

Checklist of the agaricoid fungi from Paraguay

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ABSTRACT—The aim of this work is to provide a complete literature-based checklist of the agaricoid fungi from Paraguay. For this, an extensive review of the literature and online databases was made. We list 125 species belonging to the agaricoid fungi distributed among 20 families. *Agaricaceae*, *Tricholomataceae*, *Psathyrellaceae*, and *Marasmiaceae* are the most species-abundant families. Regarding species distribution, the Capital department has the highest number of reported species, and other biogeographical regions as Chaco, Cerrado and Pantanal are practically unexplored.

INTRODUCTION

The agaricoid fungi are characterized by having ephemeral basidiomata with a putrescent consistency and lamellated hymenophore (Webster & Weber 2007, Niveiro et al. 2014, Piepenbring 2015). Usually, they have the typical umbrella shape, constituted in a pileus supported by a stipe. On the underside of the pileus, the hymenophore is usually formed by radially arranged lamellae (Webster & Weber 2007). The agaricoid fungi belong to the Agaricomycetes clade, and are distributed in 7 orders: *Agaricales*, *Boletales*, *Cantharellales*, *Gloeophyllales*, *Hymenochaetales*, *Polyporales* and *Russulales* (Hibbett et al. 2007). Together, these include more than 21000 described species (Hibbett et al. 2014), widely distributed in all ecosystems (Singer 1986).

The bibliographical references on the mycobiota of Paraguay are limited (Popoff & Wright 1998). The first records of agaricoid fungi in Paraguay date from 1883, when Carlos Spegazzini, botanist-mycologist, made a two-month expedition through the country. During that journey he visited the departments of Central, Cordillera, Caaguazú, Paraguari, Concepción and Itapúa. The results of this expedition were published by Spegazzini (1922), where he says: "*I gathered a collection of both flowering plants and cryptogams, especially fungi, which served as the basis for writing this booklet. In it the reader will not find great novelties, although I think it will not be totally devoid of interest, and I consider it a new grain of sand contributed to the increase of our knowledge of Mycology in general and that of Paraguay in particular*" (Spegazzini 1922, p.3).

In spite of this statement by Spegazzini, claiming the importance for the mycological studies in the country, for decades there were no mycological investigations in Paraguay. In this hiatus, important contribution was made especially by Rolf Singer, who studied extensively the mushrooms in the South America and revised a lot of material collected by Spegazzini, including some collections and types from Paraguay (Singer 1950, 1970, 1976).

Only in the recent 20 years a few studies on the diversity of agaricoid mushrooms from Paraguay have been published. Zanolli-Cavazzoni (1996) made a list of edible fungi known from the Central Department of Paraguay and reported 39 genera of agaricoid fungi. Gullón (2011) cited only 4 species from the Refugio Biológico Tati Yupi. Campi et al. (2013) listed 14 species as occurring in the Natural Reserve Laguna Blanca. Some articles reported species not previously known for Paraguay (De Madignac et al. 2013; Flecha et al. 2013; Campi et al. 2016, 2017a, 2017b). Some genera such as *Leucocoprinus* (Campi et al. 2015) and *Pleurotus* (Flecha et al. 2014) have received more detailed study in the country.

With the increasing number of investigations being conducted on the diversity of agaricoid fungi in Paraguay, the aim of this work is to provide a checklist of the agaricoid fungi from Paraguay that is up to date, establishing a baseline for future studies.

METHODS

An extensive review of the literature and online databases was made. All agaricoid fungi described and cited for Paraguay from 1883 until 2017 are cataloged in this work. The online databases MycoBank (www.mycobank.org) and Index Fungorum (www.indexfungorum.org) were used for taxonomic classification, renaming, and updating names of the species if necessary. For authors abbreviations, the Authors of Fungal Names (<http://www.indexfungorum.org/names/AuthorsOfFungalNames.asp>) was used. Species distribution is cited according to the department (State) where it was collected followed by the specific locality. A map with the political divisions of Paraguay and the abbreviations for each state can be seen in Figure 1. For the biogeographical regions Olson et al. (2001) and Morrone (2001, 2014) were followed.

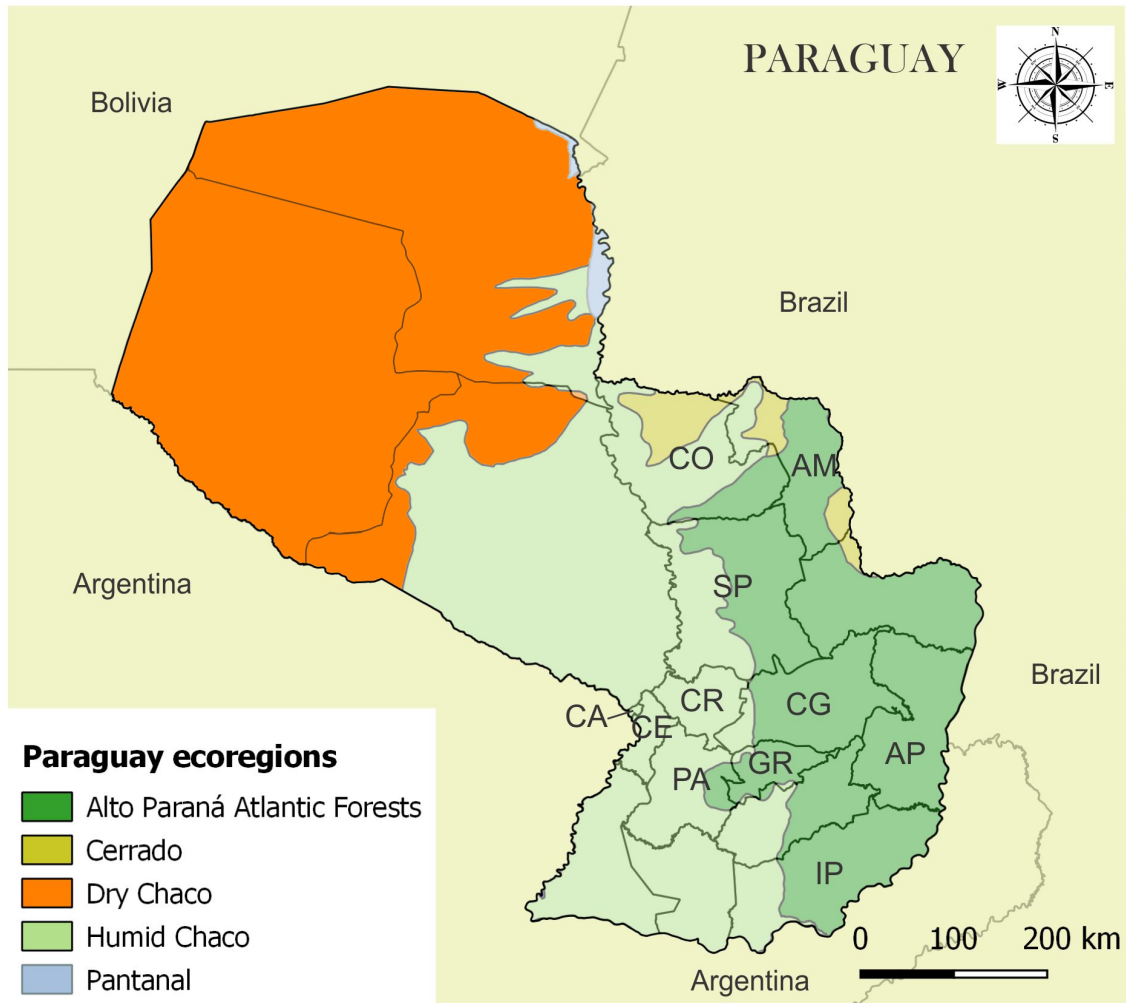


Figure 1: Map of Paraguay. Departments where agaricoid mushrooms have been collected: AM: Amambay, AP: Alto Paraná, CA: Capital, CG: Caaguazú, CE: Central, CO: Concepción, CR: Cordillera, PA: Paraguari, SP: San Pedro.

RESULTS

Based on the records found in 33 bibliographic sources, we counted 125 species (with 148 records) belonging to the agaricoid fungi distributed in 20 families has been reported for Paraguay. The list of catalogued species is shown in Table 1

Agaricaceae is the most abundant family with 22 species, followed by *Tricholomataceae* with 14 species, *Psathyrellaceae* (13 species), *Marasmiaceae* (12 species), and *Pleurotaceae* (11 species), the remaining families have less than 10 species each. Regarding species distribution by location, the Capital

department has the highest number of cited species, with a total of 72 reported species (51 %), followed by Paraguari, with 15 species (11%), Alto Paraná and Central, with 11 species (10%) (Table 2). Considering the biogeographic regions, we observed that all collections are related to the Parana Forest and Humid Chaco, and there are no collections of the other biogeographic regions present in Paraguay as Dry Chaco, Cerrado (Chacoan domain) and Pantanal (Amazonia region).

Table 1: Checklist of agaricoid fungi from Paraguay

SPECIES	DISTRIBUTION	REFERENCE
AGARICACEAE		
<i>Agaricus campestris</i> L.	PA	Spegazzini 1886
<i>Agaricus pampeanus</i> Speg.	CA	Spegazzini 1919
<i>Agaricus succineus</i> Speg.	CG	Spegazzini 1886
<i>Coprinus comatus</i> (O.F. Müll.) Pers.	AP	Campi et al. 2016
<i>Coprinus fimetarius</i> Fr.	CA	Spegazzini 1922
<i>Coprinus rufopruinatus</i> Romagn.	AP	Gullón 2011
<i>Lepiota camporum</i> (Speg.) Speg.	CA	Spegazzini 1919 (as <i>Annularia camporum</i> Speg.)
<i>Lepiota cinerascens</i> Speg.	CA	Spegazzini 1919
<i>Lepiota fuscorocelea</i> Speg.	CA	Spegazzini 1919
<i>Lepiota lycoperdinea</i> Speg.	CA	Spegazzini 1919
<i>Lepiota micromyces</i> Speg.	CA	Spegazzini 1922
<i>Lepiota pluvialis</i> Speg.	CA	Spegazzini 1919
<i>Leucoagaricus erythrellus</i> (Speg.) Singer	CA	Spegazzini 1919 (as <i>Lepiota erythrella</i> Speg.)
<i>Leucoagaricus rickianus</i> (Speg.) Singer	CA	Spegazzini 1919 (as <i>Lepiota rickiana</i> Speg.)
<i>Leucoagaricus rubrosquamosus</i> (Rick) Singer	AP	Gullón 2011
<i>Leucoagaricus lilaceus</i> Singer	AP, CE, SP	Flecha et al. 2013
<i>Leucocoprinus birnbaumii</i> (Corda) Singer	CE	Campi et al. 2015
<i>Leucocoprinus cepistipes</i> (Sowerby) Pat.	CE	Campi et al. 2015
<i>Leucocoprinus cretaceus</i> (Bull.) Locq.	AP	Campi et al. 2015
<i>Leucocoprinus straminellus</i> (Bagl.) Narducci & Caroti	AP	Campi et al. 2015
<i>Macrolepiota bonaerensis</i> (Speg.) Singer	CA, CE, PA	Spegazzini 1886 (as <i>Agaricus bonaerensis</i> Speg.), 1919 (as <i>Lepiota bonaerensis</i> Speg.)
<i>Macrolepiota excoriata</i> (Schaeff.) Wasser	CA	Spegazzini 1919 [as <i>Lepiota excoriata</i> (Schaeff.) P. Kumm.]
AMANITACEAE		

<i>Limacella laeviceps</i> (Speg.) Raithelh.	CA, CE	Spegazzini 1919 (as <i>Lepiota laeviceps</i> Speg.), Raithelhuber 1980
BOLBITIACEAE		
<i>Conocybe antipus</i> (Lasch) Fayod	CA	Spegazzini 1922 [as <i>Galera antipus</i> (Lasch) Quél.]
<i>Conocybe rickeniana</i> P.D. Orton	CA	Spegazzini 1922 [as <i>Galera teneroides</i> (Peck) Sacc.]
<i>Conocybe tenera</i> (Schaeff.) Fayod	CA	Spegazzini 1919, 1922 [as <i>Galera tenera</i> (Schaeff.) P. Kumm.]
ENTOLOMATACEAE		
<i>Clitocella himantiigena</i> (Speg.) Silva-Filho & Cortez	CA	Spegazzini 1919 (as <i>Clitocybe himantiigena</i> Speg.), Silva-Filho et al. 2018.
HYDNANGIACEAE		
<i>Laccaria fraterna</i> (Sacc.) Pegler	CR	Campi et al. 2017a.
HYMENOGASTRACEAE		
<i>Galera nemoricola</i> (Speg.) Speg.	PA	Spegazzini 1886 (as <i>Agaricus nemoricola</i> Speg.).
<i>Hebeloma fastibile</i> (Pers.) P. Kumm.	CA	Spegazzini 1919.
<i>Naucoria cerodes</i> (Fr.) P. Kumm.	CA	Spegazzini 1922.
<i>Naucoria melinoides</i> (Bull.) P. Kumm.	CA	Spegazzini 1919
INOCYBACEAE		
<i>Crepidotus mollis</i> (Schaeff.) Staude	CA	Spegazzini 1919
<i>Flammulaster muricatus</i> (Fr.) Watling	CA	Spegazzini 1922 (as <i>Pholiota muricata</i> Fr.)
MARASMIACEAE		
<i>Lactocollybia carneipes</i> (Speg.) Singer	CA	Spegazzini, 1919 (as <i>Omphalia carneipes</i> Speg.), Singer 1949 (as <i>Macrocystidia carneipes</i> Singer (1986).
<i>Marasmius balansae</i> Speg.	PA	Spegazzini 1891
<i>Marasmius caespitosus</i> Velen.	CA	Spegazzini 1919
<i>Marasmius cohortalis</i> var. <i>hymeniicephalus</i> (Speg.) Singer	CE, PA	Spegazzini 1886, 1919 [as <i>Agaricus hymeniicephalus</i> Speg.; <i>Heliomyces hymeniicephalus</i> (Speg.) Speg.], Singer 1976 [as <i>Marasmius hymeniicephalus</i> (Speg.) Singer]
<i>Marasmius crinis-equi</i> F. Muell. ex Kalchbr.	CA, CG	Spegazzini 1886 (as <i>Marasmius trichorhizus</i> Speg.), Spegazzini 1922 (as <i>Marasmius equicrinis</i> Rüll.)
<i>Marasmius ferrugineus</i> Berk.	SP	De Madrignac et al. 2013

<i>Marasmius glabellus</i> Peck	CA	Spegazzini 1919
<i>Marasmius haematocephalus</i> (Mont.) Fr.	AP, CA, SP	Spegazzini 1919, Gullón 2011, De Madriagnac et al. 2013
<i>Marasmius pallipes</i> Speg.	PA	Spegazzini 1886
<i>Marasmius petalinus</i> Berk. & M.A. Curtis	CA	Spegazzini 1919
<i>Marasmius siccus</i> (Schwein.) Fr.	SP	Campi et al. 2013
<i>Marasmius spegazzinii</i> Sacc. & Sydow	PA	Spegazzini 1891 (as <i>M. balansae</i> Speg.)
<i>Trogia icterina</i> (Singer) Corner	SP	Campi et al. 2013 [as <i>Gerronema icterinum</i> (Singer) Singer]
MYCENACEAE		
<i>Mycena corticola</i> (Pers.) Gray	PA	Spegazzini 1886 (as <i>Agaricus corticola</i> Speg.)
<i>Mycena juncicola</i> (Fr.) Gillet	CA	Spegazzini 1922
<i>Mycena paraguayana</i> Speg.	CA	Spegazzini 1922
<i>Mycena paraguariensis</i> (Speg.) Niveiro, Popoff & Albertó	PA	Spegazzini 1886 (as <i>Agaricus paraguariensis</i> Speg.), Buyck et al. 2017
<i>Mycena sosarum</i> Singer	SP	Campi et al. 2013
<i>Xeromphalina tenuipes</i> (Schwein.) A.H. Sm.	AM, CG	Pegler 1983, Campi et al. 2017b
OMPHALOTACEAE		
<i>Gymnopus peronatus</i> (Bolton) Gray	CA	Spegazzini 1919 [as <i>Marasmius urens</i> (Bull.) Fr.]
<i>Lentinula guarapiensis</i> (Speg.) Pegler	PA	Spegazzini 1886 (as <i>Agaricus guarapiensis</i> Speg.)
<i>Marasmiellus eburneus</i> (Theiss.) Singer	CA	Spegazzini 1919 (as <i>Marasmius eburneus</i> Theiss.)
<i>Marasmiellus microscopicus</i> (Speg.) Singer	CG	Spegazzini 1886 (as <i>Agaricus microscopicus</i> Speg.), Singer 1973.
<i>Marasmiellus tropicalis</i> (Speg.) Singer	CR	Spegazzini 1888 (as <i>Pleurotus tropicalis</i> Speg.)
<i>Neonothopanus nambi</i> (Speg.) R.H. Petersen & Krisai	PA	Spegazzini 1886 (as <i>Agaricus nambi</i> Speg.)
PHYSALACRIACEAE		
<i>Cyptotrampa asprata</i> (Berk.) Redhead & Ginns	SP	Campi et al. 2013
<i>Dactylosporina steffanii</i> (Rick) Dörfelt	SP	Campi et al. 2013 [as <i>Oudemansiella steffanii</i> (Rick) Singer]
<i>Oudemansiella platensis</i> (Speg.) Speg.	AP, SP	Gullón 2011, Campi et al. 2013 [as <i>Oudemansiella canarii</i> (Jungh.) Höhn.]
<i>Oudemansiella orinocensis</i> (Pat.) Speg.	CA	Spegazzini 1919

<i>Xerula pudens</i> (Pers.) Singer	CA	Spegazzini 1919 (as <i>Collybia longipes</i> P. Kumm.)
PLEUROTACEAE		
<i>Hohenbuehelia paraguayensis</i> Speg.	CA	Spegazzini 1922 (as <i>Pleurotus paraguayensis</i> Speg.)
<i>Hohenbuehelia petaloides</i> (Bull.) Schulzer	PA	Spegazzini 1888 (as <i>Pleurotus petaloides</i> Speg.)
<i>Hohenbuehelia portegna</i> (Speg.) Singer	CR, PA	Spegazzini 1886, 1888 [as <i>Agaricus portegnus</i> Speg.; <i>Pleurotus portegnus</i> (Speg.) Speg.]
<i>Pleurotus albidus</i> (Berk.) Pegler	CA, PA	Spegazzini 1886, 1919 [as <i>Agaricus laciniatocrenatus</i> (Speg.) Speg.; <i>Pleurotus laciniatocrenatus</i> (Speg.) Speg.], Flecha et al. 2014
<i>Pleurotus cystidiosus</i> O.K. Miller	CE	Flecha et al. 2014
<i>Pleurotus djamor</i> var. <i>cyathiformis</i> Corner	CA	Flecha et al. 2014
<i>Pleurotus djamor</i> var. <i>roseus</i> Corner	AP	Flecha et al. 2014.
<i>Pleurotus elegantissimus</i> Speg.	CA	Spegazzini 1922
<i>Pleurotus guaraniticus</i> Speg.	CA	Spegazzini 1922
<i>Pleurotus microspermus</i> Speg.	PA	Spegazzini 1891
<i>Pleurotus spodoleucus</i> (Fr.) Quél.	CA	Spegazzini 1922
PLUTEACEAE		
<i>Pluteus fibulatus</i> Singer	SP	Campi et al. 2013
<i>Volvariella paraguayensis</i> Speg.	CA	Spegazzini 1922 (as <i>Volvaria paraguayensis</i> Speg.)
POROTHELEACEAE		
<i>Phloeomana hiemalis</i> (Osbeck) Redhead	CA	Spegazzini 1919 [as <i>Mycena epiphloea</i> (Fr.) Sacc.]
PSATHYRELLACEAE		
<i>Coprinellus disseminatus</i> (Pers.) J.E. Lange	CA, SP	Spegazzini 1919, 1922 [as <i>Psathyrella disseminata</i> (Pers.) Quél.], Campi et al. 2013 (as <i>Coprinus disseminatus</i> (Pers.) Gray]
<i>Coprinellus ephemerus</i> (Bull.) Redhead, Vilgalys & Moncalvo	CA	Spegazzini 1922 [as <i>Coprinus ephemerus</i> (Bull.) Fr.]
<i>Coprinopsis extinctoria</i> (Fr.) Redhead, Vilgalys & Moncalvo	CA	Spegazzini 1922 (as <i>Coprinus extinctorius</i> Fr.)
<i>Panaeolina foeniseccii</i> (Pers.) Maire	CA	Spegazzini 1922 [as <i>Psilocybe foeniseccii</i> (Pers.) Quél.]
<i>Panaeolus papilionaceus</i> (Bull.) Quél.	CA	Spegazzini 1922 [as <i>Panaeolus campanulatus</i> (L.) Quél.]
<i>Parasola hemerobia</i> (Fr.) Redhead, Vilgalys & Hopple	CA	Spegazzini 1922 (as <i>Coprinus hemerobius</i> Fr.)
<i>Psathyrella argentina</i> Speg.	CA	Spegazzini 1919
<i>Psathyrella conopilea</i> (Fr.) A.	CA	Spegazzini 1922 (as <i>Psathyra</i>

Pearson & Dennis		<i>conopilus</i> (Fr.) P. Kumm.]
<i>Psathyrella asperella</i> Quél. & Schulzer	CA	Spegazzini 1922
<i>Psathyrella candolleana</i> (Fr.) Maire	CA	Spegazzini 1922 [as <i>Hypholoma appendiculatum</i> (Bull.). Quél.]
<i>Psathyrella gyroflexa</i> (Fr.) Konrad & Maubl.	CA	Spegazzini 1922 [as <i>Psathyra gyroflexa</i> (Fr.) P. Kumm.]
<i>Psathyrella microsperma</i> (Speg.) Guzmán	CA	Spegazzini 1919 (as <i>Psilocybe microsperma</i> Speg.), Guzmán & Vergeer 1978
<i>Psathyrella subcorticalis</i> Speg.	CA	Spegazzini 1922
SCHIZOPHYLLACEAE		
<i>Schizophyllum commune</i> Fr	CA, CE, GR, IP, SP	Spegazzini 1922 [as <i>Schizophyllum alneum</i> (L.) Schört], Campi et al. 2013
STROPHARIACEAE		
<i>Agrocybe pediades</i> (Fr.) Fayod	CA	Spegazzini 1922 [as <i>Naucoria semiorbicularis</i> (Bull.) Quél.]
<i>Agrocybe retigera</i> (Speg.) Singer	CA	Spegazzini 1922 (as <i>Naucoria retigera</i> Speg.); Singer 1950
<i>Agrocybe vervacti</i> (Fr.) Singer	CA	Spegazzini 1919 [as <i>Naucoria vervacti</i> (Fr.) Quél.]
<i>Cyclocybe cylindracea</i> (DC.) Vizzini & Angelini	CR	Spegazzini 1886 (as <i>Agaricus pudicus</i> Bull.)
<i>Deconica merdaria</i> (Fr.) Noordel.	CA	Spegazzini 1922 [as <i>Stropharia merdaria</i> (Fr.) Quél.]
<i>Flammula papillospora</i> Speg.	CE	Spegazzini 1919
<i>Galerina sideroides</i> (Bull.) Kühner	CA	Spegazzini 1919 [as <i>Naucoria sideroides</i> (Bull.) Quél.]
<i>Gymnopilus earlei</i> Murril.	AP	Gullón 2011
<i>Gymnopilus picreus</i> (Pers.) P. Karst.	CO	Spegazzini 1919 (as <i>Flammula picrea</i> (Pers.) Quél.)
<i>Gymnopilus sapineus</i> (Fr.) Murrill	CA	Spegazzini 1922 [as <i>Flammula sapinea</i> (Fr.) P. Kumm.]
TRICHOLOMATACEAE		
<i>Clitocybe balansae</i> Speg.	PA	Spegazzini 1891
<i>Collybia auriantella</i> (Speg.) Speg.	CG	Spegazzini 1886 (as <i>Agaricus auriantellus</i> Speg.), Spegazzini 1888
<i>Collybia brasiliensis</i> (Berk. & Mont.) Dennis	CA	Spegazzini 1919 (as <i>Marasmius brasiliensis</i> Berk. & Mont.)
<i>Collybia micheliana</i> (Fr.) Quél.	CA	Spegazzini 1922
<i>Collybia muscigena</i> (Schumach.) P. Karst.	CE	Spegazzini 1919
<i>Collybia nivea</i> (Mont.) Dennis	AP	Gullón 2011 (as <i>Marasmius niveus</i> Mont.)

<i>Melanoleuca balansae</i> (Speg.) Singer	PA	Spegazzini 1886 (as <i>Agaricus balansae</i> Speg.)
<i>Melanoleuca excissa</i> (Fr.) Singer	CA	Spegazzini 1922 [as <i>Tricholoma excissum</i> (Fr.) Quél.]
<i>Melanoleuca phaeopodia</i> (Bull.) Murrill	CA	Spegazzini 1922 [as <i>Collybia phaeopodia</i> (Bull.) Sacc.]
<i>Omphalia liliputiiana</i> Speg.	CA	Spegazzini 1919
<i>Omphalia succinea</i> Sacc.	CE	Spegazzini 1919
<i>Resupinatus alboniger</i> (Pat.) Singer	SP	Campi et al. 2013 (as <i>Resupinatus argentinus</i> Singer)
<i>Resupinatus applicatus</i> (Batsch) Gray	CA, CG	Spegazzini 1886 [as <i>Agaricus applicatus</i> Batsch; <i>Pleurotus applicatus</i> (Batsch) P. Kumm.]
<i>Resupinatus striatulus</i> (Pers.) Murril.	CA	Spegazzini 1919 (as <i>Pleurotus striatulus</i> (Pers.) P. Kumm.)
TUBARIACEAE		
<i>Tubaria trigonophylla</i> (Lasch) Fayod	CA	Spegazzini 1919
POLYPORACEAE		
<i>Lentinus berteroi</i> (Fr.) Fr.	CA, SP, PA, CO	Spegazzini 1883 (<i>Lentinus nigripes</i> Fr.), Spegazzini 1919 (<i>Lentinus nigripes</i> Fr.; and <i>Lentinus tener</i> Klotzsch), Campi et al. 2013
<i>Lentinus fasciatus</i> Berk.	PA	Spegazzini 1888 (as <i>Lentinus fusco-purpureus</i> Kalchbr.)
<i>Lentinus patulus</i> Lév.	PA	Spegazzini 1883 (as <i>Agaricus calyx</i> Speg.), Pegler 1983a [as <i>Lentinus calix</i> (Speg.) Pegler], Pegler 1983b
<i>Lentinus scleropus</i> Speg.	CA, PA	Spegazzini 1883 (as <i>Lentinus paraguayensis</i> Speg.), Pegler 1983b
<i>Lentinus striguellus</i> Berk.	PA	Spegazzini 1883 (as <i>Panus guaraniticus</i> Speg.), Pegler 1983b
<i>Lentinus tigrinus</i> (Bull.) Fr.	SP	Campi et al. 2013
<i>Lentinus velutinus</i> Fr.	CR	Spegazzini 1883 (as <i>Lentinus fallax</i> Speg.), Pegler 1983b
<i>Lentinus villosus</i> Klotzsch	PA	Spegazzini 1883

Species registered by Department: AM: Amambay, AP: Alto Paraná, CA: Capital, CG: Caaguazú, CE: Central, CO: Concepción, CR: Cordillera, GR: Guaira, IP: Itapuá, PA: Paraguari, SP: San Pedro.

Table 2. Number of species registered by Department*

FAMILY	N° species	RECORDS BY DEPARTMENT											N° records
		AM	AP	CA	CG	CE	CO	CR	GR	IP	PA	SP	
<i>Agaricaceae</i>	22	—	6	12	1	4	—	—	—	—	2	1	26
<i>Amanitaceae</i>	1	—	—	1	—	1	—	—	—	—	—	—	2
<i>Bolbitiaceae</i>	3	—	—	3	—	—	—	—	—	—	—	—	3
<i>Entolomataceae</i>	1	—	—	1	—	—	—	—	—	—	—	—	1
<i>Hydnangiaceae</i>	1	—	—	—	—	—	—	1	—	—	—	—	1
<i>Hymenogastraceae</i>	4	—	—	3	—	—	—	—	—	—	1	—	4
<i>Inocybaceae</i>	2	—	—	2	—	—	—	—	—	—	—	—	2
<i>Maramiaceae</i>	13	—	1	6	1	1	—	—	—	—	4	4	17
<i>Mycenaceae</i>	6	1	—	2	1	—	—	—	—	—	2	1	7
<i>Omphalotaceae</i>	6	—	—	2	1	—	—	1	—	—	2	—	6
<i>Physalacriaceae</i>	5	—	1	2	—	—	—	—	—	—	—	3	6
<i>Pleurotaceae</i>	11	—	1	6	—	1	—	1	—	—	4	—	13
<i>Pluteaceae</i>	2	—	—	1	—	—	—	—	—	—	—	1	2
<i>Porotheleaceae</i>	1	—	—	1	—	—	—	—	—	—	—	—	1
<i>Psathyrellaceae</i>	13	—	—	13	—	—	—	—	—	—	—	1	14
<i>Schizophyllaceae</i>	1	—	—	1	—	1	—	—	1	1	—	1	5
<i>Strophariaceae</i>	10	—	1	6	—	1	1	1	—	—	—	—	10
<i>Tricholomataceae</i>	14	—	1	7	2	2	—	—	—	—	2	1	15
<i>Tubariaceae</i>	1	—	—	1	—	—	—	—	—	—	—	—	1
<i>Polyporaceae</i>	8	—	—	2	—	—	1	1	—	—	6	2	12
TOTAL	125	1	11	72	6	11	2	5	1	1	23	15	148

* AM: Amambay, AP: Alto Paraná, CA: Capital, CG: Caaguazú, CE: Central, CO: Concepción, CR: Cordillera, GR: Guaira, IP: Itapúa, PA: Paraguari, SP: San Pedro

CONCLUSION

This work constitutes a first attempt to provide a general overview of the distribution of agaricoid fungi in Paraguay. Of the 125 species known from Paraguay, 103 were cited by Spegazzini, with 26 of them being described and proposed by him as new species. Although this indicates the incomparable value of Spegazzini's work in Paraguay, it also highlights the scarcity of modern studies on the diversity of agaricoid fungi in Paraguay. We can observe that the highest proportion of the species cited from Paraguay are historical species, many of which were found only once, or that were described in genera that have now been re-delimited, and also several names are doubtful and without a modern taxonomic approach.

Another point to consider is the concentration of information in a limited geographical area, such as the Capital department, the most urbanized of all, having large areas and biogeographical zones of Paraguay such as Chaco, Cerrado (Chacoan domain) and Pantanal (Amazonia region) which are practically unexplored in mycological terms.

Since the study of agaricoid mushrooms in Paraguay was resumed in 2011, numerous novelties have been found. Some projects are being developed in environments that were never visited by other mycologists, such as Pantanal and Chaco. However, the research team is young, and access to information and literature on South American species is scarce. Therefore, this work serves as a baseline to which future studies on diversity and taxonomy of the agaricoid fungi of Paraguay can continue to add new information in the progress towards, fully understanding the biodiversity of Paraguay.

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REFERENCES

- Buyck B, Duhem B, Das K, Jayawardena RS, Niveiro N, Pereira OL, Prasher IB, Adhikari S, Albertó EO, Bulgakov TS, Castañeda-Ruiz RF, Hembrom ME, Hyde KD, Lewis D, Michlig A, Nuytinck J, Parihar A, Popoff OF, Ramirez NA, Silva M, Verma RK, Hofstetter V. 2017. Fungal Biodiversity Profiles 21-30. *Cryptogamie Mycologie* 38(1): 101-146. <https://doi.org/10.7872/crym/v38.iss1.2017.101>
- Campi M, De Madriñac B, Flecha A, Ortellado A. 2013. Hongos de la Reserva Natural Laguna Blanca. Salpa S.A.
- Campi M, De Madriñac B, Flecha A. & Niveiro N. 2015. *Leucocoprinus* Pat. (*Agaricaceae-Agaricomycetes*) en el norte de Argentina y Paraguay. *Iheringa Ser. Bot.* 70(2): 309-320.
- Campi M, Miranda B, Maubet Y. 2016. *Coprinus comatus* (O.F. Müll.) Pers. (*Agaricaceae-Basidiomycota*), hongo de interés medicinal y gastronómico, nueva cita para Paraguay. *Steviana* 8(2): 68-74.
- Campi M, Mancuello C, Maubet Y, Niveiro N. 2017a. *Laccaria fraterna* (Cooke & Mass.: Sacc.) Pegler, 1965 (*Agaricales, Basidiomycota*) associated with exotic *Eucalyptus* sp. in northern Argentina and Paraguay. *Checklist* 13(4): 87-90. <https://doi.org/10.15560/13.4.87>
- Campi M, Maubet Y, Miranda B, Armoa J, Cristaldo E. 2017b. Dos nuevas citas de Mycenaceas para el Paraguay: *Xeromphalina tenuipes* & *Filoboletus gracilis*, un interesante agarical poroide. *Steviana* 9(1):16-24.
- De Madriñac B, Campi M, Flecha A, Ortellado A. 2013. Nuevos registros del género *Marasmius* (*Basidiomycota-Marasmiaceae*) para la región de Laguna Blanca, San Pedro-Paraguay. *Reportes de la FACEN* 4(2): 5-10.
- Flecha A, De Madriñac B, Campi M, Ortellado A. 2013. Nuevo registro de *Leucoagaricus lilaceus* Singer (*Agaricomycetes-Agaricaceae*) para Paraguay. *Reportes Científicos de la FACEN* 4(2): 11-14.
- Flecha A, De Madriñac B, Campi M. 2014. El género *Pleurotus* (*Pleurotaceae-Basidiomycota*) en Paraguay. *Steviana* 6: 70-79.
- Gullón M. 2011. Hongos Superiores del Refugio Biológico Tati Yupi. Hernandarias, Paraguay. *Biota* 15: 1-68.
- Guzmán G. Vergeer PP. 1978. Index of taxa in the genus *Psilocybe*. *Mycotaxon* 6: 464-476.
- Hibbett DS, Binder M, Bischoff JF, Blackwell M, Cannon PF, Eriksson O, Huhndorf S, James T, Kirk PM, Lücking R, Lumbsch T, Lutzoni F, Matheny PB, McLaughlin DJ, Powell MJ, Redhead S, Schoch CL, Spatafora JW, Stalpers JA, Vilgalys R, Aime MC, Aptroot A, Bauer R, Begerow D, Benny GL, Castlebury LA, Crous PW, Dai Y-C, Gams W, Geiser DM, Griffith GW, Gueidan C, Hawksworth DL, Hestmark G, Hosaka K, Humber RA, Hyde K, Køljalb U, Kurtzman CP, Larsson K-H, Lichtwardt R, Longcore J, Miadlikowska J, Miller A, Moncalvo J-M, Mozley-Standridge S, Oberwinkler F, Parmasto R, Reeb V, Rogers JD, Roux C, Ryvarden L, Sampaio JP,

- Schuessler A, Sugiyama J, Thorn RG, Tibell L, Untereiner WA, Walker C, Wang A, Weir A, Weiss M, White M, Winka K, Yao Y-J, Zhang N. 2007. A higher-level phylogenetic classification of the Fungi. *Mycol. Res.* 111: 509-547. <https://doi.org/10.1016/j.mycres.2007.03.004>
- Hibbett DS, Bauer R, Binder M, Giachini AJ, Hosaka K, Justo A, Larsson E, Larsson K-H, Lawrey JD, Miettinen O, Nagy LG, Nilsson RH, Weiss M & Thorn RG. 2014. Agaricomycetes. In: McLaughlin DJ, Spatafora JW (Eds.) *The Mycota. Vol 7A. Systematics and evolution.* Springer, Berlin, pp. 373–429. https://doi.org/10.1007/978-3-642-55318-9_14
- Morrone JJ. 2001. Biogeografía de América Latina y el Caribe. M&T Manuales & Tesis SEA, Zaragoza, 148 pp.
- Morrone JJ. 2014. Biogeographical regionalisation of the Neotropical región. *Zootaxa* 3782: 1-110. <https://doi.org/10.11646/zootaxa.3782.1.1>
- Niveiro N, Zuliani P, Ramírez N, Popoff O, Albertó E. 2014. Hongos agaricoides de las Yungas argentinas. Clave de géneros. *Lilloa* 51: 74-86.
- Olson DM, Dinerstein E, Wikramanayake ED, Burgess ND, Powell GVN, Underwood EC, D'Amico JA, Itoua I, Strand HE, Morrison JC, Loucks CJ, Allnutt TF, Ricketts TH, Kura Y, Lamoreux JF, Wettengel WW, Hedao P & Kassem KR. 2001. Terrestrial ecoregions of the world: a new map of life on Earth. *Bioscience* 51(11):933-938. [https://doi.org/10.1641/0006-3568\(2001\)051\[0933:TEOTWA\]2.0.CO;2](https://doi.org/10.1641/0006-3568(2001)051[0933:TEOTWA]2.0.CO;2)
- Pegler D. 1983a. Agaric flora of the Lesser Antilles. *Kew Bulletin, Additional series* 9: 1–668.
- Pegler D. 1983b. The genus *Lentinus*: a world monograph. *Kew Bulletin, Additional series* 10: 1–281.
- Piepenbring M. 2015. Introducción a la micología en los trópicos. St. Paul. APS Press.
- Popoff OF & Wright JE. 1998. Fungi of Paraguay. I. Preliminary check-list of wood-inhabiting Polypores (*Aphyllophorales, Basidiomycota*). *Mycotaxon* 67: 323-340.
- Raithelhuber J. 1980. Descript. fung. nov. vel comb. nov. non val. publ. *Metrodiana*. 9(2):47-48
- Silva-Filho AGS, Teixeira-Silva MA, Cortez VG. 2018. New species, new combination, and notes on *Clitocella* and *Rhodocybe* (*Entolomataceae*) from Paraná state, Brazil. *Darwiniana* 6(1): 58-67.
- Singer R. 1949. The *Agaricales* (mushrooms) in modern taxonomy. *Lilloa* 22: 1-832.
- Singer R. 1950. Type studies on Basidiomycetes IV. *Lilloa* 23: 147-246.
- Singer R. 1970. *Omphalinae* (*Clitocybeae* – *Tricholomataceae* - *Basidiomycetes*). *Flora Neotropica* 3: 1-84.
- Singer R. 1973. The genera *Marasmiellus*, *Crepidotus* and *Simocybe* in the Neotropics. *Beihefte zur Nova Hedwigia* 44: 1-517.
- Singer R. 1976. *Marasmiaceae* (*Basidiomycetes* - *Tricholomataceae*). *Flora Neotropica*, 17: 1-347.
- Singer R. 1986. The *Agaricales* in modern taxonomy. 4th ed. Koenigstein. Koeltz Scientific Books.
- Spegazzini C. 1883. Fungi Guaranitici. Pugillus I. *Anales de la Sociedad Científica de Argentina* 16(5): 242-248, 272-284.
- Spegazzini C. 1886. Fungi Guaranitici. Pugillus I. *Anales de la Sociedad Científica de Argentina* 16(5): 1-176. (Reprint available on <http://www.cybertruffle.org.uk/cyberliber/>)
- Spegazzini C. 1888. Fungi Guaranitici. Pugillus II. *Anales de la Sociedad Científica de Argentina* 26(2): 5-74.
- Spegazzini C. 1891. Fungi Guaranitici. Nonnulli Novi Vel Critici. *Revista Argentina de Historia Natural* 1(3): 1-62.
- Spegazzini C. 1919. Reliquiae Mycologicae e Tropicae et Fungí Costaricensis Nonnulli. *Boletín de la Academia de Ciencias Córdoba* 23(3-4): 365-609.
- Spegazzini C. 1922. Fungi paraguayenses. *Anales del Museo de Historia Natural de Buenos Aires* 31(2): 355-450.
- Zanotti-Cavazzoni J. 1996. Screening de Hongos comestibles que crecen en Paraguay. *Revista de Ciencia y tecnología –Dirección de investigación de la UNA.* 1(2): 85-89.
- Webster J, Weber RWS. 2007. *Introduction to Fungi.* 3rd ed. Cambridge University Press. New York. 841 p. <https://doi.org/10.1017/CBO9780511809026>