



Ascomycetes from the relic forest of *Oreomunnea mexicana*, Oaxaca, Mexico

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Abstract

La Esperanza is an Oaxacan relic area of the Tertiary, dominated by the big tree *Oreomunnea mexicana* (Juglandaceae). The forest is part of the priority region for the conservation of La Chinantla and constitutes one of the most conserved Mexican tropical montane cloud forests. We studied the Ascomycetes fungi and found 63 species, of which 32 are new records for Oaxaca. *Ascocoryne inflata*, *Calyculosphaeria macrospora*, *Cercophora costaricensis*, *Chaetosphaeria ellisii*, *Coccomyces limitatus*, *Lasiosphaeria ovina*, *Leptogidium dendriscum*, *Marthamyces quadrididus*, *Stereocaulon didymicum* and *Thelonectria lucida* are new records for Mexico. *Xylaria* was the most diverse genus with 12 species. The most abundant species were *Xylaria arbuscula* and *Lachnum apalum*. The main growth habit was lignicolous. The tropical montane cloud forest of La Esperanza has unique characteristics allowing great taxonomic diversity of Ascomycetes.

Keywords: conservation, endemism, fungi, mountains, tropical montane cloud forests

Introduction

Phylum Ascomycota is the largest group within the Fungi kingdom. Kirk *et al.* (2008) mentioned that there are 64,163 species worldwide, while for Mexico, González & Hanlin (2008) presented a compilation of 1331 species, of which 35% are lichenized fungi. One of the most diverse habitats is the tropical montane cloud forest (TMCF) for its great diversity of plants, animals, and fungi concentrated in a small area (Toledo-Aceves *et al.* 2011, Calderón-Aguilera *et al.* 2012). The distribution pattern of the TMCF in Mexico is discontinuous, analogous to an “island archipelago” of humid forests surrounded by other vegetation types (Luna-Vega *et al.* 1999, CONABIO 2010).

The tropical montane cloud forest in northern Oaxaca has *Oreomunnea mexicana* (Standl.) J.-F. Leroy as the absolute dominant element in the upper tree layer, with a 30–40 m height. This tree is considered a relic element of the Cenozoic. This association type is represented between 1400–2250 m, and it contains diverse plant associations formed by *Ilex* sp., *Clethra conzattiana* L.M. González, *Oreopanax* sp., *Clusia lundellii* Standl., *Symplocos jurgensenii* Hemsl., *Persea rufescens* Lundell, *P. albida* Kosterm., *P. chiapensis* Lundell, *Ternstroemia tepezapote* Schltld. & Cham., *Zanthoxylon melanostictum* Schltld. & Cham., *Ocotea effusa* (Meisn.) Mez, *O. sarcodes* Lorea-Hern., *O. betazensis* (Mez) H. van der Werf, *Hedyosmum mexicanum* C. Cordem., *Podocarpus matudae* Lundell, *Alchornea latifolia* Sw., and different genera of Lauraceae and Ericaceae. The tree fern *Cyathea fulva* (M. Martens & Galeotti) Fée is conspicuous. The *Oreomunnea* trees are densely covered by vascular and non-vascular epiphytes, and *Tillandsia*

grandis Schltdl. is evident. The principal member of the understory is the bambusiform *Yushania* sp., several species of Melastomataceae, *Alsophila salvinii* Hook. and *Ceratozamia*.

The humid slopes of northern Oaxaca are home to many vertebrates, several endemic to the state and restricted to the cloud forest. There is a great diversity of hylid frogs, many of them described from the area and considered as threatened by the IUCN Red List (Canseco-Márquez *et al.* 2017). Also, the presence of four big Felidae in this area has been confirmed, (Espinosa-Ramírez *et al.* 2017).

The TMCF of La Esperanza has high quality, connectivity, and richness of species. The forest of this subregion faces few threats because agriculture and livestock are limited by the steep topography of the area, and it is considered a high priority area and a reference for the conservation of TMCF in Mexico (CONABIO 2010). The absolute dominance of the tree *Oreomunnea mexicana* (Juglandaceae), a species that has survived for approximately 22 million years, is another element to consider in developing unique microclimates for ascomycete species. This study has the main objective of listing the ascomycetes present in the relic tropical montane cloud forest of *O. mexicana* in the Sierra Norte of Oaxaca, with notes about their habit and habitat and, where possible, to add comments about their association with other groups of organisms.

Study area

La Esperanza is in the municipality of Santiago Comaltepec, in the region of the Sierra Norte. It belongs to Ixtlán de Juárez district and is located at 17° 34 ' North latitude and 96° 33' West longitude, with an altitude of 2000 meters above sea level (Fig. 1). It has an area of 65.07 km² that represents 0.07% of the state's total area (INEGI 2001). The municipality is included in the physiographic province Mountainous System of Northern Oaxaca and has an abrupt topography, and most frequent slopes fluctuate between 40 and 60%. The hydrography in the region is unusual since, due to the shape of the terrain and composition of the limestone mother rock, the water currents are primarily temporary and predominate towards the formation of underground currents.

Soils in the area are derived from metamorphic rocks, deep, with a thick organic layer and pH of 3.4. The predominant type of soil is humic acrisol, which is characterized as supporting forests. They have clay accumulation, are very poor in nutrients, and are susceptible to erosion due to temperature and abundant rains. Humic cambisol is also represented (Secretaría de Finanzas de Oaxaca 2010).

Climate is temperate, corresponding to Cfbm and Cfm, with rain between 5000 and 6000 mm, frequent fog and dense mist, and atmospheric humidity near saturation point during most of the year. The annual average temperature is 18 °C.

Materials and methods

Collections were made from 2015 to 2018 in the localities of La Esperanza, San Bernardo, and El Relámpago, located approximately at km 79, 83 and 88, respectively, of the Tuxtepec-Oaxaca Road.

The sampling of ascomycetes was "free and unrestricted" (*sensu* Angulo *et al.* 2006), looking for fruiting bodies in decaying trunks and living trees, growing in leaves and organic matter in general. We characterized the collected specimens when fresh, mainly considering the shape, colour, size, consistency, and smell. Colour of the organisms was determined according to Kornerup & Wanscher (1981). Data were collected, such as date, location, vegetation type, host, habitat, and collector. Photographs of the specimens were taken on-site with Nikon S600, P510, and D7000 cameras to appreciate perishable characteristics better. To identify the specimens collected in the study area, we obtained longitudinal and transverse sections of the ascomata by freehand using a double-edged razor blade.

Temporary preparations were made in 70% alcohol and 5% KOH. Structures of taxonomic interest were observed using a microscope to determine shape, size, colour, and ornamentation of ascospores, asci, paraphyses and the morphology of the ectal and medular excipulum, among others. Specialized keys were used to identify the organisms, *e.g.*, Boehm *et al.* (2009), Breitenbach & Kränzlin (1984), Chacón (2005), Chaverri *et al.* (2011), Dennis (1981), Kanouse (1948, 1949), Mains (1954, 1955), Moreno & Manjón (2010), San Martín & Rogers (1989, 1993, 1996), San Martín *et al.* (1999) Seaver (1928), Sierra-López (2006) and Valenzuela (1990). Specimens were deposited in the fungi collection "Dr. Gastón Guzmán Huerta" from the Instituto Politécnico Nacional (ENCB). Species marked with ** are new records from Mexico; these species were described with macro- and micromorphological details. Species marked with * are recorded for the first time from Oaxaca.

TABLE 1. Classification of Ascomycota species registered. Habit: **S**=Saprotrophic; **E**=Endophytic; **L**=Lichenicolous; **P**=Phytopatogenous; **H**=Humicolous and **My**=Mycorrhizogenous. Habitat: **Ba**=bark; **W**=Wood; **Le**=Leaves; **Br**=Branches; **R**=Roots; **M**=Mosses; **S**=Soil; **Li**=Litter; **R**=Rocks; **Fu**=Fungi.

Class	Order	Family	Species	Habit	Habitat	
Dothideomycetes	Pleosporales	Melanommataceae	<i>Byssosphaeria schiedermayriana</i>	S	Br	
			<i>Herpotrichia macrotricha</i>	S	W	
		Incertae sedis	<i>Astrosphaeriella trochus</i>	S	W	
		Tubeufiales	Tubeufiaceae	<i>Tubeufia cerea</i>	S	W
Eurotiomycetes	Eurotiales	Aspergillaceae	<i>Trichocoma paradoxa</i>	S	W	
Geoglossomycetes	Geoglossales	Geoglossaceae	<i>Trichoglossum hirsutum</i>	H	S	
Lecanoromycetes	Caliciales	Physiaceae	<i>Leucodermia leucomelos</i>	L	Ba	
	Lecanorales	Cladoniaceae	<i>Cladonia didyma</i>	L	M	
		Dactylosporaceae	<i>Sclerococcum stygium</i>	S	W	
		Stereocaulaceae	<i>Stereocaulon didymicum</i>	L	R	
		Peltigerales	Collemaaceae	<i>Leptogium azureum</i>	L	Ba
		Lobariaceae	<i>Sticta kunthii</i>	L	Ba	
		Pannariaceae	<i>Leptogidium dendriscum</i>	L	Ba	
	Pertusariales	Icmadophilaceae	<i>Dibaeis baeomyces</i>	L	S	
	Leotiomycetes	Chaetomellales	Marthamycetaceae	<i>Marthamyces quadrifidus</i>	S	Li
		Helotiales	Chlorociboriaceae	<i>Chlorociboria aeruginosa</i>	S	W
Chlorospleniaceae			<i>Chlorosplenium chlora</i>	S	W	
Gelatinodiscaceae			<i>Ascocoryne inflata</i>	S	W	
Hemiphacidiaceae			<i>Chlorencoelia versiformis</i>	S	W	
Lachnaceae			<i>Incrucipulum ciliare</i>	E	Li	
			<i>Lachnum apalum</i>	E	W	
			<i>Lachnum pteridophyllum</i>	E	Br	
		<i>Lachnum rhytismatis</i>	E	Br		
		Mollisiaceae	<i>Mollisia cinerea</i>	E	W	
Leotiales	Leotiaceae	<i>Leotia lubrica</i>	My	S		
Rhytismatales	Pezizellaceae	<i>Bisporella sulfurina</i>	S	Li		
	Rhytismataceae	<i>Cerion leucophaeum</i>	S	W		
		<i>Coccomyces limitatus</i>	S	Li		
Orbiliomycetes	Orbiliales	Orbiliaceae	<i>Orbilium xanthostigm</i>	S	Fu	
Pezizomycetes	Pezizales	Sarcosecyphaceae	<i>Sarcosecypha occidentalis</i>	S	W	

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TABLE 1. (Continued)

Class	Order	Family	Species	Habit	Habitat
Sordariomycetes	Coronophorales	Nitschkiaceae	<i>Calyculosphaeria macrospora</i>	S	W
			<i>Nitschkia grevillii</i>	S	W
	Hypocreales	Bionectriaceae	<i>Bionectria grammicospora</i>	E	W
			<i>Bionectria ochroleuca</i>	E	Br
		Hypocreaceae	<i>Trichoderma citrinum</i>	E	W
			Nectriaceae	<i>Fusarium graminearum</i>	E
		<i>Thelonectria discophora</i>		E	Br
		<i>Thelonectria lucida</i>		E	Br
		Chaetosphaeriales	Chaetosphaeriaceae	<i>Chaetosphaeria ellisii</i>	E
	<i>Chaetosphaeria lapaziana</i>			E	Ba
	<i>Chaetosphaeria veuillotiana</i>			E	Ba
	Sordariales	Lasiosphaeriaceae	<i>Cercophora costaricensis</i>	E	W
			<i>Lasiosphaeria ovina</i>	E	W
	Xylariales	Diatrypaceae	<i>Diatrype microstega</i>	E	W
			<i>Eutypa flavovirens</i>	E	W
		Graphostromataceae	<i>Biscogniauxia mediterranea</i>	E	Ba
			Hypoxylaceae	<i>Jackrogersella cohaerens</i>	E
		Xylariaceae		<i>Rosellinia aquila</i>	Pa
			<i>Rosellinia corticium</i>	Pa	Li
			<i>Rosellinia necatrix</i>	Pa	R
			<i>Xylaria anisopleura</i>	E	Br
			<i>Xylaria apiculata</i>	E	W
			<i>Xylaria arbuscula</i>	E	Ro
			<i>Xylaria coccophora</i>	E	W
			<i>Xylaria corniculata</i>	E	W
			<i>Xylaria cubensis</i>	E	W
	<i>Xylaria heliscus</i>	E	W		
	<i>Xylaria laevis</i>	E	W		
	<i>Xylaria longipes</i>	E	W		
	<i>Xylaria nigrescens</i>	E	W		
	<i>Xylaria schweinitzii</i>	E	W		
	<i>Xylaria scruposa</i>	E	W		
	<i>Xylosphaera comosa</i>	E	W		

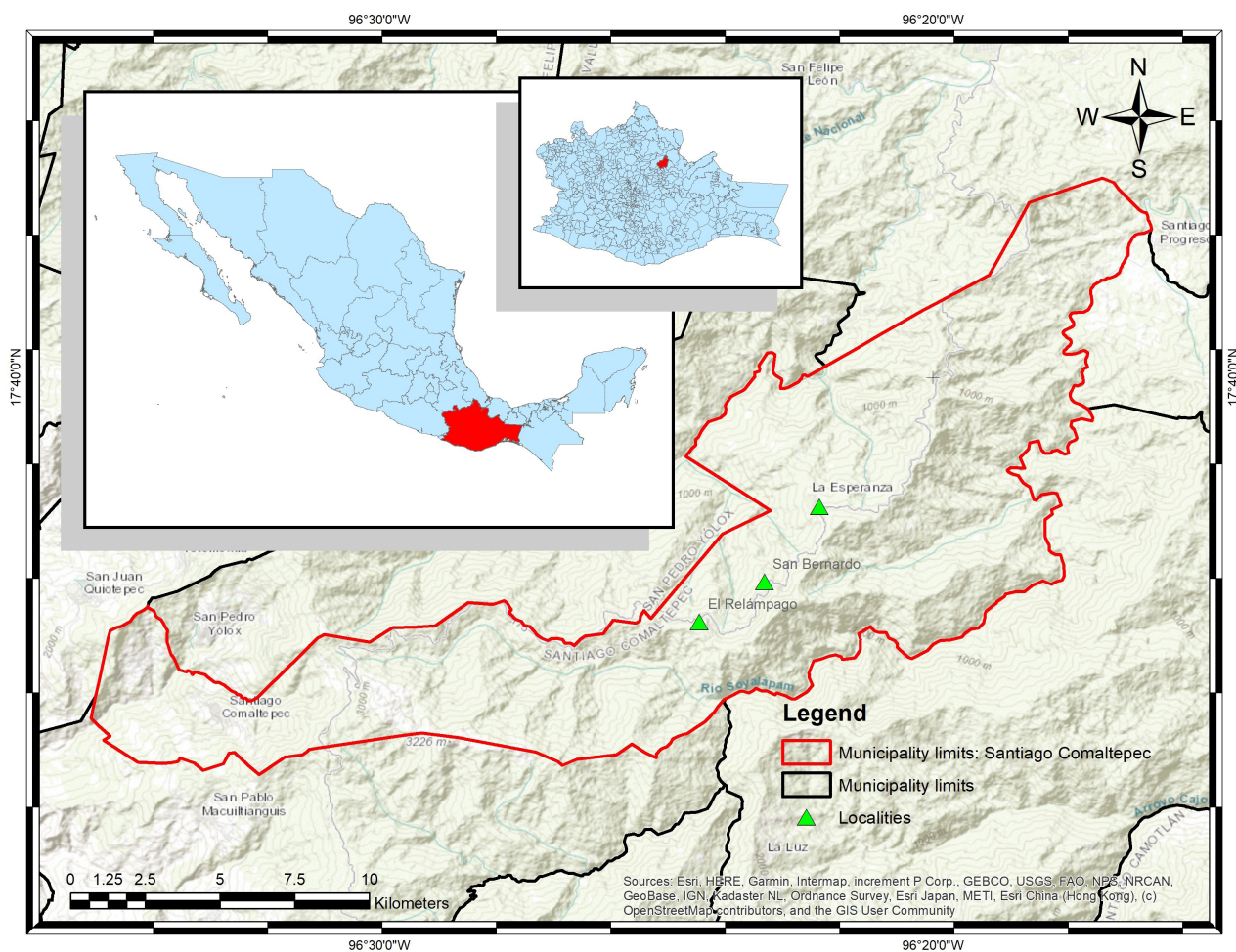


FIGURE 1. Location map of the Oaxacan *Oreomunnea* forest.

Results

Sixty-three species of Ascomycota (all found in their sexual states) were identified in the relic tropical montane forest of *Oreomunnea mexicana*. They belonged to 44 genera, 35 families, 18 orders, and eight classes of the Phylum Ascomycota (Table 1). Of these, 45 species are new records for the state of Oaxaca and ten species are new records for the country. *Calyculosphaeria* represents a new genus for Mexico. The best represented families of Ascomycetes were Xylariaceae with 16 species, and Lachnaceae and Nectriaceae with four species each. The most diverse genera were *Xylaria* with 12 species, and *Lachnum*, *Rosellinia*, and *Thelonectria* with three species each. The most frequent species were *Xylaria arbuscula* with 13 specimens and *Lachnum apalum* with nine specimens.

Most of the species in La Esperanza were found on decaying wood (33 species, 52.4%) of different angiosperms, 9 (14.3%) on bark, and 7 (11.1%) on branches. We found 33 endophytic species, 18 saprotrophic, six lichenized, three phytopathogenic, one humicolous, and one mycorrhizal fungus (Table 1).

The following nine species are new records for Mexico: *Calyculosphaeria macrospora*, *Cercophora costaricensis*, *Chaetosphaeria ellisii*, *Coccomyces limitatus*, *Lasiosphaeria ovina*, *Leptogidium dendriscum*, *Marthamyces quadrifidus*, *Stereocaulon didymicum*, *Thelonectria lucida*.

Dothideomycetes, *Pleosporales*, *Melanommataceae*

**Byssosphaeria schiedermayriana* (Fuckel) M.E. Barr, *Mycotaxon* 20(1): 34 (1984)

Habit and habitat:—saprotrophic, gregarious, on decomposing branches.

Distribution:—Veracruz (Chacón & Tapia 2014), Hidalgo (Raymundo *et al.* 2016).

Specimens:—La Esperanza, 29 April 2018, R. Valenzuela 18182 (ENCB).

Remarks:—this species has gregarious pseudothecia, 500 µm long, papilla bright orange to brick orange, globose, grooved to sulcate, surrounding the circular pore. Asci claviform to cylindrical, octosporic. Ascospores hyaline to pale yellowish, fusoid.

Herpotrichia macrotricha (Berk. & Broome) Sacc., *Syll. fung.* 2: 213 (1883)

Habit and habitat:—saprotrophic, on decomposing trunks.

Distribution:—Costa Rica, USA, Kenya (Mugambi & Huhndorf 2009), Taiwan (Chen & Hsieh 2004), Mexico (Raymundo *et al.* 2020).

Specimens:—El Relámpago, 16 May 2015, *P. Reyes 10* (ENCB).

Incertae sedis

**Astrosphaeriella trochus* (Penz. & Sacc.) D. Hawksw., *Bot. J. Linn. Soc.* 82: 46 (1981)

Habit and habitat:—wood decay.

Distribution:—Chiapas (San Martín & Lavin 1999), Veracruz (Chacón & Tapia 2014), Hidalgo (Raymundo *et al.* 2016).

Specimen:—La Esperanza, 29 May 2016, *T. Raymundo 6167* (ENCB).

Remarks:—this species forms gregarious, errumpent pseudothecia, 500–800 µm diameter, pyriform, dark brown to vinaceous with black apex, carbonaceous texture, smooth surface, substrate remains at the base giving a star appearance. Ostioles papillate, prominent. Pseudoparaphyses trabeculate, hyaline, septate, up to 1–2 µm diameter. Asci 184–232 × 13–16.8 µm, cylindrical to clavate, octosporic. Ascospores 60–66 × 6.4–7.2 µm, fusiform, green to olive, 5-septate, acute ends.

Tubeufiales, Tubeufiaceae

**Tubeufia cerea* (Berk. & M.A. Curtis) Höhn., *Sber. Akad. Wiss. Wien, Math.-naturw. Kl., Abt. 1* 128(7–8): 562 (1919)

Habit and habitat:—saprotrophic, on decaying wood.

Distribution:—San Luis Potosí (Raymundo *et al.* 2020).

Specimen:—La Esperanza, 29 May 2016, *T. Raymundo 6157* (ENCB).

Remarks:—ascomata 300–400 µm diameter, spherical to clavate-obovate, superficial, yellow to dark brown when mature. Asci octosporate, bitunicate, fissitunicate, saccate or cylindric-clavate, 190–270 × 18–29 µm, with or without an ocular chamber. Ascospores 60–80 × 8–9.8 µm, cylindric to subfusiform, 5-septate, hyaline to pale brown. In the asexual state forms cochleated coiled conidia, multiseptate and hyaline, reported as *Helicosporium virescens* (Pers.) Sivan.

Eurotiomycetes, Eurotiales, Aspergillaceae

Trichocoma paradoxa Jungh., *Verh. Batav. Genootsch. Kunst. Wet.* 17(2): 9 (1838)

Habit and habitat:—saprotrophic, on decaying wood.

Distribution:—Brazil (Dodge 1929, Trierweiler-Pereira 2007), Costa Rica (Calonge *et al.* 2006), Santo Domingo (Ciferri 1957), Mexico (Raymundo *et al.* 2020).

Specimen:—El Relámpago, 26 Sep. 2015, *R. Valenzuela 16313* (ENCB).

Geoglossomycetes, Geoglossales, Geoglossaceae

**Trichoglossum hirsutum* (Pers.) Boud., *Hist. Class. Discom. Eur.*: 86 (1907)

Habit and habitat:—humicolous, in soil.

Distribution:—Morelos (Chacón & Guzmán 1983); Estado de México, Guerrero, Michoacán, Nuevo León, Querétaro, Veracruz (Ramírez & Villegas 2007), Hidalgo (Raymundo *et al.* 2016).

Specimens:—El Relámpago, 26 Sept. 2015, *R. Valenzuela 16318* (ENCB); *T. Raymundo 5878* (ENCB); San Bernardo, 15 August 2015, *L. Hernández 115* (ENCB); 25 Sept. 2015, *A. Barbosa 7* (ENCB).

Remarks:—apothecia 34–65 × 12–15 mm, claviform to spathulate, thinning towards the base up to 2–3 mm diameter, black, covered by setae 180–120 × 6–8 µm, lanceolate, reddish-brown, distributed all over the apothecium. Paraphyses 248–256 × 2.5–3.2 µm, filiform, hyaline to pale yellowish, septate, with the apical part curved. Asci 200–240 × 12.8–13.6 µm, cylindrical, basal part truncate and apical amyloid pore. Ascospores 100–116 × 5.6–8.4 µm, filiform to fusoid, widest in middle, pale brown, 15-septate.

Lecanoromycetes, Caliciales, Physiaceae

Leucodermia leucomelos (L.) Kalb, in Mongkolsuk *et al.*, *Phytotaxa* 235(1): 35 (2015)

Habit and habitat:—lichenized, on bark.

Distribution:—cosmopolitan. Widely distributed in Mexico (Guzmán-Guillermo *et al.* 2019). Cited previously from Oaxaca (León-González & Pérez-Pérez 2020).

Specimen:—El Relámpago, 26 Sept. 2015, *T. Raymundo 5887* (ENCB).

Remarks:—this lichen has a ribbon-like foliose thallus. Cortex smooth, lacking laminal cilia, with marginal black cilia. Lower surface ecorticated, with terminal soralia. Spot-test: cortex K+ yellow; medulla K+ yellow to red, C-.

Lecanorales, Cladoniaceae

Cladonia didyma (Fée) Vain., *Acta Soc. Fauna Flora fenn.* 4(1): 137 (1887)

Habit and habitat:—lichenized, on mosses.

Distribution:—a quite common species in the Neotropics (Ahti 2000). In Mexico it is known from Chiapas, Michoacán, Oaxaca, Sonora, Tamaulipas and Veracruz (de Lesdain 1914, 1929, Pérez-Pérez & Herrera-Campos 2004, Sipman & Wolf 1998, Córdova-Chávez *et al.* 2016, León-González & Pérez-Pérez 2020).

Specimen:—La Esperanza, 29 May 2016, *T. Raymundo* 3738 (ENCB).

Remarks:—primary thallus formed by irregular squamules. Podetia form the secondary thallus with red terminal apothecia, ecorticated, lacking soredia, and numerous microsquamules. This species is similar to *C. macilenta* Hoffm.

Dactylosporaceae

**Sclerococcum stygium* (Berk. & M.A. Curtis) Olariaga, Teres, J.M. Martín, M. Prieto & Baral, in Olariaga *et al.*, *Mycol. Progr.* 18(7): 904 (2019)

Habit and habitat:—saprotrophic, on decaying wood.

Distribution:—Morelos (Butler 1940, Hafellner 1979), Veracruz (Chacón & Tapia 2012).

Specimen:—El Relámpago, 26 Sept. 2015, *T. Raymundo* 5743 (ENCB).

Remarks:—apothecia 0.5–1.5 mm, rounded, shield form, with a thickened margin, pale pink, sessile, hymenium brown vine to violet, rough texture. Paraphyses filiform, septate, forked, and with slightly thickened apices. Asci 86–90 × 10–15 µm, octosporate, biseriate, and amyloid. Ascospores 20–24 × 3.5–4.5 µm, fusiform, flattened on one side and pointed on the other, hyaline, 3-septate.

Sterocaulaceae

***Stereocaulon didymicum* I.M. Lamb, *J. Hattori bot. Lab.* 43: 291 (1977)

Thallus fruticose, saxicolous growing among mosses. Stalks erected 20–50 mm, cylindrical, and not branched in the base. Phyllocladia cylindrical and abundant on all surfaces. Soralia at the end of the stalks and with subterminal apothecia. Reactions: K+ yellow, C-, UV+ white.

Habit and habitat:—lichenized, on rocks.

Distribution:—Neotropical, Colombia, Costa Rica, Ecuador (Flakus *et al.* 2013, Rincón-Espitia & Mateus 2013, Sipman 2002).

Specimens:—La Esperanza, 30 April 2018, *T. Raymundo* 7487 (ENCB); *R. Valenzuela* 18192.

Remarks:—thallus fruticose, cylindrical phyllocladia, soralia at the end of the stalks, and with subterminal apothecia. This species is easily recognized by its numerous cylindrical phyllocladia (Rincón-Espitia & Mateus 2013).

Peltigerales, Collemataceae

Leptogium azureum (Sw.) Mont., in Webb & Berthelot, *Hist. nat. Iles Canar.* 3(2): 129 (1840)

Habit and habitat:—lichenized, on bark.

Distribution:—panropical. Oaxaca (León-González & Pérez-Pérez 2020), Baja California Sur, Sonora (Jorgensen & Nash 2004), Chiapas (Sipman & Wolf 1998), Veracruz (Pérez-Pérez 2015), Michoacán (Gómez-Peralta 1992). This species is widespread in Americas, Australasia, Asia, Africa (Jorgensen & Nash 2004).

Specimen:—El Relámpago, 26 Sept. 2015, *T. Raymundo* 5888 (ENCB).

Remarks:—foliose species characterized by a homomerous thallus with chains of *Nostoc*-like photobiont partner. Thallus smooth, irregular, plane lobes, numerous laminal apothecia in the upper surface, lacking soredia and isidia. Colour and texture vary with humidity; when dry bluish-grey. Similar to *L. cyanescens* but differing by its laminal coralloid isidia. All spot-tests negative.

Lobariaceae

**Sticta kunthii* Hook., in Kunth, *Syn. pl.* 1: 29 (1822)

Habit and habitat:—lichenized, on bark.

Distribution:—Neotropical. Brazil, Colombia, Mexico, Venezuela. In México is known from Sinaloa (Galloway & Thomas 2004).

Specimens:—La Esperanza, 30 April 2018, *T. Raymundo* 7485 (ENCB); *R. Valenzuela* 18192 (ENCB).

Remarks:—foliose species, thallus with free margins of lobes, coriaceous, medullae white, upper surface pale grey to pale greenish, lower surface cream to pale brown, tomentose, with numerous cyphella all over the lamina, soredia and isidia absent. Apothecia laminal and marginal, constricted at the base, with cilia projected from the margins. This species is easily recognized by the cilia in the apothecia margins.

Pannariaceae

***Leptogidium dendriscum* (Nyl.) Nyl., *Flora*, Regensburg 56: 195 (1873)

Thallus fruticose and corticolous, growing among mosses, adpressed to the substrate. Cortex green olivaceous. Cylindrical and very thin

branched, 80–100 µm diameter, with cyanobacterial filaments and a discoid and orange to brown apothecia, 50–200 µm. Reactions: K-, C-, KC-, UV-.

Habit and habitat:—lichenized, on bark.

Distribution:—widely distributed in Asia, Europe, Australia, and Americas (Canada, USA, Brazil, Costa Rica, Ecuador, Guyana) (Muggia *et al.* 2011, Kukwa *et al.* 2014).

Specimen:—El Relámpago, 26 Sept. 2015, *T. Raymundo 5889* (ENCB).

Remarks:—this species is characterized by its cylindrical dark blue grey filaments adpressed to the substrate, much-branched, with brown apothecia above filaments.

Pertusariales, Icmadophilaceae

**Dibaeis baeomyces* (L. f.) Rambold & Hertel, *Bibliotheca Lichenol.* 53: 231 (1993)

Habit and habitat:—lichenized, on soil.

Distribution:—common in temperate regions. Americas, Europe and Asia (Brodo *et al.* 2001, Büdel 2001, Zheludeva 2015).

Specimens:—La Esperanza, 30 April 2018, *T. Raymundo 7488*(ENCB); *R. Valenzuela 18194* (ENCB).

Remarks:—primary thallus formed by a smooth crust, grey to greenish. Secondary thallus formed by podetia with terminal apothecia without thalloid margin, disk pink to whitish, podetia unbranched, lacking soredia and isidia. Similar to *D. absoluta*, but this species lacks podetia.

Leotiomyces, Chaetomellales, Marthamycetaceae

***Marthamyces quadrifidus* (Lév.) Minter, *Mycotaxon* 87: 52 (2003) (Fig. 2)

Apothecia 0.4–1.0 mm diameter, on both surfaces of dead coriaceous leaves, subepidermal, resembling small pustules, visible initially as a round black patch, erumpent from the substrate surface, not associated with bleaching of host tissue, without zone lines, orbicular to angular, others irregular in shape, opening by 3–6 lips prominent, irregular, pruinose and with teeth. Hymenium somewhat depressed below the substrate level, pruinose, pale grey when fresh to pale yellow or grey when dry. Perimeter line absent. Paraphyses up to 80–110 × 1–1.4 µm, cylindrical, hyaline near apex, swollen and branched. Asci 75–100 × 7–9.6 µm, cylindrical, with a foot-like base and a poorly developed basal stalk, tapering slightly at the rounded apex to apiculate, wall undifferentiated at apex, octosporate. Ascospores 60–80 × 1.8–2 µm, filiform, curved to coiled on release, hyaline in KOH, thin-walled, 1–3-septate (difficult to see), apical and basal gelatinous caps.

Habit and habitat:—saprotrophic, on dead leaves of *Clusia*. Also on leaf litter of *Myrcia splendens* Standl. (Myrtaceae) and *Pera glabrata* (Schott) Baill. (Peraceae) (Oliveira dos Santos *et al.* 2019).

Distribution:—Cuba, Malesia, Venezuela (Cabarro-Hernández *et al.* 2014) and Brazil (Oliveira dos Santos *et al.* 2019).

Specimens:—La Esperanza, 30 April 2018, *T. Raymundo 7488* (ENCB), *R. Valenzuela 18194* (ENCB).

Helotiales

Chlorociboriaceae

Chlorociboria aeruginosa (Oeder) Seaver ex C.S. Ramamurthi, Korf & L.R. Batra, *Mycologia* 49(6): 859 (1958)

Habit and habitat:—saprotrophic, on decaying wood.

Distribution:—Hidalgo (Frutis & Guzmán 1983, Raymundo *et al.* 2016a), Coahuila, Hidalgo, Guerrero, Estado de México, Michoacán, Morelos, Querétaro and Veracruz (Valenzuela 1990), Durango (Raymundo *et al.* 2012).

Specimen:—San Bernardo, 27 May 2013, *R. Valenzuela 16136* (ENCB).

Chlorospleniaceae

**Chlorosplenium chlora* (Schwein.) M.A. Curtis, in Sprague, *Proc. Boston Soc. nat. Hist.* 5: 330 (1856)

Habit and habitat:—saprotrophic, on decaying wood.

Distribution:—Hidalgo (Raymundo *et al.* 2019).

Specimens:—El Relámpago, 16 May 2015, *P. Reyes 13* (ENCB); San Bernardo, 25 Sept. 2015, *R. Peralta 8* (ENCB).

Remarks:—characterized by gregarious apothecia, sessile, 1–3 mm diameter, convex to discoid, pale yellowish to lemon yellow. Ectal excipulum rugose, yellow to olive and pale brown, vertically striate to sulcate, 40–60 µm thick, with globose cells 5–10 µm diameter, forming hyphal hairs. Medular excipulum 70–80 µm thick, with an angular texture formed by hyaline hyphae 2–3.2 µm diameter. Paraphyses 54–60 × 2–3 µm, filiform, hyaline, septate, and rounded apices. Asci 50–58 × 4–5 µm, cylindrical to clavate, with apical amyloid pore and crozier at the base. Ascospores 6–7 × 1.5–2 µm, cylindrical, hyaline, smooth walls, with two guttules.

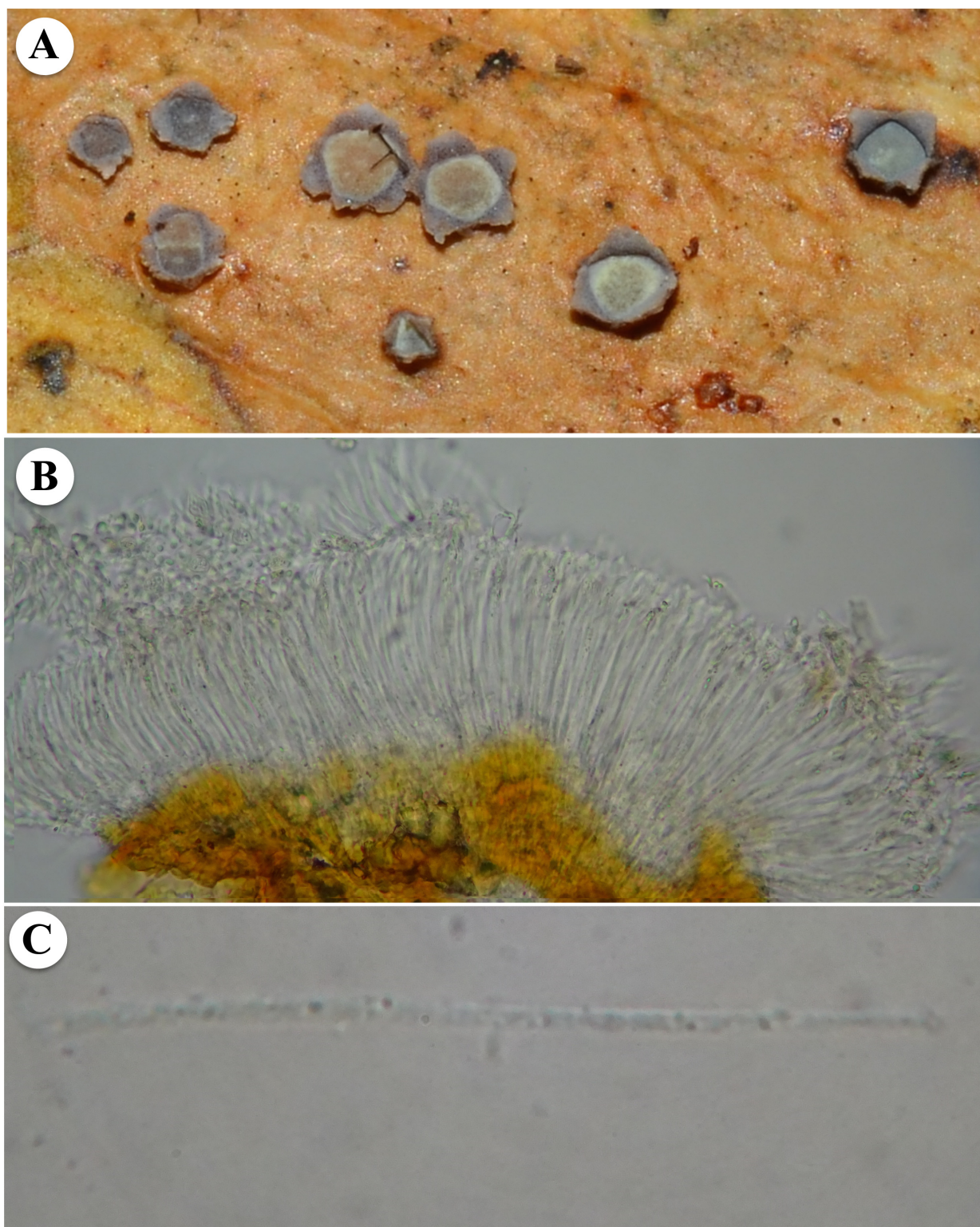


FIGURE 2. *Marthamyces quadrifidus*. A. Apothecia. B. Hymenium. C. Ascospore.

Gelatinodiscaceae

**Ascocoryne sarcoides* (Jacq. ex Gray) J. W. Groves & D. E. Wilson, *Taxon* 16: 40 (1967) (Fig. 3)

Habit and habitat:—saprotrophic, in decaying wood of *Oreomunnea mexicana*.

Distribution:—CDMX (Medel & Calonge, 2004).

Specimens:—San Bernardo, 27 May 2013, *R. Valenzuela* 16136 (ENCB); *T. Raymundo* 5718 (ENCB); El Relámpago, 16 May 2015, *T. Raymundo* 5701 (ENCB); 28 May 2016, *T. Raymundo* 6119 (ENCB); 6120 (ENCB); 6124 (ENCB); *R. Valenzuela* 16626 (ENCB); 16633 (ENCB), 16634 (ENCB); 16638 (ENCB).

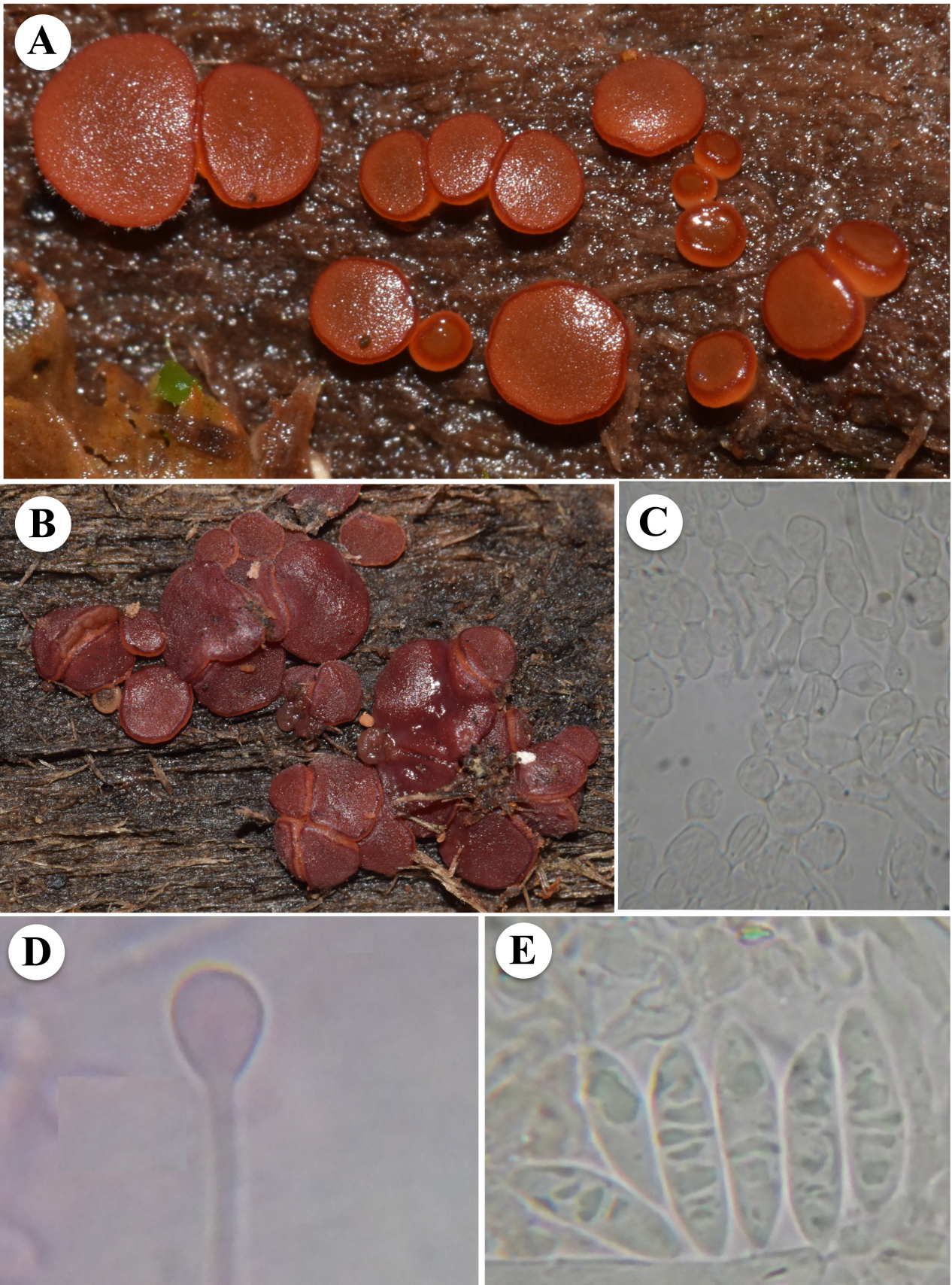


FIGURE 3. *Ascocoryne inflata*. A, B. Apothecia. C. Globose cells of ectal excipulum. D. Paraphysis. E. Ascospores.

Remarks:—this species is characterized by apothecia 4–20 mm diameter, sessile, or with a stipe immersed in the substrate. Discoidal at first, then they rise by the margin adopting a turbinate shape, and finally, they are lobed to undulate irregularly. Paraphyses

widened in the apical part, $21\text{--}35 \times 1.7\text{--}3.5 \mu\text{m}$. Asci $2.3\text{--}170 \times 1.7\text{--}2.2 \mu\text{m}$, slightly clavate, octosporic, mono- or biseriata, amyloid. Ascospores $10\text{--}20 \times 4\text{--}6 \mu\text{m}$, ellipsoid, smooth, hyaline. Ectal excipulum is formed by globose cells.

Hemiphacidiaceae

**Chlorencoelia versiformis* (Pers.) J.R. Dixon, *Mycotaxon* 1(3): 224 (1975)

Habit and habitat:—saprotrophic, on decaying wood of *Alnus* and *Quercus*.

Distribution:—Tlanchinol, Hidalgo (Raymundo *et al.* 2016).

Specimen:—La Esperanza, 23 May 2017, *T. Raymundo* 6609 (ENCB).

Remarks:—characterized by gregarious to caespitose apothecia, 5–18 mm diameter, turbinate, greenish-brown, jelly to fleshy when young to discoid-undulate, yellowish-orange, and dark orange when ripe. Central to eccentric foot, 2–5 mm long. Excipulum yellowish to cinnabar red when mature, with claviform cells in palisade. Hymenium smooth, olive-green mustard when ripe. Paraphyses $90\text{--}108 \times 1.6\text{--}2 \mu\text{m}$, cylindrical. Asci $80\text{--}100 \times 6.4\text{--}7.2 \mu\text{m}$, cylindrical, biseriata, octosporic. Ascospores $9\text{--}12.6 \times 2.4\text{--}3.2 \mu\text{m}$, cylindrical, slightly curved with rounded ends, smooth, hyaline, thick-walled.

Lachnaceae

**Incrucipulum ciliare* (Schrad.) Baral, in Baral & Krieglsteiner, *Beih. Z. Mykol.* 6: 72 (1985)

Habit and habitat:—endophyte, on leaves of *Cyathea fulva*.

Distribution:—Hidalgo (Raymundo *et al.* 2016).

Specimens:—El Relámpago, 29 May 2016, *T. Raymundo* 6139 (ENCB); *R. Valenzuela* 16652 (ENCB).

Remarks:—apothecia 1–2 mm diameter, discoid, covered by whitish hairs, $92\text{--}120 \times 2\text{--}3 \mu\text{m}$, with rounded apex embedded with crystals, with septa around the margin and the ectal excipulum, with a small central stipe. Hymenium white to pale yellowish. Ectal excipulum hyaline, globular texture to prismatic, consisting of $3\text{--}5 \mu\text{m}$ cells, globose to angular, thick wall. Medular excipulum with intricate texture. Paraphyses $58\text{--}74 \times 1.6\text{--}2.4 \mu\text{m}$, filiform to lanceolate. Asci $60\text{--}80 \times 5\text{--}6 \mu\text{m}$, claviform, conic apex. Ascospores $18\text{--}24 \times 2\text{--}2.4 \mu\text{m}$, cylindrical to fusiform to flexuose, hyaline, thin-walled.

**Lachnum apalum* (Berk. & Broome) Nannf., *Svensk bot. Tidskr.* 30(3): 299 (1936)

Habit and habitat:—endophyte, in trunk of *Oreomunnea mexicana*.

Distribution:—Hidalgo (Raymundo *et al.* 2016).

Specimens:—San Bernardo, 15 May 2015, *P. Reyes* 8 (ENCB); *R. Valenzuela*, 16132 (ENCB); *R. Valenzuela* 16122 (ENCB); *T. Raymundo* 5677 (ENCB); *R. Peralta* 12 (ENCB); 22 May 2017, *O. Araujo* 9 (ENCB); *T. Raymundo* 6608 (ENCB); *R. Valenzuela* 17236, 17237 (ENCB).

Remarks:—apothecia sessile, discoid, hymenium canary yellow, ectal excipulum with hairs $4\text{--}5 \mu\text{m}$ diameter, white, in KOH change to brown at the base and pale yellowish at apex, blunt apex, with septa every $12\text{--}14 \mu\text{m}$, asperulate to slightly equinulate. Hymenium lemon yellow, hyaline in KOH. Paraphyses $84\text{--}110 \times 2.5\text{--}3 \mu\text{m}$, filiform, with thinned apex and septa every $22\text{--}26 \mu\text{m}$, hyaline. Asci $80\text{--}100 \times 7\text{--}8 \mu\text{m}$, cylindrical-claviform, conical apex, apical pore amyloid. Ascospores $50\text{--}52 \times 2 \mu\text{m}$, filiform, with slightly thinned and blunt ends, hyaline.

Lachnum pteridophyllum (Rodway) Spooner, *Bibliotheca Mycol.* 116: 470 (1987)

Habit and habitat:—endophytic, on foliar rachis of *Cyathea divergens* Kunze.

Distribution:—Oaxaca (Haines 1980), Veracruz (Medel & Lorea-Hernández 2008), Hidalgo (Raymundo *et al.* 2016).

Specimens:—San Bernardo, 15 May 2015, *T. Raymundo* 5680, *T. Raymundo* 5688, *R. Valenzuela* 16119, *P. Reyes* 6 (ENCB).

**Lachnum rhytismatis* (W. Phillips) Nannf., *Trans. Br. mycol. Soc.* 23(3): 242 (1939)

Habit and habitat:—endophyte, on foliar rachis of *Cyathea divergens*.

Distribution:—Hidalgo (Raymundo *et al.* 2016).

Specimens:—El Relámpago, 15 May 2015, *T. Raymundo* 5724 (ENCB); *P. Reyes* 15 (ENCB).

Remarks:—characterized by apothecia $200\text{--}400 \mu\text{m}$, cupuliform to discoid when mature, white when young to cream when mature, margin covered by white hairs $40\text{--}60 \times 2.4\text{--}3.2 \mu\text{m}$ diameter, cylindrical, thick wall with irregular septa and cells inflated at the base and apex covered by crystals. Hymenium smooth, $50\text{--}60 \mu\text{m}$ thick. Paraphyses $36\text{--}4.4 \times 1\text{--}2.4 \mu\text{m}$, filiform to lanceolate. Asci $36\text{--}40 \times 3.4\text{--}4 \mu\text{m}$, clavate, apical amyloid pore, octosporic, biseriata. Ascospores $5\text{--}6 \times 1.4\text{--}1.6 \mu\text{m}$, fusiform, hyaline, smooth.

Mollisiaceae

***Mollisia cinerea* (Batsch) P. Karst., *Bidr. Känn. Finl. Nat. Folk* 19: 189 (1871)

Habit and habitat:—endophyte, on decaying wood.

Distribution:—Hidalgo (Raymundo *et al.* 2019).

Specimens:—El Relámpago, 16 May 2015, *R. Valenzuela*, 16122, 28 May 2016, *T. Raymundo* 6152 (ENCB).

Remarks:—characterized by apothecia 0.5–2 mm diameter, discoidal, lobed or irregular, outer part greyish-brown, with regular to wavy margin, at maturity some apothecia lobed, white. Ectal excipulum white to greyish changing to olive-green in 10% KOH, globose texture with globose cells, 8–10 µm diameter, olive-green to dark olive in KOH, slightly thickened walls. Medular excipulum with intricata texture, formed by interwoven hyphae, 2–4 µm, hyaline in KOH, thin-walled. Paraphyses 72–80 × 1.6–3.2 µm, cylindrical, with rounded apex, hyaline in KOH. Asci 60–72 × 4.0–4.8 µm, octosporate, cylindrical, hyaline in KOH, with a blunt apex, apical amyloid pore. Ascospores 7.2–9.6 × 2.4–2.8 µm, cylindrical to fusoid, straight to slightly curved, biseriate, hyaline in KOH, smooth.

Leotiales, Leotiaceae

Leotia lubrica (Scop.) Pers., *Comm. fung. clav.*: 31 (1797)

Habit and habitat:—mycorrhizogenous, solitary on the soil.

Distribution:—Coahuila, CDMX, Estado de Mexico, Guerrero, Michoacán, Morelos, Nuevo León, Querétaro, Tlaxcala, Veracruz (Ramírez-López & Villegas 2007), Durango (Raymundo *et al.* 2012), Oaxaca (Raymundo *et al.* 2013), Hidalgo (Frutis & Guzmán 1983), Raymundo *et al.* (2016, 2019).

Specimens:—El Relámpago, 26 Nov. 2016, *I. Aguilera* 8 (ENCB); *R. Valenzuela* 16903 (ENCB).

Rhytismatales, Pezizellaceae

**Bisporella sulfurina* (Quél.) S.E. Carp., in Korf & Carpenter, *Mycotaxon* 1(1): 59 (1974)

Habit and habitat:—saprotrophic, on cycads.

Specimens:—San Bernardo, 15 May 2015, *T. Raymundo* 5827 (ENCB); La Esperanza, 23 May 2017, *T. Raymundo* 6609 (ENCB), *R. Valenzuela* 172323 (ENCB).

Distribution:—Hidalgo (Raymundo *et al.* 2016a), Morelos (Chacón & Guzmán 1983).

Remarks:—characterized by apothecia 800–1000 µm diameter, concave when young to discoid when mature, bright yellow, smooth surface, and slightly pruinose. Paraphyses 70–72 × 0.5–1 µm, filiform, hyaline, septate. Asci 60–68 × 4–5 µm, cylindrical to claviform, octosporic, biseriate. Ascospores 8.8–10.4 × 1.4–2.2 µm, cylindrical to fusiform, hyaline with a middle septum not constrained.

Rhytismataceae

Cerion leucophaeum (Speg.) Dennis, *Kew Bull.* [13](3): 465 (1959)

Habit and habitat:—saprotrophic, on decomposing trunk of *Oreomunnea mexicana*.

Distribution:—Switzerland (Breitenbach & Kranzlin 1984), Panama (Hou 2009), Venezuela (Mardones-Hidalgo & Iturriaga 2011). Oaxaca, Hidalgo, and Puebla (Raymundo *et al.* 2020).

Specimens:—San Bernardo, 15 May 2015, *T. Raymundo* 5670, *R. Valenzuela* 16110 (ENCB), *P. Reyes* 3 (ENCB).

***Coccomyces limitatus* (Berk. & M.A. Curtis) Sacc., *Syll. fung.* 8: 747 (1889) (Fig. 4)

Ascomata 0.5–9 mm diameter, angular in outline, black wall when mature, with preformed dehiscence mechanism of light-coloured lines, opening when wet by 3 or 4 teeth, lips absent. Hymenium honey to yellow colour when fresh to yellow when dry. Paraphyses up to 96–110 × 2–4 µm, cylindrical, hyaline, near apex swollen and branched. Asci 90–110 × 4.8–5.6 µm, cylindrical, tapering slightly at the rounded apex to apiculate, thin-walled, octosporate. Ascospores 72–84 × 0.8–1 µm, filiform, hyaline in KOH, thin-walled, coated in a mucous sheath.

Habit and habitat:—saprotrophic, on abaxial surface of fallen leaves of *Clusia*.

Distribution:—Cuba and Venezuela (Cabarroí-Hernández *et al.* 2014).

Specimens:—La Esperanza, 30 April 2018, *T. Raymundo* 7488 (ENCB); *R. Valenzuela* 18194 (ENCB).

Orbiliomycetes, Orbiliales, Orbiliaceae

Orbilia xanthostigma (Fr.) Fr., *Summa veg. Scand.*, Sectio Post.: 357 (1849)

Habit and habitat:—saprotrophic, epiphytic species growing on other fungi; also on decaying wood.

Distribution:—Oaxaca and Distrito Federal (Chacón & Guzmán 1983), in tropical montane cloud forest of Hidalgo (Raymundo *et al.* 2019).

Specimens:—La Esperanza, 30 April 2018, *T. Raymundo* 7483 (ENCB); *R. Valenzuela* 18188 (ENCB); 22 May 2018, *T. Raymundo* 6596 (ENCB); *R. Valenzuela* 17226 (ENCB).

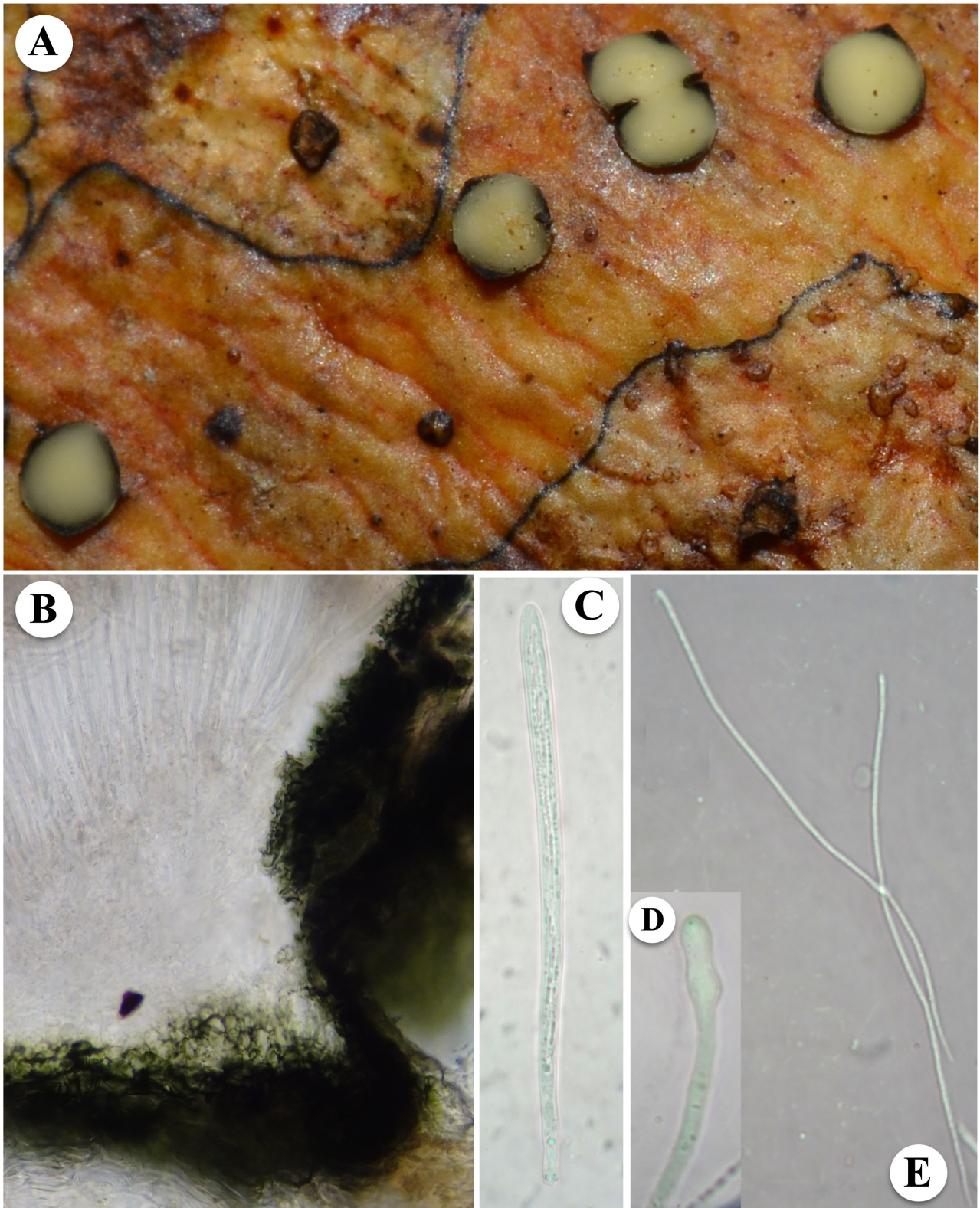


FIGURE 4. *Coccomyces limitatus*. A. Ascomata. B. Longitudinal section of ascoma. C. Ascus. D. Paraphyses. E. Ascospores.

Pezizomycetes, Pezizales, Sarcoscyphaceae

**Sarcoscypha occidentalis* (Schwein.) Sacc., *Syll. fung.* 8: 154 (1889)

Habit and habitat:—saprotrophic, on decaying wood.

Distribution:—Hidalgo, Querétaro, and San Luis Potosí (Ortega *et al.* 2019).

Specimen:—El Relámpago, 22 May 2017, R. Valenzuela 17218 (ENCB).

Remarks:—apothecia 10–20 mm diameter, cupuliform or discoidal, red with white stipe. Ectal excipule 100–200 µm thick, porrecta texture, cells 4–6 µm long, 2–3 µm diameter. Medular excipule 300–600 µm thick, intricate texture, hyphae 3–4 µm diameter. Paraphyses 2–3 µm in the middle part, cylindrical, with carotenoid pigments. Asci 240–280 × 12–15 µm, cylindrical, suboperculate, uniseriate, inamyloid, hyaline, octosporic. Ascospores 17–22 × 8–14, ellipsoidal to sub-cylindrical, smooth, uniseriate, with two large guttules and blunt ends.

Sordariomycetes, Coronophorales, Nitschkiaceae

***Calyculosphaeria macrospora* Fitzp., *Mycologia* 15(2): 53 (1923) (Fig. 5)

Ascomata 400–550 µm diameter, superficial on the substrate, dispersed or gregarious, rounded, not ostiolate, black, rugose to cracked surface with irregular warts. Walls 50–55 µm thick, consisting of 7–8 layers of rounded cells of 10–14 × 8–10 µm. Asci 90–110 × 12–14 µm, clavate, stipes up to 70 µm long, octosporic, biseriata. Ascospores 30–45 × 12–14 µm, fusiform, slightly curved, with a median septum, rounded ends, hyaline.

Habit and habitat:—saprotrophic, on decomposing trunks.

Distribution:—Florida, USA (Fitzpatrick 1923), Switzerland (Breitenbach & Kranzlin 1984), United Kingdom (Huhndorf *et al.* 2004).

Specimens:—El Relámpago, 16 May 2015, *R. Valenzuela*, 16152, 16176 (ENCB); San Bernardo, *P. Reyes* 23 (ENCB).

**Nitschkia grevillii* (Rehm) Nannf., *Svensk bot. Tidskr.* 69(1): 53 (1975)

Habit and habitat:—saprotrophic, on decomposing trunks.

Distribution:—Europe, North America, South America (Nannfeldt 1975); Veracruz (Medel & Chacón 1988b).

Specimens:—San Bernardo, 15V.2015, *T. Raymundo* 5681(ENCB); *T. Raymundo* 5681 (ENCB); *T. Raymundo* 5724 (ENCB); *P. Reyes* 4; 25 Sept. 2015, *B. Hernández* 16 (ENCB).

Remarks:—ascomata 300–400 µm, gregarious to scattered on subiculum poorly developed, black. Peridia 30–35 µm, consisting of 4–5 layers of cells 6–16 × 5 to 9 µm, rounded or slightly angular. Asci 25–35 × 5–6 µm, clavate, stipes 10–16 µm long, octosporate. Ascospores 7.2–8.6 × 1.5–2 µm, cylindrical to fusiform, with median septum, biseriata, hyaline with 2 large guttules.

Hypocreales, Bionectriaceae

**Bionectria grammicospora* (Ferd. & Winge) Schroers & Samuels, *Stud. Mycol.* 46: 154 (2001)

Habit and habitat:—endophyte, gregarious on recently fallen logs.

Distribution:—Hidalgo (Raymundo *et al.* 2016a).

Specimens:—La Esperanza, 22 May 2017, *T. Raymundo* 6580, 6589 (ENCB); *R. Valenzuela* 17205 (ENCB).

Remarks:—perithecia 160–370 × 150–360 µm, globose to subglobose, orange to orange yellowish; smooth surface when young but warted when mature, warts whitish to light yellow with perithecial wall 30–45 µm thick, composed of cells 16–25 × 27.5–35 µm diameter, epidermoid texture. Asci 50–57 × 6.5–7.5 µm, claviform, octosporic, hyaline. Ascospores 12.8–13.6 × 4.4–4.8 µm, ellipsoidal to fusiform, with a median septum, hyaline.

**Bionectria ochroleuca* (Schwein.) Schroers & Samuels, *Z. Mykol.* 63(2): 151 (1997)

Habit and habitat:—endophyte, on angiosperm leaves.

Distribution:—Veracruz (Rossmann *et al.* 1999, Schroers 2001), Hidalgo (Raymundo *et al.* 2016a).

Specimen:—Santiago, San Bernardo, 15 May 2015, *P. Reyes* 15 (ENCB).

Remarks:—perithecia 310–425 × 345–390 µm, aggregated, in groups of 5–10, superficial, globose to subglobose, orange brownish, smooth. Perithecia wall formed by epidermoid texture, 35–40 µm thick, two-layered, external cells 10–13 × 4–6 µm, with orange guttules, 4 µm diameter, inner cells 7–16 × 2.1–3.4 µm, prismatic texture. Asci 52–70 × 12–15 µm, claviform, octosporic, hyaline. Ascospores 13–14 × 4–5 µm, ellipsoidal, median septum, hyaline.

Hypocreaceae

Trichoderma citrinum (Pers.) Jaklitsch, W. Gams & Voglmayr, *Mycotaxon* 126: 147 (2014)

Habit and habitat:—endophyte, gregarious, on decaying wood.

Distribution:—Oaxaca (Raymundo *et al.* 2013), Hidalgo (Raymundo *et al.* 2016a).

Specimen:—La Esperanza, 24 June 2014, *I. Ortega* 280, 281(ENCB).

Nectriaceae

**Fusarium graminearum* Schwabe, *Flora Anhalt* 2: 285 (1839)

Habit and habitat:—endophyte, phytopathogen on monocots.

Distribution:—this species has been cited as causing rot in different Mexican Poaceae (Leyva-Mir *et al.* 2017). The sexual stage is cited for the first time from Oaxaca.

Specimen:—San Bernardo, 15 May 2015, *P. Reyes 14* (ENCB).

Remarks:—perithecia 245–345 µm diameter, subglobose, black, rugose, changing to purple with 5% KOH, solitary to gregarious. Perithecial wall 25 µm diameter, formed by cells 9.6–16.8 µm diameter, mainly angular to subglobose, thick-walled, 2.4 µm diameter, epidermoid texture. Asci 61–76 × 4.8–5.6 µm, claviform, octosporic, hyaline. Ascospores 25.6–26.4 × 4.8–5.6 µm, fusiform to allantoid, 1–3-septate, constricted and disarticulating when mature, hyaline.

**Thelonectria discophora* (Mont.) P. Chaverri & Salgado, in Chaverri *et al.*, *Stud. Mycol.* 68: 76 (2011)

Habit and habitat:—endophyte, on decomposing branches.

Distribution:—Hidalgo (Raymundo *et al.* 2017).

Specimens:—El Relámpago, 28 May 2016, *T. Raymundo 6128* (ENCB); *R. Valenzuela 16639* (ENCB); 29 May 2016, *T. Raymundo 6154*, *6155* (ENCB); La Esperanza, 23 May 2017, *T. Raymundo 6599* (ENCB).

Remarks:—perithecia 345–362 × 350–377 µm, obpyriform to subglobose, red to orange-reddish changing to dark reddish or purple with KOH 5%, smooth and shiny surface, gregarious. Ostiole slightly papillate, 154 µm diameter, slightly darker than the rest of the perithecia, with wall 10 µm diameter formed by cells 18–27 µm diameter, mainly subglobose to epidermoid, globulose texture to somewhat epidermoid. Asci 80–85.6 × 5.6–6 µm, claviform, octosporic, hyaline. Ascospores 11.2–12 × 4.8–5.6 µm, ellipsoidal, median septum, hyaline.

***Thelonectria lucida* (Höhn.) P. Chaverri & Salgado, in Chaverri *et al.*, *Stud. Mycol.* 68: 76 (2011) (Fig. 5)

Perithecia 354–385 × 346–360 µm, globose to subglobose, reddish, ostiole visible, papillate, forming a blackish disk, not collapsed when dry, smooth and shiny surface, gregarious, reacting dark red with 5% KOH. Perithecial wall 19–27 µm diameter, outer layer with cells 5.6–9 µm diameter, forming texture epidermoid and changing to angularis and prismatic texture up to the neck; medium layer with cells 12–16 µm diameter forming epidermoid texture. Asci 63–72 × 6.5–10 µm, clavate, octosporate, sometimes with overlapping ends, hyaline in 5% KOH, apical ring not visible. Ascospores 13–14 × 5.6–6.4 µm, ellipsoidal, 1-septate, not constricted, uniseriate, hyaline in 5% KOH. Anamorph, *Cylindrocarpon* type, forming sporodochia. Conidiogenous cells 12–20 × 4.5–5.5 µm, cylindrical, thick apex, hyaline with 5% KOH. Macroconidia 56–64 × 9.6–10.4 µm, cylindrical, 5-septate, thick-walled, hyaline with 5% KOH.

Habit and habitat:—endophyte, gregarious, on decomposing branches.

Distribution:—widely distributed in Asia, New Zealand, South America, North America (Chaverri *et al.* 2011b).

Specimens:—La Esperanza, 29 May 2016, *T. Raymundo 6155* (ENCB); 23 May 2017, *T. Raymundo 6599* (ENCB).

Thelonectria veuillotiana (Roum. & Sacc.) P. Chaverri & Salgado, in Chaverri *et al.*, *Stud. Mycol.* 68: 77 (2011)

Habit and habitat:—endophyte, on bark of decomposing branches.

Distribution:—Tlanchinol, Hidalgo, in the Mexican tropical montane cloud forest (Raymundo *et al.* 2017).

Specimen:—El Relámpago, 28 May 2016, *T. Raymundo 6128* (ENCB).

Remarks:—perithecia 396–414 × 284–360 µm, solitary, gregarious, superficial in the substrate, globose with an apical ring, intense red colour changing to magenta in KOH. Ostioles consisting of an apical ring 179–196 × 51–68 µm, with elongated cells, obpyriform to cordiform, 28–48 × 20–26.4 µm, thick wall up to 4 µm thick. Cells of the perithecium wall with epidermoid texture, globose to irregular, 20–21.6 × 13.6–21.6 µm diameter. Asci octosporate, clavate, 76–96 × 9–12 µm. Ascospores 13.6–16.8 × 5.6–7.2 µm, uniseriate, bicellular, with median septum, hyaline, thin-walled, ellipsoidal, spinulose to verrucose.

Chaetosphaeriales, Chaetosphaeriaceae

***Chaetosphaeria ellisii* (M.E. Barr) Huhndorf & F.A. Fernández, *Fungal Diversity* 19: 27 (2005) (Fig. 5)

Perithecia 150–300 µm diameter, globose to ovoid, black to red-brown, papillate with peridium 20–25 µm thick, globose texture by pseudoparenchymatic cells, 4 × 8 µm diameter, pale brown. Setae 20–45 µm long, brown, stiff, pointed, arising from the inner layer of small brown cells. Paraphyses 3–4 µm wide, numerous, septate, tapering toward apex. Asci 162–180 × 10–15 µm, cylindrical, rounded apex, refractive apical ring, short-stalked, octosporic, triseriate. Ascospores 50–74 × 3–4.4 µm, filiform, apical end broadly rounded, basal end narrowly rounded, straight to slightly curved, hyaline, smooth, 7-septate.

Habit and habitat:—endophyte, gregarious, on bark of decomposing branches.

Distribution:—USA (Huhndorf & Fernández 2005).

Specimen:—La Esperanza, 30 April 2018, *R. Valenzuela 18190* (ENCB).

**Chaetosphaeria lapaziana* (G.C. Carroll & Munk) F.A. Fernández & Huhndorf, *Fungal Diversity* 18: 49 (2005)

Habit and habitat:—endophyte, gregarious, on bark of decomposing branches.

Distribution:—Hidalgo (Raymundo *et al.* 2016).

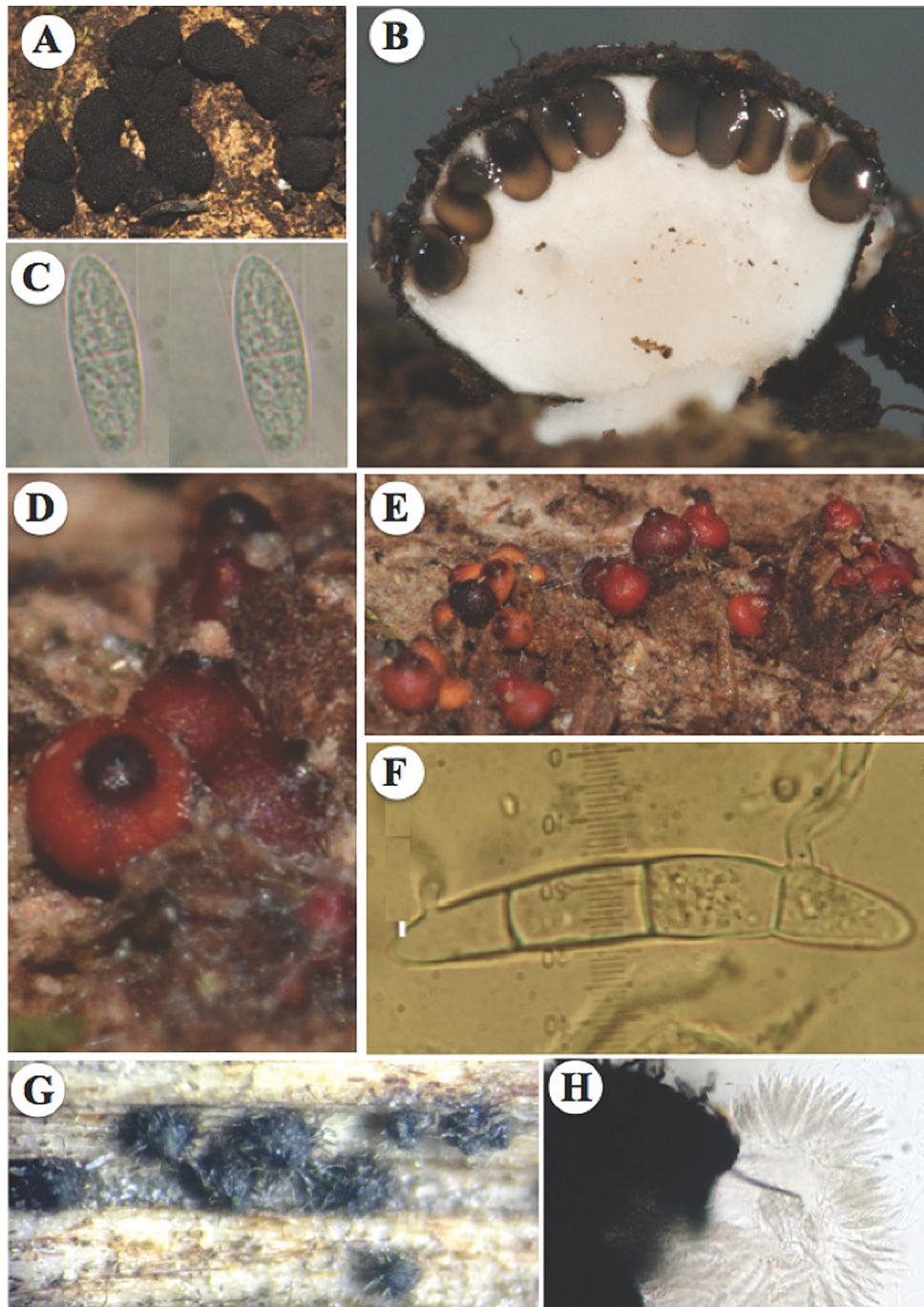


FIGURE 5. *Calyculosphaeria macrospora*. A. Stromata. B. Ascomata. C. Ascospores. *Thelonectria lucida*. D, E. Perithecia. F. Conidium. *Chaetosphaeria ellisii*. G. Perithecia. H. Hymenium.

Specimens:—La Esperanza, 30 April 2018, R. Valenzuela 18190 (ENCB).

Remarks:—perithecia 400–800 × 600–1000 μm, ovoid to pyriform, dark brown to black, smooth. Asci 160–300 × 18–24 μm, cylindrical, octosporic. Ascospores 48–80 × 4.5–7 μm, filiform, 7-septate, hyaline.

Sordariales, Lasiosphaeriaceae

*****Cercophora costaricensis*** (G.C. Carroll & Munk) O. Hilber & R. Hilber, *Z. Mykol.* 45(2): 217 (1979) (Fig. 6)

Perithecia 300–400 μm diameter, ovoid, dark brown, cartilaginous and wrinkled, scarce subiculum at the base composed of brown hyphae.

Paraphyses not observed. Asci 135–186 × 13–16 μm, clavate, stipe 30–66 μm long, octosporate. Ascospores 18–22 × 10–13 μm, cylindrical, 1/3 of the apical part inflated with ellipsoid shape, the basal part forms a septum, biseriate, usually hyaline or brown.

Habit and habitat:—endophyte, on decomposing trunks.

Distribution:—Costa Rica, Venezuela (Chaverri *et al.* 2011).

Specimen:—El Relámpago, 26 Sept. 2015, B. Pérez 10 (ENCB).

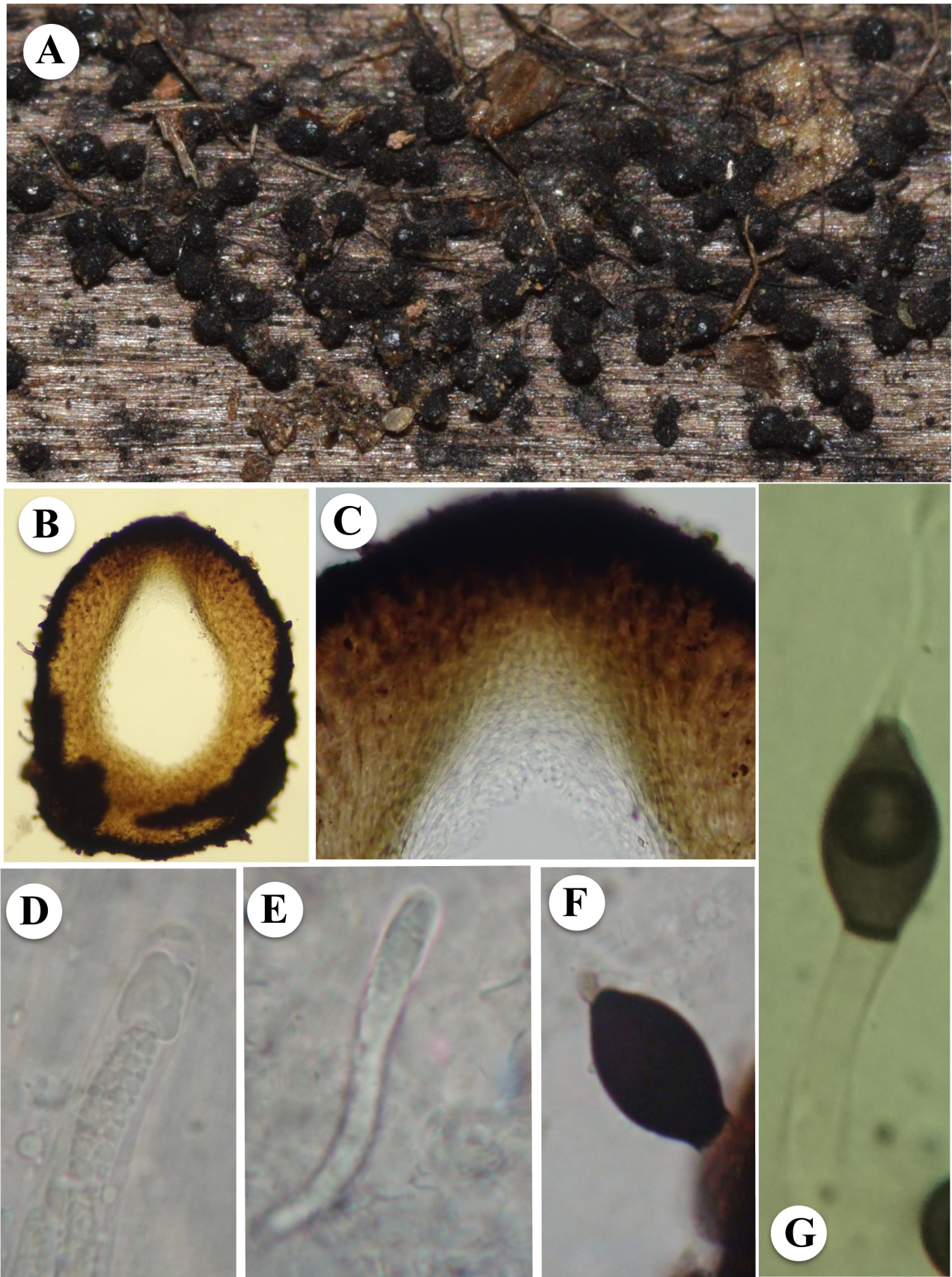


FIGURE 6. *Cercophora costarricensis*. A. Perithecia. B. Transverse section of perithecium. C. Ostiole. D. Apical pore of ascus. E. Immature ascospore. F, G. Ascospores with appendix.

*****Lasiosphaeria ovina*** (Pers.) Ces. & De Not., *Comm. Soc. crittog. Ital.* 1(fasc. 4): 229 (1863) (Fig. 7)

Perithecia 0.5 mm diameter and height, gregarious, superficial, globose-ovoid, carbonaceous consistency, black, densely covered by white hyphae, except at the apex where the ostiole is visible. Paraphyses cylindrical, septate, moliniiform. Asci 175–228 × 11.4–19 µm, cylindrical, slightly widened in the central part, rounded at the apex, unitunicate, octosporate, not amyloid. Ascospores 35.4–68 × 2.6–6.6 µm, cylindrical, curved, guttulate, septate, with appendages at both ends, more than 27 µm in length, hyaline, irregularly biseriolate.

Habit and habitat:—endophyte, on decomposing trunks, growing with *Rosellinia necatrix* Berl. ex Prill.

Distribution:—Italy (Medardi 2006), Switzerland (Breitenbach & Kranzlin 1984), Spain (Rubio *et al.* 2005).

Specimens:—El Relámpago, 26 Sept. 2015, *B. Hernández 13* (ENCB); La Esperanza, 23 May 2017, *T. Raymundo 6600* (ENCB).

Xylariales, Diatrypaceae

Diatrype microstega Ellis & Everh., *N. Amer. Pyren.*: 574 (1892)

Habit and habitat:—endophyte, on decomposing trunks.

Distribution:—Coahuila (Chacón 2003a), Oaxaca (Raymundo *et al.* 2013).

Specimens:—El Relámpago, 16 May 2015, *R. Valenzuela 16147* (ENCB); *16174* (ENCB); *T. Raymundo 5744* (ENCB); *T. Raymundo 5712* (ENCB); 26 Sept. 2015, *A. Barbosa 16* (ENCB); San Bernardo, 15 May 2015, *T. Raymundo 5683* (ENCB); *T. Raymundo 5676* (ENCB); 25 Sept. 2015, *B. Sotelo 7* (ENCB).

Eutypa flavovirens (Pers.) Tul. & C. Tul., *Select. fung. carpol.* 2: 57 (1863)

Habit and habitat:—endophyte, on decomposing trunks.

Distribution:—Oaxaca (Galicia-Ávila 2014), Tamaulipas, Veracruz (Chacón 2003a).

Specimen:—San Bernardo, 25 Sept. 2015, *B. Hernández 3* (ENCB).

Graphostromataceae

****Biscogniauxia mediterranea*** (De Not.) Kuntze, *Revis. gen. pl.* 2: 398 (1891)

Habit and habitat:—endophyte, on bark of newly fallen trees of *Oreomunnea mexicana*.

Distribution:—Ju *et al.* (1993) recorded this species from Europe and Mexico (France, Italy, Portugal and Tamaulipas, Mexico).

Specimens:—San Bernardo, 26 Sept. 2015, *B. Pérez-Rosas 15* (ENCB); 25 Nov. 2016, *T. Raymundo 6457* (ENCB); *6467* (ENCB); *6468* (ENCB); *R. Valenzuela 17078* (ENCB).

Remarks:—stromata 500–1000 × 200–400 × 6–10 mm, flattened, black, carbonaceous. Perithecia inconspicuous, subglobose to obovoid, 500–700 × 300–500 µm. Asci 90–120 × 9–12 µm, cylindrical, with stipes 15–30 µm long, apical ring amyloid, discoid, octosporic. Ascospores 10–12 × 7.2–8.4 µm, ellipsoid, with straight germ line, dark brown.

Hypoxylaceae

****Jackrogersella cohaerens*** (Pers.) L. Wendt, Kuhnert & M. Stadler, in Wendt *et al.*, *Mycol. Progr.*: 10.1007/s11557-017-1311-3, [27] (2017)

Habit and habitat:—endophyte, on bark of dead tree branches.

Distribution:—Chiapas and Tamaulipas (San Martín *et al.* 1999), Hidalgo (Raymundo *et al.* 2016a).

Specimen:—La Esperanza, 28 May 2016, *L. Fernández 9* (ENCB).

Remarks:—the species has brown pulvinate to glomerulus stromata. Growing on decaying wood of *Quercus* in Hidalgo.

Xylariaceae

****Rosellinia aquila*** (Fr.) Ces. & De Not., *G. bot. ital.* 1(1): 334 (1844)

Habit and habitat:—phytopathogen, on decaying wood.

Distribution:—Nuevo León (San Martín & Rogers 1995).

Specimens:—San Bernardo, 15 May 2015, *P. Reyes 12* (ENCB); *T. Raymundo 5710* (ENCB), *T. Raymundo 5671* (ENCB); *R. Valenzuela 16111* (ENCB); *R. Valenzuela 16145* (ENCB); 25 Sept. 2015, *T. Raymundo 5869* (ENCB); La Esperanza, 22 May 2017, *A. Maldonado 7* (ENCB).

Remarks:—perithecia 1–1.3 mm diameter, 0.8–1 mm high, dispersed or densely aggregated, globose, shiny subiculum at bottom of the stromata, outer part blackish brown, inner part black, stiff consistency, smooth surface, ostioles conical-papillate. Asci 113–139 × 6–7 µm, cylindrical, octosporate, amyloid. Ascospores 17–21 × 5.5–6 µm, ellipsoidal to navicular, inequilateral, with slightly rounded ends, brown.

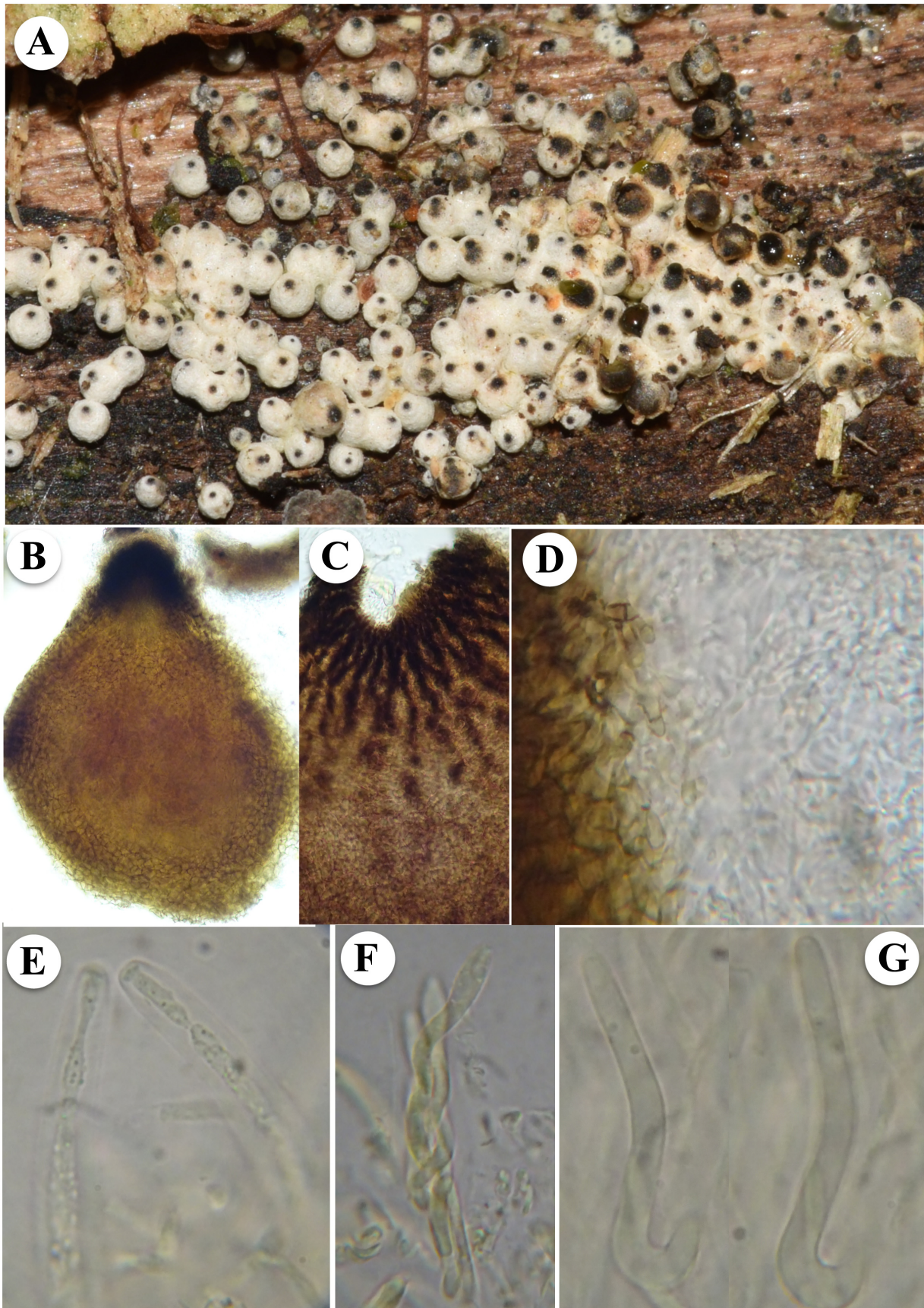


FIGURE 7. *Lasisphaeria ovina*. A, B. Perithecia. C. Ostiole. D. Perithecium wall. E. Apical pore of asci. F–G Ascospores.

**Rosellinia corticium* (Schwein.) Sacc., *Syll. fung.* 1: 253 (1882)

Habit and habitat:—phytopathogen on monocot.

Distribution:—Nuevo León (San Martín & Rogers 1995).

Specimens:—San Bernardo, 15 May 2015, *T. Raymundo 5671* (ENCB); *P. Reyes 7* (ENCB); 25 Sept. 2015, *B. Hernández 5* (ENCB); La Esperanza, 22 May 2017, *T. Raymundo 6597* (ENCB).

Remarks:—perithecia 1–1.3 mm diameter, 0.8–1 mm high, solitary or densely aggregated, globose, black, ostioles papillate. Asci 7–11×4–6.5 µm, cylindrical, octosporate, amyloid. Ascospores 19–27 × 7.5–10(–12) µm, ellipsoidal, inequilateral, olive to brown.

Rosellinia necatrix Berl. ex Prill., *Bull. Soc. mycol. Fr.* 20: 34 (1904)

Habit and habitat:—phytopathogen, on decomposing trunks.

Distribution:—Chiapas and Oaxaca (San Martín & Rogers 1995).

Specimens:—La Esperanza, 22 May 2017, *T. Raymundo 6603* (ENCB), *R. Valenzuela 17217* (ENCB), *A. Cobos Villagrán 1134* (ENCB).

Xylaria anisopleura (Mont.) Fr., *Nova Acta R. Soc. Scient. upsal.*, Ser. 3 1(1): 127 (1851)

Habit and habitat:—endophyte, on decomposing branches.

Distribution:—Chiapas, Oaxaca, Quintana Roo, Tabasco, Tamaulipas, Veracruz (San Martín & Rogers 1989, 1995), Hidalgo (Raymundo *et al.* 2016).

Specimen:—El Relámpago, 26 Sept. 2015, *A. Zamora 28* (ENCB).

Xylaria apiculata Cooke, *Grevillea* 8(46): 66 (1879)

Habit and habitat:—endophyte, on decomposing trunks.

Distribution:—Chiapas and Tamaulipas (San Martín & Rogers 1995).

Specimens:—La Esperanza, 22 May 2017, *T. Raymundo 6595* (ENCB); *R. Valenzuela 17222* (ENCB).

Remarks:—cylindrical stromata 20–30 × 5–8 mm, black, and a sterile apex. Perithecia 300–600 µm diameter, globose with thick wall. Asci 230–280 × 7–9 µm, cylindrical with apical amyloid pore. Ascospores 20–28 × 7–12 µm, ellipsoid, smooth, with straight germline

**Xylaria arbuscula* Sacc., *Michelia* 1(2): 249 (1878)

Habit and habitat:—endophyte, on roots of *Oreomunnea mexicana*.

Distribution:—Nuevo León, Tamaulipas, Quintana Roo (San Martín & Rogers 1989), Veracruz (Medel & Chacón 1999, Medel *et al.* 2008), Hidalgo (Raymundo *et al.* 2016), Michoacán (Becerril-Navarrete *et al.* 2018).

Specimens:—El Relámpago, 26 Sept. 2015, *A. Zamora 2* (ENCB); *6* (ENCB); *7* (ENCB); *8* (ENCB); *10* (ENCB); *11* (ENCB); *12* (ENCB); *15* (ENCB); *17* (ENCB); *18* (ENCB); *19* (ENCB); *21* (ENCB); *24* (ENCB).

Remarks:—cylindrical to conical stromata 30–40 × 10–14 mm, dark brown to black, with corky greyish brown scales, slightly rough by ostiolar papillae. Perithecia 300–600 µm diameter, globose with thick wall. Asci 130–200 × 6.4–8 µm, cylindrical with apical amyloid pore. Ascospores 12–18 × 4.4–6.4 µm, ellipsoid, smooth, with slightly undulating longitudinal germ pore.

**Xylaria coccophora* Mont., *Annl. Sci. Nat., Bot.*, sér. 4, 3: 109 (1855)

Habit and habitat:—endophyte, on decomposing trunks.

Distribution:—Quintana Roo and Tamaulipas (San Martín & Rogers 1989), Veracruz (Medel *et al.* 2008), Hidalgo (Raymundo *et al.* 2016).

Specimen:—El Relámpago, 26 Sept. 2015, *A. Zamora 14* (ENCB).

Remarks:—cylindrical stromata, 30–60 × 3–5 mm, black with whitish remnants, nodulous surface by conspicuous perithecia, acute and sterile apex, smooth stipe and rough stroma by ostiolar papillae. Perithecia 400–800 µm diameter, globose, with thick wall. Asci 150–160 × 5–5.6 µm, cylindrical with amyloid apical pore. Ascospores 10–13 × 4–4.4 µm, ellipsoid, smooth, with oblique longitudinal germ pore.

**Xylaria corniculata* Sacc., *Annl. mycol.* 4(1): 75 (1906)

Habit and habitat:—endophyte, on decomposing trunks.

Distribution:—Tamaulipas (San Martín & Rogers 1989), Veracruz (Medel *et al.* 2008), Michoacán (Becerril-Navarrete *et al.* 2018), Hidalgo (Raymundo *et al.* 2019).

Specimen:—El Relámpago, 26 Sept. 2015, *A. Zamora 16* (ENCB).

Remarks:—stromata 30–50 × 4–10 mm, cylindrical to digitiform, with the fertile part brown and the base black with a velvety to villous texture. Ascospores 17–19 × 7–8 µm, ellipsoidal to navicular, with sharp ends and smooth walls.

**Xylaria cubensis* (Mont.) Fr., *Nova Acta R. Soc. Scient. upsal.*, Ser 1(1): 126 (1851)

Habit and habitat:—endophyte, on decomposing trunks.

Distribution:—Chiapas, Quintana Roo, Tamaulipas (San Martín & Rogers 1989), Hidalgo (Raymundo *et al.* 2016).

Specimen:—El Relámpago, 29 May 2016, *T. Raymundo 6151* (ENCB).

Remarks:—claviform stromata, 40–60 × 10–15 mm, coppery brown to dark brown or black with age, fragile, smooth with evident ostiolar papillae. Perithecia 400–600 µm diameter, globose, with thick wall. Asci 124–160 × 4–4 µm, cylindrical, with apical amyloid pore. Ascospores 8–10 × 4–5 µm, ellipsoid, smooth, with longitudinal germ pore.

Xylaria heliscus (Mont.) J.D. Rogers & Y.M. Ju, *Mycotaxon* 68: 370 (1998)

Habit and habitat:—endophyte, on decomposing trunks.

Distribution:—Veracruz (San Martín & Rogers 1993).

Specimens:—La Esperanza, 23 May 2017, *T. Raymundo 6606, 6623* (ENCB); *R. Valenzuela 17225* (ENCB).

Remarks:—stromata 3–5 × 0.5–1 mm, clavate, branched at the base, capitate apical part, black. Ascospores 9–11 × 5–6 µm, ellipsoid, inequilateral, with a broad to narrow rounded end, with straight germ pore.

**Xylaria laevis* Lloyd, *Mycol. Notes* 65(5): 8 (1918)

Habit and habitat:—endophyte, on decomposing trunks.

Distribution:—Tamaulipas (San Martín & Rogers 1989), Veracruz (Medel *et al.* 2008), Hidalgo (Raymundo *et al.* 2016).

Specimen:—El Relámpago, 26 Sept. 2015, *A. Zamora 27* (ENCB).

Remarks:—elongated to claviform stromata 20–25 × 5–8 mm, coppery brown to dark brown to black, smooth with thin ostiolar papillae. Perithecia 300–500 µm diameter, globose with thick wall. Asci 104–196 × 5–6.4 µm, cylindrical with amyloid apical pore. Ascospores 9.6–12 × 4–5 µm, ellipsoid, smooth, with straight longitudinal germ pore.

Xylaria longipes Nitschke, *Pyrenomyc. Germ.* 1: 14 (1867)

Habit and habitat:—endophyte, on decomposing trunks.

Distribution:—Chiapas (San Martín & Rogers 1989), Jalisco and Veracruz (Medel *et al.* 2008; 2010), Hidalgo (Raymundo *et al.* 2016).

Specimen:—El Relámpago, 26 Sept. 2015, *A. Zamora 1* (ENCB).

Remarks:—stromata 40–80 × 5–10 mm, cylindrical to claviform with black rounded apices, smooth to slightly rugose by ostiolar papillae, 300–800 µm diameter, globose with thick walls. Asci 160–186 × 5–6 µm, cylindrical with apical amyloid pore. Ascospores 13–16 × 4–5 µm, ellipsoid, smooth, with a longitudinal undulating germ pore.

**Xylaria nigrescens* (Sacc.) Lloyd, *Mycol. Writ.* 5: 8 (1918)

Habit and habitat:—endophyte, decomposing trunks.

Distribution:—Chiapas (San Martín & Rogers 1989), Veracruz (Medel *et al.* 2008).

Specimen:—La Esperanza, 22 May 2017, *T. Raymundo 6595* (ENCB).

Remarks:—stromata 20–60 × 5–10 mm, cylindrical to claviform with rounded apices, dark brown to black, smooth but with evident ostioles. Perithecia 500–1000 µm diameter, globose with thick wall. Asci 160–186 × 5–6 µm, cylindrical, with apical amyloid pore. Ascospores 22–32 × 6–8 µm, ellipsoid to navicular with rounded ends, dark brown, smooth, longitudinal, oblique germ pore.

Xylaria schweinitzii Berk. & M.A. Curtis, *J. Acad. nat. Sci. Philad.*, N.S. 2(6): 284 (1854)

Habit and habitat:—endophyte, on decomposing trunks.

Distribution:—Chiapas, Nuevo León, Oaxaca, Veracruz (San Martín & Rogers 1989), Veracruz (Medel *et al.* 2008).

Specimen:—El Relámpago, 26 Sept. 2015, *A. Zamora 9* (ENCB).

**Xylaria scruposa* (Fr.) Fr., *Nova Acta R. Soc. Scient. upsal.*, Ser. 3 1(1): 127 (1851)

Habit and habitat:—endophyte, on decaying trunks.

Distribution:—Chiapas, Michoacán, Veracruz (San Martín & Rogers 1989), Michoacán (Becerril-Navarrete *et al.* 2018), Veracruz (Medel *et al.* 2008).

Specimens:—El Relámpago, 26 Sept. 2015, *A. Zamora 4* (ENCB); 22 (ENCB); 23 (ENCB) 25 (ENCB).

Remarks:—stromata 40–80 × 5–10 mm, cylindrical, claviform to irregular with rounded to acute apex, dark brown to black, rugose by ostiolar papillae. Perithecia 500–1000 µm diameter, globose with thick wall. Asci 180–224 × 7.5–8 µm, cylindrical, amyloid apical pore. Ascospores 18–21 × 4–5 µm, ellipsoid with rounded to sharp ends, brown, smooth, with undulating to longitudinal spiral germ pores.

**Xylophaera comosa* (Mont.) Dennis, *Kew Bull.* [13](1): 103 (1958)

Habit and habitat:—endophyte, on decomposing trunks.

Distribution:—Chiapas, Tabasco (San Martín & Rogers 1995).

Specimen:—El Relámpago, 26 Sept. 2015. *A. Zamora* 29 (ENCB).

Remarks:—stroma 1 cm long, 5 mm diameter, subglobose, pyriform or oblong, and slender stipes, 4 cm long, 1–1.5 mm diameter. Perithecia with papillate ostioles. Asci 200–250 × 5–6 µm, cylindrical, stipitate, octosporate, amyloid. Ascospores 29–33 × 7–9 µm, ellipsoidal, unequilateral, pointed ends, brown.

Conclusions

Ascomycetes have an exceptional richness in the tropical montane cloud forest of La Chinantla. They are favoured by unique ecologic factors, such as intense precipitation and many of the species are associated with Fagaceae trees. Biogeographically, this area is crucial because it is localized in the Mesoamerican biogeographic node of Croizat (1950) and in the Mesoamerican hotspot of Myers *et al.* (2000). The authorities of La Esperanza protect the forest and implement forest conservation programs, preventing native species of fungi, plants, animals from being removed.

Most of these fungi are endophytic species in the sense of Bayman (2007); they have a non-obstructive, asymptomatic, and transient association defined by their position. These fungi can inhabit intra- and intercellular spaces of different plant organs such as stems, roots, petioles, segments of the leaf, inflorescences, fruits, buds, and seeds. Nevertheless, there is a close relationship between some fungi with *Oreomunnea mexicana* and other dominant and co-dominant trees, endemic or with a restricted and relict distribution, as is the case of *Ascocoryne inflata*, *Biscogniauxia mediterranea*, *Cerion leucophaeum*, *Lachnum apalum*, and *Xylaria arbuscula*. Most of the endophytic fungi belong to the Chaetosphaeriales, Helotiales, Hypocreales, Sordariales, and Xylariales. Recent literature, *e.g.*, Rashmi *et al.* (2019), cited many species found in La Chinantla as endophytic.

Chacón & Medel (1993) provided the first compilation of ascomycetes from the Mexican cloud forest reporting 96 species. Later, Medel (2013) recorded 107 species, increasing by only 11 the number of species for the TMCF. Medel (2013) indicated that the best represented species of Ascomycetes in the Mexican cloud forest belong to *Hypoxylon* and *Xylaria*. However, in our study, species of *Xylaria* are the best represented.

We found the following associations between angiosperms, cycads, and fungi: *Lachnum apalum* is an endophyte in trunks of *Oreomunnea*; *L. pteridophyllum* and *L. rhytismatis* on *Cyathea divergens*; *Bisporella sulphurina* on cycads; and *Incrucipulum ciliare* on *Cyathea* spp.; *Coccomyces limitatus* and *Martamyces quadrididus* on *Clusia* sp.; *Ascocoryne inflata*, *Cerion leucophaeum*, *Lachnum apalum*, *Xylaria arbuscula*, and *Biscogniauxia mediterranea* on *Oreomunnea mexicana*.

Our findings show that the TMCF harbour a great diversity of Ascomycetes in different ecological niches that maintain the balance of the ecosystem. The taxonomic richness of this group of fungi is variable according to the geographic location and dominant floristic components. Until now, there are 208 species of Ascomycetes known in the Mexican TMCF.

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