REVISTA CIENTÍFICA IGAPÓ
Publicação da Pró-Reitoria de Pesquisa, Pós-Graduação e Inovação do Instituto Federal de Educação, Ciência e Tecnologia do Amazonas

NEW DISTRIBUTION DATA AND CONTRIBUTION TO THE KNOWLEDGE OF Agaricomycetes (Fungi: Basidiomycota) FOR THE STATE OF AMAZONAS, BRAZIL

Douglas de Moraes Couceiro[1], Marcos Diones Ferreira Santana[2], Ana Tana Rosas Nascimento[3], Albejamere Pereira de Castro[4], Afonso Duarte Leão de Souza[5], Spartaco Astolfi Filho[6] e Antonia Queiroz Lima de Souza[7].

ABSTRACT

The Brazilian Amazon, recognized for its rich diversity of flora, fauna, and funga, is one of the largest continuous tropical forests in the world, and among the various organisms, fungi play essential roles in this ecosystem, especially in nutrient cycling. The Agaricomycetes (Basidiomycota) includes fungi of different sizes, shapes, and colors, which contribute to the functioning of forests and participate in various symbioses, such as ectomycorrhizas, but still present significant knowledge gaps in different areas. This study aimed to inventory Agaricomycetes fungi in an Amazonian forest area linked to PPBio, expanding knowledge about these fungi in the region. A total of 95 species were recorded, distributed across 55 genera, 33 families, and nine orders, with Agaricales, Polyporales, and Hymenochaetales being the most representative, while Agaricaceae, Ganodermataceae, Hymenochaetaceae and Polyporaceae stood out in species diversity. In total, 15 species were recorded for the first time in the Amazon biome, was recorded for the first time in the state of Amazonas. Most species were found growing on dead wood, with distribution across the States of Amazonas and Roraima. The results increase the known richness of Agaricomycetes in the State of Amazonas and the Amazon region, highlighting that this environment harbors a large number of species yet to be recorded and providing new data on the geographic distribution of these fungi in the Brazilian Amazon.

Keywords: Macrofungi, New records, Taxonomy.

[1] Federal University of Amazonas. E-mail: douglasmcouceiro@gmail.com. ORCID: 0000-0003-4189-7478
[2] Federal University of Amazonas. E-mail: santana.mdf@gmail.com ORCID: 0000-0002-0421-3420
[3] Federal University of Amazonas. E-mail: tanarosas@gmail.com ORCID: 0000-0001-7987-1754
[4] Federal University of Amazonas. E-mail: albejamere@yahoo.com.br ORCID: 0000-0003-4850-8463
[5] Federal University of Amazonas. E-mail: souzadq@gmail.com ORCID: 0000-0001-7007-3991
[6] Federal University of Amazonas. E-mail: spartaco.biotec@gmail.com ORCID: 0000-0001-7246-6350
[7] Federal University of Amazonas. E-mail: antoniaqlsouza@gmail.com ORCID: 0000-0001-5602-8617

1. INTRODUCTION

The Brazilian Amazon is considered the largest continuous tropical forest in the world, with its rich flora, fauna, and funga (SOUSA-BAENA; GARCIA; PETERSON, 2013; MAIA et al., 2015; RYLANDS et al., 2002), making this biome one of the most important ecosystems in the world and a valuable source of bioproducts (Silva JARDIM & SILVA, 2002). As an integral component of the biotic environment of this tropical forest, fungi play a fundamental role in nutrient cycling by decomposing lignin, cellulose, and hemicellulose present in plant substrates (HOFF et al., 2004).

Among these fungi, those belonging to the phylum Basidiomycota, also known as basidiomycetes fungi, exhibit a remarkable diversity of shapes, colors, sizes, odors, and other morphological characteristics that vary among different taxonomic groups (HE et al., 2022). This phylum is characterized by complex structures, such as clamp connections, which allow the dikaryotic state, and different sexual mating systems, resulting in macroscopic forms visible to the naked eye, commonly known as "mushrooms" or "bracket fungi" (basidiomata). Within this phylum, the fungi of the class Agaricomycetes stand out, comprising approximately 31,515 described species, representing about one-fifth of all known fungi (PETERSEN, 2012; HYDE et al., 2024). Additionally, new species continue to be discovered, indicating that the true diversity of this group is considerably greater than currently documented (WU et al., 2019).

Notably, tropical forests such as the Amazon may harbor a large number of fungal species that remain poorly documented or have not yet been described by science (RYLANDS et al., 2002; HAWKSWORTH & LÜCKING, 2017). Despite the high biodiversity of the Brazilian Amazon, knowledge of macrofungal diversity remains spatially uneven, with some areas and regions still poorly represented by mycological inventories. This knowledge gap is particularly relevant for Agaricomycetes, as regional inventories are essential for documenting species occurrence, refining their known geographical distributions, and identifying new records (VARGAS-ISLA & ISHIKAWA, 2013).

In addition to this knowledge gap, Amazonian forests are continuously exposed to anthropogenic pressures, including deforestation, logging, fire, agribusiness expansion, and mining (FEARNSIDE, 2010; RITTER et al., 2017). The combination of highly diverse but incompletely documented fungal communities and ongoing environmental pressures

highlights the importance of local and regional inventories as a first step toward improving our understanding of Amazonian fungal biodiversity (COUCEIRO et al., 2022; MEDEIROS et al., 2015; SOARES et al. 2014). Such inventories are particularly valuable because apparently well-studied regions may still yield previously unreported species or distribution records, demonstrating that the current knowledge of Amazonian macrofungi remains incomplete (COUCEIRO et al., 2022).

Therefore, this study aimed to inventory the macroscopic fungi of Agaricomycetes (Basidiomycota) occurring at the Experimental Farm of the Federal University of Amazonas (UFAM), with the objective of expanding the knowledge of fungal diversity in the state of Amazonas. By documenting the species present in this area, including new records for the locality and the Brazilian Amazon, this study contributes to filling existing gaps in the knowledge of Agaricomycete distribution and provides baseline information for future biodiversity surveys and conservation efforts.

2. MATERIALS AND METHODS

2.1 Study area

The study was conducted between January and June 2023 at a Biodiversity Research Program (PPBio) sampling site (centroid coordinates: 2°38'26.48"S, 60°5'44.56"W), within the Experimental Farm of the Federal University of Amazonas (FAEXP-UFAM), located at km 38 of the BR-174 highway (2°39'0.05"S, 60°3'12.18"W). FAEXP covers an area of 3,000 hectares, predominantly characterized by dense Amazonian upland forest and forming part of a larger continuous forest area (PPBIO, 2012). The climate of the region is classified as Af – equatorial, characterized by two well-defined seasons: the dry season, from June to November, with an average precipitation of 80 mm, and the rainy season, from December to May, with an average precipitation of 261 mm. The temperature remains stable throughout the year, with an average of 27 ºC, while the relative humidity of the air hovers around 83% (ANTONIO 2017).

For this study, four plots (NS1, NS2, NS3, and NS4) were selected within the 24-km² PPBio sampling grid. In each plot, a 1,000 × 10 m transect was established, along which Agaricomycetes fungi were collected (Figure 1).

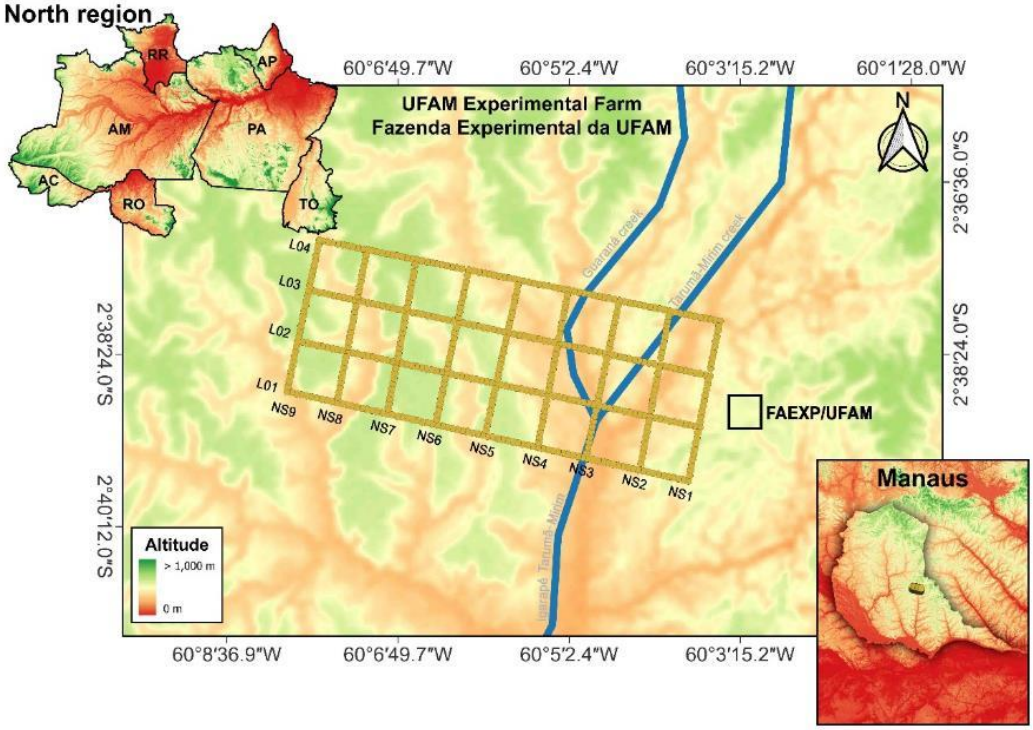
2.2 Collection, herborization and identification of Agaricomycetes fungi

Three expeditions were conducted for the collection of Agaricomycetes fungi in the pre-established transects. The collections were scheduled based on the rainfall regime of the state of Amazonas (ALVARES et al., 2013), as this period is favorable for fungal emergence and fruiting (NÚÑEZ, 1996; LINDBLAD, 2001).

The collection of Agaricomycetes fungi was conducted according to Santana et al. (2023), which involves the photographic documentation of each basidiome using a camera (we used a Canon, model Powershot SX60 HS) still on the substrates of occurrence, such as soil, branch, living or dead wood, and later removed manually with a chisel and placed individually in paper bags with field notes such as registration number, collector, substrate, location, and collection date. In the laboratory, the specimens were dried in an air-circulating oven (QUIMIS®, model Q317M-53) at 35 °C (± 2 °C) for a period of two to three days and mounted in temporary exsiccates.

The basidiomata of Agaricomycetes fungi were identified through the analysis of their macroscopic and microscopic features. The macroscopic analysis involved detailed observations of the basidiomes using a stereomicroscope (Feldman Wild Leitz, model SMZ 4.5), considering aspects such as substrate attachment, color, consistency, and characteristics of the surfaces of the pileus, pores, tubes, gills, context, and margin of each basidiome (SINGER, 1986; MILLER & MILLER, 1988; RYVARDEN, 2004; ASSIS et al., 2022).

Figure 1 — Location of the sampled plots in the Biodiversity Research Program Site of the Experimental Farm of the Federal University of Amazonas, in Manaus, Amazonas.



Source: Authors (2026).

For the microscopic analysis, sections of different parts of the basidiomata (pileus, context, tubes, gills, and stipe) were prepared using a steel blade under a stereomicroscope. The sections were mounted between glass slides and coverslips and examined in different aqueous reagents, including 3% potassium hydroxide (KOH), used to rehydrate and clarify tissues, fuchsin and cotton blue, used as staining reagents, and Melzer's reagent, used to assess the chemical reactions of the walls of the microscopic structures. These reactions can be positive or negative and vary among species, with the structures being described as hyaline (colorless, with visible cell walls), amyloid (turning blue to purple or violet), or dextrinoid (turning golden to reddish-brown) (SINGER, 1986; MILLER; MILLER, 1988; TEIXEIRA, 1995; RYVARDEN, 2004; ASSIS et al., 2022).

Finally, the specimens were analyzed under a binocular optical microscope (Feldman Wild Leitz, model SMZ 4.5) to observe the hyphal system (monomitic, dimitic, or trimitic), reproductive structures (basidia and basidiospores) and sterile structures (cystidia, cystidioles, metuloids, among others) (SINGER, 1986; MILLER & MILLER, 1988; TEIXEIRA, 1995; RYVARDEN, 2004; ASSIS et al., 2022).

After analyzing the morphological characteristics of the specimens, they were compared with the specialized literature on Basidiomycota for species identification or confirmation. The references consulted include Lange (1938), Corner (1950), Singer (1955, 1974), Reid (1965), Ryvarden (1972, 2004), Pegler & Fiard (1978), Ryvarden & Johansen (1980), Noordeloos (1981), Gilbertson & Ryvarden (1986), Pegler (1987), Pegler et al. (1995), Léger (1998), Zmitrovich (2001, 2018), Núñez & Ryvarden (2001), Capelari & Gimenes (2004), Desjardin & Ovrebo (2006), Campos-Santana & Loguercio-Leite (2008), Largent et al. (2008), Larsson & Jeppson (2008), Abrahão et al. (2009), Birkebak (2010), Dai (2010), Drechsler-Santos et al. (2012), Niveiro et al. (2013), Shirouzu et al. (2013), Silva et al. (2013), Henkel et al. (2014), Lodge et al. (2014), Menolli Junior et al. (2014), Rhother & Silveira (2009), Roblendo et al. (2014), Campos-Santana et al. (2015), Coimbra et al. (2015), Malysheva et al. (2015), Soares et al. (2015), Costa-Rezende et al. (2016, 2017), Saar (2016), Accioly et al. (2017), Alfredo et al. (2017), Alvarenga & Xavier-Santos (2016), Desjardin & Perry (2017), Ferreira-Lopes et al. (2016), Palacio et al. (2017, 2021), Alberti et al. (2020), Oliveira et al. (2022a, 2022b), Sun et al. (2020), Silva et al. (2021), Wu et al. (2021), Alvarenga & Gibertoni (2022), Lima et al. (2022), Reschke et al. (2022), Strauss et al. (2022), Seethapathy et al. (2024), Karstedt et al. (2024) and Soares et al. (2024).

All the fungal species in this study are registered in SisGen A91107E. The species nomenclature follows the updates from Index Fungorum (http://www.indexfungorum.org/), and the identified specimens were deposited in the Fungal Collection of the Herbarium of the National Institute for Amazonian Research (INPA), Manaus, Amazonas, Brazil.

2.3 Data analysis

In this study, the occurrence of Agaricomycetes species was recorded, and a database was compiled containing information on order, family, species, taxonomic references, substrate, and species distribution in the Brazilian Amazon. Species distribution data were obtained from Flora e Funga do Brasil (2025) and SpeciesLink (2025). To visualize the distribution of species, a bar chart was generated in R version 4.2.2 (R CORE TEAM, 2018) using the ggplot2 package (WICKHAM, 2016), based on the total number of species recorded in each state of the Brazilian Amazon. Specimens identified only to genus level were excluded from these counts.

3. RESULTS

Nine orders, 33 families, and 55 genera were recorded, totalling 95 species of Agaricomycetes fungi. The most representative order was Agaricales Underw., with 37 species (39%), followed by Polyporales Gäum. with 33 species (35%), and Hymenochaetales Oberw. with 13 species (14%). The orders Dacrymycetales Henn. (4 species; 4%), Auriculariales Bromhead, Geastrales K. Hosaka & Castellano, and Tremellales Fr. (all with 2 species; 2% each), as well as Boletales E.-J. Gilbert and Cantharellales Gäum., with one species each, were those with the lowest diversity of Agaricomycetes fungi (Table 1).

The most diverse family was Polyporaceae Fr. ex Corda, with nine genera and 14 species, followed by Hymenochaetaceae Donk, which had five genera and 12 species, and Ganodermataceae Donk, with four genera and 10 species, together representing approximately 38% of the total recorded richness. The genus *Amauroderma* Murrill was the most diverse, with five species, followed by *Entoloma* (Fr.) P. Kumm., *Fomitiporia* Murrill, *Leucocoprinus* Pat., and *Marasmius* Fr., each represented by four species. Together, these five genera accounted for 22% of all recorded species (Table 1).

Table 1 – List of Agaricomycetes fungi (Basidiomycota) found at the Research Program in Biodiversity site of the UFAM Experimental Farm. SU – Substrates (DT –Dead tree, LT – Living tree, FB – Fallen branch, SO – Soil and PL – Plant litter), PR – Photographic record, Fig. – figure.

Order Family *Species*	**SU**	**Reference**	**Herbarium Voucher**	**Occurrence in the Amazon**	**Fig.**
Agaricales Underw.					
Agaricaceae Chevall.					
Chlorophyllum molybdites (G. Mey.) Massee	SO	Soares et al. (2024)	INPA 303439	Amazonas and Rondônia	2
Cyathus limbatus Tul. & C.Tul.	DT	Accioly et al. (2017)	INPA 302237	Amazonas and Roraima	3
Cyathus sp.	DT	Pegler et al. (1995)	PR		4
Leucoagaricus aff. *rubrotinctus* (Peck) Singer	SO	Rhother & Silveira (2009)	INPA 302324	First record for the Amazonas	5
Leucocoprinus brebissonii (Godey) Locq.	SO	Rhother & Silveira (2009)	INPA 302209	Amazonas and Rondônia	6
L. brunneoluteus Capelari & Gimenes	SO	Capelari & Gimenes (2004)	INPA 302224	Amazonas	7
L. fragilissimus (Ravenel ex Berk. & M.A. Curtis) Pat.	SO	Niveiro et al. (2013)	PR	Amazonas and Rondônia	8
L. cf. *ianthinus* (Sacc.) P. Mohr	SO	Birkebak (2010)	INPA 302225	First record for the Amazon	9
Lycoperdon sp.	DT	Larsson & Jeppson (2008)	INPA 302196		10

Entolomataceae Kotl. & Pouzar					
Entoloma dragonosporum (Singer) E. Horak	SO	Karstedt et al. (2024)	INPA 302208	Amazonas	11
E. aff. *violaceobrunneum* Hesler	SO	Reschke et al. (2022)	INPA 302223	First record for the Amazon	12
Entoloma sp. 1	SO	Noordeloos (1981)	INPA 302201		13
Entoloma sp. 2	SO	Noordeloos (1981)	INPA 302202		14
Entoloma sp. 3	SO	Noordeloos (1981)	INPA 302204		15
Inocephallus sp.	SO	Largent et al. (2008)	INPA 302353		16
Hygrophoraceae Lotsy					
Hygrocybe cf. *occidentalis* (Dennis) Pegler	SO	Pegler & Fiard (1980)	INPA 302198	Amazonas and Rondônia	17
H. sect. Pseudofirmae sp.	SO	Lodge et al. (2014)	INPA 302203		18
H. subsect *Squamulosae* sp.	SO	Lodge et al. (2014)	INPA 302205		19
Lycoperdaceae F. Bercht. & J. Presl					
Apioperdon pyriforme (Schaeff.) Vizzini	DT	Alfredo et al. (2017)	INPA 302250	First record for the Amazon	20
Schizophyllaceae Quél.					
Schizophyllum commune Fr.	DT	Abrahão et al. (2009)	INPA 302290	Amapá, Amazonas, Pará, Rondônia and Roraima	35
S. leprieurii Linder	DT	Roblendo et al. (2014)	RF	First record for the Amazon	36
Squamanitaceae Jülich					
Cystoderma sp.	SO	Saar (2006)	RF		37
Tricholomataceae R. Heim ex Pouzar					
Tricholomopsis aurea (Beeli) Desjardin & B.A. Perry	DT	Desjardin & Perry (2017)	INPA 302248	First record for the Amazon	38
Auriculariales Bromhead					
Auriculariaceae Fr.					
Auricularia delicata (Mont. ex Fr.) Henn.	DT	Wu et al. (2021)	INPA 302263	Acre, Amazonas, Pará, Rondônia and Roraima	39
A. subglabra Looney, Birkebak, & Matheny	DT	Wu et al. (2021)	INPA 302216	First record for the Amazon	40
Boletales E.-J. Gilbert					
Sclerodermataceae Corda					
Scleroderma sp.	DT	Pegler et al. (1995)	INPA 302197		41
Cantharellales Gäum.					
Hydnaceae Chevall.					
Cantharellus guyanensis Mont.	SO	Henkel et al. (2014)	INPA 302243	Amazonas and Roraima	42
Dacrymycetales Henn.					

Dacrymycetaceae J. Schröt.					
Calocera arborea Shirouzu	LT	Shirouzu *et al*. (2013)	PR	Amazonas, Rondônia and Roraima	43
C. cornea (Batsch) Fr.	DT	Alvarenga & Xavier-Santos (2017)	PR	Amazonas and Rondônia	44
Dacryopinax elegans (Berk. & M.A. Curtis) G.W. Martin	DT	Alvarenga & Xavier-Santos (2017)	PR	Acre, Amazonas, Rondônia and Roraima	45
D. spathularia (Schwein.) G.W. Martin	DT	Alvarenga & Gibertoni (2022)	PR	Acre, Amazonas, Rondônia and Roraima	46
Geastrales K. Hosaka & Castellano					
Geastraceae Corda					
Geastrum echinulatum T.S. Cabral, B.D.B. Silva & Baseia	SO	Silva et al. (2013)	INPA 302361	Amazonas and Pará	47
Geastrum sp.	SO	Pegler et al. (1995)	INPA 302222		48
Hymenochaetales Oberw.					
Hymenochaetaceae Donk					
Fomitiporia apiahyna (Speg.) Robledo, Decock & Rajchenb.	DT	Silva et al. (2021)	INPA 302162	Acre, Amazonas and Pará	49
F. langloisii Murrill	DT	Silva et al. (2021)	INPA 302367	Roraima, First record for the Amazonas	50
F. neotropica Camp.-Sant., Amalfi, Silveira, Robledo & Decock	DT	Campos-Santana *et al*. (2015)	INPA 302184	Acre, Amazonas and Roraima	51
F. punctata (P.Karst.) Murrill	DT	Dai (2010)	INPA 302165	Acre, Amazonas and Roraima	52
Fuscoporia gilva (Schwein) T.Wagner & M.Fisch.	DT	Dai (2010)	INPA 302193	Acre, Amazonas, Pará, Roraima and Tocantins	53
Hymenochaete damicornis (Link) Lév.	SO	Léger (1998)	INPA 302266	Acre, Amazonas, Pará, Rondônia, Roraima and Tocantins	54
H. leonina M.J.Berkeley & Curt.	DT	Léger (1998)	INPA 302366	Acre, Amazonas, Mato Grosso, Pará, Rondônia and Roraima	55
H. luteobadia (Fr.) Höhnel & Litschauer	DT	Dai (2010)	INPA 302276	Amazonas, Mato Grosso, Pará, Rondônia, Roraima and Tocantins	56
Phylloporia chrysites (M.J.Berkeley) Ryvarden	DT	Ryvarden (1972)	INPA 302160	Amapá, Amazonas, Pará, Rondônia and Roraima	57
P. elegans Ferreira-Lopes, Robledo & Drechsler-Santos	SO	Ferreira-Lopes et al. (2016)	INPA 302166	First record for the Amazon	58
P. spathulata (Hook.) Ryvarden	SO	Ferreira-Lopes et al. (2016)	INPA 302172	Acre, Amapá, Amazonas, Pará, Rondônia and Roraima	59
Sclerotus extensus (Lév.) Xavier de Lima	DT	Lima *et al*. (2022)	INPA 302169	Amapá, Amazonas and Roraima	60
Incertae sedis					
Trichaptum fuscoviolaceum (Ehrenb.) Ryvarden	LT	Ryvarden & Johansen (1980)	INPA 302241	First record for the Amazon	61

Polyporales Gäum.					
Cerrenaceae O. Miettinen, A. Justo & D.S. Hibbett					
Cerrena caperata (Berk.) Zmitr.	DT	Zmitrovich (2001)	INPA 302352	Acre, Amapá, Amazonas, Mato Grosso, Pará, Rondônia, Roraima and Tocantins	62
Cerrena hydnoides (Sw.) Zmitr.	DT	Zmitrovich (2001)	INPA 302231	Acre, Amapá, Amazonas, Pará, Rondônia and Roraima	63
Fomitopsidaceae Jülich					
Ranadivia modesta (Kunze ex Fr.) Zmitr.	DT	Zmitrovich (2001)	INPA 303435	Acre, Amapá, Amazonas, Mato Grosso, Pará, Rondônia and Roraima	64
Ganodermataceae (Donk) Donk					
Amauroderma aurantiacum (Torrend) Gibertoni & Bernicchia	SO	Costa-Rezende et al. (2016)	PR	Amazonas, Mato Grosso, Pará and Rondônia	65
A. praetervisum (Pat.) Torrend	SO	Costa-Rezende et al. (2016)]	PR	Amazonas, Mato Grosso, Pará, Rondônia and Roraima	66
A. schomburgkii (Mont. & Berk.) Torrend	SO	Costa-Rezende et al. (2016)	INPA 303436	Amazonas, Mato Grosso, Pará, Rondônia e Roraima	67
A. cf. *rude* (Berk.) Torrend	SO	Ryvarden (2004)	INPA 302200	Amazonas and Pará	68
Amauroderma sp.	SO	Ryvarden (2004)	INPA 302246		69
Foraminispora rugosa (Berk.) Costa-Rez., Drechsler-Santos & Robledo	SO	Costa-Rezende et al. [62]	INPA 302199	Amazonas and Mato Grosso	70
Ganoderma citriporum Ryvarden & Iturr.	DT	Ryvarden (2004)	PR	Amazonas and Rondônia	71
G. stipitatum (Murrill) Murrill	DT	Ryvarden (2004)	INPA 303431	Amapá, Amazonas, Pará and Rondônia	72
Ganoderma sp.	DT	Ryvarden & Johansen (1980)	PR		73
Sanguinoderma rude (Berk.) Y.F. Sun, D.H. Costa & B.K. Cui	SO	Sun et al. (2020]0	INPA 302253	Amazonas and Pará	74
Grammotheleaceae Jülich					
Porogramme albocincta (Cooke & Massee) Gibertoni	LT	Soares et al. (2015)	PR	Amapá, Amazonas, Pará, Rondônia and Roraima	75
Irpicaceae Spirin & Zmitr.					
Flavodon flavus (Klotzsch) Ryvarden	FB	Ryvarden & Johansen (1980)	INPA 302218	Acre, Amazonas and Pará	76
Meripilaceae Jülich					
Rigidoporus ulmarius (Sowerby) Imazeki	DT	Ryvarden & Johansen (1980)	INPA 303432	Acre, Amazonas, Pará, Rondônia and Roraima	77
Meruliaceae Rea					
Stereopsis radicans (Berk.) D.A. Reid	SO	Reid (1965)	PR	Amazonas and Pará	78
Phanerochaetaceae Jülich					
Inflatostereum glabrum (Pat.) D.A. Reid	DT	Reid (1965)	INPA 302249	Acre, Amazonas e Pará	79

Podoscyphaceae D.A. Reid					
Podoscypha nitidula (Berk.) Pat.	DT	Reid (1965)	PR	Amazonas, Pará e Rondônia	80
Polyporaceae Fr. ex Corda					
Favolus brasiliensis (Fr.) Fr.	FB	Palacio et al. (2021)	INPA 302217	Acre, Amapá, Amazonas, Maranhão, Mato Grosso, Pará, Rondônia, Roraima and Tocantins	81
F. pseudogrammocephalus Palacio & Drechsler-Santos	DT	Palacio et al. (2021)	INPA 302206	Acre, Amazonas, Pará, Rondônia and Roraima	82
Flabellophora obovata (Jungh.) Núñez & Ryvarden	DT	Núñez & Ryvarden (2001)	INPA 303429	Acre, Amazonas, Pará, Rondônia and Roraima	83
Fomes fasciatus (Sw.) Cooke	DT	Gilbertson & Ryvarden (1986)	INPA 302235	Acre, Amazonas, Pará, Rondônia and Roraima	84
Lentinus crinitus (L.) Fr.	DT	Drechsler-Santos et al. (2012)	INPA 302252	Amazonas, Pará, Rondônia and Roraima	85
L. velutinus Fr.	DT	Drechsler-Santos et al. (2012)	INPA 302230	Amazonas, Pará, Rondônia and Roraima	86
Perenniporia martia (Berk.) Ryvarden	DT	Ryvarden & Johansen (1980)	INPA 302251	Acre, Amapá, Amazonas, Pará, Rondônia and Roraima	87
P. medulla-panis (Jacq.) Donk	DT	Ryvarden & Johansen (1980)	INPA 302188	Acre, Amapá, Amazonas, Pará, Rondônia and Roraima	88
Polyporus dictyopus Mont.	DT	Palacio et al. [69]	PR	Acre, Amapá, Amazonas, Pará, Rondônia and Roraima	89
P. guianensis Mont.	DT	Ryvarden & Johansen (1980)	INPA 303427	Acre, Amapá, Amazonas and Pará	90
Pycnoporus sanguineus (L.) Murrill	DT	Ryvarden & Johansen (1980)	INPA 302232	Acre, Amazonas, Pará and Rondônia	91
Stiptophyllum erubescens (Berk.) Ryvarden	DT	Campos-Santana & Loguercio-Leite (2008)	INPA 302351	Acre, Amazonas, Pará and Rondônia	92
Trametes elegans (Spreng.) Fr.	DT	Ryvarden & Johansen (1980)	INPA 302368	Acre, Amazonas, Pará and Rondônia	93
T. versicolor (L.) Lloyd	DT	Ryvarden & Johansen (1980)	INPA 303437	Amazonas, Pará and Roraima	94
Tremellales Fr.					
Tremellaceae Fr.					
Tremella fuciformis Berk.	DT	Malysheva et al. (2015)	INPA 303433	Acre, Amazonas, Rondônia and Roraima	95
Tremella sp.	DT	Malysheva et al. (2015)	INPA 303428		96

Source: Authors (2026).

All species are recorded for the first time at the research site of the Biodiversity Research Program at the Experimental Farm of the Federal University of Amazonas, with emphasis on the species Leucoagaricus aff. rubrotinctus (Fig. 5), L. cf. ianthinus (Fig. 9), Entoloma aff. violaceobrunneum (Fig. 12), Apioperdon pyriforme (Fig. 20), Favolaschia cf. aurantiaca (Fig.

21), Marasmius griseoradiatus (Fig. 22), M. helvoloides (Fig. 24), M. venatifolius (Fig. 25), Oudemansiella cubensis (Fig. 28), Gerronema cf. icterinum (Fig. 32), Schyzophyllum leprieurii (Fig. 36), Tricholomopsis aurea (Fig. 38), Auricularia subglabra (Fig. 40), Phylloporia elegans (Fig. 58), Trichaptum fuscoviolaceum (Fig. 61) represent first records for the Brazilian Amazon, whereas Fomitiporia langloisii (Fig. 50), represents the first record for the state of Amazonas.

Regarding species distribution, Favolus brasiliensis (Fig. 81) was the only species recorded in all nine states of the Brazilian Amazon, while Cerrena caperata (Fig. 62) was recorded in eight of these states. Additionally, nine species were restricted to the states of Amazonas and Rondônia, with records exclusively from these two states. On the other hand, two species were recorded only in Amazonas, indicating a distribution currently restricted to this state based on the available records. In total, 64 species (67%) were recorded in Amazonas, 43 (45%) in Rondônia, 41 (43%) in Pará, 37 (39%) in Roraima, 30 (32%) in Acre, 14 (15%) in Amapá, nine (9%) in Mato Grosso, six (6%) in Tocantins, and one (1%) in Maranhão (Fig. 97).

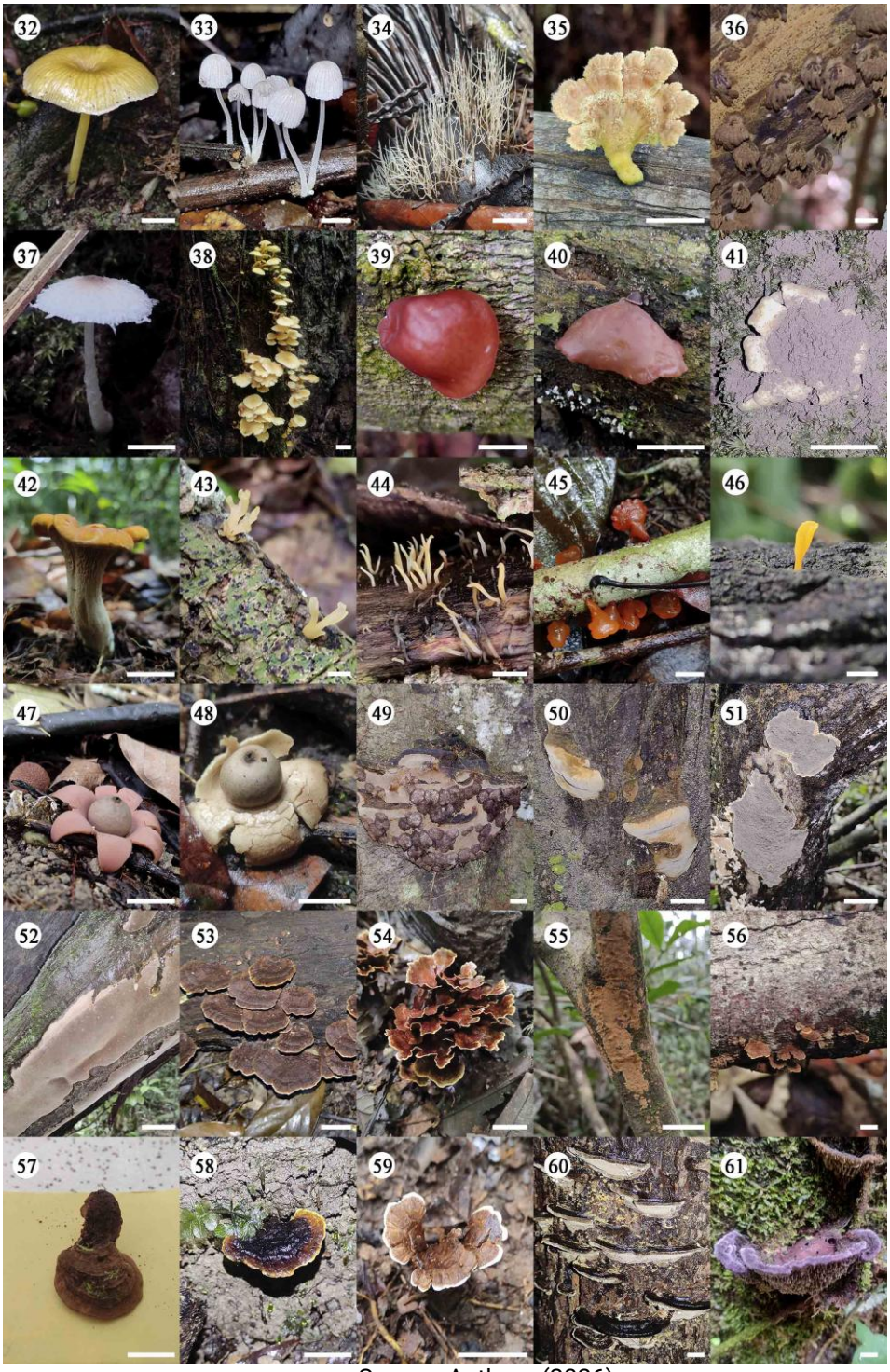
Agaricomycetes exhibited a broad ecological distribution across different substrates in the study area. Most species were recorded on dead wood (50 species, 45%), highlighting the importance of these fungi in wood decomposition and nutrient cycling in forest ecosystems. Soil-associated species (33 species, 30%) were also well represented, reflecting the contribution of these fungi to the decomposition of organic matter in the soil. Records from living trees (3 species, 3%) and fallen branches (4 species, 4%) were less frequent, but indicate the occurrence of fungi potentially associated with early stages of decomposition or specific interactions with living hosts. Finally, plant litter supported five species (5%), reinforcing the role of fungi in the decomposition of leaves and other small plant debris.

Figure 2-31 – Agaricomycetes fungi (Basidiomycota) found at the Experimental Farm of UFAM. 2. *Chlorophyllum molybdites*, 3. *Cyathus limbatus*, 4. *Cyathus* sp., 5. *Leucoagaricus* aff. *rubrotinctus*, 6. *Leucocoprinus brebissonii*, 7. *L. brunneoluteus*, 8. *L. fragilissimus*, 9. *L.* cf. *ianthinus*, 10. *Lycoperdon* sp., 11. *Entoloma dragonosporum*, 12. *E.* aff. *violaceobrunneum*, 13. *Entoloma* sp. 1, 14. *Entoloma* sp. 2, 15. *Entoloma* sp. 3, 16. *Inocephallus* sp., 17. *Hygrocybe* cf. *occidentalis*, 18. *H.* sect. *Pseudofirmae* sp., 19. *H.* subsect. *Squamulosae* sp., 20. *Apioperdon pyriforme*, 21. *Favolaschia* cf. *aurantiaca*, 22. *Marasmius griseoradiatus*, 23. *M. haematocephalus*, 24. *M. helvoloides*, 25. *M. venatifolius*, 26. *Gymnopus montagnei*, 27. *Marasmiellus cubensis*, 28. *Oudemansiella cubensis*, 29. *Pleurotus djamor*, 30. *P. ostreatus*, 31. *Pluteus* sp. Scale bar – 1 cm.



Source: Authors (2026).

Figure 32-61 – Agaricomycetes fungi (Basidiomycota) found at the Experimental Farm of UFAM. 32. *Gerronema* cf. *icterinum*, 33. *Coprinellus disseminatus*, 34. *Pterula* sp., 35. *Schizophyllum commune*, 36. *S. leprieurii*, 37. *Cystoderma* sp., 38. *Tricholomopsis aurea*, 39. *Auricularia delicata*, 40. *A. subglabra*, 41. *Scleroderma* sp., 42. *Cantharellus guyanensis*, 43. *Calocera* cf. *arborea*, 44. *C.* cf. *cornea*, 45. *Dacryopinax elegans*, 46. *D. spathularia*, 47. *Geastrum echinulatum*, 48. *Geastrum* sp., 49. *Fomitiporia apiahyna*, 50. *F. langloisii*, 51. *F. neotropica*, 52. *F. punctata*, 53. *F. gilva*, 54. *Hymenochaete damicornis*, 55. *H. leonina*, 56. *H. luteobadia*, 57. *Phylloporia chrysites*, 58. *P. elegans*, 59. *P. spathulata*, 60. *Sclerotus extensus*, 61. *Trichaptum fuscoviolaceum*. Scale bar – 1 cm.



Source: Authors (2026).

Figure 62-91 – Agaricomycetes fungi (Basidiomycota) found at the Experimental Farm of UFAM. 62. *Cerrena caperata*, 63. *C. hydnoides*, 64. *Ranadivia modesta*, 65. *Amauroderma aurantiacum*, 66. *A. praetervisum*, 67. *A. schomburgkii*, 68. *A.* cf. *rude*, 69. *Amauroderma* sp., 70. *Foraminispora rugosa*, 71. *Ganoderma citriporum*, 72. *G. stipitatum*, 73. *Ganoderma* sp., 74. *Porogramme albocincta*, 75. *Flavodon flavus*, 76. *Rigidoporus ulmarius*, 77. *Stereopsis radicans*, 78. *Inflatostereum glabrum*, 79. *Podoscypha nitidula*, 80. *Favolus brasiliensis*, 81. *F. pseudogrammocephalus*, 82. *Flabellophora obovata*, 83. *Fomes fasciatus*, 84. *Lentinus crinitus*, 85. *L. velutinus*, 86. *Perenniporia martia*, 87. *P. medulla-panis*, 88. *Polyporus dictyopus*, 89. *Polyporus guianensis*, 90. *Pycnoporus sanguineus*. Scale bar – 1 cm.



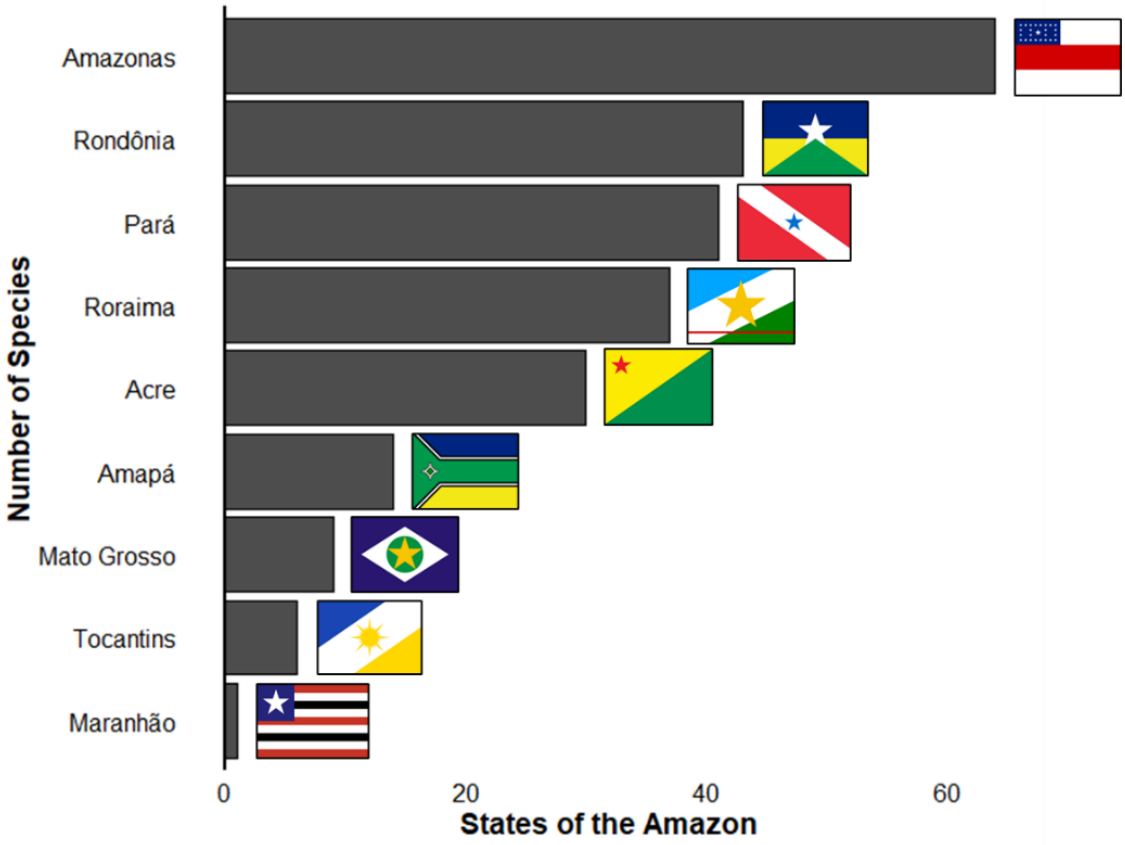
Source: Authors (2026).

Figure 92-96 – Agaricomycetes fungi (Basidiomycota) found at the Experimental Farm of UFAM. 92. *Stiptophyllum erubescens*, 93. *Trametes elegans*, 94. *T. versicolor*, 95. *Tremella fuciformis*, 96. *Tremella* sp.. Scale bar – 1 cm.



Source: Authors (2026).

Figure 97: Distribution of species found in States that make up the Amazon.



Source: Authors (2026).

4. DISCUSSION

Our sampling was conducted during the rainy season, a period that favors the emergence and fruiting of Agaricomycetes and other macrofungi (NÚÑEZ 1996; LINDBLAD, 2001). According to the Flora e Funga do Brasil list, approximately 1,064 species of basidiomycetes are known in the state of Amazonas (FLORA E FUNGA DO BRASIL, 2025). owever, the actual diversity may be considerably greater, particularly considering the species recorded in this study. Due to logistical constraints, sampling was restricted to approximately four kilometers within the 24-km² PPBio grid, yet the study yielded new records for both the state of Amazonas and the Brazilian Amazon. These findings highlight the potential for additional undocumented fungal diversity in the region (FLORA E FUNGA DO BRASIL, 2025).Thus, the importance of the RAPELD method for long-term macrofungal inventories is emphasized, as expanding spatial coverage may reveal previously undocumented taxa. The occurrence of new records within a small portion of the PPBio grid also suggests that local habitat heterogeneity contributes to the maintenance of fungal diversity. Therefore, the results do not represent the total diversity of Agaricomycetes in the area, but rather indicate that it remains underestimated and that additional sampling across the grid may reveal new taxa and expand our knowledge of their composition and distribution.

The richness found was expected for the families Agaricaceae and Polyporaceae, considering they are the most representative globally, totaling nearly 4,800 species (HYDE et al., 2024). On the other hand, the families Hymenochaetaceae and Ganodermataceae, which have fewer than 1,000 described species, have shown increasing importance. This is supported by the list of macrofungi in the Amazon, compiled by Gomes-Silva & Gibertoni (2009), as well as studies conducted in the State of Pará, such as those by Medeiros et al. (2015) in the Caxiuanã National Forest, and by Couceiro et al. (2022) in the Curuá-Una Hydroelectric Plant Forest in Santarém. Furthermore, the relevance of these last three families was also highlighted in Amapá, in the Serra do Navio, according to the study by Xavier et al. (2018). Although the richness of Agaricomycetes recorded in this study is higher than that observed by Couceiro et al. (2018) in the Tapajós National Forest, this number still represents 2% when compared to global diversity and 9% for the Amazon biome. However, such comparisons should be interpreted with caution, as differences in sampling effort, sampling period, habitat characteristics, and taxonomic resolution may strongly influence observed richness. The relatively low proportion of species recorded in this study compared with the known diversity

of the Amazon therefore does not necessarily indicate low local diversity, but may instead reflect the high turnover and spatial heterogeneity of fungal communities in tropical forests.

Among the species found, 16 could be identified up to the genus level. However, for a more accurate and robust identification, additional molecular studies are necessary, using the ITS and LSU regions to confirm the identity of each of these species, which also applies to the other seven species, which were classified as conferatum and affinis (BROWN et al., 2014). The other 15 species, considered new records, also require a more detailed analysis for better understanding; in this case, the taxonomic study conducted was sufficiently robust to include them as new records.

In this context, it is important to consider that the number and proportion of species assessed for extinction risk have rapidly increased in recent years (LUGHADHA et al., 2020; HAELEWATERS et al., 2024). At the same time, new species or even new fungal records emerge already facing a high risk of extinction, making knowledge on this topic still insufficient to represent the diversity of the Amazon. Furthermore, knowledge gaps hinder the awareness of other sectors of society beyond the scientific community, resulting in little support and low demand for qualified specialists to generate essential information about fungal diversity (PATON et al., 2020). The new records documented here have conservation relevance beyond their contribution to species inventories. Taxonomically and geographically underdocumented species may be systematically excluded from conservation assessments, not necessarily because they are common or secure, but because their distribution, population size, and ecological requirements remain unknown (BLAND et al., 2017). This knowledge deficit is particularly relevant in the Amazon, where rapid environmental change may reduce habitat availability before the distribution and ecological requirements of many fungal species are adequately documented.

Agaricomycetes fungi exhibit a wide range of basidiome forms and morphological adaptations, with the formation and maintenance of the pileus being influenced by factors such as environmental interactions, growth physiology, and adaptations to different substrates (HALBWACHS; SIMMEL; BÄSSLER, 2016). For example, Chlorophyllum molybdites has a whitish pileus with radial scales (SOARES; SANTANA; CANTO, 2024), whereas Cyathus limbatus develops distinctive nest-like basidiomes (ACCIOLY et al., 2017).

Leucoagaricus aff. rubrotinctus and Leucocoprinus brebissonii have scaly pilei, but differ in pileus coloration and texture (ROTHER; SILVEIRA, 2009). In contrast, L. brunneoluteus is characterized by its larger size and yellowish-brown coloration (CAPELARI; GIMENES, 2004), whereas L. fragilissimus is smaller and more delicate, with a thinner pileus (NIVEIRO; POPOFF; ALBERTÓ, 2013).

Fungi in the family Entolomataceae can be readily recognized by their pink to salmon-colored spore prints (KARSTEDT et al., 2024). Entoloma dragonosporum has lighter-colored basidiospores and a distinctive basidiome morphology, whereas E. aff. violaceobrunneum has darker spores and purplish coloration on the pileus. However, records of the latter species are currently limited to the northern United States (RESCHKE et al., 2022; KARSTEDT et al., 2024). Hygrocybe cf. occidentalis has a smooth, shiny pileus, whereas H. sect.
Pseudofirmae sp. is more robust, with a firm pileus, and H. subsect. Squamulosae sp. is characterized by fine scales on the pileus, distinguishing it from the other taxa (PEGLER; FIARD, 1978; LODGE et al., 2014). For both families, molecular analyses would complement the morphological approach and provide greater confidence in identification to the species level.

The morphological and ecological variation observed among the recorded taxa suggests that the study area supports a functionally diverse Agaricomycete community. The co-occurrence of soil-dwelling, lignicolous, gelatinous, and polyporoid fungi indicates the availability of multiple ecological niches and substrate types within the forest. This functional heterogeneity may contribute to the continuity of decomposition processes and nutrient cycling, as different fungal lineages can occupy distinct substrates and decomposition conditions. Therefore, the taxonomic composition recorded here should not be viewed only as a list of species, but also as an indication of the functional complexity of the fungal community (Treseder & Lennon, 2015).

Oudemansiella cubensis is a species of “porcelain fungus” belonging to the family Physalacriaceae. It is associated with dead wood of tropical trees and was historically confused with O. canarii, a species not reported from Brazil that has a paler, often yellowish pileus and is more commonly associated with temperate environments (ALBERTI et al., 2020). Pleurotus djamor, commonly known as the pink oyster mushroom, has a pileus ranging from pink to reddish in color and is widely distributed in tropical regions, whereas P. ostreatus,

commonly known as the oyster mushroom, has a white to grayish pileus and is more frequently reported in southern Brazil, where it occurs primarily on dead wood (MENOLLI JUNIOR; BRETERNITZ; CAPELARI, 2014; SEETHAPATHY et al., 2023).

Among our collections, we found groups of gelatinous fungi such as A. delicata, A. subglabra, Calocera arborea, C. cornea, Dacryopinax elegans, D. spathularia and Tremella fuciformis (ALVARENGA & XAVIER-SANTOS, 2015), which are important in applications for biotechnological processes (PAVEL et al., 2011). The presence of these gelatinous fungi in the study area underscores an additional dimension of fungal diversity. Because saprotrophic taxa often synthesize extracellular enzymes, polysaccharides, and other bioactive metabolites with biotechnological relevance, biodiversity inventories in undersampled Amazonian regions advance taxonomic and ecological understanding while simultaneously paving the way for bioprospecting initiatives (COSTA et al., 2023).

Another group includes polyporoid and/or polypore fungi, covering the orders Hymenochaetales and Polyporales, whose main families can be easily differentiated. For example, species in the Hymenochaetaceae family exhibit a xanthochroic reaction, turning black when potassium hydroxide comes into contact with the basidiome and the same with a dark brown to golden yellow coloration (RYVARDEN, 2004), while species of Polyporaceae are more diverse in terms of colours and pores, with basidiospores having smooth walls (JUSTO et al. 2017). For species in the Ganodermataceae family, it was based on the study by Costa-Rezende et al. (2020), which considers ornamented basidiospores for the family, unlike Hyde et al. (2024), who included the family as a synonym of Polyporaceae, a taxonomic description we do not agree with. This ecological flexibility points to the persistence of resilient species capable of overcoming seasonal barriers, carrying profound implications for biodiversity conservation under future scenarios of climate change and anthropogenic fragmentation (SILVA-PEREIRA et al., 2020). Conversely, the occurrence of these polyporoid taxa holds critical ecological relevance, as obligate or facultative wood-inhabiting fungi, they drive the decomposition of lignocellulosic substrates, thereby serving as key functional engines in nutrient cycling and carbon flux within tropical forest ecosystems (OLIVEIRA et al., 2024).

The geographic distribution of the species identified in our study reveals interesting patterns of local richness, with records of species associated with forest cover areas and similar biomes, such as in the states of Amazonas, Pará, Acre and Rondônia. The predominance of records in the State of Amazonas and its combination with other states, such as Rondônia and Roraima (9 occurrences, for example), suggests that these regions share favourable ecological conditions for the survival of these species, which may be related to factors such as climate, availability of suitable substrates, and ecosystem similarity (MILLIKEN et al., 2010). However, the apparent concentration of records in Amazonian states may also reflect sampling bias rather than a true biogeographical pattern. Areas with a longer history of mycological research are more likely to present a greater number of available records, whereas poorly sampled regions may appear artificially species-poor (Maia et al. 2015). Therefore, the current distribution patterns should be interpreted as a combination of ecological signals and unequal sampling effort across the Amazon.

Another relevant point is the broader distribution of some species, occurring in up to nine states, which suggests that these organisms have high adaptability and can establish themselves in different microenvironments within the Amazon. While species recorded in a few states may have more specific ecological requirements or be affected by geographic and environmental barriers (CHAPIN; MATSON; VITOUSEK, 2011; ROSALINO; VERDADE; LYRA-JORGE, 2014). The occurrence of species in states such as Mato Grosso and Tocantins, which have transition areas between the Amazon and the Cerrado, raises questions about the adaptation of these species to different biomes. This effect may indicate the presence of ecotones that favor fungal diversity or even the influence of anthropogenic factors that allowed their dispersion (SILVA-PEREIRA et al., 2020).

Understanding the lifestyle of basidiomycete fungi, especially Agaricomycetes, and their interactions with other organisms in ecosystems is essential to recognize their ecological importance. Most of the recorded species, such as those in the Polyporaceae family, act as saprobes of dead wood, while Rigidoporus ulmarius and Schizophyllum commune may have phytopathogenic behavior, causing the death of living trees by taking advantage of some disease (AGRIOS, 2005). Species from the Agaricaceae family, which occur in the soil, can establish ectomycorrhizal associations with tree roots (DEACON, 2006; TEDERSOO et al., 2007). These fungi play a crucial role in maintaining forest ecosystems, which are highly vulnerable and require special attention, and the loss of natural areas, such as in the Amazon,

can result in the extinction of species (HALLEY et al., 2016). The species recorded in this study are intrinsically linked to fundamental ecosystem processes specifically, wood-decaying fungal communities that drive the enzymatic degradation of complex lignocellulosic materials, thereby accelerating organic matter cycling and facilitating nutrient reincorporation into forest soils. Consequently, any decline in fungal richness risks triggering cascading effects that extend far beyond the loss of individual taxa, potentially compromising decomposition dynamics and impairing the functioning of the ecosystem as a whole (BODDY et al., 2021).

Although groups or families of Agaricomycetes are among the most studied, there are still significant gaps in their taxonomy, ecology, geographic distribution, and biotechnological potential that need to be explored. Our data contribute to the PPBio modules, in which these fungi were identified as neglected in these study areas (GUIMARAES et al., 2024). This information is essential to expand knowledge about the diversity of these species, especially in the Amazon, where access difficulties and the lack of support for scientific research limit progress in the field, and it is also crucial for updating the Red List of Fungi, allowing the definition of priority areas and effective conservation strategies. Moreover, the results indicate that Amazonian fungal inventories should move beyond species documentation toward a more integrative approach that connects taxonomic identity, geographic distribution, substrate association, ecological function, and conservation status. Such an approach would allow the identification of taxa that are not only rare or poorly known, but also potentially important for maintaining ecosystem processes. In this sense, the present study provides a baseline for future monitoring and highlights the need for continued sampling in the PPBio area, particularly through standardized and molecularly informed inventories.

5. CONCLUSION

This study significantly contributes to the knowledge of Agaricomycetes in the state of Amazonas, while also providing important new records for the Amazon biome. By addressing critical knowledge gaps, the compiled species inventory provides a baseline for future research on fungal diversity, distribution, conservation, and ecosystem ecology, particularly in a region where fungal communities remain largely underestimated. Moreover, the discovery of newly recorded taxa within a relatively limited sampling area underscores the importance of continuous and standardized surveys, especially through long-term monitoring frameworks such as RAPELD. These data can support future conservation assessments by improving

knowledge of species distributions and identifying taxa and habitats that may require greater attention. Ultimately, given the vital ecological functions performed by fungi, expanding their documentation represents an important step toward more effectively incorporating fungal diversity into broader biodiversity conservation strategies in the Amazon.

6. ACKNOWLEDGEMENTS

The authors thank the Federal University of Amazonas (UFAM) for the support in the development of this study at the institution's Experimental Farm, the Amazonas State Research Support Foundation (FAPEAM) for the doctoral scholarships, and the Postgraduate Program in Biodiversity and Biotechnology of the Legal Amazon – Bionorte Network (PPGBionorte) and the Multicenter Postgraduate Program in Biochemistry and Molecular Biology for academic support.

7. REFERENCES

ABRAHÃO, M. C.; GUGLIOTTA, A. D. M.; GOMES, E. Poliporóides (Basidiomycota) em fragmentos de mata no perímetro urbano de São José do Rio Preto, São Paulo, Brasil. **Brazilian Journal of Botany**, v. 32, p. 427–440, 2009.

ACCIOLY, T. *et al*. Amazonian bird's nest fungi (Basidiomycota): current knowledge and novelties on *Cyathus* species. **Mycoscience**, v. 59, p. 331–342, 2017.
AGRIOS, G. N. **Plant Pathology**. New York: Elsevier, 2005.

ALBERTI, M.; NIVEIRO, N.; ZIED, D. C.; ALBERTÓ, E. Identification of *Oudemansiella canarii* and *Oudemansiella cubensis* (Basidiomycota, Physalacriaceae) in Argentina using morphological, culture and molecular analysis. **Harvard Papers in Botany**, v. 25, p. 131–143, 2020.

ALFREDO, D. S. *et al*. Revision of species previously reported from Brazil under *Morganella*. **Mycological Progress**, v. 16, p. 965–985, 2017.

ALVARENGA, R. L. M.; XAVIER-SANTOS, S. A checklist of jelly fungi (Agaricomycotina: Basidiomycota) recorded in Brazil. **Mycotaxon**, v. 130, p. 1–14.

ALVARENGA, R. L. M.; XAVIER-SANTOS, S. New records of Dacrymycetes (Fungi: Basidiomycota) from the Cerrado biome (Brazilian savanna) and Midwest region, Brazil. **Check List**, v. 13, p. 335–342, 2017.

ALVARES, C. A. *et al*. Köppen's climate classification map for Brazil. **Meteorologische Zeitschrift**, v. 22, p. 711–728, 2013.

ANTONIO, I. C. **Série histórica dos parâmetros climáticos registrados na Estação Agrometeorológica Convencional da Embrapa, no entorno de Manaus**. Manaus: EMBRAPA, 2017.

ASSIS, N. M. D. *et al*. Checklist of Amazonian gasteroid fungi (Agaricomycetidae, Phallomycetidae, Basidiomycota). **Acta Amazonica**, v. 52, p. 131–141, 2022.
BIRKEBAK, J. M. The genus *Leucocoprinus* in western Washington. **Mycotaxon**, v. 112, p. 83–102, 2010.

BLAND, L. M.; BIELBY, J.; KEARNEY, S.; ORME, C. D. L.; WATSON, J. E. M.; COLLEN, B. Toward reassessing data-deficient species. **Conservation Biology**, v. 31, n. 3, p. 531–539.

BODDY, L.; FRANKLAND, J. C.; VAN WEST, P. **Ecology of Saprotrophic Basidiomycetes**. Academic Press, 2021.

BROWN, S. P.; RIGDON-HUSS, A. R.; JUMPPONEN, A. Analyses of ITS and LSU gene regions provide congruent results on fungal community responses. **Fungal Ecology**, v. 9, p. 65–68, 2014.

CAMPOS-SANTANA, M.; LOGUERCIO-LEITE, C. A note on *Styptophyllum erubescens*. **Mycotaxon**, v. 106, p. 127, 2008.

CAMPOS-SANTANA, M.; ROBLEDO, G. L.; DECOCK, C.; SILVEIRA, R. M. B. D. Diversity of the poroid Hymenochaetaceae (Basidiomycota) from the Atlantic Forest and Pampa in southern Brazil. **Cryptogamie, Mycologie**, v. 36, p. 43–78, 2015.

CAPELARI, M.; GIMENES, L. J. *Leucocoprinus brunneoluteus*, uma nova espécie de Agaricaceae. **Hoehnea**, v. 31, p. 331–335, 2004.

CHAPIN III, S. F.; MATSON, P. A.; VITOUSEK, P. **Principles of terrestrial ecosystem ecology**. Berlin: Springer Science & Business Media, 2011.

COIMBRA, V. R.; PINHEIRO, F. G.; WARTCHOW, F.; GIBERTONI, T. B. Studies on *Gymnopus* sect. *Impudicae* (Omphalotaceae, Agaricales) from northern Brazil: two new species and notes on *G. montagnei*. **Mycological Progress**, v. 14, p. 1–9, 2015.

CORNER, E. J. H. A monograph of Clavaria and allied genera. **Annals of Botany Memoirs**, v. 1, p. 1–740, 1950.

COSTA, M. R. L. et al. Occurrence, biological and enzymatic activities of Agaricomycetes from the Brazilian Amazon—A systematic review. **International Journal of Medicinal Mushrooms**, v. 25, n. 11, p. 25–44, 2023.

COSTA-REZENDE, D. H. *et al*. *Amauroderma calcitum* sp. nov. and notes on taxonomy and distribution of *Amauroderma* species (Ganodermataceae). **Phytotaxa**, v. 244, p. 101–124, 2016.

COSTA-REZENDE, D. H. *et al*. Morphological reassessment and molecular phylogenetic analyses of *Amauroderma* s.lat. raised new perspectives in the generic classification of the Ganodermataceae family. **Persoonia**, v. 39, p. 254–269, 2017.

COSTA-REZENDE, D. H. *et al*. Taxonomy and phylogeny of polypores with ganodermatoid basidiospores (Ganodermataceae). **Mycological Progress**, v. 19, p. 725–741, 2020.

COUCEIRO, D. M.; SANTANA, M. D. F.; COUCEIRO, S. R. M. Macrofungos (Basidiomycota) da Floresta Nacional do Tapajós, PA, Brasil. In: OLIVEIRA, L. A. *et al*. (org.). **Diversidade microbiana da Amazônia**, v. 3. Manaus: Instituto Nacional de Pesquisas da Amazônia, 2018. p. 70–77.

COUCEIRO, D. M.; SOARES, A. M. S.; COUCEIRO, S. R. M. Contribution to the knowledge of polypores (Agaricomycetes) in the Amazonian forest, with 16 new records for the state of Pará, Brazil. **Research, Society and Development**, v. 11, e35111436024, 2022.

CRIA – CENTRO DE REFERÊNCIA EM INFORMAÇÃO AMBIENTAL. **SpeciesLink**. 2025. Disponível em: http://splink.cria.org.br. Acesso em: 23 out. 2025.

DAI, Y. C. Hymenochaetaceae (Basidiomycota) in China. **Fungal Diversity**, v. 45, p. 131–343, 2010.

DEACON, J. W. **Fungal biology**. 4. ed. Malden: Blackwell Publishing, 2006.
DESJARDIN, D. E.; OVREBO, C. L. New species and new records of *Marasmius* from Panamá. **Fungal Diversity**, v. 21, p. 19–39, 2006.

DESJARDIN, D. E.; PERRY, B. A. The gymnopoid fungi (Basidiomycota, Agaricales) from the Republic of São Tomé and Príncipe, West Africa. **Mycosphere**, v. 8, p. 1317–1391, 2017.

DRECHSLER-SANTOS, E. R.; WARTCHOW, F.; COIMBRA, V. R.; GIBERTONI, T. B.; CAVALCANTI, M. A. Q. Studies on lentinoid fungi (*Lentinus* and *Panus*) from the semi-arid region of Brazil. **The Journal of the Torrey Botanical Society**, v. 139, p. 437–446, 2012.
DREWINSKI, M. P. *et al*. Over 400 food resources from Brazil: evidence-based records of wild edible mushrooms. **IMA Fungus**, v. 15, p. 1–24, 2024.

FEARNSIDE, P. M. Consequências do desmatamento da Amazônia. **SAB**, p. 54–59, 2010.

FERREIRA-LOPES, V.; ROBLEDO, G. L.; RECK, M. A.; NETO, A. G.; DRECHSLER-SANTOS, E. R. *Phylloporia spathulata* sensu stricto and two new South American stipitate species of *Phylloporia* (Hymenochaetaceae). **Phytotaxa**, v. 257, p. 133–148, 2016.

GILBERTSON, R. L.; RYVARDEN, L. **North American polypores**. v. 1–2. Oslo: Fungiflora, 1986.
GOMES, A. C.; GIBERTONI, T. B. Checklist of the aphyllophoraceous fungi (Agaricomycetes) of the Brazilian Amazonia. **Mycotaxon**, v. 108, p. 319–322, 2009.

GUIMARÃES, A. F. *et al*. Disentangling the veil line for Brazilian biodiversity: an overview from two long-term research programs reveals huge gaps in ecological data reporting. **Science of the Total Environment**, v. 10, p. 174880, 2024.

HAELEWATERS, D. *et al*. The power of citizen science to advance fungal conservation. **Conservation Letters**, e13013, 2024.

HALBWACHS, H.; SIMMEL, J.; BÄSSLER, C. Tales and mysteries of fungal fruiting: how morphological and physiological traits affect a pileate lifestyle. **Fungal Biology Reviews**, v. 30, p. 36–61, 2016.

HALLEY, J. M.; MONOKROUSOS, N.; MAZARIS, A. D.; NEWMARK, W. D.; VOKOU, D. Dynamics of extinction debt across five taxonomic groups. **Nature Communications**, v. 7, n. 1, 12283, 2016.

HAWKSWORTH, D. L.; LÜCKING, R. Fungal diversity revisited: 2.2 to 3.8 million species. **Microbiology Spectrum**, v. 5, 2017.

HE, M. Q. *et al*. Species diversity of Basidiomycota. **Fungal Diversity**, v. 114, p. 281–325, 2022.

HENKEL, T. W. *et al*. Cantharellaceae of Guyana II: new species of *Craterellus*, new South American distribution records for *Cantharellus guyanensis* and *Craterellus excelsus*, and a key to the Neotropical taxa. **Mycologia**, v. 106, p. 307–324, 2014.

HOFF, J. A. *et al*. **Roles of woody root-associated fungi in forest ecosystem processes: recent advances in fungal identification**. Washington: USDA Forest Service, 2004.

HYDE, K. D. *et al*. The 2024 outline of fungi and fungus-like taxa. **Mycosphere**, v. 15, p. 5146–6239, 2024.

JARDIM BOTÂNICO DO RIO DE JANEIRO. **Flora e Funga do Brasil**. 2025. Disponível em: http://floradobrasil.jbrj.gov.br/. Acesso em: 26 out. 2025.

JUSTO, A. *et al*. A revised family-level classification of the Polyporales (Basidiomycota). **Fungal Biology**, v. 121, p. 798–824, 2017.

KARSTEDT, F.; BERGEMANN, S. E.; GATES, G.; RATKOWSKY, D.; CUNHA, K. M.; CAPELARI, M. Species of *Entoloma* (Entolomataceae) with cuboidal basidiospores from Brazil. **Phytotaxa**, v. 654, p. 1–76, 2024.

LANGE, J. E. Studies in the agarics of Denmark. Part XII. *Hebeloma, Naucoria, Tubaria, Galera, Bolbitius, Pluteolus, Crepidotus, Pseudopaxillus, Paxillus*. **Dansk Botanisk Arkiv**, v. 9, p. 1–104, 1938.

LARGENT, D. L.; AIME, M. C.; HENKEL, T. W.; BARONI, T. J. The Entolomataceae of the Pakaraima Mountains of Guyana 2: *Inocephalus dragonosporus* comb. nov. **Mycotaxon**, v. 105, p. 185–190, 2008.

LARSSON, E.; JEPPSON, M. Phylogenetic relationships among species and genera of Lycoperdaceae based on ITS and LSU sequence data from north European taxa. **Mycological Research**, v. 112, p. 4–22, 2008.

LÉGER, J. C. **Le genre Hymenochaete Léveillé**. Berlin: J. Cramer, 1998. (Bibliotheca Mycologica, 171).

LIMA, V. X. *et al*. Taxonomy and phylogenetic analysis reveal one new genus and three new species in *Inonotus* s.l. (Hymenochaetaceae) from Brazil. **Cryptogamie, Mycologie**, v. 43, p. 1–21, 2022.

LINDBLAD, I. Diversity of poroid and some corticoid wood-inhabiting fungi along the rainfall gradient in tropical forests, Costa Rica. **Journal of Tropical Ecology**, v. 17, n. 3, p. 353–369, 2001.

LODGE, D. J. *et al*. Molecular phylogeny, morphology, pigment chemistry and ecology in Hygrophoraceae (Agaricales). **Fungal Diversity**, v. 64, p. 1–99, 2014.

LUGHADHA, E. N. *et al*. Extinction risk and threats to plants and fungi. **Plants, People, Planet**, v. 2, p. 389–408, 2020.

MAIA, L. C. et al. Diversity of Brazilian fungi. **Rodriguésia**, v. 66, n. 4, p. 1033-1045, 2015.

MAIA, L. C. *et al*. Diversity of Brazilian fungi. **Rodriguésia**, v. 66, n. 4, p. 1033–1045, 2015.

MALYSHEVA, V. F.; MALYSHEVA, E. F.; BULAKH, E. M. The genus *Tremella* (Tremellales, Basidiomycota) in Russia with description of two new species and proposal of one nomenclatural combination. **Phytotaxa**, v. 238, p. 40–70, 2015.

MEDEIROS, P. S.; CATTANIO, J. H.; SOTÃO, H. M. P. Riqueza e relação dos fungos poroides lignolíticos (Agaricomycetes) com o substrato em floresta da Amazônia brasileira. **Boletim do Museu Paraense Emílio Goeldi. Ciências Naturais**, v. 10, p. 423–436, 2015.

MENDES-ALVARENGA, R. L.; GIBERTONI, T. B. *Dacrymyces flavobrunneus* sp. nov. and two new combinations in *Dacrymyces* Nees based on morphological and phylogenetic data. **Mycological Progress**, v. 21, 96, 2022.

MENOLLI JUNIOR, N.; BRETERNITZ, B. S.; CAPELARI, M. The genus *Pleurotus* in Brazil: a molecular and taxonomic overview. **Mycoscience**, v. 55, p. 378–389, 2014.

MILLER JR., O. K.; MILLER, H. H. **Gasteromycetes: morphology and developmental features**. Eureka: Mad River Press, 1988.

MILLIKEN, W.; ZAPPI, D.; SASAKI, D.; HOPKINS, M.; PENNINGTON, R. T. Amazon vegetation: how much don't we know and how much does it matter? **Kew Bulletin**, v. 65, p. 691–709, 2010.

NIVEIRO, N.; POPOFF, O.; ALBERTÓ, E. Presence of *Leucocoprinus cretaceus* and *L. fragilissimus* in Argentina. **Mycotaxon**, v. 121, p. 265–273, 2013.

NOORDELOOS, M. E. **Introduction to the taxonomy of the genus Entoloma sensu lato (Agaricales)**. Leiden: Persoonia – Molecular Phylogeny and Evolution of Fungi, 1981.

NÚÑEZ, M. Fructification of Polyporaceae sl (Basidiomycotina) along a gradient of altitude and humidity in the Guanacaste Conservation Area (Costa Rica). **Journal of Tropical Ecology**, v. 12, p. 893-898, 1996.

NÚÑEZ, M.; RYVARDEN, L. **East Asian polypores**. Vol. 2: Polyporaceae s. lato. Oslo: Fungiflora, 2001.

OLIVEIRA, J. J. S.; CAPELARI, M.; MARGARITESCU, S.; MONCALVO, J. M. Disentangling cryptic species in the *Marasmius haematocephalus* (Mont.) Fr. and *M. siccus* (Schwein.) Fr. species complexes (Agaricales, Basidiomycota). **Cryptogamie, Mycologie**, v. 43, p. 91-137, 2022a.

OLIVEIRA, J. J. S.; MONCALVO, J.-M.; MARGARITESCU, S.; CAPELARI, M. A morphological and phylogenetic evaluation of *Marasmius* sect. Globulares (Globulares-Sicci complex) with nine new taxa from the Neotropical Atlantic Forest. **Persoonia**, v. 44, p. 240-277, 2020b.

OLIVEIRA, M. F.; SANTOS, R. H.; LIMA, J. A. Lignin-modifying enzymes and functional roles of polyporoid fungi in fragmented Amazonian landscapes. **Fungal Ecology**, v. 68, p. 101322, 2024.

PALACIO, M.; DRECHSLER-SANTOS, E. R.; MENOLLI JR., N.; SILVEIRA, R. M. B. An overview of *Favolus* from the Neotropics, including four new species. **Mycologia**, v. 113, p. 759-775, 2021.

PALACIO, M.; ROBLEDO, G. L.; RECK, M. A.; GRASSI, E.; GÓES-NETO, A.; DRECHSLER-SANTOS, E. R. Decrypting the *Polyporus dictyopus* complex: recovery of *Atroporus* Ryvarden and segregation of *Neodictyopus* gen. nov. (Polyporales, Basidiomycota). **PLoS ONE**, v. 12, e0186183, 2017.

PATON, A. *et al*. Plant and fungal collections: current status, future perspectives. **Plants, People, Planet**, v. 2, p. 499-514, 2020.

PAVEL, C. I. *et al*. Biological activities of royal jelly-review. **Scientific Papers: Animal Science and Biotechnologies**, v. 44, p. 108, 2011.

PEGLER, D. N. A revision of the Agaricales of Cuba 2. Species described by Earle and Murrill. **Kew Bulletin**, v. 42, p. 855-888, 1987.

PEGLER, D. N.; FIARD, J. P. *Hygrocybe* sect. *firmae* (Agaricales) in tropical America. **Kew Bulletin**, London, 1978.

PEGLER, D. N.; LAESSØE, T.; SPOONER, B. **British puffballs, earthstars and stinkhorns**. London: Kew Bulletin, 1995.

PETERSEN, J. H. **The Kingdom of Fungi**. New Jersey: Princeton University Press, 2012.

PPBIO. **Fazenda Experimental da UFAM**. Amazonas: INPA, 2012. Disponível em: https://ppbio.inpa.gov.br/sitios/fazufam. Acesso em: 15 out. 2025.

REID, D. A. A monograph of the stipitate stereoid fungi. **Beihefte zur Nova Hedwigia**, Jena, 1965.

RESCHKE, K. *et al*. Fungal diversity in the tropics: *Entoloma* spp. in Panama. **Mycological Progress**, v. 21, p. 93-145, 2022. DOI: 10.1007/s11557-021-01752-2.

RITTER, C. D. *et al*. Environmental impact assessment in Brazilian Amazonia: Challenges and prospects to assess biodiversity. **Biological Conservation**, v. 206, p. 161-168, 2017. DOI: 10.1016/j.biocon.2016.12.031.

ROBLEDO, G. L.; POPOFF, O. F.; AMARILLA, L.; MONCALVO, J. M.; URCELAY, R. C. *Schizophyllum leprieurii* and the *Schizophyllum umbrinum* lineage (Agaricales, Basidiomycota) in Argentina. **Lilloa**, v. 51, p. 87-96, 2014.

ROSALINO, L. M.; VERDADE, L. M.; LYRA-JORGE, M. C. Adaptation and Evolution in Changing Environments. In: VERDADE, L.; LYRA-JORGE, M.; PIÑA, C. (ed.). **Applied Ecology and Human Dimensions in Biological Conservation**. Berlin: Springer, 2014. p. 53-71.

ROTHER, M. S.; SILVEIRA, R. M. B. *Leucocoprinus* Pat. (Agaricaceae, Basidiomycota) no Parque Estadual de Itapuã, Viamão, RS, Brasil. **Acta Botanica Brasilica**, v. 23, p. 720-728, 2009.

RYLANDS, A. B. *et al*. Amazonia. In: MITTERMEIER, R. A. *et al*. (ed.). **Wilderness: Earth's last wild places**. Mexico: CEMEX, Agrupación Serra Madre, S. C., 2002. p. 56-107.

RYVARDEN, L. A critical checklist of the Polyporaceae in tropical East Africa. **Norwegian Journal of Botany**, v. 19, p. 229-238, 1972.

RYVARDEN, L. **Neotropical Polypores Part 1**. Introduction, Ganodermataceae & Hymenochaetaceae. 1. ed. Oslo: Synopsis Fungorum, 2004.

RYVARDEN, L.; JOHANSEN, I. **A preliminary polypore flora of East Africa**. Oslo: Universitetsforlaget, 1980.

SAAR, I. Type studies of some *Cystodermella* (Agaricales, Basidiomycota) species. **Nova Hedwigia**, v. 102, p. 491-500, 2016.

SANTANA, M. D. F.; KOMURA, D. L.; COUCEIRO, D.; CAMPOS, C. S.; COUCEIRO, S. R. M. **Fungos Silvestres da Amazônia Paraense: é de comer?**. 1. ed. Manaus: INPA, 2023.

SEETHAPATHY, P. *et al*. Oyster Mushroom (*Pleurotus ostreatus*). In: SEETHAPATHY, P. (ed.). **Mushrooms**. Boca Raton: CRC Press, 2023. p. 302-321.

SHIROUZU, T.; ISHIKAWA, N. K.; HIROSE, D.; MAEKAWA, N. A new Amazonian species of *Calocera* with dendroid and multi-headed basidiocarp. **Mycoscience**, v. 54, p. 252-256, 2013.

SILVA JARDIM, F. C.; SILVA, G. A. P. Análise da variação estrutural da floresta equatorial úmida da Estação Experimental de Silvicultura Tropical do Instituto Nacional de pesquisa da Amazonia-INPA, Manaus (Am). **Revista de Ciências Agrárias**, v. 39, p. 25-54, 2003.

SILVA, B. D. B. *et al*. Two new species of *Geastrum* (Geastraceae, Basidiomycota) found in Brazil. **Nova Hedwigia**, v. 96, p. 445-456, 2013. DOI: 10.1127/0029-5035/2013/0089.

SILVA, M. A.; JESUS, M. A.; PERES, R. S.; SALES-CAMPOS, C. Notes on *Fomitiporia* Murrill in Amazon region: a list of species and new records. **Check List**, v. 17, p. 323-331, 2021. DOI: 10.15560/17.2.323.

SILVA-PEREIRA, I. *et al*. Biogeographic transitions as a source of high biological diversity: Phylogenetic lessons from a comprehensive ecotone of South America. **Perspectives in Plant Ecology, Evolution and Systematics**, v. 44, 125528, 2020. DOI: 10.1016/j.ppees.2020.125528.

SILVA-PEREIRA, V. et al. How climate change will change the potential distribution of two wood-decaying fungi? **Acta Botanica Brasilica**, v. 34, n. 4, p. 780–789, 2020.

SINGER, R. A. **Monograph of Favolaschia**. Lehre: Cramer, 1974.

SINGER, R. **The Agaricales in modern taxonomy**. 4. ed. Koenigstein: Koeltz Scientific Books, 1986.

SINGER, R. Type studies on Basidiomycetes VIII. **Sydowia**, v. 9, p. 367-431, 1955.

SOARES, A. M. S.; GIBERTONI, T. B. Validation of *Porogramme albocincta* and new records of Polyporales from the Brazilian Amazonia. **The Journal of the Torrey Botanical Society**, v. 142, p. 331-336, 2015.

SOARES, A. M. S.; SOTÃO, H. M. P.; MEDEIROS, P. S.; GIBERTONI, T. B. Riqueza de fungos poliporoides (Agaricomycetes, Basidiomycota) em uma floresta ombrófila densa no Amapá, Amazônia brasileira. *Boletim do Museu de Biologia Mello Leitão*, v. 35, p. 5–18, 2014.

SOARES, D. M.; SANTANA, M. D. F.; CANTO, E. S. M. New occurrence data of the toxic mushroom *Chlorophyllum molybdites* (Basidiomycota, Agaricaceae) in the Brazilian Amazon region. **Acta Amazonica**, v. 54, e54bc23048, 2024.

SOUSA-BAENA, M. S.; GARCIA, L. C.; PETERSON, A. T. Completeness of digital accessible knowledge of the plants of Brazil and priorities for survey and inventory. **Diversity and Distributions**, v. 20, p. 369-381, 2014.

STRAUSS, D. *et al*. An overview on the taxonomy, phylogenetics and ecology of the psychedelic genera *Psilocybe*, *Panaeolus*, *Pluteus* and *Gymnopilus*. **Frontiers in Forests and Global Change**, v. 5, 813998, 2022.

SUN, Y. F. *et al*. Multi-gene phylogeny and taxonomy of *Amauroderma* s.lat. (Ganodermataceae). **Persoonia**, v. 44, p. 206-239, 2020.

TEAM, R. C. **A language and environment for statistical computing**. Vienna: R Foundation for Statistical Computing, 2018.

TEDERSOO, L.; SUVI, T.; BEAVER, K.; SAAR, I. Ectomycorrhizas of *Coltricia* and *Coltriciella* (Hymenochaetales, Basidiomycota) on Caesalpiniaceae, Dipterocarpaceae and Myrtaceae in Seychelles. **Mycological Progress**, v. 6, p. 101-107, 2007.

TEIXEIRA, A. R. **Método para estudo das hifas do basidiocarpo de fungos poliporáceos**. São Paulo: Instituto de Botânica, 1995.

TRESEDER, K. K.; LENNON, J. T. Fungal traits that drive ecosystem dynamics on land. **Microbiology and Molecular Biology Reviews**, v. 79, n. 2, p. 243–266, 2015.

WICKHAM, H. **ggplot2: Elegant Graphics for Data Analysis**. Springer-Verlag New York, 2016. Disponível em: https://ggplot2.tidyverse.org.

WU, B. *et al*. Current insights into fungal species diversity and perspective on naming the environmental DNA sequences of fungi. **Mycology**, v. 10, p. 127-140, 2019.

WU, F. *et al*. Global Diversity and Updated Phylogeny of *Auricularia* (Auriculariales, Basidiomycota). **Journal of Fungi**, v. 7, p. 933, 2021. DOI: 10.3390/jof7110933.

XAVIER, W. K. S. *et al*. Riqueza de Agaricomycetes poroides da Serra do Navio, Amazônia oriental, com novo registro de *Oxyporus lacera* para o Brasil. **Boletim do Museu Paraense Emílio Goeldi. Ciências Naturais**, v. 13, p. 303-315, 2018.

ZMITROVICH, I. V. Conspectus systematis Polyporacearum v. 1.0. **Folia Cryptogamica Petropolitana**, p. 1-145, 2018.

ZMITROVICH, I. V. Some new combinations in Polyporaceae: sapienti sat. **Mycena**, v. 1, p. 91-93, 2001.