



Crossidium geheebii (Pottiaceae, Bryophyta), a new record for the American continent

Crossidium geheebii (Pottiaceae, Bryophyta), un nuevo registro para el continente americano

Agustina C. Cottet^{1,2} , María I. Messuti¹ 

Abstract:

Background and Aims: Although the bryoflora of Argentina has been extensively studied, there are still environments to explore and taxa to record. The objective of this work was to report a new record, *Crossidium geheebii*, for the American continent.

Methods: Specimens were collected in the Argentine Patagonia. Using an optical microscope, the morphology and anatomy of the leaves, stems and sporophytes were observed.

Key results: A brief description, discussion, distribution map and illustration of the reported species are presented. Moreover, a key to identify the species of the genus *Crossidium* with distribution in America is included.

Conclusions: *Crossidium geheebii* is reported for the first time for the American continent.

Key words: Argentina, arid environments, mosses.

Resumen:

Antecedentes y Objetivos: Aunque la brioflora de Argentina ha sido extensamente estudiada, aún quedan ambientes por explorar y taxones que deberán registrarse. El objetivo de este trabajo fue reportar un nuevo registro, *Crossidium geheebii*, para el continente americano.

Métodos: Los especímenes fueron recolectados en la Patagonia argentina. Empleando un microscopio óptico se observó la morfología y anatomía de las hojas, tallos y esporofitos.

Resultados clave: Se presenta una breve descripción, discusión, mapa de distribución e ilustración de la especie reportada. También se incluye una clave para identificar las especies del género *Crossidium*, con distribución en América.

Conclusiones: Se registra por primera vez a *Crossidium geheebii* para el continente americano.

Palabras clave: ambientes áridos, Argentina, musgos.

¹Universidad Nacional del Comahue, Instituto de Investigaciones en Biodiversidad y Medioambiente, Consejo Nacional de Investigaciones Científicas y Técnicas, Quintral 1250, 8400 San Carlos de Bariloche, Río Negro, Argentina.

²Autor para la correspondencia: agustina.c.cottet@gmail.com

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Introduction

Bryophytes are a group of plants with around 20,000 species distributed on all continents (Stech and Quandt, 2014). This group consists of three Phyla: Anthocerotophyta (hornworts), Bryophyta (mosses) and Marchantiophyta (liverworts), the latter being the most diversified group (Söderström et al., 2016). Mosses include around 12,000 species distributed in 900 genera, belonging to approximately 80 families, distributed throughout the world (Gradstein et al., 2001). In particular, the Pottiaceae family, one of the most numerous moss families, hosts almost 10% of the total amount of species of this group of plants, about 1400 (Werner et al., 2004). Representatives of this family are distributed throughout the world and develop, in a dominant way, typically in arid, alpine or circumpolar areas (Gradstein et al., 2001).

The genus *Crossidium* Jur. (Pottiaceae) includes about 12 species of mosses distributed across arid and semi-arid zones regions of the world (Gradstein et al., 2001). These plants grow on soil, or rocks covered with soil, on exposed sites associated with xerophytic vegetation or dry washes (Cano et al., 1993; Gradstein et al., 2001). This genus is characterized by having short, ovate or ligulate leaves, multicellular photosynthetic filaments present on the distal ventral surface of the costa, leaves ending in a hair point or mucro, unistratose lamina, enlarged, lax basal cells that extend upward along the costa, an elongate seta and a peristomate capsule (Gradstein et al., 2001). In America, three species have been reported: *C. rosei* R.S. Williams, endemic to Peru; *C. woodii* (Delgad.) R.H. Zander, from puna formations of Bolivia and Argentina; and *C. squamiferum* (Viv.) Jur. distributed in Argentina, Asia, Europe, Macronesia, Mexico, North Africa and North America (Cano et al., 2011; Cano and Alonso, 2017).

Knowledge of the diversity of the genus *Crossidium* in America, especially in Argentina, is still limited and must be increased, although the region has favourable environments for the development of these plants. The aim of this work is to mention for the first time *C. geheebii* (Broth.) Broth. for the American continent, collected in Patagonia, Argentina. The description of the reported species is presented along with a discussion about the characteristics of the American specimens in comparison with those previ-

ously described. The studied specimens are illustrated, a distribution map of the species is presented and an identification key for the American species of this genus is included.

Materials and Methods

Samples of *C. geheebii* were collected in the province of Río Negro, Patagonia, Argentina (Fig. 1). These collections were found in dry stream soil, in environments that correspond to the ecoregion considered by Olson et al. (2001) to be temperate grassland, savannahs and shrublands. This ecoregion is characterized by low rainfall, being dominated by grasses and presenting poor soils in organic matter. Leaves, stems and sporophytes of the collected material were mounted in water with Amman's lactophenol or Hoyer's solution for morphological and anatomical analyses by the examination of microscopic characters (Frahm, 2003). An Olympus BX50 compound microscope (Olympus Corp., Tokyo, Japan) was used. Reference samples were deposited in the herbarium BCRU (Thiers, 2022), Universidad Nacional del Comahue, Argentina.

Results

Crossidium geheebii (Broth.) Broth., Nat. Pflanzenfam. I(3): 426. 1902. Fig. 2.

TYPE: EGYPT. Auf der Sinaihalbinsel, 8.IV.1902, A. Kneucker s.n. (isotype: JE-04006071 n.v.).

≡ *Tortula geheebii* Broth., Öfvers. Finska Vetensk.-Soc. Förh. 42: 98. 1900.

Plants dark green; stems up to 3 mm high; leaves oblong to ovate, 0.8-1.4 mm long, 0.4-0.6 mm wide, apex obtuse to rounded; margin recurved; costa 60-65 µm wide in the middle of the lamina, excurrent hyaline hair point, 0.2-0.4 mm long; photosynthetic filaments located in the distal half of the lamina; lamina cells quadrate, rectangular or rounded, 10-18 µm long, smooth or with one small papilla on the abaxial side; basal cells quadrate to rectangular, 16-45 µm long; cross section of leaves with 3-4 stereid layers, filaments 4-6 cells high, terminal cell subglobose,

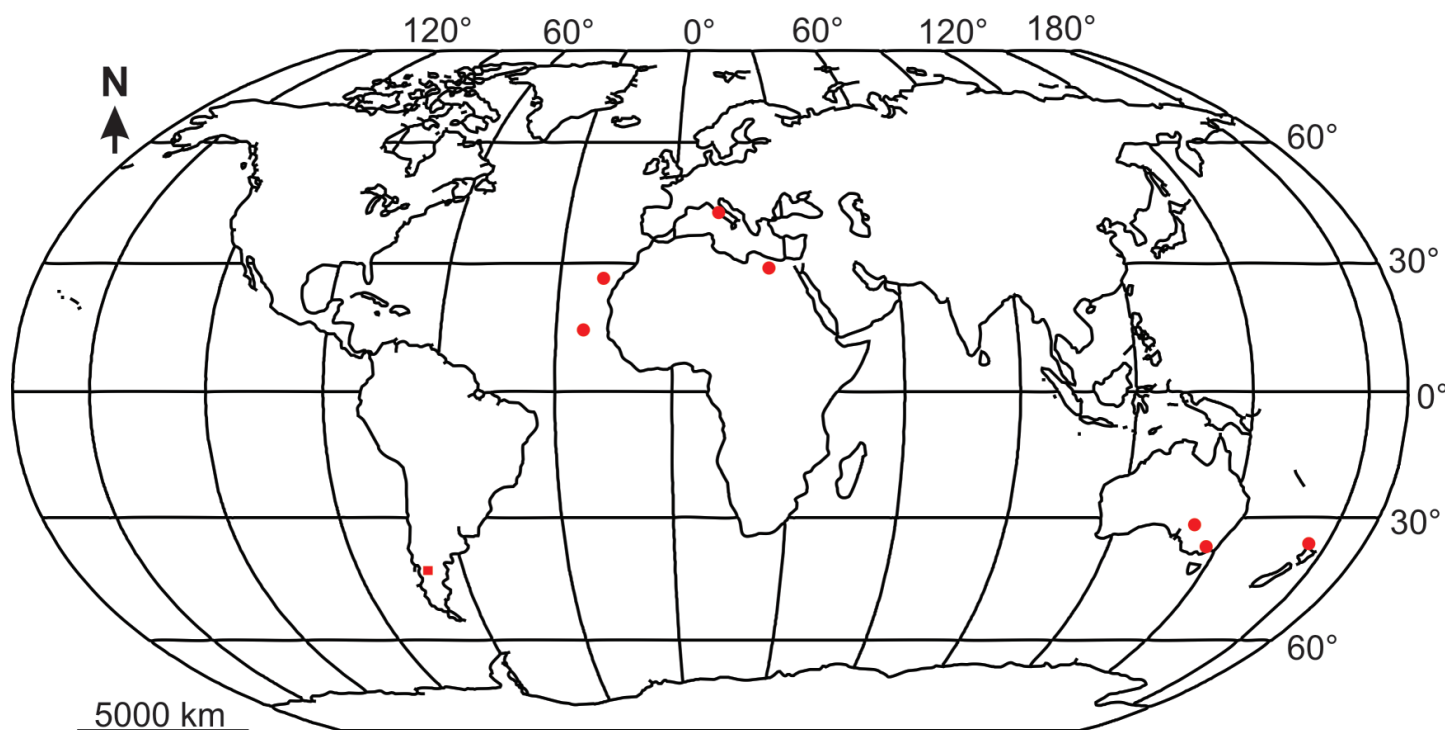


Figure 1: Global distribution map of *Crossidium geheebii* (Broth.) Broth. Previous records of *C. geheebii* (circles), new record (square).

12-18 μm , with 4-6 papillae; seta 5-10 mm long; capsule cylindrical, 1-2 mm long; peristome teeth papillose, yellowish brown; spores globose, 15-18 μm diameter.

Distribution and habitat: *Crossidium geheebii* has been reported previously from Australia, Cape Verde, Canary Islands, Egypt (Sinai), Italy and New Zealand (Cano et al., 1993; Dirkse et al., 1993; Privitera and Puglisi, 2000). This is the first report of *C. geheebii* in the New World, specifically in the province of Río Negro, Patagonia, Argentina (Fig. 1). This species grows in steppe, on sandy soil and soil-covered rocks, along dry washes.

Material examined: ARGENTINA. Province Río Negro, provincial Route 23, Yaminué bridge, on soil, 40°29'01.0"S, 66°46'08.5"W, 8.II.2017, A. C. Cottet 23 (BCRU); loc. cit., kilometer 23, on soil, 40°36'15.9"S, 66°22'42.8"W, 8.II.2017, A. C. Cottet 25 (BCRU).

Key to American species of the genus *Crossidium*

- 1a. Leaves obovate, suborbicular to ovate; costa with supracostal filaments 3-8 cells high, with smooth apical cells *Crossidium woodi* (Delgad.) R.H. Zander
- 1b. Leaves oblong or lanceolate; costa with supracostal filaments 1-6 cells high, with papillose apical cells 2
- 2a. Leaves without hyaline hair point *Crossidium rosei* R.S. Williams
- 2b. Leaves with hyaline hair point 3
- 3a. Terminal cells of filament conical with 1-5 papillae *Crossidium squamiferum* (Viv.) Jur.
- 3b. Terminal cells of filament subglobose to quadrate with 3-8 papillae 4
- 4a. Supracostal filaments 1-2(-3) cells in length *Crossidium aberrans* Holz. & Bartr.
- 4b. Supracostal filaments 4-6 cells in length *Crossidium geheebii* (Broth.) Broth.



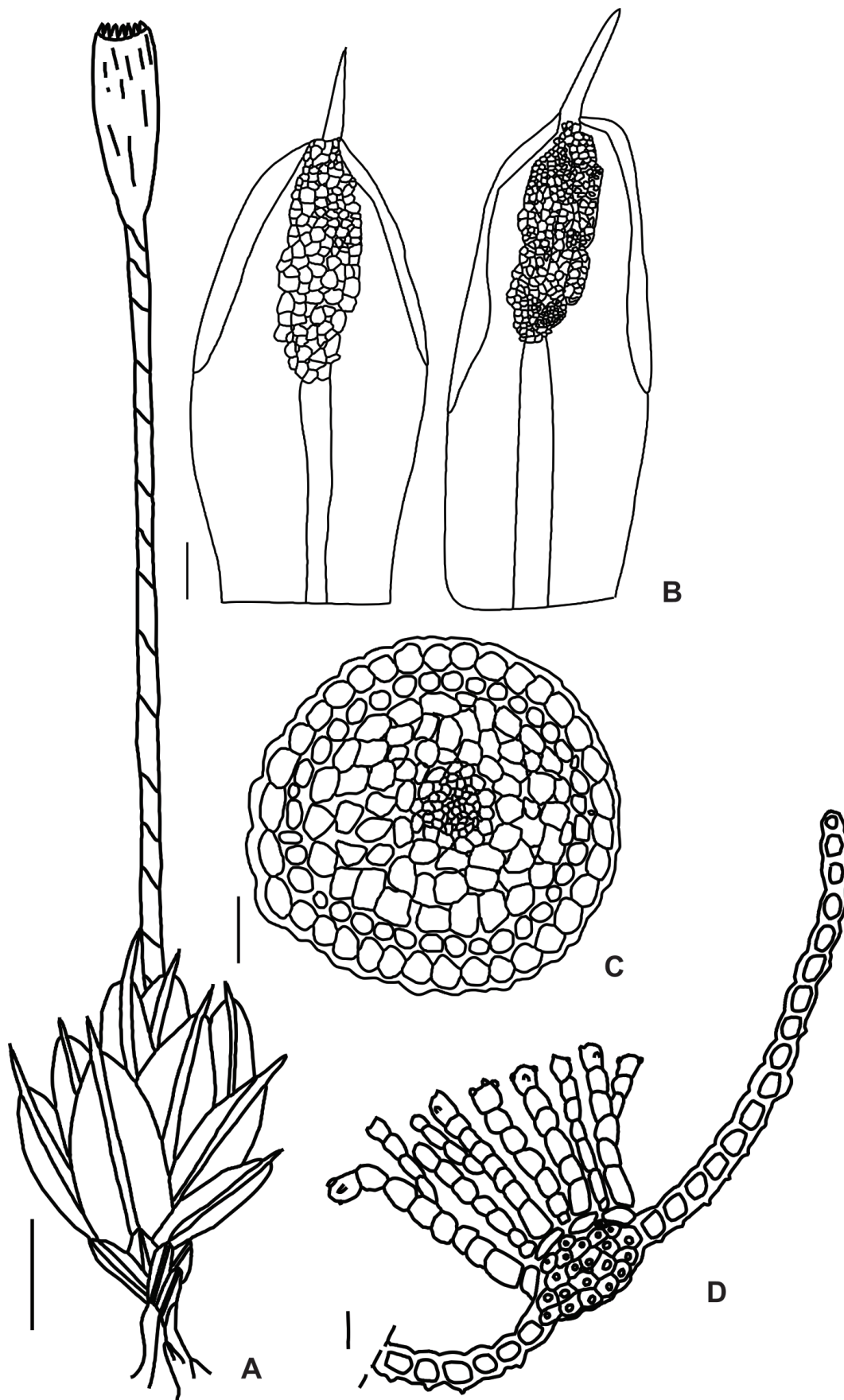


Figure 2: *Crossidium geheebii* (Broth.) Broth. A. habit; B. leaves; C. cross section of stem; D. cross section of leaf. Scale bar: A=1 mm, B=100 μ m, C=100 μ m, D=10 μ m.



Discussion

The Patagonian specimens of *Crossidium geheebii* examined exhibit minimal morphological and anatomical variations compared to those reported by other authors such as Privitera and Puglisi (2000), and Cano et al. (1993). These variations consist of smaller sizes ranges in New World material with respect to Old World material (leaves 0.8-1.4 mm long, 0.4-0.6 mm wide vs. 0.7-1.5 mm long, 0.4-0.65 mm wide; costa 60-65 μm vs. 57-65 μm wide; laminal cells quadrate to rectangular, 10-18 μm long vs. 12-24 μm long). The environments where the examined specimens were found to coincide with previous reports that mention that *C. geheebii* develops in dry to desert environments, growing on soil or rocks covered by soil (Delgadillo, 1975).

There is still a need to record and describe the species of bryophytes that grow in unexplored environments like the steppes of the American continent. Studies such as this allow us to analyse the distributions in a more exhaustive way, in order to reveal the patterns and conditions that determine the presence of bryophytes. Information emerging from descriptive studies can contribute not only to the provision of new data on bryophyte occurrence, but also to clarifying the ecological patterns underlying their ranges.

Author contributions

ACC collected and identified the examined material. ACC and MIM carried out the research, preparation and completion of the final manuscript.

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