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New records of macrofungi from Colombia and the Department of Antioquia

Denis Cristina Benjumea Aristizábal[1], Andrea Builes Vélez[1], Nataly Gómez Montoya[1,2] and Carlos A. López Quintero[1]

[1]Laboratorio de Taxonomía y Ecología de Hongos (TEHO), Instituto de Biología, Facultad de Ciencias Exactas y Naturales, Universidad de Antioquia - UdeA, Calle 70 No. 52-21, Medellín, Antioquia, Colombia.
[2]Grupo de investigación Tendencias, Universidad de Antioquia, Campus Oriente - Kilometro 6, vía Rionegro la Ceja, El Carmen de Viboral. Antioquia, Colombia.

E-mail: denis.benjumea@udea.edu.co

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Abstract: Macrofungal diversity in Colombia has increased notoriously in the last decade as a result of the new reports and new species registered in the country. The present report constitutes a contribution to those efforts by recording four new macrofungal species for the country and eight for the Department of Antioquia, all of which were collected in a mixed forest. For each new record, a brief macroscopic and microscopic description is provided.

Keywords: distribution, diversity, fungi, mixed forest, tropical dry forest.

Introduction

The term “macrofungi” does not correspond to a taxonomic category, but it is used to circumscribe all those sporocarps or fruit bodies produced by fungi that can be observed with the naked eye (Arnolds 1982). These macroscopically visible structures are mostly produced by species of the Phyla Basidiomycota, Ascomycota and Zygomycota (Park et al. 2017), and encompass a wide variety of forms, textures and colors. Macrofungi, like the rest of fungi, play important roles in forest ecosystems such as decomposers, symbionts and pathogens (Schmit and Mueller 2007; Dix and Webster 1995).

Research conducted on diversity and ecological relations of fungi in Colombia, specially macrofungi, have increased in the present century (i.e., Vasco-Palacios et al. 2005; López-Q. et al. 2011; Vasco-Palacios and Franco-Molano 2013; Vasco-Palacios 2016). Until 2021 it is believed that there were around 6992 species of Phyla Basidiomycota and Ascomycota (Gaya et al. 2021). Such consideration is likely premature since most studies have been conducted in very few places and ecosystems of Colombia. Since this country is considered among the top biodiverse areas in the world (SiB Colombia, 2022) and most ecosystems have not been explored for fungi yet (Gómez-Montoya et al. 2022), there should be a large number of unknown macrofungal species yet to be identified.

According to Mueller et al. (2004), many unknown species of fungi have been lost as a consequence of habitat loss, and with them, their biotechnological potential and importance for ecosystem functions will remain unknown. Currently, we know that there are 24 species of fungi in the Colombian Red List (The IUCN Red List of Threatened Species 2022). Therefore, any contribution to documenting fungi in this country is important due to the deforestation rates shown in the last decades. According to Erasso and Velez (2020) Colombia has lost 1.5 million hectares of forest in the last two decades, and along with that, a large number of fungi as well.

This paper is the result of the study of specimens deposited at the Herbario Universidad de Antioquia (HUA). The identification of the collections was done using the classical approach of the morphological taxonomy with specialized keys, using macroscopic and microscopical characteristics and chemical reactions. The specimens registered and briefly described herein were collected in a regenerated forest located in the Andean region and one specimen collected in a fragment of tropical dry forest.

Materials and methods

Study Area

The fungal specimens studied herein were collected in two different fragment forests located in the Department of Antioquia (Colombia). One fragment is a tropical premontane wet forest (TP-wf) (Holdridge 1967), in the Municipality of Girardota, in the rural areas at 2190 m.a.s.l. (between 6º20′41.78″ N, 75º25′58.92″ W and, 6º20′38.69″ N, 75º28′06.22″ W), with an average temperature of 20°C and annual mean precipitation of 1821 mm. The second fragment is a tropical dry forest (T-df) in the Municipality of Santa Fe de Antioquia 6º33′06.95″ N, 75º50′20.84″ W. In this case the mean temperature is 25.5°C and the mean annual precipitation is 1266 mm. The fragment is located in a plain terrain, slightly undulated, at 595 m.a.s.l.

Sampling

The carpophores were found following an opportunistic sampling (Bills et al. 2004) and the collections were done following Largent et al. (1977), and Franco-Molano et al. (2000), The available substrates such as soil, litter, rooting wood, dung, insects and living trees were explored. Carpophores were labelled and preserved in waxy paper with a fraction of the substrate to consider in the macroscopical description.

Morphological studies

Macroscopical description of specimens were made following the recommendations of Largent (1986) and Franco-Molano et al. (2000, 2005). Microscopic characters were examined in Melzer's Reagent (IKI), 3% Potassium Hydroxide (KOH) and Phloxine. Measurements of basidiospores, basidia and cystidia followed a standard sampling of 30 counts per structure (n = 30). The identification of species was based on morphological criteria tested in dichotomous or polytomous keys.

All studied specimens were deposited in the Herbario de la Universidad de Antioquia (HUA). For distributional purposes, Colombian departments were abbreviated as follows: ant=Antioquia, caq=Caquetá, cho=Chocó, cund=Cundinamarca, su=Sucre, vcau=Valle del Cauca. The Parque Nacional Natural Los Nevados has been abbreviated as PNNN.

Results

Several surveys have been carried out during the last years in different places surrounding the city of Medellín. During the morphological identification of fungal specimens collected in these activities, the authors found four species that constituted new records for Colombia. Two species were classified as Agaricales: *Entoloma brunneum* and *Collybiopsis subpruinosa*. The other species were classified as part of the Orders Gomphales: *Ramaria gracilis* and Heliotales (Ascomycota): *Hymenoscyphus atrosubiculatus*. For these records, short morphological descriptions and images showing some of the microscopical characters are provided.

As part of the examination of specimens, eight additional species that were previously known in Colombia were also identified. These cases, however, corresponded to new records for the Department of Antioquia (Table 1) and for this reason, they were included in this work.

Material examined

Ascomycota, Helotiaceae

Hymenoscyphus atrosubiculatus (Seaver & Waterston) Dennis, Persoonia 3 (1): 74 (1964). Fig. 1 E-F.

Material examined. COLOMBIA – Antioquia • Girardota; Vereda El Palmar; 6°20′40.747″N, 75°26′5.247″W; 2200 m a s l.; 28.XI.2018; López-Q. Carlos A # 1416; gregarious on decomposing trunk; HUA 218884.

Description: Apothecium small, sessil, up to 0,5 cm in diameter, discoid; smooth surface, orange brownish; margin entire. Context less than 1 mm, jelly to elastic, concolorous with upper surface. Ascospores cylindric to ellipsoids 6–8 x 2–3 µm; asci cylindric-clavate 55–85 x 5–6 µm. Growing gregarious in trunks.

Known distribution: Bermuda, Jamaica, New Zealand, United States of America, Venezuela.

Basidiomycota, Entolomataceae

Entoloma brunneum Petch, Annals of the Royal Botanic Gardens Peradeniya 9 (2): 215 (1924). Fig. 1 A-B.

Material examined. COLOMBIA – Antioquia • Girardota; Vereda El Palmar; 6°20′40.747″N, 75°26′5.247″W; 2584 m asl; 29.XI.2018; López-Q. Carlos A # 1427; gregarious on decaying wood; HUA 218881.

Description: Small to medium agarics. Pileus 0.8–2.4 cm in diameter, convex with a small central papilla; surface slightly hygrophanous at the centre, dark brown with some hues of tobacco brown, striate towards the margin; finely and radially fibrillose, margin entire. Context thin, 2 mm at the disk, white greyish to light brown, compact. Lamellae free, pinkish brown, up to 5 mm broad, moderately close, with lamellulae of three lengths; edge entire. Stipe 1–2 cm x 1–2 mm, central, cylindric - decurved, bulbous at the base, solid; surface white to light brown, smooth, interior compact and concolorous with surface. Spores subquadrate to ovoid 8–11 x 6–8(9) µm. Basidia 25–35 x 8–11 µm, clavate. Pileipellis a cutis of repent hyphae. Gregarious on rotten wood.

Known distribution: Chile, Madagascar, Malay Peninsula, Papua New Guinea, Sarawak and Sri Lanka-India.

Basidiomycota, Omphalotaceae

Collybiopsis subpruinosa (Murrill) R.H. Petersen, in Petersen & Hughes, Mycotaxon 136(2): 344 (2021). Figure 1 C-D

Material examined. COLOMBIA – Antioquia • Girardota; Vereda El Palmar; 6°20′40.747″N, 75°26′5.247″W; 2560 m asl.; 29.XI.2018; Benjumea D.C.# 72; gregarious on ground; HUA 218885.

Description: Medium sized agarics. Pileus 6–6.5 cm in diameter, plane-umbonate, surface smooth, hygrophanous, beige pinkish, turning darker later; margin finely striate and undulated. Context 5mm at the disk, light brown in the upper side, lighter downwards. Lamellae adnate with decurrent tooth, close, beige in colour and with irregular folds, lamellulae with different lengths. Stipe up to 7 x 0,6 cm, central to eccentric, cylindric, surface finely fibrillose, white cream darker at the base, interior fistulate and concolorous with the surface. Basidiospores ellipsoid, (6) 6.5–8 x 3–4 µm; basidia cylindric-clavate, 21–28 x 5–7 µm; cheilocystidia versiforms 21–30 x 3–4 µm. Growing on the ground, gregarious.

Known distribution: Brazil, Chile, Congo, Costa Rica, Ecuador, Hawaii, India, Jamaica, Lesser Antilles, New Zeland, Panama, Puerto Rico and United States of America.

Basidiomycota, Gomphaceae

Ramaria gracilis (Pers.) Quél., Flore mycologique de la France et des pays limitrophes: 463 (1888). Fig. 1 G-H-I.

Material examined. COLOMBIA – Antioquia • Girardota, Vereda Juan Cojo; 6°20′53.31″N, 75°28′6.482″W; 2291 masl.; 23.XI.2018; López-Q. Carlos A # 1387; solitary on ground; HUA 218922; López-Q. Carlos A # 1368; HUA 218945. COLOMBIA, Antioquia, Municipio Girardota, Vereda Juan Cojo; 6°20’53.031’ N, 75°28’6.482’’W; 2291 m asl.; 24.XI.2018; Benjumea D.C. # 51; solitary on ground; HUA 218944.

Description: Basidiocarps ramarioid, up to 5 cm tall and 4 cm wide; light brown in colour; branching from the base. Branch 1-2 mm in diameter, cylindric with profuse dichotomic ramification and

short, slender, acute and whitish-brownish tips. Interior solid, ochre. Basal mycelium poorly developed composed by a few white and fine threads. Basidiospores ellipsoid, 5–6 x 2–3 μm (some collections with bigger spores 6-9 x 4-5 μm); basidia clavate, 42–50 x 6–9 μm. Growing solitary, on the ground.

Known distribution: Australia, Brazil, Denmark, Estonia, Germany, Norway, Spain, Sweden, United Kingdom and United States of America.

Table 1. Additional species of fungi not previously known for the Department of Antioquia with information on the areas where the species was previously reported and herbarium specimen numbers.

Species	**Jurisdictions*where previously reported**	**Collection number (HUA)**
Aleuria aurantia	cund	HUA 218883
Cordyceps militaris	cund	HUA 218877
Crepidotus uber	cho, cund, vcau	HUA 218932
Dacryopinax elegans	su, vcau	HUA 218894
Phylloporia chrisites	to	HUA 214843; HUA 214843; HUA 214870.
Rhodophana nitellina	caq	HUA 218934
Stereum subtomentosum	PNNN	HUA 218920
Xylaria anisopleura	PNNN, caq	HUA 218950

*caq=Caquetá, cho=Chocó, cund=Cundinamarca, to=Tolima, su=Sucre, vcau=Valle del Cauca, PNNN= Parque Nacional Natural Los Nevados.

Discussion

A vast mosaic of ecosystems and biogeographic regions in Colombia are responsible for its high biodiversity, which has been documented for different groups of organisms (mainly birds, butterflies, plants and frogs). The data used for documenting those patterns has been collected over time, however, ecologically relevant groups such as fungi have been understudied in the same periods. During the last three decades, studies and inventories on fungi in the country have increased considerably, and results reveal a high fungal diversity. In this manner new species and several new reports of fungi had been published during that time. Mostly of reported species had been collected in relatively well-preserved forests Andean and Amazon forests (López-Q et al. 2012;Vasco-Palacios 2016), The new records of species of macromycetes for Colombia reported herein were collected in forests with frequent human intervention, implying that high macrofungal diversity is also present in such places and probably new reports of macrofungi are waiting to be recorded. This report contributes to widen the biogeographic distribution of species and supports the assumption that Colombia has a high potential to be considered as a fungal megadiverse country.

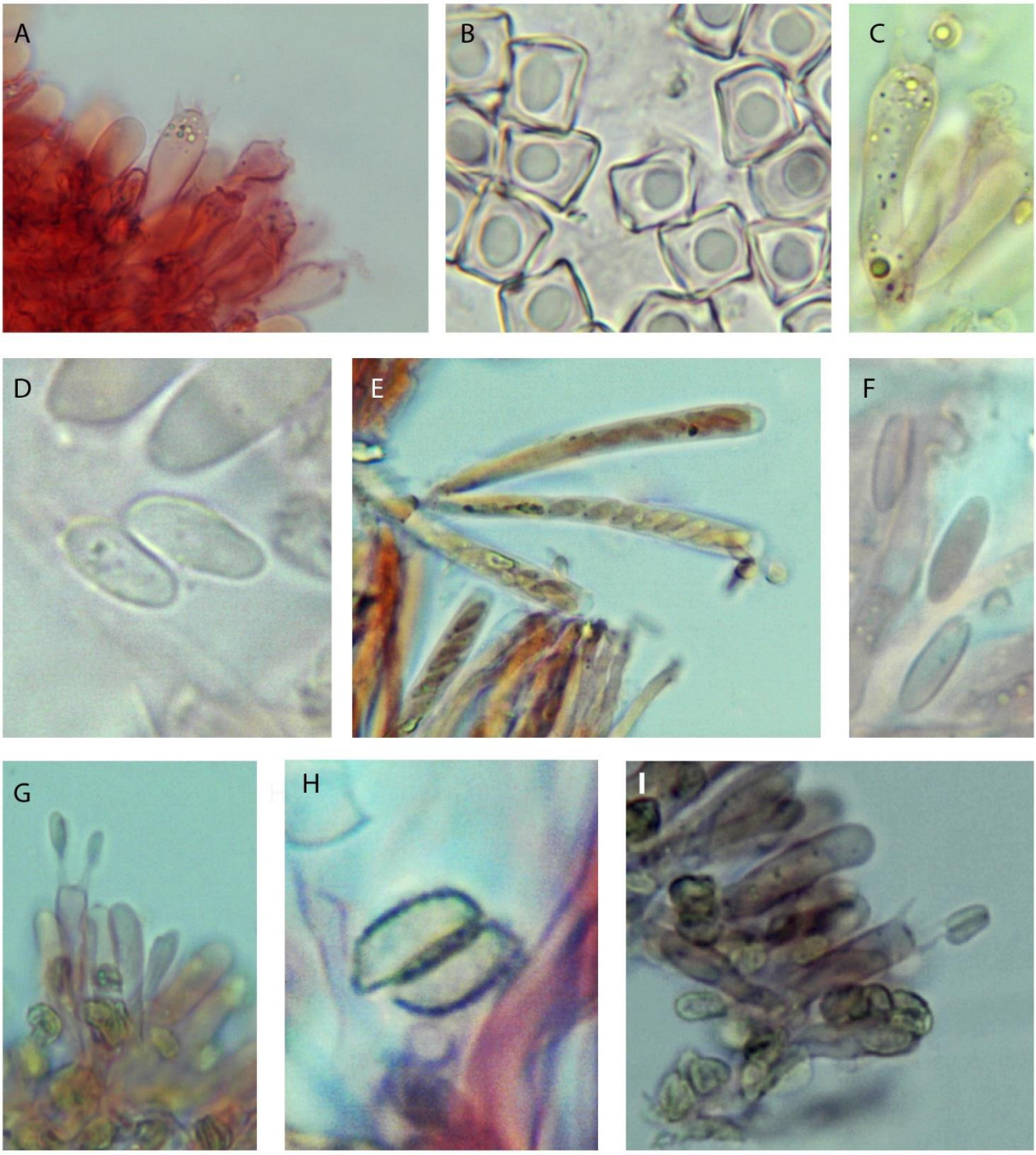

Figure 1. Microscopical structures observed in the present study. A-B. Basidia and spores of *Entoloma brunneum*, C-D. Basidia and spores of *Collybiopsis subpruinosa*, E-F Asci and spores of *Hymenoscyphus atrosubiculatus*, G-H-I. Basidia and spores of *Ramaria gracilis*.

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