1810

Reprinted from MYCOLOGIA, Vol. LXVIII, No. 5, pp. 1097–1103, Sept.–Oct., 1976
Printed in U. S. A.

NOTES ON DISTRIBUTION AND SPORE ORNAMENTATION OF *MYCOLEVIS SICCIGLEBA* (BASIDIOMYCETES, CRIBBEACEAE)

ROBERT FOGEL

Department of Forest Management, Oregon State University, Corvallis, Oregon 97331

The genus *Mycolevis* differs from other hypogeous Basidiomycetes by having amyloid spore ornamentation formed within the thick inner spore wall, a collar of amyloid material surrounding the basal pore of the spore, and a dark green reaction of the fresh peridium to Melzer's reagent (bluish green as revived). Smith (1965) described the genus with one species, *M. siccigleba,* from a single Idaho collection; it has not been reported since. He tentatively placed *Mycolevis* in the family Cribbeaceae on the basis of spore ornamentation, then transferred it to the "Asterogastraceae" because of the amylaceous material covering the spore ornamentation (Smith, 1973). Singer (1971) retained *Mycolevis* in the Cribbeaceae, intermediate between *Cribbea* and *Setchelliogaster.*

In my studies of *Mycolevis,* anatomical features were described from sections mounted in 5% KOH or Melzer's reagent. Dried herbarium material was prepared for scanning electron microscopy by the trichlorotrifluorethane-freon 13 critical-point-drying method. Dried spores were dusted directly on tacky silver paint, coated with approximately 100 Å of gold:palladium alloy (60:40), and photographed with an International Scientific Instruments MSM-2 Mini-SEM on P/N 55 Polaroid film. Dried herbarium material was prepared for transmission electron microscopy by double-fixing in 5% glutaraldehyde in *p*H 7.0 Sorensons monobasic-dibasic sodium phosphate buffer for 2 h followed by 1 h in 1% osmonium tetroxide, dehydrated in a acetone-water series (30, 50, 70%), stained with uranyl acetate in 70% acetone for 8–12 h, embedded in Epon 812, sectioned, and photographed under a Phillips EM 200 transmission electron microscope.

MYCOLEVIS SICCIGLEBA Smith, Mycopathol. Mycol. Appl. **26**: 391–393. 1965.

BASIDIOCARPS globose to lobed or angular from external pressure, 1–4 cm diam. PERIDIUM thin, minutely pubescent, white in youth, becoming yellowish in age to grayish olive at maturity, not staining where cut or bruised. GLEBA white in youth, finally buff to olivaceous at maturity, brittle after drying; locules globose, ca 0.25 mm diam, empty; columella occasionally present, bluish gray, unbranched, (1–2 mm wide) giving rise to a basal rhizomorph. Rhizomorphs appressed, basal, concolorous with peridium. ODOR fruity to nauseous, taste similar but less intense. CHEMICAL REACTIONS on peridium: KOH, negative; Melzer's reagent, copper green to bluish green; $FeSO_4$, negative.

BASIDIOSPORES globose to broadly ellipsoidal, 8–14(–18) × 9–12(–16) μm, hyaline in KOH and violet in Melzer's reagent, with a basal pore at the point of sterigmal attachment. Spore wall 0.7–1.0 μm thick, two-layered, in KOH the ornamentation appearing as spines projecting from a thick inner wall (1–2 μm) into an outer gelatinous wall; in Melzer's reagent the spines amyloid and a thin amyloid layer covering the outer wall, the ends of the spines appearing as spots on the spore surface; basal pore surrounded by a broad amyloid collar. BASIDIA 35–40 × 11–15 μm, clavate to turbinate, loosely arranged in a hymenium, hyaline, thin-walled, with content granular in KOH, 4-spored; sterigmata straight, 5–6 × 2 μm at base. Brachybasidioles 35–40 × 5–10 μm, clavate, hyaline, thin-walled. Cystidia none. MEDIOSTRATUM 50–125 μm wide, of nongelatinous, thin-walled hyphae 2–7 μm diam at septa but most cells inflated to 5–20 μm, hyaline in KOH and orange in Melzer's reagent. PERIDIUM (30–)190–250

μm thick; epicutis a tangled turf (often collapsed) of hyaline, thin-walled, septate hyphae 2.5–5 μm diam; subcutis of hyaline, thin-walled, interwoven hyphae 3–5 μm diam; both layers dark green in Melzer's reagent with some areas sordid blue to bluish green; amyloid debris abundant throughout. Clamp connections none.

Etymology.—Myc = fungus (Gr.), levis = light weight (L); siccus = dry (L), gleba.

Holotype.—Idaho, Priest River, in duff under conifers, 26 July 1964, Smith 68654 (MICH).

Material examined.—MEXICO, MEXICO STATE: Camino Amecameca-Tlamacas, under *Abies religiosa* Lindl., 14 August 1972, Trappe 3403 (OSC, ENCB). U.S.A., CALIFORNIA, HUMBOLDT CO.: Hoopa Indian Reservation, under *Abies concolor* (Gord. & Glend.) Lindl., 8 November 1974, leg. D. Largent (OSC 34756). SAN MATEO CO.: Redwood Park, under *Lithocarpus densiflora* Rehd., 14 May 1924, Parks 2222 (UC 276336). SIERRA CO.: Yuba Pass, 29 September 1967, Thiers 21118 (SFSU). IDAHO, ADAMS CO.: Boulder Creek, New Meadows, 9 September 1964, leg. Harrison, Smith 70364 (MICH). Upper Payette Lake, Twenty Mile Creek, 18 August 1964, Smith 69550 (MICH). BONNER CO.: Priest River, 27 July 1964, Smith 66860, 68664 (MICH). VALLEY CO.: McCall, Lake Fork Creek, under *Picea* sp., 26 August 1958, Smith 60576 (MICH). McCall, Brundage Mountain, July, Smith 68806 (MICH). OREGON, UMATILLA CO.: Emmigrant Springs State Park, under *Abies lasiocarpa* (Hook.) Nutt. and *Picea engelmannii* Parry, 17 July 1969, Trappe 1924 (OSC). WALLOWA CO.: Hat Point, Sacajawea Campground, under *Abies lasiocarpa,* 16 July 1969, Trappe 1914 (OSC). UTAH, IRON CO.: Bristlecone Trail, near Cedar Breaks National Monument, under *Abies lasiocarpa* and *Picea engelmannii,* 18 August 1973, Fogel F628A (OSC). WASHINGTON, PEND ORIELLE CO.: below Cusick, under *Pseudotsuga menziesii* (Mirb.) Franco and *Larix* sp., 2 July 1964, Smith 68121 (MICH).

Mycolevis siccigleba is a widely distributed western North American species (FIG. 1) which fruits from May to November and may be an ectomycorrhizal associate of *Abies* spp. and perhaps *Picea* spp. All collections are from montane or subalpine coniferous forests with the exception of one lowland coastal record from San Mateo County, California (Parks 2222).

Smith (1965) originally described the spore wall as two-layered with the "outermost layer a thin amyloid crust breaking up in places and in some spores seen to separate in flakes, beneath this a thick layer (2 μm thick) transversed by canals opening to the outer surface as spots and so numerous that the openings (when one focuses on the spore surface) appear as an obscure closely knit reticulum . . .". My interpretation of light photographs (FIG. 2) was that the ornamentation is composed of spines projecting from the inner spore wall into a covering of gel or similar substance. Scan electron micrographs (FIG. 3) show that the outer layer is continuous and completely covers the spines. Subsequent transmission electron microscopy (FIG. 4) reveals that the

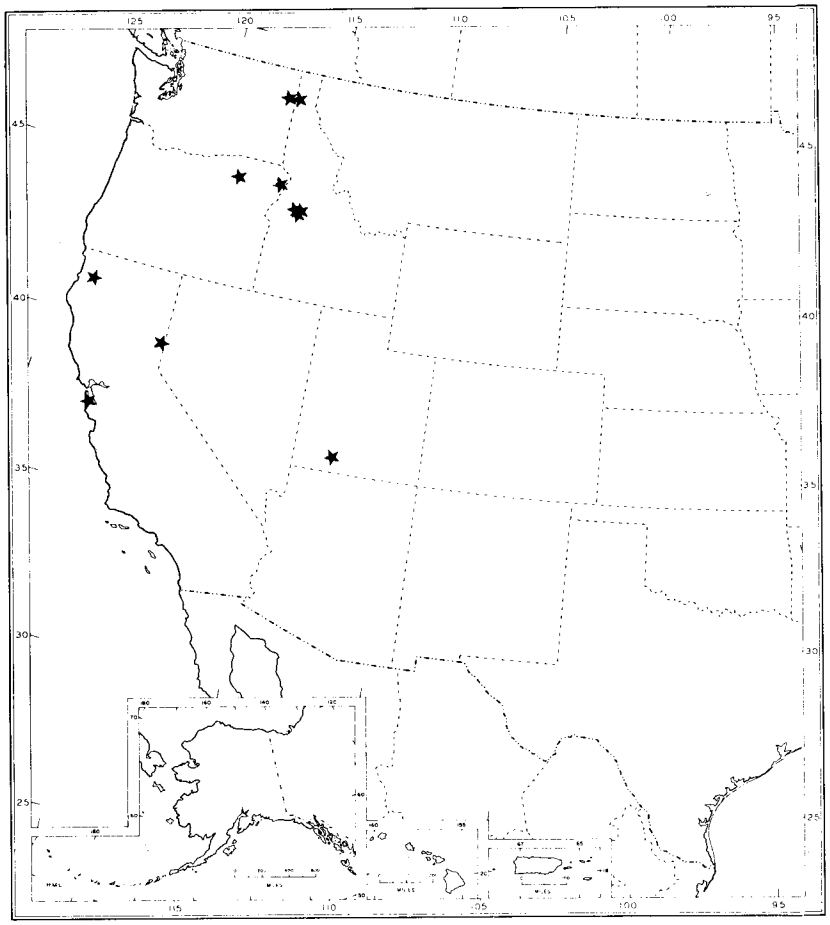
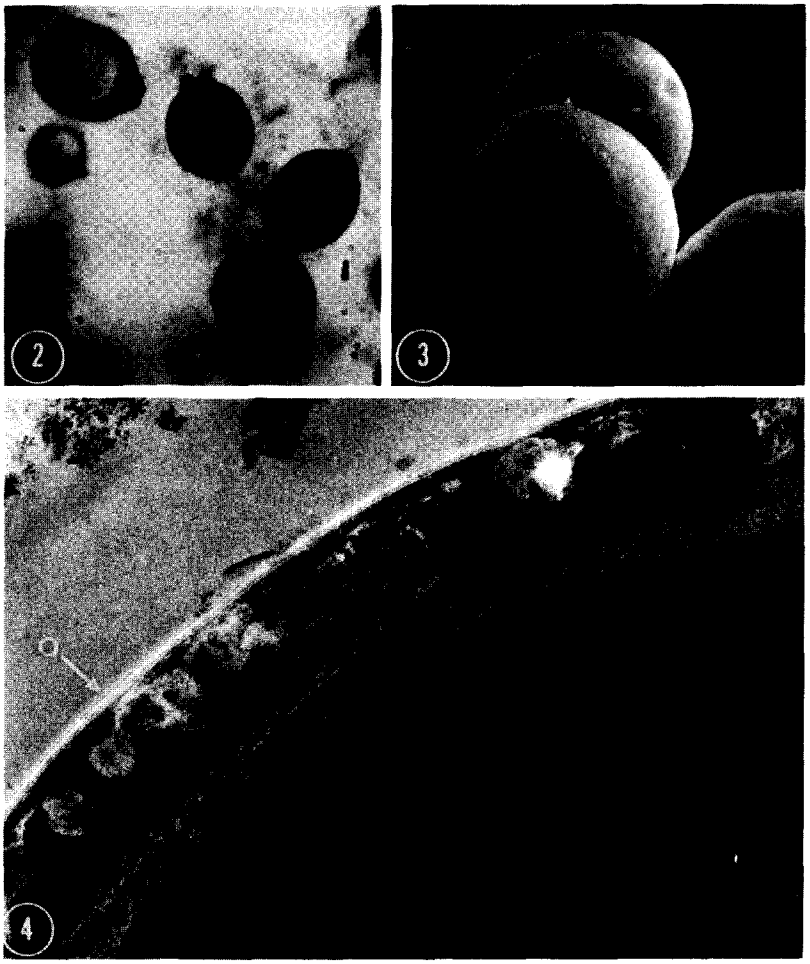


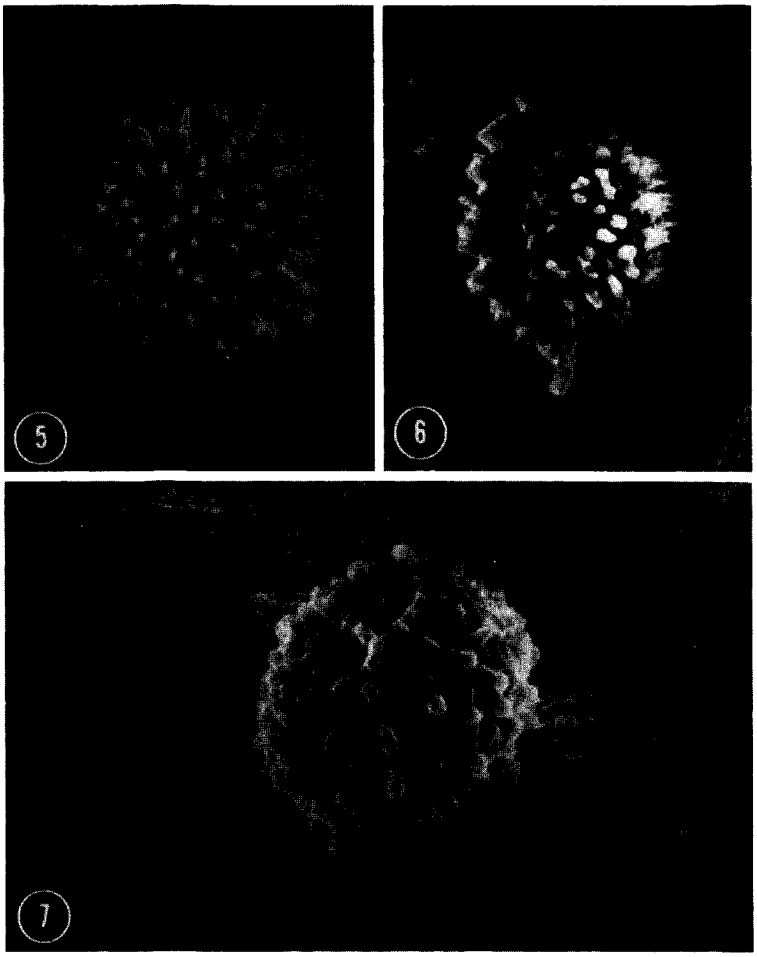
FIG. 1. Distribution of *Mycolevis siccigleba* in western North America. The collection from central Mexico (Trappe 3403) is not shown.



FIGS. 2–4. *Mycolevis siccigleba* (Thiers 21118). 2. Light micrograph of basidiospores mounted in Melzer's reagent, × 400. 3. Scanning electron micrograph of basidiospores, × 3,000. 4. Transmission electron micrograph of spore wall, × 23,505. Outer wall (0.05 μm thick) indicated by o.

spore wall is two-layered: the outer layer is very thin (0.05 μm) and the underlying ornamentation is separated by less dense pockets possibly resulting from partial dissolution of the thick inner spore wall (0.9–1.1 μm). The end result is a continuous, thick inner wall from which project irregular spines with tips that flare to form an outer, discontinuous crust; the whole is covered by a smooth, thin, continuous outer wall.

The spore wall structure of *Mycolevis* indicates a closer affinity to



FIGS. 5–7. *Zelleromyces gilkeyae* Singer & Smith (Fogel F946), *Macowanites chlorinosmus* Smith & Trappe (Trappe 3720), and *Gymnomyces alveolatus* Singer & Smith (Trappe 3779). 5. Scanning electron micrograph of *Z. gilkeyae* basidiospores, × 3,000. 6. SEM photograph of *M. chlorinosmus* basidiospore, × 5,000. 7. SEM micrograph of *G. alveolatus* basidiospore, × 5,000.

the Cribbeaceae than to the "Asterogastraceae". Members of the "Asterogastraceae" sensu Smith (1973) examined by SEM (FIGS. 5, 6, 7; Hawker, 1975) have very prominent spore ornamentation consisting of spines, warts, and ridges and lacking any indication of the thin outer wall present in *Mycolevis*. The spore wall of the Cribbeaceae, typified by *Cribbea,* is described by Smith and Reid (1962)

as two-layered "with an inner often refractive nongelatinous wall and a thicker outer matrix (or wall?) through which projections in the form of rods, spines or plates extend from the inner wall to the spore surface, the spore surface appearing warty or reticulate if the matrix does not revive completely". Despite the apparent similarity in spore ornamentation between *Mycolevis* and the Cribbeaceae a proper evaluation of their relationship cannot be made until spores of the Cribbeaceae have been examined by electron microscopy.

The preparation of this paper was supported in part by National Science Foundation Grant GB-36810X under the Coniferous Forest Biome (contribution no. 225), Ecosystem Analysis Studies, US/IBP, NSF Doctoral Dissertation Research Grant BMS 74-12750 and done in cooperation with the Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon. The author wishes to thank Rudolph B. Addison of the Forestry Sciences Laboratory for preparing the TEM micrographs.

LITERATURE CITED

Hawker L. E. 1975. Scanning electron microscopy of basidiospores as an indication of relationship among hypogeous Gasteromycetes. *Beih. Nova Hedwigia* **51**: 123–133.

Singer, R. 1971. A revision of the genus *Melanomphalia* as a basis of the phylogeny of the Crepidotaceae. pp. 441–474. *In:* Petersen, R. H., Ed. *Evolution in the higher Basidiomycetes.* University of Tennessee Press, Knoxville.

Smith, A. H. 1965. New and unusual Basidiomycetes with comments on hyphal and spore wall reactions with Melzer's solution. *Mycopathol. Mycol. Appl.* **26**: 385–402.

——. 1973. Agaricales and related secotioid Gasteromycetes. pp. 421–450. *In:* Ainsworth G. C., Sparrow, F. K. and A. S. Sussman, Eds. *The fungi.* Vol. IV B. Academic Press, New York.

——, **and D. A. Reid.** 1962 A new genus of the Secotiaceae. *Mycologia* **54**: 98–104.