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First record of the family Micromitriaceae (Bryophyta) in Argentina

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Abstract: The first record of Micromitriaceae Smyth *ex* Goffinet & Budke, represented by *Micromitrium wrightii* (Müll. Hal.) Crosby, is reported for northern Argentina. Micromitriaceae are a monotypic family of cleistocarpic, ephemeral mosses, separated from the Ephemeraceae J.W.Griff. & Henfr. by molecular analyses. This family is distinguished by the presence of a minute calyptra, a dehiscence line on the capsule, and the absence of stomata. *Micromitrium wrightii* is a cleistocarpic species characterized by the small size of the plants, linear-lanceolate leaves, the proximal ones weakly costate, irregularly rhomboidal and smooth laminal cells; a persistent calyptra, and large spores. Based on samples collected in Río Pilcomayo National Park reserve (Formosa – Argentina), the monotypic family Micromitriaceae, represented by *Micromitrium wrightii,* is reported for the first time in Argentina. A complete description with illustration under Light Microscopy and Scanning Electron Microscopy, and a dichotomous key to distinguish this taxon with related species of the Ephemeraceae, are presented here.

Keywords: cleistocarpic, *Ephemerum*, *Nanomitrium,* protonema

INTRODUCTION

Micromitriaceae Smyth *ex* Goffinet & Budke is a monogeneric family established on the basis of molecular analyses (Goffinet et al., 2011) to segregate *Micromitrium* Austin from *Ephemerum* Hampe, both of which had previously grouped within the Ephemeraceae J.W.Griff. & Henfr. based on the small size of the plants, their ephemeral life cycle, and the presence of a persistent protonema. Commonly known as pygmy mosses, these plants – along with other genera – are pioneers on bare, often disturbed soils (Pursell & Allen, 1996). *Micromitrium* was erected in 1870 by Austin to include two American species of *Ephemerum* (Salmon, 1899), but was later replaced by Lindberg in 1874 with *Nanomitrium* Lindb., stating that the name *Micromitrium* had previously been used in 1867 for a taxon in the Orthotrichaceae by Spruce (Crosby, 1968). *Micromitrium* includes ca. nine species, mostly distributed in North and South America, many of which were previously treated under the genus *Nanomitrium* (Salmon, 1899; Bryan & Anderson, 1957; Bryan, 2007; Fife, 2014), until Crosby (1968) reinstated *Micromitrium* on the basis of the Nomenclatural Code.

Micromitrium includes small and delicate plants, with a persistent, minute calyptra; a globose, sessile, gymnostomous, either cleistocarpous or stegocarpous capsule; and usually ecostate leaves with large, hyaline, non-papillose leaf cells. These plants inhabit sunny or partly shaded areas, on moist or drying disturbed soil, where there is little competition from more persistent mosses and larger plants (Bryan & Anderson, 1957; Bryan, 2007). Most species of *Micromitrium* are characterized by the presence of a dehiscence line, a non-stomata capsule, and the absence of a differentiated spore sac (Crum & Anderson, 1981; Bryan, 2007). Despite this, *Micromitrium wrightii* (Müll.Hal.) Crosby, along with *M. megalosporum* Austin, are the only two taxa of the genus distinguished by the presence of cleistocarpous capsules, a two-layered exothecium, and stomata at the base of the capsule, resembling *Ephemerum* species (Salmon, 1899; Pursell & Allen, 1996; Bryan, 2007).

In South America, *Micromitrium wrightii* was previously cited from Brazil (Costa et al., 2011), but was later excluded from the Brazilian flora by Lima et al. (2020) due to the lack of herbarium specimens matching the taxon description. In Argentina, Schiavone & Sarmiento (1985) revised all species of the Ephemeraceae cited in South America. In their work, they identified four species of *Ephemerum*, three of which were from Argentina (*Ephemerum argentinicum* Schiavone & Sarmiento, *E. conicum* Müll.Hal., and *E. uleanum* Müll.Hal.), but none of them showed the combination of characters analyzed here.

As part of a broader study aimed at analyzing bryophyte communities associated with native vegetation, some samples collected from native palm groves of *Copernicia alba* Morong in Río Pilcomayo National Park (Formosa – Argentina) matched the diagnostic characters of *Micromitrium wrightii*. A complete description, light and scanning electron microscopy (LM and SEM) illustrations, and a dichotomous key to distinguish *Micromitrium wrightii* from morphologically similar species of the genus *Ephemerum* recorded in Argentina are presented here.

MATERIAL AND METHODS

The study was conducted in Río Pilcomayo National Park, located in the northeastern corner of Formosa Province, Argentina, near the locality of Laguna Blanca (25.033333°S, 58.133333°W). The park covers approximately 51,889 ha and lies along the Río Pilcomayo, which forms part of the international border with the Republic of Paraguay. Established in 1951, the park was designated as a Wetland of International Importance under the Ramsar Convention in 1992. According to Cabrera (1971), the park is situated within the Chaco Phytogeographical Province, specifically in the Eastern Chaco District, a transitional zone between the Chaco and Amazonian domains. The vegetation is characterized by a mosaic of xerophilous woody communities and grassland formations (Yañez et al. 2021) (Fig. 1, A–B).

The specimens were studied morphologically using classical bryological techniques and mounted in Hoyer's solution (Anderson, 1954). Microscopic characters were examined by using the Light Microscope Arcano XSZ-100BNT, and Scanning Electron Microscopy ZEISS EVO 15 operating at 10 kV. Characters illustrated using SEM were obtained from samples fixed in Formaldehyde-acetic-acid-alcohol-water (FAA), critical-point dried, mounted on double-sided tape and coated with gold-palladium. Spores were obtained from mature capsules, removed with alcohol, mounted directly on aluminum stubs and subsequently coated with gold-palladium. The nomenclatural status, and the distribution of the species, were verified using the Tropicos (MOBOT) and GBIF databases, as well as specific bibliographic sources for the taxon.

RESULTS AND DISCUSSION

MICROMITRIUM WRIGHTII (Müll.Hal.) Crosby, The Bryologist 71: 116. 1968. ≡ *Ephemerum wrightii* Müll.Hal. Linnaea 43: 351. 1882. ≡ *Nanomitrium wrightii* (Müll.Hal.) V.S.Bryan & L.E.Anderson, The Bryologist 60: 86. 1957. Holotype: Insula Cuba, ubi Charles Wright collegit pro Herb. Sullivantiano. (Type: NY not seen) (Fig. 2, 3, 4).

Plants 1.0–2.0 mm long; protonema scarce, short, with ascending, dichotomous branches. *Leaves* 8–10, weakly shrunken when dry, spreading when wet; basal leaves 0.5–0.9 × 0.1–0.3 mm, lanceolate, apex acuminate, weakly serrulate at the apex, ecostate or costa rudimentary, 2–3 cells wide, weakly reaching middle-leaf; apical leaves 1.1–1.3 × 0.2–0.3 mm, linear-lanceolate, apex acute, margin serrulate; costa rudimentary, 2–3 cells wide, failing short of apex; laminal cells thin-walled, rectangular at base, smooth, 40–60 × 14–18 µm, irregularly rhomboidal to middle-leaf and apex, smooth, 55–60 × 10–20 µm. *Dioicous*. *Calyptra* persistent, 0.2 mm long, campanulate, smooth, covering the short-apiculum; vaginula cylindrical. *Capsule* sessile, cleistocarpous, glossy, yellowish-brown to orange-brown at maturity, globose, short-apiculate, exothecial cells in 2 layers; stomata phaneropore, few, distributed at the base of the capsule. *Spores* spheroid, convex-concave, often remaining in tetrads, 44–55 µm, verrucose, verrucae with irregular protuberances at the apex, united at the base as depressed rows.

Specimens examined: Argentina. Formosa. Dpto. Pilcomayo. Parque Nacional Río Pilcomayo, terrícola al costado del sendero, sobre suelo arenoso, sombrío y algo húmedo, 23/I/2012, *Jimenez & Martín 329* (CTES). En suelo de palmar de

Fig. 1. A. Entrance to the Rio Pilcomayo National Park (Formosa - Argentina). B. Palm groves of *Copernicia alba*. C–D. *Micromitrium wrightii* at base of Cyperaceae shrubs with thalloid liverworts.

Copernicia alba adulto, con quema mayor a 2 años, terrícola en la base de montículo de Cyperaceae, con *Riccia* sp., húmedo, escaso, 25°02'22"S 58°07'33.8"W, 23/XI/2024, *Jimenez, Michlig, Niveiro & Roggero Luque* 885 (CTES).

Ecology and distribution: this species was found growing on wet, sandy soil along trail margins, and beneath Cyperaceae shrubs in *Copernicia alba* palm groves (Fig. 1, C–D). Both collected samples were profusely producing sporophytes; however, the capsules from specimens collected in late spring were immature compared to those collected in mid-summer, which were fully mature. This taxon has been recorded in North America, including the United States, Canada, and Cuba (Crum & Anderson, 1981; Buck &

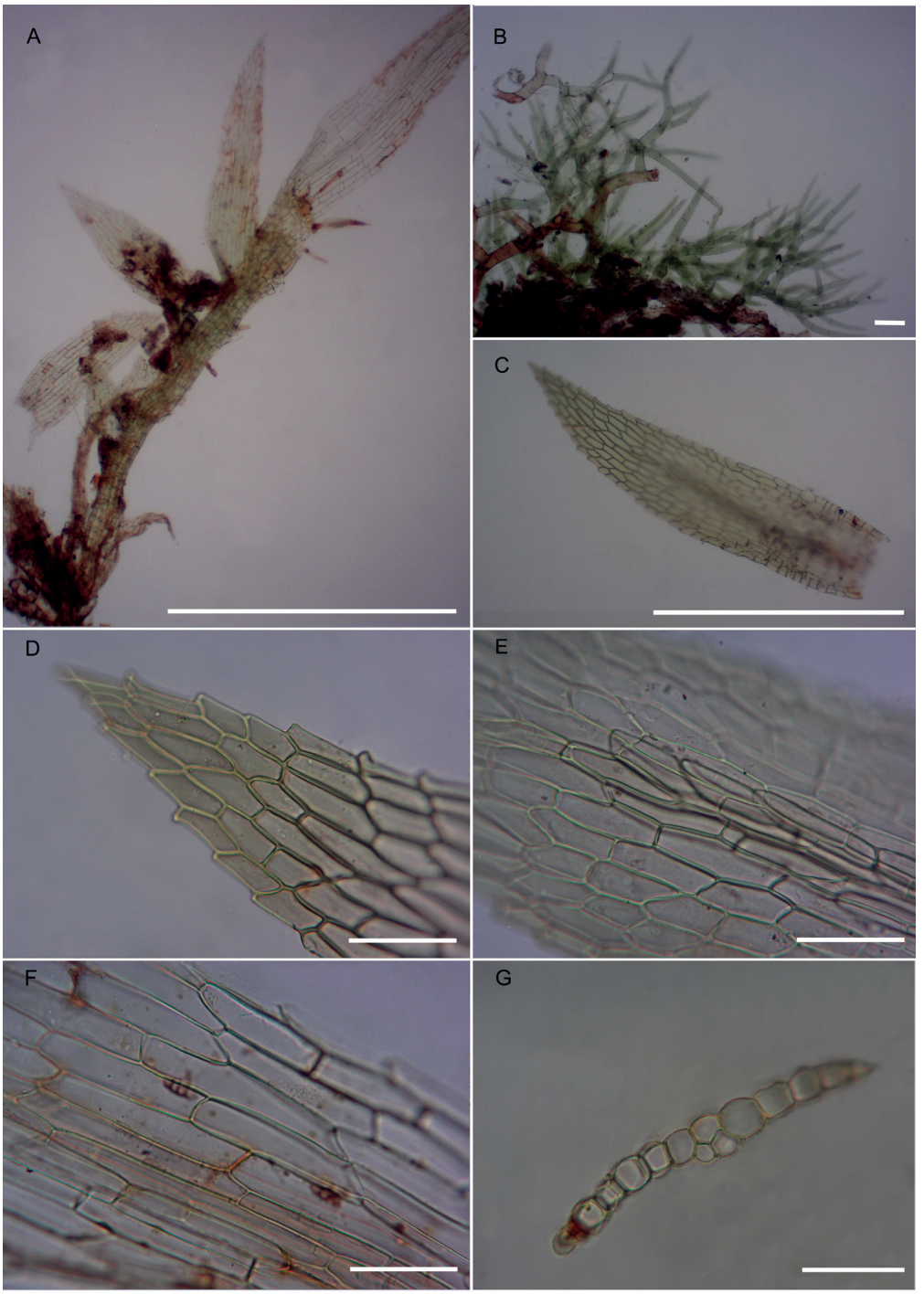

Fig. 2. *Micromitrium wrightii.* Light microscopy. A. Plant. B. Protonema. C. Apical leaf. D. Apex of the apical leaf. E. Costa reaching ⅔ lamina length. F. Laminal cells at middle leaf. G. Transverse section of the lamina at mid-leaf. (All from Jimenez, Michlig, Niveiro & Roggero Luque 885. CTES. Scale bars: A,C. 1 mm. B,D–F. 50 μm).

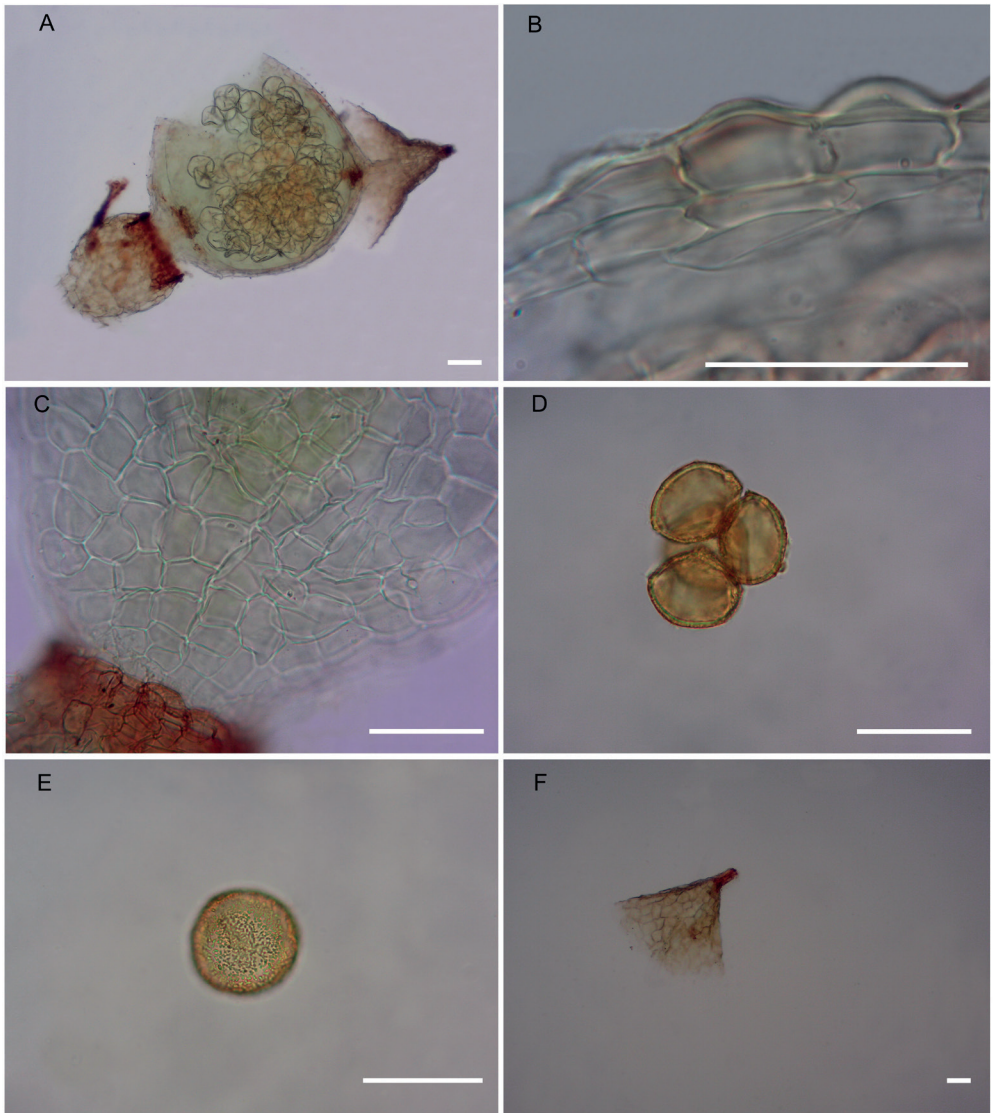

Fig. 3. *Micromitrium wrightii*. Light microscopy. A. Longitudinal view of a sporophyte and the calyptra on top. B. Transverse section of capsule with 2 layers of exothecial cells. C. Base of capsule with sparse stomata (arrows). D. Spores in tetrads. E. Spore ornamentation in LM. F. Calyptra. (All from Jimenez, Michlig, Niveiro & Roggero Lugue 885. CTES. Scale bars: 50 µm).

Goffinet, 2024). The presence of *Micromitrium wrightii* in southern South America is confirmed here, with its southernmost point in northern Argentina (Fig. 5).

Comments: The samples analyzed in this study differ from published descriptions of *Micromitrium wrightii* (Crum & Anderson, 1981; Bryan, 2007) in the scarcity of protonema, the smaller size of the laminal cells (40–60 µm), and the leaf apices, which end in a single cell that is shorter than illustrated by Crum & Anderson (1981).

As stated by Crum & Anderson (1981), although the leaves of *Micromitrium wrightii* are most accurately described as ecostate, the apical ones (those proximal to the capsule) may show indications of a costa. Some have merely thick-walled cells in the median part of the leaf, while others may exhibit approximately three undifferentiated

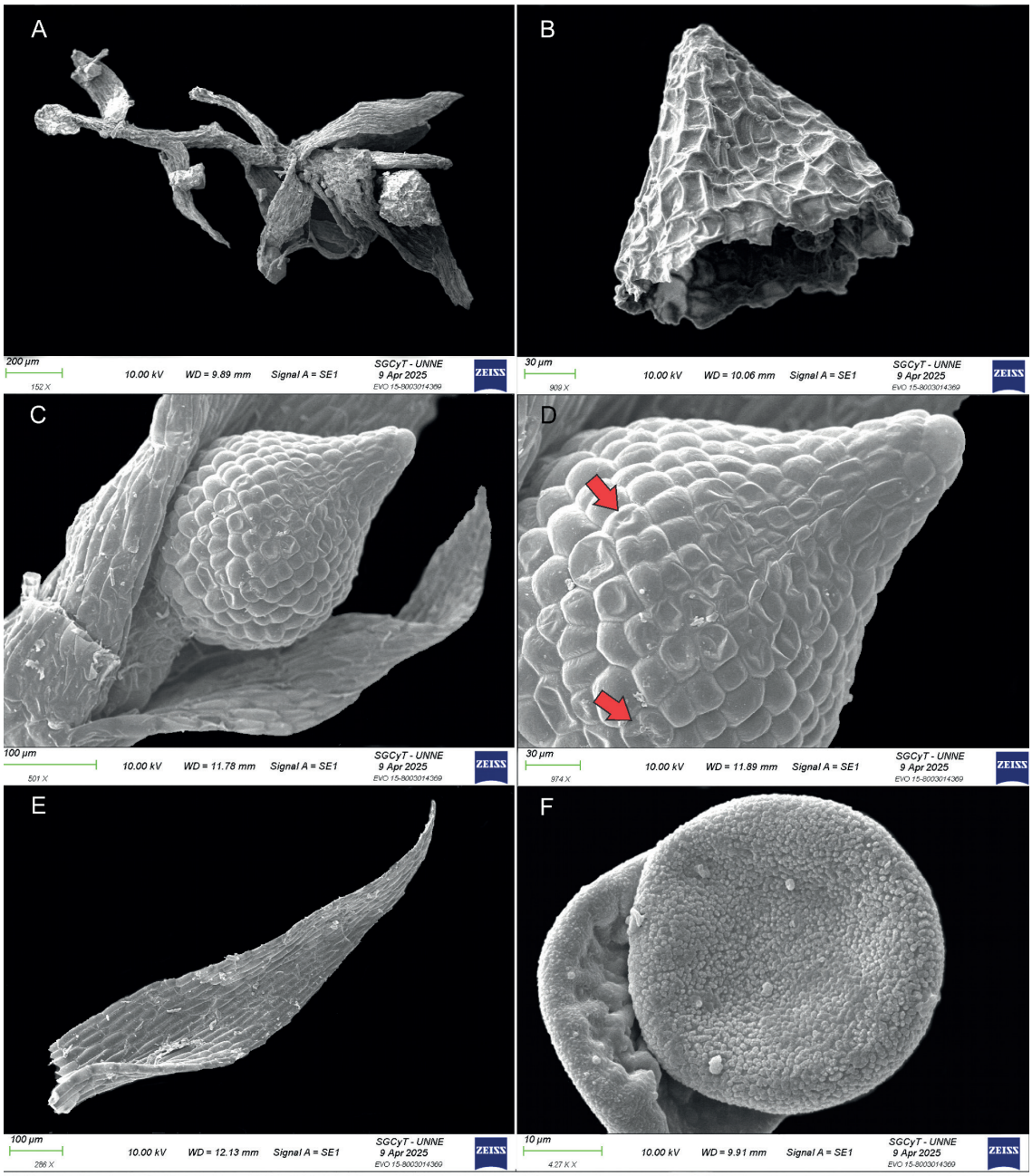

Fig. 4. *Micromitrium wrightii.* SEM. A. Whole plant. B. Detail of calyptra. C. Capsule with a short apiculum. D. Exothecial cells lacking a differentiated dehiscence line and stomatas at base (arrows). E. Apical leaf. F. Spores with ornamentation. (All from Jimenez, Michlig, Niveiro & Roggero Luque 885. CTES. Scale bars: 50 µm).

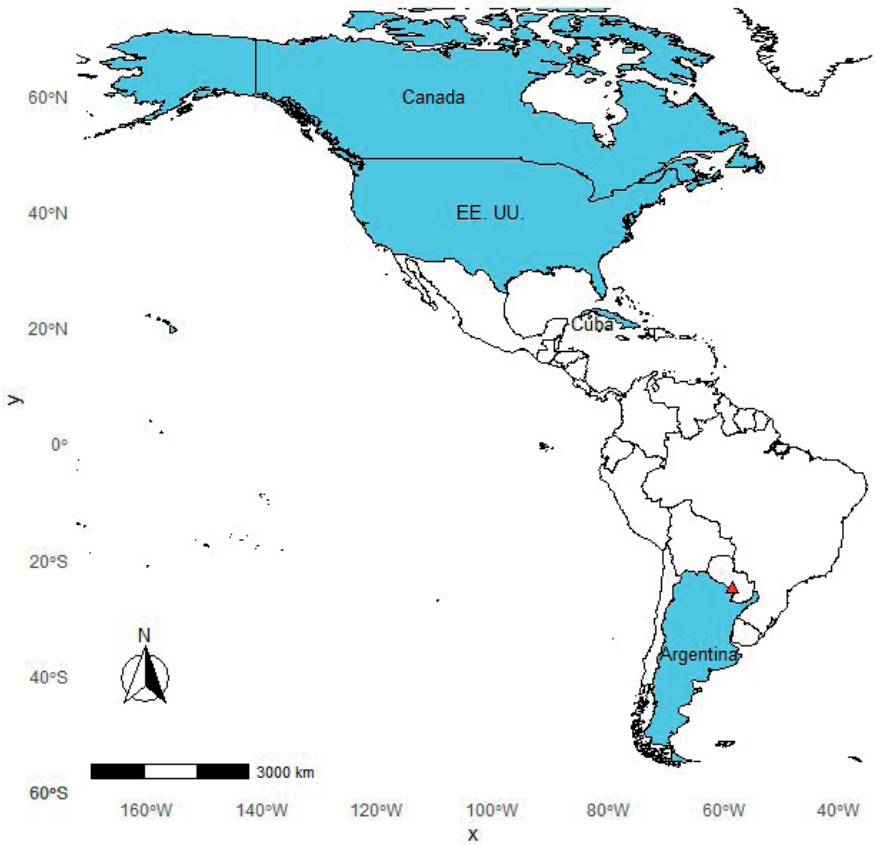

Fig. 5. Map of the distribution of *Micromitrium wrightii* in the American continent. Countries where the species currently occurs are shown in blue; the red triangle indicates the new country where the species is recorded (Argentina).

median cells arranged in a double layer (Fig. 2, C–G). Both specimens collected in Formosa present this trait and are consistent with the descriptions by Crum & Anderson (1981) and Bryan (2007).

Micromitrium wrightii can be misidentified as the African *Nanomitriopsis longifolia* Cardot due to the presence of leaves with large, thin-walled cells, weak costae, margins consistently one cell thick, a very short seta, and large spores (Iwatsuki, 1980; Stone, 1996). However, it differs in lacking a dehiscence line and it has been described as dioicous, although in the examined specimens only archegonia and sporophytes were observed, while no male plants were found. It is possible that *M. wrightii* and *N. longifolia* are conspecific, but further typological analysis is needed to clarify their relationships.

Among the species in the genus *Ephemerum*, *Micromitrium wrightii* resembles *E. recurvifolium* in plant size, leaf size, laminal cells, and spores, but differs in the ovate-lanceolate shape of the leaves and the absence of a costa in the latter. In Argentina, of the three *Ephemerum* species recorded to date, only *E. uleanum* presents stomata at the base of the capsule as in *M. wrightii*, although its spores are larger and the apiculum is longer than in *M. wrightii*.

Key to separate *M. wrightii* from Argentinian species of *Ephemerum*

1. Protonema sparse; leaves with a costa suggested by a double layer of cells that reaches ¾ of the lamina; margin serrulate; spores verrucose, 44–55 µm Micromitriaceae (*Micromitrium wrightii*)
1'. Protonema abundant; leaves ecostate; margin serrate to dentate; spores verrucose, gemmate, or clavate, 57–92 µm 2 (Ephemeraceae)

2. Leaf margin serrate; stomata at base of the capsule *Ephemerum uleamum*
2'. Leaf margin dentate; stomata on all capsule surfaces 3

3. Stomata numerous; spores clavate-gemmate *E. argentinicum*
3'. Stomata scarce; spores clavate *E. conicum*

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REFERENCES

Anderson, L. E. 1954. Hoyer's solution as a rapid permanent mounting medium for bryophytes. *The Bryologist* 57: 242–244. https://doi.org/10.2307/3240091

Bryan, V.S. & Anderson, L.E. 1957. The Ephemeraceae in North America. *The Bryologist* 60: 67–102. https://doi.org/10.2307/3240009

Bryan, V.S. 2007. Ephemeraceae Schimper. In: Crosby et al. (eds). *Flora of North America North of Mexico*, vol. 27, part 1, Oxford University Press, New York. 713 pp.

Buck, W. R. & Goffinet, B. 2024. A new checklist of the mosses of the continental United States and Canada. *The Bryologist* 127(4): 484–549. https://doi.org/10.1639/0007-2745-127.4.484

Cabrera, A. 1971. Fitogeografía de la República Argentina. *Boletín de la Sociedad Argentina de Botánica* 14: 1–42.

Costa, D.P., Pôrto, K.C., Luizi-Ponzo, A.P., Ilkiu-Borges, A.L., Bastos, C.J.P., Câmara, P.E.A.S., Peralta, D.F., Bôas-Bastos, S.B.V., Imbassahy, C.A.A., Henriques, D.K., Gomes, H.C.S.,Rocha, L.M.D., Santos, N.D.D., Siviero, T.S., Vaz-Imbassahy, T.D.F. & Churchill, S.P. 2011. Synopsis of the Brazilian moss flora: checklist, distribution and conservation. *Nova Hedwigia* 93: 277–334. https://doi.org/10.1127/0029-5035/2011/0093-0277

Crosby, M. R. 1968. *Micromitrium* Aust., an earlier name for *Nanomitrium* Lindb. *The Bryologist* 71(2): 114–117. https://doi.org/10.2307/3240671

Crum, H. & Anderson, L. E. 1981. Mosses of eastern north America (Vol. 1). *Columbia University Press*. 663 pp.

Fife, A.J. 2014. Ephemeraceae. In: Heenan, P.B., Breitwieser, I. & Wilton, A.D (eds.). *Flora of New Zealand Mosses*. Fascicle 4. Manaaki Whenua Press, Lincoln. http://dx.doi.org/10.7931/J27P8W9N

GBIF.org (05 June 2025) GBIF Occurrence Download https://doi.org/10.15468/dl.bg4khk

Goffinet, B., Budke, J. M., & Newman, L. C. 2011. Micromitriaceae: a new family of highly reduced mosses. *Taxon* 60(5): 1245–1254. https://doi.org/10.1002/tax.605002

Iwatsuki, Z. 1980. Notes on genera *Pseudephemerum* (Lindb.) Hag. and *Nanomitriopsis* Card. *Miscellanea Bryologica et Lichenologica* 8: 129–133.

Lima, J.S., Carmo, D.M., Amélio, L.A. & Peralta, D.F. 2020. Sinopse da família de musgos Ephemeraceae Schimper (Bryophyta) no Brasil. *Hoehnea* 47: e062020. http://dx.doi.org/10.1590/2236-8906-06/2020

Pursell, R.A. & Allen, B. 1996. The Ephemeraceae (Musci) in Maine. *Evansia* 13(1): 1–9.

Salmon, E. S. 1899. Notes on the genus *Nanomitrium* Lindberg. *Botanical Journal of the Linnean Society* 34(236): 163–170.

Schiavone, M.M. & Sarmiento, M.R.D. 1985. Contribución al conocimiento de los musgos de la Argentina I. Género *Ephemerum*. *Lilloa* 36: 221–231

Stone I. G. 1996. A revision of Ephemeraceae in Australia. *Journal of Bryology* 19(2): 279–295. https://doi.org/10.1179/jbr.1996.19.2.279

Yañez, A., C. R. Spagarino, C. Villalba & E. Paiva. 2021. *Acrostichum danaei folium* (Pteridaceae) en Argentina y Paraguay: El Parque Nacional Río Pilcomayo (Formosa, Argentina) como área de conservación de la especie en el Chaco oriental. *Boletín de la Sociedad Argentina de Botánica* 56: 243–249. https://doi. org/10.3105510.31055/1851.2372.v56.n2.32388