Fundación Miguel Lillo
Tucumán
Argentina

Neottiella ricciae (Pyronemataceae, Ascomycota): a hepaticolous fungus in South America

Neottiella ricciae (Pyronemataceae, Ascomycota): un hongo hepatófito en Sudamérica

Guillermo M. Suárez[1,2*]; Denise J. Alvarez[1,2]

[1] Unidad Ejecutora Lillo (CONICET – Fundación Miguel Lillo), Miguel Lillo 251, (4000) San Miguel de Tucumán, Tucumán, Argentina.
[2] Facultad de Ciencias Naturales e I.M.L., Universidad Nacional de Tucumán, Miguel Lillo 205, (4000) San Miguel de Tucumán, Tucumán, Argentina.
* Corresponding author: <suarezgm@csnat.unt.edu.ar>

Abstract

Neottiella ricciae is characterized by asci containing eight smooth, ellipsoid to ovoid ascospores, typically with one rounded side and the other somewhat fusiform. This species is reported for the first time in South America, where it was found colonizing a new host, *Riccia cavernosa*. The present work provides a detailed description of this fungus with photographs of its macroscopic and microscopic features.

Keywords: Argentina; Bryophilous; Entre Rios; Marchantiophyta; Pezizales; *Riccia cavernosa*.

Resumen

Neottiella ricciae se caracteriza por presentar ascas formadas por ocho ascosporas lisas, elipsoides a ovoides, en su mayoría con un lado redondeado y el otro algo fusiforme. La especie se reporta por primera vez para Sudamérica, donde se encontró creciendo en un nuevo hospedador, *Riccia cavernosa*. Se provee una descripción del hongo, además de fotografías de sus características macroscópicas y microscópicas.

Palabras clave: Argentina; briófilos; Entre Ríos; Marchantiophyta; Pezizales; *Riccia cavernosa*.

➤ Ref. bibliográfica: Suárez, G. M.; Alvarez, D. J. 2025. *Neottiella ricciae* (Pyronemataceae, Ascomycota): a hepaticolous fungus in South America. *Lilloa 62* – Suplemento N° 2: "Interacciones biológicas en un mundo cambiante": 53-60. doi: https://doi.org/10.30550/j.lil/2077
➤ Recibido: 19 de diciembre 2024 – Aceptado: 14 de abril 2025 – Publicado: 27 de junio 2025.
➤ URL de la revista: http://lilloa.lillo.org.ar

INTRODUCTION

Bryophilous fungi primarily inhabit mosses (Phylum Bryophyta), but over 20% of known species growing on liverworts (Phylum Marchantiophyta). Among the octosporaceous bryophilous fungi, small, orange to yellow (occasionally red) ascomata are characteristic of the genera *Filicupula* Y.J. Yao & Spooner, *Lamprospora* De Not., *Octospora* Hedw., *Octosporella* Döbbeler, *Octosporopsis* U. Lindemann & M. Vega, and *Neottiella* (Cooke) Sacc. (Eckstein, 2024).

The genus *Filicupula* includes species with clavate apothecia that develop into obovoid or turbinate forms, flattening at the top (Yao & Spooner, 1996). Examples include *F. suboperculata* (Döbbeler & P. James) Y.J. Yao & Spooner from Europe and *F. cyanopoda* Döbbeler & P.G. Davison from North America, both biotrophic on *Frullania* Raddi (Döbbeler & Davison, 2021).

Conversely, the genus *Lamprospora* comprises approximately 50 species, primarily associated with acrocarpic mosses found mainly in the subclass Dicranidae Doweld (orders Dicranales M. Fleisch. and Pottiales M. Fleisch.). However, a few species reside in the subclass Bryidae Engl. (orders Bryales Limpr. and Bartramiales M. Menzel), with only *L. aneurae* Benkert and *L. maireana* Seaver forming associations with liverworts, specifically on *Aneura pinguis* (L.) Dumort. and *Fossombronia* Raddi species.

Octospora stands out as the largest genus among bryophilous fungi, thriving on both acrocarpous and pleurocarpous mosses (Suárez *et al*., 2023, 2025), as well as liverworts. Although it encompasses numerous species, the high degree of specific variability suggests that it likely represents more than one distinct genus (Németh *et al*., 2017).

Exclusively associated with the Phylum Marchantiophyta, the genus *Octosporella* is typically found on leafy liverworts, while *Octosporopsis* grows on thalloid liverworts. *Octosporella* can be distinguished from other bryophilous octosporaceous fungi by its functionally perithecioid ascomata (Döbbeler, 2011), highlighting the diversity within this ecological niche.

Finally, *Neottiella* represents one of the smallest genera in the Pyronemataceae family, with only six known species. Recently, sampling of bryophytes in Entre Rios (Argentina) yielded small orange apothecia growing on *Riccia cavernosa* Hoffm. These were identified as *Neottiella ricciae*, marking its first record in South America and contributing to our understanding of the region's fungal biodiversity.

MATERIALS AND METHODS

The material was collected in winter on arable land in northeastern Argentina. The preparations were mounted in tap water and examined under a microscope. The description and photographs were based on fresh material, whereas 10–30 values of spore size and at least 10 values of other structures were measured in each collection. *Neottiella ricciae* was identified according to Németh *et al*. (2017) and Eckstein (2016). The spores studied with scanning electron microscopy (ZEISS-EVO 15 operating at 15 KV) were previously rehydrated in a solution of distilled water (20 ml) with TritonX detergent (3 drops) for 24 hours, then they were fixed in Formalin-Aceto-Alcohol (FAA), critical-point dried and then mounted on aluminum discs on double-sided tape, to later be coated with gold-palladium for two minutes (Salgado Laurenti & Galíndez, 2023). The *Riccia* specimens were analyzed according to Bischler-Causse *et al*. (2005). All considered fungal material has been preserved and stored as exsiccate in the herbarium of the Foundation Miguel Lillo (LIL) in San Miguel de Tucumán, Argentina.

RESULTS

Neottiella ricciae (P.Crouan & H.Crouan)
Korf & W.Y. Zhuang, Mycotaxon 40: 96 (1991).
Basionym: *Peziza ricciae* P. Crouan & H. Crouan 1867.
A complete list of synonyms can be found in Németh *et al*. (2017).
Host. *Riccia cavernosa* Hoffm. Deutschl. Fl. 2: 95. 1795 [1796].

Macroscopic features (Fig. 1).— Apothecia 0.2–0.8 mm in diameter, orange, initially spherical, later barrel-shaped to discoid, sessile, margin rimmed with hyalin, stiff acute hairs. Hairs 120–220 μm long, thick walled, 1–2 septate, 6–11 μm broad at base and gradually tapering. Hymenium orange.

Microscopic features (Fig. 2).— Asci 125–190 μm, 8-spored, cylindrical, operculate, spores uniseriate. Paraphyses straight, filiform, septate, 3–6 μm wide, apically slightly inflated, contain orange granulates. Ascospores hyaline, smooth, ellipsoid to ovoid, 17–23 × 10–16 μm, mostly markedly egg-shaped with one rounded side and the other tapering (Fig. 3), with one large lipid drop. Medullary excipulum textura globulosa, ectal excipulum textura intricata.

Material examined.— ARGENTINA. Prov. Entre Ríos, Dpto. Nogoyá, Laurencena, 32°16'52.4"S 59°40'17.6"W, 16-VI-2024, D. J. Alvarez 542 (LIL).

Fig. 1. *Neottiella ricciae.* A-D) Apothecia growing on *Riccia cavernosa*.

Fig. 1. *Neottiella ricciae.* A-D) Apotecios creciendo sobre *Riccia cavernosa*.

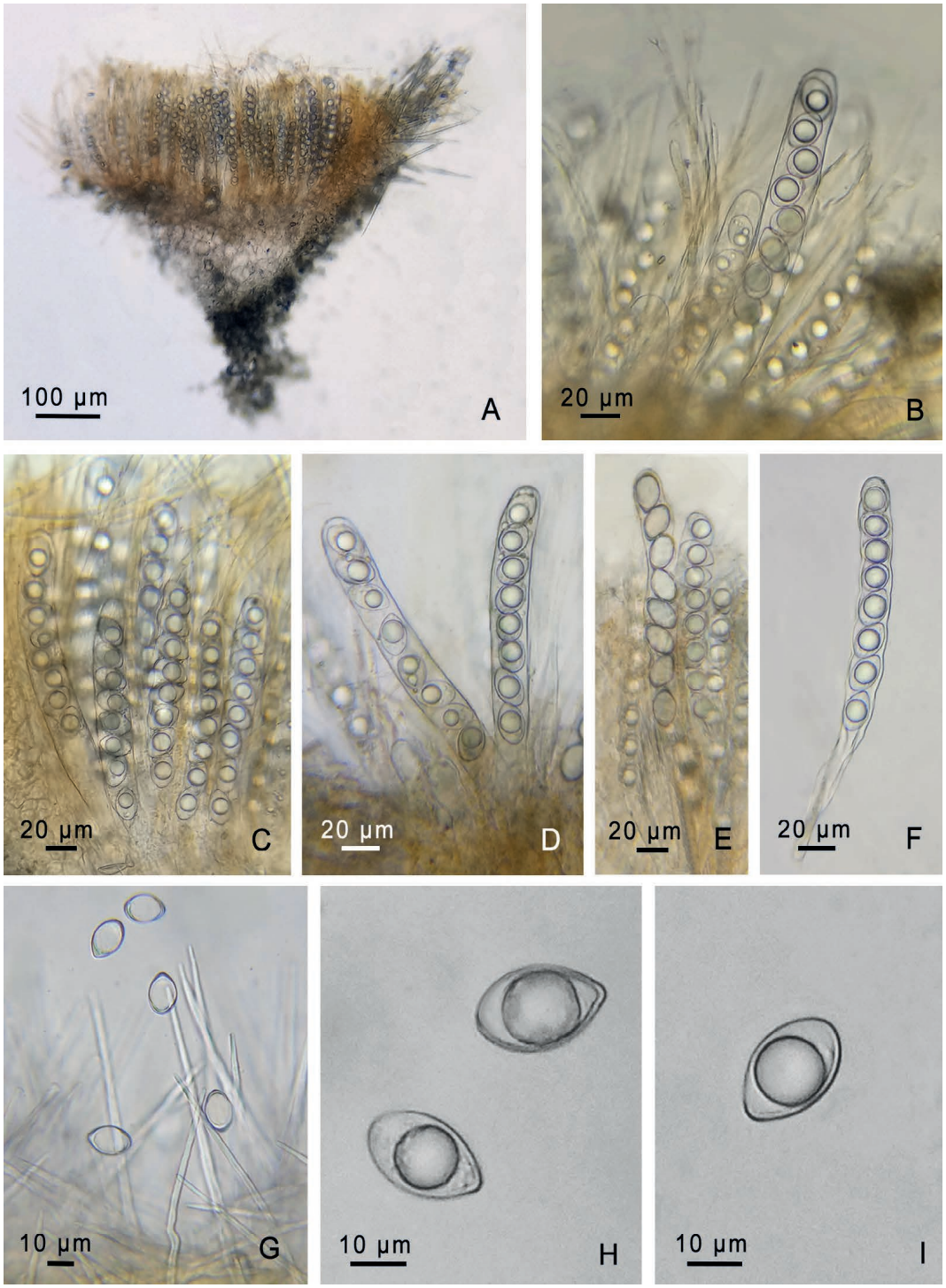

Fig. 2. *Neottiella ricciae*. A) Longitudinal section of an apothecium with stiff hyaline hairs on the margin. B-F) Asci with ascospores and paraphyses. G-I) Ascospores.

Fig. 2. *Neottiella ricciae.* A) Sección longitudinal de un apotecio con pelos hialinos rígidos. B-F) Ascas con ascosporas y parafisis. G-I) Ascosporas.

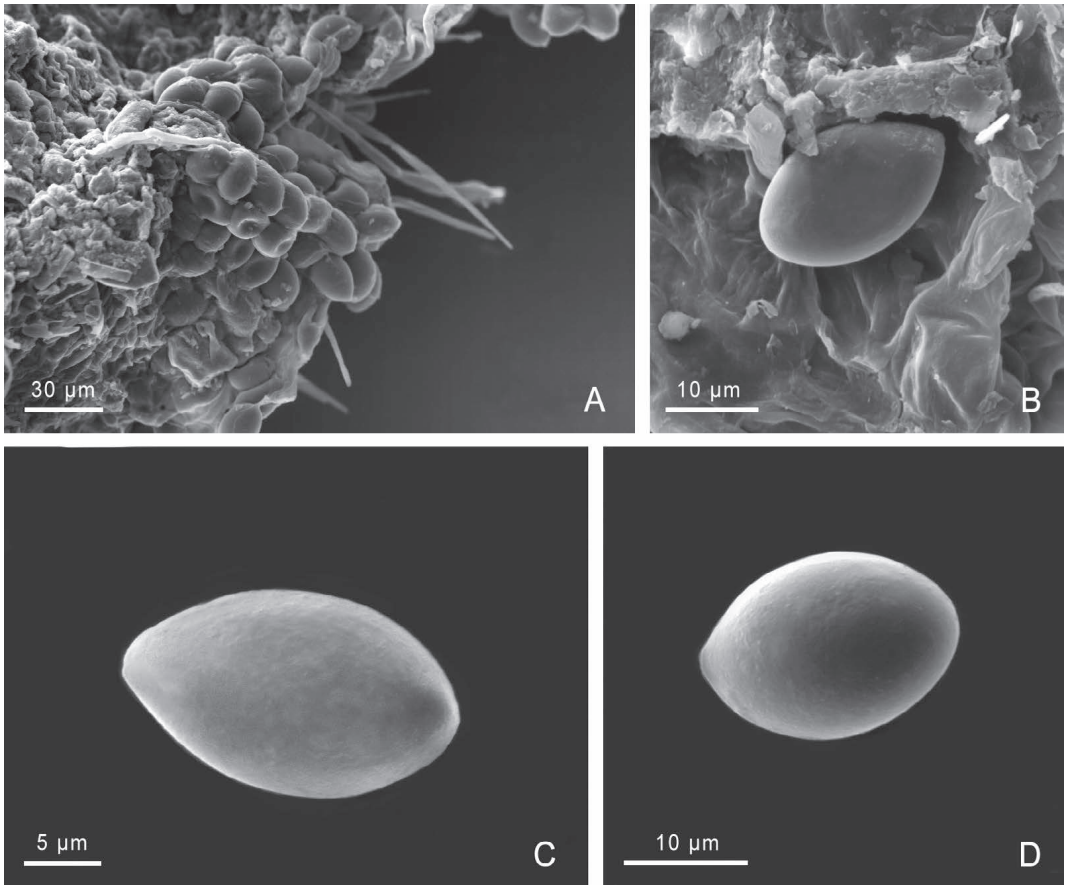

Fig. 3. *Neottiella ricciae.* A-D) Spores (examined using scanning electron microscopy).
Fig. 3. *Neottiella ricciae.* A-D) Esporas (estudiadas con microscopio electrónico de barrido).

DISCUSSION

The description of *N. ricciae* from Argentina generally confirms the observations presented in Németh *et al*. (2017) about finds from Europe. The species was found growing on the thallus of *R. cavernosa*, a species with a wide distribution. While many species have restricted host ranges, typically associated with only one species or genus of bryophytes, others exhibit a broader host spectrum (Quintero *et al.*, 2020). *Neottiella ricciae* is recognized as ricciophilous, previously documented on *Riccia sorocarpa* Bisch., *R. glauca* L., *R. beyrichiana* Hampe ex Lehm., and *R. nigrella* DC. (Németh *et al*., 2017). Notably, it is the only *Neottiella* reported to grow on a liverwort, raising questions about its true taxonomic position within the genus. Most other species in the genus are associated with the Polytrichaceae family, including *Neottiella albocincta* (Berk. & M.A. Curtis) Sacc. on *Atrichum undulatum* (Hedw.) P. Beauv. (Benkert, 1987) and *Neottiella gigaspora* M. Zeng, Q. Zhao & K.D. Hyde on *Atrichum* sp. (according to image 46a in Yuan *et al*., 2020), as well as *Neottiella aphanodictyon* (Kobayasi) Dissing, Korf & Sivertsen, *Neottiella rutilans* (Fr.) Dennis, and *Neottiella vivida* (Nyl.) Dennis found on *Polytrichum* Hedw., *Polytrichastrum* G.L. Sm., or *Oligotrichum* DC

(Benkert, 1994). Németh *et al*. (2017) suggest the placement of *N. ricciae* in *Octospora* but refrain from the new combination until more molecular data of the heterogeneous genus *Octospora* is available.

In Argentina, *N. ricciae* has somewhat smaller spores than those observed in Europe. Additionally, *R. cavernosa* belongs to the subgenus *Ricciella* in contrast to the other known hosts, which all belong to the subgenus *Riccia*. These differences indicate at least a small deviation, which could merit taxonomic recognition in the future when more data is available.

This finding marks the first record of *Neottiella ricciae* in South America, specifically in Argentina, expanding our understanding of its geographic distribution from previously recorded locations in Europe, Africa (Canary Islands), North America and India (Németh *et al*., 2017; Döbbeler *et al*., 2023). The new record in Argentina adds the fifth continent in the distribution of *N. ricciae*, making it a cosmopolitan species. The Argentinian record includes *R. cavernosa* as a previously undocumented host.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

ACKNOWLEDGEMENTS

We would like to thank Jan Eckstein for valuable comments on the manuscript. This research was supported by the National Scientific and Technological Research Council (CONICET, PIP 0177), and the Research Project of the National University of Tucumán (PIUNT G744).

BIBLIOGRAPHY

Benkert, D. (1987). *Neottiella atrichi* (= *N. catharinaea*) in Europa. *Beiträge zur Kenntnis der Pilze Mitteleuropas* 3: 407-411.

Benkert, D. (1994). Beiträge zur Kenntnis bryophiler Pezizales-Arten. 2. Die Identität von *Peziza albo-cincta* Berk. & Curt. *Beiträge zur Kenntnis der Pilze Mitteleuropas* 9: 131-138.

Bischler-Causse, H., Gradstein, S. R., Jovet-Ast, S., Long, D. G. & Salazar Allen, N. (2005). Marchantiidae. *Flora Neotropica*, Vol. 97. New York Botanical Garden Press.

Döbbeler, P. (2011). Two new hepaticolous species of the genus *Octosporella* (Pezizales). *Herzogia* 24 (2): 357-365. http://dx.doi.org/10.13158/heia.24.2.2011.357

Döbbeler, P. & Davison, P. G. (2021). Non-hypocrealean ascomycetes on *Frullania* mainly from Southeastern North America. *Nova Hedwigia* 113: 361-401. http://dx.doi.org/10.1127/nova_hedwigia/2021/0663

Döbbeler, P., Davison, P. G. & Buck, W. R. (2023). Bryoyphilous ascomycetes of North America – an overview of the recorded species. *Herzogia* 36: 305-370. http://dx.doi.org/10.13158/heia.36.2.2023.305

Eckstein, J. (2016). Key to main groups of bryoparasitic Pezizales. – http://www.octospora.de/identification.htm (accessed: 28.09.2024)

Eckstein, J. (2024). Bryoparasitic Pezizales. – http://www.octospora.de (accessed: 28.09.2024).

Németh, C., Eckstein, J. & Stöckli, E. (2017). New European occurrences of *Neottiella ricciae*, a bryophilous ascomycete. *Herzogia* 30 (2): 353-361. http://dx.doi.org/10.13158/heia.30.2.2017.353

Quintero, M., Quijada, L., Negrín, R. & Losada-Lima, A. (2020). Pezizales asociados a briófitos en las islas Canarias: estado actual y contribución a su estudio en la isla de Tenerife. *Ascomycete.org* 12 (1): 19-28. https://doi.org/10.25664/art-0292

Salgado Laurenti, C. R. & Galíndez, M. C. (2023). Fast and simple biological simple preparation and observation procedure for scanning electron microscopy. *Acta Microscopia* 32: 13-26.

Suárez, G. M., Domínguez, F. G., Pajot, H. P., Flores, J. R. & Catania, M. V. (2023). *Octospora tucumanensis* (Pezizales), a new bryophilous ascomycete on *Dimerodontium balansae* (Bryophyta) from Argentina. *Springer Heidelberg, Mycological Progress* 22 (54). http://dx.doi.org/10.1007/s11557-023-01909-1

Suárez, G. M., L. A. Castillo & M. A. Ibiris. (2025). Discovery of *Octospora excipulata* (Pezizales) in South America. *Bonplandia* 34 (1): 1-8. http://dx.doi.org/10.30972/bon.3417990

Yao, Y-. J. & Spooner, B. M. (1996). Notes on British *Octosporella* with a new genus *Filicupula* (Pezizales). *Kew Bulletin* 51 (1): 193-196. http://dx.doi.org/10.2307/4118759

Yuan, H. S., Lu, X., Dai, Y. C., Hyde, K. V. D., Kan, Y. H., Kušan, I., He, S. H., Liu, N. G., Sarma, V. V., Zhao, C. L., Cui, B. K., Yousaf, N., Sun, G. Y., Liu, S. Y., Wu, F., Lin, C. G., Dayarathne, M. C., Gibertoni, T. B., Conceição, L. B., … Zhou, L. W. (2020). Fungal diversity notes 1277-1386: taxonomic and phylogenetic contributions to fungal taxa. *Fungal Diversity* 104: 1-266. http://dx.doi.org/10.1007/s13225-020-00461-7