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Studies in Austral Bryaceae (Bryopsida) I. New Combinations in *Ptychostomum* Hornsch. from southern South America

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Abstract

The genus *Ptychostomum* (Bryaceae, Bryopsida) is examined from southern South America including southern Patagonia and Tierra del Fuego regions of Argentina and Chile south of 50° S latitude. Five new combinations transferred from *Bryum* are made; *Ptychostomum dicarpum* (E.B. Bartram) J.R. Spence, *Ptychostomum chorizodontum* (Card. & Broth.) J.R. Spence, *Ptychostomum lamprochaete* (Dusén) J.R. Spence, *Ptychostomum pauperculum* (E.B. Bartram) J.R. Spence, and *Ptychostomum vernicosum* (Dusén) J.R. Spence. *Bryum coelophyllum* is placed into synonymy under *P. nivale*. *Bryum macrosporum* is placed into synonymy under *P. chorizodontum*. The type of *B. pallidoviride* represented undetermined material that could not be assigned to any species. A preliminary key to the 20 species of *Ptychostomum* currently recognized for the region is presented.

Keywords: Bryaceae, *Ptychostomum*, mosses, South America, Patagonia, Tierra del Fuego

Introduction

The Bryaceae are a large family of acrocarpous mosses distributed worldwide. Current estimates suggest there are perhaps as many as 500 described species in 15 or 16 genera (Spence, unpublished). Fieldwork in western North America, especially in California, has shown that additional undescribed species exist (e.g., Spence & Shevock 2012, 2015; Spence & Kellman 2015), even though the state has been well covered in past studies. This is likely to be the case in other parts of the world that are less well surveyed. Field and laboratory studies are underway on the family from the Aleutian Islands, China, Chile, the Falkland Islands (Islas Malvinas), and Hawaii.

Recent intensive field studies in Tierra del Fuego and the Falkland Islands have revealed significant levels of diversity in the Bryaceae, including the presence of undescribed species and significant range extensions (Spence, unpublished). Ochi (1982) monographed the family in the temperate to subantarctic portions of South America, listing 60 species from the region. Matteri (2003) and Müller (2009) provided updated checklists for Argentina and Chile that included these two regions.

The genus *Ptychostomum* Hornschuch (1824: 62) was lectotypified by Spence (2005) with the species *P. cernuum* Hornschuch (1824: 64; Spence 2005: 19). Subsequent morphological and molecular studies have provided strong support for the genus (e.g., Pedersen et al. 2007; Holyoak & Pedersen 2007; Wang & Zhao 2009). There are two subgenera, *Ptychostomum* and *Cladodium* Bridel (1826: 620), with ca. 65–70 species known. Critical taxonomic characters include peristome structure, spore size, and sexuality. A majority of species are distributed in the northern hemisphere in boreal-temperate, arctic and alpine environments, while the genus is poorly represented in South Africa and Australasia. However, these recent field studies have shown that *Ptychostomum* is very diverse in southern South America in cool-temperate to subantarctic regions.

Methods and Materials

Types were examined for eight species from the Tierra del Fuego-southern Patagonia regions of South America (Region XII in Müller 2009; TF and southern portions of SC in Matteri 2003) that appeared to be related to *Ptychostomum* based on species descriptions (e.g., Bartram 1946; Ochi 1982). In this paper, I transfer five species of *Bryum* Hedwig (1801: 181) from the region to the genus *Ptychostomum* and discuss three additional names and their placement under existing species. Ochyra & Bednarek-Ochyra (2017) previously transferred eight southern hemisphere species to the genus, six of which occur in the region. A preliminary key to *Ptychostomum* for the southern South America south of ca. 50° S latitude is included.

New Combinations

Ptychostomum chorizodontum (Card. & Broth.) J.R. Spence *comb. nov.* Basionym: *Bryum chorizodontum* Card. & Broth., *Kongl. Svenska Vetensk. Acad. Handl., Ny Följd* 63(10): 45. 1923 (Cardot & Brotherus 1923: 45) (BM!). *Syn. nov.*: *Bryum macrosporum* E.B. Bartram, *Farlowia* 2(3): 313. 1946 (Bartram 1946: 313) (FH!).

Ochi (1982) did not see the types of *B. chorizodontum* or *B. macrosporum*. The two are very similar, although the material of *B. macrosporum* is in better condition. However, *B. chorizodontum* is the older name. It is a distinctive species in subgenus *Cladodium* characterized by synoicous sexuality, a well-developed peristome, large spores (30–40 µm), and elongate strongly incrassate distal laminal cells. It appears to be related to *P. inclinatum* Spence (2005: 21) and *P. pendulum* Hornschuch (1824: 64) and their allies.

Ptychostomum dicarpum (E.B. Bartram) J.R. Spence *comb. nov.* Basionym: *Bryum dicarpum* E.B. Bartram, *Farlowia* 2(3): 313. 1946 (Bartram 1946: 313) (FH!).

Ochi (1982) placed *B. dicarpum* into synonymy under *Bryum pseudotriquetrum* (Hedwig 1801: 190) Gärtner et al. (1802: 102) as *Mnium psuedotriquetrum* Hedwig (1801: 190). However, the species differs in its synoicous sexuality (vs. dioicous), much larger spores (32–36 µm vs 12–18 µm) and in commonly having two sporophytes derived from the same perichaetium. This species may be conspecific with *B. lamprocarpum* Müller (1890: 294), as annotated by T. Seki on the type. Further investigations are required to confirm this.

Ptychostomum lamprochaete (Dusén) J.R. Spence *comb. nov.* Basionym: *Bryum lamprochaete* Dusén, *Rep. Princeton Univ. Exp. Patagonia, Botany 1896–1899, Vol. viii, 1[2], Botany* 8(3): 89. 16; 9 f. 13–15 (Dusén 1903: 16) (NY!).

Ochi (1982) did not study the type. It is a poorly understood species known only from the type collection from southern Patagonia in Argentina, characterized by large spores (26–30 µm), and a strongly reduced peristome lacking cilia and with a low basal membrane. It is superficially similar to *P. creberrimum* (Taylor 1846: 54) J.R. Spence & H.P. Ramsay in Spence (2005: 23), but probably closest to *P. vernicosum* (see below).

Ptychostomum pauperculum (E.B. Bartram) J.R. Spence, *comb. nov.* Basionym: *Bryum pauperculum*, E.B. Bartram, *Farlowia* 2(3): 314. 1946 (Bartram 1946: 314) (FH!).

Ochi (1982) placed this in synonymy under *Bryum pallens* Swartz (1801: 538). However, it appears to be related to subgenus *Cladodium* and is superficially remarkably similar to *Gemmabryum caespiticium* (Hedwig 1801:180) Spence (2009: 497). It has a well-developed peristome, dioicous sexuality and large spores (30–35 µm), an unusual combination in the genus. This species appears to be quite common in Tierra del Fuego based on recent collections.

Ptychostomum vernicosum (Dusén) J.R. Spence *comb. nov.* Basionym: *Bryum vernicosum* Dusén, *Rep. Princeton Univ. Exp. Patagonia, Botany 1896–1899, Vol. viii, 1[2], Botany* 1(1–4): 90–91, f. 17: a–f; pl. 10, f. 1–2. 1903 (Dusén 1903:90) (NY!).

A poorly understood species known only from the type in southern Patagonia, most likely from Argentina (exact locality not known). Ochi (1982) did not study the type. It is characterized by a combination of a strongly reduced

peristome lacking cilia, a low basal membrane with short processes, large spores (28–30 µm), an elongate long-necked capsule, and dioicous sexuality. It appears to be related to *P. pauperculum* which is also dioicous and has a similar capsule.

Ptychostomum nivale (Müll. Hal.) (Müller 1848: 262) Ochyra & Bednarek-Ochyra (2017: 171). *Syn. nov.*: *Bryum coelophyllum* D.C. Eaton, *Contr. U.S. Natl. Herb.* 1: 139. 1892 (Eaton 1892: 139) (US!).

The type of *Bryum coelophyllum* from the area near Ushuaia, Argentina is an unusual specimen with leaves that are somewhat decurrent, recurved when wet and with a row of inflated cells across the leaf base. Although the material is sterile, these characters indicate that it is conspecific with the Tierra del Fuego species *P. nivale*.

The type material for *Bryum pallidoviride* Cardot (1905: 1007) from the Straits of Magellan consists of poorly preserved material with damaged capsules. The leaves suggest an affinity with either *P. creberrimum* (Taylor 1846: 54) J.R. Spence & H.P. Ramsay in Spence (2005: 23) or *P. pallescens* (Schleich. ex Schwägrischen 1816: 107) Spence (2005: 21) but there is insufficient material to make an unequivocal determination (P!).

Below, a preliminary key to the 20 *Ptychostomum* species currently recognized for the Tierra del Fuego and southern Patagonia region south of ca. 50° S latitude, is presented. Distributions are not well understood for many species, but ongoing studies for the Cape Horn Flora project will eventually provide a better understanding. In addition to the six species discussed above, the following 14 species are also known from the region:

- Ptychostomum bimum* (Schreber 1802: 79) Spence (2005: 22).
- Ptychostomum cernuum* (Hedwig 1801: 58) Hornschuch (1822: 64).
- Ptychostomum creberrimum* (Taylor 1846: 54) J.R. Spence & H.P. Ramsay in Spence (2005: 23).
- Ptychostomum donatii* (Thériot 1935: 175) Ochyra & Bednarek-Ochyra (2017: 171).
- Ptychostomum gayanum* (Mont. ex Müller 1848: 267) Ochyra & Bednarek-Ochyra (2017: 171).
- Ptychostomum inclinatum* (Swartz ex Bridel 1803: 144) Spence (2005: 21).
- Ptychostomum mucronatum* (Mitten in Hooker 1867: 442) Ochyra & Bednarek-Ochyra (2017: 171).
- Ptychostomum orthothecium* (Cardot & Brotherus 1923: 47) Holyoak & Pedersen (2007: 120).
- Ptychostomum pallens* (Swartz 1801: 538) Spence (2005: 21).
- Ptychostomum pallescens* (Schleich. ex Schwägrichen 1816: 107) Spence (2005: 21).
- Ptychostomum pendulum* Hornschuch (1824: 64).
- Ptychostomum psuedotriquetrum* (Hedwig 1801: 190) J.R. Spence & H.P. Ramsay ex Holyoak & Pedersen (2007: 120)
- Ptychostomum turbinatum* (Hedwig 1801: 191) Spence (2005: 22).
- Ptychostomum zeballosicum* (Cardot & Brotherus 1923: 44) Ochyra & Bednarek-Ochyra (2017: 171).

Preliminary key to *Ptychostomum* of Tierra del Fuego and Southern Patagonia

1. Leaves uniform in color, red, pink, green to yellow-green, leaf base color not contrasting; limbidium at least partially bistratose, narrow; subalar auriculate inflated group of cells of fertile shoot leaves absent; costa percurrent to short-excurrent Subgenus *Ptychostomum*
- Leaves typically green or yellow-green, leaf base typically reddish, contrasting from upper leaf; limbidium unistratose, strong or sometimes weak or rarely absent; pinkish to reddish subalar inflated auriculate group of cells present, at least on leaves of fertile shoots; costa percurrent to long-excurrent in distinct awn Subgenus *Cladodium*

Note that for many species sexuality is critical and mature capsules are needed as spore size and peristome development are also critical characters. Sterile material of many species cannot be unequivocally identified. Peristome reduction includes cilia shortened or typically absent, reduced endostome processes, and a low basal membrane (<1/2 height of exostome) which is sometimes fused with the exostome.

Subgenus *Ptychostomum*

1. Plants often pink to red, rarely green; spores 18–24 µm; capsule elongate-clavate, ± straight, peristome well-developed; sexuality dioicous *P. pallens*
- Plants green, yellow-green to brown; spores 12–35 µm, capsule turbinate to clavate, straight or rarely curved, peristome well-developed to strongly reduced; sexuality dioicous, autoicous or synoicous 2
2. Autoicous; plants green; leaf with distinct limbidium; spores >30 µm, capsule elongate-clavate, somewhat curved; peristome reduced, cilia absent *P. cernuum*
- Dioicous or synoicous; plants green to yellow-green or brown; leaf limbidium present or absent; spores <30 µm; capsule turbinate to short-clavate, typically not curved, peristome well-developed to strongly reduced 3
3. Leaves strongly recurved when wet, with narrow decurrent base; basal most proximal laminal cells somewhat inflated, distinct from cells above; capsule unknown *P. nivale*

- Leaves erect but not recurved when wet, base broader, not decurrent; proximal laminal cells not inflated or distinct from cells above; capsules often present4
- 4. Leaf margins plane; sexuality dioicous; spores 12–16 μm , capsule turbinate, cilia present and well-developed *P. turbinatum*
- Leaf margin recurved proximally; sexuality synoicous; spores 22–26 μm , capsule clavate, cilia absent *P. mucronatum*

Subgenus *Cladodium*

- 1. Plants large, stems often >2 (6) cm, mostly evenly foliate (intermediate plants key here).....2
- Plants small, stems mostly <1(2) cm, comose-tufted or rarely evenly foliate8
- 2. Leaves strongly and distinctly decurrent (except for depauperate material from harsh climates), ovate; sexuality dioicou.....
..... *P. pseudotriquetrum*
- Leaves not or only weakly decurrent, ovate to ovate-lanceolate or lingulate; sexuality dioicous, synoicous or autoicous3
- 3. Costa percurrent or short-excurrent as mucro; sexuality dioicous or synoicous4
- Costa excurrent in distinct medium to long awn; sexuality dioicous, autoicous or synoicous9
- 4. Leaf margins plane, limbidium lacking *P. zeballosicum*
- Leaf margins recurved, at least proximally, limbidium present, distinct5
- 5. Sexuality dioicous; distal leaf margins serrulate; capsule erect to suberect, thick-necked, spores 10–15 μm *P. orthothecium*
- Sexuality synoicous or autoicous; distal leaf margins smooth to serrulate; capsule mostly nodding to inclined, neck slender, tapering into seta; spore size various but often >20 μm 6
- 6. Leaves narrowly ovate-lanceolate; sexuality autoicous; cilia absent, endostome adherent to exostome; spores 22–26 μm
..... *P. gayanum*
- Leaves ovate; sexuality synoicous; peristome well-developed; cilia present, exostome and endostome free, spores <20 or >30 μm
.....7
- 7. Capsule mouth straight; fertile shoots unisetose, peristome well developed, spores 12–16 μm *P. bimum*
- Capsule mouth oblique; fertile shoots often bisetose; peristome reduced, cilia absent, basal membrane low, spores 30–36 μm
..... *P. dicarpum*
- 8. Costa short excurrent as mucro, limbidium weak to absent; sexuality synoicous *P. donatii*
- Costa usually medium to long-excurrent in awn, limbidium present although sometimes obscure; sexuality dioicous, autoicous or synoicous9
- 9. Sexuality synoicous or dioicous; spores size from 10–40 μm , plants strongly short comose-tufted, capsule pyriform to elongate-clavate; wet to dry sites10
- Sexuality autoicous; spores 16–20 μm , plants loosely tufted, stems somewhat elongate; capsule elongate-clavate; wetland sites ...
..... *P. pallescens*
- 10. Sexuality synoicous, peristome well-developed, spores 10–16 μm *P. creberrimum*
- Sexuality dioicous or synoicous, peristome well-developed to strongly reduced, spores >(18) 20 μm 11
- 11. Sexuality synoicous; endostome and exostome adherent giving teeth chambered appearance; capsule short-pyriform, mouth narrow *P. pendulum*
- Sexuality dioicous or synoicous; endostome and exostome free; capsule pyriform, short or long-necked to clavate, mouth narrow to wide12
- 12. Peristome well-developed, cilia well-developed or sometimes shortened but present, spores 18–40 μm 13
- Peristome strongly reduced, cilia absent or strongly shortened, stub-like, spores 26–30 μm 15
- 13. Synoicous, spores 18–24 μm , distal cells <60 μm , thin walled, cilia sometimes shortened or only 1–2 present
..... *P. inclinatum*
- Synoicous or dioicous; spores >28 μm ; distal cells often >80 μm , often incrassate; 2–3 cilia present, well-developed14
- 14. Dioicous; distal laminal cells thin to firm-walled; spores (26) 30–36 μm *P. pauperculum*
- Synoicous; distal laminal cells distinctly incrassate, spores (28) 30–40 μm *P. chorizodontum*
- 15. Dioicous *P. vernicosum*
- Synoicous *P. lamprochaete*

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