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Redescription of the genus *Cryphidium* (Cryphaeaceae, Bryophyta), with notes on its taxonomy

JORGE R. FLORES[1] y GUILLERMO M. SUÁREZ[1]

Summary: *Cryphidium leucocoleum* (Mitt.) A. Jaeger is a member of Cryphaeaceae, a mainly pleurocarpic moss family. The finding of this controversial species in the Pampa Region allowed us to carry out a comprehensive study about its taxonomy and morphology. As a result, the first complete description and illustration of the species are here presented. Additionally, the nomenclatural identity of other species is clarified.

Key words: *Cryphaea*, Cryphaeaceae, *Cryphidium*, Pampa Region.

Resumen: Redescripción del género *Cryphidium* (Cryphaeaceae, Bryophyta), con notas sobre su taxonomía. *Cryphidium leucocoleum* (Mitt.) A. Jaeger es un miembro de Cryphaeaceae, una familia de musgos predominantemente pleurocárpicos. El hallazgo de esta especie, con posición taxonómica muy discutida, en la Región Pampeana nos permitió llevar a cabo un estudio meticuloso acerca de su taxonomía y morfología. Como resultado, se presenta la primera descripción e ilustración completa de la especie. Adicionalmente, la identidad nomenclatural de otras especies es definida.

Palabras clave: *Cryphaea*, Cryphaeaceae, *Cryphidium*, Región Pampeana.

Introduction

As part of our studies on the bryophytes of Uruguay (Flores & Suárez, 2012; Suárez, 2012; Suárez & Jimenez, 2011; Suárez & Schiavone, 2013a, b), some recently collected samples from this country were identified as *Cryphidium leucocoleum* (Mitt.) A. Jaeger, a scarcely known taxon with a troubled taxonomic status (Robinson, 1972; Buck, 1980; Rao, 2001).

This unispecific genus was described based on material collected by Gibert from Montevideo, Uruguay. It is represented in the phytogeographical region of the Pampas from Argentina, Brazil and Uruguay (Matteri, 2003; Suárez & Schiavone, 2010; Yano, 2011). *Cryphidium leucocoleum* is currently circumscribed based on its rounded leaf apices and almost non-aristate, wide inner perichaetial leaves (Buck, 1980; Rao, 2001) but an exhaustive analysis of its morphology has never been completed.

Three species are considered synonyms with *C. leucocoleum*, which were described from Uruguay and Argentina, and the identity of one of them (*C. orbifolia*) is uncertain. According to the literature, the question remains if the genus will be kept independent or will be included within *Cryphaea*, so this work aims to clarify the identity of *C. leucocoleum* and its synonyms. This paper presents a detailed description and the first complete illustrations of the species and represents an emended description of the species and genus and its synonyms are re-evaluated. We present a distribution map of the taxa in the Neotropics.

[1] Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET). Facultad de Ciencias Naturales e Instituto Miguel Lillo-Universidad Nacional de Tucumán; Miguel Lillo 205, 4000 San Miguel de Tucumán, Tucumán. Fundación Miguel Lillo, Miguel Lillo 251, 4000 San Miguel de Tucumán, Tucumán. jrflores@conicet.gov.ar

Materials and Methods

We studied types and specimens from BM, H, H-BR, and NY, in addition to our own collections deposited in LIL (Thiers, 2013).

The specimens were studied morphologically with conventional techniques for bryophytes and mounted in water-glycerine-phenol or Hoyer's solution (Anderson, 1954).

Results

Taxonomic Treatment

Cryphidium leucocoleum (Mitt.) A. Jaeger, *Bericht über die Thätigkeit der St. Gallischen Naturwissenschaftlichen Gesellschaft* 1874–75: 274 (Gen. Sp. Musc. 2: 178). 1876; *Neckera leucocolea* Mitt., *Journal of the Linnean Society, Botany* 12: 457. 1869; *Cryphaea leucocolea* (Mitt.) H. Rob., *Phytologia* 23: 150. 1972. ≡*Cryphaea orbifolia* Besch., *Journal de Botanique (Morot)* 5: 342. 1891; *Cryphidium orbifolum* (Besch.) Broth., *Die natürlichen Pflanzenfamilien* I(3): 743. 1905. Synonymyzed by Brotherus (1925). Type: URUGUAY. *Brasilia, Montevideo*, Gibert 650 (Holotype: NY!, Isotype: MO). Fig. 1.

Cryphaea aurantiorum Müll. Hal., *Linnaea* 43: 469. 1882; *Cryphidium aurantiorum* (Müll.Hal.) Broth., *Die natürlichen Pflanzenfamilien* I(3): 743. 1905. Type: ARGENTINIA temperata, *Buenos-Airensis*, insula del recreo, fluminis del Paraná, ad corticem *Citri Aurantii* cum *Dimerodontio Schnyderi*, *Ortrotricho Aurantiorum* et *Lasia*, 7. Martio 1880: Prof O. Schnyder (not seen). Synonymyzed by Brotherus (1925).

Plants dark green to brownish. Primary stems creeping, 2–4 cm long, turning as much as 90° to become secondary stems. Branches erect, sometimes bending at tips, 0.4–0.7 cm long, without tertiary branches. Axillary hairs consisting of one basal brownish cell and 3–4 distal hyaline cells. Leaves densely imbricate towards the branch apices, somewhat looser over the stem when dry, spreading or almost erect when wet, 1.5–1.7 × 1.0–1.1 mm, oblong-ovate to orbicular; margins entire and incurved throughout; apex characteristically rounded (obtuse); base decurrent; costa sub-percurrent, longer than 0.8 of the lamina length, occasionally forked; upper laminal cells rounded-elliptical at midleaf, 9–12 × 6–9 μm, rounded to nearly quadrate towards the margins; basal laminal cells linear-rhomboidal to vermiculate, brown at insertion point, 12–15 × 9–6 μm; branch leaves somewhat smaller.

Autoicous. Perigonia axillary, gemmate, pedicellate antheridia without paraphyses; perigonial leaves elliptical-rounded, 400 μm long. Perichaetia lateral, 2–4 disposed in a row over one side of the axis; inner perichaetial leaves ovate to oblong, shortly acuminate, 1.7–1.5 × 0.7–1.0 mm, without differentiated shoulders, costa extending throughout the leaf lamina, marginal cells longer than middle ones; outermost perichaetial leaves acute, costa only present at middle part of the lamina. Seta short, 156–176 μm. Capsule ovoid to long ellipsoidal, urn 1.5–1.7 mm long; columella 1014–1053 μm long; exothecial cells short- to long-rectangular, 30–60 (–115) × 10–20 μm, wilth flexuose walls. Peristome double, exostome teeth brown, lanceolate, 201–225 μm, middle line and trabeculae disappearing at base, papillose, endostome segments almost hyaline, filiform, 270–290 μm, sparsely papillose. Operculum conic and smooth. Calyptra mitriform, roughened by prorate cells, with an asymmetrically lobed base. Spores 18–21 μm diameter, scarcely papillose.

Studied material. The extension ranges of *Cryphidium leucocoleum* in the different countries are marked with "*". ARGENTINA. *Prov. Buenos Aires*: P. G. Lorentz s/n (H-BR) as *Cryphaea aurantiorum*. URUGUAY. * *Depto. Tacuarembo*: 13.4 km de Tacuarembo, camino a Gruta de los Helechos, 31°38'22''S, 56°02'05''W, 197 m, zona lomada pedregosa con rocas grandes aflorando, 28-II-2012, G. Suárez, M. Dematteis, E. Meza-Torres y A. Vega 1337 (LIL, NY). * *Depto. Lavalleja*: 6.9 km NO de Lascano, 33°38'27''S, 54°16'16.5''W, 32 m, 02-III-2012, G. Suárez, M. Dematteis, E. Meza-Torres y A. Vega 1435 (LIL, NY). BRAZIL. *Estado Rio Grande do Sul*: Rio dos Sinos, 10 m, on tree, 15-II-1942, Sehnem 229 (NY). *Estado Sao Paulo*: Neimeyer s/n (NY 01817302).

Habitat. As was observed by Rao (2001) *C. leucocoleum* grows in Uruguay, in periodically submerged habitats at the bases of trees. This species is found in the Pampas Region of Argentina, Brazil and Uruguay (Fig. 2).

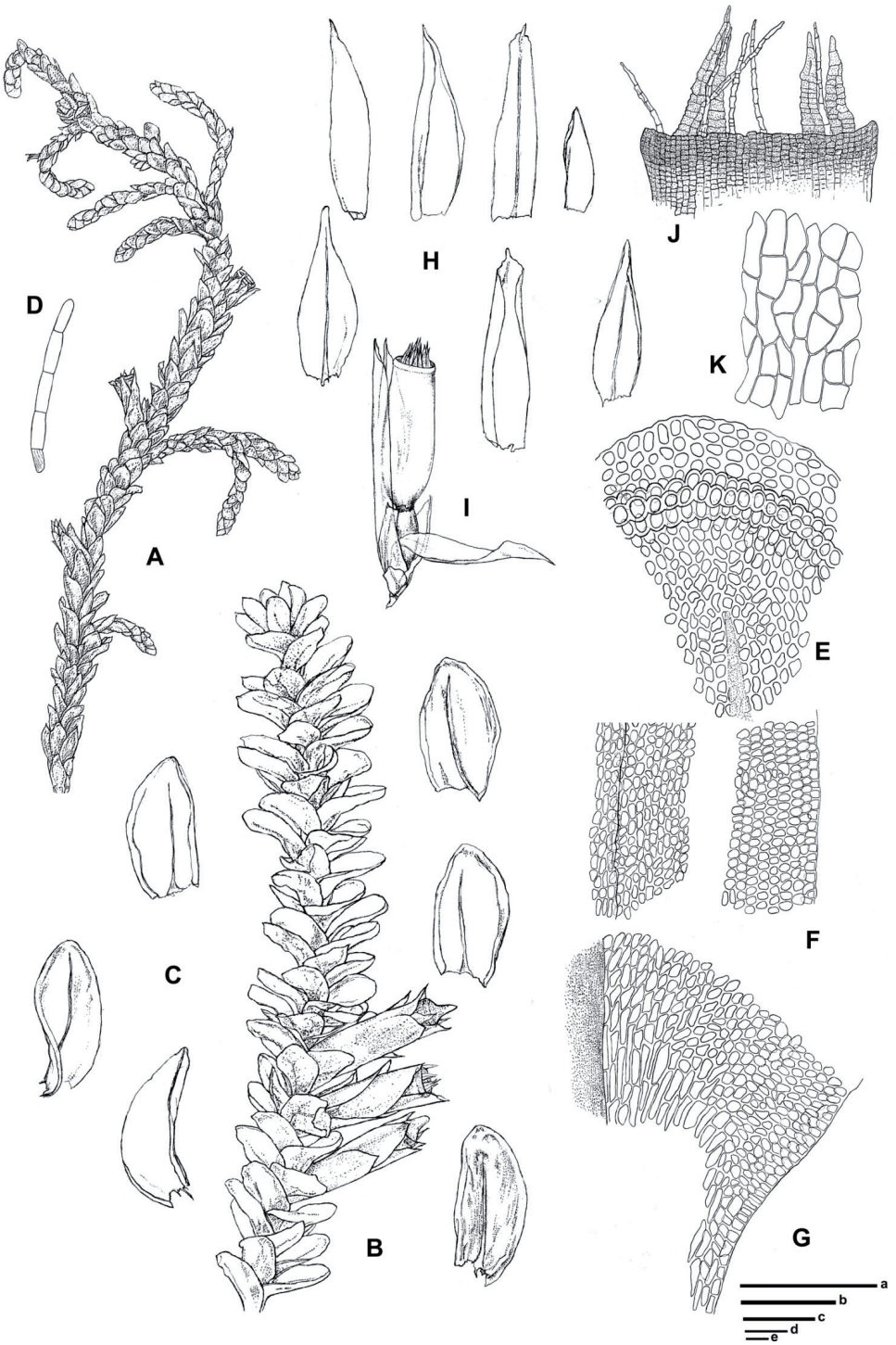

Fig. 1. ***Cryphidium leucocoleum***. A: Habit, dry. B: Habit, moist. C: Leaves. D: Axillary hair. E: Apical cells. F: Median cells. G: Basal cells. H: Perichaetial leaves. I: Sporophyte. J: Portion of peristome. K: Exothecial cells. Scale bars: a = 6 mm (A), 3 mm (B); b = 200 µm (J); c = 1 mm (C, H, I); d = 25 µm (D–G); e = 40 µm (K). From *G. Suárez et al. 1337* (LIL).

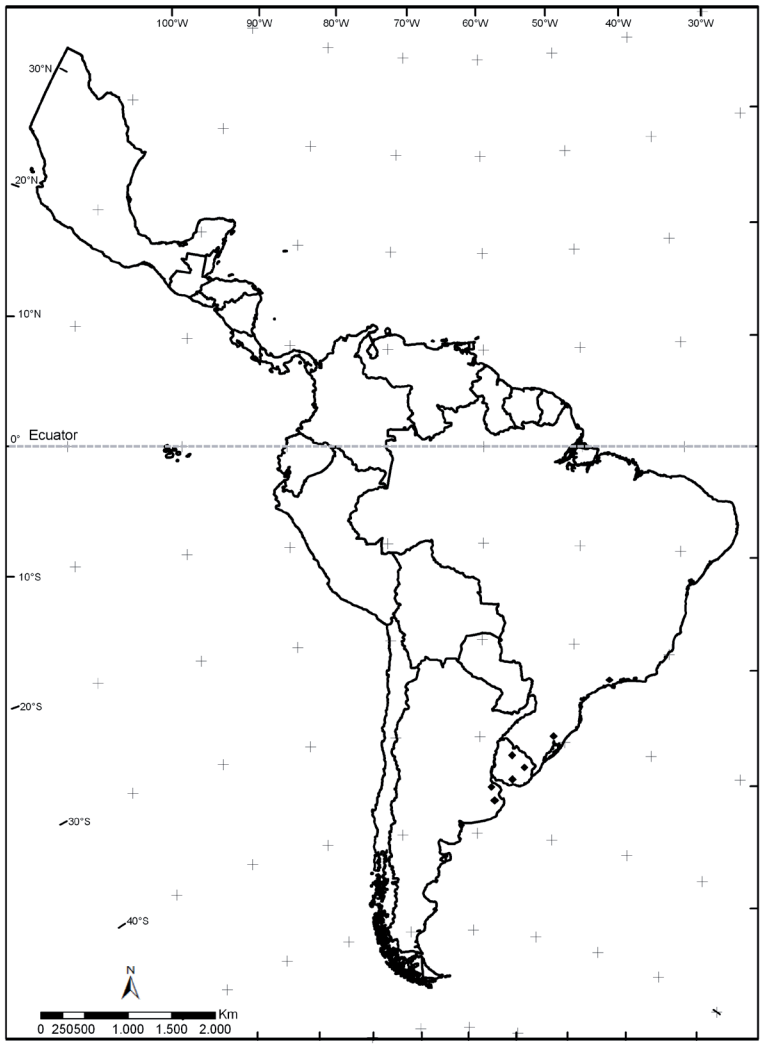

Fig. 2. Distribution map of *Cryphidium leucocoleum* in South America.

Nomenclatural Notes on the genus Cryphidium in South America. Mitten (1869) described the new section *Cryphidium* to accommodate a single species, his newly described *Neckera leucocolea* from Uruguay. Later, Jaeger (1876) raised the section to generic level and transferred *Neckera leucocolea* into it. Brotherus (1905, 1925) modified the generic concept by adding nine species, two of them are from South America and the rest are from Australia and adjacent islands.

Cryphidium aurantiorum was described by Müller (1882) as a *Cryphaea* species based on a collection made by O. Schnyder in Buenos Aires (Argentina) while *Cryphidium orbifolum* was described (Bescherelle, 1891) from specimens collected in Uruguay and southern Brazil. The last one was considered a synonym of *C. aurantiorum* by Fleischer (1914). Brotherus, in 1925, regarded these two species as conspecific with *Cryphidium leucocoleum*.

To conclude, most of the species included in *Cryphidium* by Brotherus (1905, 1925) are now considered part of *Cyptodon*. The genus *Cryphidium*, which has suffered numerous modifications, contains a single species endemic to South America (Argentina, Brazil and Uruguay), *Cryphidium leucocoleum* (Buck, 1980; Rao, 2001; Suárez & Schiavone, 2010), a decision with which we agree.

Nomenclatural Notes on Cryphidium leucocoleum. The French Professor, Joseph Ernest Gibert, arrived in the Republic of Uruguay in 1851 for a collection trip in Paraguay. After this trip all his plant collections were lost in a shipwreck, and he subsequently settled permanently in Montevideo. He continued collecting plant species to the end of his days, among them some bryophytes.

Cryphidium leucocoleum was described by Mitten (1869) as *Neckera leucocolea* from material collected by Gibert in Montevideo. The Type material of *C. leucocoleum* has been located in the personal herbarium of W. Mitten at NY. This material is in good conditions (with sporophytes) and represents perfectly the characters of the species.

In the same herbarium an Isotype of *Cryphaea orbifolia* was found. After checking the protologue of this species and revising the material deposited in NY, we corroborate that this plant is a homotypic synonym of *C. leucocoleum*, because it was described based on the same material (*Gibert 650*).

The type material of *Cryphaea aurantiorum* was not found, but additional material collected by Lorentz in Argentina and determined as *C. aurantiorum* is deposited in BM. Our observations of this material are consistent with the previously proposed synonymies.

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