



Occurrence of Agaricomycetes (Basidiomycota) in two areas of the Amazon Forest in the state of Acre, Brazil

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ABSTRACT. Agaricomycetes are macroscopic fungi popularly known as mushrooms and wooden ears. Few studies have documented the diversity of Agaricomycetes in the state of Acre, Brazil. Thus, the objective of this work was to describe the occurrence and type of substrate of Agaricomycetes in two areas of the Amazon Forest in the State of Acre, Brazil. Collections were made at the UFAC Parque Zoobotânico and at the Fazenda Experimental Catuaba. The Agaricomycetes were collected in pre-existing trails, the fungal basidiome was removed from the substrate with the aid of a penknife and packed in paper bags and plastic boxes. In order to identify the Agaricomycetes, the macroscopic and microscopic characteristics were observed with the aid of specific literature, and specimens of all collected material were prepared. A total of 100 Agaricomycetes were collected, of which 86% of the specimens were identified, distributed across 21 families, 37 genera, and 18 species, while the remaining 14% were kept at the order taxonomic level. The orders observed were Agaricales (82%), Polyporales (11%), Geastrales (2%), Phallales (2%), Auriculariales (1%), Hymenochaetales (1%), and Russulales (1%). This study describes the Agaricomycetes found in two areas of the Amazon Rainforest in the state of Acre, expanding knowledge on fungal biodiversity in the Brazilian Amazon. Additionally, it records for the first time the occurrence of the species *Filoboletus gracilis*, *Xeromphalina tenuipes*, *Lentinula raphanica*, *Pleurotus djamor*, and *Poromycena* cf. *violacella* in state of Acre, Brazil.

Keywords: agaricales; *Filoboletus gracilis*; *Xeromphalina tenuipes*; *Lentinula raphanica*; *Pleurotus djamor*.

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Introduction

Agaricomycetes are macroscopic fungi of the phylum Basidiomycota, popularly known as mushrooms and wood ear fungi, and are widely distributed across the planet. This group exhibits remarkable morphological and functional diversity, playing essential ecological roles such as organic matter decomposition, nutrient cycling, and the formation of symbiotic associations with plants. Due to their importance in ecosystem maintenance, Agaricomycetes are considered one of the most significant groups within the Fungi kingdom (Martínez et al., 2019).

The phylum Basidiomycota includes 4 subphyla, 18 classes, 68 orders, 241 families, 1,928 genera, and 41,270 species (He et al., 2019). Agaricomycotina is the most diverse subphylum, with 3 classes, 29 orders, 150 families, 1,514 genera, and 30,788 species (Wijayawardene et al., 2020). The class Agaricomycetes belongs to the subphylum Agaricomycotina, it is an important class with approximately 2,100 described species (Hibbett et al., 2014).

The Amazon comprises the largest tropical forest in the world, covering 5.5 million km², accounting for approximately 40% of tropical forests and possibly 40% of all existing species, thus being considered the forest with the greatest biodiversity on the planet (Hansen et al., 2013; Gibertoni et al., 2016). Although it is considered the forest with the greatest diversity in the world, the diversity of Agaricomycetes is still poorly studied.

Currently, there are 1,445 species described for the Amazon, a number considered small when compared to the number of species in the Atlantic Forest (1,506 species) (Flora e Funga do Brasil, 2025). In the state of Acre, studies with the description of Agaricomycetes are still scarce (Bononi, 1992; Wartchow et al., 2014; Silva et al., 2020; Costa et al., 2021; Teixeira-Silva et al., 2024).

The most recent study presented 15 species of macrofungi that had not yet been reported for this region (Silva et al., 2020), demonstrating the importance of inventorying the diversity of fungi. Thus, the objective of this work was to describe the occurrence and type of substrate of Agaricomycetes in two areas of the Amazon Forest in the State of Acre, Brazil.

Material and methods

Study area

Collections were made during the rainy season, in the months of March, April and November 2018 and January to May 2019. Agaricomycetes were collected in the Parque Zoobotânico (PZ) (9°57'8" S - 67°52'25" W) located at the *Universidade Federal do Acre* (UFAC), this remnant is an urban forest fragment located in the city of Rio Branco, Acre State, Brazil, and at Fazenda Experimental Catuaba (FEC) (10°04' S and 67°37' W), located at 214 m of altitude, in the close to the confluence of the BR-364 and BR-317, in the city of Senador Guiomard. The FEC is an area of approximately 1,116 ha and constitutes a forest fragment located in the region dominated by the Dense Ombrophylous Forest (Figure 1).

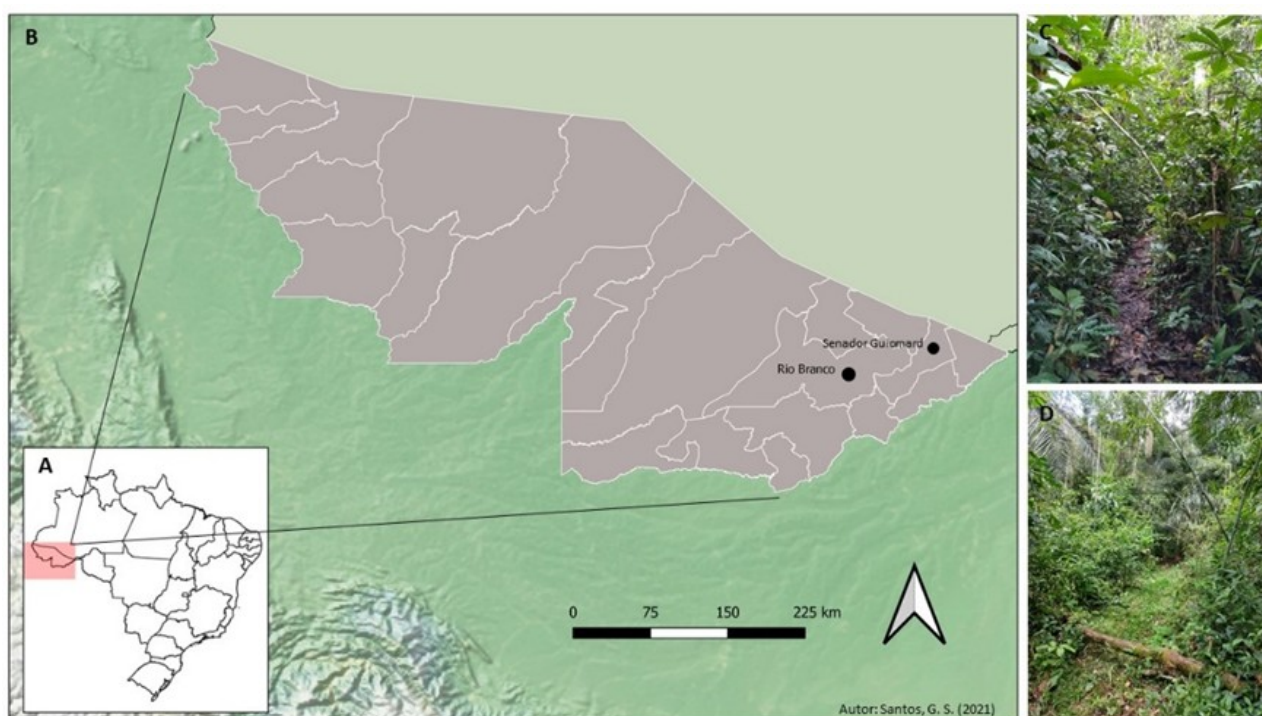


Figure 1. Location of Agaricomycetes collection areas in the State of Acre. A. Brazil; B. State of Acre and cities of Senador Guiomard and Rio Branco; C. Vegetation of the Parque Zoobotanical Park of the *Universidade Federal do Acre*; D. Vegetation at the Fazenda Experimental Catuaba (Prepared by the authors).

Collection and identification

The mushrooms were collected in pre-existing trails, the fungal basidiome was removed from the substrate with the aid of a penknife and packed in paper bags and plastic boxes. All specimens were photographed, numbered and field data, such as the substrate was recorded at the time of collection. During the collection, mushrooms with a soft texture and a mild, pleasant, slightly sweet aroma, characteristic of edible species, were selected. The basidiome were taken to the *Laboratório de Microbiologia* (LABMICRO) from UFAC, for observation and analysis of macroscopic and microscopic characteristics. After making all the observations, the specimens were made. For this purpose, the material was dehydrated in an oven at 45°C for 24-48 hours (Vargas-Isla et al., 2014). When dried, the samples were wrapped in aluminum foil, placed in kraft paper bags, and stored in a plastic box for preservation. They were then deposited in the reference collection of LABMICRO.

To identify the basidiomycetes, macroscopic and microscopic characteristics were observed. The macroscopic characteristics observed while fresh were cap (color, shape, surface and margin), stipe (color,

position and surface) and lamellae (color and appearance) (Gimenes & Matheus, 2010). The description of coloration followed a color chart (Kornerup & Wanscher, 1963).

In order to observe the microscopic structures, freehand cuts were made with a steel blade in the basidiome, the cuts were placed between slide and cover slip with 3% potassium hydroxide and 1% phloxin (Largent et al., 1977). Identification keys were used according to specific literature (Ryvarden & Johansen, 1980; Gilbertson & Ryvarden, 1986; Nunez & Ryvarden, 1995; Ryvarden, 1991, 2004, 2010, Ryvarden, 2015) and databases such as Index Fungorum (<http://www.indexfungorum.org>) and Mycobank (<http://www.mycobank.org/>).

Results

Collection and identification

A total of 60 specimens were collected at the Parque Zoobotânico and 40 specimens at Fazenda Experimental Catuaba, totaling 100 Agaricomycetes. These were classified into the orders Agaricales (82%), Polyporales (11%), Geastrales (2%), Phallales (2%), Auriculariales (1%), Hymenochaetales (1%), and Russulales (1%). Of the total number of Agaricomycetes collected, 86% of the specimens were identified, distributed in 21 families, 37 genera and 18 species, and 14% remained at the taxonomic level of order (Table 1).

Table 1. Agaricomycetes collected at the Parque Zoobotânico and Fazenda Experimental Catuaba, Acre State, Brazil.

Taxonomy	Substrate	Local	Voucher
AGARICALES			
Agaricaceae Chevall.			
<i>Agaricus</i> sp. 1	So	FEC	5.328
<i>Agaricus</i> sp. 2	Li	FEC	5.352
<i>Chlorophyllum molybdites</i> (G. Mey.) Massee	So	PZ	5.315
<i>Lepiota</i> sp.	Tr	PZ	5.326
<i>Leucoagaricus</i> sp. 1	So	FEC	5.285
<i>Leucoagaricus</i> sp. 2	So	PZ	5.305
<i>Leucoagaricus</i> sp. 3	Li	PZ	5.314
<i>Leucoagaricus</i> sp. 4	So	FEC	5.346
<i>Leucocoprinus</i> sp. 1	So	PZ	5.265/5.308
<i>Leucocoprinus birnbaumii</i> (Corda) Singer	So	PZ	5.301
<i>Leucocoprinus cretaceus</i> (Bull.) Locq.	Li	PZ	5.309
<i>Leucocoprinus</i> sp. 2	So/Li	FEC	5.333
<i>Leucocoprinus</i> sp. 3	So	FEC	5.343/5.348
<i>Macrolepiota</i> sp.	So	PZ	5.303
Hygrophoraceae Lotsy			
<i>Hygrocybe</i> sp.	Li	FEC	5.349
Hymenogastraceae Vittad.			
<i>Gymnopilus</i> sp.	Tr	FEC	5.335
Lycoperdaceae Chevall.			
<i>Calvatia</i> sp. 1	So	PZ	5.296
<i>Calvatia</i> sp. 2	Br	FEC	5.341
Marasmiaceae Roze ex Kühner			
<i>Marasmiellus</i> sp.	Tr	PZ	5.271
<i>Marasmius</i> sp. 1	Li	PZ	5.272
<i>Marasmius</i> sp. 2	Li	PZ	5.291
<i>Marasmius</i> sp. 3	Li	PZ	5.292
<i>Marasmius</i> sp. 4	Li	PZ	5.294
<i>Marasmius</i> sp. 5	Li	PZ	5.299
<i>Marasmius</i> sp. 6	Li	PZ	5.316
<i>Marasmius</i> sp. 7	Br	FEC	5.337
<i>Marasmius</i> sp. 8	Tr	FEC	5.345
<i>Marasmius</i> sp. 9	Tr	FEC	5.350
<i>Marasmius</i> sp. 10	Li	PZ	5.356
<i>Marasmius</i> sp. 11	Li	PZ	5.364
Mycenaceae Overeem			
<i>Filoboletus gracilis</i> (Klotzsch ex Berk.) Singer*	Tr	FEC	5.283
<i>Hydropus nigrita</i> (Berk. & M.A. Curtis) Singer	Li	PZ	5.269
<i>Poromyцена</i> cf. <i>violacella</i> (Speg.) Singer*	Li	PZ	5.302

<i>Xeromphalina tenuipes</i> (Schwein.) A.H. Sm.*	So/Li	PZ	5.290/5.313
Omphalotaceae Bresinsky			
<i>Lentinula raphanica</i> (Murrill) Mata & R.H. Petersen*	Tr	PZ/FEC	5.318/5.342/5.359
<i>Gymnopus</i> sp.	Li	PZ	5.365
Physalaciaceae Corner			
<i>Dactylosporina macracantha</i> (Singer) Dörfelt	So	FEC	5.280
<i>Oudemansiella steffenii</i> (Rick) Singer	So	FEC	5.281/5.340/5.354
<i>Oudemansiella canarii</i> (Jungh.) Höhn	Tr	FEC	5.332
<i>Oudemansiella</i> sp.	Tr	PZ/FEC	5.295/5.331
Pleurotaceae Kühner			
<i>Hohenbuehelia</i> sp.	Br	PZ	5.358
<i>Pleurotus djamor</i> (Rumph. ex Fr.) Boedijn*	Br	FEC	5.330
<i>Pleurotus</i> sp.	Br	PZ	5.362
Porothelaceae Murrill			
<i>Gerronema</i> sp. 1	Tr	PZ	5.266
<i>Gerronema</i> sp. 2	Br	PZ	5.270
<i>Gerronema</i> sp. 3	So	FEC	5.277
<i>Gerronema</i> sp. 4	Li	FEC	5.284
<i>Gerronema</i> sp. 5	Li	PZ	5.293
<i>Gerronema</i> sp. 6	Tr	PZ	5.304
<i>Gerronema</i> sp. 7	Br	PZ	5.317
<i>Gerronema</i> sp. 8	Li	PZ	5.320
Pluteaceae Kotl. & Pouzar			
<i>Pluteus</i> sp. 1	Li	PZ	5.307
<i>Pluteus</i> sp. 2	Tr	PZ	5.360
<i>Pluteus</i> sp. 3	So	PZ	5.363
<i>Volvariella</i> sp.	So/Tr	FEC	5.279/5.336
Strophariaceae Singer & AH Sm.			
<i>Panaeolus</i> sp. 1	Li	FEC	5.351
<i>Panaeolus</i> sp. 2	Li	PZ	5.357
Tricholomataceae R. Heim ex Pouzar			
<i>Leucopaxillus</i> sp.	So	PZ	5.356
AURICULARIALES			
Auriculariaceae Fr.			
<i>Auricularia fuscusuccinea</i> (Mont.) Henn.	Tr	PZ	5.361
GEASTRALES			
Geastraceae Corda			
<i>Geastrum</i> sp. 1	Tr	PZ	5.324
<i>Geastrum</i> sp. 2	Tr	FEC	5.344
HYMENOGASTRALES			
Hymenochaetaceae Donk			
<i>Cotylidia aurantiaca</i> (Pers.) A.L. Welden	Tr	PZ	5.306
PHALLALES			
Phallaceae Corda			
<i>Phallus indusiatus</i> Vent.	So/Tr	PZ	5.311/5.355
POLYPORALES			
Panaceae Miettinen, Justo & Hibbett			
<i>Panus</i> sp. 1	So	FEC	5.282
<i>Panus</i> sp. 2	So	PZ	5.323
Polyporaceae Fr. ex Corda			
<i>Favolus tenuiculus</i> P. Beauv.	Tr	PZ/FEC	5.268/5.329
<i>Lentinus</i> sp. 1	So	FEC	5.278
<i>Lentinus strigosus</i> Fr.	Tr	PZ	5.312
<i>Polyporus</i> sp.	So	FEC	5.338
Steccherinaceae Parmasto			
<i>Flabellophora</i> sp.	Tr	PZ	5.297
RUSSULALES			
Russulaceae Lotsy			
<i>Lactifluus</i> sp.	So	FEC	5.353

Br: Branch; Li: litter; So: Soil; Tr: Trunk. PZ: Parque Zoológico; FEC: Fazenda Experimental Catuaba. *New occurrence.

The species *Filoboletus gracilis*, *Xeromphalina tenuipes*, *Lentinula raphanica*, *Pleurotus djamor*, and *Poromyces* cf. *violacella* are being recorded for the first time for the State of Acre, Brazil (Figure 2).

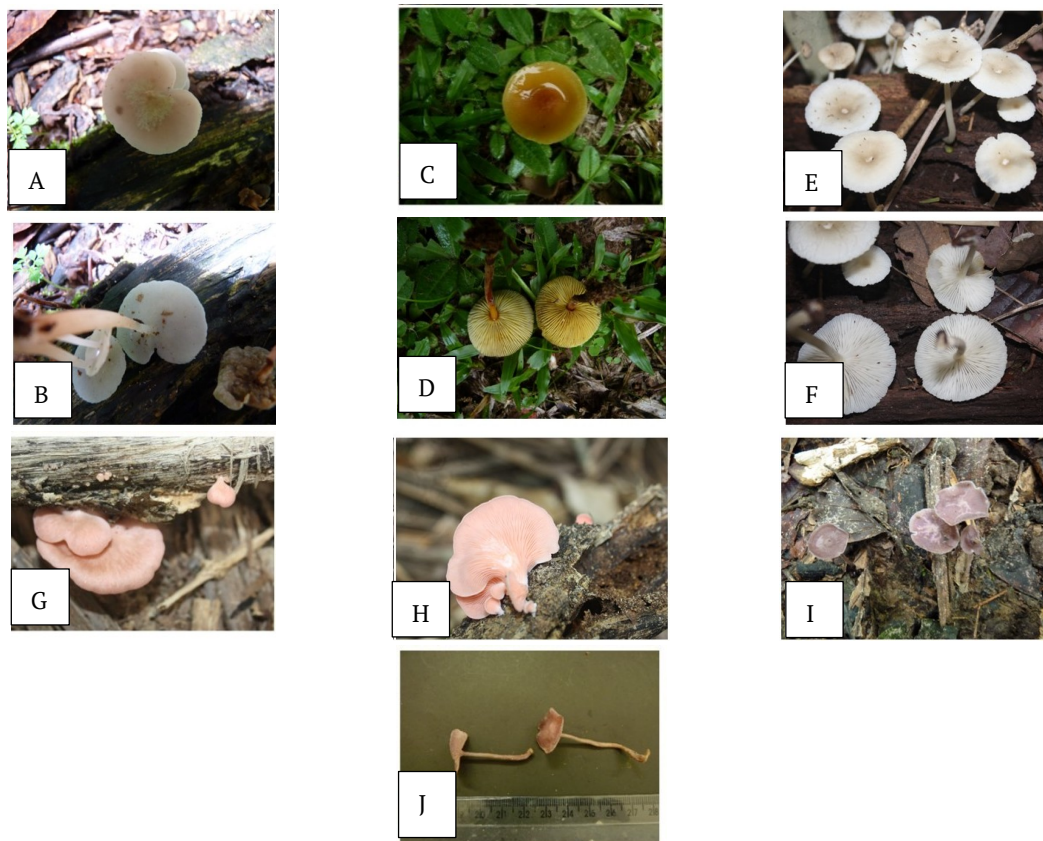


Figure 2. Basidiome of fungi with new occurrences for the State of Acre, Brazil. A-B. *Filoboteus gracilis*; C-D. *Xeromphalina tenuipes*; E-F. *Lentinula raphanica*; G-H. *Pleurotus djamor*; I-J. *Poromycena* cf. *violacella*.

Agaricomycetes were found in four types of substrates: soil (32%), trunk (30%), litter (26%) and branch (12%). Only Agaricomycetes of the order Agaricales were found in all types of substrates (Figure 3).

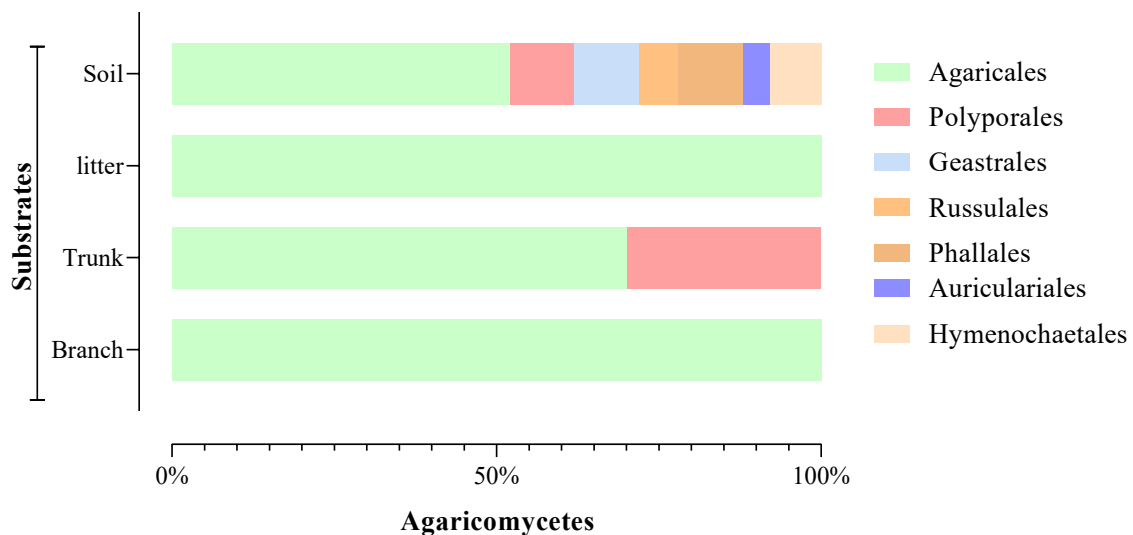


Figure 3. Agaricomycetes collected at the Parque Zoológico and Fazenda Experimental Catuaba distributed by taxonomic order and types of substrates.

Discussion

Of the total number of Agaricomycetes collected, 82% belong to the order Agaricales. Agaricales is the largest order of Agaricomycetes, according to the Catalog of Life there are more than 23,000 described species (Yoo et al., 2022). For Brazil, there are 1,096 species, and for the Amazon 146 described (Flora e Funga do Brasil, 2025).

In a systematic review aimed at analyzing studies on the diversity of Agaricales, six studies were identified within the Brazilian Amazon biome, reporting a total of 87 fungal species distributed across 22 genera. The most frequent genera were *Marasmius* (13.6%), *Hygrocybe* (10%), *Gymnopus* (9.1%), and *Agaricus* (9.1%) (Silvestre et al., 2019). In the present study, the genera *Agaricus*, *Gymnopus*, *Hygrocybe*, and *Marasmius* were identified in the collection areas studied.

The species *Dactylosporina macracantha* and *Oudemansiella steffeni* identified in this study have previously been reported in another study conducted at Fazenda Experimental Catuaba (Wartchow et al., 2014). A study done in a forest fragment in the State of Acre presented species of the genus *Calvatia*, *Leucocoprinus*, *Marasmius* and *Favolus*, also reported in the present work (Silvestre et al., 2019). The most recent study for the state of Acre done in a protected area presented species of the genera *Leucocoprinus*, *Geastrum*, *Hygrocybe*, *Calvatia*, *Gerronema*, *Marasmius*, *Oudemansiella*, and *Favolus*, common genera in this work (Silva et al., 2020).

The species *Filoboletus gracilis*, *Xeromphalina tenuipes*, *Lentinula raphanica*, *Pleurotus djamor*, and *Poromycena* cf. *violacella* are being registered for the first time for the State of Acre, Brazil.

The genus *Filoboletus* is from the Mycenaceae family, it is a tropical genus of small mycenoid fungi with poroid hymenophore, central stipe and smooth-walled amyloid spores, and several species have bioluminescent chemical properties, however, the species *F. gracilis* is not a bioluminescent species (Oliveira et al., 2012; Campi et al., 2017). The *F. gracilis* species has been reported for some countries in South America, such as Paraguay, Colombia, and Ecuador (Franco-Molano & Calle, 2000; Ullah et al., 2002; Campi et al., 2017). In Brazil, the species *F. gracilis* has been reported in the states of Rondônia, São Paulo, Paraná and Rio Grande do Sul (Flora e Funga do Brasil, 2025).

The genus *Xeromphalina* belongs to the Mycenaceae family, being found from the tropics to habitats under temperate climatic conditions in the Northern and Southern Hemispheres, having convex to conical basidiomata, orange to yellow in color (Campi et al., 2017). For Brazil, the species *X. tenuipes* was reported in the states of Rondônia, São Paulo and Rio Grande do Sul (Flora e Funga do Brasil, 2025).

The genus *Lentinula* belongs to the Omphalotaceae family, has a wide distribution that covers much of southern Asia, and tropical and subtropical regions of America (Sierra-Patev, 2023). This genus includes edible species such as *L. edodes*, popularly known as shiitake. The species *L. raphanica* is an edible wild species, it is consumed by the Yanomami Indians, a group of approximately 3,000 people residing in 19 villages in a federal indigenous reserve in the Awaris region, close to the Brazilian border with Venezuela (Carlos Jr. & Welch, 2018). The species *Lentinula raphanica* has already been reported for the states of Amazonas and São Paulo (Flora e Funga do Brasil, 2025).

Species of the genus *Pleurotus* are distributed throughout the world, belonging to the Pleurotaceae family, are known to be edible mushrooms with high nutritional value, are part of the group of fungi that cause white rot, thus being widely studied for their ligninolytic properties (Raman et al., 2015; Bellettini et al., 2019).

The species *P. djamor* is popularly known as pink oyster mushroom, it is the most common species of wild *Pleurotus* in pan-tropical climates, it is saprophytic, preferring tropical and subtropical woods, including palm trees, deciduous trees and rubber trees (Stamets, 2000). The species *Pleurotus djamor* has already been recorded in the states of Amazonas, Amapá, Pará, Paraíba, Paraná, Pernambuco, Rondônia, Rio de Janeiro, Rio Grande do Sul and São Paulo (Flora e Funga do Brasil, 2025).

The genus *Mycena* comprises about 600 small mushroom species widely distributed worldwide (Thoen et al., 2020). The species *Poromycena violacella* was recorded from the Rio Furnas Reserve, in the state of Santa Catarina, and in the state of São Paulo (Flora e Funga do Brasil, 2025). This species is a possible new occurrence for the Brazilian Amazon.

Conclusion

The Parque Zoobotânico and Fazenda Experimental Catuaba presented a great diversity of Agaricomycetes, being represented mainly by specimens of the order Agaricales. The species *Filoboletus gracilis*, *Xeromphalina tenuipes*, *Lentinula raphanica*, *Pleurotus djamor* and *Poromycena* cf. *violacella* are being recorded for the first time for the State of Acre, Brazil. Future studies with molecular characterization are essential to confirm and expand the identification of the collected Agaricomycetes. It is important to point out that studies with the description of species of Agaricomycetes are necessary for this region of the Brazilian Amazon, since knowledge about the diversity of these fungi is still insufficient.

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