Macromycetes from woodland zones of Milpa Alta mayoralty, Mexico City, Mexico

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ABSTRACT — Previous studies about macromycete diversity in the Milpa Alta mayoralty demonstrated the presence of only one species (*Amanita aspera* var. *franchetii*). To update records from this region, specimens were collected in woodland areas during the rainy seasons (June-October) from 2008 to 2017. A total of 225 specimens were collected in 32 localities across different elevations and vegetation types. Specimens were morphologically identified with specialized literature. The macromycetes studied include 82 species, 59 genera, and 36 families. There is one new record for the country (*Calyptella campanula*) and 29 for Mexico City, and all the species are new to the mayoralty. Reference material was deposited in the Herbarium of the Sciences Faculty, UNAM, Mexico City (FCME). There are still unexplored localities in the area, so many more species are expected to be discovered.

KEY WORDS — *Ascomycota*, *Basidiomycota*, Sierra Chichinautzin, taxonomy, Trans-Mexican Volcanic Belt.

Introduction

The current knowledge of macromycetes in Mexico City is insufficient with only 257 species of macromycetes cited so far. This study is part of the project entitled "Contribution to the knowledge of the biodiversity of macromycetes in the Basin of Mexico" (Sierra & al. 2016). In the case of Milpa Alta mayoralty, only one macromycete record was found, *Amanita aspera* var. *franchetii* (current name: *Amanita franchetii* (Boud.) Fayod (Fayod 1889; Pérez-Silva & Herrera 1982). Other records of macromycetes, lacking taxonomic support or scientific names, in Milpa Alta mayoralty are given by Silva-Galeana (1989), mentioning only the common names (Nahua language name and Spanish name) of some food mushrooms for the inhabitants of the area, such as Mazayelle (“Panes”-Breads), Xoletl (“Clavitos”-Small nails), Chilnanacatl (“hongo como chile”-mushroom like chili) and Menanacatl (“hongo de maguey”-mushroom of maguey). The purpose of this study was to generate the first comprehensive list of macromycetes for Milpa Alta mayoralty.

Study area. The Basin of Mexico lies in the Trans Mexican Volcanic Belt. It has been mainly inhabited by Nahua-speaking people, and some of the current inhabitants of Milpa Alta mayoralty are descendants of those. Mexico City is administratively divided into urban, and conservation land (the latter covering 51% of the total in 2016). Milpa Alta mayoralty has an area of 284.64 km2. It is part of the Trans Mexican Volcanic Belt and the Sierra Chichinautzin volcanic field and comprises landscapes of mountain ranges strongly dissected by ravines, small volcanoes and flat areas (CONAFOR 2008; Rodríguez-Gamiño & López-Blanco 2006) (Figure 1). About 98% of the mayoralty is conservation land with 43% of it composed of coniferous and angiosperm forest (DGCORENADER-SAGARPA 2005).

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In 1987 Milpa Alta mayoralty became an Ecological Conservation Area, now a crucial area for the sustainability of this great metropolis. It is of vital importance in the recharging process of Mexico City aquifers, due to the porosity of the soil, the infiltration, and storage of rainwater in groundwater (Wacher-Rodarte 2006). It is registered in the ecological recovery purposes of the Basin of Mexico as it provides almost 30% water to it. In addition, it provides other environmental services such as oxygen production, carbon dioxide capture, biodiversity conservation, erosion control land, natural landscape generation, and a place for recreation among others (CONANP 2013).

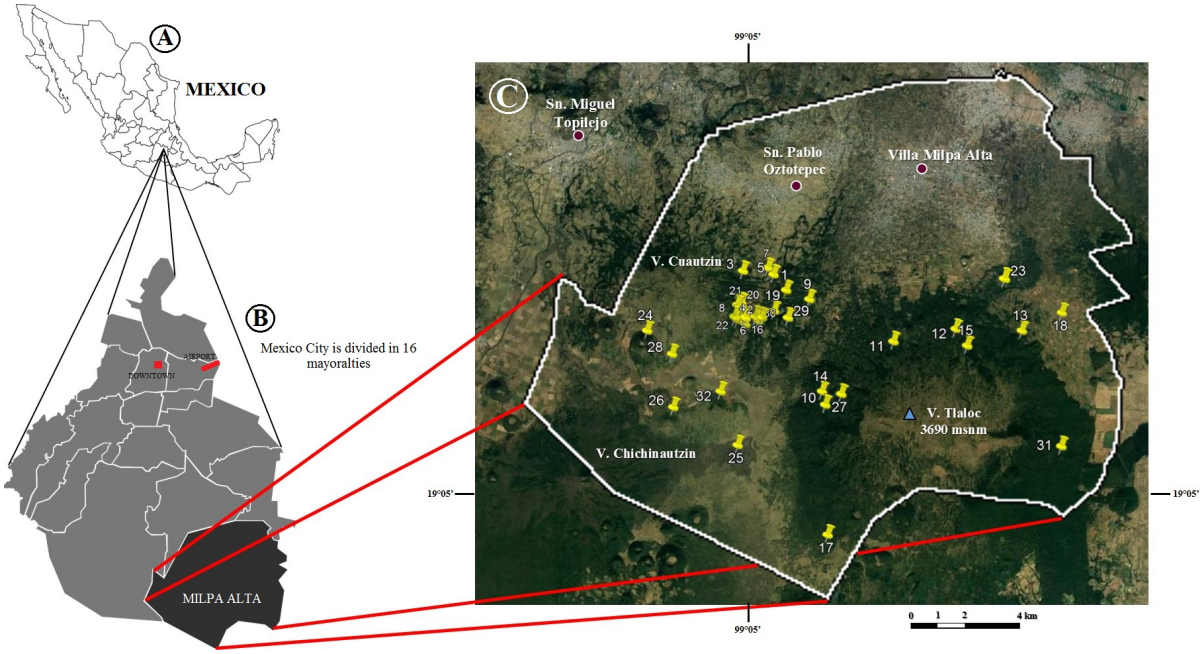

Figure 1. Distribution of the sites sampled in the Milpa Alta mayoralty, Mexico City. **A**: Map of Mexico. **B**: Map of Mexico City. Milpa Alta mayoralty is marked in black. **C.** Localities where macromycetes collections were made 📌 in Milpa Alta mayoralty woodland zones. Elevation of the highest regional peak (Tláloc Volcano, 3690 m asl) is also shown ▲.

Of the 10 main types of vegetation described from Mexico (Rzedowski 2006), Milpa Alta mayoralty has five of them: "religious fir" forest [*Abies religiosa* (Kunth) Schltdl. & Cham.], "pine" forest (*Pinus hartwegii* Lindl. and *Pinus montezumae* Lamb.), "oak" forest (*Quercus* spp.), grassland, and xerophytic scrub. All of these vegetation systems are primary sources for the presence of saprophytic and symbiotic macromycetes (CONAFOR 2008).

Materials & methods

Field work was conducted from 2008 to 2017 during the rainy season (June-October). The specimens were collected from 32 localities in the Milpa Alta mayoralty (**Table 1**; **Figure 1**) following the techniques outlined by Cifuentes & al. (1986). Colors were documented with the Methuen Handbook of Colour (Kornerup & Wanscher 1978) and Munsell Soil Color Chart (U.S.D.A. 1989). The specimens were sectioned with a thin razor blade, in different parts of the sporome according to each taxonomic group. Sections were placed on a slide and rehydrated with distilled water or 70% alcohol and subsequently mounted with 3, 5 or 10 % potassium hydroxide (KOH), depending on the material, or a drop of Melzer′s reagent to test for an amyloid or dextrinoid reaction. Observations and measurements of microscopic structures were carried out for an accurate taxonomic identification of the specimens. The identifications were made using taxonomic keys specific to each genus or

group (Lowy 1971, Jenkins 1977, Pérez-Silva & Herrera 1991, Kong & Estrada-Torres 1994, Cifuentes 1996, Bessette & al. 2000, Kong 2002, Samuels 2007, González-Mendoza 2015, Pérez-Pazos & al. 2019, among others), as well as the following field guides: Lincoff 1981, Breitenbach & Kränzlin 1984, 1986, 1991, 1995, 2000, McKnight & McKnight 1987, Bon & al. 1988, Barron 1999, Kränzlin 2005, and Phillips & al. 2010.

LOCALITY	COORDINATES	ALTITUDE
1 km N of the Volcán Ocusacayo	19°09′00”N 99°04′03″W	3070 m asl
1 km W of the Volcán Ocusacayo	19°08′27″N 99°04′33″W	3060 m asl
1.2 km N of Manitas pintadas	19°09′23″N 99°04′57″W	3130 m asl
1.2 km W of the Volcán Ocusacayo	19°08′26″N 99°04′41″W	3085 m asl
1.3 km N of the Volcán Ocusacayo	19°09′19″N 99°04′19″W	3030 m asl
1.5 km W of the Volcán Ocusacayo	19°08′25″N 99°04′54″W	3070 m asl
1.6 km SE from the guardhouse of San Pablo Oztotepec	19°09′27″N 99°04′26″W	2980 m asl
1.9 km W of the Volcán Ocusacayo	19°08′26″N 99°05′07″W	3066 m asl
2 km NE of the Volcán Ocusacayo	19°08′49″N 99°03′34″W	3030 m asl
200 m W of Atlimeya, west slope, Volcán Tláloc	19°06′42″N 99°03′14″W	3180 m asl
3.6 km E of the Volcán Ocusacayo	19°07′58″N 99°01′49″W	3280 m asl
4.5 km NE of the Volcán Tláloc	19°08′13″N 99°00′31″W	3230 m asl
6.4 km NE of the Volcán Tláloc	19°08′11″N 98°59′08″W	3180 m asl
Atlimeya, west slope, Volcán Tláloc	19°06′58″N 99°03′18″W	3250 m asl
Climbing the Volcán La Comalera	19°06′39″N 99°06′24″W	3160 m asl
Cuauhtempa and Temascal, south slope, Volcán Tláloc	19°04′05″N 99°03′11″W	3060 m asl
Cuaxuxpa, abandoned gas station	19°08′33″N 98°58′15″W	2790 m asl
High part of the Volcán Tulmiac	19°08′11″N 99°06′56″W	3300 m asl
Manitas pintadas	19°08′45″N 99°04′59″W	3130 m asl
N of Oyamepulli	19°08′42″N 99°05′04″W	3130 m asl
N of Tepexitlaco	19°09′13″N 98°59′28″W	2800 m asl
Oyamepulli	19°08′24″N 99°05′04″W	3100 m asl
Pedregal, between the volcanoes San Bartolo and Yecahuazac	19°05′53″N 99°05′04″W	3010 m asl
Road from Volcán Ocusacayo to Volcán Tulmiac	19°08′19″N 99°04′54″W	3070 m asl
Road to Cuauxuspa	19°07′53″N 99°00′17″W	3102 m asl
Tecpalo, west slope, Volcán Tláloc	19°06′55″N 99°02′54″W	3230 m asl
Volcán El Tulmiac	19°07′43″N 99°06′26″W	3080 m asl
Volcán Ocusacayo	19°08′26″N 99°04′00″W	3120 m asl
Volcán Ocusacayo, road to the mine	19°08′23″N 99°04′38″W	3070 m asl
Volcán Pelagatos, E of the Volcán Tláloc	19°05′52″N 98°58′19″W	3205 m asl
Volcán San Bartolo	19°06′58″N 99°05′25″W	3100 m asl
W and N slope of the Volcán Ocusacayo	19°08′35″N 99°04′18″W	3095 m asl

Table 1. List of localities.

Results

A total of 227 specimens were collected and compiled in a list of 82 species (**Appendix 1**. Taxonomic list of species). Data of phenology, vegetation and substrate type are reported in **Tables 2-5**. There is one new record for the country, 29 for Mexico City, and all are new to Milpa Alta mayoralty. All samples were deposited in the Sección de Hongos, FCME herbarium.

Description of a new record for the country

Calyptella campanula (Nees) W.B. Cooke, Beih. Sydowia 4: 32 (1961). **Fig. 2**

Basidiomata campanulate-stipitate to pseudostipitate, positive geotropism, up to 5 mm high (Figure 2A); color yellowish-white (3A2) to pastel-yellow (3A4), when dried yellow to orange; pileus up to 3 mm in diameter; inside of pileus slightly ridged; irregular edge at maturity; outside finely velvety; stipe up to 1.5 mm long, cylindrical, less than one mm wide.

Spores 6−8 × 4.5−6 μm, elliptical, smooth, hyaline; hilar appendix up to one μm in length (Figure 2C); basidia 22−24 × 7−8 μm, four-sterigmate, hyaline (Figure 2B); sterigmata up to 4 × 1.5; hyphae with clamp connections.

Specimens examined: MEXICO, Mexico City: Milpa Alta mayoralty, 1 km N from Volcán Ocusacayo, 19°09′00″N 99°04′03″W, 3070 m asl, coll. S. Castro-Santiuste ncn (no collection number), 05/IX/2008 (FCME 27328). 1.2 km N from Manitas pintadas, 19°09′23″N 99°04′ 57″W, 3130 m asl, coll. D. Guzmán-Ramírez 75, 13/IX/2014 (FCME 27327).

Habitat: In *Pinus-Alnus* forest, on rotten wood.

Taxonomic comments. Cooke (1962) describes *Calyptella campanula* transferring it from the genus *Peziza* (*Peziza campanul*a Ness. 1816), proposing two varieties: *C. campanula* v. *campanula* and *C. campanula* v. *myceliosa*. Of the two varieties discussed by Cooke, the v. *campanula* is the one that has the most similar characteristics with the Mexican material. He mentioned "*…margin straight to inrolled…*" and this can be seen in **Figure 2A**, as well as the shape and size of the basidiospores "*…spores hyaline, smooth, apiculate, ovate to tear-shaped, 7−9.5 x 4−6 µm …*" compared to those presented here: spores 6−8 × 4.5−6 μm, elliptical, smooth, hyaline; hilar appendix up to 1 μm in length (**Figure 2C**). Cooke (1962) reports it for Europe and North America. Based on the above morphological descriptors, it is considered the first record for Mexico.

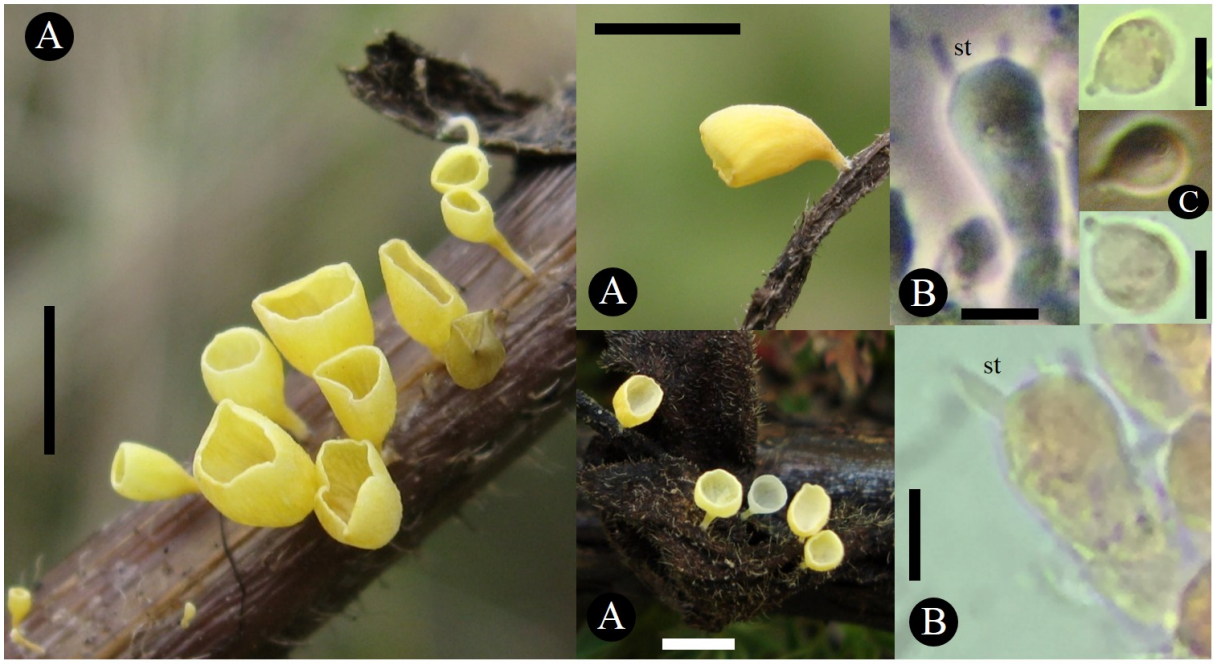

Figure 2. *Calyptella campanula*. A. Basidiomata. B. Basidia with visible sterigmata. C. Spores. Scale bars: A. 5 mm. B and C. 5 µm.

Discussion

Of the 82 species studied here, six species complexes are recognized (*Cantharellus cibarius*, *Gymnopus dryophilus*, *Lactarius deliciosus*, *Lyophyllum decastes*, *Russula brevipes*, and *Suillus granulatus* complexes), five species are cited as *confer* (cf.), and only four species are recognized to genus level. The reported species belong to 59 genera and 36 different families according to the Index Fungorum (2021). Regarding species abundance the order Agaricales is represented with 22 species, followed by Boletales with 15, and Dacrymycetales with seven. Some species are illustrated in **Figures 3—8**. At the phylum level, 18 Ascomycota species (22%) were collected compared to 64 Basidiomycota (78%) resulting in a ratio closest to 1: 4 which is similar to previous ratios of 1: 4 to 1: 9 reported from other parts of México (Guzmán-Dávalos & Guzmán 1979, Cifuentes & al. 1997, Villarruel-Ordaz & Cifuentes 2007, Mori del Águila & al. 2011, Villarruel-Ordaz & al. 2015).

VEGETATION	NUMBER OF COLLECTIONS/SPECIES
Pinus spp.	82/32
Abies religiosa - *Pinus* spp.	78/30
Pinus spp. - *Alnus* spp.	54/19
Abies religiosa	7/5
Pinus spp. - *Cupressus lusitanica*	3/1
Pinus spp. - *Quercus* spp.	2/1
Abies religiosa - *Cupressus lusitanica*	1/1

Table 2. Number of macromycetes species based on the type of vegetation.

It should be noted that both *Pinus* spp. and *Abies religiosa* forests are the most abundant in the area of the mayoralty and therefore represent the biggest number of fungal collections (**Table 2**).

In a period of 10 years, the most frequently collected species from the phylum Ascomycota were *Helvella macropus* (five times), *Helvella lacunosa* and *Geopyxis vulcanal*is (four times each). A number of 10 species (unusual or rare) are represented by a single collection or record over these 10 years.

With respect to the phylum Basidiomycota, the species *Dacrymyces dictyosporus* (14 times), *Dacrymyces chrysospermus* (13), *Calocera macrospora* and *Laccaria trichodermophora* (9) are the most frequent. 23 species (unusual or rare) are represented by a single collection or record over these 10 years.

Of the 227 specimens, more than 130 (57%) were collected in seven of the 32 explored localities.

SUBSTRATE	SPECIMENS
Dung	3
Humus	32
Parasite	1
Soil	127
Soil/Humus	1
Wood-inhabiting	63
Total	227

Table 3. Substrate type of macromycetes specimens collected.

Regarding the substrate in which they grow, we have that most were on soil (127 specimens), followed by wood (63), humus (32), dung (3), and one specimen growing as a parasite and one in soil with a lot of organic matter (**Table 3**).

Figure 3. Macromycetes species found in the Milpa Alta mayoralty, Mexico City. A. *Faerberia carbonaria*. B. *Geopyxis carbonaria*. C. *Coprinopsis atramentaria*. D. *Boletus* cf. *reticulatus*. E. *Lyophyllum decastes* complex. F. *Tricholoma imbricatum*.

Figure 4. Macromycetes species found in the Milpa Alta mayoralty, Mexico City. A. *Helvella acetabulum*. B. *Crucibulum laeve*. C. *Phaeoclavulina abietina*. D. *Boletus* cf. *reticulatus*. E. *Amanita muscaria* var. *flavivolvata*. F. *Laccaria trichodermophora*.

Figure 5. Macromycetes species found in the Milpa Alta mayoralty, Mexico City. A. *Lycoperdon perlatum*. B. *Helvella lacunosa*. C. *Lactarius deliciosus* complex. D. *Sowerbyella rhenana*. E. *Pseudohydnum gelatinosum*. F. *Guepinia helvelloides*. G. *Amanita basii*. H. *Porphyrellus porphyrosporus*.

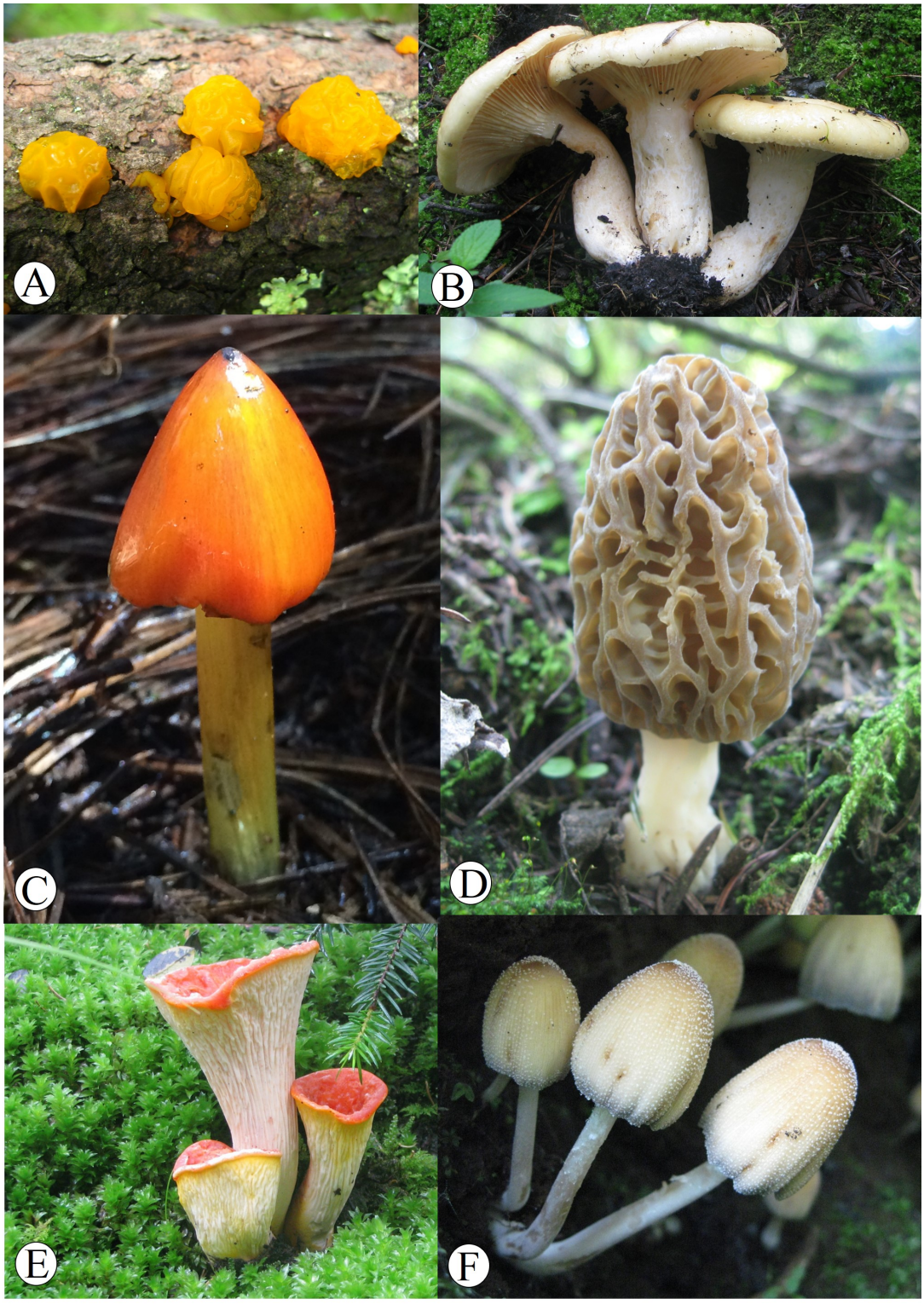
A
B
C
D
E
F

Figure 6. Macromycetes species found in the Milpa Alta mayoralty, Mexico City. A. *Dacrymyces chrysospermus*. B. *Lactarius mexicanus*. C. *Hygrocybe conica*. D. *Morchella esculenta*. E. *Turbinellus floccosus*. F. *Coprinellus micaceus*.

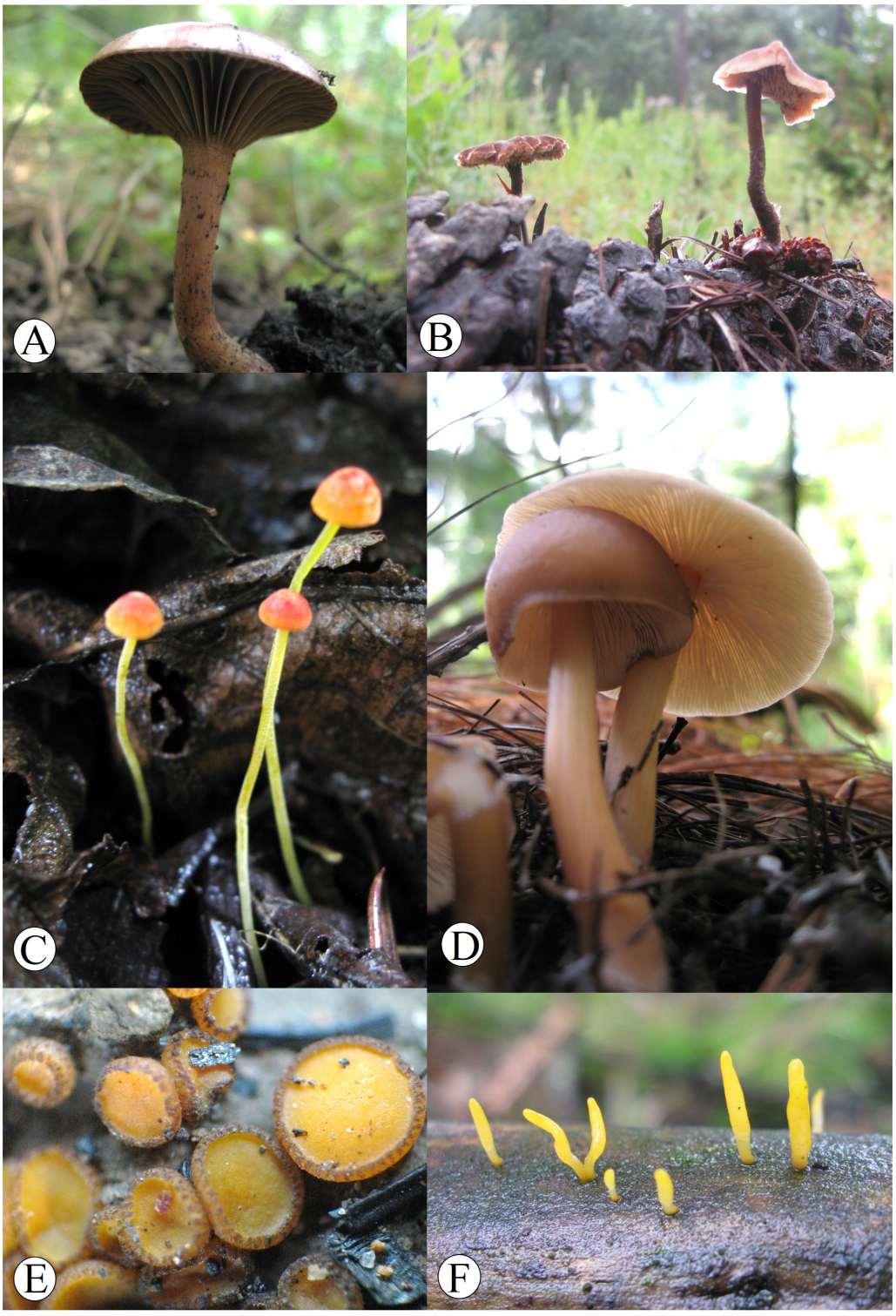

Figure 7. Macromycetes species found in the Milpa Alta mayoralty, Mexico City. A. *Chroogomphus* cf. *rutilus*. B. *Auriscalpium vulgare*. C. *Mycena acicula*. D. *Gymnopus dryophilus* complex. E. *Anthracobia melaloma*. F. *Calocera macrospora*.

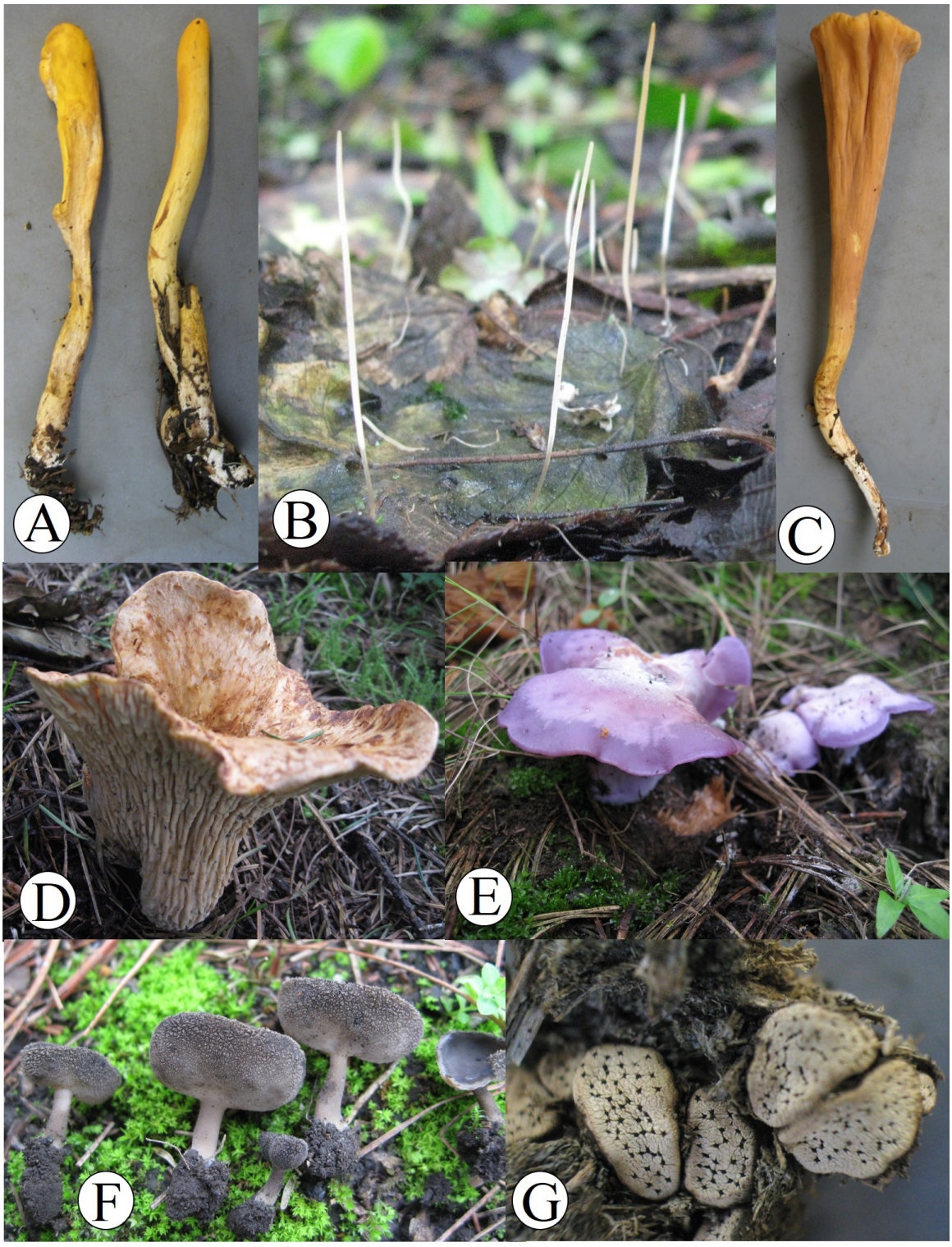

Figure 8. Macromycetes species found in the Milpa Alta mayoralty, Mexico City. A. *Clavariadelphus* sp. B. *Typhula juncea*. C. *Clavariadelphus truncatus*. D. *Turbinellus kauffmanii*. E. *Lepista nuda*. F. *Helvella macropus*. G. *Poronia punctata*.

YEAR	SPECIMENS
2008	49
2009	44
2010	21
2012	3
2013	20
2014	21
2015	41
2016	24
2017	4
Total	227

Table 4. Specimens recollected by year.

The collection of specimens was very uneven in terms of the years of exploration. The years with most specimens collected were 2008 (49), 2009 (44) and 2015 (41) and the least represented by 2011 (0), 2012 (3) and 2017 (4) (**Table 4**). Due to different circumstances, not every year the same number of explorations was performed.

MONTH	SPECIMENS
June	35
July	34
August	80
September	64
October	14
Total	227

Table 5. Specimens collected by month.

In terms of the phenology, it was observed that in August and September there was a very large increase of collections made (80 and 64 specimens respectively). While in June (35), July (34) and October (14) there was a decrease in the number of specimens collected (**Table 5**). The rainiest months are from June to October, while the maximum temperatures present in the same months oscillate between the 20 and 25°C (Spark, 2021), an ideal climate for the appearance of sporomes.

Lists and inventories of biodiversity are the starting point of evolutionary, environmental, biotechnology, distribution research work and even social issues. Therefore, we need to encourage classical taxonomy along with molecular techniques, especially in little-explored regions. Studies based on macromycetes fruiting bodies make it possible to identify species and obtain lists of them, including information on their lifestyle, associations with other organisms and morphological characteristics (Schmit & Lodge 2005).

Various taxonomic studies based on macromycetes show that it is feasible to find new species within 10 years of continuous collecting (Arnolds 1988, Perini & al. 1989) and up of 21 years (Tofts & Orton 1998, Straatsma & al. 2001). Hence, the value of this work, given the fact that after 10 years of exploration in the area

we continue to find species not previously cataloged. Schmit & Lodge (2005) mention that classical sampling methods can consume more time than the use of molecular techniques. They also mention that more taxonomic expertise is required for classical methods than for molecular ones, since species must be identified based on their morphological characters. And, with the relative scarcity and continuous reduction of trained taxonomists (Buyck 1999) identification will take longer periods to complete.

Macromycetes play important ecological roles in any habitat, either as decomposers or mutualistic symbionts (mycorrhizae), essential for the optimal maintenance of the forests where they are present. Moreover, macromycetes also have social importance because some human communities make a sustainable and balanced use of them as non-timber forest resources and food consumption. The main threats to biodiversity in the world are destruction and alteration of habitats, overexploitation, chemical pollution, climate change and introduced species (Kaul 2007). Two of the biggest problems in the Milpa Alta mayoralty are forest fires and illegal logging, which have been increasing in recent years, jeopardizing the balance between conservation and urban areas. In addition, the atmospheric pollution, product of the activities of more than 10 million inhabitants from the metropolitan area, is another of the problems faced, not only by the fungal communities, but, as a whole, by all the biological diversity of the area.

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Appendix 1. Taxonomic list of species

Taxonomic Group **Vegetation type**

Ascomycota
Pezizomycotina

Pezizales

Discinaceae

Gyromitra infula (Schaeff.) Quél., Enchir. fung. (Paris): 272 (1886) Ab-P
3.6 km E to the Volcán Ocusacayo, 19°07′58″N 99°01′49″W, 3270 m asl, on soil, coll. S. Sierra ncn, 06/IX/2012 (FCME 27413).

Helvellaceae

Helvella acetabulum (L.) Quél., Hyménomycètes, Fasc. Suppl. (Alençon): 102 (1874) **Fig. 4A** Ab
Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on soil, coll. L. Izquierdo-San Agustín 06, 22/VIII/2008 (FCME 27414). Coll. L. Izquierdo-San Agustín ncn, 11/IX/2009 (FCME 2741).

Helvella atra J. König, in Olafsens & Povelsens, Reisen ingien. Island, Append.: 20 (1770) P
Pedregal, between the volcanoes San Bartolo and Yecahuazac, 19°05′53″N 99°05′04″W, 3010 m asl, on soil, coll. L. Izquierdo-San Agustín 12, 28/VIII/2008 (FCME 27416).

Helvella crispa (Scop.) Fr., Herb. Fr. (Paris) 10: tab. 465, fig. 1 (1790) Ab-P
N of Oyamepulli, 19°08′42″N 99°05′04″W, 3130 m asl, on soil, coll. I. Rodríguez-Gutiérrez 2009-XLIV, 07/X/2009 (FCME 27417). Manitas pintadas, 19°08′45″N 99°04′59″W, 3130 m asl, on soil, coll. S. Sierra ncn, 03/IX/2010 (FCME 27418). Coll. E. Juárez-Ángeles ncn, 09/IX/2015 (FCME 27419).

Helvella lacunosa Afzel., K. svenska Vetensk-Akad. Handl., ser. 2 4: 304 (1783) **Fig. 5B** Ab-P
1.5 km W to the Volcán Ocusacayo, 19°08′14″N 99°04′19″W, 3070 m asl, on humus, coll. L. Izquierdo-San Agustín 32, 26/IX/2008 (FCME 27422). Volcán Ocusacayo, 19°08′26″N 99°04′00″W, 3120 m asl, in soil, coll. L. Izquierdo-San Agustín 33, 26/IX/2008 (FCME 27421). Oyamepulli, 19°08′24″N 99°05′04″W, 3100 m asl, on humus, coll. I. Rodríguez-Gutiérrez 2009-XXIV, 04/IX/2009 (FCME 27422). Manitas pintadas, 19°08′45″N 99°04′59″W, 3130 m asl, on humus, coll. S. Sierra ncn, 03/IX/2010 (FCME 27423).

Helvella macropus (Pers.) P. Karst., Bidr. Känn. Finl. Nat. Folk 19: 37 (1871) **Fig. 8F** P
Volcán San Bartolo, 19°06′58″N 99°05′25″W, 3100 m asl, on soil, coll. S. Sierra 2008-8, 15/VIII/2009 (FCME 26161). Cuaxuxpa, abandoned gas station, 19°08′33″N 98°58′15″W, 2790 m asl, coll. L. Izquierdo-San Agustín 113, 08/VIII/2010 (FCME 26200). Manitas pintadas, 19°08′45″N 99°04′59″W, 3130 m asl, on soil, coll. L. Izquierdo-San Agustín 63, 28/VIII/2009 (FCME 26192). Coll. L. Izquierdo-San Agustín 71 (FCME 26193). N of Oyamepulli, 19°08′42″N 99°05′57″W, 3116 m asl, coll. L. Izquierdo-San Agustín 77, 07/X/2009 (FCME 26198).

Morchellaceae

Morchella esculenta (L.) Pers., Syn. meth. fung. (Göttingen) 2: 618 (1801) **Fig. 6D** Ab-P
High part of the Volcán Tulmiac, 19°08′11″N 99°06′56″W, 3300 m asl, coll. Aisenberg ncn, 19/VI/2015 (FCME 27462). Coll. L. Santiago-Gómez ncn, 19/VI/2015 (FCME 27463).

Pezizaceae

**** Anthracobia melaloma*** (Alb. & Schwein.) Arnould, Bull. Soc. mycol. Fr. 9(2): 112 (1893) **Fig. 7E** Ab
Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on burn soil, coll. S. Castro-Santiuste ncn, 11/VII/2013 (FCME 27305).

Pyronemataceae

**** Geopyxis carbonaria*** (Alb. & Schwein.) Sacc., Syll. fung. (Abellini) 8: 71 (1889) **Fig. 3B** Ab-P
Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on burn soil, coll. L. Chávez-García 5, 26/VII/2013 (FCME 27403).

**** Geopyxis vulcanalis*** (Peck) Sacc., Syll. fung. (Abellini) 8: 65 (1889) Ab-P
Pedregal, between the volcanoes San Bartolo and Yecahuazac, 19°05′53″N 99°05′04″W, 3010 m asl, on soil, coll. L. Izquierdo-San Agustín 11, 28/VIII/2008 (FCME 26177). Cuaxuxpa, abandoned gas station, 19°08′33″N 98°58′15″W, 2790 m asl, on soil, coll. L. Izquierdo-San Agustín 114, 08/VIII/2010 (FCME 26201). 147, 21/IX/2010 (FCME 26216). Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on soil, coll. L. Izquierdo-San Agustín 123, 13/VIII/2010 (FCME 26208).

Humaria hemisphaerica (F.H. Wigg.) Fuckel, Jb. nassau. Ver. Naturk. 23-24: 322 (1870) [1869-70] Ab-P
Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on soil, coll. L. Izquierdo-San Agustín 5, 22/VIII/2008 (FCME 26173). Cuaxuxpa, abandoned gas station, 19°08′33″N 98°58′15″W, 2790 m asl, on soil, coll. L. Izquierdo-San Agustín 149, 21/IX/2010 (FCME 26214). Road to Cuauxuspa, 19°07′53″N 99°00′17″W, 3102 m asl, coll. L. Izquierdo-San Agustín 167, 28/IX/2010 (FCME 26226).

**** Sowerbyella rhenana*** (Fuckel) J. Moravec, Mycol. helv. 2(1): 96 (1986) **Fig. 5D** P
Manitas pintadas, 19°08′45″N 99°04′59″W, 3130 m asl, on soil, coll. A. González-Mendoza 2, 03/IX/2010 (FCME 26210). Cuaxuxpa, abandoned gas station, 19°08′33″N 98°58′15″W, 2790 m asl, on soil, coll. L. Izquierdo-San Agustín 170, 28/IX/2010 (FCME 26229).

Tarzetta cupularis (L.) Lambotte Mém. Soc. Roy. Sci. Lieja, Serie 2 14: 325 [prepr.] (1887) P
Cuaxuxpa, abandoned gas station, 19°08′33″N 98°58′15″W, 2790 m asl, on soil, coll. L. Izquierdo-San Agustín 166, 21/IX/2010 (FCME 26225).

Sarcoscyphaceae

Pithya cupressina (Batsch) Fuckel, Jb. nassau. Ver. Naturk. 23-24: 317 (1870) Ab-Cu
1.3 km N of the Volcán Ocusacayo, 19°09′19″N 99°04′19″W, 3030 m asl, in humus (fall leaves of *Cupressus* sp.), coll. L. Izquierdo-San Agustín 21, 05/IX/2008 (FCME 26179).

Sarcosomataceae

**** Donadinia nigrella*** (Seaver) M. Carbone, Agnello & P. Alvarado, Ascomycete.org 5(1): 6 (2013) [2012] P
Cuaxuxpa, abandoned gas station, 19°08′33″N 98°58′15″W, 2790 m asl, on soil, coll. L. Izquierdo-San Agustín 171, 28/IX/2010 (FCME 26230).

Hypocreales

Hypocreaceae

Hypomyces lactifluorum (Schwein.) Tul. & C. Tul., Annls Sci. Nat., Bot., sér. 4 13: 11 (1860) P

3.6 km E of the Volcán Ocusacayo, 19°07′58″N 99°01′49″W, 3280 m asl, parasitic on *Russula* sp., coll. S. Sierra ncn, 06/IX/2012 (FCME 27441).

Xylariales

Hypoxylaceae

**** Daldinia concentrica*** (Bolton) Ces. & De Not., Comm. Soc. crittog. Ital. 1(fasc. 4): 197 (1863) P
Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on wood-rotting, coll. S. Sierra ncn, 13/VIII/2010 (FCME 27395).

**** Poronia punctata*** (L.) Fr., Summa veg. Scand., Sectio Post. (Stockholm): 382 (1849) **Figure 8G** P
Cuauhtempa and Temascal, south slope of the Volcán Tláloc, 19°04′05″N 99°03′11″W, 3060 m asl, on cow dung, coll. L. Izquierdo-San Agustín 58, 21/VIII/2009 (FCME 27469).

Basidiomycota
Agaricomycotina

Agaricales

Amanitaceae

**** Amanita basii*** Guzmán & Ram.-Guill., Biblthca Mycol. 187: 11 (2001) **Figure 5G** P
Manitas pintadas, 19°08′45″N 99°04′59″W, 3130 m asl, on soil, coll. S. Sánchez-Ramírez ncn, 28/VIII/2009 (FCME 27300). N of Oyamepulli, 19°08′42″N 99°05′04″W, 3130 m asl, on soil, coll. I. Rodríguez-Gutiérrez 2009-XLIII, 07/X/2009 (FCME 27301). 1.6 km SE from the guardhouse of San Pablo Oztotepec, 19°09′27″N 99°04′26″W, 2980 m asl, on soil, coll. G.M. Araceli ncn, 02/VII/2014 (FCME 27302). Manitas pintadas, 19°08′45″N 99°04′59″W, 3130 m asl, on soil, coll. S. Castro-Santiuste 294, 01/VII/2015 (FCME 27303).

Amanita muscaria var. ***flavivolvata*** (Singer) D.T. Jenkins, Biblthca Mycol. 57: 56 (1977) **Figure 4E** Ab-P
Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on soil, coll. S. Sánchez-Ramírez ncn, 11/IX/2013 (FCME 27304).

Hydnangiaceae

**** Laccaria trichodermophora*** G.M. Muell., Mycotaxon 20(1): 112 (1984) **Figure 4F** P
N of Oyamepulli, 19°08′42″N 99°05′04″W, 3130 m asl, in soil, coll. Izquierdo 74, 07/X/2009 (FCME 27445). Cuauhtempa and Temascal, south slope of the Volcán Tláloc, 19°04′05″N 99°03′11″W, 3060 m asl, on soil, coll. Izquierdo 54, 21/VIII/2009 (FCME 27444). Tecpalo, west slope, Volcán Tláloc, 19°06′55″N 99°02′54″W, 3230 m asl, on humus, coll. E. Ramírez-Flores 2, 25/VII/2013 (FCME 27446). Climbing the Volcán La Comalera, 19°06′39″N 99°06′24″W, 3160 m asl, on humus, coll. D. Guzmán-Ramírez 138, 17/IX/2014 (FCME 27448). On soil, coll. D. Guzmán-Ramírez 140, 17/IX/2014 (FCME 27443). Coll. D. Guzmán-Ramírez 149, 17/IX/2014 (FCME 27449). Coll. D. Guzmán-Ramírez 137, 17/IX/2014 (FCME 27447). W and N slope of the Volcán Ocusacayo, 19°08′35″N 99°04′18″W, 3095 m asl, on humus, coll. A. Gutiérrez-Sánchez 78, 29/VII/2015 (FCME 27450). Volcán Ocusacayo, road to the mine, 19°08′23″N 99°04′38″W, 3070 m asl, on soil, coll. D. Guzmán-Ramírez ncn, 29/VI/2016 (FCME 27451).

Hygrophoraceae

Hygrocybe* cf. *miniata (Fr.) P. Kumm., Führ. Pilzk. (Zerbst): 112 (1871) P-Al

1.3 km N of the Volcán Ocusacayo, 19°09′19″N 99°04′19″W, 3030 m asl, on soil, coll. T. Ramírez-Viga, 05/IX/2008 (FCME 27424). Climbing the Volcán La Comalera, 19°06′39″N 99°06′24″W, 3160 m asl, on soil, coll. D. Guzmán-Ramírez 143, 17/IX/2014 (FCME 27425).

Hygrocybe conica (Schaeff.) P. Kumm., Führ. Pilzk. (Zerbst): 111 (1871) **Figure 6C** P-Al

2 km NE of the Volcán Ocusacayo19°08′49″N 99°03′34″W, 3030 m asl, on soil, coll. T. Ramírez-Viga, 19/IX/2008 (FCME 27428). Volcán San Bartolo, 19°06′58″N 99°05′25″W, 3100 m asl, in soil, coll. I. Rodríguez-Gutiérrez 2008-4, 15/VIII/2008 (FCME 27427). S. Castro-Santiuste 148, 15/VIII/2008 (FCME 27426). Atlimeya, west slope of the Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on soil, coll. S. Castro-Santiuste 179, 14/VIII/2009 (FCME 27429). Climbing the Volcán La Comalera, 19°06′39″N 99°06′24″W, 3160 m asl, on soil, coll. D. Guzmán-Ramírez 147, 17/IX/2014 (FCME 27430). W and N slope of the Volcán Ocusacayo, 19°08′35″N 99°04′18″W, 3095 m asl, on soil, coll. L. Chávez-García 153, 29/VII/2015 (FCME 27431).

Hygrophorus chrysodon (Batsch) Fr., Epicr. syst. mycol. (Upsaliae): 320 (1838) [1836-1838] P

N of Oyamepulli, 19°08′42″N 99°05′57″W, 3116 m asl, on soil, coll. S. Castro-Santiuste 191, 07/IX/2009 (FCME 27436). Cuauhtempa and Temascal, south slope of the Volcán Tláloc, 19°04′05″N 99°03′11″W, 3060 m asl, on soil, coll. L. Izquierdo-San Agustín 56, 21/VIII/2009 (FCME 27434). Manitas pintadas, 19°08′45″N 99°04′59″W, 3130 m asl, on soil, coll. Sánchez 2009-01, 28/VIII/2009 (FCME 27435). Volcán El Tulmiac, 19°07′43″N 99°06′26″W, 3080 m asl, on soil, coll. S. Castro-Santiuste 222, 08/VIII/2013 (FCME 27437). Climbing the Volcán La Comalera, 19°06′39″N 99°06′24″W, 3160 m asl, on soil, coll. D. Guzmán-Ramírez 136, 17/IX/2014 (FCME 27438).

Hymenogastraceae

**** Gymnopilus sapineus*** (Fr.) Murrill, Mycologia 4(5): 254 (1912) P

Manitas pintadas, 19°08′45″N 99°04′59″W, 3130 m asl, on soil, coll. S. Sierra ncn, 03/IX/2010 (FCME 27405). Coll. A. Gutiérrez-Sánchez 64, 01/VII/2015 (FCME 27406). Ocusacayo, way to the mine, 19°08′23″N 99°04′38″W, 3070 m asl, on soil, coll. S. Sierra ncn, 15/VII/2015 (FCME 27407). 1.5 km W of the Volcán Ocusacayo, 19°08′14″N 99°04′19″W, 3070 m asl, in soil, coll. A. Gutiérrez-Sánchez 56, 05/VI/2015 (FCME 27408). Coll. A. Gutiérrez-Sánchez 61, 05/VI/2015 (FCME 27410). Coll. A. Gutiérrez-Sánchez 57, 05/VI/2015 (FCME 27409).

Incertae sedis

****§ Calyptella campanula*** (Nees) W.B. Cooke, Beih. Sydowia 4: 32 (1961) **Figure 2** P-Al

1 km N of the Volcán Ocusacayo, 19°09′00″N 99°04′03″W, 3070 m asl, on rotten wood, coll. S. Castro-Santiuste 165, 05/IX/2008 (FCME 27328). 1.2 km N of Manitas pintadas, 19°09′23″N 99°04′57″W, 3130 m asl, on rotten wood, coll. D. Guzmán-Ramírez 75, 13/IX/2014 (FCME 27327).

**** Crucibulum laeve*** (Huds.) Kambly, Gast. Iowa: 167 (1936) **Figure 4B** P

1.5 km W of the volcán Ocusacayo, 19°08′14″N 99°04′19″W, 3070 m asl, in soil, coll. S. Sierra ncn, 26/IX/2008 (FCME 27356). 1.3 km N of the Volcán Ocusacayo, 19°09′19″N 99°04′19″W, 3030 m asl, in humus, coll. S. Sierra ncn, 05/IX/2008 (FCME 27355). Atlimeya, west slope,

Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on soil, coll. S. Sierra ncn, 25/VII/2013 (FCME 27357).

Panaeolina foenisecii (Pers.) Maire, Treb. Mus. Ciènc. Nat. Barcelona, sér. Bot. 15(no. 2): 109 (1933) P
Volcán San Bartolo, 19°06′58″N 99°05′25″W, 3100 m asl, on dung, coll. S. Castro-Santiuste 145, 15/VIII/2008 (FCME 27466).

Lycoperdaceae

*** *Apioperdon pyriforme*** (Schaeff.) Vizzini, in Vizzini & Ercole, Phytotaxa 299(1): 81 (2017) P
Pedregal, between the volcanoes San Bartolo and Yecahuazac, 19°05′53″N 99°05′04″W, 3010 m asl, on soil, coll. L. Izquierdo-San Agustín 13, 28/VIII/2008 (FCME 27306). Cuauhtempa and Temascal, south slope of the Volcán Tláloc, 19°04′05″N 99°03′11″W, 3060 m asl, on soil, coll. S. Sierra 2009-22, 21/VIII/2009 (FCME 27307). Manitas pintadas, 19°08′45″N 99°04′59″W, 3130 m asl, on soil, coll. S. Sierra 2009-44, 28/VIII/2009 (FCME 27309). Coll. S. Sierra 2009-37, 28/VIII/2009 (FCME 27308).

Lycoperdon perlatum Pers., Observ. Mycol. (Lipsiae) 1: 4 (1796) **Figure 5A** P
1 km W of the Volcán Ocusacayo, 19°08′27″N 99°04′33″W, 3060 m asl, on soil, coll. J.J. Ruiz Ramos ncn, 15/VI/2016 (FCME 27457).

Lyophyllaceae

***Lyophyllum decastes* complex** (Fr.) Singer, Lilloa 22: 165 (1951) [1949] **Figure 3E** P
Manitas pintadas, 19°08′45″N 99°04′59″W, 3130 m asl, on soil, coll. Santiago Sánchez 2009-02, 28/VIII/2009 (FCME 27461). Road from Volcán Ocusacayo to Volcán Tulmiac, 19°08′19″N 99°04′54″W, 3070 m asl, on soil, L. Chávez-García 9, 29/XIII/2013 (FCME 27458). Volcán Ocusacayo, road to the mine, 19°08′23″N 99°04′38″W, 3070 m asl, on soil, coll. S. Sierra ncn, 15/VII/2015 (FCME 27459). Coll. A. Gutiérrez-Sánchez 158, 29/VI/2016 (FCME 27460).

Marasmiaceae

***Tetrapyrgos* sp.** P
2 km NE of the Volcán Ocusacayo 19°08′49″N 99°03′34″W, 3030 m asl, wood-rotting, coll. T. Ramírez-Viga, 19/IX/2008 (FCME 27490).

Mycenaceae

*** *Mycena acicula*** (Schaeff.) P. Kumm., Führ. Pilzk. (Zerbst): 109 (1871) **Figure 7C** P
Volcán Ocusacayo, road to the mine, 19°08′23″N 99°04′38″W, 3070 m asl, on soil, coll. A. Gutiérrez-Sánchez 152, 29/VI/2016 (FCME 27464). Volcán Pelagatos, E of the Volcán Tláloc, 19°05′52″N 98°58′19″W, 3205 m asl, on soil, coll. A. Gutiérrez-Sánchez ncn, 23/VIII/2017 (FCME 27465).

Omphalotaceae

***Gymnopus dryophilus* complex** (Bull.) Murrill, N. Amer. Fl. (New York) 9(5): 362 (1916) **Figure 7D** P-Q
Manitas pintadas, 19°08′45″N 99°04′59″W, 3130 m asl, on soil, coll. D. Guzmán-Ramírez ncn, 09/IX/2015 (FCME 27411). N of Tepexitlaco, 19°09′13″N 98°59′28″W, 2800 m asl, on soil, coll. N. López-Garduza 1, 01/VI/2017 (FCME 27412).

Psathyrellaceae

Coprinellus micaceus (Bull.) Vilgalys, Hopple & Jacq. Johnson, Taxon 50(1): 234 (2001) **Figure 6F** P-Al

1.9 Km W of the Volcán Ocusacayo 19°08′26″N 99°05′07″W, 3066 m asl, on humus, coll. S. Sierra 2008-59, 31/X/2008 (FCME 27350. L. Izquierdo-San Agustín 42, 31/X/2008 (FCME 27349). Coll. S. Castro-Santiuste 177, 25/VII/2013 (FCME 27348). 1.3 km N of the Volcán Ocusacayo, 19°09′19″N 99°04′19″W, 3030 m asl, on soil/humus, coll. L. Izquierdo-San Agustín 16, 05/X/2008 (FCME 27351). Tecpalo, west slope, Volcán Tláloc, 19°06′55″N 99°02′54″W, 3230 m asl, on soil, coll. E. Ramírez-Flores 02, 25/VII/2013 (FCME 27352). 6.4 Km NE of the Volcán Tláloc, 19°08′11″N 98°59′08″W, 3180 m asl, on soil, coll. N. López-Garduza 19, 09/VIII/2017 (FCME 27353).

Coprinopsis atramentaria (Bull.) Redhead, Vilgalys & Moncalvo, Taxon 50(1): 226 (2001) **Figure 3C** Ab-P

Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on soil, coll. E. Ramírez-Flores 01, 25/VII/2013 (FCME 27354).

Strophariaceae

Hypholoma fasciculare (Huds.) P. Kumm., Führ. Pilzk. (Zerbst): 72 (1871) P

1 km W of the Volcán Ocusacayo, 19°08′27″N 99°04′33″W, 3060 m asl, in humus, coll. S. Sierra ncn, 05/VI/2015 (FCME 27440). In soil, coll. A. Gutiérrez-Sánchez 60, 05/VI/2015 (FCME 27439).

Tricholomataceae

Lepista nuda (Bull.) Cooke, Handb. Brit. Fungi 1: 192 (1871) **Figure 8E** P

Pedregal, between the volcanoes San Bartolo and Yecahuazac, 19°05′53″N 99°05′04″W, 3010 m asl, on soil, coll. S. Castro-Santiuste ncn, 28/VIII/2008 (FCME 27455). Volcán Ocusacayo, road to the mine, 19°08′23″N 99°04′38″W, 3070 m asl, on soil, coll. D. Guzmán Ramírez ncn, 29/VI/2016 (FCME 27456).

**** Tricholoma imbricatum*** (Fr.) P. Kumm., Führ. Pilzk. (Zerbst): 133 (1871) **Figure 3F** P-Al

Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on soil, coll. S. Castro-Santiuste 156, 22/VIII/2008 (FCME 27491). Coll. S. Castro-Santiuste 183, 11/IX/2009 (FCME 27495). Coll. L. Izquierdo-San Agustín 44, 14/VIII/2009 (FCME 27492). Cuauhtempa and Temascal, south slope of the Volcán Tláloc, 19°04′05″N 99°03′11″W, 3060 m asl, on soil, coll. S. Sierra 2009-24, 21/VIII/2009 (FCME 27493). Manitas pintadas, 19°08′45″N 99°04′59″W, 3130 m asl, on soil, coll. L. Izquierdo-San Agustín 66, 29/VIII/2009 (FCME 27494).

Typhulaceae

**** Typhula juncea*** (Alb. & Schwein.) P. Karst., Bidr. Känn. Finl. Nat. Folk 37: 181 (1882) **Figure 8B** P-Al

1.2 km N of Manitas pintadas, 19°09′23″N 99°04′57″W, 3130 m asl, on humus, coll. S. Sierra ncn, 02/VII/2014 (FCME 27500).

Boletales

Boletaceae

**** Boletus pinophilus*** Pilát & Dermek, Česká Mykol. 27(1): 6 (1973) P-Al

High part of the Volcán El Tulmiac, 19°07′43″N 99°06′26″W, 3080 m asl, on soil, coll. Aisemberg ncn, 19/VI/2015 (FCME 27315).

Boletus* cf. *reticulatus Schaeff., Fung. bavar. palat. nasc. (Ratisbonae) 4: 78 (1774) **Figure 3D, 4D** P-Al

Cuauhtempa and Temascal, south slope of the Volcán Tláloc, 19°04′05″N 99°03′11″W, 3060 m asl, on soil, coll. I. Rodríguez-Gutiérrez ncn, 15/VIII/2008 (FCME 27314). Coll. S. Sierra 2009-16, 21/VIII/2009 (FCME 27313).

*** *Imleria pallida*** (Frost) A. Farid, A.R. Franck, & J. Bolin, Mycologia 112(2): 431 (2020) P

1 km W of the Volcán Ocusacayo, 19°08′27″N 99°04′33″W, 3060 m asl, on soil, coll. A. Gutiérrez-Sánchez 62, 05/VI/2015 (FCME 27442).

*** *Porphyrellus porphyrosporus*** (Fr. & Hök) E.-J. Gilbert, Les Livres du Mycologue Tome I-IV, Tom. III: Les Bolets: 99 (1931) **Figure 5H** P-Al

2 km NE of the Volcán Ocusacayo 19°08′49″N 99°03′34″W, 3030 m asl, on soil, coll. L. Izquierdo, 19/IX/2008 (FCME 27470). Tecpalo, west slope, Volcán Tláloc, 19°06′55″N 99°02′54″W, 3230 m asl, on soil, coll. L. Chávez-García 1, 25/VII/2013 (FCME 27471). Manitas pintadas, 19°08′45″N 99°04′59″W, 3130 m asl, on soil, coll. L. Chávez-García 146, 1/VII/2015 (FCME 27472).

*** *Xerocomellus chrysenteron*** (Bull.) Šutara, Czech Mycol. 60(1): 49 (2008) Ab-P

Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on soil, coll. S. Sánchez ncn, 11/VII/2013 (FCME 27502). 1.5 km W of the Volcán Ocusacayo, 19°08′25″N 99°04′54″W, 3070 m asl, on soil, coll. A. Gutierrez-Sánchez 64, 05/VI/2015 (FCME 27503). 6.4 km NE of the Volcán Tláloc, 19°08′11″N 98°59′08″W, 3180 m asl, coll. N. Lopez-Garduza 9, 09/VIII/2017 (FCME 27504).

Xerocomellus* cf. *porosporus (Imler ex Watling) Šutara, Czech Mycol. 60(1): 50 (2008) P

Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on soil, coll. S. Sierra 2010-23, 13/VIII/2010 (FCME 27501).

*** *Xerocomellus truncatus*** (Singer, Snell & E.A. Dick) Klofac, Öst. Z. Pilzk. 20: 39 (2011) Ab-P

1.5 km W of the Volcán Ocusacayo, 19°08′25″N 99°04′54″W, 3070 m asl, coll. S. Sierra ncn, 05/VI/2015 (FCME 27505). Coll. S. Sierra ncn, 26/IX/2008 (FCME 27506). Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on soil, coll. J. Pérez-Trejo 11, 22/VIII/2008 (FCME 27507). Tecpalo, west slope, Volcán Tláloc, 19°06′55″N 99°02′54″W, 3230 m asl, on soil, coll. L. Chávez-García 2, 25/VII/2013 (FCME 27508).

Xerocomus* cf. *subtomentosus (L.) Quél., Fl. mycol. France (Paris): 418 (1888) P

Manitas pintadas, 19°08′45″N 99°04′59″W, 3130 m asl, on soil, coll. A. Gutiérrez-Sánchez 65, 01/VII/2015 (FCME 27509).

Gomphidiaceae

Chroogomphus* cf. *rutilus (Schaeff.) O.K. Mill., Mycologia 56(4): 543 (1964) **Figure 7A** P-Al

North of Oyamepulli, 19°08′42″N 99°05′57″W, 3116 m asl, on soil, coll. L. Izquierdo 78, 7/X/2009 (FCME27332). Volcán El Tulmiac, 19°07′43″N 99°06′26″W, 3080 m asl, on soil, coll. A. Argüelles-Moyao ncn, 8/VIII/2013 (FCME 27335). Manitas pintadas, 19°08′45″N 99°04′59″W, 3130 m asl, on soil, coll. S. Castro-Santiuste 287, 1/VII/2015 (FCME 27333). W and N slope of the Volcán Ocusacayo, 19°08′35″N 99°04′18″W, 3095 m asl, on soil, coll. A. Gutiérrez-Sánchez 77, 29/VII/2015 (FCME 27334). Volcán Ocusacayo, road to the mine,

19°08′23″N 99°04′38″W, 3070 m asl, on soil, coll. J.J. Ruiz Ramos ncn, 1/VI/2016 (FCME 27336).

Suillaceae

**** Suillus americanus*** (Peck) Snell, in Slipp & Snell, Lloydia 7(1): 39 (1944) P-Al

1 km W of the Volcán Ocusacayo, 19°08′27″N 99°04′33″W, 3060 m asl, on soil, coll. López-Sandoval ncn, 15/VII/2016 (FCME 27482).

Suillus bellini (Inzenga) Kuntze Revis. gen. pl. (Leipzig) 3(3): 534 (1898) Ab-P

1.9 Km W of the Volcán Ocusacayo, 19°08′26″N 99°05′07″W, 3066 m asl, on soil, coll. S. Sierra 2008-57, 31/X/2008 (FCME 27484). Volcán Ocusacayo, road to the mine, 19°08′23″N 99°04′38″W, 3070 m asl, on soil, coll. S. Sierra 2015-73, 15/VII/2015 (FCME 27485). Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on soil, coll. S. Sierra 2008-09, 22/VIII/2008 (FCME 27483).

Suillus brevipes (Peck) Kuntze, Revis. gen. pl. (Leipzig) 3(3): 535 (1898) Ab-P

1 km W of the Volcán Ocusacayo, 19°08′27″N 99°04′33″W, 3060 m asl, on soil, coll. J.J. Ruiz-Ramos 79, 24/VIII/2016 (FCME 27486).

Suillus granulatus **complex** (L.) Roussel, Fl. Calvados: 34 (1796) P

1.2 km N of Manitas pintadas, 19°09′23″N 99°04′57″W, 3130 m asl, on soil, coll. D. Guzmán-Ramírez 48, 02/VII/2014 (FCME 27487).

Suillus tomentosus Singer, Mycologia 51(4): 570 (1960) [1959] Ab-P

W and N slope of the Volcán Ocusacayo, 19°08′35″N 99°04′18″W, 3095 m asl, on soil, coll. A. Gutiérrez-Sánchez 175, 24/VIII/2016 (FCME 27489). Volcán Ocusacayo, 19°08′26″N 99°04′00″W, 3120 m asl, on soil, coll. D. Guzmán-Ramírez 92, 03/IX/2014 (FCME 27488).

Hygrophoropsidaceae

Hygrophoropsis aurantiaca (Wulfen) Maire, L'Empoisonnem. Champ.: 99 (1921) P

Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on soil, coll. S. Castro-Santiuste 157, 22/VIII/2008 (FCME 27432). High part of the Volcán El Tulmiac, 19°07′43″N 99°06′26″W, 3080 m asl, on soil, coll. Aisemberg ncn, 19/VI/2015 (FCME 27433).

Russulales

Auriscalpiaceae

Auriscalpium vulgare Gray, Nat. Arr. Brit. Pl. (London) 1: 650 (1821) **Figure 7B** P-Cu

1.2 km N of Manitas pintadas, 19°09′23″N 99°04′57″W, 3130 m asl, on soil, coll. D. Guzmán-Ramírez 54, 02/VII/2014 (FCME 27312). 1 km W of the Volcán Ocusacayo, 19°08′27″N 99°04′33″W, 3060 m asl, on soil, coll. A. Gutiérrez-Sánchez 50, 05/VII/2015 (FCME 27310). Manitas pintadas, 19°08′45″N 99°04′59″W, 3130 m asl, on soil, coll. S. Sierra ncn, 03/IX/2010 (FCME 27311).

Russulaceae

Lactarius deliciosus **complex** (L.) Gray, Nat. Arr. Brit. Pl. (London) 1: 624 (1821) **Figure 5C** Ab-P

Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on soil, coll. T. Ramírez-Viga ncn, 22/VIII/2008 (FCME 27452). Coll. I. Rodríguez-Gutiérrez 2009-XXX, 11/IX/2009 (FCME 27453).

Lactarius mexicanus A. Kong & Estrada, Mycotaxon 52(2): 446 (1994) **Figure 6B** P-Al

Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on soil, coll. I. Rodríguez-Gutiérrez 2009-XXXII, 11/IX/2009 (FCME 27454).

Russula brevipes **complex** Peck, Ann. Rep. Reg. N.Y. St. Mus. 43: 66 (1890) P

Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on soil, coll. L. Izquierdo-San Agustín 10, 22/VIII/2008 (FCME 27475). Coll. S. Sierra 2009-15, 14/VIII/2009 (FCME 27477). Volcán San Bartolo, 19°06′58″N 99°05′25″W, 3100 m asl, on soil, coll. T. Ramírez-Viga ncn, 15/VIII/2008 (FCME 27474). 1.3 km N of the Volcán Ocusacayo, 19°09′19″N 99°04′19″W, 3030 m asl, on soil, coll. T. Ramírez-Viga ncn, 05/IX/2008 (FCME 27476). North of Oyamepulli, 19°08′42″N 99°05′57″W, 3116 m asl, on soil, coll. I. Rodríguez-Gutiérrez 2009-XLII, 07/X/2009 (FCME 27479). Cuauhtempa and Temascal, south slope of the Volcán Tláloc, 19°04′05″N 99°03′11″W, 3060 m asl, on soil, coll. S. Sierra 2009-17, 21/VIII/2009 (FCME 27478).

Thelephorales

Bankeraceae

Sarcodon imbricatus (L.) P. Karst., Revue mycol., Toulouse 3(no. 9): 20 (1881) Ab-P

Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on soil, coll. S. Castro-Santiuste 155, 22/VIII/2008 (FCME 27480). Coll. I. Rodríguez-Gutiérrez 2009-XXXIV, 11/IX/2009 (FCME 27481).

Polyporales

Incertae sedis

**** Faerberia carbonaria*** (Alb. & Schwein.) Pouzar, Česká Mykol. 35(4): 187 (1981) **Figure 3A** Ab-P

Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on burn soil, coll. S. Sierra ncn, 11/IX/2009 (FCME 27402).

Hymenochaetales

Hymenochaetaceae

Coltricia perennis (L.) Murrill, J. Mycol. 9(2): 91 (1903) Ab-P

Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on soil, coll. S. Sierra 2008-13, 22/VIII/2008 (FCME 27344). Coll. S. Sierra 2009-16, 14/VIII/2009 (FCME 27346). Pedregal, between the volcanoes San Bartolo and Yecahuazac, 19°05′53″N 99°05′04″W, 3010 m asl , on soil, coll. S. Castro-Santiuste 160, 28/VIII/2008 (FCME 27345). Manitas pintadas, 19°08′45″N 99°04′59″W, 3130 m asl, on soil, coll. S. Sierra ncn, 05/VIII/2015 (FCME 27347).

Gomphales

Clavariadelphaceae

Clavariadelphus **sp. Figure 8A** Ab-P

Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on soil, coll. S. Castro-Santiuste 187, 11/IX/2009 (FCME 27337).

Clavariadelphus truncatus Donk, Meded. Bot. Mus. Herb. Rijks Univ. Utrecht 9: 73 (1933) Ab-P
Figure 8C
Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on soil, coll. S. Castro-Santiuste 186, 11/IX/2009 (FCME 27338).

Gomphaceae

*** *Phaeoclavulina abietina*** (Pers.) Giachini, Mycotaxon 115: 189 (2011) **Figure 4C** Ab
Atlimeya, west slope, Volcán Tláloc, 19°06′24″N, 99°03′18″W, 3250 m asl, in humus, coll. L. Izquierdo-San Agustín 46, 14/VIII/2009 (FCME 27467).

Turbinellus floccosus (Schwein.) Earle ex Giachini & Castellano, Mycotaxon 115: 196 (2011) Ab-P
Figure 6E
Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on soil, coll. I. Rodríguez-Gutiérrez 2009-XXIII, 11/IX/2009 (FCME 27497). High part of the Volcán El Tulmiac, 19°07′43″N 99°06′26″W, 3080 m asl, on soil, coll. A. Gutiérrez-Sánchez ncn, 19/VI/2015 (FCME 27496).

*** *Turbinellus kauffmanii*** (A.H. Sm.) Giachini, Mycotaxon 115: 197 (2011) **Figure 8D** Ab-P
Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on soil, coll. S. Castro-Santiuste 154, 22/VIII/2008 (FCME 27498). Tecpalo, west slope, Volcán Tláloc, 19°06′55″N 99°02′54″W, 3230 m asl, on soil, coll. D. Guzmán-Ramírez 4, 25/VII/2013 (FCME 27499).

Auriculariales

Auriculariaceae

*** *Exidia thuretiana*** (Lév.) Fr., Hymenomyc. eur. (Upsaliae): 694 (1874) P-Al
1.2 km N of Manitas pintadas, 19°09′23″N 99°04′57″W, 3130 m asl, on wood-rotting, coll. A. Gutiérrez-Sánchez 35, 02/VII/2014 (FCME 27396). Coll. A. Gutiérrez-Sánchez 40, 02/VII/2014 (FCME 27401). 500-800 m W of the Volcán Ocusacayo, coll. A. Gutiérrez-Sánchez 155, 29/VI/2016 (FCME 27397). Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on wood-rotting, coll. S. Sierra ncn, 11/VII/2013 (FCME 27398). Road from Volcán Ocusacayo to Volcán Tulmiac, 19°08′19″N 99°04′54″W, 3070 m asl, on wood-rotting, coll. E. Figueroa ncn, 03/VIII/2016 (FCME 27399). Oyamepulli, 19°08′24″N 99°05′04″W, 3100 m asl, on wood-rotting, coll. S. Sierra ncn, 04/IX/2009 (FCME 27400).

Incertae sedis

Guepinia helvelloides (DC.) Fr., Elench. fung. (Greifswald) 2: 30 (1828) **Figure 5F** Ab-P
200 m al O de Atlimeya, west slope, Volcán Tláloc, 19°06′42″N 99°03′14″W, 3180 m asl, on humus, coll. S. Sierra ncn, 13/VIII/2010 (FCME 27404).

Pseudohydnum gelatinosum (Scop.) P. Karst. Not. Sällsk. Fauna et Fl. Fenn. Förh. 9: 374 (1868) Ab-P
Figure 5E
Atlimeya, west slope, Volcán Tláloc, 19°06′24″N, 99°03′18″W, 3250 m asl, on wood-rotting, coll. S. Sierra ncn, 13/IX/2010 (FCME 27473).

Cantharellales

Cantharellaceae

***Cantharellus cibarius* complex** Fr., Syst. mycol. (Lundae) 1: 318 (1821) P

Road from Volcán Ocusacayo to Volcán Tulmiac, 19°08′19″N 99°04′54″W, 3070 m asl, on soil, coll. S. Sierra ncn, 29/VIII/2013 (FCME 27330). Coll. D. Guzmán-Ramírez ncn, 3/VIII/2016 (FCME 27331). Manitas pintadas, 19°08′45″N, 99°04′59″W, on soil, coll. S. Sierra ncn, 05/VIII/2015 (FCME 27329).

Clavulina parvispora Pérez-Pazos & M. Villegas-Ríos, Mycological Progress 18 (9): 1194 (2019) P

Pedregal, between the volcanoes San Bartolo and Yecahuazac, 19°05′53″N 99°05′04″W, 3010 m asl, on soil, coll. J. Pérez-Trejo ncn, 28/VIII/2008 (FCME 27339). Manitas pintadas, 19°08′45″N 99°04′59″W, 3130 m asl, on soil, coll. S. Castro-Santiuste 291, 01/VII/2015 (FCME 27340).

Clavulina reae Olariaga (sensu Pérez-Pazos & al. 2019) P

1.5 km W of the Volcán Ocusacayo, 19°08′25″N 99°04′54″W, 3070 m asl, on soil, coll. L. Izquierdo-San Agustín 35, 26/IX/2008 (FCME 27341).

Clavulina rugosa (Bull.) J. Schröt, in Cohn, Krypt.-Fl. Schlesien (Breslau) 3.1(25–32): 442 (1888) [1889] Ab-P

1.3 km N of the Volcán Ocusacayo, 19°09′19″N 99°04′19″W, 3030 m asl, on soil, coll. L. Izquierdo-San Agustín 20, 05/IX/2008 (FCME 27342). N of Oyamepulli, 19°08′42″N 99°05′57″W, 3116 m asl, on soil, coll. I. Rodríguez-Gutiérrez ncn, 07/X/2009 (FCME 27343).

Dacrymycetales

Dacrymycetaceae

**** Calocera macrospora*** Brasf., Lloydia 1(2): 156 (1938) **Figure 7F** Ab-P

4.5 km NE of the Volcán Tláloc, 19°08′13″N 99°00′31″W, 3230 m asl, on wood-rotting, coll. S. Castro-Santiuste 298, 26/VIII/2015 (FCME 27319). 200 m W to Atlimeya, west slope, Volcán Tláloc, 19°06′42″N 99°03′14″W, 3180 m asl, on wood-rotting, coll. S. Sierra 2010-21, 13/VIII/2010 (FCME 27320). Volcán Ocusacayo, road to the mine, 19°08′23″N 99°04′38″W, 3070 m asl, on wood-rotting, coll. A. Gutiérrez-Sánchez 150, 29/VI/2016 (FCME 27321). Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on wood-rotting, coll. S. Sierra 2008-14, 22/VIII/2008 (FCME 27316). Coll. S. Sierra 2009-71, 11/IX/2009 (FCME 27317). Road from Volcán Ocusacayo to Volcán Tulmiac, 19°08′19″N 99°04′54″W, 3070 m asl, on wood-rotting, coll. P. García-Cruz ncn, 03/VIII/2016 (FCME 27322). High part of the Volcán El Tulmiac, 19°07′43″N 99°06′26″W, 3080 m asl, on wood-rotting, coll. J. Pérez-Trejo 2014-2, 22/X/2014 (FCME 27323). Coll. L. Santiago-Gómez ncn, 19/VI/2015 (FCME 27324). Coll. D. Guzmán-Ramírez ncn, 19/VI/2015 (FCME 27318).

***Calocera* sp.** Ab

1.2 km W of the Volcán Ocusacayo, 19°08′26″N 99°04′41″W, 3085 m asl, on wood-rotting, coll. A. Gutiérrez-Sánchez 55, 05/VI/2015 (FCME 27325).

Calocera viscosa (Pers.) Fr., Syst. mycol. (Lundae) 1: 486 (1821) Ab-P

Road to Cuauxuspa, 19°07′53″N 99°00′17″W, 3102 m asl, on humus, coll. S. Sierra ncn, 28/IX/2010 (FCME 27326).

Dacrymyces chrysospermus Berk. & M.A. Curtis, Grevillea 2(no. 14): 20 (1873) **Figure 6A** P

1 km W of the Volcán Ocusacayo, 19°08′27″N 99°04′33″W, 3060 m asl, on wood-rotting, coll. A. Gutiérrez-Sánchez 128, 15/VI/2016 (FCME 23360). Coll. D. Guzmán-Ramírez ncn, 15/VI/2016 (FCME 27361). 1.2 km N of Manitas pintadas, 19°09′23″N 99°04′57″W, 3130 m asl, on wood-rotting, coll. A. Gutiérrez-Sánchez 37, 02/VII/2014 (FCME 27362). 4.5 km NE of the Volcán Tláloc, 19°08′13″N 99°00′31″W, 3230 m asl, on wood-rotting, coll. S. Castro-Santiuste 297, 26/VIII/2015 (FCME 27363). Volcán Ocusacayo, road to the mine, 19°08′23″N 99°04′38″W, 3070 m asl, on wood-rotting, coll. A. Gutiérrez-Sánchez 153, 29/VI/2016 (FCME 27364). Coll. A. Gutiérrez-Sánchez 154 (FCME 27365). Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on wood-rotting, coll. S. Sierra ncn, 11/VII/2013 (FCME 27366). Road from Volcán Ocusacayo to Volcán Tulmiac, 19°08′19″N 99°04′54″W, 3070 m asl, on wood-rotting, coll. E. Figueroa ncn, 03/VIII/2016 (FCME 27367). W and N slope of the Volcán Ocusacayo, 19°08′35″N 99°04′18″W, 3095 m asl, on wood-rotting, coll. A. Gutiérrez-Sánchez 178, 24/VIII/2016 (FCME 27368). High part of the Volcán El Tulmiac, 19°07′43″N 99°06′26″W, 3080 m asl, on wood-rotting, coll. E. Juárez-Ángeles 6, 15/X/2014 (FCME 27369). Climbing the Volcán La Comalera, 19°06′39″N 99°06′24″W, 3160 m asl, on wood-rotting, coll. D. Guzmán-Ramírez-145, 17/IX/2014 (FCME 27359). Tecpalo, west slope, Volcán Tláloc, 19°06′55″N 99°02′54″W, 3230 m asl, on wood-rotting, coll. L. Chávez-García 7, 25/VII/2013 (FCME 27370). Volcán San Bartolo, 19°06′58″N 99°05′25″W, 3100 m asl, on wood-rotting, coll. S. Sierra 2008-9, 15/VIII/2008 (FCME 27358).

**** Dacrymyces dictyosporus*** G.W. Martin, Mycologia 50(6): 939 (1959) [1958] Ab-P

1 km W of the Volcán Ocusacayo, 19°08′27″N 99°04′33″W, 3060 m asl, on wood-rotting, coll. A. Gutiérrez-Sánchez 125, 15/VI/2016 (FCME 27371). Coll. A. Gutiérrez-Sánchez 129 (FCME 27372). 1.3 km N of the Volcán Ocusacayo, 19°09′19″N 99°04′19″W, 3030 m asl, on wood-rotting, coll. S. Sierra 2008-24, 05/IX/2008 (FCME 27380). 1.5 km W of the Volcán Ocusacayo, 19°08′25″N 99°04′54″W, 3070 m asl, on wood-rotting, coll. S. Sierra 2008-40, 26/IX/2008 (FCME 27381). 1.6 km SE from the guardhouse of San Pablo Oztotepec 19°09′27″N 99°04′26″W, 2980 m asl, on wood-rotting, coll. D. Guzmán-Ramírez 70, 13/VIII/2014 (FCME 27383). 2 km NE of the Volcán Ocusacayo 19°08′49″N 99°03′34″W, 3030 m asl, on wood-rotting, coll. S. Sierra 2008-34, 19/IX/2008 (FCME 27384). Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on wood-rotting, coll. S. Sierra 2008-15.5, 22/VIII/2008 (FCME 27379). Cuauhtempa and Temascal, south slope, Volcán Tláloc, 19°04′05″N 99°03′11″W, 3060 m asl, on wood-rotting, coll. S. Sierra 2009-20, 21/VIII/2009 (FCME 27382). Volcán El Tulmiac, 19°07′43″N 99°06′26″W, 3080 m asl, on wood-rotting, coll. D. Guzmán-Ramírez 11, 08/VIII/2013 (FCME 27373). Manitas pintadas, 19°08′45″N 99°04′59″W, 3130 m asl, on wood-rotting, coll. S. Sierra ncn, 03/IX/2010 (FCME 27374). Coll. S. Castro-Santiuste 290, 01/VII/2015 (FCME 27375). Coll. S. Sierra ncn, 05/VIII/2015 (FCME 27376). Coll. A. Gutiérrez-Sánchez 91, 09/IX/2015 (FCME 27377). High part of the Volcán El Tulmiac, 19°07′43″N 99°06′26″W, 3080 m asl, on wood-rotting, coll. A. Gutiérrez-Sánchez 123, 19/VI/2015 (FCME 27378).

**** Dacrymyces punctiformis*** Neuhoff, Schweiz. Z. Pilzk. 12: 81 (1934) Ab-P

1 km W to the Volcán Ocusacayo, 19°08′27″N 99°04′33″W, 3060 m asl, on wood-rotting, coll. A. Gutiérrez-Sánchez 130, 15/VI/2016 (FCME 27385). Coll. D. Guzmán-Ramírez ncn, 15/VI/2016 (FCME 27386).

Dacryopinax lowyi S. Sierra & Cifuentes, Mycotaxon 92: 244 (2005) Ab-P

2 km NE of the Volcán Ocusacayo 19°08′49″N 99°03′34″W, 3030 m asl, on wood-rotting, coll. S. Sierra 2008-33, 19/IX/2008 (FCME 27388). 4.5 km NE of the Volcán Tláloc, 19°08′13″N

99°00′31″W, 3230 m asl, on wood-rotting, coll. S. Castro-Santiuste 295, 26/VIII/2015 (FCME 27389). Atlimeya, west slope, Volcán Tláloc, 19°06′58″N 99°03′18″W, 3250 m asl, on wood-rotting, coll. S. Sierra 2009-8, 14/VIII/2009 (FCME 27387). Coll. S. Sierra 2012-16, 06/IX/2012 (FCME 27390. Volcán El Tulmiac, 19°07′43″N 99°06′26″W, 3080 m asl, on wood-rotting, coll. D. Guzmán-Ramírez 9, 08/VIII/2013 (FCME 27391). Coll. D. Guzmán-Ramírez 10, 08/VIII/2013 (FCME 27392). Manitas pintadas, 19°08′45″N 99°04′59″W, 3130 m asl, on wood-rotting, coll. A. Gutiérrez-Sánchez 92, 09/IX/2015 (FCME 27393). High part of the Volcán El Tulmiac, 19°07′43″N 99°06′26″W, 3080 m asl, on wood-rotting, coll. A. Gutiérrez-Sánchez 122, 19/VI/2015 (FCME 27394).

Tremellales

Phragmoxenidiaceae

***Phyllogloea* sp.** Ab-P

2 km NE of the Volcán Ocusacayo 19°08′49″N 99°03′34″W, 3030 m asl, on wood-rotting, coll. S. Sierra 2008-30, 19/IX/2008 (FCME 27468).

(§) new record for the country
(*) new records for the CDMX

Vegetation type
Ab = *Abies religiosa*
P = *Pinus* spp.
Cu = *Cupressus lusitanica*
Al = *Alnus* spp.
Q = *Quercus* spp.