
Bryomyces, a Genus Described from Foliar Moss Gemmae, Is an Earlier Name for *Plenogemma* (Orthotrichaceae)

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ABSTRACT. *Bryomyces* Miq. and *Phragmidium* Müll. Hal., originally described as genera of endophytic bryophilous ascomycetes, refer instead to foliar moss gemmae based on a comparative assessment of their published illustrations with bryophyte specimens and relevant bryological literature. *Phragmidium* and *Plenogemma* Plášek, Sawicki & Ochyra are morphologically congeneric with *Bryomyces*, the latter of which has priority. The new combination *B. phyllanthus* (Brid.) J. J. Atwood, W. R. Buck & Goffinet is proposed. *Bryomyces elegans* Miq., *Phragmidium apicale* Müll. Hal., and *Ulota phyllantha* Brid. [= *Plenogemma phyllantha* (Brid.) Sawicki, Plášek & Ochyra] are new synonyms of that species. *Bryomyces montagneanus* Miq. is a new synonym of *Calymperes androgynum* Mont. [= *Syrrophodon rigidus* Hook. & Grev.], whereas *B. muelleri* Miq., *Phragmidium ramosum* Müll. Hal., and *Phragmidium sparsum* Müll. Hal. are new synonyms of *Orthotrichum lyellii* Hook. & Taylor [= *Pulvigerella lyellii* (Hook. & Taylor) Plášek, Sawicki & Ochyra]. Lectotypes are designated for *B. montagneanus*, *Phragmidium*, *Phragmidium apicale*, and *Phragmidium ramosum*, while a neotype is designated for *B. elegans*.

Key words: *Bryomyces*, bryophytes, *Calymperes*, gemmae, nomenclature, *Orthotrichum*, *Phragmidium*, *Plenogemma*, *Ulota*.

Bryophyte gemmae are specialized, vegetative reproductive structures that vary in frequency, size, number of cells, shape, and color, and in their origin, occurring on protonemata, rhizoids, stems, and leaves (Correns, 1899). Aside from select fern families, bryophytes are the only plant group with gametophytic gemmae (Farrar, 1974; Wyatt, 1994). At least 12% to 15% of mosses produce gemmae, particularly orthotropic, dioicous species (Crum, 2001). In some moss genera, gemmae are so conspicuous that their presence and morphology serve to distinguish species. Well-documented examples of

moss species with gemmae occur in *Orthotrichum* Hedw. (Lewinsky, 1977), *Zygodon* Hook. & Taylor (Malta, 1926; Wilbraham & Long, 2005), *Calymperes* Sw. ex F. Weber, *Mitthyridium* H. Rob., *Syrrophodon* Schwägr. (Reese, 2001), and *Streptopogon* Wilson ex Mitt. [= *Syntrichia* Brid. sect. *Streptopogon* (Wilson ex Mitt.) Brinda, Jáuregui-Lazo & Mishler] (Zander, 1993; Gallego et al., 2022). The function of gemmae is considered to have an adaptive role for colonist species to inhabit disturbed and extreme environments (Newton & Mishler, 1994; Laaka-Lindberg et al., 2003).

Bryophilous ascomycetes are an understudied but systematically and ecologically diverse group of fungi (Döbbeler, 2025). When parasitizing mosses, these small, obligate endophytes can have species-specific hosts, colonize either parts of the gametophyte or sporophyte with particular specificity (Ptaszynska et al., 2009), and have reduced fruiting bodies that can resemble gemmae of the host (Döbbeler, 1997). Early 19th-century attempts to catalog the diversity of endophytic bryophilous fungi resulted in the description of two obscure genera, *Bryomyces* Miq. and *Phragmidium* Müll. Hal., which are based instead on foliar moss gemmae. Miquel (1839a) briefly described *Bryomyces* for a single species, *B. elegans* Miq., which formed cylindrical outgrowths on the apices and adaxial lamina of the upper leaves of an *Orthotrichum* species. Alongside *B. elegans*, Miquel made mention of a second, undescribed species of *Bryomyces* based on similar outgrowths on the leaves of *Calymperes* and illustrations of *C. androgynum* Mont. by Montagne (1835: pl. 3, fig. 2; Fig. 1). This second species was subsequently described by Miquel (1839b) as *B. montagneanus* Miq. based on its paler and denser outgrowths that are clustered at the tips of leaves of *C. androgynum* and *C. afzelii* Sw.

A more formal description of *Bryomyces* was published later by Miquel (1842), who included an illus-

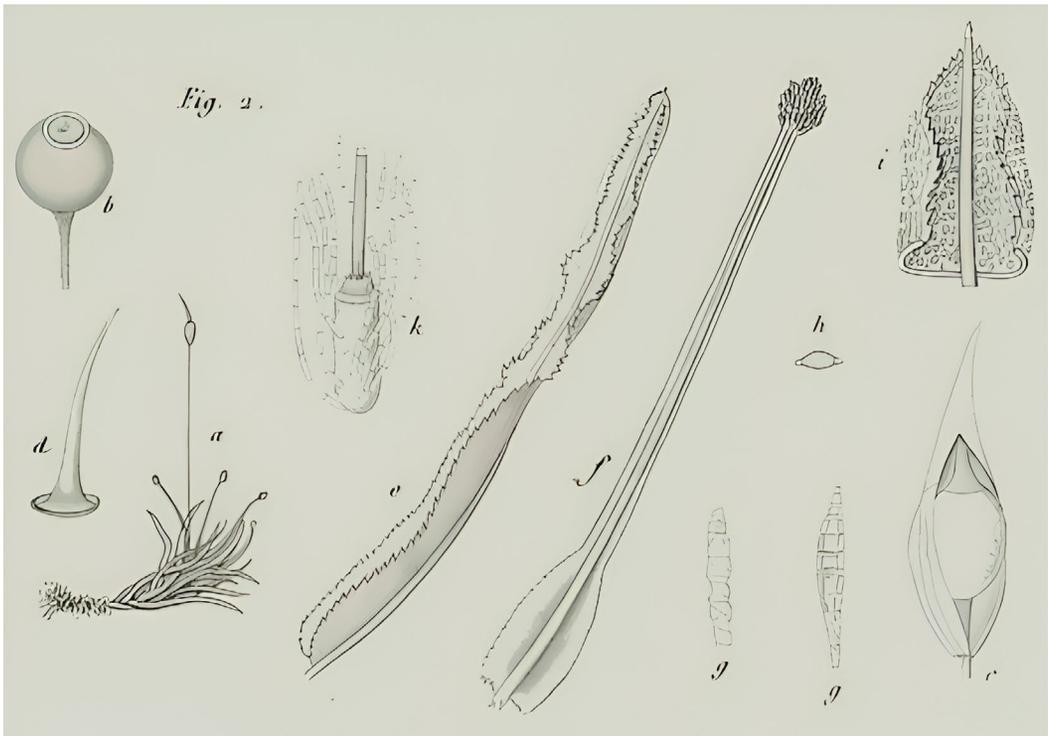


Figure 1. Original material of *Bryomyces montagneanus* Miq.; illustration published by Montagne (1835: pl. 3, fig. 2).

tration of *B. elegans* (tab. LV; Fig. 2) that was later adapted for part 8 of *Flora Batava* by Kops and Van Hall (1844: fig. 619). The illustration shows several moss leaves with conspicuous clusters of brown, cylindrical, and multi-septate outgrowths radiating from the upper lamina and adaxial surface of the costa. These outgrowths, based on a comparative assessment of orthotrichaceous moss specimens in MO as well as relevant literature, are not fungal spores as perceived by Miquel, but rather belong to the foliar gemmae of *Ulota phyllantha* Brid. [\equiv *Plenogemma phyllantha* (Brid.) Sawicki, Plášek & Ochyra], at least in part. The gemmae superficially resemble the spores of several fungi in shape, color, and septation, but arise from divisions of the moss leaf cells, rather than from a fungal mycelium between or on the cells (Greiff & Döbbeler, 2024).

The genus *Phragmidium* was described by Müller (1841a; Fig. 3) for two species with brownish tubular outgrowths occurring in the upper leaves and on the tips of several *Orthotrichum* s.l. species. The structures of *Phragmidium ramosum* Müll. Hal. were described as simple or branched and scattered on the leaves of *Orthotrichum lyellii* Hook. & Taylor [\equiv *Pulviger a lyellii* (Hook. & Taylor) Plášek, Sawicki & Ochyra], *O. gymnostomum* Bruch ex Brid. [\equiv *Nyholmiella gymnostoma* (Bruch ex Brid.) Holmen & E. Warncke], and *O. ob-*

tusifolium Brid. [\equiv *N. obtusifolia* (Brid.) Holmen & E. Warncke], whereas those of *Phragmidium apicale* Müll. Hal. were described as simple and forming star-shaped clusters on the leaf tips of *Plenogemma phyllantha*. Miquel (1841) attempted to place *Phragmidium ramosum* into *Bryomyces* and described the illegitimate *B. muelleri* Miq. as a replacement name, for which Müller (1841b) also described *Phragmidium sparsum* Müll. Hal. as another superfluous replacement. In the later work, Müller noted that, in his opinion, *Phragmidium* should be adopted over *Bryomyces*, as the compound generic ending “-myces” is inappropriate for the species involved.

Although *Phragmidium* remains an obscure generic name, *Bryomyces* was later ascribed to *Orthotrichum* as a synonym (Crosby & Magill, 1977). The connection between *Bryomyces* and *Plenogemma* would have remained buried if it were not for a recent article by Greiff and Döbbeler (2024) that resolved the illegitimate name *Bryomyces* Döbbeler [\equiv *Bryobroma* Döbbeler & Greiff] and discussed the interesting history of *Bryomyces* Miq. as well as the erroneous interpretation of its gemmae as fungal spores. Subsequent research to index the species of *Bryomyces* from the bryological literature uncovered the forgotten *Phragmidium* and its species.



Figure 2. Illustration of *Bryomyces elegans* Miq. published by Miquel (1842: t. LV, fig. 2).

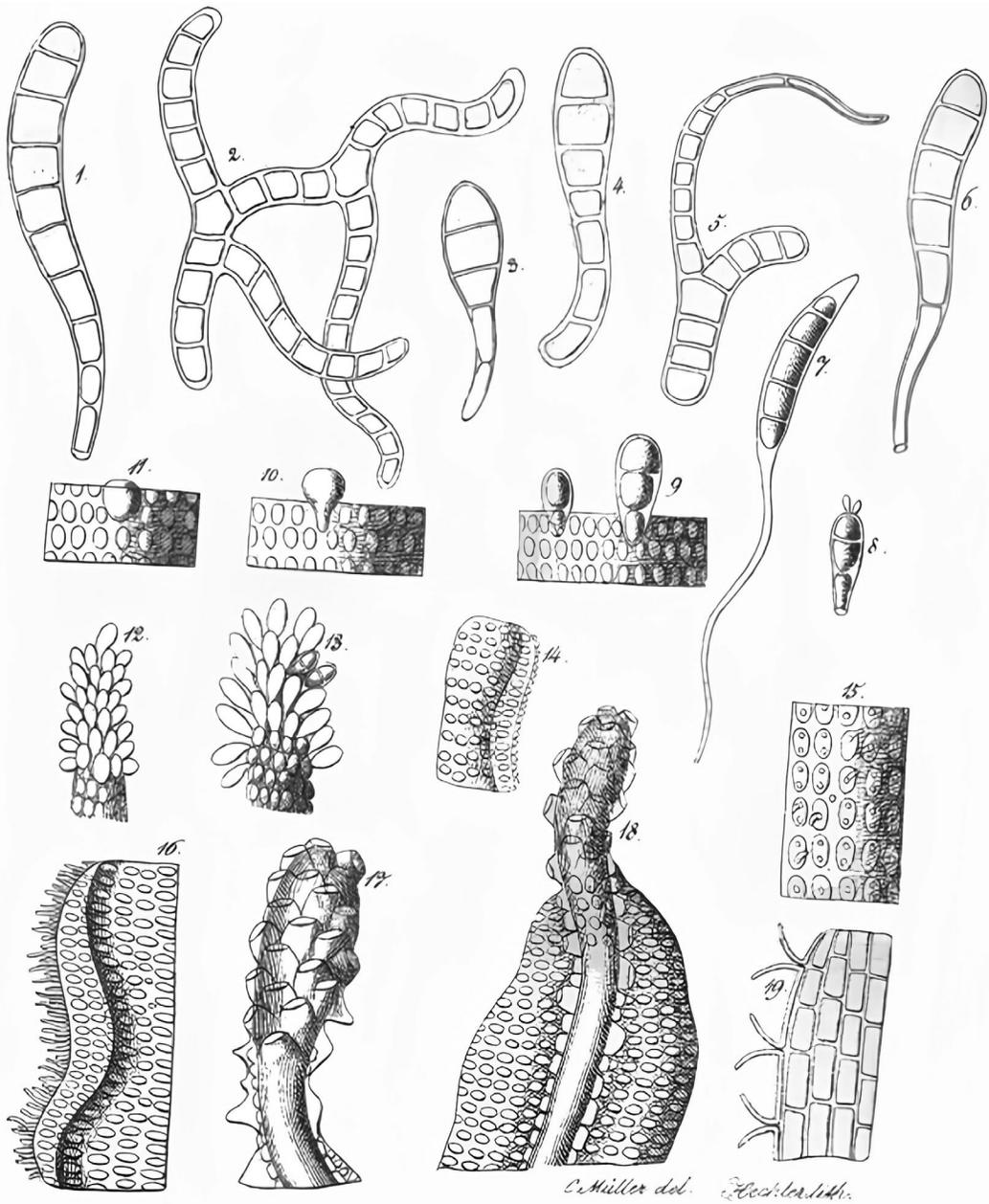


Figure 3. Original material of *Phragmidium* Müll. Hal.; illustration published by Müller (1841a [suppl.]: t. I, figs. 1–19).

Bryomyces has nomenclatural priority (Art. 11.3; Turland et al., 2018) over the morphologically congeneric *Phragmidium* and *Plenogemma*, necessitating new synonymy and a new combination. Although the basis of *Bryomyces* has long been overlooked in the literature, we have chosen not to conserve *Plenogemma* against it. *Plenogemma* is a comparatively young name and includes the single species, *Plenogemma phyllan-*

tha. Plášek et al. (2015) segregated the species from *Ulotia* D. Mohr based on its dioicous versus monoicous sexuality and profuse production of foliar gemmae in the upper leaf apices. Such a systematic concept was congruent with early molecular phylogenetic studies (Goffinet et al., 2004; Sawicki et al., 2010), and was subsequently supported by inferences from more comprehensive data (Draper et al., 2021), although not uni-

versally accepted (Wang & Jia, 2016, 2023), as *Ulota* s.l. composes indeed a monophyletic entity (Draper et al., 2021). Recognition of *Bryomyces* requires only a single new combination that is minimally disruptive to nomenclature. Although adopting a generic name ending in “-myces” appears to be without precedent among plants with compound generic names, we do not find it to be etymologically confusing. For example, the grammitid ferns *Ascogrammitis* Sundue and *Mycopteris* Sundue exist without confusion with fungi. Both genera were described for their close association with the ascomycete *AcrospERMUM* Tode that produces black fruiting bodies on the fronds (Sundue, 2010, 2013). Likewise, we expect *Bryomyces* to cause no more confusion with fungi than existing fungal, lichen, and lycophyte generic names beginning with “Bryo-” cause confusion with bryophytes.

Bryomyces Miq., Bull. Sci. Phys. Nat. Néerl. 1839: 37. 1839, non *Bryomyces* Döbbele, Mitt. Bot. Staatsamml. München 14: 233. 1978, nom. illeg. (= *Bryobroma* Döbbele & Greiff). TYPE: *Bryomyces elegans* Miq., monotypic when published.

Phragmidium Müll. Hal., Flora 24(11): 167. 1841, syn. nov. TYPE: *Phragmidium apicale* Müll. Hal. (lectotype, designated here).

Plenogemma Plásek, Sawicki & Ochyra, Acta Mus. Siles. Sci. Nat. 64: 172. 2015, syn. nov. TYPE: *Plenogemma phyllantha* (Brid.) Sawicki, Plásek & Ochyra, monotypic when published (*Ulota phyllantha* Brid.).

Notes. *Phragmidium* is even more obscure than *Bryomyces* in that it has not been included in any of the major nomenclatural indices (e.g., Index Fungorum) and has only recently been indexed in TROPICOS® and The Bryophyte Nomenclator (Brinda & Atwood, 2025). Müller (1841a) did not designate a type species, and *P. apicale* and *P. ramosum* have equal priority. Although Miquel (1841) attempted to place *P. ramosum* into *Bryomyces*, designating *P. apicale* as the type species is less nomenclaturally disruptive, since it makes *Phragmidium* a synonym of *Bryomyces*. Otherwise, if *Phragmidium ramosum* were to be the generitype, four species of *Pulviger* Plásek, Sawicki & Ochyra would require new combinations. *Phragmidium ramosum* is better treated as a synonym of *Pulviger lyellii* (Hook. & Taylor) Plásek, Sawicki & Ochyra.

Bryomyces phyllanthus (Brid.) J. J. Atwood, W. R. Buck & Goffinet, comb. nov. Basionym: *Ulota phyllantha* Brid., Muscol. Recent. Suppl. 4: 113. 1819 [1818]. *Orthotrichum phyllanthum* (Brid.) Steud., Nomencl. Bot. 2: 304. 1824. *Weissia phyllantha* (Brid.) Lindb., Musci Scand.: 28. 1879. *Plenogemma phyllantha* (Brid.) Sawicki, Plásek

& Ochyra, Acta Mus. Siles. Sci. Nat. 64: 172. 2015. TYPE CITATION: in Jutlandiae maritimis prope Tundern in salicibus legit Ludwig et communi cavit. TYPE: Denmark, E Danice maritimus, 1811, *Ludwigius s.n.* (holotype, see Zippel [2006: 933], B [barcode] B-31024101 not seen).

Bryomyces elegans Miq., Bull. Sci. Phys. Nat. Néerl. 1839: 38. 1839, syn. nov. TYPE CITATION: habitat in foliis *Orthotrichi striati* sterilis, eorum apices sive partem mediam superiorem occupans, inprimis in superiori surculorum parte. Martio. TYPE: [icon in] Miquel, Nov. Acad. Leop. 19(2): tab. LV, fig. e. 1842 (neotype, designated here).

Phragmidium apicale Müll. Hal., Flora 24(11): 169. 1841, syn. nov. TYPE CITATION: Habit. in fol. *Orth. phyllanthi*. TYPE: [icon in] Müller, Flora 24(1), suppl., tab. 1, 17–18. 1841 (lectotype, designated here).

Notes. Among orthotrichaceous mosses, Miquel’s (1839a, 1842) descriptions of *Bryomyces*, discussion on the position and arrangement of the outgrowths, and his illustration (tab. LV) mostly align with *Plenogemma phyllantha* and its distinct foliar gemmae, except that the outgrowths are not entirely restricted to the upper leaf apices as shown in his figures a and b. While the gemmae in *P. phyllantha* are also not always restricted to the upper leaf apices—they can be borne farther down the costa as well as throughout the upper third of the lamina (Flora of North America Editorial Committee, 2014: fig. on p. 79)—an examination of *P. phyllantha* specimens in MO found that their occurrence on the lamina consistently corresponds to their presence also on the excurrent part of costa. Since figures a and b in Miquel’s (1842) illustration depict the outgrowths on the upper lamina exclusively, it would seem that *Bryomyces* is based in part on the foliar gemmae of *P. phyllantha* as well as one or more other orthotrichaceous moss or mosses. Miquel’s interest, after all, was with the outgrowths and not the moss itself, making it likely that he commingled more than one taxon in his description.

Heterogeneous elements in original gatherings are not uncommon among species described in the early 19th century, and according to the *International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code)*, a single element can be typified in such cases to determine to which species they should apply (Art. 9.14; Turland et al., 2018). Miquel’s private herbarium, according to Stafleu and Cowan (1981), is deposited in Utrecht, now the Naturalis Biodiversity Center (L). A search for original material of *Bryomyces elegans* in the fungal and bryophyte herbaria by Nicolien Sol resulted in no specimens bearing that name (Nicolien Sol, pers. comm., 2024). Due to the lack of original specimens, Miquel’s illustration of *B. elegans* would seem to be the next best option for lectotypification,

but it unfortunately was published after the protologue (Art. 9.4; Turland et al., 2018: 159), and was not explicitly available to the author when the species was published. The illustration nevertheless is an important tool for recognizing elements used in the description. The orthotrichaceous moss depicted by Miquel in his figures a and b does not appear to have the same distinct excurrent costa shown for *Plenogemma phyllantha* in his figures c and e, nor are the outgrowths attached to the leaf apices. Figures a and b, along with figure d, showing the origin and attachment of a developing outgrowth, and figure f, showing an individual outgrowth, are excluded from the type due to their lack of detail, as they broadly apply to numerous Orthotrichaceae and their foliar gemmae. Only Miquel's figure e unambiguously corresponds to the morphology of *P. phyllantha* and its foliar gemmae, and therefore is selected as the neotype (Art. 9.8; Turland et al., 2018).

Original specimens of *Phragmidium* do not appear to be extant, as they were likely destroyed by fire, along with most of the other Carl Müller specimens in the B herbarium, during the bombing of Berlin (Merrill, 1943). The protologue of *Phragmidium apicale* notes the species to occur on the leaves of *Plenogemma phyllantha*, with the corresponding illustrations, especially figures 17 and 18, showing the distinct, excurrent costae of that species, with differentiated cells and outgrowths. These figures can therefore be connected to *Phragmidium apicale* and are designated as the lectotype of that species.

Pulviger a lyellii (Hook. & Taylor) Plášek, Sawicki & Ochyra, Acta Mus. Siles. Sci. Nat. 64: 171. 2015. *Orthotrichum lyellii* Hook. & Taylor, Muscol. Brit.: 76. 1818. *Dorcadion lyellii* (Hook. & Taylor) Lindb., Musci Scand.: 28. 1879. TYPE CITATION: on trees in the New Forest, Hants, *Mr. Lyell*. TYPE: England, Hants, New Forest, *Lyell* (lectotype, designated by Vitt [1973: 43 as holotype], FH not seen; isolectotype, E [bc] E00007542!).

Phragmidium ramosum Müll. Hal., Flora 24(11): 168. 1841, syn. nov. *Bryomyces muelleri* Miq., Flora 24(21): 322. 1841, nom. illeg. *Phragmidium sparsum* Müll. Hal., Flora 24(36): 563. 1841, nom. illeg. TYPE CITATION: Habit. in fol. *Orth. Lyellii*, *Gymnostomi* et *obtusifolii*. TYPE: [icon in] Müller, Flora 24(1), suppl. tab. 1, figs. 2, 10, 15. 1841 (lectotype, designated here).

Notes. In the protologue of *Phragmidium ramosum*, Müller (1841a) noted the species to occur on *Pulviger a lyellii*, *Nyholmiella gymnostoma*, and *N. obtusifolia*, clear heterogeneous elements, for which a single element needs to be typified. The corresponding illustrations of the outgrowths unfortunately make it difficult to distinguish the species, as not enough of the moss leaves are adequately depicted. Müller (1841a:

suppl. tab. 1, figs. 1–6) furthermore showed the outgrowths ranging from simple and cylindrical to clavate, filamentous, and many-branched, a range that matches the descriptions of the gemmae for the three noted species of *Orthotrichum* s.l. (Lewinsky, 1993). However, Müller's discussion references figures 10 and 15 as belonging to *Pulviger a lyellii*, to which the multi-branched structure in figure 2 can also be added, as it does not occur in the other two species of *Orthotrichum* s.l. These figures in Müller's (1841a) illustration are designated as the lectotype of *Phragmidium ramosum*.

Syrrophodon rigidus Hook. & Grev., Edinburgh J. Sci. 3: 226. 1825. TYPE CITATION: upon trees on Mt. St. Andrew, at an elevation of 1012 ft. above the level of the sea, in the island of St. Vincent, *Rev. L. Guilding* [s.n.]. TYPE: St. Vincent, *Guilding s.n.* (lectotype, designated by Florschütz [1964: 164], BM [bc] BM000664308 digital image!; isolectotypes, NY [bc] NY00635658!, NY00635659!, NY00635660!).

Calymperes androgynum Mont., Ann. Sci. Nat., Bot., sér. 2, 3: 195. 1835. *Syrrophodon androgynus* (Mont.) Besch., Ann. Sci. Nat., Bot., sér. 6, 3: 197. 1876. TYPE CITATION: Cette intéressante espèce forme des gazons étendus sur les écorces des arbres dans les forêts humides de la Guiane centrale, où *M. Leprieur* l'a recueillie en fruits mûrs dans les mois de mai et de juin. Elle occupe le côté des troncs exposés à l'Est. TYPE: French Guiana. Sur les arbres vivants, exposition à l'Est, (en mai et juin), forêts humides, *Leprieur* (lectotype, designated by Reese [1977: 24], MO!; isolectotype, PC [bc] PC0736651 digital image!).

Bryomyces montagneanus Miq., Bull. Sci. Phys. Nat. Néerl. 1839: 453. 1839, syn. nov. TYPE: [icon in] Montagne, Ann. Sci. Nat., Bot., sér. 2, 3: Pl. 3, fig. 2a, f–g. 1835 (lectotype, designated here).

Notes. Aside from *Bryomyces elegans*, the other legitimate species associated with *Bryomyces*, *B. montagneanus*, was described by Miquel (1839b) from the leaves of *Calymperes afzelii* Sw. and *C. androgynum* Mont. In his discussion of *B. montagneanus*, Miquel referenced Montagne's (1835) illustration of the type of *C. androgynum* that depicts numerous outgrowths from the leaf apices. This illustration is therefore part of the original material of *B. montagneanus* and connects it to *C. androgynum*. Specifically within Montagne's (1835) illustration, figures a and f–g detail the positioning and morphology of the outgrowths. *Calymperes androgynum* has since been treated as a synonym of *Syrrophodon rigidus* Hook. & Grev. (Mitten, 1869).

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Literature Cited

- Brinda, J. C. & J. J. Atwood (editors). 2025. The Bryophyte Nomenclator. <<https://www.bryonames.org/>>, accessed 3 January 2025.
- Correns, C. 1899. Untersuchungen über die Vermehrung der Laubmoose. Gustav Fischer, Jena.
- Crosby, M. R. & R. E. Magill. 1977. Dictionary of Mosses. Missouri Botanical Garden, St. Louis.
- Crum, H. A. 2001. Structural Diversity of Bryophytes. University of Michigan Herbarium, Ann Arbor.
- Döbbeler, P. 1997. Biodiversity of bryophilous ascomycetes. *Biodivers. & Conservation* 6: 721–738.
- Döbbeler, P. 2025. Beyond the moss: An exploration of bryophilous ascomycetes. *Nova Hedwigia* 1–26. https://doi.org/10.1127/nova_hedwigia/2025/1113
- Draper, I., R. Garilieti, J. A. Calleja, M. Flagmeier, V. Mazimpaka, B. Vigalondo & F. Lara. 2021. Insights into the evolutionary history of the subfamily Orthotrichoideae (Orthotrichaceae, Bryophyta): New and former supra-specific taxa so far obscured by prevailing homoplasy. *Frontiers Pl. Sci.* 12: 629035 [1–18].
- Farrar, D. R. 1974. Gemmiferous fern gametophytes—Vittariaceae. *Amer. J. Bot.* 61: 146–155.
- Flora of North America Editorial Committee (editors). 2014. *Flora of North America North of Mexico Bryophyta*, Vol. 28, Pt. 2. Oxford University Press, New York.
- Floreschütz, P. A. 1964. Musci. 6(1): Pp. 1–271 in A. A. Pulle (editor), *Flora of Suriname*. Koninklijke Vereniging Indisch Instituut, Amsterdam.
- Gallego, M. T., M. J. Cano, J. A. Jiménez & J. Guerra. 2022. Circumscription and phylogenetic position of two propagulose species of *Syntrichia* (Pottiaceae, Bryophyta) reveals minor realignments within the tribe Syntricheae. *Plants* 11: 626 [1–22].
- Goffinet, B., A. J. Shaw, C. J. Cox, N. J. Wickett & S. Boles. 2004. Phylogenetic inferences in the Orthotrichoideae (Orthotrichaceae: Bryophyta) based on variation in four loci from all genomes. Pp. 270–289 in B. Goffinet, V. Hollowell & R. Magill (editors), *Molecular Systematics of Bryophytes*. Monogr. Syst. Bot. Missouri Bot. Gard. 98.
- Greiff, G. R. L. & P. Döbbeler. 2024. *Bryobroma*, *nom. nov.*, a replacement for pyrenomycetous bryophilous ascomycetes formerly included in the illegitimate genus *Bryomyces* Döbbeler. *Ascomycete.org* 16: 15–16.
- Kops, J. & H. C. Van Hall. 1844. *Flora Batava of Afbeelding en Beschrijving van Nederlandsche Gewassen*. Part 8, J. C. Sepp en Zoon, Amsterdam.
- Laaka-Lindberg, S., H. Korpelainen & M. Pohjamo. 2003. Dispersal of asexual propagules in bryophytes. *J. Hattori Bot. Lab.* 93: 319–330.
- Lewinsky, J. 1977. The genus *Orthotrichum*. Morphological studies and evolutionary remarks. *J. Hattori Bot. Lab.* 43: 31–61.
- Lewinsky, J. 1993. A synopsis of the genus *Orthotrichum* Hedw. (Musci, Orthotrichaceae). *Bryobrothera* 2: 1–59.
- Malta, N. 1926. Die Gattung *Zygodon*. *Armijas Spiestuve, Riga*.
- Merrill, E. D. 1943. Destruction of the Berlin Herbarium. *Science* 98: 490–491.
- Miquel, F. A. W. 1839a. *Mélanges botaniques*. *Bull. Sci. Phys. Nat. Néerl.* 1839: 37–48.
- Miquel, F. A. W. 1839b. Note sur quelques plantes cellulaires nouvelles. *Bull. Sci. Phys. Nat. Néerl.* 1839: 453–457.
- Miquel, F. A. W. 1841. Ein Wort über die Pilzgattung *Bryomyces*. *Flora* 24: 321–322.
- Miquel, F. A. W. 1842 [1843]. *Epistola de novo fungorum entophytorum genere, quam Academiae praesidi (die xx Julii a. mdccxxxvii)*. *Nov. Actorum Acad. Caes. Leop.-Carol. Nat. Cur.* 19: 161–168, pl. 55.
- Mitten, W. 1869. *Musci Austro-Americani*. *J. Linn. Soc., Bot.* 12: 1–659.
- Montagne, C. 1835. Énumération des mousses et des hépatiques recueillies par M. Leprieur, dans la Guiane Centrale, et description de plusieurs nouvelles espèces de ces deux familles. *Ann. Sci. Nat., Bot., sér. 2*, 3: 193–219.
- Müller, C. 1841a. Ueber die Conferva *Orthotrichi* Dillw. *Flora* 24: 161–170, tab. 1 (suppl.).
- Müller, C. 1841b. Ueber *Bryomyces* Miquel als Pilzgattung. *Flora* 24: 561–564.
- Newton, A. E. & B. D. Mishler. 1994. The evolutionary significance of asexual reproduction in mosses. *J. Hattori Bot. Lab.* 76: 127–145.
- Plášek, V., J. Sawicki, R. Ochyra, M. Szczecińska & T. Kulik. 2015. New taxonomic arrangement of the traditionally conceived genera *Orthotrichum* and *Ulotia* (Orthotrichaceae, Bryophyta). *Acta Mus. Siles. Sci. Nat.* 64: 169–174.
- Ptaszyńska, A., W. Mułenko & J. Żarnowiec. 2009. Bryophytes microniches inhabited by microfungi. *Ann. Univ. Mariae Curie-Skłodowska, Sect. C, Biol.* 64: 35–43.
- Reese, W. D. 1977. The genus *Syrhophodon* in the Americas. I. The elimbate species. *Bryologist* 80: 2–31.
- Reese, W. D. 2001. The gemmae of the Calymperaceae. *Bryologist* 104: 282–289.
- Sawicki, J., V. Plášek & M. Szczecińska. 2010. Molecular studies resolve *Nyholmiella* (Orthotrichaceae) as a separate genus. *J. Syst. Evol.* 48: 183–194.
- Stafleu, F. A. & R. S. Cowan. 1981. *Taxonomic Literature*, ed. 2. Vol. III: Lh–O. Bohn, Scheltema & Holkema, Utrecht.
- Sundue, M. 2010. A monograph of *Ascogrammitis*, a new genus of grammitid ferns (Polypodiaceae). *Brittonia* 62: 357–399.
- Sundue, M. 2014 [2013]. *Mycopteris*, a new neotropical genus of grammitid ferns (Polypodiaceae). *Brittonia* 66: 174–185.
- Turland, N. J., J. H. Wiersema, F. R. Barrie, W. R. Greuter, D. L. Hawksworth, S. Knapp, W. Kusber, et al. 2018. *International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code)*. *Regnum Veg.* 159.
- Vitt, D. H. 1973. A revision of the genus *Orthotrichum* in North America, north of Mexico. *Bryophyt. Biblioth.* 1: 1–208.
- Wang, Q.-H. & Y. Jia. 2016. A taxonomic revision of *Ulotia* Mohr (Orthotrichaceae) in South and Central America. *Pl. Diversity* 38: 82–109.
- Wang, Q.-H. & Y. Jia. 2023. *A Monograph of the Genus Ulotia s.l. (Orthotrichaceae, Moss)*. Science Press, EDP Sciences, Les Ulis, France.
- Wilbraham, J. & D. G. Long. 2005. *Zygodon* Hook. & Taylor and *Bryomaltaea* Goffinet (Bryopsida: Orthotrichaceae) in the Sino-Himalaya. *J. Bryol.* 27: 329–342.
- Wyatt, R. 1994. Population genetics of bryophytes in relation to their reproductive biology. *J. Hattori Bot. Lab.* 76: 147–157.
- Zander, R. H. 1993. Genera of the Pottiaceae: Mosses of harsh environments. *Bull. Buffalo Soc. Nat. Sci.* 32: 1–378.
- Zippel, E. 2006. Type material in the moss herbarium of Samuel Elisée von Bridel, I. *Willdenowia* 36: 913–935.