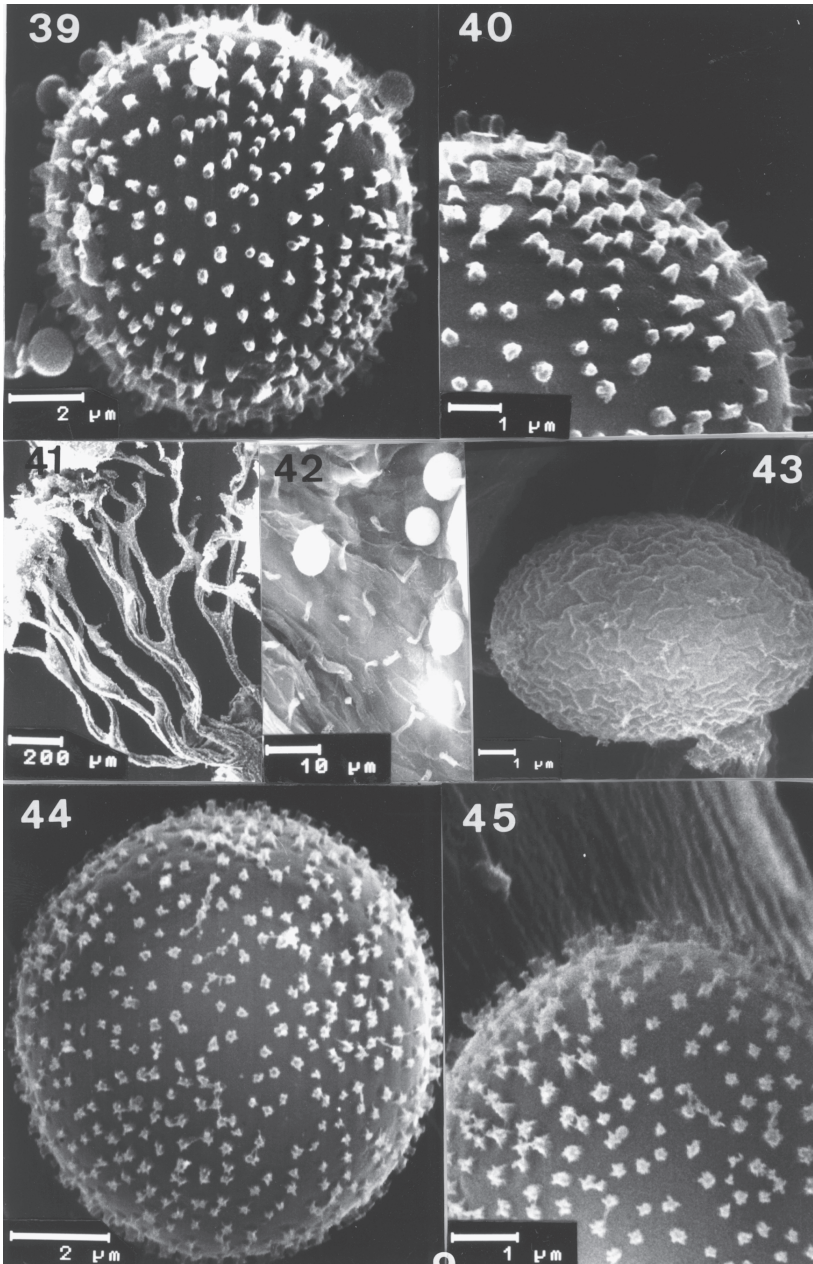
***Comatricha tenerrima*** (M. A. Curtis) G. Lister (Figs. 44–45)

in Lister, Guide Brit. Mycetozoa, edn. 4: 39. 1919.

*Comatricha tenerrima* can usually be recognized by its fusoid sporocarps, pointed apex, long stalk and pale brown colour. With SEM the spore ornamentation consists of baculae with stellate apices (Rammeloo 1983b). Previously known in Mexico from the state of Guerrero (Braun & Keller 1976).

Locality: 15.





Figs. 39–45. — 39 and 40: *Badhamia foliicola* G. Lister (AH 18625). SEM of a spore and detail of ornamentation. — 41–43: *Ceratiomyxa fruticulosa* (O. F. Müller) T. Macbr. (AH 20015). — 41: SEM of sporophore. — 42: Detail of insertion of a spore with the sporophore. — 43: SEM of a spore. — 44 and 45: *Comatricha tenerrima* (M. A. Curtis) G. Lister (AH 15884). Spore and detail of ornamentation.

***Craterium leucocephalum*** (J. F. Gmelin) Ditmar (Figs. 46–47)

in Sturm., *Deutschl. Fl.* 3(1): 21. 1813.

*Craterium leucocephalum*, common in Mexico, is macroscopically distinguished by its stalked, obovate to cylindric sporocarps, white peridium covered with calcareous deposits and circumscissile dehiscence leaving a deep cup. With SEM

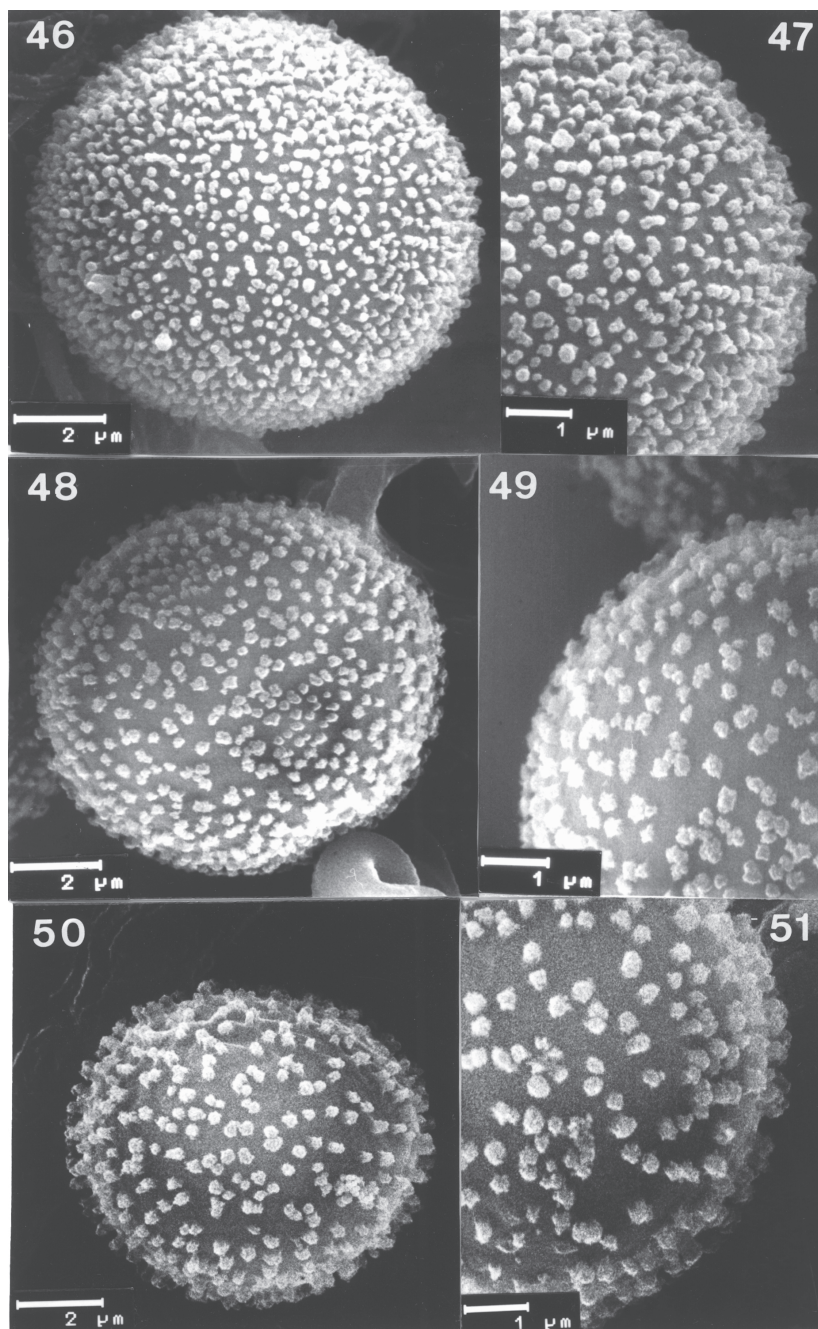
the spore ornamentation is densely warted, the warts sometimes unite to form small crests.

Locality: 29.

***Craterium minutum*** (Leers) Fr. (Figs. 48–49)

*Syst. Mycol.* 3: 151. 1829.

*Craterium minutum* is characterized macro-



Figs. 46–51. — 46 and 47: *Craterium leucocephalum* (J. F. Gmelin) Ditmar (AH 20161). Spore and detail of ornamentation. — 48 and 49: *Craterium minutum* (Leers) Fr. (AH 21022). Spore and detail of ornamentation. — 50 and 51: *Craterium scyphoides* (Cooke & Balf) Lizárraga, Illana & G. Moreno (AH 18493). Spore and detail of ornamentation.

scopically by its small sporocarps, forming deep cups and dehiscence by a brown, limeless operculum. With SEM the spores are ornamented with scattered warts which have forked apices (Neubert *et al.* 1995).

We have added SEM photographs of the sample AH 21022 from Spain, which presents the

same ornamentation as the sample from Baja California, but in this case the spores have collapsed despite critical point treatment.

Farr (1976) included this species from Mexico in her monograph, but did not indicate the locality.

*Mexican specimen examined.* — Baja California: On



leaves of *Quercus agrifolia*, Las Chichiuas, Ensenada, 5.V.1994, *M. Lizárraga* (AH 18470).

***Craterium obovatum*** Peck (Figs. 52–55)

Bull. Buffalo Soc. Nat. Sci. 1: 64. 1873.

*Craterium obovatum* can be recognised macroscopically by its stalked, subglobose to obovoid sporocarps in large groups and by circumscissile dehiscence leaving a deep cup. With SEM the spore ornamentation is densely pilate, with wide base and verrucose apex. We have compared the type specimen (Figs. 54–55) with the Baja Californian material and found that it coincides in its macroscopic and microscopic characters.

*Craterium obovatum* var. *dictyosporum* (Rostaf.) G. Moreno & Illana (Moreno *et al.* 1993), differs by its spore ornamentation, having large ridges forming a reticulum, the apex of each ridge is, however, verrucose. For this reason we prefer to treat, this taxon as a variety and not as a separate species as Neubert *et al.* (1995) have recently proposed. *Craterium muscorum* Ing is also closely related to *C. obovatum* var. *obovatum* but the former taxon has completely reticulate spore ornamentation.

*Craterium obovatum* has also been reported in Mexico from the state of Veracruz (López *et al.* 1981, Guzmán & Villarreal 1984).

Locality: 24.

***Craterium scyphoides*** (Cooke & Balf) Lizárraga, Illana & G. Moreno, *comb. nov.* (Figs. 50–51)

*Physarum scyphoides* Cooke & Balf. in Masee, Jour. Myc. 5: 186. 1889. — *Craterium leucocephalum* var. *scyphoides* (Cooke & Balf.) G. Lister in Lister, Monogr. Mycetozoa, edn. 2, 97. 1911.

Sporocarps gregarious, stalked, 0.3–0.5 mm in total height, 0.5–0.9 mm in diam., subglobose or globose. Stalk cylindrical, 0.1–0.3 mm long, reddish brown. Hypothallus colourless. Peridium of two appressed layers; the outer cartilaginous white or grey, encrusted with lime, reddish-brown below; the inner membranous. Dehiscence circumscissile, leaving a cup. Capillitium of white

irregular lime nodes connected by hyaline threads, the lime nodes form a pseudocolumella in the centre of the sporocarp. Spores 8–9 µm diam., globose, black in mass, brown-violaceous by transmitted light, irregularly and minutely warted. With SEM the spores are ornamented with stout, irregularly distributed bacula.

The status of this taxon has varied with different authors, some of whom include it within the variability of *Craterium leucocephalum* (Martin & Alexopoulos 1969, Farr 1976), and others who treat it as a variety of the present species (Lister 1925, Nannenga-Bremekamp 1991, Neubert *et al.* 1995).

Our own observations of the macroscopical differences between the type variety and *Craterium leucocephalum* var. *scyphoides* lead us to conclude that two distinct species are involved. *Craterium leucocephalum* var. *scyphoides* has small globose and not cylindrical sporocarps and its spore ornamentation is more prominent. Differences in the microscopic characters have been given earlier by Nannenga-Bremekamp (1991).

Differences in the spore ornamentation are evident with SEM, where we observe that the warts of *Craterium leucocephalum* var. *scyphoides* are larger and irregularly distributed. These differences apply to both Spanish material and specimens from Baja California. For these reasons we regard *Craterium leucocephalum* var. *scyphoides* as a distinct species in the genus *Craterium*.

*Craterium scyphoides* is a new record for Mexico.

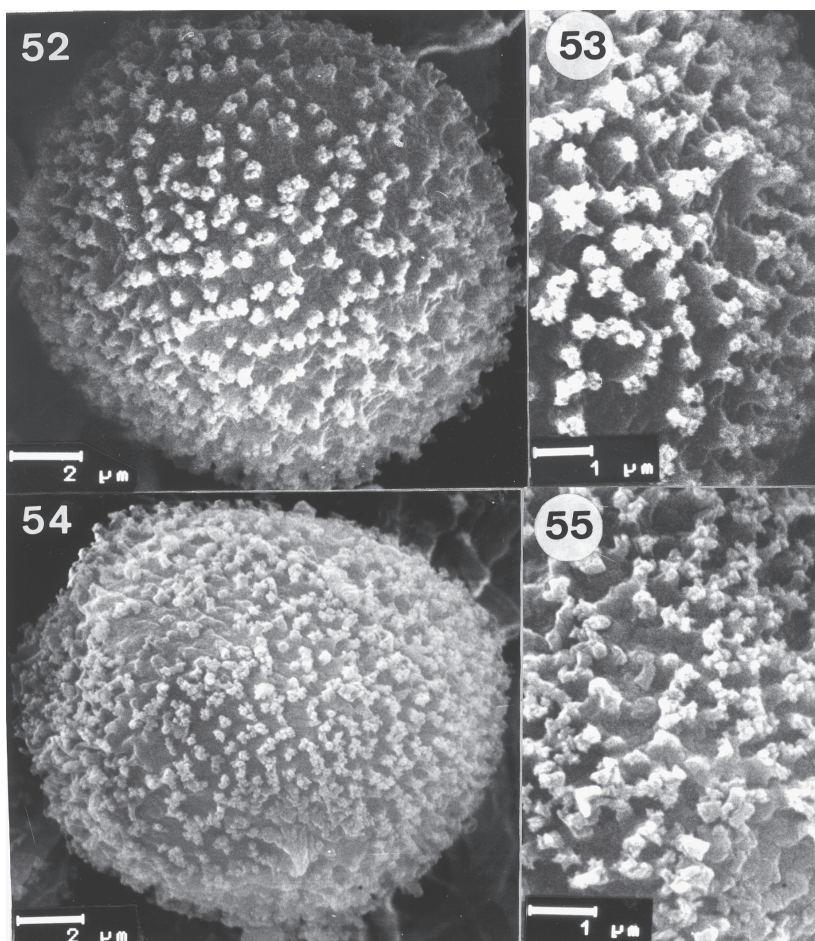
*Mexican specimens examined.* — Baja California: On leaves of *Quercus agrifolia*, Ejido Ignacio Zaragoza, 65 km from Tecate–Ensenada road, 6. II. 1993, *G. Moreno, C. Illana & M. Lizárraga* (AH 18498, 18622). On wood of *Quercus agrifolia*, Ensenada–Santo Tomás Mexico highway 1 (Rancho las Jacarandas, Cañón de las Ánimas), 7. II. 1993, *F. Bersan, C. Illana & G. Moreno* (AH 18493). On leaves of *Quercus agrifolia*, Santa Rosa, Ensenada, 10. II. 1993, *F. Bersan, C. Illana & G. Moreno* (AH 18492). On stem of Poaceae and *Rhus laurina*, Garden of the Facultad de Ciencias, Ensenada, 21. I. 1995, *M. Lizárraga* (AH 17061).

***Diachea leucopodia*** (Bull.) Rostaf. (Figs. 56–57)

Sluzowce Monogr. 190. 1874.

*Diachea leucopodia* is a species easy to rec-





Figs. 52–55. *Craterium obovatum* Peck. Spore and detail of ornamentation (52 and 53 from AH 24443; 54 and 55 from type in NY).

ognize and is common in Mexico. With SEM the spore ornamentation is baculate with divided apex.

Localities: 13, 16, 23.

***Dictydiaethalium plumbeum*** (Schum.) G. Lister (Figs. 58–59)

Monogr. Mycetoza 157. 1894.

*Dictydiaethalium plumbeum* can be recognised macroscopically by its depressed yellowish brown to dark brown pseudoethalium. With SEM the spore ornamentation is baculate, sometimes united forming small crests.

*Dictydiaethalium plumbeum* has occasionally been reported in Mexico from the States of Nuevo

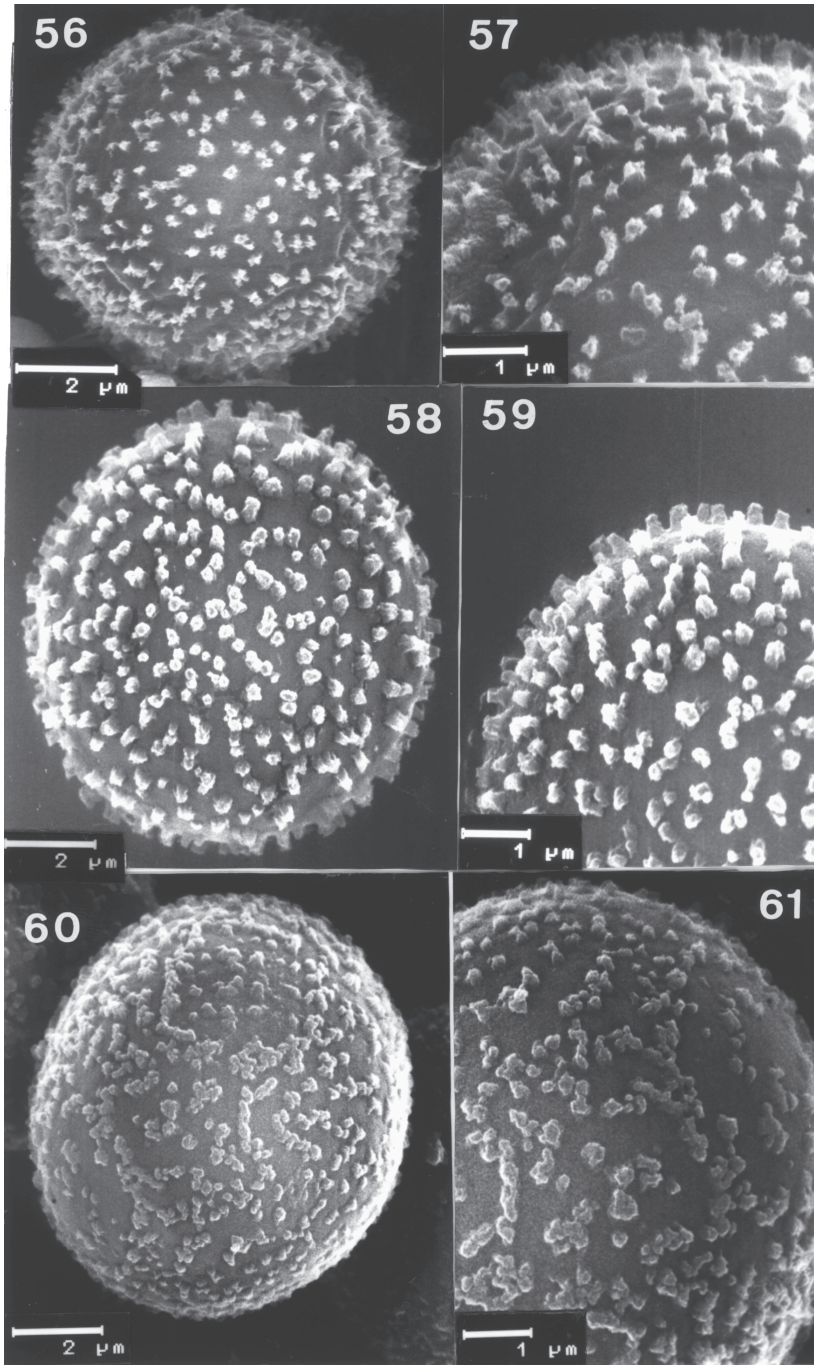
León (Gómez-Sánchez & Castillo 1981), Queretaro (Villarreal 1990) and Veracruz (Ogata *et al.* 1996).

Localities: 2, 11, 13.

***Dictydiaethalium plumbeum* var. *cinnabarinum*** (Berk. & Br.) Shirai & Hara (Figs. 60–61)

List. Jap. Fungi, edn. 3: 119. 1925. — *Licea cinnabarina* Berk. & Br., Jour. Linn. Soc. 14: 86. 1873. — *Dictydiaethalium cinnabarinum* (Berk. & Br.) H. Neubert, Nowotny & K. Baumann, Die Myxomyceten 1: 122. 1993.

Pseudoaethalium depressed, 2–6 mm diam., brown, composed of numerous sporocarps, closely compacted into a palisade layer. Hypothallus silvery. Peridium single, thick, and persistent at the



Figs. 56–61. — 56 and 57: *Diachea leucopodia* (Bull.) Rostaf. (AH 15894). Spore and detail of ornamentation. — 58 and 59: *Dictydiaethalium plumbeum* (Schum.) Lister G. (AH 15990). Spore and detail of ornamentation. — 60 and 61: *Dictydiaethalium plumbeum* var. *cinnabarium* (Berk. & Br.) Shirai & Hara (AH 20287). Spore and detail of ornamentation.

apex like polyhedral plates, evanescent at the base. Dehiscence by rupturing along the spaces between the sporocarps. Pseudocapillitium and spores yellowish red to reddish orange in mass. Pseudocapillitium is formed from the remains of the peridium which remains attached to the corners of the apical

cap after dehiscence, filiform, threads 2–3 μm diam., the inner side smooth and the outer with fringes. Spores 8–10 μm diam., globose, yellowish in transmitted light, warted. By SEM the spore ornamentation is baculate and with small crests.

The microscopic characters of *Dictydiaetha-*

*lium plumbeum* var. *plumbeum* and *D. plumbeum* var. *cinnabarinum* are similar in the material studied by us compared with the collections of herbarium of Neubert (4862), including the spore ornamentation with SEM. The only difference is the colour of the spore mass and capillitium which is yellowish brown to dark brown in the former and yellowish red to reddish orange in the latter. For this reason we think that it is better to maintain both taxa as colour varieties, and not as separate species as proposed by Neubert *et al.* (1993). It would be convenient to find the material of *Dictydiaethalium plumbeum* var. *cinnabarinum* in order to confirm our hypothesis.

*Dictydiaethalium plumbeum* var. *cinnabarinum* strongly resembles *Enteridium rubiginosum* Gràcia, Illana & G. Moreno due to its peridium consisting of polygonal areolae and ferruginous-brown colour (Gràcia *et al.* 1996).

This is the first report from Mexico.

*Mexican specimens examined.* — Baja California: On wood of *Quercus agrifolia*, Las Chichiuas, Ensenada, 10.II.1993, C. Illana, G. Moreno & M. Lizárraga (AH 15998). On stem of *Adenostoma fasciculatum*, Colonia Buenavista, Tijuana, 10.II.1996, M. Lizárraga (AH 20224, 20274, 20293). On wood, Colonia Lomas Taurinas, Tijuana, 6.II.1996, M. Lizárraga (AH 20287).

***Diderma hemisphaericum*** (Bull) Hornem. (Figs. 62–63)

Fl. Dan. 11(33): 13. 1829.

*Diderma hemisphaericum* is characterized by its stalked and discoid sporocarps and its large, discoid columella. With SEM the spores have scattered small warts. This species is widely distributed in Mexico.

Locality: 11.

***Didymium anellus*** Morgan (Figs. 64–65)

J. Cincinnati Soc. Nat. Hist. 16: 148. 1894.

*Didymium anellus* is characterized macroscopically by its pulvinate sporocarps or small, annulate, plasmodiocarps, peridium is covered with a layer of whitish lime crystals, capillitium is elastic, abundant. With SEM the spore ornamentation is baculate with irregular apices, at the

base united by fine lines forming a reticulum.

In Mexico *Didymium anellus* has been found only in the states of Guerrero (Braun & Keller 1976) and Tlaxcala (Galindo-Flores 1992).

Localities: 6, 7, 10.

***Didymium clavus*** (Alb. & Schwein.) Rabenh. (Figs. 66–67)

Deutsch. Krypt-Fl. 1: 280. 1844.

*Didymium clavus* can easily be recognized by its stipitate, discoid sporocarps, dark stalk, and spores 6–8 µm diam., nearly smooth by transmitted light. With SEM the spore ornamentation is densely baculate.

This species has previously been reported in Mexico from the states of Chiapas (Pérez-Moreno & Villarreal 1988) and Yucatán (Keller & Braun 1977).

Localities: 11, 20.

***Didymium difforme*** (Pers.) Gray (Figs. 68–69)

Nat. Arr. Brit. Pl. 1: 571. 1821.

The main characteristics of *Didymium difforme* are its sessile, flat-pulvinate sporocarps, double peridium, the smooth outer layer composed of densely aggregated, small lime crystals, the membranous pale purple inner layer and minutely warted spores, dark purple-brown in transmitted light, paler on one side. With SEM the spore ornamentation is similar to that of *Didymium anellus*, with warts united by a fine reticulum (Neubert *et al.* 1995).

*Didymium difforme* is a common species in the states of Baja California on decomposing succulent plants, wood and leaves, and in Distrito Federal (Keller & Braun 1977) and Jalisco (Braun & Keller 1976).

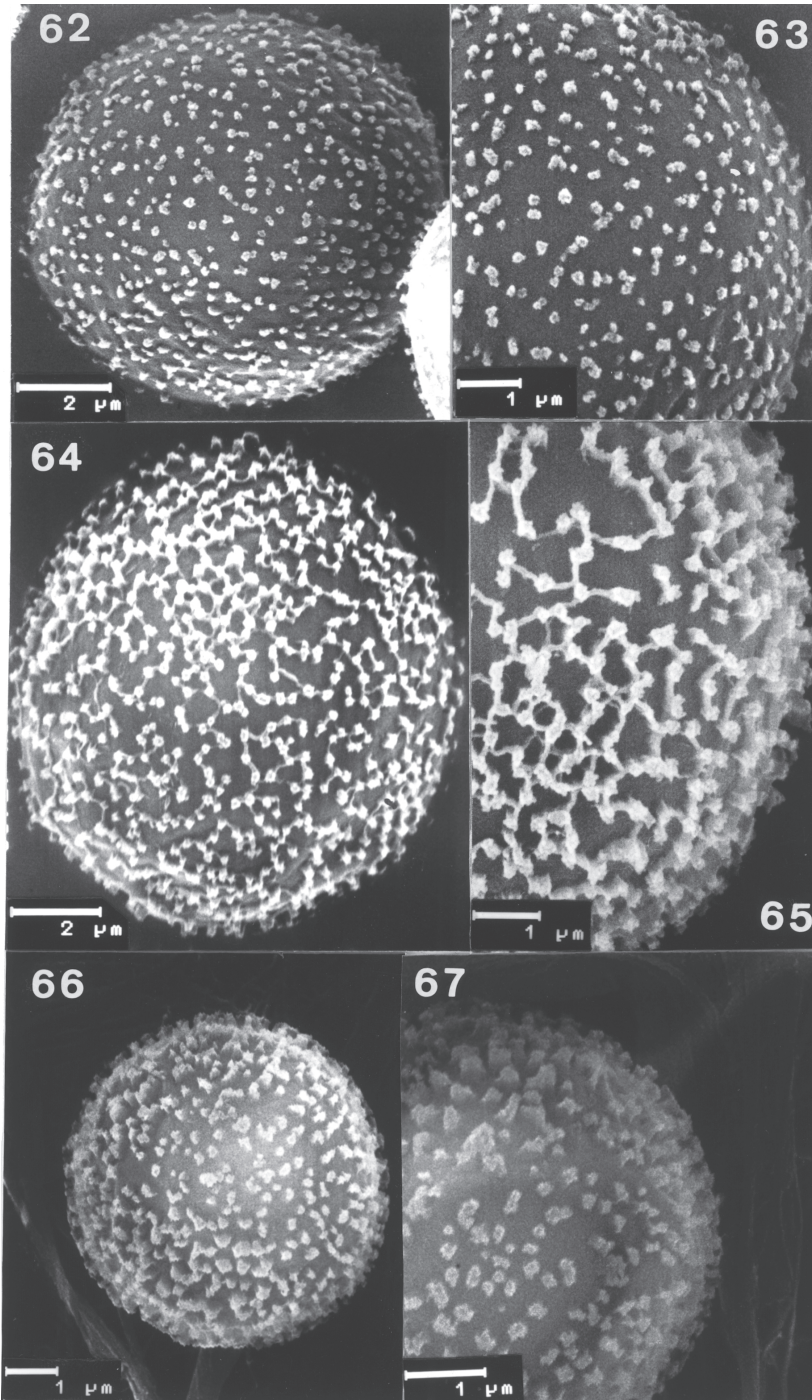
Localities: 1, 4, 5, 6, 7, 8, 20, 26.

***Didymium squamulosum*** (Alb. & Schwein.) Fr. (Figs. 70–71)

Symb. Gasteromyc. 3: 19. 1818.

*Didymium squamulosum* is a variable cos-



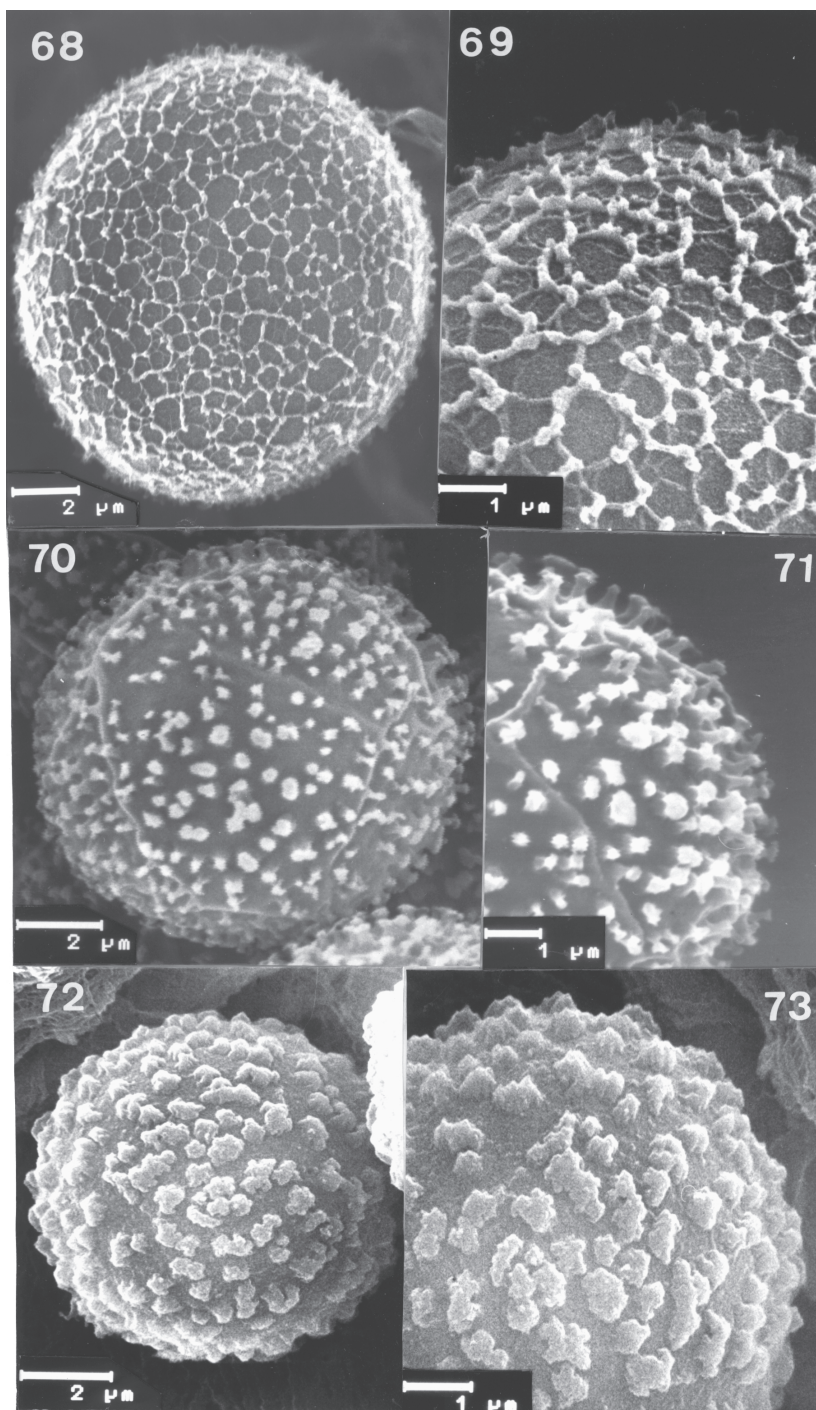


Figs. 62–67. — 62 and 63: *Didymium hemisphaericum* (Bull.) Hornem. (AH 18624). Spore and detail of ornamentation. — 64 and 65: *Didymium anellus* Morgan (AH 15931). Spore and detail of ornamentation. — 66 and 67: *Didymium clavus* (Alb. & Schwein.) Rabenh. (AH 21007). Spore and detail of ornamentation.

mopolitan species, also widely distributed in Mexico. It can be confused with related species as: *D. applanatum* Nann.-Bremek., *D. intermedium* Schroet., *D. lenticulare* K. S. Thind & T. N. Lakh., *D. projectile* T. N. Lakh. & Mukerji, *D. simlensis*

T. N. Lakh. & Mukerji and *D. muscorum* T. N. Lakh. & Mukerji.

*Didymium floccosum* G. W. Martin, K. S. Thind & Rehill is macroscopically similar to *D. squamulosum*, but the former is characterized by its peri-



Figs. 68–73. — 68 and 69: *Didymium difforme* (Pers.) Gray (AH 15952). Spore and detail of ornamentation. — 70 and 71: *Didymium squamulosum* (Alb. & Schwein) Fr. (AH 17075). Spore and detail of ornamentation. — 72 and 73: *Didymium vaccinum* (Durieu & Mont.) Buchet (AH 18462). Spore and detail of ornamentation.

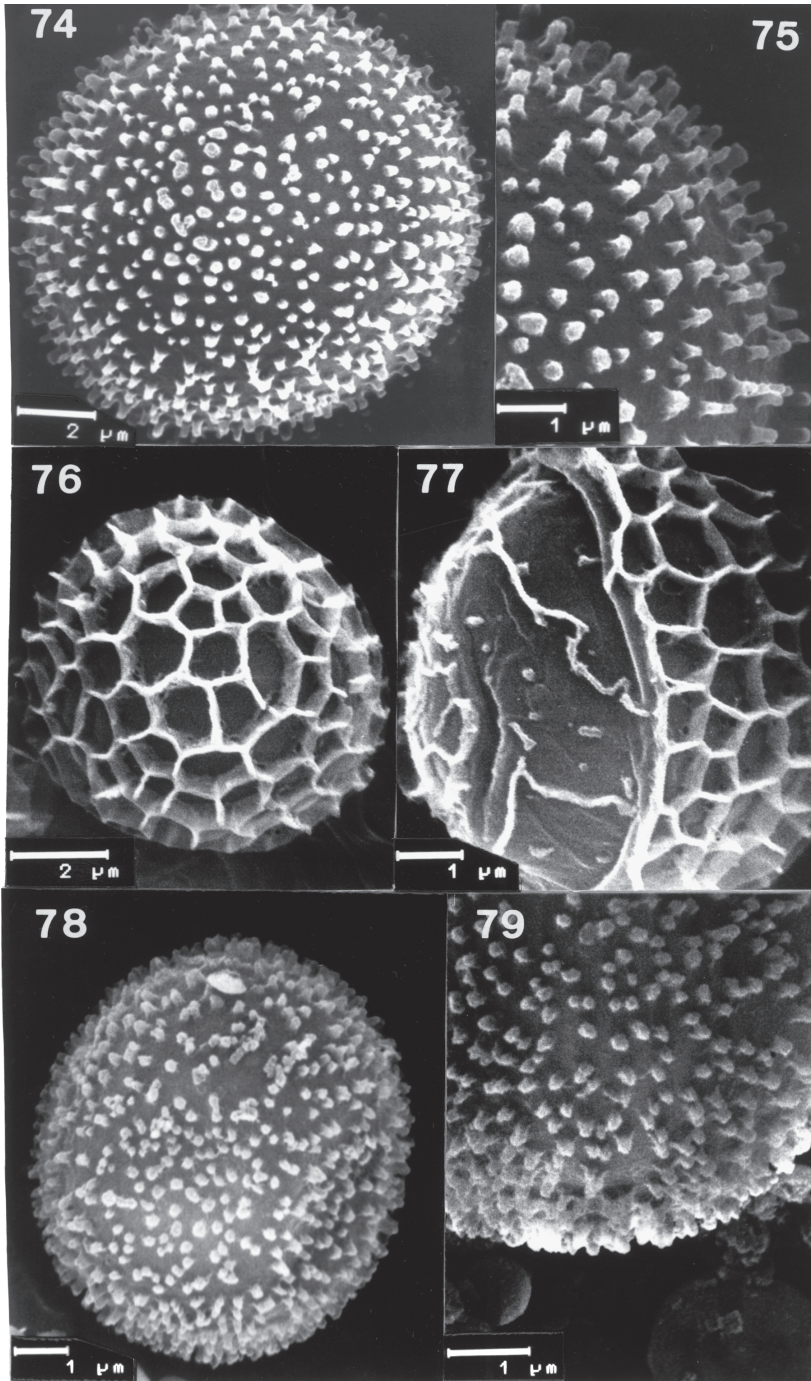
dium with dark, brown patches separated by hyaline zones and calcareous stalk (Matsumoto & Deguchi 1994, Chung & Liu 1996).

By SEM the spore ornamentation is pilate, the

spore surface is frequently covered with lines or zones which easily collapse, leaving a polyhedral morphology.

Localities: 1, 13, 16, 20, 27.





Figs. 74–79. — 74 and 75: *Enerthenema papillatum* (Pers.) Rostaf. (AH 17126). Spore and detail of ornamentation. — 76 and 77: *Enteridium lycoperdon* (Bull.) M. L. Farr (AH 24445). Spore and detail of ornamentation. — 78 and 79: *Fuligo septica* (L.) F. H. Wigg. (AH 24446). Spore and detail of ornamentation.

*Didymium vaccinum* (Durieu & Mont.) Buchet (Figs. 72–73)

in Buchet, Chermezon & Évrard, Bull. Soc. Mycol. France 36: 110. 1920.

*Didymium vaccinum* is characterized by spo-

rocarps with a smooth, white peridium, circumscissile dehiscence, and short stalk. With SEM the spore ornamentation is of large warts to short and low crests.

There is only one previous record of *Didymium vaccinum* from Mexico in the state of Nuevo León

(Gómez-Sánchez & Castillo 1981). However, we believe that it must be a common species on decomposing succulent plants.

Localities: 3, 9, 11, 19, 22, 26.

***Enerthenema papillatum*** (Pers.) Rostaf. (Figs. 74–75)

Sluzowce Monogr. Suppl. 28. 1876. 4).

*Enerthenema papillatum* can be recognized by its stalked sporocarps, fibrous stalk, evanescent peridium with the exception of a disc in the top, columella reaching to the apex and flexuose capillitium, emerging from the apex of the apical disc. With SEM the spore ornamentation is regularly baculate.

This species was reported from Distrito Federal (Braun & Keller 1986) and recently from state of Tlaxcala by Rodríguez-Palma and Estrada-Torres (1996).

Localities: 10, 13, 24.

***Enteridium lycoperdon*** (Bull.) M. L. Farr (Figs. 76–77)

Taxon 25: 514. 1976.

*Enteridium lycoperdon* is a common species and easy to recognize by its large aethalium. This myxomycete is eaten in Mexico and popularly known as “caca de luna u hongo de luna” (Guzmán *et al.* 1993).

With SEM the spore ornamentation has a net covering about 2/3 of the spore surface, the remainder being smooth.

***Fuligo septica*** (L.) F. H. Wigg. (Figs. 78–79)

Prim. Fl. Holsat. 112. 1780.

*Fuligo septica* is a very common species — also in Mexico — characterized by its large aethalium. With SEM the spore ornamentation is regularly baculate.

Locality: 25.

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