Acta Botanica
Mexicana

First record of *Mycoporum buckii* (Dothideomycetes, Pleosporales) in Mexico

Primer registro de *Mycoporum buckii* (Dothideomycetes, Pleosporales) en México

Yenitze A. García-Martínez¹ , Gabriela Heredia² , Ricardo Valenzuela¹ , Tania Raymundo^{1,3}

Abstract

Background and Aims: The genus *Mycoporum* of the class Dothideomycetes of the phylum Ascomycota is characterised by ascostromata with scattered, aggregated locules without a wall of their own, bitunicate asci with a short pedicel, as well as ellipsoidal, fusiform to clavate ascospores with broader upper hemispores, and a variable number of septa. The objective of this study is to report *Mycoporum buckii* for the first time in Mexico.

Methods: The specimens were collected on *Rhizophora mangle* bark in the Cozumel Island Biosphere Reserve, Quintana Roo, Mexico, in 2019, and were deposited in the herbarium ENCB of the Instituto Politécnico Nacional, Mexico. The material was reviewed in dry state, and macro- and micro-morphological characters were described. Specimens were identified with specialised keys and literature.

Key results: The description of *Mycoporum buckii* of Mexico is presented. This species is characterised by multilocular, sessile ascostromata, clavate asci, and ellipsoidal ascospores with one transversal septum.

Conclusions: *Mycoporum buckii* grows on *Rhizophora mangle* and produces its sporomas during the rainy and dry seasons in the Cozumel Island Biosphere Reserve, Quintana Roo, Mexico.

Key words: Caribbean Sea, *Rhizophora mangle*, taxonomy.

Resumen

Antecedentes y Objetivos: El género *Mycoporum* de la clase Dothideomycetes del phylum Ascomycota se caracteriza por un ascostroma con lóculos dispersos, agregados sin pared propia, ascas bitunicadas con un pedicelo corto y ascoporas elipsoidales, fusiformes a clavadas, con el hemisferio superior más ancho, y un número variable de septos. El objetivo de este estudio es reportar a *Mycoporum buckii* por primera vez en México.

Métodos: Los especímenes fueron recolectados sobre corteza de *Rhizophora mangle* en la Reserva de la Biosfera Isla de Cozumel, México, durante el año 2019, y fueron depositados en el herbario ENCB del Instituto Politécnico Nacional, México. El material se revisó en seco y se describieron sus características macro y micromorfológicas. Estos fueron identificados con claves y literatura especializada.

Resultados clave: Se presenta una descripción de *Mycoporum buckii* para México. Esta especie se caracteriza por un ascostroma multilocular, sésil, ascas clavadas y ascoporas elipsoidales con un septo transversal.

Conclusiones: *Mycoporum buckii* se encontró creciendo sobre *Rhizophora mangle* y produce esporomas en temporada seca y húmeda en la Reserva de la Biosfera Isla de Cozumel, Quintana Roo, México.

Palabras clave: Mar Caribe, *Rhizophora mangle*, taxonomía.

¹Instituto Politécnico Nacional, Escuela Nacional de Ciencias Biológicas, Laboratorio de Micología, Prolongación de Carpio y Plan de Ayala, Santo Tomás, Alcaldía Miguel Hidalgo, 11340 Cd. Mx., México.

²Instituto de Ecología, A.C., Red de Biodiversidad y Sistemática, Carretera antigua a Coatepec No. 351, Congregación El Haya, 91070, Xalapa-Enríquez, Veracruz, México.

³Corresponding author: traymundoo@ipn.mx; raymundot.tr@gmail.com

Received: October 16, 2020.

Reviewed: November 19, 2020.

Accepted by Marie-Stéphanie Samain: December 8, 2020.

Published Online first: January 22, 2021.

Published: Acta Botanica Mexicana 128 (2021).

Este es un artículo de acceso abierto bajo la licencia Creative Commons 4.0 Atribución-No Comercial (CC BY-NC 4.0 Internacional).

To cite as: García-Martínez, Y. A., G. Heredia, R. Valenzuela and T. Raymundo. 2021. First record of *Mycoporum buckii* (Dothideomycetes, Pleosporales) in Mexico. Acta Botanica Mexicana 128: e1802. DOI: <https://doi.org/10.21829/abm128.2021.1802>

e-ISSN: 2448-7589

Introduction

Mycoporum Flot. ex Nyl. is a monotypic genus of the family Mycoporaceae (Hyde et al., 2013) within the order Pleosporales, class Dothideomycetes. According to Index Fungorum (2020), this genus comprises 48 species, is saprobe, and not or facultatively lichenised (Nash et al., 2002). It includes species that grow on tree bark; and develops multi-loculate, scattered, aggregated, sphaerical or conical ascostromata, erumpent or superficial, black, globose to subglobose. Locules have no own wall, and open through an apical pore or an elongated channel; pseudoparaphyses are filiform, hyaline, often septate; asci are octosporate, bitunicate, fissitunicate, cylindrical to obclavate, with a short pedicel; ascospores are ellipsoidal, fusiform to clavate with a larger hemispore, variably septate; hyaline to brown; the asexual state is unknown (Aptroot, 2002; Hyde et al., 2013).

In America, 19 species of *Mycoporum* have been reported (Imshaug, 1956; Harris, 1995; Nash et al., 2002; Mercado-Díaz, 2009; Hodkinson, 2010; Lendemer and Harris, 2014). In Mexico, only three species in this genus are currently known: *Mycoporum eschweileri* (Müll. Arg.) R.C. Harris in the Sonora Desert, Baja California, Baja California Sur, Sinaloa (Aptroot, 2002) and Jalisco, and *M.*

californicum (Zahlbr.) R.C. Harris and *M. lacteum* (Ach.) R.C. Harris in Jalisco (Herrera-Campos et al., 2017).

The objective of this study is to report *Mycoporum buckii* R.C. Harris for the first time in Mexico.

Materials and Methods

The samples were collected in mangrove forests located in the Punta Sur Ecological Park in the Cozumel Island Biosphere Reserve (20°16'41"N, 86°58'5"W and 20°18'27"N, 87°00'41"W) (Fig. 1). The climate is tropical, with an average temperature of 25 °C, and a mean annual precipitation of 1570 mm (annual maximum occurs in October with 250 mm and minimum in April with 40 mm) (INEGI, 2013). The mangrove forests are represented by the species *Rhizophora mangle* L., *Laguncularia racemosa* (L.) C.F. Gaertn., *Conocarpus erectus* L. and *Avicennia germinans* L. (Téllez-Valdez et al., 1989). The specimens were collected in May and October 2019 on *R. mangle* bark and were deposited in the fungal collection "Dr. Gastón Guzmán Huerta" in the Herbarium of the Escuela Nacional de Ciencias Biológicas of the Instituto Politécnico Nacional, Mexico City, Mexico (ENCB). Longitude and latitude coordinates were obtained with a GPS eTrex (Garmin). Morphological examinations were conducted as outlined by Brodo et al. (2001). The

Figure 1: Location of records of *Mycoporum buckii* R.C. Harris.

morphology of the specimens was examined using a microscope Nikon eclipse 8i with an adapted camera Nikon DS-Fi1 (Nikon, Tokyo, Japan). Ascospore measurements were made in water at $\times 1000$ magnification, and only well-developed ascospores lying outside the asci were measured.

Results

Ascomycota

Dothideomycetes

Pleosporales

Mycoporaceae

Mycoporum buckii R.C. Harris, More Florida Lichens, Inc. 10 Cent Tour Pyrenol: 68. 1995. Figs. 2-3.

TYPE: UNITED STATES OF AMERICA. Florida, Duval Co., Jacksonville Beach, W. R. Buck B175 (holotype: MICH, NY).

Non-lichenised; ascostromata 0.1-0.7 mm diameter, spherical, black, superficial, scattered, locules 6-12, composed of pale brown mycelium, upper wall 18-20 μm and bottom wall 40-60 μm thick; locules 50-65(73) $\times$ 40-60 μm , spherical to peritheciode, without wall of their own, immersed in the ascostroma, aggregated; ostiole forming an short apical pore, 7-11 $\times$ 13-15 μm ; peridium of pseudoparenchymatous cells of variable size, brown; hymenium hyaline, gelatinous, with globose texture; pseudoparaphyses 0.5-1 μm thick, filiform, hyaline; asci 35-40 $\times$ 7-9(-12) μm , obclavate, hyaline, bitunicate, octosporate, ectotunica thin; endotunica very thick in upper half of asci, with a pedicel 6-9 $\times$ 2-3 μm ; ascospores (10)10.5-12 $\times$ 2.5-3.5(5) μm , ellipsoidal, hyaline, with smooth wall, with a transversal septum, often with broader upper hemisphere, irregularly arranged in asci. Not able to grow in culture media. Asexual state not seen.

Ecology and distribution: habit saprobe, growing on dry, dead primary branches still on the living tree and dead fallen branches of *Rhizophora mangle* in a mangrove forest

in a coastal lagoon called Laguna Colombia. The individuals of *R. mangle* on which *M. buckii* was growing were found in the upper zone of the coastal lagoon, where the level of flooding is minimum. The species was found in greater abundance in the dry season, but was able to form asci with ascospores in both dry and rainy seasons. It was found frequently growing together with the non-lichenised fungus *Naevia pinastri* (Anzi) Thiyagaraja, Lücking & K.D. Hyde. *Mycoporum buckii* has been reported in the United States of America in a floodplain in Florida and in the Dominican Republic in El Morro de Monte Cristi in low dry forest near the sea (CNALH, 2020). Our discovery thus is a new record for Mexico.

Specimens studied: MEXICO. Quintana Roo, municipality Cozumel, Punta sur, 20°16'48"N, 86°58'44"W, 0 m, 19.V.2019, Y. A. García and M. A. Bravo 40 (ENCB), 42 (ENCB), 43 (ENCB); loc. cit., 20°17'57"N, 86°60'14"W, 0 m, Y. A. García and M. A. Bravo 51 (ENCB), 57 (ENCB), 60 (ENCB); loc. cit., 20°18'00"N, 86°60'14"W, 7 m, 16.X.2019, T. Raymundo 8321b (ENCB), Y. A. García and M. A. Bravo 70 (ENCB), 73 (ENCB).

Discussion

Mycoporum buckii is characterised by its black ascomata, superficial with locules 50-100 $\times$ 40-60 μm , asci oboclavate with a short pedicel 6-9 $\times$ 2-3 μm , ascospores 10-13 $\times$ 2.5-3.5 μm with one transversal septum (Figs. 2, 3). *Mycoporum* is a genus reported as facultative-lichenised (Thiyagaraja et al., 2020) and Harris (1995) reports *M. buckii* as lichenised species. We observed a whitening bark where *M. buckii* was growing; however, during the microscopic examination, it was not proven that this was caused by thallus formation, thus we report it as a non-lichenised species.

According to Harris (1995), this species has been found associated with *Taxodium* Rich. and *Quercus* L. in Florida (USA) and in flood plain forest and vegetation near the sea in Dominican Republic. Therefore, it can be considered that *M. buckii* is a species that is distributed near bodies of fresh and salt or brackish water, as was the case in this study, where it was found in mangrove forests. So far, *M. buckii* has only been recorded for the American continent.

Figure 2: *Mycoporum buckii* R.C. Harris: A. ascostromata on bark of *R. mangle*; B. longitudinal section of ascomata, showing the locules; C. locules; D. individual locule, E, F. asci; G, H. ascospores.

Figure 3: *Mycoporum buckii* R.C. Harris: A. locules in ascostromata; B. asci with ascospores; C. ascospores.

Mycoporum eschweileri is a species similar to *M. buckii* due to the characteristics of the ascostroma, the multilocular condition and the tropical distribution. However, the shape of the asci is different since in *M. eschweileri* they

have a pyriform shape, are 50-60 µm in length, and the ascospores are larger, 17-25 × 5-8 µm. *Mycoporum antecellens* (Nyl.) R.C. Harris is a species with spores similar in shape and septum, but larger in size (Table 1) (Nash et al., 2002).

Table 1: Comparison of *Mycoporum antecellens* (Nyl.) R.C. Harris, *Mycoporum buckii* R.C. Harris and *Mycoporum eschweileri* R.C. Harris.

	<i>M. antecellens</i> (Nyl.) R.C. Harris	<i>M. buckii</i> R.C. Harris	<i>M. eschweileri</i> (Müll) R.C. Harris
Ascostroma size (mm)	0.2-0.3	0.1-0.7	0.4-0.7
Locule size (µm)	Not specified	50-65 (73) × 40-60	Not specified
Asci size (µm)	60-70 × 18-22	35-40 × 7-9 (-12)	50-60 × 15-20
Asci form	Pyriform	Obclavate	Pyriform
Ascospore size (µm)	25-30 × 6-9	(10) 10.5-12 × 2.5-3.5 (5)	17-25 × 5-8
Number of ascospores septa	1-3	1	1
Distribution	Wide distribution	Dominican Republic, Mexico, USA	Pantropical

Author contributions

YG, RV, GH and TR conceived and designed the study. YG and TR made the collections. All authors wrote the manuscript and contributed to the discussion, review, and approval of the final manuscript.

Funding

This study was supported by the Consejo Nacional de Ciencia y Tecnología project 252934 and by the Instituto Politécnico Nacional (IPN) through the Secretaría de Investigación y Posgrado (SIP), projects 20200248, 20200956, 20210315 and 20200956.

Acknowledgments

All authors thank the Fundacion de Parques y Museos de Cozumel for the facilities to carry out this study and to Manuel Escamilla for generating the drawing of this paper.

Literatura citada

Aptroot, A. 2002. *Mycoporum*. In: Nash, T. H. III, B. D. Ryan, C. Gries and F. Bungartz (eds.). Lichen Flora of the Greater Sonoran Desert Region. Vol I. Lichens unlimited. Lichens unlimited, Arizona State University. Arizona, USA. Pp. 287-288.

Brodo, I. M., S. D. Sharnoff and S. Sharnoff. 2001. The Lichens of North America. Yale University Press. New Haven, USA. 828 pp.

CNALH. 2020. Consortium of North American Lichen Herbaria. National Science Foundation. Alexandria, USA. <https://lichenportal.org/cnalh/collections>. (consulted October, 2020).

Harris, R. C. 1995. More Florida lichens including the 10c tour of the pyrenolichens. Published by the author. The New York Botanical Garden. New York, USA. 192 pp.

Herrera-Campos, M. A., R. Miranda-González, R. Lücking, N. Sánchez-Téllez and A. Barcenás-Peña. 2017. Inventario y base de datos de los líquenes de la selva seca de Jalisco. Instituto de Biología, Universidad Nacional Autónoma de México; Informe final Sistema Nacional de Información sobre Biodiversidad en México-Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, proyecto No. JF157. Cd. Mx., México. Pp. 126-133.

Hodkinson, B. P. 2010. A first Assessment of Lichen Diversity for one of North America's Biodiversity hotspots in the Southern Appalachians of Virginia. *Castanea* 75(1): 126-133.

Hyde, K. D., E. B. G. Jones, J-K Lui, H. Ariyawansa, E. Boehm, S. Boonmee, U. Braun, P. Chomnunti, P. W. Crous, D.-Q. Dai, P. Diederich, A. Dissanayake, M. Doilom, F. Doveri, S. Hongsan, R. Jayawardena, J. D. Lawrey, Y.-M. Li, Y.-X. Liu, R. Lücking, J. Monkai, L. Muggia, P. M. Nelsen, K.-L. Pang, R. Phookamsak, I. C. Senanayake, C. A. Shearer, S. Suetrong, K. Tanaka, K. M. Thambugala, N. N. Wijayawardene, S. Wikee, H. X. Wu, Y. Zhang, B. Aguirre-Hudson, S. A. Alias, A.

- Aptroot, A. Bahkali, J. L. Bezerra, D. J. Bhat, E. Camporesi, E. Chukeatirote, C. Gueidan, D. L. Hawksworth, K. Hirayama, S. De Hoog, J. C. Kang, K. Knudsen, W. J. Li, X.-H. Li, Z. Y. Liu, A. Mapook, E. H. C. McKenzie, A. N. Miller, P. E. Mortimer, A. J. L. Phillips, H. A. Raja, C. Scheuer, F. Schumm, J. E. Taylor, Q. Tian, S. Tibpromma, D. N. Wanasinghe, Y. Wang, J. C. Xu, S. Yacharoen, J. Y. Yan and M. Zhang. 2013. Families of Dothideomycetes. *Fungal Diversity* 63: 1-313. DOI: <https://doi.org/10.1007/s13225-013-0263-4>
- Imshaug, H. A. 1956. Catalogue of central American lichens. *The Bryologist* 53(2): 69-14. DOI: <https://doi.org/10.1007/s13225-013-0263-4>
- Index Fungorum. 2020. Index Fungorum base de datos. <http://www.indexfungorum.org/names/Names.asp> (consulted September, 2020).
- INEGI. 2013. Conociendo Quintana Roo. México. Instituto Nacional de Estadística y Geografía. Cd. Mx., México. http://internet.contenidos.inegi.org.mx/contenidos/productos/prod_serv/contenidos/espanol/bvinegi/productos/estudios/conociendo/QUINTANA_ROO.pdf (consulted January, 2021).
- Lendemer, J. and R. C. Harris. 2014. Studies in Lichens and Lichenicolous Fungi-No. 18: Resolution of three names Introduced by Degelius and Magnusson Based on Material from the Great Smoky Mountains. *Castanea* 79(2): 106-117.
- Mercado-Díaz, J. A. 2009. Preliminary checklist of lichens and lichenicolous fungi of Puerto Rico (Version 1, July 2009). Published by the author. San Juan, Puerto Rico. 54 pp.
- Nash, T. H. III, B. D. Ryan, C. Gries and F. Bungartz (eds.). 2002. Lichen Flora of the Greater Sonoran Desert Region. Vol. 1. Lichen Unlimited. Arizona State University. Arizona, USA. 532 pp.
- Téllez-Valdez, O., E. Cabrera-Cano, E. Linares and R. Bye. 1989. Las plantas de Cozumel. (Guía botánico-turística de la Isla Cozumel) Quintana Roo, México. Instituto de Biología, Universidad Nacional Autónoma de México. Cd. Mx., Mexico. 75 pp.
- Thiyagaraja, V., R. Lucking, D. Ertz, D. N. Wanasingue, S. N. Karunarathna, E. Camporesi and K. D. Hyde. 2020. Evolution of non-lichenized, saprotrophic species of *Arthonia* (Ascomycota, Arthoniales) and resurrection of *Naevia*, with notes on *Mycoporum*. *Fungal Diversity* 102: 205-224. DOI: <https://doi.org/10.1007/s13225-020-00451-9>