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Gomphillus caribaeus Belongs in the New Genus *Bryogomphus* (Lecanorales: Pilocarpaceae)

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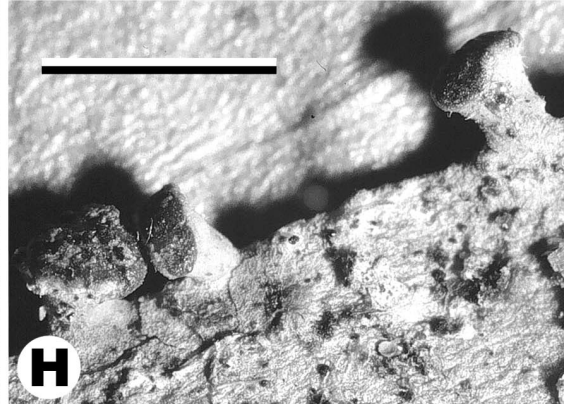
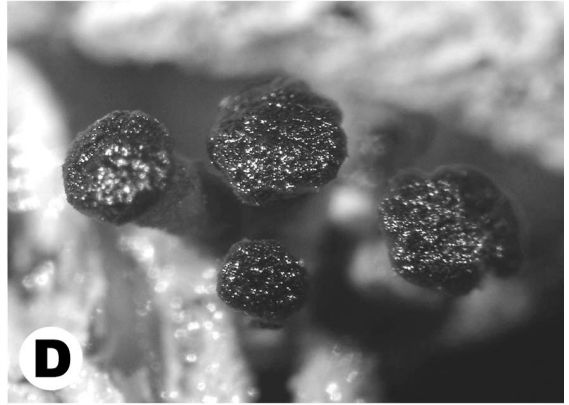
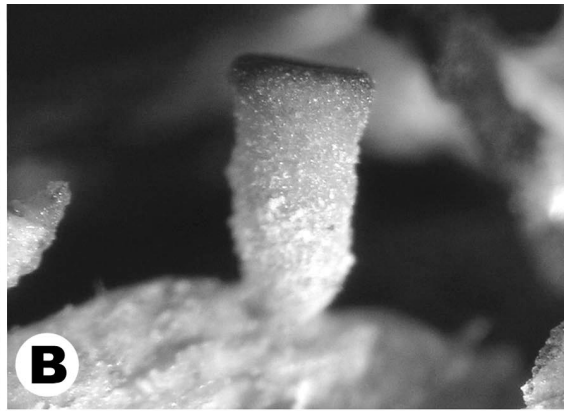
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Abstract. *A revision of the lichen genus Gomphillus Nyl. in the Americas reveals that G. caribaeus W. R. Buck does not belong in that genus, but is a member of the Pilocarpaceae in the Lecanorales. Because of its distinctive features, the species cannot be accommodated in any of the known genera of that family, and the new genus Bryogomphus Lücking, W. R. Buck, Sérus. & L. I. Ferraro is established for it. Bryogomphus is characterized by turbinate, vertically elongate, obconical apothecia with a disc-shaped top, anastomosing paraphyses forming a reticulum around individual asci, amyloid asci of the Sporopodium-type, and filiform, multiseptate ascospores. Most similar within the Pilocarpaceae is Bapalmuia marginalis, but that species differs in having unbranched, strongly coherent paraphyses and Byssoloma-type asci with a darker tubular structure in the tholus. Calopadia turbinata (Tuck.) Sérus. & Lücking comb. nov. is also related but has a paraplectenchymatous excipulum, largely unbranched paraphyses, and oblong-ellipsoid, muriform ascospores. Bryogomphus shows a remarkable convergence with Gomphillus in the Gomphillaceae (Ostropales), being extremely similar even in many details, except for the amyloid asci, slightly thicker and irregularly bent paraphyses, externally thinly byssoid excipulum with labyrinthical structure, and disc-shaped top of the apothecia.*

Keywords. *Bapalmuia, Bryogomphus, Calopadia, Gomphillaceae, Gomphillus, Lopadium, muscicolous, Ostropales, Pilocarpaceae, Sporopodium, Tapellaria.*

Initiated by the discovery of the new species *Gomphillus pedersenii* in Argentina, the first and last author (Ferraro & Lücking 2005; this issue) compiled a synopsis of the genus for the Americas. While extracting diagnostic characters and prepar-

ing a key to the supposedly five known species (Buck 1998; Esslinger 1975; Kalb & Vězda 1988), some elements in the original description of *Gomphillus caribaeus* W. R. Buck made it necessary to restudy the material cited in the protologue. Char-



acters such as “. . . *thallo minore minute granuloso . . . excipulo . . . tomentuloso crystall(i)fero . . .*” (Buck 1998: 72) do not fit *Gomphillus* or the Gomphillaceae in general but rather point to certain members of the Pilocarpaceae. Representatives of that family frequently have a farinose-granulose thallus and a partly byssoid excipulum, and the genus *Bapalmuia* matches *Gomphillus* in having filiform, transversely multiseptate ascospores (Kalb et al. 2000; Sérusiaux 1993). There is even a species, *B. marginalis* (Vain.) Sérus. (FIG. 1H), with turbinate, vertically elongate apothecia like those of *Gomphillus*. That species and its similarities with *Gomphillus calycioides* (Del. ex Duby) Nyl. were already discussed by Santesson (1952; as *Bacidia marginalis*), and he concluded that “. . . in spite of these great similarities, *Gomphillus calycioides* and *Bacidia marginalis* are not close relatives . . .” (Santesson 1952: 447–448). We therefore suspected that *Gomphillus caribaeus* could belong in the genus *Bapalmuia* and might even be identical with *B. marginalis*.

Surprisingly, when studying the type material and other specimens available, we found that, while *Gomphillus caribaeus* is indeed similar to *Bapalmuia marginalis*, it differs in important hamathecium and ascus characters and thus cannot be accommodated in the genus *Bapalmuia*. Instead, the new genus *Bryogomphus*, which combines features of *Gomphillus*, *Bapalmuia*, *Sporopodium*, and *Tappellaria*, is established to house this enigmatic taxon.

BRYOGOMPHUS Lücking, W. R. Buck, Sérus. & L. I. Ferraro, *gen. nov.* FIGS. 1A–D, 2

Genus novum ascomycetum lichenisati ad familiae Pilocarpacearum in ordine Lecanorales pertinens. Sicut *Gomphillus calycioides* vel *Bapalmuia marginalis*, cum apotheciis turbinatis et ascosporis filiformibus transversaliter multiseptatis, sed *Gomphillo* ascis I+ caeruleis et *Bapalmuia* ascis ad typo *Sporopodio* pertinentibus et paraphysis ramoso-conexis I– differt.

Thallus smooth to farinose, ecorticate. Photobiont chlorococcoid. Apothecia turbinate, vertically elongate, obconical, with pale flanks and apically with a slightly expanded, flat to slightly convex, dark disc. Excipulum prosoplectenchymatous, with rather thick-walled cells in labyrinthical arrangement, yellowish brown, laterally with short, free hyphae (*Bapalmuia confusa*-type; see Kalb et al. 2000: 283). Hamathecium of richly branched and

anastomosing, non-gelatinized paraphyses forming a reticulum around individual asci, I–. Asci very elongate-cylindrical, I+ persistently dark blue throughout, with distinct, basally broad ocular chamber, I+ dark blue tholus without discernible structure and I+ blue outer wall (*Sporopodium*-type; see Hafellner 1984: 277). Ascospores filiform, transversely multiseptate. Conidiomata not observed.

TYPE SPECIES: *Bryogomphus caribaeus* (W. R. Buck) Lücking, W. R. Buck, Sérus. & L. I. Ferraro, *comb. nov.*; *Gomphillus caribaeus* W. R. Buck in Glenn et al., *Lichenogr. Thomsoniana*: 72. 1998.

Etymology.—The name of the new genus refers to the strong resemblance with the systematically unrelated genus *Gomphillus* [*gomphus* = nail] and its bryophilus habitat.

Bryogomphus is a remarkable new genus which combines features of several, partly unrelated, partly related genera (Table 1). The muscicolous growth, turbinate, vertically elongate apothecia and filiform, transversely multiseptate ascospores closely resemble *Gomphillus*, for which it was mistaken in its original description. The lecanoroid, amyloid asci, together with the apically disc-shaped apothecia, suggest placement in *Bapalmuia* and even possible synonymy with *B. marginalis*. However, the richly anastomosing, non-gelatinized paraphyses forming a reticulum around individual asci and the *Sporopodium*-type asci differ from all known species of *Bapalmuia* and closely related genera (e.g., *Byssoloma*, *Fellhanera*), which have rather indistinct, strongly coherent paraphyses (unbranched in *Bapalmuia*) and *Byssoloma*-type asci with I+ darker tubular structure in the tholus (Kalb et al. 2000). Because of the coherent paraphyses, the entire hymenium reacts I+ blue in these genera, while in *Bryogomphus*, only the asci are I+ persistently blue while the hamathecium is I–. The hymenium therefore looks very characteristic when stained with Lugol, the asci being clearly visible as blue tubes between the reticulate, unstained paraphyses. This type of hymenium is more typical of genera such as *Calopadia* (paraphyses largely unbranched), *Sporopodium* (paraphyses anastomosing), and *Tappellaria* (paraphyses forming a reticulum around individual asci). However, these genera never produce filiform ascospores and have a paraplectenchymatous excipulum and a campylidial anamorph, as well as other differences (Lücking 1999; Vězda 1986).

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FIGURE 1. Apothecial morphology in *Bryogomphus*, *Gomphillus*, and *Bapalmuia*. —A–D. *Bryogomphus caribaeus* (holotype). —E–F. *Gomphillus calycioides* (Chile). —G. *Gomphillus ophiosporus*, hydrated (Costa Rica). —H. *Bapalmuia marginalis* (holotype). —Scale = 1 mm, except for B and D (0.7 mm) and G (2 mm).

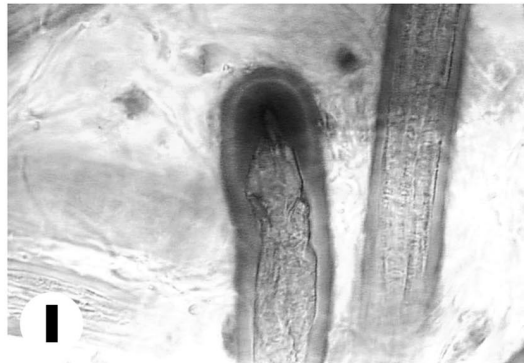
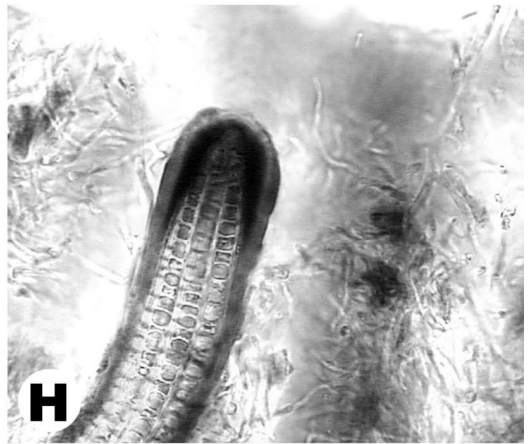
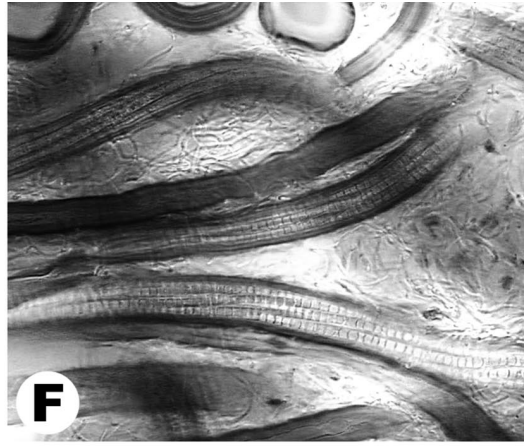
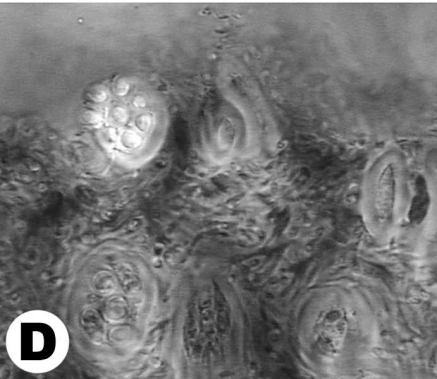
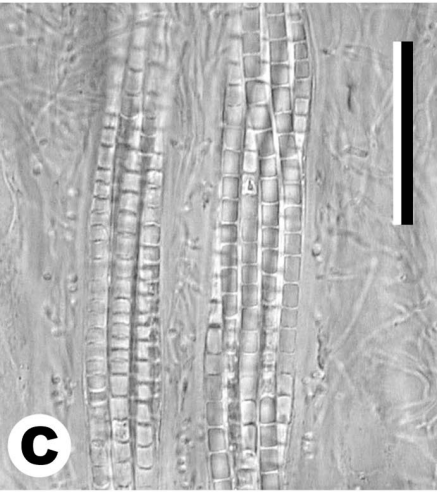
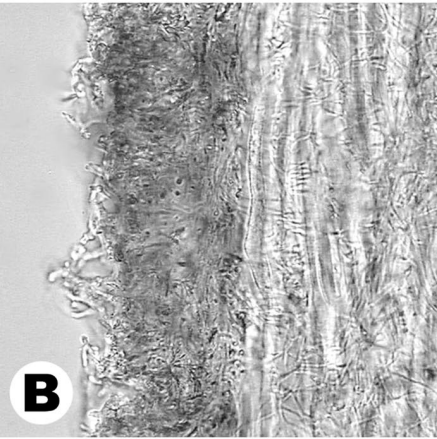
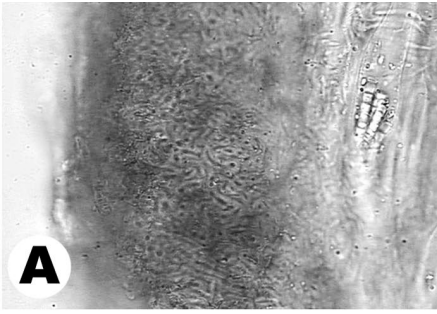


TABLE 1. Comparison of species with turbinate, vertically elongate apothecia and filiform, transversely multiseptate ascospores, in the three genera *Gomphillus*, *Bryogomphus*, and *Bapalmuia*.

	<i>Gomphillus calycioides</i>	<i>Bryogomphus caribaeus</i>	<i>Bapalmuia marginalis</i>
Family (Order)	Gomphillaceae (Ostropales)	Pilocarpaceae (Lecanorales)	Pilocarpaceae (Lecanorales)
Thallus	cartilaginous-corticate (<i>Gyalideopsis</i> -type)	smooth-farinose-ecorticate (<i>Bapalmuia</i> -type)	smooth-farinose-ecorticate (<i>Bapalmuia</i> -type)
Photobiont	chlorococcoid (<i>Trebouxia</i>)	chlorococcoid (genus?)	chlorococcoid (genus?)
Apothecia	turbinate (vertically elongate) with club-shaped top	turbinate (vertically elongate) with disc-shaped top	turbinate (vertically elongate) with disc-shaped top
Excipulum	hyphal (<i>Gyalideopsis</i> -type)	psoroplectenchymatous (<i>Bapalmuia</i> -type)	psoroplectenchymatous (<i>Bapalmuia</i> -type)
Hamathecium	anastomosing, I-, strongly gelatinized (<i>Gyalideopsis</i> type)	anastomosing, I-, non-gelatinized (<i>Tapellaria</i> type)	unbranched, I+, gelatinized (coherent) (<i>Bapalmuia</i> type)
Asci	annelasceous, I- (<i>Gyalideopsis</i> -type)	lecanoroid, I+ blue (<i>Sporopodium</i> -type)	lecanoroid, I+ blue (<i>Byssoloma</i> -type)
Ascospores	filiform, multiseptate 200–350 × 2–3.5 µm	filiform, multiseptate 300–400 × 3–5 µm	filiform, multiseptate 300–500 × 2–2.5 µm

Remarkably enough, there is a muscicolous species described as *Lecidea turbinata* (Tuckerman 1864) [= *Lopadium turbinatum* (Tuck.) Zahlbr.] that actually belongs in *Calopadia* [*Calopadia turbinata* (Tuck.) Sérus. & Lüicking, *comb. nov.*; *Lecidea turbinata* Tuck., Proc. Amer. Acad. Arts 6: 282. 1864]. Its apothecia are somewhat similar to those of *Bryogomphus* but less elongate, its excipulum and paraphyses are of the *Calopadia* type, and its ascospores are muriform and frequently remain partly extruded in the apothecial disc and then disintegrate into numerous very small conidia. It is thus clear that the two taxa are not congeneric, although belonging in the same family. *Calopadia turbinata*, originally also described from Cuba, has been found abundantly over mosses in montane rain forests of Costa Rica in the frame of the TICOLICHEN project (Lüicking et al. 2004), as well as in the Lesser Antilles (St. Lucia and Guadeloupe: Basse-Terre).

The Pilocarpaceae have recently been emended to include the Micareaceae and Ectolechiaceae (Andersen & Ekman 2004), with a large number of genera and many enigmatic taxa, such as *Roccellinastrum* Follmann (Follmann 1967; Henssen et al. 1982; Kantvilas 1990) and *Sczcawinskia* Funk (Holien & Tønsberg 2002), growing in sheltered situations and thus not easily and frequently collected. It is therefore not surprising to discover a new genus growing over bryophytes.

The analogies between *Bryogomphus* and *Gom-*

phillus are indeed amazing and not just restricted to the muscicolous growth and the turbinate, vertically elongate apothecia. Even apothecial sections look extremely similar at first glance, and some of the differences, such as the prosoplectenchymatous, externally thinly byssoid excipulum are easily overlooked or attributed to infrageneric variation; many Gomphillaceae do indeed have a prosoplectenchymatous excipulum, although different in structure (Lüicking 1997; Lüicking et al. 2005). In addition to the slight differences in the appearance of the paraphyses and asci, the two taxa can easily be separated by the I-reaction: negative in *Gomphillus*, but with the asci quickly turning deep blue in *Bryogomphus*.

Another genus with turbinate apothecia and filiform ascospores is *Conotremopsis* Vězda (1977), known from Tasmania and New Zealand (Kantvilas & Jarman 1999) and recently found in La Réunion in the Indian Ocean (Kalb 2004). It differs by its byssoid thallus, lichenized with *Trentepohlia*, and its Ostropales-type apothecia; it is presently placed in Stictidaceae (Eriksson 2005).

In its original description as *Gomphillus caribaeus* (Buck 1998: 72), the ascospores of *Bryogomphus caribaeus* are given as 5–7 µm broad. We revised the three collections cited in the protologue and found that the ascospores are narrower (3–5 µm) and resemble those of *Gomphillus calycioides* (FIG. 1E–F). Interestingly, all three collections were first identified as *G. calycioides*, and it was the sup-

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FIGURE 2. Apothecial anatomy in *Bryogomphus caribaeus* (holotype). —A–B. Lateral excipulum; note the labyrinthical structure in A and the external byssoid hyphae in B. —C–E. Asci with ascospores and single ascospore. —F–I. Asci stained in Lugol's solution; note the unstained, richly anastomosing paraphyses and the uniformly dark tholus with lateral flanks and ocular chamber (oc). —Scale = 40 µm, except for A–B (60 µm), F (80 µm), and G and I (50 µm).

posedly broader ascospores that triggered the description of the new species. Had the original identification as *G. calycioides* been maintained, we would probably have never discovered this enigmatic genus. To make things even more complicated, the type collection of *Gomphillus (Bryogomphus) caribaeus* also contains a small specimen of *Gomphillus ophiosporus* (FIG. 1G) with several apothecia; the two are well separated on different areas of the phorophyte moss and easily distinguished morphologically.

Specimens of Bryogomphus caribaeus examined (in addition to those cited by Buck 1998: 72).—LESSER ANTILLES. GUADELOUPE: Basse-Terre, NW of La Soufrière, along Victor Hughues track starting at forest house of Matouba, slightly disturbed forest and plantations, 800–1,000 m, on terricolous mosses and on mossy trunk, April 1995 and March 1996, *Sérusiaux s.n.* (LG).

Specimens of Calopadia turbinata examined.—CUBA. Unknown locality, invading the thallus of *Coccocarpia erythroxyli*, Wright 2 [with the annotation “illegible”] (FH, holotype!). LESSER ANTILLES. ST. LUCIA: Quillesse Forest, near interpretation center, undisturbed forest with *Heliconia* and *Cyathea*, 300–350 m, on tree, February 1993, *Sérusiaux s.n.* (LG). GUADELOUPE: Basse-Terre, La Grande Traversée road, track between Col des Mamelles and Morne Léger, slightly disturbed humid forest, 600 m, on mossy tree, March 1996, *Sérusiaux s.n.* (LG); *ibid.*, S of Saint-Rose, track starting at the sulfur spring of Sofaia, little disturbed forest, 450 m, on mossy tree, April 1995, *Sérusiaux s.n.* (LG).

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