



DISCOVERY OF *OCTOSPORA EXCIPULATA* (PEZIZALES) IN SOUTH AMERICA

Descubrimiento de *Octospora excipulata* (Pezizales) en Sudamérica

Guillermo M. Suárez^{1,2} , Lucas A. Castillo¹  & Martín A. Ibris¹ 

Summary: The bryophilous ascomycete *Octospora excipulata* (Clem.) Benkert is reported as a new record in South America, based on samples collected in Tucumán, Argentina. The species was observed infecting the American moss *Funaria calvescens* (Funariaceae). This study provides a concise description and illustrations highlighting both macroscopic and microscopic characteristics of the species. Additionally, comments on the host identity are included.

Key words: Argentina, bryoparasitic Pezizales, *Funaria*, Funariaceae, Pyronemataceae, Yungas.

Resumen: El ascomiceto briófilo *Octospora excipulata* (Clem.) Benkert se reporta como un nuevo registro en América del Sur, basado en muestras recolectadas en Tucumán, Argentina. La especie fue observada infectando a *Funaria calvescens* (Funariaceae), un musgo americano. Este estudio proporciona una descripción concisa e ilustraciones que destacan tanto las características macroscópicas como microscópicas de la especie. Además, se incluyen comentarios sobre la identidad del huésped.

Palabras clave: Argentina, *Funaria*, Funariaceae, Pezizales briófilos, Pyronemataceae, Yungas.

Introduction

The genus *Octospora* Hedw. comprises bryophilous ascomycetes that form associations with the gametophytes of mosses (Bryophyta) and, to a lesser extent, liverworts (Marchantiophyta). As noted by Németh (2017), bryophilous fungi are primarily observed and collected by bryologists. In Latin America, fungi associated with bryophytes remain largely understudied (Suárez *et al.*, 2023), likely due to the limited research on bryophytes in the region, with many areas yet to be thoroughly surveyed. The true species diversity in South America could potentially rival that of Europe, with about 50 accepted and described taxa of *Octospora sensu stricto* (Janošík *et al.*, 2022; Eckstein, 2024).

In Argentina, Gamundí (1960) listed four species of *Octospora*, but only one, *O. leucoloma*, is truly bryophilous and thus represents a genuine *Octospora*. Additionally, *O. cashiae* (Gamundí) Benkert (as *Lamprospora cashii* in Gamundí, 1973) and *O. humosa* (Fr.) Dennis were identified in the south (Gamundí *et al.*, 2004), while *O. tucumanensis* Catania & G.M. Suárez was found in the north (Suárez *et al.*, 2023).

During a visit to Aconquija National Park in Tucumán (northwest Argentina), numerous apothecia of an *Octospora* species with smooth ascospores were found growing among the shoots of *Funaria calvescens* Schwägr. (Funariaceae). The fungus was identified as *Octospora excipulata* (Clem.) Benkert, a relatively common species in Europa, known

¹ Facultad de Ciencias Naturales e IML, Universidad Nacional de Tucumán, Miguel Lillo 205, (4000) San Miguel de Tucumán, Argentina.

² Unidad Ejecutora Lillo (CONICET-Fundación Miguel Lillo), Miguel Lillo 251, (4000) San Miguel de Tucumán, Argentina. E-mail: suarezgm@csnat.unt.edu.ar

primarily for its parasitic relationship with Funariaceae mosses (Benkert, 2007; Németh *et al.*, 2023).

While the species has been recorded from Europe and North America (Jukić *et al.*, 2018), this study presents the first documented instance of *O. excipulata* on *F. calvescens* in South America, thereby expanding our understanding of the ecological interactions between fungi and bryophytes in the region.

Materials and Methods

Apothecia of *O. excipulata* were collected from Aconquija National Park in Tucumán, Argentina, which represents the southernmost relict of the Yungas. The Yungas are a biogeographic region of cloud forests and jungles that extend along the eastern slopes of the Andes in South America, characterized by unique biodiversity and a warm, humid climate. The samples were photographed in their natural habitat, and ecological characteristics were noted. They were then placed in a paper box and transported to the laboratory for drying and preparation. Fresh apothecia were photographed, measured, and described macroscopically using a stereoscope (Nikon SMZ800). Microscopic features were observed and illustrated using a light microscope (Leica DM500). The material was mounted in tap water, potassium hydroxide solution (5% KOH), or lactophenol cotton blue (LPCB). At least 30 measurements of spore size and 10 measurements of other structures were taken in water. Staining with lactophenol cotton blue was employed to study the infection structure, and the iodine reaction of the asci was tested with Melzer's solution. Identification was assisted by the references of Eckstein (2016) and Jukić *et al.* (2020). The host was analyzed using conventional techniques for bryophytes (Frahm *et al.*, 2003; Delgadillo-Moya *et al.*, 2022). Specimens were deposited at the Foundation Miguel Lillo herbarium (LIL).

Examined material: **ARGENTINA. Tucumán:** Parque Nacional Aconquija, zona de recreación, 27°17'06"S, 65°52'17"W, 922 m a.s.l., 1-VII-2024, *Castillo 2043* (LIL); *ibid.*,

Castillo 2044 (LIL); Jardín Botánico Fundación Miguel Lillo, 26°49'52"S, 65°13'20"W, 440 m a.s.l., 10-IX-2024, *Suárez 2048* (LIL).

Results

Octospora excipulata (Clem.) Benkert. Mycologia Montenegrina 10: 10 (2008) [2007] (Figs. 1-4).

Apothecia 1-7 mm in diameter, broad discoid, partly submerged in the soil among shoots of its host, more concave when young, hymenium orange with conspicuous less bright coloured to whitish membranaceous margin. Appressoria nearly circular or elliptical, on rhizoids, stem and leaves (Fig. 3). Excipulum mainly consists of prominent and long-celled texture globulosa-angularis, cells 10-50 µm in diam. Asci cylindrical, octosporous, with distinctly obtuse apical part with operculum, tapering towards the base, 160-250 × 13-15 µm (Fig. 2D-G). Paraphyses cylindrical, slightly enlarged below apical part, containing large quantities of yellow-orange pigment (Fig. 2A-C). Spores 21-22 × 12-13 µm, ellipsoid, smooth, hyaline, with a large oil drop (exceptionally two); thick wall only present in fully mature spores (Fig. 2F-I).

Host and ecology: *Octospora excipulata* was found fruiting on *Funaria calvescens* (Fig. 4A, B), an American annual moss typical of disturbed environments, including ruderal sites. The sample was collected from a recreational area in Aconquija National Park, located in the southernmost relict of the Yungas, growing in association with *Bryum coronatum* Schwägr. and *Bryum argenteum* Hedw. (*lanatum* form) (Fig. 1).

Isolated *F. calvescens* plants exhibited higher rates of *O. excipulata* infection and reduced plant size compared to those growing in denser populations, which showed no fungal infections and more robust growth. Nearby populations of *F. calvescens* coexisting with *Trematodon crispifolius* Thér. and *Polytrichum juniperinum* Hedw. were devoid of *Octospora*.



Fig. 1. *Octospora excipulata*. A-D: Habit in National Park Aconquija. E: Apothecia with the host, *Funaria calvescens*.

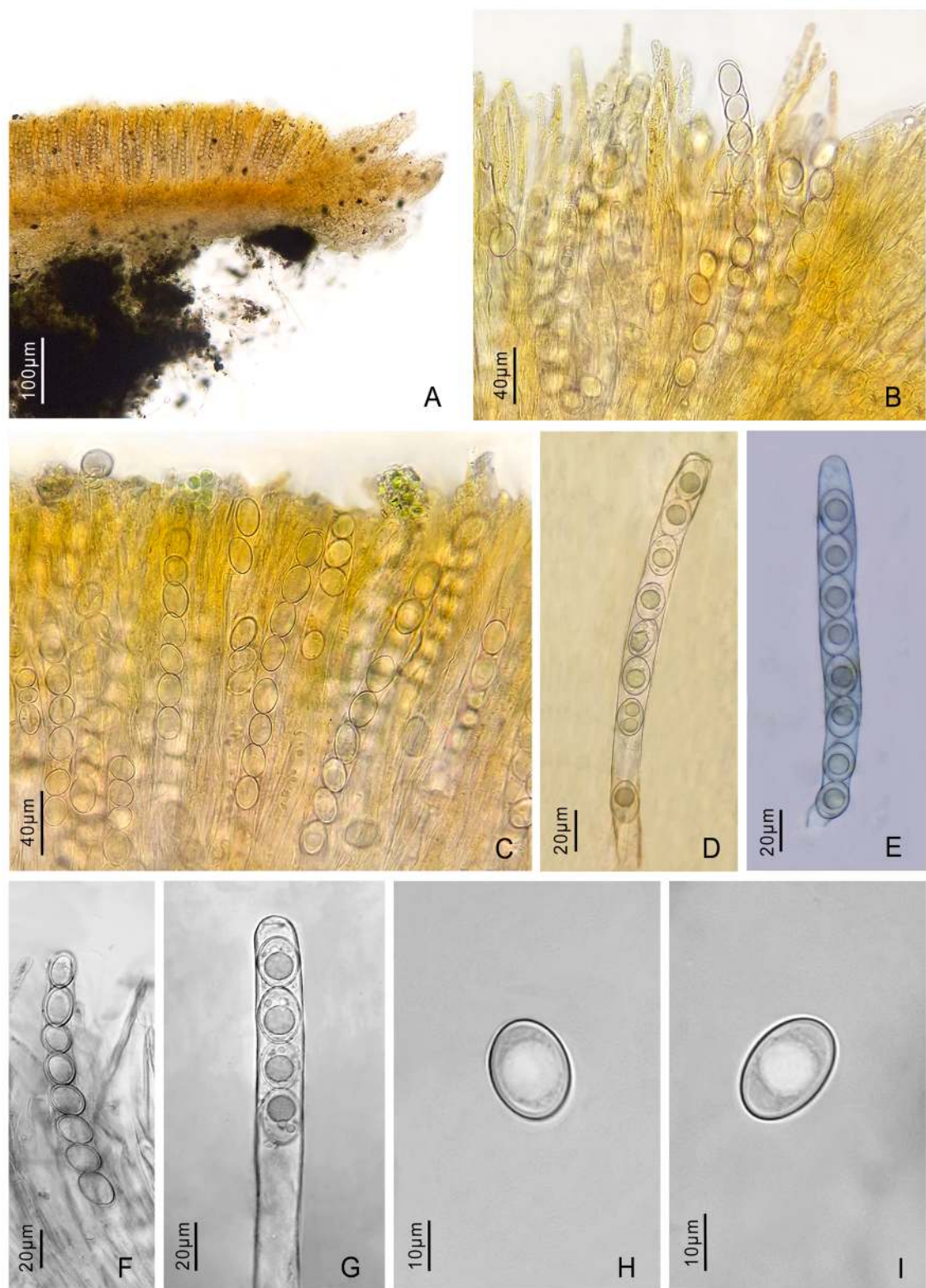


Fig. 2. *Octospora excipulata*. A: Longitudinal section of an apothecium showing a membranaceous margin. B-C: Detail of the hymenium. D-G: Asci and ascospores. H-I: Mature spores. A-I, *Castillo 2043* (LIL).

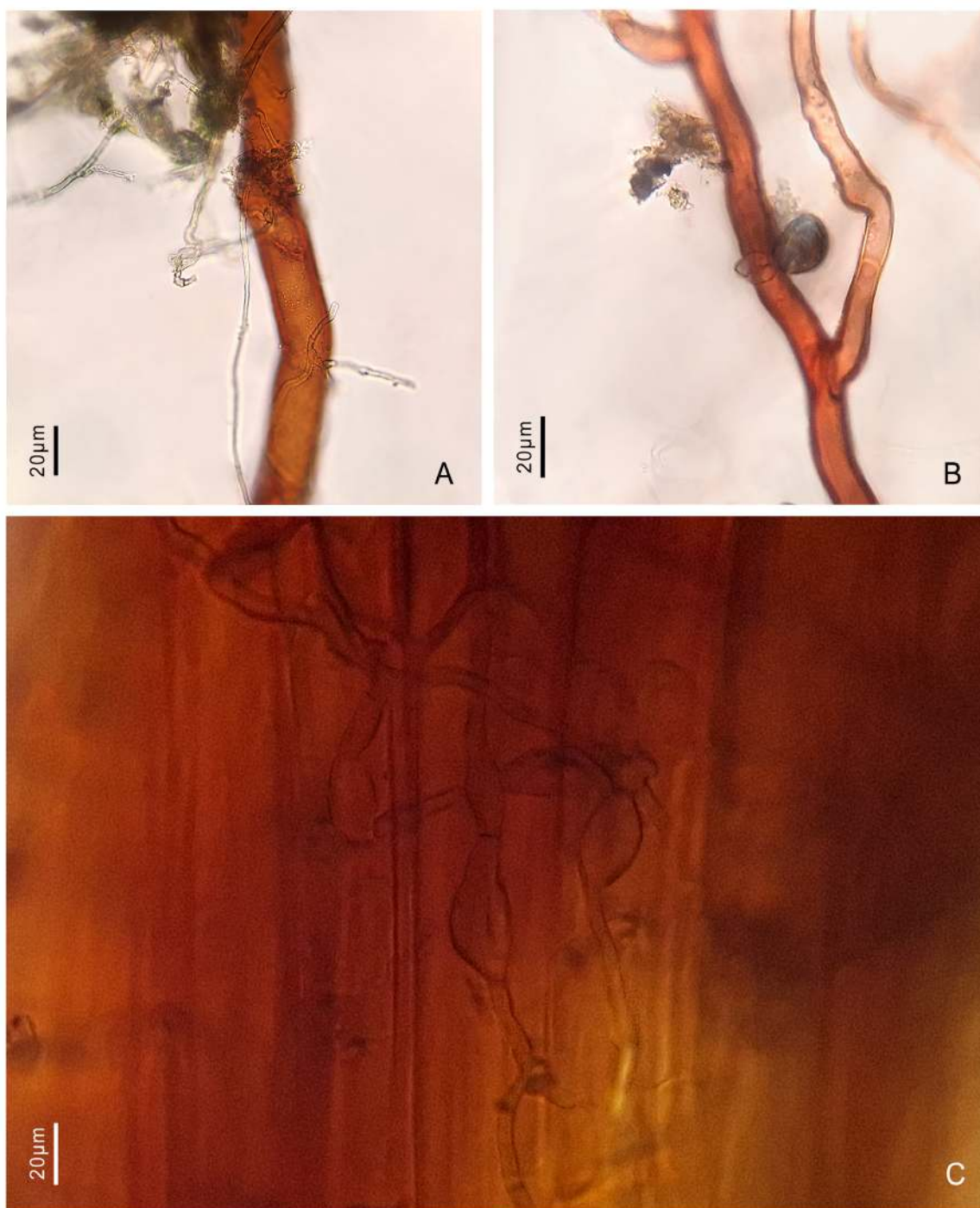


Fig. 3. *Octospora excipulata*. A: Rhizoids with hyphae. B: Appressoria on rhizoid. C: Appressoria on the surface of the stem. A-C, *Castillo 2043* (LIL).

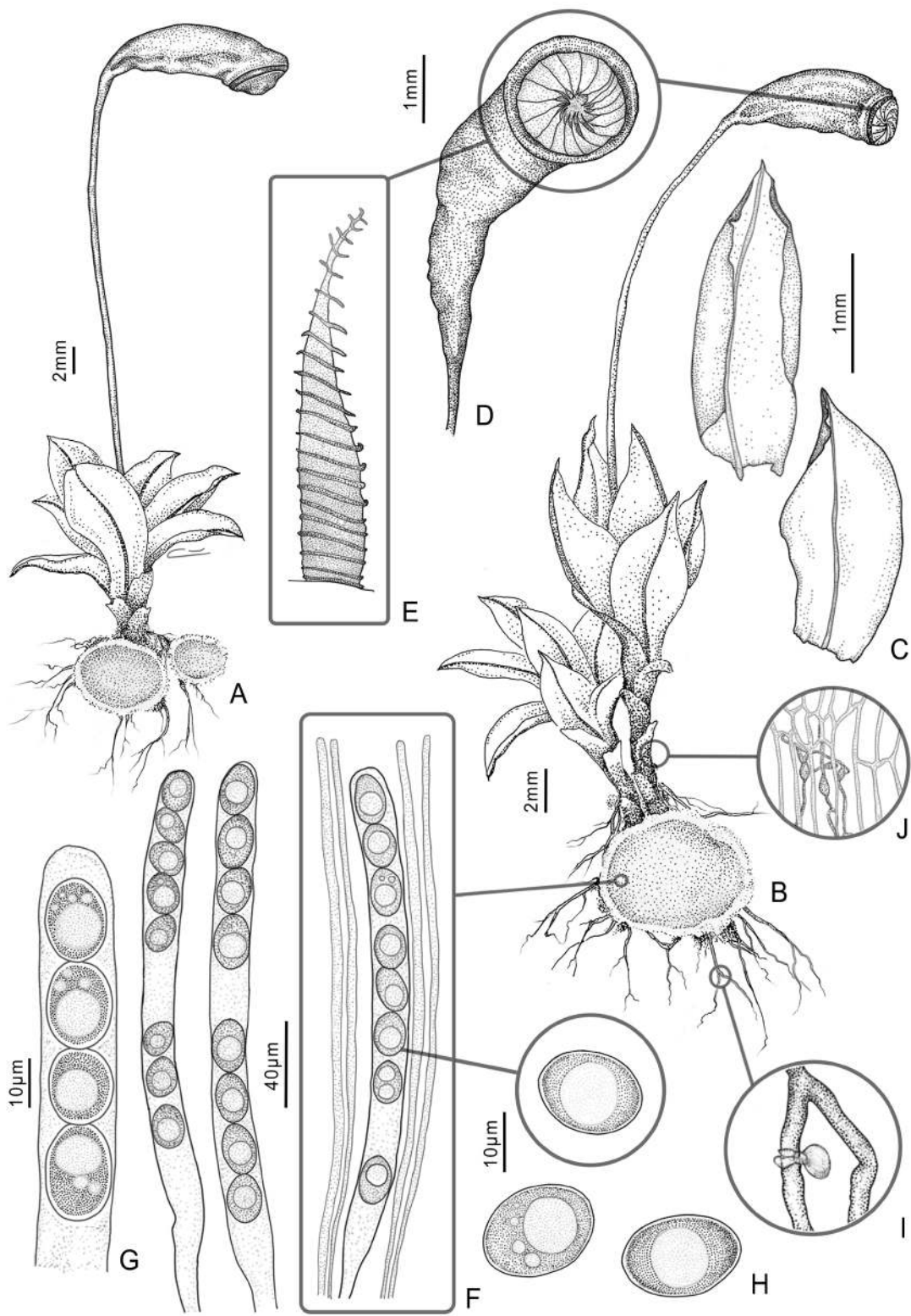


Fig. 4. *Octospora excipulata*. A-B: Apothecia with the host, *Funaria calvescens*. C: Leaves. D: Sporophyte. E: Exostome teeth. F-G: Asci and ascospores. H: Ascospores. I-J: Appressoria. A-I, Castillo 2043 (LIL).

Discussion

In the literature, *F. calvescens* has been considered a synonym of *F. hygrometrica* Hedw. (Ochi, 1968) or a variety of the latter [*F. hygrometrica* var. *calvescens* (Schwägr.) Mont] (Sharp *et al.*, 1994). However, based on our study of American specimens, we agree with Dias *et al.* (2018) that these taxa should be considered separate species. *Funaria calvescens* differs from *F. hygrometrica* in having a more robust habit, with the sporophyte capsule being suberect or horizontally pendulous, featuring a tapered neck and a mouth wider than the capsule width when dry (Fig. 4D). Gametophytically, it differs in having deeply concave leaves when wet, giving an involute appearance (Fig. 4C).

Funaria calvescens, commonly found in moist and shaded areas throughout Argentina, provides a suitable substrate for *Octospora excipulata* to thrive. In Europe, the primary host is *F. hygrometrica*, but Benkert (2007) notes collections of *O. excipulata* on *Physcomitrium* (Brid.) Brid. and *Physcomitrella* Bruch & Schimp., and suggests that these may represent distinct taxa, implying that *O. excipulata sensu stricto* is confined to *Funaria* spp. The spore size in European specimens is $(17)19\text{--}27(39) \times (12)13\text{--}17(18) \mu\text{m}$ (Eckstein, 2024). Our measurements in the Argentinean *O. excipulata* are at the lower margin of this range $(21\text{--}22 \times 12\text{--}13 \mu\text{m})$.

This discovery underscores the importance of further research into fungal biodiversity in South America, particularly in understanding the ecological roles and interactions of fungi with moss communities. It also highlights the need for conservation efforts to preserve these delicate ecological relationships in the face of environmental changes.

Acknowledgements

We thank Jan Eckstein for comments on the manuscript. This study was supported by CONICET (PIP 0177) and Universidad Nacional de Tucumán (PIUNT G744).

Bibliography

- BENKERT, D. (2008) [2007]. Zur Kenntnis des Vorkommens bryophiler Pezizales (Ascomycota) in Südost-Europa. *Mycologia Montenegrina* 10: 7-21.
- DELGADILLO-MOYA, C., ESCOLÁSTICO, D. A., HERNÁNDEZ-RODRÍGUEZ, E., HERRERA-PANIAGUA, P., PEÑA-REYES, P. & JUÁREZ-MARTÍNEZ, C. (2022). *Manual de Briofitas*. 3ra ed. Universidad Nacional Autónoma de México, México.
- DIAS, M. S., FERNANDES PERALTA, D. & DA SILVA NETO, S. J. (2018). Taxonomic treatment of the Funariaceae from Brazil. *Phytotaxa* 357: 77-93. <https://doi.org/10.11646/phytotaxa.357.2.1>
- ECKSTEIN, J. (2016). Key to main groups of bryoparasitic Pezizales. <http://www.octospora.de/identification.htm> (Accessed: 15/07/2024).
- ECKSTEIN, J. (2024). Bryoparasitic Pezizales. <http://www.octospora.de> (Accessed: 15/07/2024)
- FRAHM, J. P., PÓCS, T., O'SHEA, B., KOPONEN, T., PIIPPO, S., ENROTH, J., RAO, P. & FANG, Y. M. (2003). *Manual of Tropical Bryology*. Board, Germany. <https://doi.org/10.11646/bde.23.1.1>
- GAMUNDÍ, I. J. (1960). Discomycetes operculados de la Argentina familias Pezizaceae y Humariaceae. *Lilloa* 30: 296-338.
- GAMUNDÍ, I. J. (1973). Discomycetes de Tierra del Fuego II. Especies nuevas de Humariaceae. *Boletín de la Sociedad Argentina de Botánica* 15: 85-92.
- GAMUNDÍ, I. J., MINTER, D. W., ROMERO, A. I., BARRERA, V. A., GIAIOTTI, L. A., MESSUTI, M. I. & STECCONI, M. (2004). Checklist of the discomycetes (Fungi) of Patagonia, Tierra del Fuego and adjacent Antarctic areas. *Darwiniana* 42: 63-164. <https://doi.org/10.14522/darwiniana.2014.421-4.155>
- JANOŠÍK, L., SOCHOROVÁ, Z., ECKSTEIN, J., VEGA, M. & KOUKOL, O. (2022). Ascospore morphology of bryophilous Pezizales is closely associated with the place of infection and host ecology. *Fungal Ecology* 61: 101200. <https://doi.org/10.1016/j.funeco.2022.101200>
- JUKIĆ, N., TOMIĆ, S., SABOVLEVIĆ, M. & OMERVIĆ, N. (2018). Notes on some bryophilous Pezizales (fungi) in the Mediterranean part of Bosnia and Herzegovina. *Glasnik Šumarskog fakulteta Univerziteta u Banjoj Luci* 28: 71-83. <https://doi.org/10.17110/StudBot.2017.48.1.105>
- NÉMETH, C. (2017). *Octospora erzbergeri* (Pyronemataceae), a bryophilous ascomycete in Hungary. *Studia Botanica Hungarica* 48: 105-123. <https://doi.org/10.17110/StudBot.2017.48.1.105>

- Németh, C., Vega, M., Hernanz, J., Eckstein, J. & Janošík L. (2023). *Octospora entosthodontophila*, a new smooth-spored bryophilous ascomycete on *Entosthodon* spp. *Herzogia* 36: 283-304. <https://doi.org/10.13158/heia.36.2.2023.283>
- Ochi, H. (1968). A revision of the family Funariaceae (Musci) in Japan and the adjacent regions. *Japanese Journal of Botany* 20: 1-34.
- SHARP, A. J., CRUM, H. A. & ECKEL, P. M. (eds). (1994). The Moss Flora of Mexico. *Memoirs of the New York Botanical Garden* 69: 1-1113.
- SUÁREZ, G. M., DOMÍNGUEZ, F. G., PAJOT, H., FLORES, J. R. & CATANIA, M. (2023). *Octospora tucumanensis* (Pezizales), a new bryophilous ascomycete on *Dimerodontium balansae* (Bryophyta) from Argentina. *Mycological Progress* 22, 54. <https://doi.org/10.1007/s11557-023-01909-1>