

Cyathodium bischlerianum, sp. nov. (Marchantiales) a New Species from the Neotropics

NORIS SALAZAR ALLEN

Departamento de Botánica, Universidad de Panamá e Instituto Smithsonian de Investigaciones Tropicales, Apartado 2072, Balboa, República de Panamá

Abstract. *Cyathodium bischlerianum* is described as a new Neotropical species from Panama. The species is distinguished by its slender, delicate thallus; a prominent dorsal pore at base of involucre; monoicous condition with 1–2 archegonia per involucre, and male receptacles on sides of thallus; sporophytes without operculum; cells of upper third of capsule with bar-like thickenings; elaters attached to base of capsule wall with 3–4 bands; and spinose-bulbose spores. This species resembles the Asiatic *C. aureonitens* in spore ornamentation, but its monoicous condition, lack of operculum, naked involucre, and ornamentation of upper capsule cells separate it from its Asiatic relative. It is also related in morphology, sexual condition, and spore ornamentation to *C. cavernarum*.

Cyathodium Kunze is a pantropical thalloid liverwort distributed mainly in the Paleotropics. In a recent revision, Srivastava and Dixit (1996) recognized 11 species, most of them distributed on the Indian subcontinent. Three of the species occur in the Neotropics: *C. cavernarum* Kunze, *C. spruceanum* Proskauer, and *C. steerei* Hässel. Only *C. cavernarum* is of pantropical distribution, while the latter two are endemics in the Neotropics. Neotropical species of *Cyathodium* are characterized by dichotomously branched, yellow-green to green thalli notched at the apex; some species (*C. cavernarum* and *C. bischlerianum*) have a metallic luster and are fan-shaped or in discrete rosettes; the thalli are composed of a central layer of air chambers covered by two layers of cells, one above and one below, air chambers open by dorsal pores flanked by 5–10(–20) botuliform cells, oil bodies are in specialized triangular-shaped cells (*C. bischlerianum*, *C. cavernarum*, *C. steerei*) or in cells containing both chloroplasts and oil bodies (*C. spruceanum*); rhizoids are abundant, smooth to lightly pegged, ± sinuous, long, and colorless except for the basal light to dark-brown colored portion. Ventral scales are multicellular, hyaline, without appendages, and have specialized cells containing 1(–2) oil bodies. It can be monoicous (*C. cavernarum*, *C. steerei*, *C. bischlerianum*) or dioicous (*C. spruceanum*). Sporophytes are terminal, single or rarely 2(–3) per involucre, with or without operculum. Spores are spinose or lamellate-reticulate. Species of *Cyathodium* have been collected on soil, rock, bark, cement gutters, walls along roadsides, cement flower pots, river banks, caves, and in the understory of seasonally inundated lowland tropical forests.

During our studies of Neotropical material,

mixed collections of *Cyathodium* were found in various localities (Fig. 1) in the watershed of the Panama Canal (Parque Nacional Soberanía) and in the Province of Coclé (El Valle de Antón) containing two morphs, one corresponding to *C. cavernarum* but the other differing in thallus morphology and spore ornamentation. None of the Neotropical species resembled this morph nor most species from the Palaeotropics. The new species is named in honor of Dr. Helene Bischler, an outstanding hepaticologist in the Marchantiales and who kindly suggested the monographic studies of the genus for the Neotropics.

CYATHODIUM BISCHLERIANUM Salazar Allen, sp. nov.

FIGS. 1–3

Thallus monoicus delicatus metallice viridis luteo-viridescens, dichotome ramosus, involucri basi poro dorsali conspicuo praeditus; sporophytum in involucro inoperculato; cellulae capsulae ultra mediam vittato-incrassatae; elateres capsulae basi affixi, 3–4 vittati; sporae spinis basi bulbosis echinatae.

TYPE: PANAMA. PROVINCE OF PANAMA. Parque Nacional Soberanía, Río Pedro Miguel by Camino de Cruces (09°01' N, 79°36' W), on rocky banks of river, Salazar Allen, Chung & Rivera. 14390 (holotype, PMA). PARATYPE. PANAMA. PROVINCE OF PANAMA. Parque Nacional Soberanía, Río Pedro Miguel entrando por Camino de Cruces (09°01' N, 79°36' W), Salazar Allen et al. 14386, 14393, 14395 p.p., 16599, 16600, 16612 p.p., 16613 p.p., 16643 (PMA); Rodríguez 220b, 221 (PMA); Sendero El Charco (09°05' N, 79°41' W), Rodríguez 209, 211, 216 (PMA); Río Masambí Grande (09°04' N, 79°40' W) en el Camino hacia Canopy Tower, Salazar Allen 16772, 16763, 16765, 16772, 16789, 16791, 16796 p.p., 16798, 16799, 16800, 16804, 16805 (PMA); Province of Coclé, El Valle de Antón, Río Las Mozas (08°37' N, 80°08' W), Salazar Allen et al. 14447 (PMA).

Thallus metallic green to yellowish-green, deli-

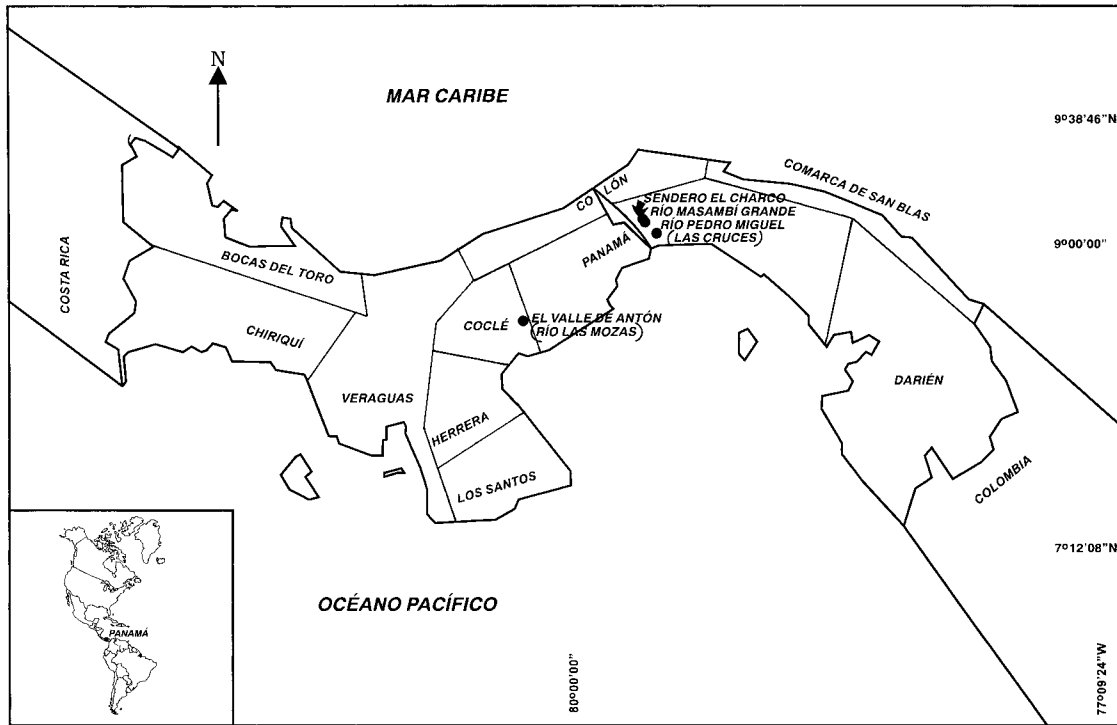


FIGURE 1. Distribution of *Cyathodium bischlerianum*.

cate, small, dichotomously branched, with two ear-shaped apical lobes contracted distally; dorsal epidermis delicate, chlorophyllose, chloroplasts larger than those of ventral cells, cells $22.5\text{--}54\text{--}(79.5)$ μm long, $(19.5\text{--})22.5\text{--}52.5\text{--}(60.0)$ μm wide, walls thin, lacking trigones; oil bodies light brown, 1(–2), in cells lacking chloroplasts; border cells with outer walls strongly convex; oil cells triangular, smaller than adjacent border cells; dorsal pores one to few, usually one large, on dorsal epidermis at base of involucre, simple, wide open, surrounded by 2–3(–4) concentric rows of 4–6 botuliform cells; abaxial epidermis chlorophyllose, cells polygonal, larger than those of dorsal epidermal layer, $(37.5\text{--})40.5\text{--}123\text{--}(144)$ μm long, $22.5\text{--}55.5\text{--}(67.5)$ μm wide. Midrib absent. Rhizoids long and colorless with \pm straight to sinuate walls, lightly pegged. Ventral scales simple, borne near thallus apex, on ventral walls of involucre and around male receptacles, without appendages, filamentous to \pm elongated triangular, uniseriate to multiseriate, 3–8 cells long, 2–4 cells wide at base with apical or lateral idoblasts containing 1(–3) oil bodies. Monoicous. Male receptacles lateral, sometimes occurring in close proximity of female receptacles, cushion-shaped to oblong triangular; involucre dissected into two lips above, with single (–2) archegonia, border cells elongated in 2(–3) rows, outermost row with inner tangential walls thickened and brown-

red in color, mid-cells polygonal, larger, thin-walled, hyaline towards base, $(25\text{--})45.0\text{--}82.5$ μm long, $(12.5\text{--})30.0\text{--}82.5$ μm wide. Sporophyte shortly pedunculate, peduncle of 9 uniseriate narrow cells, capsule ovoid, 1(–2) per involucre, 0.35–0.52 mm long, 0.32–0.46 mm wide, orange brown when mature, without operculum. Capsule wall one cell thick, cells in upper 1/3 with transverse, bar-shaped thickenings, dehiscent by 4–6(–7) irregular valves, cells of lower 2/3 thin-walled with large oil bodies, non-dehiscent. Spores green to light brown, $(37.5\text{--})40.0\text{--}55.5\text{--}(60.0)$ μm in longest diameter, echinate, base of spines bulbous, oval-triangular. Elaters 2–7, attached to base of capsule, with 3–4 narrow helical bands, attenuate at distal end, widened and funnel-shaped at proximal end.

Distribution and habitat.—*Cyathodium bischlerianum* has been collected in the area of the Canal (sea level–50 m) and in the Province of Coclé (580 m) in Panama. It is probably widely distributed in Central America and other areas in the Neotropics, but due to its small size and similar appearance to *C. cavernarum*, with which it grows, it may be easily overlooked in mixed collections. It grows sympatrically with *C. cavernarum*, *C. spruceanum*, and *Notothylas* in very moist areas, near creeks, on rocky and muddy unstable banks of rivers, subject to partial submergence during high water levels, and on tree cortex (e.g., *Ficus* sp., *Anacardium excelsum* (Bertero &

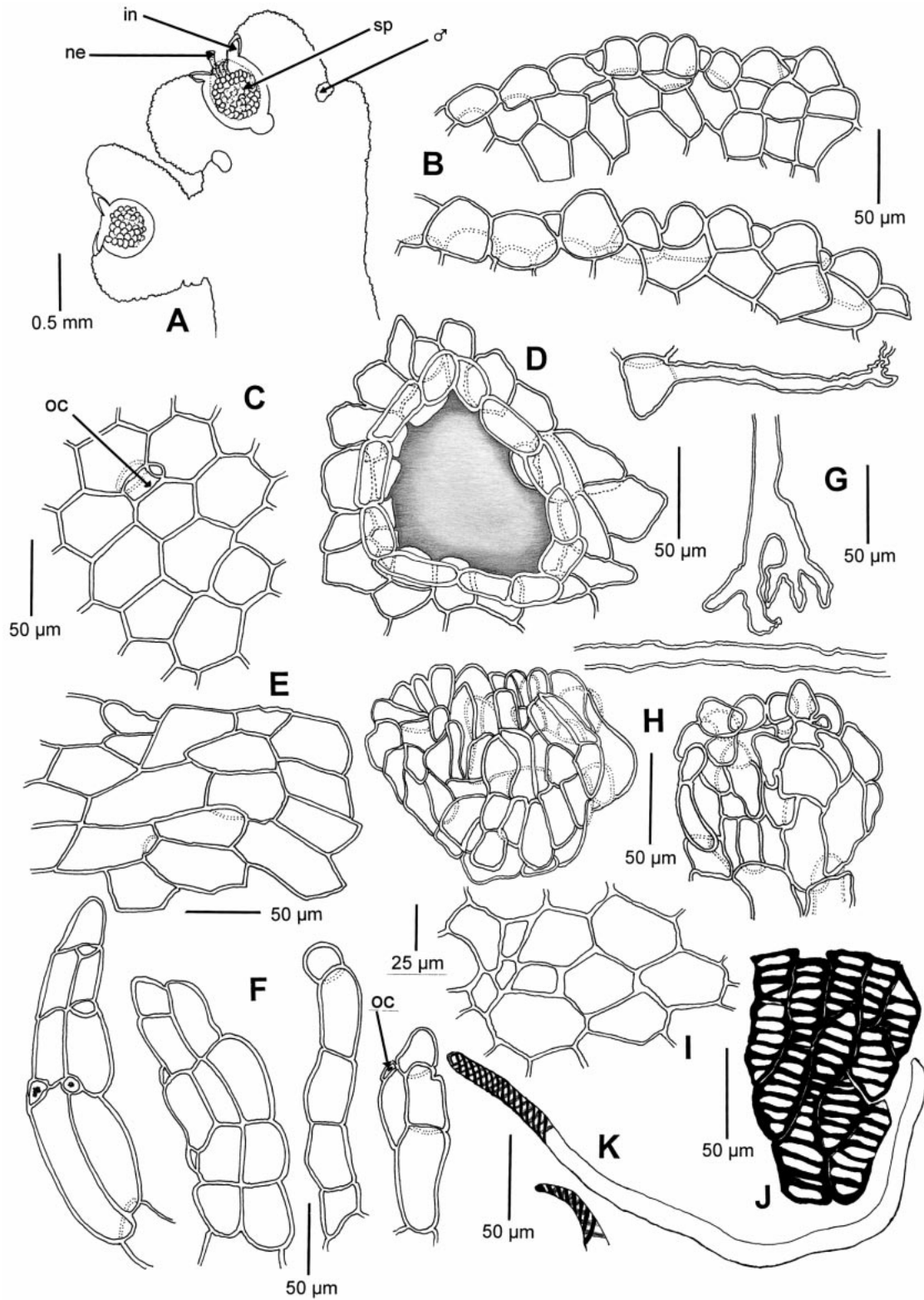


FIGURE 2. *Cyathodium bischlerianum*. — A. Habit. — B. Border cells. — C. Upper epidermal cells. — D. Pore. — E. Lower epidermal cells. — F. Scales. — G. Rhizoids. — H. Male receptacles. — I. Cells of involucre. — J. Upper capsule cells. — K. Elater (in, involucre; ne, archegonial neck; oc, oil cell; sp, sporophyte; ♂, male receptacle). All drawings from Holotype.

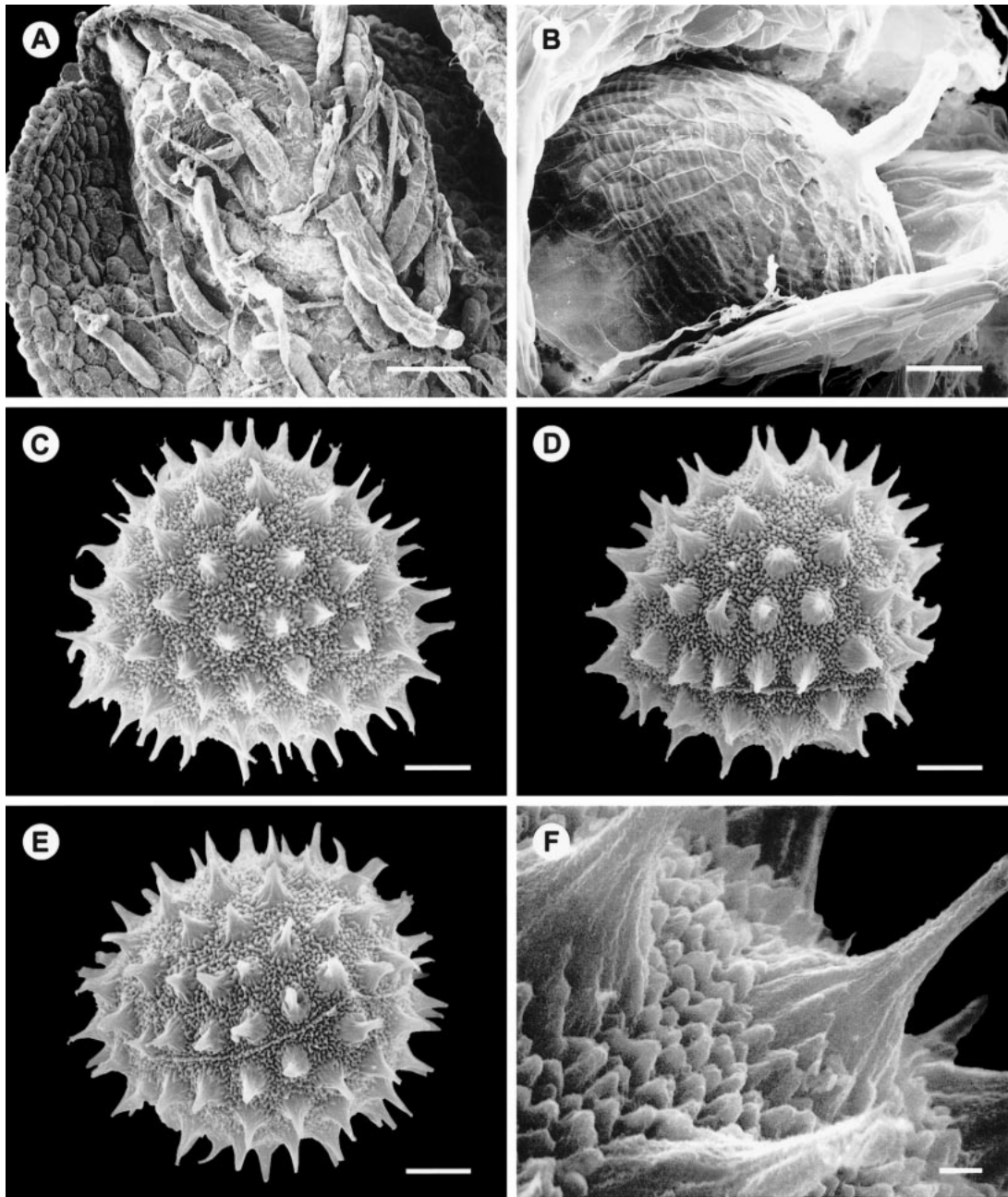


FIGURE 3. *Cyathodium bischlerianum*, SEM micrographs. — A. Ventral scales of involucre. — B. Surface view of calyptra cells and neck of archegonium (thickenings of upper capsule cells are observed underneath the calyptra cells). — C. Spore, distal face. — D. Spore, side view showing part of the midgirdle. — E. Spore, side view of midgirdle. Upper surface of spore, distal face; lower surface, proximal face. — F. Ornamentation of the exine, proximal view, short stubby spines; distal and upper left view, bulbous base of large spines. All micrographs from Holotype. Scales bars: A = 100 μm ; B = 50 μm ; C–E = 10 μm and F = 1 μm .

Balb.) Skeels, *Attalea butyracea* (L.f.) Wess. Boer.). Analyses of three samples of bark from *A. excelsum* gave pH readings in the range of 6.96–6.98. This species, like other Neotropical species of *Cyathodium*, grows closely associated with cyanobacteria.

Cyathodium bischlerianum differs from *C. cav-*

ernarum in having a slender, more elongate and delicate thallus with an irregular border due to pronounced conic projections of border cells and fewer pores on dorsal epidermis (usually a single, prominent one at base of involucre). In *C. bischlerianum*, the apical lobes are large, ear-shaped and abruptly

constricted towards base at insertion of male receptacles, and when mature, the lips of the involucre are below or at the same level as the thallus rim, and sporophytes abut prominently from the upper and ventral side of the involucre. Spore color and ornamentation are unique among Neotropical species of *Cyathodium*. Nevertheless, its thallus morphology with specialized oil cells, monoicous condition, and spinose spores is more closely related to *C. cavernarum*. Spinose spores with bulbous bases are only known for the Asiatic *C. aureonitens* (Griff.) Mitt., but its dioicous condition, hairy involucre, presence of an operculum, ornamentation of upper cells of capsule, and color of spores and capsules readily separate the latter species from *C. bischlerianum*.

ACKNOWLEDGMENTS

Sincere thanks to C. Chung, B. Cuadra, A. Espinosa, E. Montenegro, and A. Velásquez for valuable help in the

field, to the Smithsonian Tropical Research Institute (STRI) for financial support for my research on bryophytes, to G. Maggiori and M. Leone of STRI for their help with the logistic related to collecting permits and to A.N.A.M. authorities and park rangers for their helpful cooperation. My gratitude to R. Barneby and W. R. Buck for help with the latin description, J. Cevallos for SEM micrographs, and A. Castillo and L. González of the Digital Imaging Laboratory for illustrations. Special acknowledgments to curators of the following herbaria for loan of specimens, BA, G, GOET, PC, S, and W. David G. Long, María I. Morales, Julián Monge, and Dale H. Vitt provided helpful comments to improve the manuscript.

LITERATURE CITED

SRIVASTAVA, S. C. & R. DIXIT. 1996. The genus *Cyathodium* Kunze. *Journal of the Hattori Botanical Laboratory* 80: 149–215.

ms. received May 17, 2000; accepted July 20, 2000.