DOI 10.12905/0380.sydowia74-2021-0033 Published online 21 June 2021

# Glomeromycota in Mexico, a country with very high richness

Martin Hassan Polo-Marcial[1], Luis A. Lara-Pérez[2], Bruno Tomio Goto[3], Xochitl Margarito-Vista[3] & Antonio Andrade-Torres[4,*]

[1] Doctorado en Ciencias en Ecología y Biotecnología, Instituto de Biotecnología y Ecología Aplicada, Universidad Veracruzana, Av. De las Culturas Veracruzanas No. 101, Campus para la Cultura, las Artes y el Deporte, Col. Emiliano Zapata, C.P. 91090, Xalapa, Veracruz, México.
[2] Tecnológico Nacional de México, Instituto Tecnológico de la Zona Maya. Carretera Chetumal-Escárcega km 21.5 Ejido Juan Sarabia, C.P. 77965 Quintana Roo, México.
[3] Departamento de Botânica e Zoologia, Universidade Federal do Rio Grande do Norte, Campus Universitário, 59072-970, Natal, RN, Brazil.
[4] Instituto de Biotecnología y Ecología Aplicada, CA 173 Ecología y manejo de la Biodiversidad, Universidad Veracruzana, Av. De las Culturas Veracruzanas No. 101, Campus para la Cultura, las Artes y el Deporte, Col. Emiliano Zapata, C.P. 91090, Xalapa, Veracruz, México.

* e-mail: aandrade@uv.mx

Polo-Marcial M.H., Lara-Pérez L.A., Goto B.T., Margarito-Vista X. & Andrade-Torres A. (2021) Glomeromycota in Mexico: a country with very high richness. – Sydowia 74: 33–63.

The biogeographical species list based on data compilation represent a powerful tool to understand fungal diversity distribution. After five decades of extensive studies on arbuscular mycorrhizal (Glomeromycota) diversity we compiled a checklist with 160 species recorded in Mexico based in 95 publications. The richness found represents 49 % of species, distributed in 34 genera, 13 families and five orders in Glomeromycota. The genera *Acaulospora* and *Glomus* were dominant, with 27 and 26 species, respectively. The most represented spore development type was ectocarpic species (72 %) followed by glomerocarpic (28 %). The vegetation type with the highest species richness was agroecosystems (135 spp.), followed by xerophytic shrublands (74 species). Low number of species were recorded in aquatic and underwater vegetation (38 spp.) and coastal sand dunes (28 spp.). The Jaccard similarity index varied from 0.32 to 0.66, indicating a low to medium level of overlapping in AMF species between vegetation types in Mexico. More effort should be carried out on ecological and morphological studies of a larger geographical scale mostly in priority areas or less-studied vegetation types to better understand species distribution and to increase the number of AMF species that may still be discovered in Mexico. The inventory allows the definition of strategies for future studies in Mexico, a very biodiverse country, aiming to expand knowledge of AMF distribution as well as allowing the description of new taxa.

Keywords: distribution, ecology, mycorrhiza, taxonomy, vegetation types.

The phylum Glomeromycota (Schüssler et al. 2001, Tedersoo et al. 2018, Wijayawardene et al. 2020) comprises the arbuscular mycorrhizal fungi (AMF) that form mutualistic and obligate symbiotic associations with around 80 % of vascular plants (Wang & Qiu 2006, Brundrett & Tedersoo 2018). The AMF represent one of the most important biological components of the soil microbiota in natural and agronomic ecosystems worldwide (Moreira & Siqueira 2006). Symbiotic interactions with AMF regulate and maintain plant biodiversity and plant species composition (van der Heijden et al. 2015). This is because the extraradical hyphae facilitate nutrient uptake, in change for carbohydrates and lipids (Smith & Red 2008). Due to their multiple beneficial effects, AMF have gained considerable attention in sustainable agriculture, restoration programs and evolutionary relationships in different plant groups (Wang & Qiu 2006). So far, 330 species of AMF have been described and are currently classified in three classes, five orders, 16 families and 48 genera (Goto & Jobim 2019, Wijayawardene et al. 2020). Of these, *Geosiphon pyriformis* (Kütz.) F. Wettst. is the only representative of this phylum that forms associations with cyanobacteria of the genus *Nostoc* (Schüssler 2012).

Mexico harbours around 12 % of the species biodiversity worldwide and is fifth in the list of countries with the most endemic plants. It has a wide territorial expansion (1, 972, 550 km$^2$) (CONANP 2018, Mittermeier et al. 2004), topography with an altitudinal gradient, contrasting climates and geographic history, and the positions between Nearctic and Neotropical bioregions led to different eco-physiological vegetation and the occurrence of three hotspots of biodiversity (Rzedowski 1981, Myers et al. 2000, Plascencia et al. 2011). Vegetal communities of Mexico are classified in seven types: tropical evergreen forest, tropical deciduous forest, tropical montane cloud forest, temperate forest, xerophytic shrublands, pastures, and aquatic and underwater vegetation (Challenger & Soberón 2008). According to humidity and temperature, Mexico is classified into six climate regions: mild wet climate, mild humid, very dry, dry, warm humid and warm wet (INEGI 1991). Overall, these vegetation types include over 22 900 plant species (Villaseñor et al. 2007, Ulloa et al. 2017). Therefore, Mexico is expected to harbour an important number of AMF species because it comprises a mosaic of vegetation and contrasting environments with high endemism and plant richness (Montaño et al. 2012, Varela et al. 2019).

Initially, studies on AMF in Mexico were rather sporadic. The first work on AMF in Mexico began in the 70's with the record of *Endogone fulva* (= *Redeckera fulvum*) (Trappe & Guzmán 1971). The AMF species list increased over the following 11 years with the description of four new species isolated from agricultural and natural systems *Acaulospora foveata, A. scrobiculata*, *Glomus clavisporum* (as *Sclerocystis clavispora*) and *Septoglomus constrictum* (as *Glomus constrictum*) – and three species described using additional material from Mexico – *Acaulospora spinosa, Diversispora epigaea* (as *Glomus epigaeum*) and *Funneliformis halonatus* (as *Glomus holonatum*) (Trappe 1977, Daniels & Trappe 1979, Rose & Trappe 1980, Walker & Trappe 1981, Janos & Trappe 1982). Varela & Trejo (2001) compiled the first AMF checklist with 44 species recorded mainly from agroecosystems (36 spp.). A decade later, fortunately, interest in this group of fungi gradually increased; consequently, the number of recorded AMF species increased to 95 species, a rise of 62 % of record species, with a clearly higher number of studies in agroecosystems (Alarcon et al. 2012, Montaño et al. 2012). Since then, different studies on diversity, description of new species and inventories of AMF in different environments have led to an increase to 149 AMF species with predominance in agroecosystems and xerophytic shrublands (Varela et al. 2019, Chimal-Sánchez et al. 2019). These works gather important information on ecological plant-fungi interactions and distribution of AMF in Mexican ecosystems. In recent years, molecular and morphological studies have led to a major advance in the taxonomy of the phylum Glomeromycota, and phylogenetic analysis of nuclear rDNA genes have transferred many species to new families or genera and synonymized some species (Oehl et al. 2008, Oehl et al. 2011d, Błaszkowski et al. 2015, Błaszkowski et al. 2017, Corazon-Guivin et al. 2019a, b, c). We aimed to compile a current checklist of AMF in Mexico, organized to include its distribution by vegetation type and climate zones. Additionally, we included the type locality and the herbarium collection where the type species is stored. These new records contribute to the additional richness of AMF by providing a more complete overview of Glomeromycota distributed in Mexico and are intended to summarize taxonomic information that can be used as a baseline for future taxonomic and ecological studies.

## Materials and methods

We conducted literature research of AMF recorded in Mexico using different databases: Google Scholar, Scopus and Web of Science. The terms used for the literature search were: arbuscular, vesicular, mycorrhizal, Glomeromycota and each of the AMF families and genera, which were included in combination with the words 'native' and 'Mexico'. As a result, a survey of 95 papers published from 1971 to 2020 was used conducted to compile a checklist of AMF.

We included papers with a morphological identification system at a species level, and description of taxa of the following publications: Trappe & Guzmán (1971)[1], Trappe (1977)[2], Daniels & Trappe (1979)[3], Rose & Trappe (1980)[4], Walker & Trappe (1981)[5], Janos & Trappe (1982)[6], Berch et al. (1989)[7], Varela & Vázquez (1989)[8], Estrada-Torres et al. (1992)[9], Gavito & Varela (1993)[10], Sigüenza et al. (1996)[11], Ramírez-Gerardo et al. (1997)[12], Allen et al. (1998)[13], Chamizo et al. (1998)[14], Guadarrama & Álvarez-Sánchez (1999)[15], Lesueur et al. (2001)[16], Ortega-Larrocea et al. (2001)[17], Varela & Trejo (2001)[18], Pimienta-Barrios et al. (2002)[19], Guadarrama et al. (2004)[20], Allen et al. (2005)[21], Pezzani et al. (2006)[22], Bashan et al. (2007)[23], Franco-Ramírez et al. (2007)[24], Guadarrama-Chávez et al. (2007)[25], Ortega-Larrocea et al. (2007)[26], Aguilera-Gómez et al. (2008)[27], Estrada-Luna & Davies (2008)[28], García-Sánchez et al. (2008)[29], Gavito et al. (2008)[30], Pezzani et al. (2008)[31], Tapia-Goné et al. (2008)[32], Violi et al. (2008)[33], Varela et al. (2008)[34], Aguilar-Fernández et al. (2009)[35], Muñoz-Márquez et al. (2009)[36], Ochoa-Meza et al. (2009)[37], Paleo et at. (2009)[38], Zulueta-Rodríguez et al. (2010)[39], Trejo et al. (2011)[40], Olivera-Morales et al. (2011)[41], Alarcón et al. (2012)[42], Arias et al. (2012)[43], González-Cortés et al. (2012)[44], Guadarrama et al. (2012)[45], Méndez-Cortés et al. (2012)[46], Montaño et al. (2012)[47], Pérez-Luna et al. (2012)[48], Ramos-Zapata et al. (2012)[49], Carballar-Hernández et al. (2013)[50], Carmona-Escalante et al. (2013)[51], Lara-Chávez et al. (2013)[52], Osorio-Miranda et al. (2013)[53], Trejo-Aguilar et al. (2013)[54], Bautista-Cruz et al. (2014)[55], Guadarrama et al. (2014)[56], Lara-Pérez et al. (2014)[57], Rodríguez-Morelos et al. (2014)[58], Salgado-Garcia et al. (2014)[59], Carreón-Abud et al. (2015)[60], Chimal-Sánchez et al. (2015a)[61], Chimal-Sánchez et al. (2015b)[62], Trejo et al. (2015)[63], Zulueta-Rodríguez et al. (2015)[64], Álvarez-Sánchez et al. (2016)[65], Chimal-Sánchez et al. (2016)[66], Monroy-Ata et al. (2016)[67], Trejo et al. (2016)[68], Alejandro-Córdova et al. (2017)[69], Álvarez-Sánchez et al. (2017)[70], Carballar-Hernández et al. (2017)[71], Fabián et al. (2018)[72], Furrazola et al. (2017)[73], Varela et al. (2017) [74], Mejia-Alva et al. (2018)[75], Retama-Ortiz et al. (2017)[76], Trinidad-Cruz et al. (2017)[77], Hernández-Zamudio et al. (2018)[78], Álvarez-Lopeztello et al. (2018)[79], Bertolini et al. (2018)[80], Chimal-Sánchez et al. (2018)[81], Monroy-Ata & Ramírez-Saldívar (2018)[82], Posada et al. (2018)[83], Alvarado-Herrejón et al. (2019)[84], Álvarez-Lopeztello et al. (2019a)[85], Álvarez-Lopeztello et al. (2019b)[86], Chimal-Sánchez et al. (2019)[87], Martínez et al. (2019)[88], Montaño-Raya et al. (2019)[89], Ramírez-Viga et al. (2019)[90], Reyes-Jaramillo et al. (2019)[91], Bertolini et al. (2020)[92], Ramírez-Viga et al. (2020)[93], Solís-Rodríguez et al. (2020)[94], Lara-Pérez et al. (2020)[95].

We followed the classification proposed by Oehl et al. (2008, 2011a, b, c, d) and Błaszkowski (2012), including additional taxa proposed by Błaszkowski et al. (2015; 2017, 2018), Goto et al. (2012), Marinho et al. (2014), Sieverding et al. (2014), Symanczik et al. (2018), Jobim et al. (2019) and Corazon-Guivin et al. (2019a, b, c). To assign taxonomy authorities and synonyms of genera, families and AMF species, we consulted Mycobank Database (http://www.mycobank.org). We used the generic name *Rhizoglomus* Sieverd., G.A. Silva & Oehl proposed by Sieverding et al. (2014) instead of *Rhizophagus* C. Walker & A. Schüssler and adopted the terms "glomerospores" and "glomerocarps" proposed by Goto & Maia (2006) and Jobim et al. (2019), respectively. For glomerocarpic organization we adopted the suggestion proposed by Gerdemann & Trappe (1974), Goto & Maia (2005), Jobim et al. (2019). For the types of vegetation, we followed the classification of Challenger & Soberón (2008), including agroecosystems and coastal sand dunes. With the AMF assemblage and type of vegetation, we constructed a presence and absence matrix to perform a cluster analysis based on the Jaccard similarity index to determine the percentage of overlapping AMF species between the different vegetation types. The dendrogram was generated with the unweighted-pair-group method with arithmetic mean (UPGMA), using the PAST-V.3 software (Paleontological Statistics Software Package).

## Results

We compiled a checklist of 160 species, distributed in five orders: Archaeosporales (12), Diversisporales (48), Gigasporales (31), Glomerales (63) and Paraglomerales (6). These five orders are distributed in 13 families and 34 genera (Table 1). This checklist corresponded to 86 % of the families, 70 % of the genus and 49 % of the AMF species described in Glomeromycota. It can be seen that *Acaulospora* and *Glomus* are the dominant genera, with 27 and 26 species, respectively (Table 1).

Of the total richness (160 spp.), 135 species (84 %) are represented in agroecosystems, 74 spp. (46 %) in xerophytic shrublands, 73 spp. (44 %) in grasslands, 58 spp. (34 %) in tropical montane cloud forest, 57 spp. in evergreen tropical forest (33 %), 53 spp. (33 %) in tropical deciduous forest, 39 spp. (24 %) in temperate forest, 38 spp. (23 %) in aquatic and underwater vegetation, and 28 spp. (18 %) in coastal sand dunes (Fig. 1). According to habit, 115 spp. (72 %) are ectocarpic species of the five orders: Archaeosporales (11 spp.), Diversisporales (42 spp.), Gigasporales (31 spp.), Glomerales (25 spp.) and Paraglomerales (6 spp.) (Fig. 1). Glomerosporic species are represented by 45 spp. (28 %) of three orders: Archaeosporales (2 spp.), Diversisporales (4 spp.) and Glomerales (39 spp.) (Fig. 1). The dominant AMF family is Acaulosporaceae, followed by Glomeraceae; the same pattern is presented in all different types of vegetation, except in temperate forest which presented an inverted pattern (Fig. 2). The less represented AMF families are Pacisporaceae and Sacculosporaceae (Fig. 2). Geosiphonacaeae, Intraornatosporaceae and Pervetustaceae so far were not recorded in Mexico. The species with a wide distribution in the nine types of vegetation are *Acaulospora morrowiae*, *A. rehmii*, *A. scrobiculata, Funneliformis geosporus*, *F. mosseae* and *Septoglomus constrictum*, while *Acaulospora foveata, A. laevis, A. spinosa, Claroideoglomus claroideum, Entrophospora infrequens, Rhizoglomus clarum, R. microaggregatum, Sclerocystis sinuosa* and *Scutellospora calospora* were recorded in eight vegetation types.

**Tab. 1.** Taxonomic clasification of the arbuscular mycorrhiza fungi of Mexico according to Oehl et al. (2008, 2011a– d), Błaszkowski (2012), including additional taxa.

| Class (3) | Order (5) | Family (13) | Genus (34) | Species (160) |
|---|---|---|---|---|
| Archaeosporomycetes | Archaeosporales | Archaeosporaceae | *Archaeospora* | 3 |
| | | | *Intraspora* | 1 |
| | | Ambisporaceae | *Ambispora* | 8 |
| Glomeromycetes | Glomerales | Glomeraceae | *Glomus* | 26 |
| | | | *Dominikia* | 2 |
| | | | *Funneliformis* | 9 |
| | | | *Rhizoglomus* | 9 |
| | | | *Oehlia* | 1 |
| | | | *Septoglomus* | 5 |
| | | | *Sclerocystis* | 2 |
| | | | *Simiglomus* | 1 |
| | | | *Halonatospora* | 1 |
| | | Entrophosporaceae | *Entrophospora* | 1 |
| | | | *Albahypha* | 2 |
| | | | *Claroideoglomus* | 4 |
| | Diversisporales | Diversisporaceae | *Diversispora* | 9 |
| | | | *Otospora* | 1 |
| | | | *Tricispora* | 1 |
| | | | *Redeckera* | 1 |
| | | | *Corymbiglomus* | 2 |
| | | | *Sieverdingia* | 1 |
| | | Sacculosporaceae | *Sacculospora* | 1 |
| | | Pacisporaceae | *Pacispora* | 4 |
| | | Acaulosporaceae | *Acaulospora* | 27 |
| | | | *Kuklospora* | 1 |
| | Gigasporales | Gigasporaceae | *Gigaspora* | 7 |
| | | Scutellosporaceae | *Scutellospora* | 4 |
| | | | *Orbispora* | 1 |
| | | Racocetraceae | *Racocetra* | 7 |
| | | | *Cetraspora* | 4 |
| | | Dentiscutataceae | *Dentiscutata* | 5 |
| | | | *Fuscutata* | 2 |
| | | | *Quatunica* | 1 |
| Paraglomeromycetes | Paraglomerales | Paraglomeraceae | *Paraglomus* | 6 |

The Jaccard similarity index varied from 0.32 to 0.66, indicating a low and medium level of overlapping AMF species with vegetation types. The major cluster is formed by a sub-cluster at 0.66 similarity. One of the sub-clusters is formed by xerophytic shrublands, grasslands and agricultural systems, and a second by tropical evergreen forest and tropical deciduous forest (Fig. 3). Temperate forest was also similar to tropical montane cloud forest (0.56), and more dissimilar (<0.24) vegetation types were aquatic and underwater vegetation and coastal sand dunes (Fig. 3).

Exclusive AMF species in the overall vegetation type represent 20 % (32 spp.). The agroecosystem

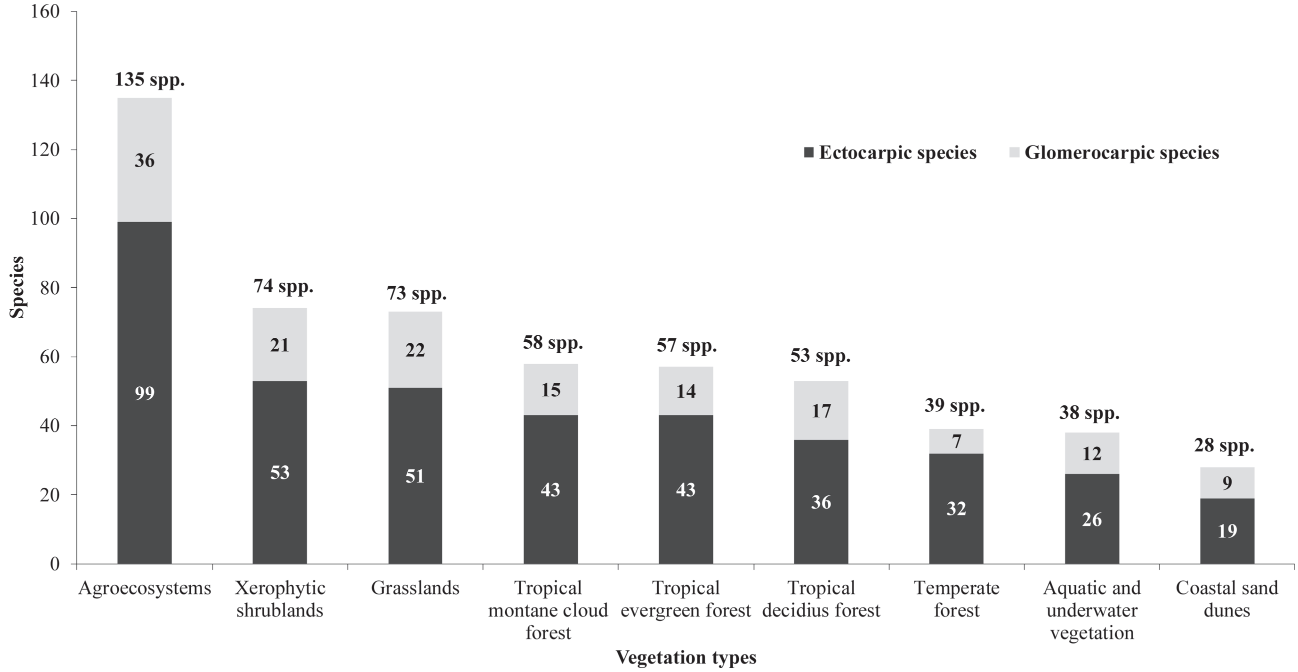


**Fig. 1.** Richness of arbuscular mycorrhizal fungi by habit (ectocarpic and glomerocapic) in different vegetation types of Mexico.

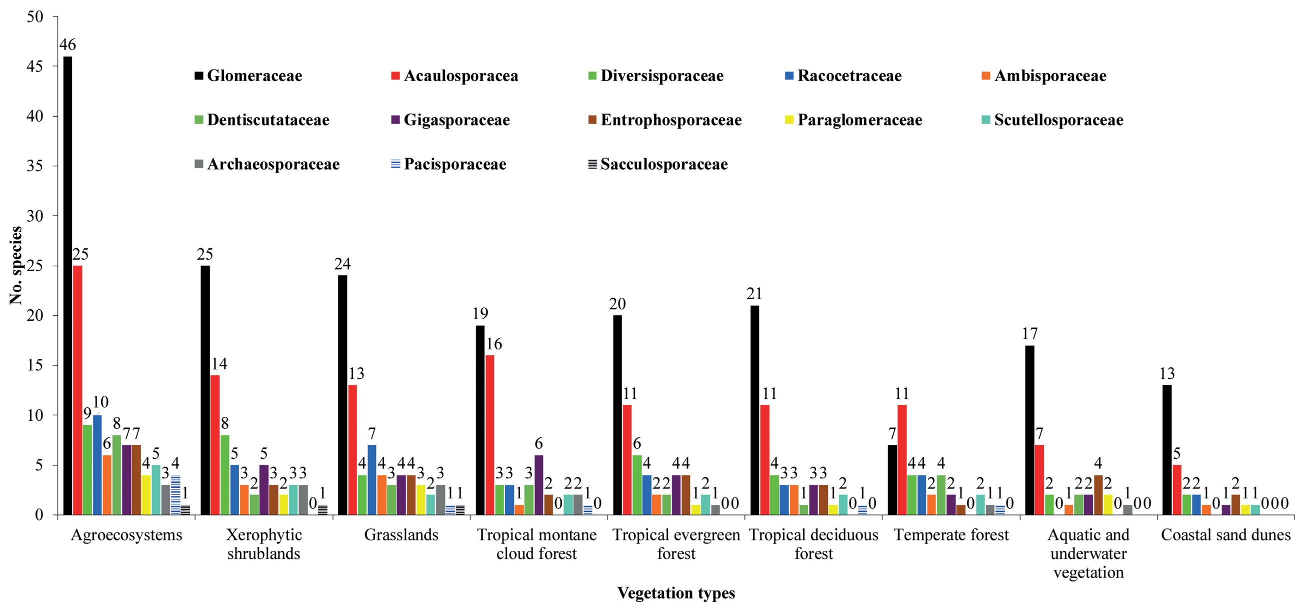


**Fig. 2.** Arbuscular mycorrhizal fungi families in different vegetation types of Mexico.

and xerophytic shrublands recorded a higher richness of exclusive species with 28 and 6 species, respectively, and tropical montane cloud forest and tropical deciduous forest recorded the lowest, with two exclusive species each (Table 2). No exclusive species were present in coastal sand dunes and aquatic and underwater vegetation. Comparing natural vegetation and agroecosystems were detected 106 overlapping species, 25 of which were exclusive to natural vegetation and 28 which were exclusive to the agroecosystem. Sixty-four species were exclusive to tropical grasslands and only two species were exclusive to temperate grasslands (Fig. 4). Within agroecosystems, cloud forest was the richer ecosystem with 85 spp. and 38 exclusive species, followed by temperate forest with 55 spp. and

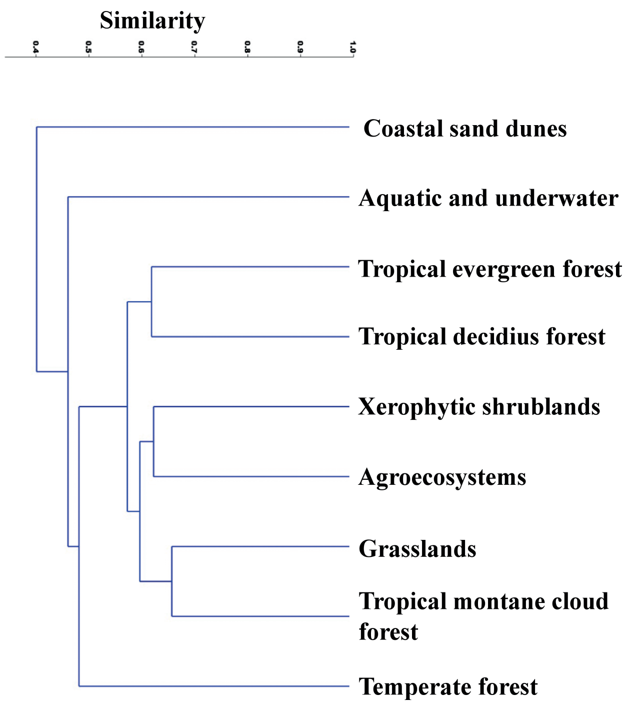


**Fig. 3**. Dendrogram from a cluster analysis base on presence and absence of arbuscular mycorrhizal species recorded in different vegetation types in Mexico, utilizing Jaccard's index and unweighted-pair group methods (UPGMA).

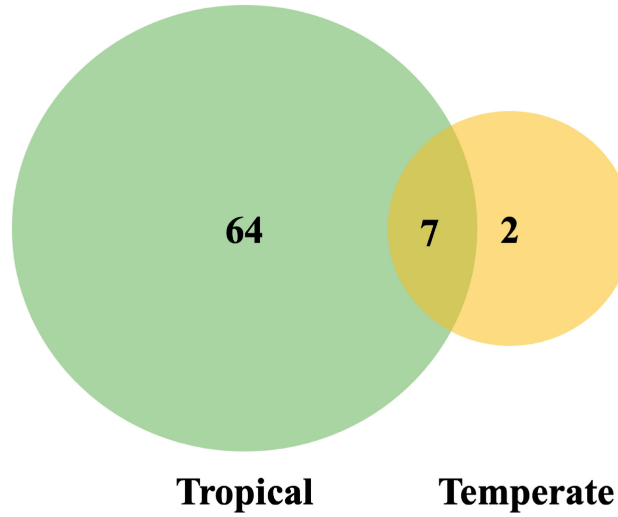


**Fig. 4.** Venn diagram of exclusive and common arbuscular mycorrhizal fungi species between tropical and temperate pastures in Mexico.

16 exclusive species, respectively. Eight species are common in the five ecosystem types *Acaulospora mellea*, *A. morrowiae*, *A. scrobiculata*, *Claroideoglomus claroideum*, *Entrophospora infrequens*, *Funneliformis geosporum*, *F. mosseae* and *Sclerocystis sinuosa* (Fig. 5).

**Tab. 2.** Exclusive arbuscular mycorrhiza fungi species in different vegetation type of Mexico

| Vegetation types | Total | Species |
|---|---|---|
| Agroecosystem | 28 | *Acaulospora capsicula, Acaulospora cavernata, Acaulospora longula, Acaulospora koskei, Albahypha walkeri, Ambispora jimgerdemannii, Ambispora reticulata, Cetraspora armeniaca, Dentiscutata reticulata, Funneliformis kerguelensis, Fuscutata savannicola, Glomus badium, Glomus citricola, Glomus flavisporum, Glomus fuegianum, Glomus pallidum, Halonatospora pansihalos, Orbispora projecturata, Pacispora coralloidea, Pacispora franciscana, Paraglomus laccatum, Racocetra alborosea, Racocetra castanea, Racocetra coralloidea, Rhizoglomus proliferum, Rhizoglomus vesiculiferum, Septoglomus xanthium* and *Tricispora nevadensis* |
| Grasslands | 1 | *Ambispora nicolsonii* |
| Xerophytic shrublands | 6 | *Acaulospora sporocarpia, Corymbiglomus corymbiforme, Diversispora versiformis, Glomus cerebriforme, Septogloms mexicanum* and *Paraglomus bolivianum* |
| Temperate forest | 3 | *Acaulospora alpina, Diversispora epigaea* and *Glomus radiatum* |
| Tropical montane cloud forest | 2 | *Acaulospora colossica* and *Glomus multicaule* |
| Tropical evergreen forest | 4 | *Diversispora arenaria, Diversispora insculpta, Funneliformis multiforus* and *Rhizoglomus custos* |
| Tropical deciduous forest | 2 | *Ambispora callosa* and *Glomus magnicaule* |

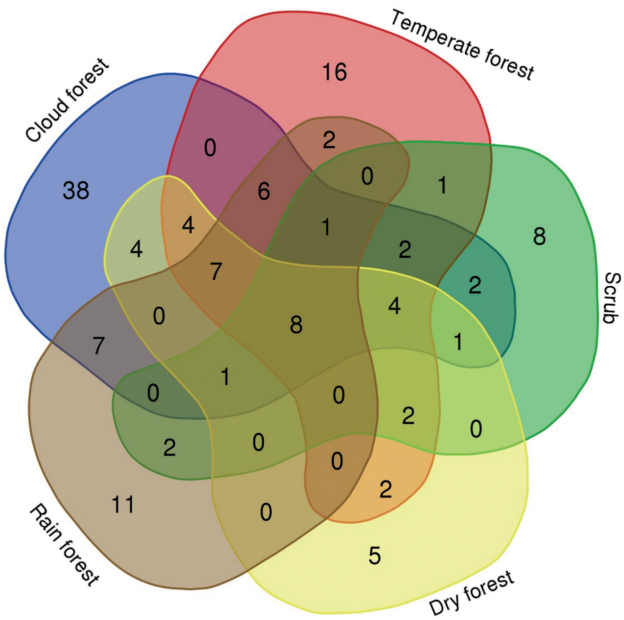


**Fig. 5.** Venn diagram of exclusive and common AMF species between agricultural systems by ecosystems in Mexico.

## Checklist of AMF from Mexico

**Glomeromycota** C. Walker & A. Schüssler

**Archaeosporomycetes**

**Archaeosporales** C. Walker & A. Schüssler

**1. *Archaeospora myriocarpa*** (Spain, Sieverd. & N.C. Schenck) Oehl, G.A. Silva, B.T. Goto & Sieverd., Mycotaxon 117: 430 (2011). ≡ *Acaulospora myriocarpa* Spain, Sieverd. & N.C. Schenck, Mycotaxon 25: 112 (1986).

Occurrence: aquatic and underwater vegetation and grasslands. [33, 93]

Typification details: MBT67574/ herbarium: OSC/ type material: Colombia.

**2. *Archaeospora trappei*** (R.N. Ames & Linderman) J.B. Morton & D. Redecker, Mycologia 93: 183 (2001). ≡ *Acaulospora trappei* R.N. Ames & Linderman, Mycotaxon 3: 566 (1976).

Occurrence: agroecosystems and xerophytic shrublands.[22, 88]

Typification details: MBT467737/ herbarium: OSC 01/ type material: Oregon/USA.

**3. *Archaeospora undulata*** (Sieverd.) Sieverd., G.A. Silva, B.T. Goto & Oehl, Mycotaxon 117: 430 (2012). ≡ *Acaulospora undulata* Sieverd., Angewandte Botanik 62: 373 (1988).

Occurrence: agroecosystems, grasslands, tropical montane cloud forest and xerophytic shrublands. [33, 34, 49, 55]

Typification details: MBT 78285/ herbarium: GOET/ type material: Democratic Republic of Congo.

***Intraspora*** Oehl & Sieverding

**4. *Intraspora schenckii*** (Sieverd. & S. Toro) Oehl & Sieverd., Journal of Applied Botany 80: 77 (2006). ≡ *Entrophospora schenckii* Sieverd. & S. Toro, Mycotaxon 28: 210 (1987). ≡ *Archaeospora schenckii* (Sieverd. & S. Toro) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera: 53. (2010).

Occurrence: agroecosystems, grasslands, temperate forest, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands. [22,33,48,77,83,85,86]

Typification details: MBT 75806/ herbarium: OSC/ type material: Colombia.

**Ambisporaceae** C. Walker, Vestberg & A. Schüssler

***Ambispora*** C. Walker, Vestberg & A. Schüssler

**5. *Ambispora appendicula*** (Spain, Sieverd. & N.C. Schenck) C. Walker, Mycological Research 112: 298 (2008). ≡ *Acaulospora appendicula* Spain, Sieverd. & N.C. Schenck, Mycologia 76: 686 (1984). ≡ *Appendicispora appendicula* (Spain, Sieverd. & N.C. Schenck) Spain, Oehl & Sieverd., Mycotaxon 97: 170 (2006). ≡ *Paracaulospora appendicula* (Spain, Sieverd. & N.C. Schenck) S.P. Gautam & U.S. Patel: 5: (2007).

Occurrence: agroecosystems, aquatic and underwater vegetation, grasslands, tropical evergreen forest, tropical deciduous forest and xerophytic shrublands. [7, 25, 30, 34, 56, 61, 62, 70, 77, 83, 85, 86, 92, 93]

Typification details: MBT 68284/ herbarium: OSC 41495/ type material: Colombia.

**6. *Ambispora callosa*** (Sieverd.) C. Walker, Vestberg & A. Schüssler, Mycological Research 111: 148 (2006). ≡ *Glomus callosum* Sieverd., Angewandte Botanik 62: 374. (1988). ≡ *Appendicispora callosa* (Sieverd.) C. Walker, Vestberg & A. Schüssler, Mycological Research 111: 254 (2007).

Occurrence: tropical deciduous forest. [16]

Typification details: MBT 510213/ herbarium: GOET/type material: Democratic Republic of Congo.

**7. *Ambispora fennica*** C. Walker, Vestberg & A. Schüssler, Mycological Research 111: 148 (2006). ≡ *Appendicispora fennica* (C. Walker, Vestberg & A.

Schüssler) C. Walker, Vestberg & A. Schüssler, Mycological Research 111: 254 (2007).

Occurrence: agroecosystems, temperate forest and xerophytic shrublands.[74, 78, 83]

Typification details: MBT 510210/ herbarium: W 3887/ type material: Finland.

**8. *Ambispora gerdemannii*** (S.L. Rose, B.A. Daniels & Trappe). C. Walker, Vestberg & Schüssler, Mycol. Res. 111: 148 (2007). ≡ *Glomus gerdemannii* S.L. Rose, B.A. Daniels & Trappe, Mycotaxon 8: 297 (1979). ≡ *Archaeospora gerdemannii* (S.L. Rose, B.A. Daniels & Trappe) J.B. Morton & D. Redecker, Mycologia 93: 186 (2001). ≡ *Appendicispora gerdemannii* (S.L. Rose, B.A. Daniels & Trappe) Spain, Oehl & Sieverd., Mycotaxon 97: 174 (2006).

Occurrence: agroecosystems, coastal sand dunes, grasslands, tropical deciduous forest, tropical evergreen forest and xerophytic shrublands.[13, 23, 24, 43, 58, 69, 70, 75, 78]

Typification details: MBT 115820/ herbarium: OSC S-101/ type material: USA.

**9. *Ambispora jimgerdemannii*** (Spain, Oehl & Sieverd.) C. Walker, Mycological Research 112: 298 (2008). ≡ *Acaulospora gerdemannii* N.C. Schenck & T.H. Nicolson, Mycologia 71: 193 (1979). ≡ *Appendicispora jimgerdemannii* Spain, Oehl & Sieverd., Mycotaxon 97: 176 (2006).

Occurrence: agroecosystems.[42]

Typification details: MBT 154146/ herbarium: OSC/ type material: USA.

**10. *Ambispora leptoticha*** (N.C. Schenck & G.S. Sm.) C. Walker, Vestberg & A. Schüssler, Mycological Research 111: 148 (2006). ≡ *Glomus leptotichum* N.C. Schenck & G.S. Sm., Mycologia 74: 82 (1982). ≡ *Archaeospora leptoticha* (N.C. Schenck & G.S. Sm.) J.B. Morton & D. Redecker, Mycologia 93: 184 (2001). ≡ *Pseudoglomus leptotichum* (N.C. Schenck & G.S. Sm.) S.P. Gautam & U.S. Patel, The Mycorrhizae: Diversity, Ecology and Applications: 10: (2007). ≡ *Appendicispora leptoticha* (N.C. Schenck & G.S. Sm.) C. Walker, Vestberg & A. Schüssler, Mycological Research 111: 255 (2007).

Occurrence: agroecosystems, grasslands, temperate forest and tropical montane cloud forest.[33, 44, 60, 68, 83, 84]

Typification details: MBT 70607/ herbarium: OSC 40249/ type material: USA.

**11. *Ambispora nicolsonii*** (C. Walker, L.E. Reed & F.E. Sanders) Oehl, G.A. Silva, B.T. Goto & Sieverd., Mycotaxon 117: 431 (2012). ≡ *Acaulospora nicolsonii* C. Walker, L.E. Reed & F.E. Sanders, Transacciones of the British Mycological Society 83: 360 (1984).

Occurrence: grasslands.[33]

Typification details: MBT 68295/ herbarium: OSC 281/ type material: United Kingdom.

**12. *Ambispora reticulata*** Oehl & Sieverd., J. Appl. Bot. and Food Quality-Angewandte Botanik 85: 130 (2012).

Occurrence: agroecosystems.[92]

Typification details: MBT 800269/ herbarium: Z+ZT 24171/ type material: Switzerland.

**Diversisporales** C. Walker & A. Schüssler

**Acaulosporaceae** J.B. Morton & Benny, Mycotaxon 37: 479 (1990).

***Acaulospora*** Gerdemann & Trappe

**13. *Acaulospora alpina*** Oehl, Sýkorová & Sieverd., Mycologia 98: 289 (2006).

Occurrence: temperate forests.[74]

Typification details: MBT 117542/ herbarium: Z+ZT Myc 41-4101/ type material: Switzerland.

**14. *Acaulospora bireticulata*** F.M. Rothwell & Trappe, Mycotaxon 8: 472 (1979).

Occurrence: agroecosystems and tropical evergreen forest.[10, 43, 52, 71]

Typification details: MBT 308075/ herbarium: OSC SP169/ type material: USA.

**15. *Acaulospora capsicula*** Błaszk., Mycologia 82: 794 (1990).

Occurrence: agroecosystems.[88]

Typification details: MBT 75574/ herbarium: DPP 1414/ type material: Poland.

**16. *Acaulospora cavernata*** Błaszk., Cryptogamic Botany 1: 204 (1989).

Occurrence: agroecosystems.[83]

Typification details: MBT 74890/ herbarium: DPP 1285/ type material: Poland

**17. *Acaulospora colossica*** P.A. Schultz, Bever & J.B. Morton, Mycologia 91: 677 (1999).

Occurrence: tropical montane cloud forest.[33]

Typification details: MBT 788567/ herbarium: OSC 69035/ type material: USA.

**18. *Acaulospora delicata*** C. Walker, C.M. Pfeiff. & Bloss, Mycotaxon 25: 622 (1986).

Occurrence: agroecosystems, grasslands, temperate forest, tropical montane cloud forest, tropical deciduous forest, tropical evergreen forest and xerophytic shrublands.[9,22,25,30,31,33,34,38,43,44,49,60,65,68,70,73,77,84]

Typification details: MBT67217/ herbarium: OSC/ type material: USA.

**19. *Acaulospora denticulata*** Sieverd. & S. Toro, Angewandte Botanik 61: 217 (1987).

Occurrence: agroecosystems, grasslands, temperate forest, tropical deciduous forest, tropical montane cloud forest and xerophytic shrublands.[21, 22, 29, 31, 33, 34, 44, 50, 52, 55, 60, 68, 73, 77, 83, 88, 92]

Typification details: MBT 77322/ herbarium: GOET/ type material: Colombia.

**20. *Acaulospora dilatata*** J.B. Morton, Mycologia 78: 641 (1986).

Occurrence: agroecosystems, grasslands, tropical deciduous forest and tropical montane cloud forest.[35,43]

Typification details: MBT 67218/ herbarium: OSC 331/ type material: USA.

**21. *Acaulospora elegans*** Trappe & Gerd., Mycologia Memoirs 5: 34 (1974).

Occurrence: agroecosystems, grasslands and tropical montane cloud forest.[33, 73, 83]

Typification details: MBT 67218/ herbarium: OSC 2220/ type material: USA.

**22. *Acaulospora excavata*** Ingleby & C. Walker, Mycotaxon 50: 100 (1994).

Occurrence: agroecosystems, grasslands, tropical deciduous forest and tropical montane cloud forest.[34, 43, 48, 77, 80, 92]

Typification details: MBT81912/ herbarium: OSC 1674/ type material: Ivory Coast.

**23. *Acaulospora foveata*** Trappe & Janos, Mycotaxon 15: 516 (1982).

Occurrence: agroecosystems, aquatic and underwater vegetation, grasslands, temperate forest, tropical deciduous forest, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[6, 19, 25, 33, 34, 40, 44, 53, 56, 58, 59, 60, 63, 65, 68, 70, 73, 80, 83, 85, 86, 92, 93]

Typification details: MBT 70097/ herbarium: OSC 3601/ type material: Mexico.

**24. *Acaulospora kentinensis*** (C.G. Wu & Y.S. Liu) Kaonongbua, J.B. Morton & Bever, Mycologia 102: 1501 (2010). ≡ *Entrophospora kentinensis* C.G. Wu & Y.S. Liu, Mycotaxon 53: 287 (1995). ≡ *Kuklospora kentinensis* (C.G. Wu & Y.S. Liu) Oehl & Sieverd., Journal of Applied Botany 80: 74 (2006).

Occurrence: agroecosystems, aquatic and underwater vegetation, grasslands, tropical evergreen forest and tropical montane cloud forest.[34, 70, 72, 83, 90, 94]

Typification details: MBT 82989/ herbarium: Taiwan Agricultural Res. Inst/ type material: Taiwan.

**25. *Acaulospora koskei*** Błaszk., Mycological Research 99: 237 (1995).

Occurrence: agroecosystems.[44, 60]

Typification details: MBT 82741/ herbarium: DPP 1941/ type material: Poland.

**26. *Acaulospora lacunosa*** J.B. Morton, Mycologia 78: 643 (1986).

Occurrence: agroecosystems, coastal sand dunes and tropical montane cloud forest.[11, 33, 73]

Typification details: MBT67219/ herbarium: OSC 332/ type material: USA.

**27. *Acaulospora laevis*** Gerd. & Trappe, Mycologia Memoirs 5: 33 (1974).

Occurrence: agroecosystems, coastal sand dunes, grasslands, temperate forest, tropical deciduous forest, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[7, 9, 10, 24, 25, 33, 38, 41, 43, 44, 49, 55, 56, 60, 62, 65, 70, 71, 75, 77, 80, 83, 84, 85, 86, 88]

Typification details: MBT67219/ herbarium: OSC 2085/ type material: USA.

**28. *Acaulospora longula*** Spain & N.C. Schenck, Mycologia 76: 689 (1984).

Occurrence: agroecosystems.[83]

Typification details: MBT 68292/ herbarium: OSC 41496/ type material: Colombia.

**29. *Acaulospora mellea*** Spain & N.C. Schenck, Mycologia 76: 689 (1984).

Occurrence: agroecosystems, grasslands, temperate forest, tropical deciduous forest, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[9, 10, 25, 33, 34, 40, 41, 43, 48, 56, 57, 65, 68, 70, 71, 73, 77, 83, 85, 86, 92]

Typification details: MBT 68293/ herbarium: OSC 41494/ type material: Colombia.

**30. *Acaulospora minuta*** Oehl, Tchabi, Hount., Palenz., I.C. Sánchez & G.A. Silva, Journal of Applied Botany and Food Quality 84: 214 (2011).

Occurrence: agroecosystems and xerophytic shrublands.[81, 91]

Typification details: MBT 170234/ herbarium: Z+ZT Myc 3343/ type material: Benin.

**31. *Acaulospora morrowiae*** Spain & N.C. Schenck, Mycologia 76: 692 (1984).

Occurrence: agroecosystems, aquatic and underwater vegetation, coastal sand dunes, grasslands, temperate forest, tropical deciduous forest, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[22, 25, 31, 33, 34, 48, 49, 50, 54, 56, 64, 65, 68, 70, 71, 72, 75, 77, 83, 86, 88]

Typification details: MBT68294/ herbarium: OSC 41493/ type material: Colombia.

**32. *Acaulospora papillosa*** C.M.R. Pereira & Oehl, Phytotaxa 260: 16 (2016).

Occurrence: agroecosystems and xerophytic shrublands.[81, 91]

Typification details: MBT 202639/ herbarium: URM 87964/ type material: Brazil.

**33. *Acaulospora paulineae*** Błaszk., Bulletin of the Polish Academy of Sciences Biology 36: 271 (1988).

Occurrence: agroecosystems, tropical deciduous forest and xerophytic shrublands.[50, 83]

Typification details: MBT 4894/ herbarium: DPP 428/ type material: Poland.

**34. *Acaulospora reducta*** Oehl, B.T. Goto & C.M.R. Pereira, Mycotaxon 130: 986 (2016).

Occurrence: agroecosystems and xerophytic shrublands.[81, 91]

Typification details: MBT 201236/ herbarium: URM87697/ type material: Brazil.

**35. *Acaulospora rehmii*** Sieverd. & S. Toro, Angewandte Botanik 61: 219 (1987).

Occurrence: agroecosystems, aquatic and underwater vegetation, coastal sand dunes, grasslands, temperate forest, tropical deciduous forest, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[30, 33, 34, 44, 50, 60, 68, 70, 73, 77, 83, 84, 91, 92, 93, 95]

Typification details: MBT 77323/ herbarium: GOET/ type material: Colombia.

**36. *Acaulospora scrobiculata*** Trappe, Mycotaxon 6: 363 (1977).

Occurrence: agroecosystems, aquatic and underwater vegetation, coastal sand dunes, grasslands, temperate forest, tropical deciduous forest, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[2, 7, 12, 15, 16, 20, 24, 25, 30, 33, 34, 35, 40, 43, 44, 45, 48, 49, 50, 54, 55, 56, 57, 58, 59, 60, 64, 65, 68, 70, 71, 72, 73, 75, 76, 77, 83, 85, 86, 89, 90, 91, 92, 95]

Typification details: MBT 67219/ herbarium: OSC 3795/ type material: Mexico.

**37. *Acaulospora spinosa*** C. Walker & Trappe, Mycotaxon 12: 515 (1981).

Occurrence: agroecosystems, aquatic and underwater vegetation, grasslands, temperate forest, tropical deciduous forest, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[5, 12, 15, 16, 20, 21, 33, 34, 40, 41, 43, 44, 48, 50, 52, 55, 58, 60, 62, 64, 65, 67, 68, 70, 71, 73, 77, 80, 83, 84, 85, 86, 91, 92, 95]

Typification details: MBT 71260/ herbarium: OSC 164/ type material: USA.

**38. *Acaulospora splendida*** Sieverd., Chaverri & I. Rojas, Mycotaxon 33: 252 (1988).

Occurrence: agroecosystems and temperate forest.[9, 44, 71, 83, 84]

Typification details: MBT 78286/ herbarium: GOET/ type material: Costa Rica.

**39. *Acaulospora sporocarpia*** S.M. Berch, Mycotaxon 23: 409 (1985).

Occurrence: xerophytic shrublands.[22, 31]

Typification details: MBT 67976/ herbarium: OSC47836 / type material: USA.

***Kuklospora*** Gerdemann & Trappe

**40. *Kuklospora colombiana*** (Spain & N.C. Schenck) Oehl & Sieverd., Journal of Applied Botany 80: 74 (2006). ≡ *Entrophospora colombiana* Spain & N.C. Schenck, Mycologia 76: 693 (1984). ≡ *Acaulospora colombiana* (Spain & N.C. Schenck) Kaonongbua, J.B. Morton & Bever, Mycologia 102: 1501 (2010).

Occurrence: agroecosystems, aquatic and underwater vegetation and tropical montane cloud forest.[33, 72, 83]

Typification details: MBT 68373/ herbarium: OSC 41497/ type material: Colombia.

**Diversisporaceae** C. Walker & A. Schüssler, emend. Oehl, Palenz., I.C. Sánchez, G.A. Silva, B.T. Goto & Sieverd., Mycotaxon 117: 297 (2011).

***Corymbiglomus*** Błaszk. & Chwat

**41. *Corymbiglomus corymbiforme*** (Błaszk.) Błaszk. & Chwat, The Glomeromycota 1: 274 (2012). ≡ *Glomus corymbiforme* Błaszk., Mycologia 87: 732 (1995).

Occurrence: xerophytic shrublands.[66]

Typification details: MBT 172184/ herbarium: DPP 2022/ type material: Poland.

**42. *Corymbiglomus globiferum*** (Koske & C. Walker) Błaszk. & Chwat, Mycotaxon 26:133 (2013). ≡ *Glomus globiferum* Koske & C. Walker, Mycotaxon 26: 133 (1986).

Occurrence: aquatic and underwater vegetation, coastal sand dunes and xerophytic shrublands.[45, 62]

Typification details: MBT 622179/ herbarium: OSC 535/ type material: USA.

***Sieverdingia*** Błaszk., Niezgoda & B.T. Goto

**43. *Sieverdingia tortuosa* (N.C. Schenck & G.S. Sm.)** Błaszk., Niezgoda & B.T. Goto, Mycological Progress 18: 1369 (2019) ≡ *Corymbiglomus tortuosum* (N.C. Schenck & G.S. Sm.) Błaszk. & Chwat, 99: (2013). ≡ *Glomus tortuosum* N.C. Schenck & G.S. Sm., Mycologia 74: 83 (1982). ≡ *Parapseudoglomus tortuosum* (N.C. Schenck & G.S. Sm.) S.P. Gautam & U.S. Patel, The Mycorrhizae: Diversity, Ecology and Applications 11: (2007).

Occurrence: agroecosystems, grasslands, temperate forest, tropical deciduous forest, tropical montane cloud forest and xerophytic shrublands.[19, 30, 33, 44, 53, 61, 62, 73, 80]

Typification details: MBT 832298/ herbarium: OSC 40251/ type material: USA.

***Diversispora*** C. Walker & A. Schüssler emend. G.A. Silva, Oehl & Sieverd.

**44. *Diversispora arenaria*** (Błaszk. Tadych & Madej) Oehl, G.A. Silva & Sieverd., Mycotaxon 116: 108 (2011). ≡ *Glomus arenarium* Błaszk., Tadych & Madej, Acta Societatis Botanicorum Poloniae 70: 97 (2001).

Occurrence: tropical evergreen forest.[46]

Typification details: MBT 518472/ herbarium: DPP 2182/ type material: Poland.

**45. *Diversispora aurantia*** (Błaszk., Blanke, Renker & Buscot) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera 43: (2010). ≡ *Glomus aurantium* Błaszk., Blanke, Renker & Buscot, Mycotaxon 90: 450 (2004).

Occurrence: agroecosystems, tropical deciduous forest and tropical evergreen forest.[46, 52, 58, 70, 71, 76, 77, 83, 89]

Typification details: MBT 542918/ herbarium: DPP 2444/ type material: Poland.

**46. *Diversispora eburnea*** (L.J. Kenn., J.C. Stutz & J.B. Morton) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera 43: (2010). ≡ *Glomus eburneum* L.J. Kenn., J.C. Stutz & J.B. Morton, Mycologia 91: 1084 (1999).

Occurrence: agroecosystems, grasslands, aquatic and underwater vegetation, tropical evergreen forest and xerophytic shrublands.[53, 70, 72, 69, 78]

Typification details: MBT no data/ herbarium: OSC/ type material: USA.

**47. *Diversispora epigaea*** (B.A. Daniels & Trappe) C. Walker & A. Schüssler Mycological Research 108: 982 (2004). ≡ *Glomus epigaeus,* [as *'epigaeum'*], B.A. Daniels & Trappe, Canadian Journal of Botany 57: 540 (1979).

Occurrence: temperate forest.[3]

Typification details: MBT no data/ herbarium: OSC 5174/ type material: USA.

**48. *Diversispora insculpta*** (Błaszk.) Oehl, G.A. Silva & Sieverd., Mycotaxon 116: 110 (2011). ≡ *Glomus insculptum* Błaszk**.,** Mycotaxon 89: 227 (2004).

Occurrence: tropical evergreen forest.[70]

Typification details: MBT 114021/ herbarium: DPP 2271/ type material: Poland.

**49. *Diversispora pustulata*** (Koske, Friese, C. Walker & Dalpé) Oehl, G.A. Silva & Sieverd., Mycotaxon 116: 110 (2011). ≡ *Glomus pustulatum* Koske, Friese, C. Walker & Dalpé, Mycotaxon 26: 143 (1986).

Occurrence: agroecosystems, grasslands, coastal sand dunes and tropical evergreen forest.[34, 68]

Typification details: MBT 67207/ herbarium: OSC 1064/ type material: USA.

**50. *Diversispora spurca*** (C.M. Pfeiff., C. Walker & Bloss) C. Walker & A. Schüssler, Mycological Research 108: 982 (2004). ≡ *Glomus spurcum* C.M. Pfeiff., C. Walker & Bloss, Mycotaxon 59: 374 (1996).

Occurrence: agroecosystems, grasslands, temperate forest, tropical deciduous forest, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[30, 44, 60, 70, 71, 84, 85, 86, 88, 89, 91]

Typification details: MBT 84579/ herbarium: OSC W989 / type material: USA.

**51. *Diversispora trimurales*** (Koske & Halvorson) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera 43. (2010). ≡ *Glomus trimurales* Koske & Halvorson, Mycologia 81: 930 (1990).

Occurrence: agroecosystems and xerophytic shrublands.[66, 83, 91]

Typification details: MBT no data/ herbarium: OSC 565/ type material: USA.

**52.** ***Diversispora versiformis*** (P. Karst.) Oehl, G.A. Silva & Sieverd., Mycotaxon 116: 110 (2011). ≡ *Endogone versiformis* P. Karst 39. 1884. ≡ *Glomus versiforme* (P. Karst.) S.M. Berch, Canadian Journal of Botany 61: 2614 (1983).

Occurrence: xerophytic shrublands.[19, 23]

Typification details: MBT no data/ herbarium: not available / type material: Finland.

***Otospora*** Oehl, J. Palenzuela & N. Ferrol

**53.** ***Otospora bareae*** Palenzuela, N. Ferrol & Oehl, Mycologia 100. 298 (2008).

Occurrence: agroecosystems and xerophytic shrublands.[83]

Typification details: MBT no data/ herbarium: Z+ZT Myc 160/ type material: Spain.

***Redeckera*** C. Walker & A. Schüssler emend. Oehl, G.A. Silva & Sieverd.

**54.** ***Redeckera fulvum*** (Berk. & Broome) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera 43 (2010). ≡ *Paurocotylis fulva* Berk. & Broome, Botanical Journal of the Linnean Society 14: 137 (1873). ≡ *Endogone fulva* (Berk. & Broome) Pat., Bulletin de la Société Mycologique de France 19: 341 (1903). ≡ *Glomus fulvum* (Berk. & Broome) Trappe & Gerd., [as *'fulvus'*], Mycologia Memoirs 5: 59 (1974).

Occurrence: agroecosystems, temperate forest, tropical deciduous forest and tropical montane cloud forest.[1, 25, 41, 55, 56]

Typification details: MBT 513527/ herbarium and type material: not available.

***Tricispora*** Oehl, Sieverd., G.A. Silva & Palenz.

**55.** ***Tricispora nevadensis*** (Palenz., N. Ferrol, Azcón-Aguilar & Oehl) Oehl, Palenz., G.A. Silva & Sieverd., Mycotaxon, 117: 310 (2012). ≡ *Entrophospora nevadensis* Palenz., N. Ferrol, Azcón-Aguilar & Oehl, Mycologia 102: 627 (2009).

Occurrence: agroecosystems.[89]

Typification details: MBT no data/ herbarium: Z+ZT Myc 1625/ type material: Spain.

**Pacisporaceae** C. Walker, Błaszk., A. Schüssler & Schwarzott, Mycological Research 108: 716 (2004).

***Pacispora*** Sieverd. & Oehl

**56.** ***Pacispora chimonobambusae*** (C.G. Wu & Y.S. Liu) Sieverd. & Oehl ex C. Walker, Vestberg & A. Schüssler, Mycological Research 111: 255 (2007). ≡ *Glomus chimonobambusae* C.G. Wu & Y.S. Liu, Mycotaxon 53: 284 (1995). ≡ *Gerdemannia chimonobambusae* (C.G. Wu & Y.S. Liu) C. Walker, Błaszk, A. Schüssler & Schwarzott, Mycological Research 108: 717 (2004).

Occurrence: agroecosystems and grasslands.[34, 68]

Typification details: MBT 82941/ herbarium: Taiwan Agricultural Research Institute, Wu-82041201/ type material: Taiwan

**57.** ***Pacispora coralloidea*** Sieverd. & Oehl, Journal of Applied Botany 78: 78 (2004).

Occurrence: agroecosystems.[44, 71]

Typification details: MBT 114120/ herbarium: Z+ZT Myc 3401/ type material: Switzerland.

**58.** ***Pacispora franciscana*** Sieverd. & Oehl, Journal of Applied Botany 78: 78 (2004).

Occurrence: agroecosystems.[33]

Typification details: MBT 114120/ herbarium: Z+ZT Myc 3101/ type material: Italy

**59.** ***Pacispora scintillans*** Sieverd., & Oehl, Journal of Applied Botany 78: 78 (2004). ≡ *Glomus scintillans* S.L. Rose & Trappe, Mycotaxon 10: 417 (1980).

Occurrence: agroecosystems, temperate forest, tropical deciduous forest and tropical montane cloud forest.[25, 33, 41, 44, 56, 60]

Typification details: MBT 72098/ herbarium: OSC S-220/ type material: USA.

**Sacculosporaceae** Oehl & Sieverd. emend. Oehl, Sieverd., Palez. & G.A. Silva, Mycotaxon, 117: 297 (2011).

***Sacculospora*** Oehl, Sieverd., G.A. Silva, B.T. Goto, I.C. Sánchez & Palenz.

**60.** ***Sacculospora baltica*** (Błaszk., Madej & Tadych) Oehl, Palenzuela, I.C. Sánchez, B.T. Goto, G.A. Silva & Sieverd. Mycotaxon 117: 311 (2012). ≡ *Entrophospora baltica* Błaszk., Madej & Tadych, Mycotaxon 68: 167 (1998).

Occurrence: agroecosystems, grasslands and xerophytic shrublands.[68, 91]

Typification details: MBT 86707/ herbarium: DPP 2148/ type material: Poland.

**Glomerales** J.B. Morton & Benny

**Entrophosporaceae** Oehl & Sieverd. emend. Oehl, Sieverd., Palez. & G.A. Silva, Mycotaxon, 117: 297 (2011).

***Albahypha*** Oehl, G.A. Silva, B.T. & Sieverd.

**61. *Albahypha drummondii*** (Błaszk. & Renker), Oehl, B.T. Goto & G.A. Silva, Mycotaxon 117: 308 (2012). ≡ *Glomus drummondii* Błaszk. & Renker, Mycological Research 110: 559 (2006). ≡ *Claroideoglomus drummondii* (Błaszk. & C. Renker) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera: 22 (2010).[85, 86]

Occurrence: agroecosystems, grasslands and tropical evergreen forest.

Typification details: MBT no data/ herbarium: DDP 2578 / type material: Poland.

**62. *Albahypha walkeri*** (Błaszk. & Renker) Sieverd., Oehl, B.T. Goto & G.A. Silva, Mycotaxon 117: 309 (2012). ≡ *Glomus walkeri* Błaszk. & Renker, Mycological Research 110. 563 (2006). ≡ *Claroideoglomus walkeri* (N.C. Schenck & G.S. Sm.) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera: 22 (2010).

Occurrence: agroecosystems.[83]

Typification details: MBT no data/ herbarium: Herbarium Bogoriense KK-277/ type material: Indonesia.

***Claroideoglomus*** C. Walker & A. Schüssler emend. Oehl, G.A. Silva & Sieverd.

**63. *Claroideoglomus claroideum*** (N.C. Schenck & G.S. Sm.) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera: 13 (2010). ≡ *Glomus claroideum* N.C. Schenck & G.S. Sm., Mycologia 74: 84 (1982).

Occurrence: agroecosystems, aquatic and underwater vegetation, coastal sand dunes, grasslands, tropical deciduous forest, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[22, 23, 25, 31, 33, 43, 48, 49, 50, 53, 55, 56, 62, 65, 70, 71, 72, 73, 75, 77, 83, 89, 91, 92, 94]

Typification details: MBT no data/ herbarium: OSC 40252/ type material: USA.

**64. *Claroideoglomus etunicatum*** (W.N. Becker & Gerd.) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera: 13 (2010). ≡ *Glomus etunicatum* W.N. Becker & Gerd. [as *'etunicatus'*], Mycotaxon 6: 29 (1977).

Occurrence: agroecosystems, aquatic and underwater vegetation, coastal sand dunes, tropical deciduous forest, tropical evergreen forest and xerophytic shrublands.[8, 9, 10, 22, 23, 31, 43, 45, 49, 52, 54, 58, 61, 62, 64, 70, 72, 77, 83, 89, 90, 91, 93]

Typification details: MBT no data/ herbarium: OSC 02/ type material: USA.

**65. *Claroideoglomus lamellosum*** (Dalpé, Koske & Tews) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera: 13 (2010). ≡ *Glomus lamellosum* Dalpé, Koske & Tews, Mycotaxon 43: 289 (1992).

Occurrence: agroecosystems and grasslands.[69, 84]

Typification details: MBT no data/ herbarium: DAOM 212349/ type material: Canada.

**66. *Claroideoglomus luteum*** (L.J. Kenn, J.C. Stutz & J.B. Morton) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera: 22 (2010). ≡ *Glomus luteum* L.J. Kenn., J.C. Stutz & J.B. Morton, Mycologia 91: 1090 (1999).

Occurrence: agroecosystems and aquatic and underwater vegetation.[48, 71, 94]

Typification details: MBT no data/ herbarium: OSC / type material: USA.

***Entrophospora*** Ames & Schneid. emend. Oehl & Sieverd.

**67. *Entrophospora infrequens*** (I.R. Hall) R.N. Ames & R.W. Schneid., Mycotaxon 8: 348 (1979). ≡ *Glomus infrequens* I.R. Hall. Transactions of the British Mycological Society 68: 345 (1977).

Occurrence: agroecosystems, aquatic and underwater vegetation, grasslands, temperate forest, tropical deciduous forest, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[22, 23, 25, 31, 33, 34, 39, 43, 44, 48, 50, 52, 55, 56, 61, 62, 67, 68, 70, 71, 72, 73, 77, 78, 82, 83, 88, 89, 91, 92]

Typification details: MBT154527/ herbarium: PDD 34858/ type material: New Zeland.

**Glomeraceae** Piroz. & Dalpé emend. Oehl, G.A. Silva, Goto, B.T. & Sieverd., Mycotaxon, 116: 75 (2011).

***Funneliformis*** C. Walker & Schüssler emend. Oehl, G.A. Silva & Sieverd.

**68. *Funneliformis caesaris*** (Sieverd. & Oehl) Oehl, G.A. Silva & Sieverd., Mycotaxon 116: 102 (2011). ≡ *Glomus caesaris* Sieverd. & Oehl, Mycotaxon 84: 381 (2002).

Occurrence: coastal sand dunes, grasslands and xerophytic shrublands.[53, 62, 75, 82]

Typification details: MBT 101136/ herbarium: Z+ZT Myc 15-191/ type material: Germany.

**69. *Funneliformis coronatus*** (Giovann.) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera: 13 (2010). ≡ *Glomus coronatum* Giovann., Canadian Journal of Botany 69: 162 (1991).

Occurrence: agroecosystems, aquatic and underwater vegetation, grasslands and xerophytic shrublands.[23, 43, 53, 83, 93]

Typification details: MBT no data/ herbarium: Herbarium Horti Botanici Pisani PI-HMZ3-4/ type material: Italy.

**70. *Funneliformis geosporus*** (T.H. Nicolson & Gerd.) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera: 13 (2010). ≡ *Endogone macrocarpa* var. *geospora* T.H. Nicolson & Gerd., Mycologia 60: 318 (1968). ≡ *Glomus macrocarpum* var. *geosporus* (T.H. Nicolson & Gerd.) Gerd. & Trappe, Mycologia Memoirs 5: 55 (1974). ≡ *Glomus geosporum* (T.H. Nicolson & Gerd.) C. Walker, Mycotaxon 15: 56 (1982).

Occurrence: agroecosystems, aquatic and underwater vegetation, coastal sand dunes, grasslands, temperate forest, tropical deciduous forest, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[11, 12, 13, 16, 17, 22, 25, 27, 29, 30, 31, 34, 40, 44, 45, 48, 49, 50, 51, 52, 53, 55, 56, 57, 60, 62, 64, 65, 68, 70, 71, 72, 73, 75, 78, 82, 84, 85, 86, 89, 90, 92, 93, 94]

Typification details: MBT no data/ herbarium: Farlow Herbarium Harvard University/ type material: Scotland.

**71. *Funneliformis halonatus*** (S.L. Rose & Trappe) Oehl, G.A. Silva & Sieverd., Mycotaxon 116: 102 (2011). ≡ *Glomus halonatum* S.L. Rose & Trappe, [as *'halonatus'*], Mycotaxon 10: 413 (1980).

Occurrence: agroecosystems, grasslands and xerophytic shrublands.[4, 91]

Typification details: MBT 72096/ herbarium: OSC S-225/ type material: England.

**72. *Funneliformis kerguelensis*** (Dalpé & Strullu) Oehl, G.A. Silva & Sieverd., Mycotaxon 116. 102 (2011). ≡ *Glomus kerguelense* Dalpé & Strullu, Mycotaxon 84. 53 (2002).

Occurrence: agroecosystems.[83]

Typification details: MBT 101135/ herbarium: DAOM 229603/ type material: France

**73. *Funneliformis monosporus*** (Gerd. & Trappe) Oehl, G.A. Silva & Sieverd., Mycotaxon 116: 102 (2011). ≡ *Glomus monosporum* Gerd. & Trappe, Mycologia Memoirs 5: 41 (1974).

Occurrence: agroecosystems, grasslands and tropical deciduous forest.[30, 35, 73]

Typification details: MBT no data/ herbarium: OSC 2089/ type material: USA.

**74. *Funneliformis mosseae*** (T.H. Nicolson & Gerd.) C. Walker & A. Schüssler., The Glomeromycota: a species list with new families and new genera: 13 (2010). ≡ *Endogone mosseae* T.H. Nicolson & Gerd., Mycologia 60: 314 (1968). ≡ *Glomus mosseae* (T.H. Nicolson & Gerd.) Gerd. & Trappe, Mycologia Memoirs 5: 40 (1974).

Occurrence: agroecosystems, aquatic and underwater vegetation, coastal sand dunes, grasslands, temperate forest, tropical deciduous forest, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[7, 9, 10, 11, 17, 21, 22, 23, 26, 31, 32, 33, 41, 43, 44, 49, 50, 55, 59, 60, 61, 62, 64, 70, 71, 73, 75, 77, 78, 82, 83, 84, 88, 89, 91, 92, 94]

Typification details: MBT no data/ herbarium: Farlow Herbarium, Harvard University/ type material: Scotland .

**75. *Funneliformis multiforus*** (Tadych & Błaszk.) Oehl, G.A. Silva & Sieverd., Mycotaxon 116: 103 (2011). ≡ *Glomus multiforum* Tadych & Błaszk., Mycologia 89: 805 (1997).

Occurrence: tropical evergreen forest. [70]

Typification details: MBT 85714/ herbarium: DPP2108/ type material: Poland.

**76. *Funneliformis verruculosus*** (Błaszk.) C. Walker & A. Schüssler., The Glomeromycota: a species list with new families and new genera: 14 (2010). ≡ *Glomus verruculosum* Błaszk., Mycologia 89: 809 (1997).

Occurrence: agroecosystems, aquatic and underwater vegetation, tropical deciduous forest and xerophytic shrublands.[25, 48, 50, 56, 72]

Typification details: MBT no data/ herbarium: DPP 2148/ type material: Poland.

***Glomus*** Tul. & Tul. emend. Oehl, G.A. Silva & Sieverd.

**77. *Glomus ambisporum*** G.S. Sm. & N.C. Schenck, Mycologia 77: 566 (1985).

Occurrence: agroecosystems, aquatic and underwater vegetation, grasslands, tropical evergreen forest and tropical montane cloud forest.[24, 34, 53, 59, 68, 70, 72, 73, 83]

Typification details: MBT 68097/ herbarium: OSC 44289/ type material: USA.

**78. *Glomus badium*** Oehl, D. Redecker & Sieverd., Journal of Applied Botany 79: 39 (2005). ≡ *Funneliformis badium* (Oehl, D. Redecker & Sieverd.) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera: 13 (2010).

Occurrence: agroecosystems.[89]

Typification details: MBT no data/ herbarium: Z+ZT Myc 4992/ type material: Germany.

**79. *Glomus brohultii*** R.A. Herrera, Ferrer & Sieverd., Journal of Applied Botany 77: 37 (2003).

Occurrence: agroecosystems and tropical montane cloud forest.[73, 83]

Typification details: MBT no data/ herbarium: BSRS-3032/ type material: Cuba.

**80. *Glomus caledonium*** (T.H. Nicolson & Gerd.) Trappe & Gerd., Mycologia Memoirs 5: 56 (1974). ≡ *Endogone macrocarpa* var. *caledonia* T.H. Nicolson & Gerd., Mycologia 60: 322 (1968). ≡ *Funneliformis caledonium* (T.H. Nicolson & Gerd.) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera: 13 (2010).

Occurrence: agroecosystems, grasslands and xerophytic shrublands.[19, 53, 62, 73]

Typification details: MBT no data/ herbarium: OSC 3162/ type material: USA.

**81. *Glomus cerebriforme*** McGee, Transactions of the British Mycological Society 87: 123 (1986).

Occurrence: xerophytic shrublands.[22, 31]

Typification details: MBT 67357/ herbarium: ADW 16898 / type material: South Australia

**82. *Glomus citricola*** D.Z. Tang & M. Zang, Acta Botanica Yunnanica [as 'citriculum']: 301 (1984).

Occurrence: agroecosystems.[24, 89]

Typification details: MBT 68389/ herbarium: KUN 10401/ type material: China.

**83. *Glomus clavisporum*** (Trappe) R.T. Almeida & N.C. Schenck, Mycologia 82: 710 (1990). ≡ *Sclerocystis clavispora* Trappe, Mycotaxon 6: 359 (1977). ≡ *Sclerocystis microcarpus* S.H. Iqbal & Perveen, Transactions of the Mycological Society of Japan 21: 58 (1980).

Occurrence: agroecosystems, aquatic and underwater vegetation, grasslands, tropical deciduous forest, tropical evergreen forest and xerophytic shrublands.[2, 9, 10, 13, 15, 20, 25, 25, 50, 53, 56, 59, 70, 76, 91, 93]

Typification details: MBT no data/ herbarium: OSC 3868/ type material: Mexico.

**84. *Glomus flavisporum*** (M. Lange & E.M. Lund) Trappe & Gerd., Mycologia Memoirs 5: 58 (1974). *Endogone flavispora* M. Lange & E.M. Lund, Friesia 5: 93 (1954).

Occurrence: agroecosystems.[83]

Typification details: MBT 143997/ herbarium: Mus. Bot. Haun M4054 / type material: Denmark

**85. *Glomus fuegianum*** (Speg.) Trappe & Gerd., Mycologia Memoirs 5: 58 (1974). ≡ *Endogone fuegiana* Speg., Anales de la Sociedad Científica Argentina 24: 125 (1887).

Occurrence: agroecosystems.[80]

Typification details: MBT no data/ herbarium: material not available/ type material: Straits of Magellan.

**86. *Glomus glomerulatum*** Sieverd., Mycotaxon 29: 74 (1987).

Occurrence: agroecosystems, coastal sand dunes, grasslands, tropical deciduous forest and tropical evergreen forest.[30, 43, 77, 85, 86, 95]

Typification details: MBT 76700/ herbarium: CIAT C-163-4/ type material: Colombia.

**87. *Glomus heterosporum*** G.S. Sm. & N.C. Schenck, Mycologia 77: 567 (1985).

Occurrence: grasslands and tropical montane cloud forest.[33]

Typification details: MBT 68098/ herbarium: OSC 44288/ type material: USA.

**88. *Glomus hyderabadensis*** Swarupa, Kunwar, G.S. Prasad & Manohar., Mycotaxon 89: 247 (2004).

Occurrence: aquatic and underwater vegetation and tropical evergreen forest.[46, 90]

Typification details: MBT 114017/ herbarium: HCIO 43918/ type material: India.

**89. *Glomus liquidambaris*** (C.G. Wu & Z.C. Chen) R.T. Almeida & N.C. Schenck ex Y.J. Yao, Kew Bulletin 50: 306 (1995). ≡ *Sclerocystis liquidambaris* C.G. Wu & Z.C. Chen, Transactions of the Mycological Society of the Republic of China 2: 74 (1987). ≡ *Glomus liquidambaris* (C.G. Wu & Z.C. Chen) R.T. Almeida & N.C. Schenck, Mycologia 82: 711 (1990).

Occurrence: agroecosystems and xerophytic shrublands.[83, 91]

Typification details: MBT 74380/ herbarium: WU 860203/ type material: Taiwan.

**90. *Glomus macrocarpum*** Tul. & C. Tul., Giornale Botanico italiano 1: 63 (1845). ≡ *Endogone macrocarpa* (Tul. & C. Tul.) Tul. & C. Tul., [as 'var. *macrocarpa*'], Fungi Hypogaei: Histoire et Monographie des Champignons Hypogés: 182: 20 (1851). ≡ *Paurocotylis fulva* var. *zealandica* Cooke, Grevillea 8: 59 (1879). ≡ *Endogone pampaloniana* Bacc., Nuovo Giornale Botanico italiano: 79 (1903). ≡ *Endogone guttulata* E. Fisch., Berichte Schweiz bot. Ges.: 13 (1923). ≡ *Endogone nuda* Petch, Annals of the Royal Botanic Gardens Peradeniya 9: 322 (1925).

Occurrence: agroecosystems, grasslands, tropical deciduous forest, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[19, 21, 23, 34, 40, 54, 83, 85, 86, 91, 92]

Typification details: MBT no data/ herbarium: PC 1841/ type material: France.

**91. *Glomus magnicaule*** I.R. Hall, [as *'magnicaulis'*], Transactions of the British Mycological Society 68: 345 (1977).

Occurrence: tropical deciduous forest.[13]

Typification details: MBT 154529/ herbarium: PDD 34855/ type material: New Zealand

**92. *Glomus melanosporum*** Gerd. & Trappe, Mycologia Memoirs 5: 46 (1974).

Occurrence: agroecosystems, grasslands and tropical montane cloud forest.[33]

Typification details: MBT no data/ herbarium: OSC 507/ type material: USA.

**93. *Glomus microcarpum*** Tul. & C. Tul., [as *'microcarpus'*], Giornale Botanico italiano 1: 63 (1845). ≡ *Endogone microcarpa* (Tul. & C. Tul.) Tul. & C. Tul., Fungi Hypogaei: Histoire et Monographie des Champignons Hypogés: 182: 20 (1851). ≡ *Endogone neglecta* Rodway, Papers and Proceedings of the Royal Society of Tasmania 1917: 107 (1918).

Occurrence: agroecosystems, aquatic and underwater vegetation, tropical deciduous forest, tropical evergreen forest and xerophytic shrublands.[19, 23, 50, 65, 72, 83, 93, 94]

Typification details: MBT no data/ herbarium: PC 1911 / type material: France.

**94. *Glomus multicaule*** Gerd. & B.K. Bakshi, Transactions of the British Mycological Society 66: 340 (1976).

Occurrence: tropical montane cloud forest.[33]

Typification details: MBT no data/ herbarium: FRI 8273/ type material: India.

**95. *Glomus pachycaule*** (C.G. Wu & Z.C. Chen) Sieverd. & Oehl, Mycotaxon 116: 99 (2011). ≡ *Sclerocystis pachycaulis* C.G. Wu & Z.C. Chen, Taiwania 31: 74 (1986).

Occurrence: agroecosystems, grasslands and tropical montane cloud forest.[73, 83]

Typification details: MBT 80260/ herbarium: Wu-043 (TAI)/ type material: Taiwan.

**96. *Glomus pallidum*** I.R. Hall, Transactions of the British Mycological Society 68. 343 (1977).

Occurrence: agroecosystems.[83]

Typification details: MBT 154530/ herbarium: PDD 34854/ type material: New Zealand.

**97. *Glomus radiatum*** (Thaxt.) Trappe & Gerd., Mycologia Memoirs 5: 46 (1974). ≡ *Endogone radiata* Thaxt., Proceedings of the American Academy of Arts and Sciences 57: 316 (1922).

Occurrence: temperate forest.[33]

Typification details: MBT no data/ herbarium: OSC 2043/ type material: USA.

**98. *Glomus rubiforme*** (Gerd. & Trappe) R.T. Almeida & N.C. Schenck, Mycologia 82: 709 (1990). ≡ *Sclerocystis rubiformis* Gerd. & Trappe, Mycologia Memoirs 5: 60 (1974). ≡ *Sclerocystis indica* Bhattacharjee & Mukerji, Acta Botanica Indica 8: 99 (1980).

Occurrence: agroecosystems, aquatic and underwater vegetation, coastal sand dunes, grasslands, tropical deciduous forest, tropical montane cloud forest and xerophytic shrublands.[9, 13, 21, 33, 34, 43, 44, 49, 53, 55, 59, 62, 68, 72, 73, 77, 78, 90, 91, 93]

Typification details: MBT no data/ herbarium: OSC 2108/ type material: USA.

**99. *Glomus spinuliferum*** Sieverd. & Oehl, Mycotaxon 86: 158 (2003).

Occurrence: agroecosystems, aquatic and underwater vegetation, tropical deciduous forest, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[50, 55, 70, 78, 94]

Typification details: MBT 100321/ herbarium: Z + ZT Myc 01070702/ type material: Germany.

**100. *Glomus taiwanense*** (C.G. Wu & Z.C. Chen) R.T. Almeida & N.C. Schenck ex Y.J. Yao, Kew Bulletin 50: 306 (1995). ≡ *Sclerocystis taiwanensis* C.G. Wu & Z.C. Chen, Transactions of the Mycological Society of the Republic of China 2: 78 (1987).

Occurrence: agroecosystems and grasslands.[80, 83, 86, 92]

Typification details: MBT 74381/ herbarium: Wu-850820 / type material: Taiwan.

**101. *Glomus tenebrosum*** (Thaxt.) S.M. Berch, Canadian Journal of Botany 61: 2615 (1983). ≡ *Endogone tenebrosa* Thaxt., Proceedings of the American Academy of Arts and Sciences 57: 314 (1922).

Occurrence: agroecosystems, tropical deciduous forest and tropical evergreen forest.[13, 35, 56, 58]

Typification details: MBT no data/ herbarium: FH3 /type material: Canada.

**102. *Glomus trufemii*** B.T. Goto, G.A. Silva & F. Oehl, Mycotaxon 120: 3 (2012).

Occurrence: agroecosystems, grasslands and tropical evergreen forest.[79, 80, 86, 92]

Typification details: MBT 169879/herbarium: UFRN 1482/ type material: Brazil.

***Oehlia*** Błaszk., Kozłowska, Niezgoda, B.T. Goto & Dalpé

**103. *Oehlia diaphana*** (J.B. Morton & C. Walker) Błaszk., Niezgoda, B.T. Goto & Kozłowska., Nova Hedwigia 107: 507 (2018) ≡ *Glomus diaphanum* J.B. Morton & C. Walker, Mycotaxon 21: 433 (1984). ≡ *Rhizophagus diaphanum* (J.B. Morton & C. Walker) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera: 19 (2010).

Occurrence: agroecosystems and tropical evergreen forest.[14, 28, 70, 77]

Typification details: MBT no data/ herbarium: OSC 73/ type material: USA.

***Septoglomus*** Sieverd., G.A. Silva & Oehl

**104. *Septoglomus constrictum*** (Trappe) Sieverd., G.A. Silva & Oehl, Mycotaxon 116: 105 (2011). ≡ *Glomus constrictum* Trappe, [as *'constrictus'*], Mycotaxon 6: 361 (1977). ≡ *Funneliformis constrictum* (Trappe) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera: 14 (2010).

Occurrence: agroecosystems, aquatic and underwater vegetation, grasslands, coastal sand dunes, temperate forest, tropical deciduous forest, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[2, 12, 15, 19, 20, 21, 22, 23, 25, 31, 34, 39, 40, 43, 49, 54, 55, 57, 58, 61, 65, 68, 70, 71, 72, 73, 78, 85, 86, 88, 89, 90, 91, 94, 95]

Typification details: MBT no data/ herbarium: OSC 3574/ type material: Mexico.

**105. *Septoglomus deserticola*** (Trappe, Bloss & J.A. Menge) G.A. Silva, Oehl & Sieverd., Mycotaxon 116: 106 (2011). ≡ *Glomus deserticola* Trappe, Bloss & J.A. Menge, Mycotaxon 20: 123 (1984).

Occurrence: agroecosystems, aquatic and underwater vegetation, coastal sand dunes and xerophytic shrublands.[11, 19, 27, 77, 93]

Typification details: MBT 68692/ herbarium: OSC 25/ type material: USA.

**106. *Septoglomus mexicanum*** E. Chimal-Sánchez, C. Senés-Guerrero, N.M. Montaño, L. Varela, R. García-Sánchez, A. Pacheco, S. Montaño-Arias & S.L. Camargo-Ricalde. Mycologia 112: 121 (2019).

Occurrence: xerophytic shrublands.[87]

Typification details: MBT no data/ herbarium: ENCB 121801/ type material: Mexico.

**107. *Septoglomus viscosum*** (T.H. Nicolson) C. Walker, D. Redecker, D. Stiller & A. Schüssler: Mycorrhiza 23: 515 (2013). ≡ *Viscospora viscosa* (T.H. Nicolson) Sieverd., Oehl & G.A. Silva in Oehl, Silva, Goto & Sieverding, Mycotaxon 116: 108 (2011). ≡ *Glomus viscosum* T.H. Nicolson in Walker, Giovannetti, Avio, Citernesi & Nicolson, Mycological Research 99: 1502 (1995).

Occurrence: agroecosystems, grasslands and temperate forest.[34, 44, 60, 77]

Typification details: MBT 83475/ herbarium: PI-HMZ 10/ type material: Italy.

**108. *Septoglomus xanthium*** (Błaszk., Blanke, Renker & Buscot) G.A. Silva, Oehl & Sieverd., Mycotaxon 116: 106 (2011). ≡ *Glomus xanthium* Błaszk., Blanke, Renker & Buscot, Mycotaxon 90: 459 (2004). ≡ *Funneliformis xanthium* (Błaszk., Blanke, Renker & Buscot) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera: 14 (2010).

Occurrence: agroecosystems.[83]

Typification details: MBT no data/ herbarium: DPP 2444/ type material: Poland.

***Simiglomus*** Sieverd., G.A. Silva & Oehl.

**109. *Simiglomus hoi*** (S.M. Berch & Trappe) G.A. Silva, Oehl & Sieverd., Mycotaxon 116: 104 (2011). ≡ *Glomus hoi* S.M. Berch & Trappe, Mycologia 77: 654 (1985).

Occurrence: agroecosystems and tropical montane cloud forest.[31, 33]

Typification details: MBT 68099/ herbarium: OSC 29177/ type material: USA.

***Dominikia*** Błaszk., Chwat & Kovács

**110. *Dominikia aurea*** (Oehl & Sieverd.) Błaszk., Chwat, G.A. Silva & Oehl, Nova Hedwigia, 101. 71 (2014). ≡ *Glomus aureum* Oehl & Sieverd., Journal of Applied Botany 77: 111 (2003).

Occurrence: agroecosystems, coastal sand dunes, tropical deciduous forest and tropical evergreen forest.[46, 83, 95]

Typification details: MBT no data/ herbarium: Z+ZT Myc 8-171/ type material: Switzerland.

**111. *Dominikia minuta*** (Błaszk., Tadych & Madej) Błaszk., Chwat & Kovács, Nova Hedwigia 100: 230 (2014). ≡ *Glomus minutum* Błaszk., Tadych & Madej, Mycotaxon 76: 189 (2000).

Occurrence: agroecosystems, tropical evergreen forest and xerophytic shrublands.[70, 71, 78]

Typification details: MBT no data/ herbarium: DPP 2246/ type material: Poland.

***Rhizoglomus*** Sieverd. G.A. Silva & Oehl

**112. *Rhizoglomus aggregatum*** (N.C. Schenck & G.S. Sm.) Sieverd., G.A. Silva & Oehl, Mycotaxon 129: 378 (2015). ≡ *Glomus aggregatum* N.C. Schenck & G.S. Sm., Mycologia 74: 80 (1982). ≡ *Rhizophagus aggregatus* (N.C. Schenck & G.S. Sm.) C. Walker, The Glomeromycota: a species list with new families and new genera: 19 (2010).

Occurrence: agroecosystems, coastal sand dunes, tropical deciduous forest and xerophytic shrublands.[11, 25, 26, 27, 29, 31, 40, 49, 61, 62, 64, 76, 83]

Typification details: MBT 70603/ herbarium: OSC 40255/ type material: USA.

**113. *Rhizoglomus clarum*** (T.H. Nicolson & N.C. Schenck) Sieverd., G.A. Silva & Oehl, Mycotaxon 129: 380 (2015). ≡ *Glomus clarum* T.H. Nicolson & N.C. Schenck, [as *'clarus'*], Mycologia 71: 182 (1979). ≡ *Rhizophagus clarus* (T.H. Nicolson & N.C. Schenck) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera: 19 (2010).

Occurrence: agroecosystems, aquatic and underwater vegetation, grasslands, temperate forest, tropical deciduous forest, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[19, 30, 33, 43, 44, 69, 70, 72, 77, 83, 84]

Typification details: MBT no data/ herbarium: material not available/ type material: USA.

**114. *Rhizoglomus custos*** (C. Cano & Dalpé) Sieverd., G.A. Silva & Oehl, Mycotaxon 129: 380 (2015). ≡ *Glomus custos* C. Cano & Dalpé, Mycotaxon 109: 502 (2009). ≡ *Rhizophagus custos* (C. Cano & Dalpé) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera: 19 (2010).

Occurrence: tropical evergreen forest.[46]

Typification details: MBT 514011/ herbarium: GDA 51596 / type material: Spain.

**115. *Rhizoglomus fasciculatum*** (Thaxt.) Sieverd., G.A. Silva & Oehl, Mycotaxon 129: 380 (2015). ≡ *Endogone fasciculata* Thaxt., Proceedings of the American Academy of Arts and Sciences 57: 308 (1922). ≡ *Glomus fasciculatum* (Thaxt.) Gerd. & Trappe, [as *'fasciculatus'*], Mycologia Memoirs 5: 51 (1974). ≡ *Rhizophagus fasciculatus* (C. Cano & Dalpé) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera: 19 (2010).

Occurrence: agroecosystems, aquatic and underwater vegetation, grasslands, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[19, 23, 34, 43, 58, 68, 70, 71, 72, 69, 78, 83, 85, 86, 94]

Typification details: MBT no data/ herbarium: OSC 3065/ type material: USA.

**116. *Rhizoglomus intraradices*** (N.C. Schenck & G.S. Sm.) Sieverd., G.A. Silva & Oehl, Mycotaxon 129: 380 (2015). ≡ *Glomus intraradices* N.C. Schenck & G.S. Sm., Mycologia 74: 78 (1982). ≡ *Rhizophagus intraradices* (T.H. Nicolson & N.C. Schenck) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera: 19 (2010).

Occurrence: agroecosystems, aquatic and underwater vegetation, coastal sand dunes, grasslands, tropical deciduous forest, tropical montane cloud forest and xerophytic shrublands.[17, 23, 32, 39, 40, 43, 48, 49, 50, 54, 57, 62, 64, 69, 72, 77, 83, 91, 92]

Typification details: MBT no data/ herbarium: OSC 40255/ type material: USA.

**117. *Rhizoglomus irregulare*** (Błaszk., Wubet, Renker & Buscot) Sieverd., G.A. Silva & Oehl, Mycotaxon 129: 381 (2015). ≡ *Glomus irregulare* Błaszk., Wubet, Renker & Buscot, Mycotaxon 106: 252 (2009). ≡ *Rhizophagus irregulare* (Błaszk., Wubet, Renker & Buscot) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera: 19 (2010).

Occurrence: agroecosystems, coastal sand dunes and tropical deciduous forest.[84, 95]

Typification details: MBT no data/ herbarium: DPP 2340/ type material: Poland.

**118. *Rhizoglomus microaggregatum*** (Koske, Gemma & P.D. Olexia) Sieverd., G.A. Silva & Oehl, Mycotaxon 129: 380 (2015). ≡ *Glomus microaggregatum* Koske, Gemma & P.D. Olexia, Mycotaxon 26: 125 (1986).

Occurrence: agroecosystems, aquatic and underwater vegetation, coastal sand dunes, grasslands, temperate forest, tropical deciduous forest, tropical montane cloud forest and xerophytic shrublands.[7, 22, 23, 25, 27, 30, 31, 41, 43, 44, 56, 57, 60, 62, 72, 77, 78, 93, 94, 95]

Typification details: MBT 67219/ herbarium: OSC / type material: USA.

**119. *Rhizoglomus proliferum*** (Dalpé & Declerck) Sieverd., G.A. Silva & Oehl, Mycotaxon 129: 380 (2015). ≡ *Glomus proliferum* Dalpé & Declerck, Mycologia 92: 1180 (2000). ≡ *Rhizophagus proliferus* (Dalpé & Declerck) The Glomeromycota: a species list with new families and new genera: 19 (2010).

Occurrence: agroecosystems.[83]

Typification details: MBT no data/ herbarium: DAOM 226389/ type material: France.

**120. *Rhizoglomus vesiculiferum*** (Thaxt.) Błaszk., Kozłowska, Niezgoda, B.T. Goto & Dalpé, Nova Hedwigia 107: 509 (2018). ≡ *Endogone vesiculifera* Thaxt., Proceedings of the American Academy of Arts and Sciences 57: 309 (1922). ≡ *Glomus vesiculiferum* (Thaxt.) Gerd. & Trappe, Mycologia Memoirs 5: 49 (1974). ≡ *Funneliformis vesiculiferum* (Thaxt.) C. Walker & A. Schüssler, The Glomeromycota: a species list with new families and new genera: 19 (2010). ≡ *Rhizophagus vesiculiferus* (Thaxt.) C. Walker & A. Schüssler, Mycorrhiza 23: 520 (2013).

Occurrence: agroecosystems.[83]

Typification details: MBT no data/ herbarium: OSC 2077/ type material: USA.

***Sclerocystis*** Berk. & Broome

**121. *Sclerocystis coremioides*** Berk. & Broome, Botanical Journal of the Linnean Society 14: 137 (1873). ≡ *Ackermannia dussii* Pat., Bulletin de la Société Mycologique de France 18: 181 (1902). ≡ *Xenomyces ochraceus* Ces., Atti dell'Accademia di Scienze Fisiche e Matematiche Napoli 8: 26 (1879). ≡ *Ackermannia coccogena* Pat., Bulletin de la Société Mycologique de France 18: 182 (1902). ≡ *Glomus coremioides* (Berk. & Broome) D. Redecker & J.B. Morton, Mycologia 92: 284 (2000).

Occurrence: agroecosystems, tropical deciduous forest, tropical montane cloud forest and xerophytic shrublands.[25, 27, 40, 49, 56, 57]

Typification details: MBT no data/ herbarium: OSC 2049/ type material: USA.

**122. *Sclerocystis sinuosa*** Gerd. & B.K. Bakshi, Transactions of the British Mycological Society 66: 343 (1976). ≡ *Sclerocystis pakistanica* S.H. Iqbal & Perveen, Transactions of the Mycological Society of Japan 21: 59 (1980). ≡ *Glomus sinuosum* (Gerd. & B.K. Bakshi) R.T. Almeida & N.C. Schenck, Mycologia 82: 710 (1990).

Occurrence: agroecosystems, aquatic and underwater vegetation, coastal sand dunes, grasslands, tropical deciduous forest, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[8, 9, 19, 15, 17, 20, 24, 25, 26, 27, 30, 33, 34, 35, 36, 37, 39, 44, 45, 48, 53, 56 58, 59, 60, 62, 67, 70, 71, 72, 73, 76, 77, 80, 82, 89, 90, 91, 92, 95]

Typification details: MBT no data/ herbarium: FRI 8274 / type material: India.

***Halonatospora*** Błaszk., Niezgoda, B.T. Goto & Kozłowska

**123. *Halonatospora pansihalos*** (S.M. Berch & Koske) Błaszk., Kozłowska & Dalpé, Nova Hedwigia 106. 3 (2018). ≡ *Glomus pansihalos* S.M. Berch & Koske, Mycologia 78: 832 (1986).

Occurrence: agroecosystems.[73]

Typification details: MBT 80348/ herbarium: OSC 558 / type material: USA.

**Gigasporales** Sieverd., G.A. Silva, B.T. Goto & Oehl

**Dentiscutataceae** Sieverd., F.A. Souza & Oehl, Mycotaxon 106: 340 (2008).

***Dentiscutata*** Sieverd., F.A. Souza & Oehl

**124. *Dentiscutata biornata*** (Spain & J. Miranda) Sieverd., F.A. Souza & Oehl, Mycotaxon 106: 342 (2009). ≡ *Scutellospora biornata* Spain, Sieverd. & S. Toro, Mycotaxon 35: 220 (1989).

Occurrence: agroecosystems and tropical montane cloud forest.[43]

Typification details: MBT 74377/ herbarium: CIAT / type material: Colombia.

**125. *Dentiscutata cerradensis*** (Spain & J. Miranda) Sieverd., F.A. Souza & Oehl, Mycotaxon 106: 342

(2009). ≡ *Scutellospora cerradensis* Spain & J. Miranda, Mycotaxon 60: 130 (1996).

Occurrence: agroecosystems, grasslands, temperate forest and xerophytic shrublands. [44, 83, 84, 88, 91]

Typification details: MBT 85014/ herbarium: OSC / type material: Brazil.

**126. *Dentiscutata nigra*** (J.F. Redhead) Sieverd., F.A. Souza & Oehl, Mycotaxon 106: 342 (2009). ≡ *Gigaspora nigra* J.F. Redhead, Mycologia 71: 187 (1979). ≡ *Scutellospora nigra* (J.F. Redhead) C. Walker & F.E. Sanders, Mycotaxon 27: 181 (1986).

Occurrence: agroecosystems and temperate forest.[49]

Typification details: MBT 154521/ herbarium: OCS /type material: USA.

**127. *Dentiscutata reticulata*** (Koske, D.D. Miller & C. Walker) Sieverd., F.A. de Souza & Oehl, Mycotaxon 106: 342 (2009). ≡ *Gigaspora reticulata* Koske, D.D. Mill. & C. Walker, Mycotaxon 16: 429 (1983). ≡ *Scutellospora reticulata* (Koske, D.D. Mill. & C. Walker) C. Walker & F.E. Sanders, Mycotaxon 27: 181 (1986).

Occurrence: agroecosystems.[44]

Typification details: MBT 69926/ herbarium: OSC/ type material: USA.

**128. *Dentiscutata scutata*** (C. Walker & Dieder.) Sieverd., F.A. de Souza & Oehl, Mycotaxon 106: 311 (2008). ≡ *Scutellospora scutata* C. Walker & Dieder., Mycotaxon 35: 357 (1989).

Occurrence: agroecosystems, temperate forest, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[33, 34, 44, 62, 68, 91]

Typification details: MBT 74378/ herbarium: OSC/ type material: Brazil.

***Fuscutata*** Oehl, F.A. Souza & Sieverd

**129. *Fuscutata heterogama*** Oehl, F.A. Souza, L.C. Maia & Sieverd., Mycotaxon 106: 344 (2009).

Occurrence: agroecosystems, aquatic and underwater vegetation, grasslands, temperate forest and tropical evergreen forest.[24, 53, 65, 72]

Typification details: MBT no data/ herbarium: URM 84-8401/ type material: Brazil.

**130. *Fuscutata savannicola*** (R.A. Herrera & Ferrer) Oehl, F.A. Souza & Sieverd., Mycotaxon 106: 347 (2009). ≡ *Gigaspora savannicola* R.A. Herrera & Ferrer, Revista del Jardín Botánico Nacional Habana 1. 57 (1981). ≡ *Scutellospora savannicola* (R.A. Herrera & Ferrer) C. Walker & F.E. Sanders, Mycotaxon 27. 180 (1986). ≡ *Dentiscutata savannicola* (R.A. Herrera & Ferrer) C. Walker & A. Schüssler, Mycological Progress 13. 1172 (2014).

Occurrence: agroecosystems.[83]

Typification details: MBT no data/ herbarium: 23-H/F-HAC / type material: Cuba.

***Quatunica*** F.A Souza, Sieverd. & Oehl

**131. *Quatunica erythropa*** (Koske & C. Walker) F.A. Souza, Sieverd. & Oehl, Mycotaxon 106: 311 (2008). ≡ *Gigaspora erythropus* Koske & C. Walker, Mycologia 76: 250 (1984). ≡ *Scutellospora erythropus* (Koske & C. Walker) C. Walker & F.E. Sanders, Mycotaxon 27: 181 (1986).

Occurrence: agroecosystems, aquatic and underwater vegetation, grasslands, tropical deciduous forest and tropical montane cloud forest.[25, 33, 53, 56, 77, 83, 93]

Typification details: MBT 68689/ herbarium: OSC 383/ type material: USA.

**Gigasporaceae** Morton & Benny emend. Sieverd., F.A. Souza & Oehl Sieverd., Mycotaxon 106: 311 (2008).

***Gigaspora*** Gerdemann & Trappe emend. Oehl, F.A. Souza & Sieverd.

**132. *Gigaspora albida*** N.C. Schenck & G.S. Sm., Mycologia 74: 85 (1982).

Occurrence: agroecosystems, temperate forest and tropical montane cloud forest.[44, 57, 60, 84]

Typification details: MBT 68689/ herbarium: OSC 40253/ type material: USA.

**133. *Gigaspora candida*** Bhattacharjee, Mukerji, J.P. Tewari & Skoropad, Transactions of the British Mycological Society 78: 184 (1982).

Occurrence: agroecosystems, aquatic and underwater vegetation, temperate forest and xerophytic shrublands.[66, 71, 90, 91]

Typification details: MBT 70995/ herbarium: DU/ KMB 494/ type material: India.

**134. *Gigaspora decipiens*** I.R. Hall & L.K. Abbott, Transactions of the British Mycological Society 83: 204 (1984).

Occurrence: agroecosystems, aquatic and underwater vegetation, grasslands, tropical deciduous forest, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[22, 25, 30, 31, 35, 52, 56, 57, 64, 68, 72, 73, 84, 85, 86, 93]

Typification details: MBT 68387/ herbarium:? / type material: Western Australia.

**135. *Gigaspora gigantea*** (T.H. Nicolson & Gerd.) Gerd. & Trappe, Mycologia Memoirs 5: 29 (1974). ≡ *Endogone gigantea* T.H. Nicolson & Gerd., Mycologia 60: 321 (1968).

Occurrence: agroecosystems, grasslands, tropical deciduous forest, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[9, 19, 21, 25, 30, 33, 38, 40, 48, 53, 56, 60, 62, 70, 73, 91]

Typification details: MBT no data/ herbarium: Farlow herbarium/ type material: USA.

**136. *Gigaspora margarita*** W.N. Becker & I.R. Hall, Mycotaxon 4: 155 (1976).

Occurrence: agroecosystems, grasslands, tropical montane cloud forest and xerophytic shrublands.[9, 10, 27, 33, 61, 71, 73, 83, 84]

Typification details: MBT no data/ herbarium: OSC/ type material: USA.

**137. *Gigaspora ramisporophora*** Spain, Sieverd. & N.C. Schenck, Mycotaxon 34: 668 (1989).

Occurrence: agroecosystems, coastal sand dunes, grasslands, tropical deciduous forest tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[30, 34, 35, 45, 62]

Typification details: MBT 78934/ herbarium: FLAS/ type material: Brazil.

**138. *Gigaspora rosea*** T.H. Nicolson & N.C. Schenck, Mycologia 71: 190 (1979).

Occurrence: agroecosystems, tropical evergreen forest and tropical montane cloud forest. [15, 20, 33, 64, 65]

Typification details: MBT 154523/ herbarium: OSC/ type material: USA.

**Racocetraceae** Sieverd., F.A. Souza & Oehl Sieverd., Mycotaxon 106: 311 (2008).

***Cetraspora*** Oehl, F.A. Souza & Sieverd.

**139. *Cetraspora armeniaca*** (Błaszk.) Oehl, F.A. Souza & Sieverd., Mycotaxon 106. 338 (2009). ≡ *Scutellospora armeniaca* Błaszk., Mycologia 84. 939 (1993).

Occurrence: agroecosystems.[83]

Typification details: MBT 80780/ herbarium: DPP 1614/ type material: Poland.

**140. *Cetraspora gilmorei*** (Trappe & Gerd.) Oehl, F.A. de Souza & Sieverd., Mycotaxon 106: 342 (2009). ≡ *Gigaspora gilmorei* Trappe & Gerd., Mycologia Memoirs 5: 27 (1974) ≡ *Scutellospora gilmorei* (Trappe & Gerd.) C. Walker & F.E. Sanders, Mycotaxon 27: 181 (1986).

Occurrence: agroecosystems, grasslands and tropical evergreen forest.[53, 70, 83]

Typification details: MBT 154523/ herbarium: OSC 2175/ type material: USA.

**141. *Cetraspora nodosa*** (Błaszk.) Oehl, G.A. Silva, B.T. Goto & Sieverd., Mycotaxon 117: 431 (2012). ≡ *Scutellospora nodosa* Błaszk., Mycologia 83: 537 (1991).

Occurrence: agroecosystems, grasslands and xerophytic shrublands.[62, 68, 83]

Typification details: MBT 79861/ herbarium: DPP 1491/ type material: Poland.

**142. *Cetraspora pellucida*** (T.H. Nicolson & N.C. Schenck) Oehl, F.A. de Souza & Sieverd., Mycotaxon 106: 342 (2009). ≡ *Gigaspora pellucida* T.H. Nicolson & N.C. Schenck, Mycologia 71: 189 (1979). ≡ *Scutellospora pellucida* (T.H. Nicolson & N.C. Schenck) C. Walker & F.E. Sanders, Mycotaxon 27: 181 (1986).

Occurrence: agroecosystems, grasslands, temperate forest, tropical deciduous forest, tropical evergreen forest tropical, montane cloud forest and xerophytic shrublands.[9, 10, 13, 23, 25, 29, 33, 34, 38, 50, 52, 60, 55, 56, 61, 62, 64, 68, 71, 73, 85, 86, 88, 91]

Typification details: MBT 154522/ herbarium: ? / type material: USA.

***Racocetra*** Oehl, F.A. Souza & Sieverd.

**143. *Racocetra alborosea*** (Ferrer & R.A. Herrera) Oehl, F.A. Souza & Sieverd., Mycotaxon 106: 336 (2009). ≡ *Gigaspora alborosea* Ferrer & R.A. Herrera, Revista del Jardín Botánico Nacional Habana 1: 55 (1981). ≡ *Scutellospora alborosea* (Ferrer & R.A. Herrera) C. Walker & F.E. Sanders, Mycotaxon 27: 180 (1986). ≡ *Parascutellospora alborosea* (Ferrer & R.A. Herrera) S.P. Gautam & U.S. Patel, The Mycorrhizae: Diversity, Ecology and Applications 8 (2007).

Occurrence: agroecosystems.[83]

Typification details: MBT 72393/ herbarium: 2-H/F-HAC, 3-H/F-HAC, 4-H/F-HAC, 5-H/F-HAC/ type material: Cuba.

**144. *Racocetra castanea*** (C. Walker) Oehl, F.A. Souza & Sieverd., Mycotaxon 106: 336 (2009). ≡ *Scutellospora castanea* C. Walker, Cryptogamie Mycologie 14: 280 (1993).

Occurrence: agroecosystems.[52]

Typification details: MBT 80194/ herbarium: Royal Botanic Garden/ type material: France.

**145. *Racocetra coralloidea*** (Trappe, Gerd. & I. Ho) Oehl, F.A. Souza & Sieverd., Mycotaxon 106: 336 (2009). ≡ *Gigaspora coralloidea* Trappe, Gerd. & I. Ho, Mycologia Memoirs, 5: 30 (1974). ≡ *Scutellospora coralloidea* (Trappe, Gerd. & I. Ho) C. Walker & F.E. Sanders, Mycotaxon 27: 181 (1986).

Occurrence: agroecosystems.[51]

Typification details: MBT no data/ herbarium: OSC 2538/ type material: USA.

**146. *Racocetra fulgida*** (Koske & C. Walker) Oehl, F.A. Souza & Sieverd., Mycotaxon 106: 336 (2009). ≡ *Scutellospora fulgida* Koske & C. Walker, Mycotaxon 27: 221 (1986).

Occurrence: agroecosystems, coastal sand dunes, grasslands, temperate forest, tropical montane cloud forest and xerophytic shrublands.[23, 33, 44, 45, 60, 91]

Typification details: MBT 75795/ herbarium: OSC/ type material: USA.

**147. *Racocetra gregaria*** (N.C. Schenck & T.H. Nicolson) Oehl, F.A. Souza & Sieverd., Mycotaxon 106: 337 (2009). ≡ *Gigaspora gregaria* N.C. Schenck & T.H. Nicolson, Mycologia 71: 185 (1979). ≡ *Scutellospora gregaria* (N.C. Schenck & T.H. Nicolson) C. Walker & F.E. Sanders, Mycotaxon 27: 181 (1986).

Occurrence: agroecosystems, coastal sand dunes, grasslands, temperate forest, tropical evergreen forest and xerophytic shrublands.[27, 29, 44, 51, 60, 62, 70, 77, 82, 84, 85, 86]

Typification details: MBT 154520/ herbarium: OSC S-04/ type material: USA.

**148. *Racocetra persica*** (Koske & C. Walker) Oehl, F.A. Souza & Sieverd., Mycotaxon 106: 337 (2009). ≡ *Gigaspora persica* Koske & C. Walker, Mycologia 77: 708 (1985). ≡ *Scutellospora persica* (Koske & C. Walker) C. Walker & F.E. Sanders, Mycotaxon 27: 181 (1986).

Occurrence: grasslands, tropical deciduous forest, tropical evergreen forest and xerophytic shrublands.[35, 86, 91]

Typification details: MBT 67689/ herbarium: OSC 374/ type material: USA.

**149. Racocetra verrucosa** (Koske & C. Walker) Oehl, F.A. Souza & Sieverd., Mycotaxon 106: 337 (2009). ≡ *Gigaspora verrucosa* Koske & C. Walker, Mycologia 77: 705 (1985). ≡ *Scutellospora verrucosa* (Koske & C. Walker) C. Walker & F.E. Sanders, Mycotaxon 27: 181 (1986).

Occurrence: agroecosystems, grasslands, temperate forest, tropical deciduous forest and tropical montane cloud forest.[16, 33, 44, 52]

Typification details: MBT 67690/ herbarium: OSC 457/ type material: USA.

**Scutellosporaceae** Sieverd., F.A. Souza & Oehl, Mycotaxon 106: 311 (2008).

***Orbispora*** Oehl, G.A. Silva & D.K. Silva

**150. *Orbispora projecturata*** (Kramad. & C. Walker) Oehl, G.A. Silva & D.K. Silva, Mycotaxon 116. 166 (2011). ≡ S*cutellospora projecturata* Kramad. & C. Walker, Annals of Botany 86. 22 (2000).

Occurrence: agroecosystems.[83]

Typification details: MBT 89779/ herbarium: BO W1717/ type material: Indonesia.

***Scutellospora*** (Walker & Sanders) emend. Oehl, F.A Souza & Sieverd.

**151. *Scutellospora arenicola*** Koske & Halvorson, Mycologia 81: 927 (1990).

Occurrence: agroecosystems and xerophytic shrublands.[19, 83]

Typification details: MBT 74374/ herbarium: OSC 2374/ type material: USA.

**152. *Scutellospora calospora*** (T.H. Nicolson & Gerd.) C. Walker & F.E. Sanders, Mycotaxon 27: 180 (1986). ≡ *Endogone calospora* T.H. Nicolson & Gerd., Mycologia 60: 322 (1968). ≡ *Gigaspora calospora* (T.H. Nicolson & Gerd.) Gerd. & Trappe, Mycologia Memoirs 5: 28 (1974).

Occurrence: agroecosystems, coastal sand dunes, grasslands, temperate forest, tropical deciduous forest, tropical evergreen forest, tropical montane cloud forest and xerophytic shrublands.[7, 19, 21, 27, 33, 45, 55, 62, 65, 84, 88, 91, 92]

Typification details: MBT 67219/ herbarium: FH/ type material: Scotland.

**153. *Scutellospora dipapillosa*** (C. Walker & Koske) C. Walker & F.E. Sanders, Mycotaxon 27: 181 (1986). ≡ *Gigaspora dipapillosa* C. Walker & Koske, Mycologia 77: 709 (1985).

Occurrence: agroecosystems and tropical montane cloud forest.[43]

Typification details: MBT 67688/ herbarium: OSC 656/ type material: USA.

**154.** ***Scutellospora dipurpurescens*** J.B. Morton & Koske, Mycologia 80: 520 (1988).

Occurrence: agroecosystems, grasslands, temperate forest, tropical deciduous forest, tropical evergreen forest and xerophytic shrublands.[9, 10, 25, 41, 50, 56, 70, 71, 77, 84, 85, 86]

Typification details: MBT78283/ herbarium: OSC 323/ type material: USA.

**Paraglomerales** C. Walker & Schüssler

***Paraglomeraceae*** J.B. Morton & D. Redecker, Mycologia 93: 188 (2001).

***Paraglomus*** Morton & Redecker

**155.** ***Paraglomus albidum*** (C. Walker & L.H. Rhodes) Oehl, F.A. Souza, G.A. Silva & Sieverd., Mycotaxon 116. 112 (2011). ≡ *Glomus albidum*, [as *'albidus'*], C. Walker & L.H. Rhodes, Mycotaxon 12: 509 (1981).

Occurrence: agroecosystems, coastal sand dunes, grasslands and tropical evergreen forest.[11, 14, 28, 34, 68, 70]

Typification details: MBT 71396/ herbarium: OSC 169/ type material: USA.

**156.** ***Paraglomus bolivianum*** (Sieverd. & Oehl) Oehl & G.A. Silva, Journal of Applied Botany and Food Quality 86: 115 (2013). ≡ *Pacispora boliviana* Sieverd. & Oehl, Journal of Applied Botany 78: 79 (2004).

Occurrence: xerophytic shrublands.[81, 92]

Typification details: MBT 114119/ herbarium: Z+ZT Myc 35-3501/ type material: Bolivia

**157.** ***Paraglomus brasilianum*** (Spain & J. Miranda) J.B. Morton & D. Redecker, Mycologia 93: 190 (2001). ≡ *Glomus brasilianum* Spain & J. Miranda, Mycotaxon 60: 139 (1996).

Occurrence: agroecosystems and tropical deciduous forest.[21, 83]

Typification details: MBT no data/ herbarium: OSC/ type material: Brazil.

**158.** ***Paraglomus laccatum*** (Błaszk.) Renker, Błaszk. & Buscot, Nova Hedwigia 84: 400 (2007). ≡ *Glomus laccatum* Błaszk., Bulletin of the Polish Academy of Sciences Biology 36: 271 (1988).

Occurrence: agroecosystems.[83]

Typification details: MBT 74895/ herbarium: DPP 631/ type material: Poland.

**159.** ***Paraglomus lacteum*** (S.L. Rose & Trappe) Oehl, F.A. Souza, G.A. Silva & Sieverd., Mycotaxon 116: 112 (2011). ≡ *Glomus lacteum,* [as *'lacteus'*], S.L. Rose & Trappe, Mycotaxon 10: 415 (1980).

Occurrence: grasslands and aquatic and underwater vegetation.[33, 93]

Typification details: MBT 72097/ herbarium: OSC S-210/ type material: USA

**160.** ***Paraglomus occultum*** (C. Walker) J.B. Morton & D. Redecker, Mycologia 93: 190 (2001). ≡ *Glomus occultum* C. Walker, Mycotaxon 15: 50 (1982).

Occurrence: agroecosystems, grasslands, aquatic and underwater vegetation and xerophytic shrublands.[23, 34, 72, 83, 84]

Typification details: MBT 70214/ herbarium: OSC 140/ type material: USA.

## Discussion

Currently, the richness of AMF in Mexico is composed of 160 species, representing 49.7 % of the Glomeromycota phylum (Goto & Jobim 2019). The species recorded represented 68 % of the species in tropical forests, a very rich ecosystem (Marinho et al. 2018). All orders were reported, with the higher richness in Glomerales (64 spp.) and Diversisporales (47 spp.) and the lowest richness in Paraglomerales (6 spp.). In Mexican soils, we counted eight monospecific genera: *Otospora, Tricispora, Entrophospora, Oehlia, Simiglomus, Sieverdingia, Halonatospora* and *Quatunica*. From the total AMF species, only 3 % were described from collections made in the country: *Acaulospora foveata, A. scrobiculata, Glomus clavisporum* and *Septoglomus constrictum* from agricultural vegetation (Trappe 1977, Janos & Trappe 1982), *S. mexicanum* from xerophytic vegetation (Chimal-Sánchez et al. 2019), and *Acaulospora spinosa, Diversispora epigaea* and *Funneliformis halonatus* as such a complementary material from Mexico (Daniels & Trappe 1979, Rose & Trappe 1980, Walker & Trappe 1981).

In this review, a cosmopolitan distribution pattern was evident for the Acaulosporaceae, Ambisporaceae, Diversisporaceae, Gigasporaceae and Glomeraceae families. The last family was dominant, with 58 species, while Sacculosporaceae was the least represented, with a single species (*Sacculospora baltica*) restricted to agroecosystems. The AMF species with wide distribution and high degree of tolerance to different ecological conditions in Mexico are *Acaulospora rehmii, A. scrobiculata, Funneliformis geosporus, F. mosseae* and *Septoglomus constrictum*, and the vegetation type with exclusive species was agroecosystem (28 spp.). In contrast, grasslands, tropical deciduous forest and tropical montane cloud forest only showed 2 exclusive species each.

Interestingly, Jaccard index similarity showed important overlapping of the AMF species in the majority of vegetation types, with some similarity in altitudes or vegetation types that are adjacent to each other; for example, tropical montane cloud forest and temperate forest (Challenger and Soberón, 2008). Costal sand dunes, aquatic ecosystems and underwater vegetations were the most dissimilar when compared to the other vegetation types. However, information on AMF in natural ecosystems only comes from a few studies in a single state and does not necessarily reflect the actual AMF richness. Future studies on a higher biogeographic scale will give a better appreciation of AMF composition. When compared AMF richness from natural vegetation and agroecosystems, 80 % of species (106 spp.) were shared. This could be due to arable lands in Mexico being distributed in the majority of vegetation types and occupying an important territory extension (Challenger and Soberón, 2008). The majority of publications deal with the isolation of glomerospores from agroecosystems; only this type of vegetation contributes in 80 % of the inventoried species.

Most orders and families of Glomeromycota maintain a ubiquitous distribution pattern, however, the dominance by genus is uneven in climatic zones (Davison et al. 2015, Stürmer et al. 2018). In this review, the AMF species distribution was recorded from country where two biogeographic regions converge: Nearctic and Neotropical (Challenger & Soberón 2008). In the Neartic region there were 12 families, 22 genera and 87 species, while 13 families, 30 genera with 110 spp. were recorded in the Neotropical region. The Glomerales order was the better represented in the Neotropical (47 spp.) than in the Nearctic region (33 spp.), Diversisporales was more dominant in the Neotropical (30 spp.) than in the Nearctic region (27 spp.), Gigasporales had a similar richness in the Neotropical (21 spp.) and Nearctic region (18 spp.). At the family level, Glomeraceae was dominant with 42 spp. in the Neotropical compared to 28 spp. in the Nearctic region. Acaulosporaceae had a greater presence in the Neotropical (18 spp.) than in the Nearctic region (16 spp.).

The presence of *Sacculospora baltica* and *Sieverdingia tortuosa* indicates an unusual biogeographic distribution, therefore, it is necessary to carry out detailed morphological and molecular analyzes in order to verify the identification (Błaszkowski et al. 1998, 2019) or if both fungi represent potential new morphological related species.

The most represented genus in the majority of the vegetation types were *Glomus* and *Acaulospora;* these two genera are commonly reported as dominant or co-dominant in different tropical ecosystems (e.g. Cuenca et al. 1998, Picone 2000, Lovelock et al. 2003, Gavito et al. 2008, Goto et al. 2010, Stürmer & Siqueira 2011, Guadarrama et al. 2014, Pereira et al. 2014, Jobim et al. 2018, Marinho et al. 2018, Vieira et al. 2020, Maia et al. 2020), common pattern to the genera with the highest number of species in Glomeromycota with wide ecological plasticity (Goto & Jobim 2020, Maia et al. 2020). The high richness in agricultural vegetation is due to a large number of studies conducted to plant species of agronomic interest and to the use of mycorrhizal inoculants (e.g. Gavito & Varela 1995, Mena-Violante et al. 2006, Alarcón et al. 2012, Montaño et al. 2012, Furrazola et al. 2017, Reyes-Jaramillo et al. 2019), contrasting with coastal sand dunes, which show a low representation of AMF species (28 spp.) due to under explored vegetation type in Mexico (Sigüenza et al. 1996, Ramos-Zapata et al. 2012, Guadarrama et al. 2012, Lara-Pérez et al. 2020). In tropical forests 92 species were reported, representing 40 % of the inventoried diversity in this kind of ecosystems in the world (Marinho et al. 2018).

Although there are relatively well-explored vegetation types and agricultural cultures, there are many areas that still await study. For example, the AMF species recorded from mountain cloud forest (MCF), the most threatened vegetation type in Mexico with high diversity and number of endemic plant species (Gual-Díaz & Rendón-Correa 2014), only come from three of the 12 states where MCF is distributed (Violi et al. 2008, Arias et al. 2012, Bautista-Cruz et al. 2014, Lara-Pérez et al. 2014, Furrazola et al. 2017). This vegetation type is a biodiversity hotspot and a priority ecoregion for conservation in Mexico (Myers et al. 2000). For now, after only three scientific reports, MCF is home of high richness with 52 Glomeromycota species. Despite having few works carried out in aquatic and underwater vegetation (Fabián et al. 2018, Ramírez-Viga et al. 2019, 2020, Solís-Rodríguez et al. 2020) the AMF diversity is high, representing 45 % (37 spp.) of the species reported for this ecosystem worldwide (Queiroz et al. 2020). Within this type of vegetation, there are habitats with little or no attention in terms of AMF diversity: mangroves, for example, with only two studies (Ramírez-Viga et al. 2019, 2020), reported 61 % (22 spp.) with respect to those species known in this habitat (Queiroz et al. 2020).

The recent description of *Septoglomus mexicanum* and new records (e.g *Acaulospora minuta, A. papillosa, A. reducta, Corymbiglomus corymbiforme, Diversispora trimurales, Gigaspora candida* and *Paraglomus bolivianum*) by Chimal-Sánchez et al. (2016, 2018, 2019), from Mexico associated with xerophytic scrub vegetation demonstrate the potential of this ecophysiognomy to increase the diversity of Glomeromycota. Therefore, it represents a priority area for ecological, taxonomy and conservation studies, due to its high number of endemic plant genera and species, in addition to its wide territorial extension (> 40 %) in Mexico (Rzedowski 2006). Concomitantly, we record 45 glomerocarpic species with different degrees of structural complexity (Gerdemann & Trappe 1974, Goto & Maia 2005, Jobim et al. 2019).

The genera with the most recorded species were *Glomus* (19 spp.) and *Rhizoglomus* (9 spp.). The high richness reported here represents 52 % of the known taxa with this habit in Glomeromycota, mainly in the Glomerales and Diversisporales orders, whose ecological role remains uncertain (Redecker et al. 2007, Jobim et al. 2019). The vegetation types with the most reported glomerocarpic species were the agroecosystem (36 spp.), grasslands (22 spp.) and xerophytic shrublands (21 spp.), while the lowest reported was in temperate forests (7 spp.).

However, the greatest richness of AMF (135 spp.) was detected in non-natural vegetation types, that is, ecosystems transformed for agricultural use, contrary to what has been reported in Brazil, with 173 spp. of a total of 192 species in 38 genera of AMF present in natural ecosystems (Maia et al., 2020). In the same review, 15 of the 16 families currently described was recorded, of which Glomeraceae (60 spp.) and Acaulosporaceae (43 spp.) were the most representative. One family (Intraornatosporaceae) and four genera were erected from Brazilian biomes, namely: *Bulbospora, Intraornatospora, Paradentiscutata* and *Sclerocarpum*, which have only been reported in this country (Goto et al. 2012, Marinho et al. 2014, Jobim et al. 2019).

Taking into account the great similarity in species richness between the agroecosystem and eight distinct natural vegetation, interest is aroused in direct research on natural vegetation with few studies, for example, in aquatic and underwater vegetation, coastal sand dunes and high-altitude vegetation, where reports of new records or species will contribute to broadening the knowledge about distribution patterns, limitations and possible endemisms of AMF and estimating the possible loss of species in priority areas or hotspots of Mexico. As highlighted by Maia et al. (2020) studies of AMF communities are subject to multiple factors that can generate a bias in the inventories, for example: species considered as non-sporulans, sporulation to seasonality, use of trap cultures, exclusion of species, lack of experience in morphological identification, among others. Unfortunately, destruction and fragmentation of natural ecosystems has increased excessively in recent years (González-Abraham et al. 2015, Curtis et al. 2018), putting vulnerable taxa at risk, and may lead to loss of species diversity even before we have the opportunity to study and discover them. In order to accelerate the rate of discovery of new AMF species and to estimate the richness more accurately it will be necessary to combine taxonomy and DNA barcoding phylogenetic analysis of glomerospores from trap cultures or high throughput sequencing in soil of natural ecosystems and roots of plant species. The data compiled here significantly increases knowledge on the diversity and natural ecosystem distribution of Glomeromycota in Mexico, as well as the occurrence of AMF globally.

## Acknowledgements

The authors thank the Consejo Nacional de Ciencia y Tecnología (CONACyT) for the financial support through the grant awarded to Polo-Marcial H. (603895) to carry out doctoral studies at INBIOTECA-UV and for the scholarship for doctoral studies in Systematics and Evolution awarded to Margarito-Vista X (439665) in Brazil.

## References

Aguilar-Fernández M., Jaramillo V.J., Varela L., Gavito M.E. (2009) Short-term consequences of slash-and-burn practices on the arbuscular mycorrhizal fungi of a tropical dry forest. *Mycorrhiza* **19**: 179–186.

Aguilera-Gómez L.I., Rivas-Manzano I.V., Ocampo-Jiménez O., Olalde-Portugal V. (2008) Los Glomales de las planicies del Desierto de Sonora. In: Micorrizas arbusculares en ecosistemas áridos y semiáridos (eds. Montaño N.M., Camargo-Ricalde S.L., García-Sánchez R., Monroy-Ata A.), Mundi-Prensa, México: 198–218.

Alarcón A., Hernández-Cuevas L.V., Ferrera-Cerrato R., Franco-Ramírez A. (2012) Diversity and Agricultural Applications of Arbuscular Mycorrhizal Fungi in Mexico. *Journal Biofertilizers & Biopesticides* **3**: 2–10.

Alejandro-Córdova A., Rivera-Cruz M.C., Hernández-Cuevas L.V., Alarcón A., Trujillo-Narcía A., García-De La Cruz R. (2017) Responses of arbuscular mycorrhizal fungi and grass *Leersia hexandra* Swartz exposed to soil with crude oil. *Water, Air, & Soil Pollution* **228**: 1–12.

Allen E.B., Rincón E., Allen M.F., Péréz-Jiménez A., Huante P. (1998) Disturbance and seasonal dynamics of mycorrhizae in a sub-deciduous tropical forest in Mexico. *Biotropica* **30**: 261–274.

Allen M.F., Allen E.B., Gómez-Pompa A. (2005) Effects of Mycorrhizal and nontarget organisms on restoration of a sesonal tropical forest in Quintana Roo, Mexico: factors limiting tree establishment. *Restoration Ecology* **13**: 325–333.

Álvarez-Lopeztello J., Hernández-Cuevas L.V., Castillo R.F.D., Robles C. (2018) Segundo registro mundial de *Glomus trufemii* (Glomeromycota: Fungi), un hongo micorrízico arbuscular de una sabana mexicana. *Revista mexicana de biodiversidad* **89**: 298–300.

Alvarado-Herrejón M., Larsen J., Gavito M.E., Jaramillo-López P.F., Vestberg M., Martínez-Trujillo M., Carreón-Abud Y. (2019) Relation between arbuscular mycorrhizal fungi, root-lesion nematodes and soil characteristics in maize agroecosystems. *Applied soil ecology* **135**: 1–8.

Álvarez-Lopeztello J., del Castillo R.F., Robles C., Hernández-Cuevas L.V. (2019a) Spore diversity of arbuscular mycorrhizal fungi in human-modified neotropical ecosystems. *Ecological Research* **34**: 394–405.

Álvarez-Lopeztello J., Hernández-Cuevas L.V., del Castillo R.F, Robles C. (2019b) Diversity of arbuscular mycorrhizal fungi associated with *Brachiaria brizantha* pastures in lowlands of Oaxaca, Mexico. *Grassland Science* **65**: 197–201.

Álvarez-Sánchez J., Sánchez-Gallen I., Hernández-Cuevas L.V., Hernández L., Cruz C. (2016) What can the arbuscular mycorrhizal fungi community tell us about plant biodiversity loss? In: Recent advances on mycorrhizal fungi (eds. Pagano M.C.). Springer Cham. 23–33.

Álvarez-Sánchez J., Sánchez-Gallen I., Hernández-Cuevas L.V., Hernández-Oro L., Meli P. (2017) Diversidad, abundancia y variación estacional en la comunidad de hongos micorrizógenos arbusculares en la selva Lacandona, Chiapas, México. *Scientia Fungorum* **45**: 37–51.

Arias R.M., Heredia-Abarca G., Sosa V.J., Fuentes-Ramírez L.E. (2012) Diversity and abundance of arbuscular mycorrhizal fungi spores under different coffee production systems and in a tropical montane cloud forest patch in Veracruz, Mexico. *Agroforestry Systems* **85**: 179–193.

Bashan Y., Khaosaad T., Salazar B.G., Ocampo J.A., Wiemken A., Oehl F., Vierheilig H. (2007) Mycorrhizal characterization of the boojum tree, *Fouquieria columnaris*, an endemic ancient tree from the Baja California Peninsula, Mexico. *Trees* **21**: 329–335.

Bautista-Cruz A.A., Montaño N.M., Camargo-Ricalde S.L., Pacheco L. (2014) Hongos micorrizógenos arbusculares y nutrimentos del suelo asociados a cuatro especies de helechos en dos ecosistemas de Oaxaca, México. *Revista Chapingo. Serie ciencias forestales y del ambiente* **20**: 199–212.

Berch S.M., Ferrera-Cerrato R., González-Chávez M.C. (1989) Vesicular arbuscular mycorrhizal fungi from corn fields in Atlacomulco, Mexico. *Mycologia* **81**: 933–935.

Bertolini V., Montaño N.M., Sánchez E.C., Fregoso L.V., Ruiz J.G., Vázquez J.M. (2018) Abundance and richness of arbuscular mycorrhizal fungi in coffee plantations from Soconusco, Chiapas, Mexico. *Revista de Biología Tropical* **66**: 91–105.

Bertolini V., Montaño N.M., Salazar-Ortuño B.L., Chimal-Sánchez E., Varela L. (2020) Diversidad de hongos micorrizógenos arbusculares en plantaciones de café (*Coffea arabica*) del volcán Tacaná, Chiapas, México. *Acta Botanica Mexicana* **127**: 1–16.

Błaszkowski J., Madej T., Tadych M. (1998) *Entrophospora baltica* sp. nov. and *Glomus fuegianum*, two species in the Glomales from Poland. *Mycotaxon* **68**:165–184

Błaszkowski J. (2012) Glomeromycota. W. Szafer Institute of Botany, Polish Academy of Sciences. Kraków, Poland.

Błaszkowski J., Chwat G., Góralska A., Ryszka P., Kovács G.M. (2015) Two new genera, *Dominikia* and *Kamienskia*, and *D. disticha* sp. nov. in Glomeromycota. *Nova Hedwigia* **100**: 225–238.

Błaszkowski J., Kozłowska A., Crossay T., Symanczik S., Al-Yahya'ei M.N. (2017) A new family, Pervetustaceae with a new genus, *Pervetustus*, and *P. simplex* sp. nov. (Paraglomerales), and a new genus, *Innospora* with *I. majewskii* comb. nov. (Paraglomeraceae) in the Glomeromycotina. *Nova Hedwigia* **105**: 397–410.

Błaszkowski J., Kozłowska A., Niezgoda P., Goto B.T., Dalpé Y. (2018) A new genus, *Oehlia* with *Oehlia diaphana* comb. nov. and an emended description of *Rhizoglomus vesiculiferum* comb. nov. in the Glomeromycotina. *Nova Hedwigia* **107**: 501–518.

Błaszkowski J., Niezgoda P., Paiva J.N., Silva, K.J.G., Theodoro R.C., Jobim K., Orfanoudakis M., Goto B.T. (2019) *Sieverdingia* gen. nov., *S. tortuosa* comb. nov., and *Diversispora peloponnesiaca* sp. nov. in the Diversisporaceae (Glomeromycota). *Mycological Progress* **18**: 1363–1382.

Brundrett M.C., Tedersoo L. (2018) Evolutionary history of mycorrhizal symbioses and global host plant diversity. *New Phytologist* **220**: 1108–1115.

Carballar-Hernández S., Hernández-Cuevas L.V., Montaño N.M., Larsen J., Ferrera-Cerrato R., Taboada-Gaytán O.R., Montiel-González A.M., Alarcón A. (2017) Native communities of arbuscular mycorrhizal fungi associated with *Capsicum annuum* L. respond to soil properties and agronomic management under field conditions. *Agriculture, Ecosystems & Environment* **245**: 43–51.

Carballar-Hernández S., Palma-Cruz F.J., Hernández-Cuevas L.V., Robles C. (2013) Arbuscular mycorrhizal potential and mycorrhizal fungi diversity associated with *Agave potatorum* Zucc. in Oaxaca, Mexico. *Ecological Research* **28**: 217–226.

Carmona-Escalante A.C., Guadarrama P., Ramos-Zapata J., Castillo-Argüero S., Montaño N.M. (2013) Arbuscular mycorrhizal fungi associated with coastal vegetation in Chuburna, Yucatan, México. Tropical and Subtropical *Agroecosystems* **16**: 431–443.

Carreón-Abud Y., Vega-Fraga M., Gavito M.E. (2015) Interaction of arbuscular mycorrhizal inoculants and chicken manure in avocado rootstock production. *Journal of Soil Science and Plant Nutrition* **15**: 867–881.

Challenger A., Soberón J. (2008) Los ecosistemas terrestres. *Capital Natural de México* **1**: 87–108.

Chamizo A., Ferrera-Cerrato R., Varela L. (1998) Identificación de especies de un consorcio del género *Glomus*. *Scientia Fungorum* **3**: 37–40.

Chimal-Sánchez E., García-Sánchez R., Hernández-Cuevas L.V. (2015a) Gran riqueza de hongos micorrizógenos arbusculares en el Valle del Mezquital, Hidalgo, México. *Revista Mexicana de Micología* **41**: 14–26.

Chimal-Sánchez E., Araiza-Jacinto M.L., Román-Cárdenas V.J. (2015b) Fire effect on arbuscular mycorrhizal fungi species richness associated with plants of desert scrubland in the Eco Park "Cubitos". *TIP Revista Especializada en Ciencias Químico-Biológicas* **18**: 107–115.

Chimal-Sánchez E., Montaño N.M., Camargo-Ricalde S.L., García-Sánchez R., Hernández-Cuevas L.V. (2016) Nuevos registros de hongos micorrizógenos arbusculares para México. *Revista Mexicana de Biodiversidad* **87**: 242–247.

Chimal-Sánchez E., Reyes Jaramillo I., Salmerón-Castro J.Y., Vázquez-Pérez N., Varela-Fregoso L. (2018) Cuatro nuevos registros de hongos micorrizógenos arbusculares (Glomeromycota) asociados con *Agave karwinskii* y *A. angustifolia* (Agavaceae) de Oaxaca, México. *Acta Botánica Mexicana* **125**: 173–187.

Chimal-Sánchez E., Senés-Guerrero C., Varela L., Montaño N.M., García-Sánchez R., Pacheco A., Montaño-Arias S.A., Camargo-Ricalde S.L. (2019) *Septoglomus mexicanum*, a new species of arbuscular mycorrhizal fungi from semiarid regions in Mexico. *Mycologia* **112**: 121–132.

CONANP (Comisión Nacional de Áreas Naturales Protegidas) (2018) 100 años de conservación en México: Áreas Naturales Protegidas de México. Semarnat-conanp. México, 21–54.

Corazon-Guivin M.A., Mendoza A.C., Guerrero-Abad J.C., Vallejos-Tapullima A., Carballar-Hernández S., da Silva G.A., Oehl F. (2019a) *Funneliglomus*, gen. nov., and *Funneliglomus sanmartinensis*, a new arbuscular mycorrhizal fungus from the Amazonia region in Peru. *Sydowia* **71**: 17–24.

Corazon-Guivin M.A., Cerna-Mendoza A., Guerrero-Abad J.C., Vallejos-Tapullima A., Carballar-Hernández S., da Silva G.A., Oehl F. (2019b) *Microkamienskia* gen. nov. and *Microkamienskia peruviana*, a new arbuscular mycorrhizal fungus from Western Amazonia. *Nova Hedwigia* **109**: 355–368.

Corazon-Guivin M.A., Cerna-Mendoza A., Guerrero-Abad J.C., Vallejos-Tapullima A., Carballar-Hernández S., da Silva G.A., Oehl F. (2019c) *Nanoglomus plukenetiae*, a new fungus from Peru, and a key to small-spored Glomeraceae species, including three new genera in the "*Dominikia* complex/clades". *Mycological Progress* **18**: 1395–1409.

Cuenca G., De Andrade Z., Escalante G. (1998) Diversity of Glomalean spores from natural, disturbed and revegetated communities growing on nutrient-poor tropical soils. *Soil Biology and Biochemistry* **30**: 711–719.

Curtis P.G., Slay C.M., Harris N.L., Tyukavina A., Hansen M.C. (2018) Classifying drivers of global forest loss. *Science* **361**: 1108v1111.

Daniels B.A., Trappe J.M. (1979) *Glomus epigaeus* sp. nov., a useful fungus for vesicular–arbuscular mycorrhizal research. *Canadian Journal of Botany* **57**: 539–542.

Davison J., Moora M., Öpik M., Adholeya A., Ainsaar L., Bâ A., Burla S., Iedhiou I., Hiiesalu I., Jairus T., Johnson N.C., Kane A., Koorem K., Kochar M., Ndiaye C., Pärtel M., Reier U., Saks Ü., Singh R., Vasar M., Zobel M. (2015) Global assessment of arbuscular mycorrhizal fungus diversity reveals very low endemism. *Science* **349**: 970–973.

Estrada-Luna A.A., Davies FT. (2008) Estado nutrimental y crecimiento de plantas micropropagadas de nopal (*Opuntia albicarpa* Scheinvar cv.'Reyna') colonizadas con tres cepas seleccionadas de endomicorrizas. In: Micorrizas arbusculares en ecosistemas áridos y semiáridos (eds. Montaño N.M., Camargo-Ricalde S.L., García-Sánchez R., Monroy-Ata A.), Mundi-Prensa, México: 203–213.

Estrada-Torres A., Várela L., Hernández-Cuevas L.V., Gavito M.E. (1992) Algunos hongos micorrízicos arbusculares del Estado de Tlaxcala, México. *Revista Mexicana de Biodiversidad* **8**: 85–110.

Fabián D., Guadarrama P., Hernández-Cuevas L.V., Ramos-Zapata J.A. (2018) Arbuscular mycorrhizal fungi in a coastal wetland in Yucatan, Mexico. *Botanical Sciences* **96**: 24–34.

Franco-Ramírez A., Ferrera-Cerrato R., Varela-Fregoso L., Pérez-Moreno J., Alarcón A. (2007) Arbuscular mycorrhizal fungi in chronically petroleum-contaminated soils in Mexico and the effects of petroleum hydrocarbons on spore germination. *Journal of Basic Microbiology* **47**: 378–383.

Furrazola E., Heredia G., Olvera G., Sosa V. (2017) Efecto de comunidades nativas de hongos micorrizógenos arbusculares sobre el crecimiento de plántulas de maíz y sorgo/ Effect of native communities of arbuscular mycorrhizal fungi on the growth of corn and sorghum seedlings. *Acta Botánica Cubana* **216**: 127–136.

García-Sánchez R., Monroy-Ata A., Chimal S.E. (2008) Hongos micorrizógenos arbusculares asociados a diferentes plantas y matorrales del Valle del Mezquital, Hidalgo, México. In: Micorrizas arbusculares en ecosistemas áridos y semiáridos (eds. Montaño N.M., Camargo-Ricalde S.L., García-Sánchez R., Monroy-Ata A.), Mundi-Prensa, México: 47–60.

Gavito M.E., Pérez-Castillo D., González-Monterrubio C.F., Vieyra-Hernández T., Martínez-Trujillo M. (2008) High compatibility between arbuscular mycorrhizal fungal communities and seedlings of different land use types in a tropical dry ecosystem. *Mycorrhiza* **19**: 47–60.

Gavito M.E., Varela L. (1993) Seasonal dynamics of mycorrhizal associations in maize fields under low input agriculture. *Agriculture, Ecosystems & Environment* **45**: 275–282.

Gavito M.E., Varela L. (1995) Response of "criollo" maize to single and mixed species inocula of arbuscular mycorrhizal fungi. *Plant and Soil* **176**: 101–105.

Gerdemann J.W., Trappe J.M. (1974) The Endogonaceae of the Pacific Northwest. *Mycologia Memoir* **5**: 1–76.

González-Abraham C., Ezcurra E., Garcillán P.P., Ortega-Rubio A., Kolb M., Creel J.E.B. (2015) The human footprint in Mexico: physical geography and historical legacies. *PLoS One* **10**: e0128055.

González-Cortés J.C., Vega-Fraga M., Varela-Fregoso L., Martínez-Trujillo M., Carreón-Abud Y., Gavito M.E. (2012) Arbuscular mycorrhizal fungal (AMF) communities and land use change: the conversion of temperate forests to avocado plantations and maize fields in central Mexico. *Fungal Ecology* **5**: 16–23.

Goto B.T., Maia L.C. (2005) Sporocarpic species of arbuscular mycorrhizal fungi (Glomeromycota), with a new report from Brazil. *Acta Botanica Brasilica* **19**: 633–637.

Goto B.T., Maia L.C. (2006) Glomerospores: a new denomination for the spores of Glomeromycota, a group molecularly distinct from the Zygomycota. *Mycotaxon* **96**: 129–132.

Goto B.T., da Silva G.A., Yano-Melo A.M., Maia L.C. (2010) Checklist of the arbuscular mycorrhizal fungi (Glomeromycota) in the Brazilian semiarid. *Mycotaxon* **113**: 251–254.

Goto B.T., Silva G.A., Assis D., Silva D.K., Souza R.G., Ferreira A.C., Jobim K., Mello C.M.A., Vieira H.E.E., Maia L.C., Oehl F. (2012) Intraornatosporaceae (Gigasporales), a new family with two new genera and two new species. *Mycotaxon* **119**: 117–132.

Goto B.T., Jobim K. (2020) Laboratório de Biologia de Micorrizas. Disponível em: http://glomeromycota.wixsite.com/lbmicorrizas. Accessed: 10/03/2020.

Guadarrama P., Álvarez-Sánchez F.J. (1999) Abundance of arbuscular mycorrhizal fungi spores in different environments in an evergreen tropical forest, Veracruz, Mexico. *Mycorrhiza* **8**: 267–270.

Guadarrama P., Álvarez-Sánchez J., Briones O. (2004) Effects of arbuscular mycorrhizal fungi on seedling growth and competition of two pioneer tropical species. *Euphytica* **138**: 113–121.

Guadarrama-Chávez P., Ricalde S.L., Hernández-Cuevas L.V., Castillo-Argüero S. (2007) Los hongos micorrizógenos arbusculares de la región de Nizanda, Oaxaca, México. *Boletín de la Sociedad Botánica de México* **81**: 131–137.

Guadarrama P., Ramos-Zapata J., Salinas-Peba L., Hernández-Cuevas L., Castillo S. (2012) La vegetación de dunas costeras y su interacción micorrícica en Sisal, Yucatán: una propuesta de restauración. *Recursos Acuáticos Costeros del Sureste* **2**: 131–152.

Guadarrama P., Castillo S., Ramos-Zapata J.A., Hernández-Cuevas L.V., Camargo-Ricalde S.L. (2014) Arbuscular mycorrhizal fungal communities in changing environments: The effects of seasonality and anthropogenic disturbance in a seasonal dry forest. *Pedobiologia* **57**: 87–95.

Gual-Díaz M., Rendón-Correa A. (2014) Bosques mesófilos de montaña de México, diversidad, ecología y manejo. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO), México, D. F.

Hernández-Zamudio G., Sáenz-Mata J., Moreno-Reséndez A., Castañeda-Gaytán G., Ogaz A., Carballar-Hernández S., Hernández-Cuevas L.V (2017) Dinámica de la diversidad temporal de los hongos micorrícicos arbusculares de *Larrea tridentata* (Sesse & Mocino ex DC) Coville en un ecosistema semiárido. *Revista Argentina de Microbiología* **50**: 301–310.

INEGI (1991) Datos básicos de la geografía de México. Segunda edición. Instituto Nacional de Estadística Geografía e Informática. Ciudad de México, México.

Janos D.P, Trappe JM. 1982. Two new *Acaulospora* species from Tropical America. *Mycotaxon* **15**: 515–522.

Jobim K., Błaszkowski J., Niezgoda P., Kozłowska A., Zubek S., Mleczko P., Chachuła P., Ishikawa N.K., Goto B.T. (2019) New sporocarpic taxa in the phylum Glomeromycota: *Sclerocarpum amazonicum* gen. et sp. nov. in the Family Glomeraceae (Glomerales) and *Diversispora sporocarpia* sp. nov. in the Diversisporaceae (Diversisporales). *Mycological Progress* **18**: 369–384.

Jobim K., Vista X.M., Goto B.T. (2018) Updates on the knowledge of Arbuscular Mycorrhizal Fungi (Glomeromycotina) in the Atlantic Forest biome – an example of very high species richness in the Brazilian landscape. *Mycotaxon* **133**: 209–209.

Lara-Chávez M.B.N., Ávila-Val C., T., Aguirre-Paleo S., Vargas-Sandoval, M. (2013) Arbuscular mycorrhizal fungi identification in avocado trees infected with *Phytophthora cinnamomi* rands under biocontrol. *Tropical and Subtropical Agroecosystems* **16**: 415–421.

Lara-Pérez L.A., Noa-Carrazana J.C., López L., de Jesús Á., Hernández-González S., Oros-Ortega I., Andrade-Torres A. (2014) Colonization and structure of arbuscular mycorrhizal fungi community in *Alsophila firma* (Cyatheales: Cyatheaceae) from a tropical montane cloud forest in Veracruz, México. *Revista de Biologia Tropical* **62**: 1609–1623.

Lara-Pérez L.A., Oros-Ortega I., Córdova-Lara I., Estrada-Medina H., O'Connor-Sánchez A., Góngora-Castillo, E., Sáenz-Carbonell L. (2020) Seasonal shifts of arbuscular mycorrhizal fungi in *Cocos nucifera* roots in Yucatan, Mexico. *Mycorrhiza* **30**: 269–283.

Lesueur D., Ingleby K., Odee D., Chamberlain J., Wilson J., Manga T.T., Sarrailh J.M., Pottinger A. (2001) Improvement of forage production in *Calliandra calothyrsus*: methodology for the identification of an effective inoculum containing *Rhizobium* strains and arbuscular mycorrhizal isolates. *Journal of Biotechnology* **91**: 269–282.

Lovelock C.E., Andersen K., Morton J.B. (2003) Arbuscular mycorrhizal communities in tropical forests are affected by host tree species and environment. *Oecologia* **135**: 268–279.

Maia L.C., Passos J.H., Silva J.A., Oehl F., Assis D.M.A. (2020) Species diversity of Glomeromycota in Brazilian biomes. *Sydowia* **72**: 181–205.

Marinho F., Silva G.A., Ferreira A.C.A., Veras J.S.N., Souza N.M.F., Goto B.T., Maia L.C., Oehl F. (2014) *Bulbospora minima*, a new genus and a new species in the Glomeromycetes from semi-arid Northeast Brazil. *Sydowia* **66**: 313–323.

Marinho F., Silva I.R., Oehl F., Maia L.C. (2018) Checklist of arbuscular mycorrhizal fungi in tropical forests. *Sydowia* **70**: 107–127.

Martínez A.J., Castorena M.D.C.G, Castorena E.V.G., Alarcón A, Pardo M.E.G., Árias N.M.M. (2019) The role of fungi in the conservation of Andosols: case study in Tlaxcala México. *Terra Latinoamericana* **37**: 93–103.

Mejia-Alva B., Ramos-Zapata J., Abdala-Roberts L., Parra-Tabla V. (2018) Effects of arbuscular mycorrhizal fungi on above-ground tri-trophic interactions are contingent upon plant genetic effects of cross type in the perennial herb *Ruellia nudiflora*. *Journal of Ecology* **106**: 1133–1141.

Mena-Violante H.G., Ocampo-Jiménez O., Dendooven L., Martínez-Soto G., González-Castañeda J., Davies F.T., Olalde-Portugal V. (2006) Arbuscular mycorrhizal fungi enhance fruit growth and quality of Chile ancho (*Capsicum annuum* L. cv San Luis) plants exposed to drought. *Mycorrhiza* **16**: 261–267.

Méndez-Cortés H., Marmolejo-Monsivais J.G., Olalde-Portugal V., Cantú-Ayala C.M., Varela-Fregoso L. (2012) Nuevos registros de hongos micorrizógenos arbusculares para México. *Revista mexicana de micología* **36**: 49–56.

Mittermeier R.A., Robles Gil P., Hoffmann M., Pilgrim J., Brooks T., Mittermeier C.G., Lamoreux J., da Fonseca G.A.B (2004) Hotspots revisited: Earth's biologically richest and most endangered ecoregions. CEMEX, Mexico City.

Monroy-Ata A., Peña-Becerril J.C., García-Díaz M. (2016) Mycorrhizal symbiosis organization of dominant tree *Prosopis laevigata* (mesquite) in a xeric shrub of central México. In Recent Advances on Mycorrhizal Fungi Springer (eds. Pagano M.C.), Springer Cham: 35–45.

Monroy-Ata A., Ramírez-Saldívar K.Y. (2018) Relación entre sucesión ecológica vegetal y hongos micorrizógenos arbusculares en un matorral xerófilo en el centro de México. *TIP Revista Especializada en Ciencias Químico-Biológicas* **21**: 13–29.

Montaño N.M., Alarcón A., Camargo-Ricalde S.L., Hernández-Cuevas L.V., Álvarez-Sánchez J., González-Chávez M.C., Gavito M.E., Sánchez-Gallen I., Ramos-Zapata J., Guadarrama P., Maldonado-Mendoza I.E., Castillo S., García-Sánchez R., Trejo D., Ferrera-Cerrato R. (2012) Research on arbuscular mycorrhizae in Mexico: an historical synthesis and prospects. *Symbiosis* **57**: 111–126.

Montaño-Raya Y.A., Barrios P.A., Paleo S.A., Sandoval M.V., Da Silva R.P., Lara-Chávez M.B.N. (2019) Identificación de hongos micorrizógenos arbusculares en huertos de agua-

cate de Uruapan, Michoacán. *Revista mexicana de ciencias agrícolas* **23**: 267–276.
Moreira F.S., Siqueira J.O. (2006) Microbiologia e Bioquímica do Solo. Editora UFLA, Lavras, MG, Brasil.
Muñoz-Márquez E., Macías-López C., Franco-Ramírez A., Sánchez-Chávez E., Jiménez-Castro J., González-García J. (2009) Identificación y colonización natural de hongos micorrízicos arbusculares en nogal. *Terra Latinoamericana* **27**: 355–361.
Myers, N., Mittermeier, R. A., Mittermeier, C. G., Da Fonseca, G. A., & Kent, J. (2000) Biodiversity hotspots for conservation priorities. *Nature* **403**: 853–858.
Ochoa-Meza A., Esqueda M., Fernández-Valle R., Herrera-Peraza R. (2009) Seasonal variation of arbuscular mycorrhizal fungi associated with *Agave angustifolia* haw. at the Sonoran Sierra, Mexico. *Revista Fitotecnia Mexicana* **32**: 189–199.
Oehl F., de Souza F.A., Sieverding E. (2008) Revision of *Scutellospora* and description of five new genera and three new families in the arbuscular mycorrhiza-forming Glomeromycetes. *Mycotaxon* **106**: 311–360.
Oehl F., Silva G.A., Goto B.T., Sieverding E. (2011a) Glomeromycota: three new genera, and glomoid species reorganized. *Mycotaxon* **116**: 75–120.
Oehl F., Silva G.A., Goto B.T., Maia L.C., Sieverding E. (2011b) Glomeromycota: two new classes and a new order. *Mycotaxon* **116**: 365–379.
Oehl F., Sieverding E., Palenzuela J., Ineichen K., Silva G.A. (2011c) Advances in Glomeromycota taxonomy and classification. *IMA fungus* **2**: 191–199.
Oehl F., Silva D.K.A.D., Maia L.C., Sousa N.M.F.D., Vieira H.E.E., Silva G.A. (2011d) *Orbispora* gen. nov., ancestral in the Scutellosporaceae (Glomeromycetes). *Mycotaxon* **116**: 161–169.
Olivera-Morales D., Castillo-Argüero S., Guadarrama P., Ramos-Zapata J., Álvarez-Sánchez J., Hernández-Cuevas L.V. (2011) Establecimiento de plántulas de *Quercus rugosa* Née inoculadas con hongos micorrizógenos arbusculares en un bosque templado de México. *Boletín de la Sociedad Botánica de México* **89**: 115–121.
Ortega-Larrocea M.P., Siebe C., Bécard G., Méndez I., Webster R. (2001) Impact of a century of wastewater irrigation on the abundance of arbuscular mycorrhizal spores in the soil of the Mezquital Valley of Mexico. *Applied Soil Ecology* **16**: 149–157.
Ortega-Larrocea M.P., Siebe C., Estrada A., Webster R. (2007) Mycorrhizal inoculum potential of arbuscular mycorrhizal fungi in soils irrigated with wastewater for various lengths of time, as affected by heavy metals and available P. *Applied Soil Ecology* **37**: 129–138.
Osorio-Miranda M., Castelán-Estrada M., Gómez-Leyva J.F., Salgado-García S., Hernández-Cuevas L.V. (2013) Arbuscular mycorrhizal fungi from savannah soils in Tabasco, México. *Tropical and Subtropical Agroecosystems* **16**: 171–182.
Paleo S.A., Carreóm-Abud Y., Varela L. (2009) Impacto de la materia orgánica en huertos convencionales y huertos orgánicos de aguacate, sobre la biodiversidad de hongos micorrizógenos arbusculares. *Biológicas* **11**: 112–121.
Pereira C.M.R., da Silva D.K.A., Ferreira A.C.A., Goto B.T., Maia L.C. (2014) Diversity of arbuscular mycorrhizal fungi in Atlantic forest areas under different land uses. *Agriculture, Ecosystems & Environment* **185**: 245–252.
Pérez-Luna Y.D., Álvarez-Solís J.D., Mendoza-Vega J., Pat-Fernández J.M., Gómez-Álvarez R., Henrández-Cuevas L.V. (2012) Diversidad de hongos micorrícicos arbusculares en maíz con cultivo de cobertura y biofertilizantes en Chiapas, México. *Gayana Botánica* **69**: 46–56.
Pezzani F., Montaña C., Guevara R. (2006) Associations between arbuscular mycorrhizal fungi and grasses in the successional context of a two-phase mosaic in the Chihuahuan Desert. *Mycorrhiza* **16**: 285–295.
Pezzani F., Guevara R., Hernández-Cuevas L.V., Montaña C. (2008) Mycorrhizal interactions in mapimi biosphere reserve: arbuscular mycorrhizae fungi associated with grasses from the Chihuahuan desert. In: Micorrizas arbusculares en ecosistemas áridos y semiáridos (eds. Montaño N.M., Camargo-Ricalde S.L., García-Sánchez R., Monroy-Ata A.), Mundi-Prensa, México: 109–122.
Picone C. (2000) Diversity and abundance of arbuscular–mycorrhizal fungus spores in tropical forest and pasture. *Biotropica* **32**: 734–750.
Pimienta-Barrios E., Pimienta-Barrios E., Salas-Galván M.E., Zañudo-Hernández J., Nobel P.S. (2002) Growth and reproductive characteristics of the columnar cactus *Stenocereus queretaroensis* and their relationships with environmental factors and colonization by arbuscular mycorrhizae. *Tree Physiolo*gy **22**: 667–674.
Plascencia R., Castañon-Barrientos A., Raz-Guzmán A. (2011) La biodiversidad en México: su conservación y las colecciones biológicas. *Ciencias* **101**: 36–43.
Posada R.H., de Prager M.S., Heredia-Abarca G., Sieverding E. (2018) Effects of soil physical and chemical parameters, and farm management practices on arbuscular mycorrhizal fungi communities and diversities in coffee plantations in Colombia and Mexico. *Agroforestry Systems* **92**: 555–574.
Queiroz M.B.D., Jobim K., Vista X.M., Leroy J.A., Gomes S.R.B.S., Goto B. (2020) Occurrence of Glomeromycota species in aquatic habitats: a global overview. *Mycotaxon* **135**: 469–469.
Ramírez-Gerardo M., Álvarez-Sánchez J., Guadarrama-Chávez P., Sánchez-Gallén I. (1997) Estudio de hongos micorrizógenos arbusculares bajo árboles remanentes en un pastizal tropical. *Boletín de la Sociedad Botánica de México* **61**: 15–20.
Ramírez-Viga T., Guadarrama P., Castillo-Argüero S., Estrada-Medina H., García-Sánchez R., Hernández-Cuevas L.V., Sánchez-Gallén I., Ramos-Zapata J.A. (2019) Relationship between arbuscular mycorrhizal association and edaphic variables in mangroves of the coast of Yucatán, Mexico. *Wetlands* **40**: 539–549.
Ramírez-Viga T.K., Ramos-Zapata J.A., Cantón C.C.G., Hernández-Cuevas L.V., Guadarrama-Chávez P. (2020) Arbuscular mycorrhizal association in *Conocarpus erectus* (Combretaceae) in mangroves from Yucatán, México. *Botanical Sciences* **98**: 66–75.
Ramos-Zapata J.A., Marrufo-Zapata D., Guadarrama P., Carrillo-Sánchez L., Hernández-Cuevas L.V., Caamal-Maldonado A. (2012) Impact of weed control on arbuscular mycorrhizal fungi in a tropical agroecosystem: a long-term experiment. *Mycorrhiza* **22**: 653–661.
Redecker D., Raab P., Oehl F., Camacho F.J., Courtecuisse R. (2007) A novel clade of sporocarp-forming species of glomeromycotan fungi in the Diversisporales lineage. *Mycological Progress* **6**: 35–44.
Retama-Ortiz Y., Ávila-Bello C.H., Alarcón A., Ferrera-Cerrato R. (2017) Effectiveness of native arbuscular mycorrhiza on the growth of four tree forest species from the Santa Marta Mountain, Veracruz (Mexico). *Forest Systems* **26**: 1–9.

Reyes-Jaramillo I., Chimal-Sánchez E., Salmerón-Castro J.Y., Vázquez-Pérez N., Varela-Fregoso L. (2019) Comunidad de hongos micorrizógenos arbusculares (Glomeromycota) asociada con agaves mezcaleros de Oaxaca y su relación con algunas propiedades edáficas. *Revista Mexicana de Biodiversidad* **90**: 1–15.

Rodríguez-Morelos V.H., Soto-Estrada A., Pérez-Moreno J., Franco-Ramírez A., Díaz-Rivera P. (2014) Arbuscular mycorrhizal fungi associated with the rhizosphere of seedlings and mature trees of *Swietenia macrophylla* (Magnoliophyta: Meliaceae) in Los Tuxtlas, Veracruz, Mexico. *Revista chilena de historia natural* **87**: 1–9.

Rose S.L., Trappe J.M. (1980) Three new endomycorrhizal *Glomus* spp. associated with actinorrhizal shrubs. *Mycotaxon* **10**: 413–420.

Rzedowski J. (1981) Un siglo de la botánica en México. *Botanical Sciences* **40**: 1–14.

Rzedowski J. (2006) Vegetación de México. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, México.

Salgado-García S., Castelán-Estrada M., Jiménez-Jerónimo R., Gómez-Leyva J.F., Osorio-Miranda M. (2014) Diversidad de hongos micorrícicos arbusculares en suelos cultivados con caña de azúcar en la región de la Chontalpa, Tabasco. *Revista Mexicana de Micología* **40**: 7–16.

Schüssler A. (2012) The *Geosiphon–Nostoc* endosymbiosis and its role as a model for arbuscular mycorrhiza research. In: *Fungal associations* (eds. Hock B.). *The Mycota* (A Comprehensive Treatise on Fungi as Experimental Systems for Basic and Applied Research) 9: 77–91. Springer, Berlin, Heidelberg.Springer, Berlin, Heidelberg.

Schüssler A., Schwarzott D., Walker C. (2001) A new fungal phylum, the Glomeromycota: phylogeny and evolution. *Mycological Research* **105**: 1413–1421.

Sieverding E., da Silva G.A., Berndt R., Oehl F. (2014) *Rhizoglomus*, a new genus of the Glomeraceae. *Mycotaxon* **129**: 373–386.

Sigüenza C., Espejel I., Allen E.B. (1996) Seasonality of mycorrhizae in coastal sand dunes, Baja California. *Mycorrhiza* **6**: 151–157.

Smith S.E., Read D.J. (2008) Mycorrhizal symbiosis, 3rd edn. Academic Press, London.

Solís-Rodríguez U.R.J., Ramos-Zapata J.A., Hernández-Cuevas L.V., Salinas-Peba L., Guadarrama P. (2020) Arbuscular mycorrhizal fungi diversity and distribution in tropical low flooding forest in Mexico. *Mycological Progress* **19**: 195–204.

Stürmer S.L., Siqueira J.O. (2011) Species richness and spore abundance of arbuscular mycorrhizal fungi across distinct land uses in Western Brazilian Amazon. *Mycorrhiza* **21**: 255–267.

Stürmer S.L., Bever J.D., Morton J.B. (2018) Biogeography of arbuscular mycorrhizal fungi (Glomeromycota): a phylogenetic perspective on species distribution patterns. *Mycorrhiza* **28**: 587–603.

Symanczik S., Al-Yahya'ei M.N., Kozłowska A., Ryszka P., Błaszkowski J. (2018) A new genus, *Desertispora*, and a new species, *Diversispora sabulosa*, in the family Diversisporaceae (order Diversisporales, subphylum Glomeromycotina). *Mycological Progress* **17**: 437–449.

Tapia-Goné J., Ferrera-Cerrato R., Varela-Fregoso L., Rodríguez-Ortiz J.C., Lara-Mireles J., Soria Colunga J.C., Cuellar-Torres H., Tiscareño-Iracheta M.A., Cisneros-Almazán R. (2008) Caracterización e identificación morfológica de hongos formadores de micorriza arbuscular, en cinco suelos salinos del estado de San Luis Potosí, México. *Revista Mexicana de Micología* **26**: 1–7.

Tedersoo L., Sánchez-Ramírez S., Koljalg U., Bahram M., Döring M., Schigel D., May T., Ryberg M., Abarenkov K. (2018) High-level classification of the Fungi and a tool for evolutionary ecological analyses. *Fungal Diversity* **90**: 135–159.

Trappe J.M. (1977) Three new Endogonaceae: *Glomus constrictus*, *Sclerocystis clavispora*, and *Acaulospora scrobiculata*. *Mycotaxon* **6**: 359–366.

Trappe J.M., Guzmán G. (1971) Notes on some hypogeous fungi from Mexico. *Mycologia* **63**: 317–332.

Trejo D., Ferrera-Cerrato R., García R., Varela L., Lara L., Alarcón A. (2011) Efectividad de siete consorcios nativos de hongos micorrízicos arbusculares en plantas de café en condiciones de invernadero y campo. *Revista Chilena de Historia Natural* **84**: 23–31.

Trejo-Aguilar D., Lara-Capistrán L., Maldonado-Mendoza I.E., Zulueta-Rodríguez R., Sangabriel-Conde W., Mancera-López M.E., Negrete-Yankelevich S., Barois I. (2013) Loss of arbuscular mycorrhizal fungal diversity in trap cultures during long-term subculturing. *IMA Fungus* **4**: 161–167.

Trejo D., Guzman G., Lara L., Zulueta-Rodríguez R., Palenzuela J., Sánchez-Castro I., da Silva G.A., Sieverding E., Oehl F. (2015) Morphology and phylogeny of *Acaulospora foveata* (Glomeromycetes) from Mexico. *Sydowia* **67**: 119–126.

Trejo D., Barois I., Sangabriel-Conde W. (2016) Disturbance and land use effect on functional diversity of the arbuscular mycorrhizal fungi. *Agroforestry Systems* **90**: 265–279.

Trinidad-Cruz J.R., Quiñones-Aguilar E.E., Hernández-Cuevas L.V., López-Pérez L., Rincón-Enríquez G. (2017) Hongos micorrízicos arbusculares asociados a la rizósfera de *Agave cupreata* en regiones mezcaleras del estado de Michoacán, México. *Revista Mexicana de Micología* **45**: 13–25.

Ulloa C.U., Acevedo-Rodríguez P., Beck S., Belgrano M.J., Bernal R., Berry P.E., Brako L., Celis M., Davidse G., Forzza R.C., Gradstein R.S., Hokche O., León B., León-Yánez S., Magill R.E., Neill D.A., Nee M., Raven P.H., Stimmel H., Strong M.Y., Villaseñor J.L., Zarucchi J.L., Zuloaga F.O., Jørgensen P.M. (2017) An integrated assessment of the vascular plant species of the Americas. *Science* **358**: 1614–1617.

Van der Heijden M.G., Martin F.M., Selosse M.A., Sanders I.R. (2015) Mycorrhizal ecology and evolution: the past, the present, and the future. *New Phytologist* **205**: 1406–1423.

Varela L., Vázquez R. (1989) Incidencia y descripción de dos hongos micorrízicos vesículo-arbusculares aislados de un suelo cultivado con arroz. *Revista Mexicana de Micología* **5**: 233–239.

Varela L., Trejo D. (2001) Los hongos micorrizógenos arbusculares como componentes de la biodiversidad del suelo en México. *Acta Zoológica Mexicana* **1**: 39–51.

Varela L., Mora-Velázquez A., Chávez-Hernández C.G., Martínez-Bernal A., García-Sánchez R., Chimal-Sánchez E., Montaño N.M. (2017) *Acaulospora alpina* y *Ambispora fennica*, dos registros nuevos de hongos micorrizógenos arbusculares para México. *Revista Mexicana de Biodiversidad* **88**: 496–501.

Varela L., Hernández-Cuevas L.V., Chimal-Sánchez E., Montaño N.M. (2019) Diversidad taxonómica de hongos micorrízogenos citados de México. In: Biodiversidad de microorganismos de México. Importancia, aplicación y conservación (eds. Álvarez-Sánchez F.J., Rodríguez-Guzmán P., Alarcón A.), México: 8–38.

Varela L., Estrada-Torres A., Álvarez-Sánchez J., Sánchez-Gallen I. (2008) Catálogo ilustrado de hongos micorrizógenos arbusculares de la Reserva de la Biosfera de Los Tuxtlas. (CD-Room) México: SEMARNAT-CONACYT. GEF. TSBF. CIAT. Instituto de Ecología, A.C.F.

Vieira L.C., Silva D.K.A., Escobar I.E.C., Silva J.M.D., Moura I.A.D., Oehl F., da Silva G.A. (2020) Changes in an arbuscular mycorrhizal fungi community along an environmental gradient. *Plants* **9**: 52.

Villaseñor J.L., Maeda P., Rosell J.A., Ortiz E. (2007) Plant families as predictors of plant biodiversity in Mexico. *Diversity and Distributions* **13**: 871–876.

Violi H.A., Barrientos-Priego A.F., Wright S.F., Escamilla-Prado E., Morton J.B., Menge J.A., Lovatt C.J. (2008) Disturbance changes arbuscular mycorrhizal fungal phenology and soil glomalin concentrations but not fungal spore composition in montane rainforests in Veracruz and Chiapas, Mexico. *Forest Ecology and Management* **254**: 276–290.

Walker C., Trappe J.M. (1981) *Acaulospora spinosa* sp. nov. with a key of *Acaulospora*. *Mycotaxon* **12**: 515–521.

Wang B., Qiu Y.L. (2006) Phylogenetic distribution and evolution of mycorrhizas in land plants. *Mycorrhiza* **16**: 299–363.

Wijayawardene et al. (2020) Outline of Fungi and fungi-like taxa. *Micosphere* **11**: 1060–1456.

Zulueta-Rodríguez R., Varela L., Aguilar-Espinosa S., Trejo-Aguilar D., Lara-Capistrán L. (2010) Estatus micorrízico de *Jacaratia mexicana* y hongos formadores de micorriza arbuscular presentes en selvas bajas caducifolias del Golfo de México. *Revista Mexicana de Micología* **31**: 37–44.

Zulueta-Rodríguez R., Hernández-Montiel L., Murillo-Amador B., Matson C., Lara-Capistrán L., Alemán-Chávez I. (2015) Survival and growth of *Jacaratia mexicana* seedlings inoculated with arbuscular mycorrhizal fungi in a tropical dry forest. *Madera y Bosques* **21**: 161–167.

*(Manuscript accepted 7 April 2021; Corresponding Editor: I. Krisai-Greilhuber)*