Research article

Acta Botanica Mexicana

Hymenochaete liliae (Agaricomycetes, Fungi), a new species from the state of Oaxaca, Mexico

Hymenochaete liliae (Agaricomycetes, Fungi), una nueva especie del estado de Oaxaca, México

Magdalena Contreras-Pacheco[1,2], Tania Raymundo[2], Leticia Pacheco[3], Silvia Bautista-Hernández[2], Ricardo Valenzuela[2,4]

Abstract:

Background and Aims: *Hymenochaete* is the genus with the highest number of species of the family Hymenochaetaceae in Mexico; 25 species have been described. It is characterized by its mainly resupinate basidiome, although it may be pileate and stipitate, of brown colors, with presence of setae and xanthocroid reaction. The objective of this study is to describe a new species of *Hymenochaete*.

Methods: The fresh material was studied and described macro and micromorphologically, using a stereoscopic and optical microscope, taking photos *in situ*. Vouchers of the herbaria ENCB y FCME were studied, and specialized literature was reviewed for its description.

Key results: *Hymenochaete liliae* sp. nov. is characterized by a resupinate, adnate, fleshy basidiome, smooth hymenophore, with numerous setae, determinate margin, abrupt, with monomitic hyphal system, simple septae; abundant subfusiform setae in the hymenium, 69-80 × 6-8 µm, acute, with crystals; and ellipsoid basidiospores, thin-walled, 5-8 × 2-3 µm. Although it resembles *H. rhabarbarina*, it can be differentiated by setae covered with crystals and spores of 4.8-6 × 2.3-3.3 µm. It could also be confused with *H. minuscula* due to its basidiome color; however, the setae are smaller (40-60 µm), as well as the basidia (15-20 µm). It can be separated from *H. cinnamomea* because it does not present a stratose basidiome; setae with crystals, 69-80 × 6-8 µm; basidiospores 5-8 × 2-3 µm, ellipsoidal.

Conclusions: *Hymenochaete liliae* is proposed as a new species, which is distributed in the tropical dry forest of the state of Oaxaca, and until now only reported from the type locality.

Key words: Fabaceae, Hymenochaetales, Isthmus of Tehuantepec, tropical dry forest.

Resumen:

Antecedentes y Objetivos: *Hymenochaete* es el género con el mayor número de especies de la familia Hymenochaetaceae en México, teniendo registradas 25 especies. Se caracteriza por su basidioma principalmente resupinado, aunque puede ser pileado o estipitado, de colores pardos, con presencia de setas y reacción xantocroide. El presente estudio tiene por objetivo describir una nueva especie de *Hymenochaete*.

Métodos: Los materiales estudiados en fresco se describieron macro y micro morfológicamente usando microscopio estereoscópico y óptico, y tomando fotos *in situ*. Se revisaron ejemplares de los herbarios ENCB y FCME, así como literatura especializada para su descripción.

Resultados clave: *Hymenochaete liliae* sp. nov. se caracteriza por el basidioma resupinado, adnato, carnoso, himenóforo liso, con numerosas setas, margen determinado, abrupto, con sistema hifal monomítico, septos simples; setas subfusiformes, abundantes en el himenio, 69-80 × 6-8 µm, agudas, con cristales y basidiosporas elipsoides, de paredes delgadas, 5-8 × 2-3 µm. Aunque se asemeja a *H. rhabarbarina*, se diferencia por presentar setas cubiertas con cristales y esporas de 4.8-6 × 2.3-3.3 µm. También se podría confundir con *H. minuscula* por su color del basidioma; sin embargo, las setas son de menor tamaño (40-60 µm), así como los basidios (15-20 µm). Se separa de *H. cinnamomea* por no presentar un basidioma estratoso, setas con cristales, de 69-80 × 6-8 µm, basidiosporas de 5-8 × 2-3 µm, elipsoidales.

Conclusiones: Se propone *Hymenochaete liliae* como una especie nueva, que se distribuye en el bosque tropical del estado de Oaxaca, y hasta la fecha solo reportada de la localidad tipo.

Palabras clave: Fabaceae, Hymenochaetales, Istmo de Tehuantepec, selva baja caducifolia.

[1]Universidad Autónoma Metropolitana-Iztapalapa, Departamento de Biología, Doctorado en Ciencias Biológicas y de la Salud, Av. San Rafael Atlixco 186, Col. Vicentina, 09340 Cd. Mx., Mexico.
[2]Instituto Politécnico Nacional, Escuela Nacional de Ciencias Biológicas, Departamento de Botánica, Laboratorio de Micología, 11340 Cd. Mx., Mexico.
[3]Universidad Autónoma Metropolitana-Iztapalapa, Departamento de Biología, Av. San Rafael Atlixco 186, Col. Vicentina, 09340 Cd. Mx., Mexico.
[4]Autor para la correspondencia: rvalenzg@ipn.mx

Received: June 15, 2021.
Reviewed: August 11, 2021.
Accepted by Marie-Stéphanie Samain: October 5, 2021.
Published Online first: October 26, 2021.
Published: Acta Botanica Mexicana 128 (2021).

To cite as: Contreras-Pacheco, M., T. Raymundo, L. Pacheco, S. Bautista-Hernández and R. Valenzuela. 2021. *Hymenochaete liliae* (Agaricomycetes, Fungi), a new species from the state of Oaxaca, Mexico. Acta Botanica Mexicana 128: e1907. DOI: https://doi.org/10.21829/abm128.2021.1907

e-ISSN: 2448-7589

Introduction

Among the Hymenochaetaceae, the genus *Hymenochaete* Lév. is the best represented in terms of its number of species. It has been described by Léveille in 1846, with the type species *Hymenochaete rubiginosa* (Dicks. Fr.) Lév., and belongs to the order Hymenochaetales, class Agarycomycetes of the phylum Basidiomycota. It is characterized by a smooth basidiome, ranging from stipitate to resupinate, with a monomytic hyphal system, numerous setae in the hymenium, and a xanthochroid reaction (Parmasto, 2001). The fungi of the genus *Hymenochaete* are xylophagous, since they feed on the wood of logs and/or fallen branches and obtain their energy from the decomposition of substrates such as cellulose, hemicellulose and/or lignin, a process known as wood rot. Its representatives are mainly distributed in tropical areas, but have also been found in temperate zones parasitizing young willow plants, and on cocoa, cotton, rubber tree, breadfruit, and camphor tree in tropical regions; causing death in its hosts (Parmasto, 2001). Approximately 130 species have been described in the world (Léger, 1998), and 28 for North America (Parmasto, 2001). In Mexico, 24 species have been cited (Table 1). The present study is aimed at describing *Hymenochaete liliae* as a new species. Its morphological description, distribution as well as habitat are presented. Moreover, a taxonomic key of the species that exist in Mexico is included.

Materials and Methods

Specimens of the new species were collected on the Cerro Negro, Santiago Laollaga municipality, in the southeast of the state of Oaxaca, Mexico (Fig. 1), specifically in the region of the Isthmus of Tehuantepec. The municipality is located at an average altitude ranging around 110 m a.s.l. In this area, the vegetation is characterized by tropical dry forest (Rzedowski, 1978). In this type of ecosystem there is an arboreal stratum with extended crowns, with an average height of 7 to 8 m, for example *Conzattia multiflora* (Robinson) Standl., *Pithecellobium dulce* (Roxb.) Benth., *Enterolobium cyclocarpum* (Jacq.) Griseb., *Ficus petiolaris* Kunth and species of *Bursera* Jacq. ex L. The shrub stratum has an altitude that varies from 3 to 6 m; characteristic taxa are *Acacia* Mill., *Cordia* (P. Browne) G. Don., *Croton* L., *Malpighia* L., *Manihot* L., *Liabum glabrum* Hemsl., *Salvia sessei* Benth. and *Dioon edule* Lindl. Columnar and candelabriform cacti can also be found, such as *Pachycereus* (A. Berger) Britton & Rose, *Stenocereus* (J.G. Ortega) Buxb., *Cephalocereus* Pfeiff., and *Opuntia* Mill. (Trejo, 1999). The herbaceous stratum depends on the shadow cast by the canopy; examples are *Bromelia* L., *Begonia heracleifolia* Schltdl. & Cham., *Callisia fragrans* (Lindl.) Woodson and *Dorstenia contrajerva* L.

The following specialized literature on the genus *Hymenochaete* was reviewed: Reeves and Welden (1967), Léger (1998), Parmasto (1985; 2001), Dai (2010), Wagner and Fisher (2002), He (2010); He and Li (2011a, b, c; 2012), He and Dai (2012), Parmasto et al. (2014), Nie et al. (2017) and Contreras-Pacheco et al. (2018). Additionally, specimens from the herbaria FCME of the Facultad de Ciencias, Universidad Nacional Autónoma de México, and ENCB, Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional, were studied.

A morphological study was carried out following the protocol of Léger (1998) and Parmasto (2001), which was based on the fresh material collected by the authors. Organoleptic characters were recorded as well as basidiome colors coded from the Munsell soil color chart (Munsell Color, 2010). Photographs were taken with a Nikon D7000 camera (Nikon, Tochigi and Miyagi, Japan).

The different layers of the basidiome, length, width, shape and color of setae, hyphae, and basidiospores were observed using a Carl Zeiss model K-7 microscope (Mexico City, Mexico). Very thin cross sections of the basidiome were sectioned by hand using a commercial double-edged razor. The sections were mounted in preparations with 70% alcohol and 5% KOH for rehydration, and examined under the microscope with 10, 40 and 100 × objectives. Photographs of the microscopic features were taken with a Nikon Colpix 4300 camera (Nikon, Tochigi and Miyagi, Japan).

Finally, we here present a dichotomous key of the Mexican *Hymenochaete* species modified from Parmasto (2001), based on macroscopic and microscopic characters (presence/absence of the different layers that constitute the basidiome, shape and size of the mushrooms, spores, etc.).

Table 1: *Hymenochaete* Lév. species cited for Mexico.

Taxa cited for Mexico	Reference	State
Hymenochaete allantospora Parmasto	Parmasto, 2001	Veracruz
Hymenochaete americana Gresl. & Parmasto	Reeves and Welden, 1967; Montaño et al., 2006; Raymundo et al., 2009; 2013	Sonora
Hymenochaete carpatica Pilát	Reeves and Welden, 1967; Montaño et al., 2006; Raymundo et al., 2009; 2013	Sonora
Hymenchaete cervina Berk. & M.A. Curtis	Parmasto, 2001	Veracruz
Hymenochaete cifuentesii Contr.-Pach., R. Valenz., Raymundo & Pacheco	Contreras-Pacheco et al., 2018	San Luis Potosí
Hymenochaete cinnamomea (Pers.) Bres.	Montaño et al., 2006; Raymundo et al., 2012	Chiapas, Durango, Guerrero, Sonora
Hymenochaete curtisii (Berk.) Morgan	Parmasto, 2001	Baja California Sur
Hymenochaete damicornis (Link) Lév.	Bandala-Muñoz et al., 1987; Vázquez and Valenzuela, 2010	Chihuahua, Estado de México, Oaxaca, Puebla, Veracruz
Hymenochaete digitata Burt	Pérez-Ramírez, 2002	Guerrero, Querétaro, Tamaulipas
Hymenochaete escobarii J.C. Léger	Reeves and Welden, 1967; Montaño et al., 2006; Raymundo et al., 2009, 2013	Sonora
Hymenochaete episphaeria (Schwein.ex Fr.) Massee	Parmasto, 2001	Veracruz
Hymenochaete fulva Burt	Parmasto, 2001	Veracruz
Hymenochaete leonina Berk. & M.A.Curtis	Parmasto, 2001	Oaxaca
Hymenochaete luteobadia (Fr.) Höhn. & Litsch.	Parmasto, 2001	Veracruz
Hymenochaete odontoides S.H. He & Y.C. Dai	Valenzuela and Nava, 1996; Álvarez et al., 2016	San Luis Potosí, Baja California Sur, Coahuila, Ciudad de México, Durango, Estado de México, Hidalgo, Michoacán, Querétaro, Tamaulipas
Hymenochaete opaca Burt	Reeves and Welden, 1967; Montaño et al., 2006; Raymundo et al., 2009, 2013	Sonora
Hymenochaete pinnatifida Burt	García-Romero et al., 1970	Nuevo León
Hymenochaete potosina Contr.-Pach., R. Valenz., Raymundo & Pacheco,	Contreras-Pacheco et al., 2018	San Luis Potosí
Hymenochaete raduloides Contr.-Pach., R. Valenz., Raymundo & Pacheco	Contreras-Pacheco et al., 2018	San Luis Potosí
Hymenochaete rhabarbarina (Berk.) Cooke	Reeves and Welden, 1967; Montaño et al., 2006; Raymundo et al., 2009, 2013	Sonora
Hymenochaete resupinata (Sw.) Parmasto	Valenzuela y Nava, 1996	Chiapas
Hymenochaete rheicolor (Mont.) Lév.	García-Romero et al., 1970	Chiapas, Estado de México, Oaxaca, Veracruz
Hymenochaete rubiginosa (Dicks.) Lév.	Raymundo et al., 2012	Durango
Hymenochaete unicolor Berk. & M.A. Curtis	Pérez-Ramírez, 2002	Estado de México

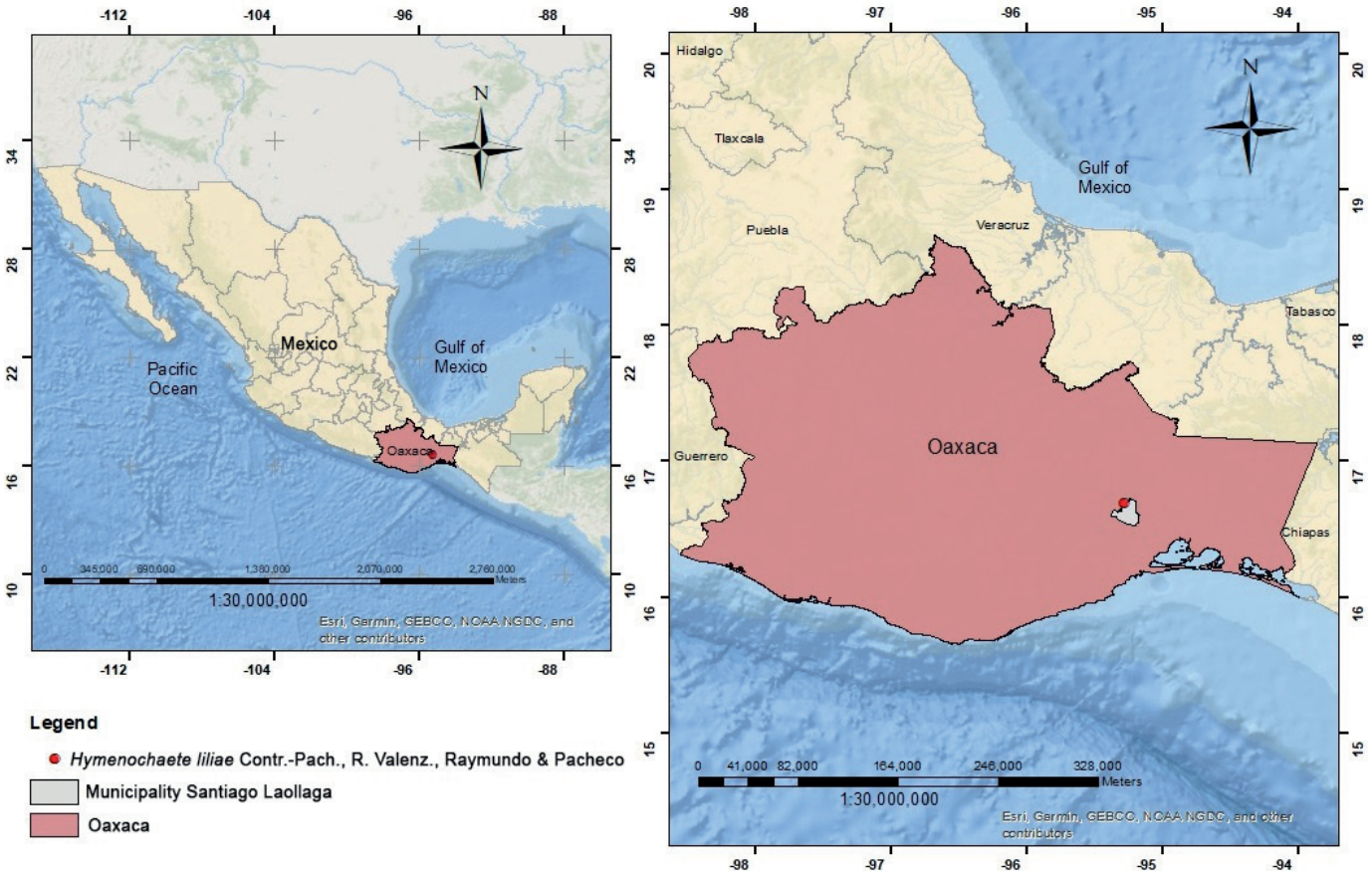

Figure 1: Type locality of *Hymenochaete liliae* Contr.-Pach., R. Valenz., Raymundo & Pacheco in the Istmo region, Tehuantepec district (southeast of the state), municipality Santiago Laollaga, Oaxaca, Mexico.

Results

Hymenochaete liliae Contr.-Pach., R. Valenz., Raymundo & Pacheco, sp. nov. Fig. 2.

TYPE: MEXICO. Oaxaca, Istmo region, Tehuantepec district (southeast of the state), municipality Santiago Laollaga, Cerro Negro, 110 m, 16°41'41.3''N, 95°17'26.1''W, tropical dry forest, 25.X.2014, *M. M. Contreras-Pacheco 001* (holotype: ENCB!). Mycobank: 840975**.**

Hymenochaete liliae differs from H. cinnamomea (Pers.) Bres. because the former has acute setae, with crystals, abundant throughout the hymenium; ellipsoid basidiospores, while the latter presents acute setae, without crystals, arranged in the different layers of the basidiome, and cylindrical basidiospores.

Basidiomata 23-46 × 9-12 mm, resupinate, adhered to the substrate, consistency membranous-fleshy, growing in circles that are fused; hymenophore smooth, color suede (10YR 6/6); margin determined, concolor with the hymenophore; without tomentum or cortex; hymenium 25-30 µm wide, subiculum 50-70 µm wide, with crystals; hyphal system monomitic, subhymenal hyphae 2.5-3 µm diameter, yellowish, continuous, septa simple; hyphae of the subiculum (together with the substrate) 5-6 µm diameter long, wall wide, 1 µm wide, brown, septa simple; setae 69-80 × 6-8 µm, thick-walled, covered with crystals, apex acute, 50 µm long, protruding from the hymenium, brown, abundant; basidia 24-26 × 3-5 µm, cylindrical, torulous, tetrasporic, sterigma 3-4 µm; basidiospores 5-8 × 2-3 µm, ellipsoid, thin-walled, smooth, hyaline.

Habitat: lignicolous, found growing on woody remains of a leguminous tree.

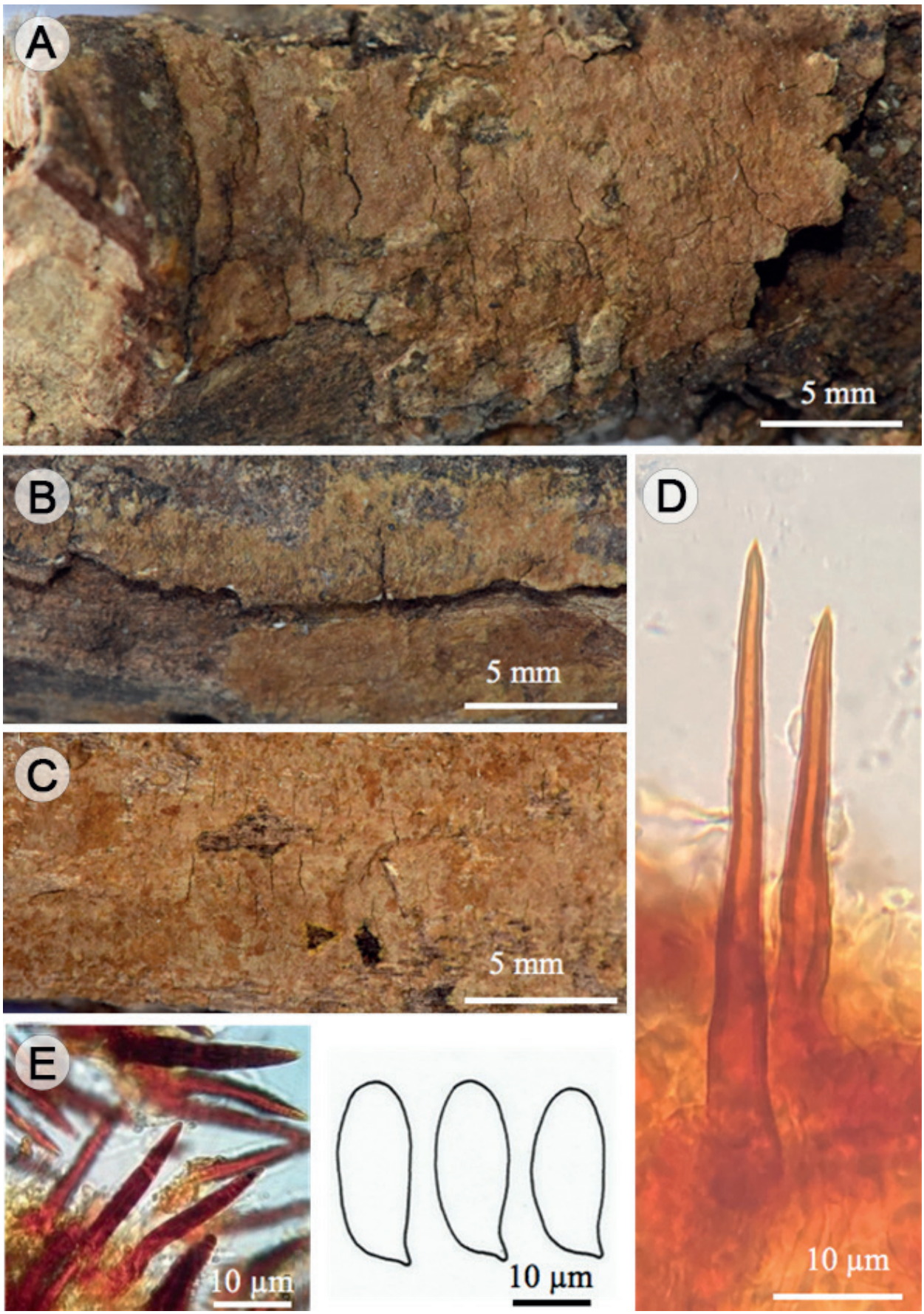

Figure 2: *Hymenochaete liliae* Contr.-Pach., R. Valenz., Raymundo & Pacheco. A. setae; B. spore; C-D. basidiome.

Etymology: the name of this species is dedicated to the biologist Lilia Pérez-Ramírez, a pioneer in the study of corticioid fungi in Mexico.

Additional material studied: MEXICO. Oaxaca, Istmo region, Tehuantepec district (southeast of the state), municipality Santiago Laollaga, Cerro Negro, 110 m, 16°41'41.3''N, 95°17'26.1''W, tropical dry forest, 26.X.2014, *M. M. Contreras-Pacheco 002* (ENCB, paratype).

We here present an identification key for all known species of the genus *Hymenochaete* in Mexico.

Taxonomic key for *Hymenochaete* species in Mexico

1a. Hymenophore hydnoid or odontoid 2
1b. Hymenophore smooth or with scattered tubercules .. 3
2a. Tomentum absent, cortex absent, with round to flattened teeth, margin determinate, abrupt, fibrilose, with setae, sometimes lighter coloured, yellowish (7.5Y 9/4, 5A4) ..... *Hymenochaete raduloides* Contr.-Pach., R. Valenz., Raymundo & Pacheco
2b. Tomentum present 4
3a. Basidiome pileate, effused-reflexed or umbonate 5
3b. Basidiome effused, margins sometimes slightly elevated 6
4a. Tomentum present, cortex present as dark line, setae rare, 25-55 × 5-9 µm .... *Hymenochaete odontoides* S.H. He & Y.C. Dai
4b. Tomentum present, cortex present, with numerous dichohyphae, setae numerous, 90-160(240) × 7.2-12 µm ..... *Hymenochaete resupinata* (Sw.) Parmasto
5a. Basidiome pileate, with a stipe, sometimes branched, usually growing near tree ....*Hymenochaete damicornis* (Link) Lév
5b. Basidiome pileate, without a stipe 8
6a. Accessory elements present 7
6b. Accessory elements absent 13
7a. Dendrohyphidia with thickened walls, without tomentum, with cortex and hyphal layer, sometime stratose, alternating hyphal and setal layer .....*Hymenochaete pinnatifida* Burt
7b. Pseudoacanthophyses numerous, with tomentum, with cortex and hyphal layer; presenting two types of setae (some small and others large) .... *Hymenochaete digitata* Burt
8a. Pileus flexible, hyphal layer well-developed, loosely arranged, spores cylindrical, slightly curved, 1.5-2.5 µm broad 9
8b. Pileus coriaceous, hyphal layer generally absent, when present densely arranged, spores cylindrical or ellipsoid, 1.2-4.8 µm broad 10
9a. Basidiome effused-reflexed, setae rare, in sterile hymenium hyphidia with coiled tips, spores 5.5-8.3 µm long ..... *Hymenochaete curtisii* (Berk.) Morgan
9b. Basidiome sessile-pileate or sessile-umbonate, setae rare or numerous, hyphidia absent, spores 4.5-7 µm long ..... *Hymenochaete rheicolor* (Mont.) Lév.
10a. Setae 4-8 µm diameter 11
10b. Setae 7-15 µm diameter 12
11a. Dendrohyphidia present, setal layer stratose, cystidia absent; setae (25)35-80(100) × (4)5-8(9) µm; spores ellipsoid, 5-6.5 × 3.5-4.5 µm .... *Hymenochaete escobarii* J.C. Léger
11b. Dendrohyphidia absent, setal layer monostratose, hyphidia numerous, with encrusted thickened walls, setae (25)40-60 × 5-8 µm; spores oblong-ellipsoid 4-5(5.5) × 1.8-2.5 µm .... *Hymenochaete luteobadia* (Fr.) Höhn. & Litsch
12a. Basidiome woody, pileal surface velutinous, setae 40-80(100) × 8-10(12) µm, spores ellipsoid with one side flattened, 4-5.5 × 2-2.8 µm .... *Hymenochaete rubiginosa* (Dicks.) Lév.
12b. Basidiome coriaceous, pileal surface hirsute, setae 80-150 × 10-15 µm, spores allantoid, 8.5-11 × 2-2.7 µm ..... *Hymenochaete allantospora* Parmasto
13a. Hyphal layer present (sometime thin) 14
13b. Hyphal layer absent 20
14a. Hyphal layer duplex, basidiome with dark line dividing into two parts .... *Hymenochaete leonina* Berk. & M.A. Curtis
14b. Hyphal layer simple, basidiome of different colors .. 15
15a. Cortex present 16
15b. Cortex absent 17
16a. Setae incrusted, 70-100 × 8-12 µm, spores cylindrical or sigmoid, 7.5-9 × 2.5-3 µm .... *Hymenochaete americana* Gresl. & Parmasto

16b. Setae not incrusted, 70-90 × 7-9 µm, spores ellipsoid, 5-6 × 3-4 µm ..... *Hymenochaete fulva* Burt

17a. Setae rare, spores 5.6 × 2.4 µm, basidiome dark orange (5YR6/8; 6A8) ..... *Hymenochaete potosina* Contr.-Pach., R. Valenz., Raymundo & Pacheco

17b. Setae numerous 18

18a. Setae acicular, numerous, abundant across subiculum, 52-68 × 6-10 µm, completely encrusted whit crystals, spores ellipsoid, 5.4-7.6 × 4 µm ..... *Hymenochaete cifuentesii* Contr.-Pach., R. Valenz., Raymundo & Pacheco

18b. Setae not acicular 19

19a. Setae without crystals, 55-120 × 5-9 µm, basidiome stratose, setal layers 2-10, spores cylindrical or ellipsoid, 4.5-6.5 × 2-3 µm ..... *Hymenochaete cinnamomea* (Pers.) Bres.

19b. Setae with crystals, 69-80 × 6-8 µm, basidiome not stratose; one setal layer; spores ellipsoid, 5-8 × 2-3 µm ..... *Hymenochaete liliae* Contr.-Pach., R. Valenz., Raymundo & Pacheco

20a. Setae more than 8 µm wide 21

20b. Setae less than 8 µm wide 23

21a. Setae with obtuse tip, with crystals, 60-90 × 8-11(14) µm, hyphidia absent, cortex 30-40 µm wide, basidiome yellowish brown (7.5 YR5.5,5-6/6) ..... *Hymenochaete episphaeria* (Schwein. ex Fr.) Massee

21b. Setae with acute tip 22

22a. Setae with apex with crystals, 70-85(100) × 8-10(12) µm, cystidia of the type hyphidia present or absent, hymenial surface smooth, spores ellipsoid, 5-7.5 × 3.5-4 µm ..... *Hymenochaete cervina* Berk. & M.A. Curtis

22b. Setae with apex without crystals, (60)70-90 × 8-11 µm, cystidia of the type basidioles present, hymenial surface velutinous, spores cylindrical to subalantoid, 5-7.5 × 3.5-4 µm ..... *Hymenochaete opaca* Burt

23a. Setae not encrusted 24

23b. Setae encrusted, 60-105 × 5-8 µm, spores ovoid to elliptical, 4.5-5 × 2.5-3.5 µm ..... *Hymenochaete rhabarbarina* (Berk.) Cooke

24a. Spores 5.5-6.5 × 3-3.5 µm; setae 50-90 × 6-10 µm, only distributed in the hymenium ..... *Hymenochaete carpatica* Pilát

24b. Spores 4.5-5.5 × 3-3.5 µm; setae 30-60 × 5-7 µm, distributed in the different layers of the basidiome ..... *Hymenochaete unicolor* Berk. & M.A. Curtis

Discussion

Hymenochaete liliae belongs to *Hymenochaete* section *Fultochaete* Esc. ex Léger, because it lacks cortex. It is characterized by its suede color, thin setae, 69-80 × 6-8 µm, basidiospores 5-8 × 2-3 µm. It can be differentiated from *H. cinnamomea* (Pers.) Bres. because it does not present a basidiome with setae in different layers, and has ellipsoid basidiospores. Although it resembles *H. rhabarbarina* (Berk.) Cooke, it differs from the latter species because of its setae covered with crystals, and its spores measuring 4.5-5 × 2.5-3.5 µm. The old specimens of *H. rhabarbarina* have setae arranged in 2-3 obscure layers, and incrustation setae have reddish brown granules (Parmasto, 2001). Furthermore, it could be confused with *H. minuscula* G.H. Cunningham due to its mustard color; however, the setae (40-60 µm) and basidia (15-20 µm) are smaller, and *H. minuscula* has not been reported for Mexico (Dai, 2010).

Author contributions

MCP, RV, and TR conceived and designed the study. MCP carried out the collections and determination of the species. MCP, RV, TR, LP, and SBH contributed to the acquisition of important data for the work. The photos of the figures were taken by MCP and TR. RV, TR, SBH, and LP wrote the manuscript with the help of MCP. All authors contributed to the discussion, review, and approval of the final manuscript.

Funding

This study was supported by the Instituto Politécnico Nacional (IPN) through the Secretaria de Investigación y Posgrado (SIP): 20210315 and 20210661 and by Consejo Nacional de Ciencia y Tecnología (CONACYT) in the project 252934. RV and TR thank to the Sistema Nacional de Investigadores (SNI), to the Comisión de Operación y Fomento a las Actividades Académicas (COFAA), IPN, and to the Secretaría de Investigación y Posgrado, IPN for the grants to carry out their investigations.

Acknowledgements

We thank the authorities of the Escuela Nacional de Ciencias Biológicas (ENCB) of the Instituto Politécnico Nacional for the facilities granted to carry out this study and the herbarium of the Facultad de Ciencias for allowing the consultation of their material. We thank Jessica Gómora Cercas for preparing the map.

Literature cited

Álvarez, I., T. Raymundo and R. Valenzuela. 2016. Los hongos poliporoides de la Huasteca Potosina, San Luis Potosí, México. Polibotánica 41: 31-48. DOI: http://doi.org/10.18387/polibotanica.41.2

Bandala-Muñoz, V. M., L. Montoya-Bello y G. Guzmán. 1987. Nuevos registros de hongos del estado de Veracruz, III. Descripción de algunos Ascomycetes y Aphyllophorales. Revista Mexicana de Micología 3: 51-69.

Contreras-Pacheco, M., R. Valenzuela, T. Raymundo and L. Pacheco. 2018. *Hymenochaete cifuentesii*, *H. potosina* and *H. raduloides* spp. nov. from the tropical dry forest of Mexico. Mycotaxon 133(3): 499-512. DOI: https://doi.org/10.5248/133.499

Dai, Y. C. 2010. Hymenochaetaceae (Basidiomycota) in China. Fungal Diversity 45: 131-343. DOI: https://doi.org/10.1007/s13225-010-0066-9

García-Romero, L., G. Guzmán and T. Herrera. 1970. Especies de macromicetos citados de México, I. Ascomycetes, Tremellales y Aphyllophorales. Boletín de la Sociedad Mexicana de Micología 4: 54-76.

He, S. H. 2010. *Hymenochaete* (Hymenochaetales) in Hainan. Mycosystema 29(10): 819-823.

He, S. H. and Y. C. Dai. 2012. Taxonomy and phylogeny of *Hymenochaete* and allied genera of Hymenochaetaceae (Basidiomycota) in China. Fungal Diversity 56:77-93. DOI: https://doi.org/10.1007/s13225-012-0174-9

He, S. H. and H. J. Li. 2011a. *Hymenochaete rhododendricola* and *H. quercicola* spp. nov. (Basidiomycota, Hymenochaetales) from Tibet, southwestern China. Nordic Journal of Botany 29(4): 484-487. DOI: https://doi.org/10.1111/j.1756-1051.2011.01217.x

He, S. H. and H. J. Li. 2011b. Two new species of *Hymenochaete* (Hymenochaetales) from China. Mycotaxon 115: 375-382. DOI: https://doi.org/10.5248/115.375

He, S. H. and H. J. Li. 2011c. Three species of *Hymenochaete* (Hymenochaetales) new to China. Mycosystema 30(4): 644-648.

He, S. H. and H. J. Li. 2012. *Hymenochaete* in China 1. Three species new to China from Guandong and Anhui provinces. Mycosystema 31(1): 50-54.

Léger, J. 1998. Le genre *Hymenochaete* Léveillé. Bibliotheca Mycologica 171: 1-319.

Montaño, A., R. Valenzuela, A. Sánchez, M. Coronado and M. Esqueda. 2006. Aphyllophorales de Sonora, México, I. Algunas especies de la Reserva Forestal Nacional y Refugio de Fauna Silvestre Ajos-Bavispe. Revista Mexicana de Micología 23: 17-26.

Munsell Color. 2010. Munsell soil color charts: with genuine Munsell color chips. Munsell Color Company. Baltimore, USA.

Nie, T., Y. Tian, S. L. Liu, J. Yang and S. H. He. 2017. Species of *Hymenochaete* (Hymenochaetales, Basidiomycota) on bamboos from East Asia, with descriptions of two new species. Mycokeys 20: 51-65. DOI: https://doi.org/10.3897/mycokeys.20.11754

Parmasto, E. 1985. The species concept in Hymenochaetaceae (Fungi, Hymenomycetes). Process Indian Academic Science (Plant Science) 94: 369-380.

Parmasto, E. 2001. Hymenochaetoid fungi (Basidiomycota) of North America. Mycotaxon 79: 107-176.

Parmasto, E., I. Saar, E. Larsson and S. Rummo. 2014. Phylogenetic taxonomy of *Hymenochaete* and related genera (Hymenochaetales). Mycological Progress 13(1): 55-64. DOI: https://doi.org/10.1007/s11557-013-089-9

Pérez-Ramírez, L. 2002. Estudio taxonómico de algunos hongos corticioides (Aphyllophorales, Basidiomycetes) en México. Tesis de Licenciatura. Facultad de Ciencias. Universidad Nacional Autónoma de México. Cd. Mx., México. 57 pp.

Raymundo, T., R. Valenzuela and M. Esqueda-Valle. 2009. The family Hymenochaetaceae from México 4: New records from Sierra de Álamos-Río Cuchujaqui biosphere reserve. Mycotaxon 110: 387-398. DOI: https://doi.org/10.5248/110.387

Raymundo, T., R. Valenzuela, R. Díaz-Moreno, J. Cifuentes and L. Pacheco. 2012. La familia Hymenochaetaceae en México V. Especies del bosque Las Bayas, Durango. Boletín de la Sociedad Micológica de Madrid 36: 37-51.

Raymundo, T., R. Valenzuela, A. Gutiérrez, M. Coronado and M. Esqueda. 2013. Agaricomycetes xilófagos de la planicie cen-

tral del desierto Sonorense. Revista Mexicana de Biodiversidad 84: 417-424. DOI: https://doi.org/10.7550/rmb.31604

Reeves, F. and A. L. Welden. 1967. West Indian Species of *Hymenochaete*. Mycologia 59(6): 1034-1049. DOI: https://doi.org/10.2307/3757273

Rzedowski, J. 1978. Vegetación de México. Limusa. México, D.F., México. 432 pp.

Trejo, I. 1999. El clima de la selva baja caducifolia en México. Investigaciones Geográficas 39: 40-52.

Valenzuela, R. and R. Nava, 1996. La familia Hymenochaetaceae en México I. El género *Hydnochaete* Bres. Polibotánica 1: 7-15.

Vázquez, S. and R. Valenzuela. 2010. Macromicetos de la Sierra Norte del Estado de Puebla, México. Naturaleza y Desarrollo 8(1): 43-57.

Wagner, T. and M. Fischer. 2002. Classification and phylogenetic relationships of *Hymenochaete* and allied genera of the Hymenochaetales, inferred from rDNA sequence data and nuclear behaviour of vegetative mycelium. Mycological Progress 1(1): 93-104. DOI: https://doi.org/10.1007/s11557-006-0008-9