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A new species and new records of gasteroid fungi (Basidiomycota) from Central Amazonia, Brazil

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Abstract

A new species, *Geastrum inpaense*, is described morphologically and molecularly. *Geastrum lloydianum, G. schweinitzii, Phallus merulinus* and *Staheliomyces cinctus* are reported here as new records for Central Amazonia. In addition, *Mutinus fleischeri* is reported as a new record for the Americas and *Phallus atrovolvatus*, as a new record for Brazil.

Introduction

In the past few years, studies involving gasteroid fungi have intensified in Brazil, resulting in new species, new occurrence data of known species, and first records of known species for several biomes (Hennings 1904, Capelari & Maziero 1988, Baseia & Milanez 2002, Baseia *et al*. 2003, Baseia & Calonge 2005, 2006, Leite *et al.* 2007, Silva *et al.* 2007, Cortez *et al*. 2008, Fazolino *et al.* 2008, Gurgel *et al.* 2008, Trierveiler-Pereira *et al*. 2009, Fazolino *et al*. 2010, Ottoni *et al*. 2010, Leite *et al*. 2011, Trierveiler-Pereira *et al*. 2011, Cruz *et al.* 2012, Alves & Cortez 2013, Alfredo *et al*. 2012a, 2012b, 2014, Silva *et al*. 2013, Alfredo & Baseia 2014, Cabral *et al.* 2014). The northern region of Brazil harbors most of the megadiverse Amazon rainforest (MMA 2002), the richest assemblage of plant species and the largest pool of tropical carbon on Earth (ter Steege *et al*. 2013). The Amazon River basin drains approximately 6.9 million km^2, about 40% of South America, and about two thirds of it are in Brazil, with the rest in Bolivia, Peru, Ecuador, Colombia, Venezuela, Guyana, Suriname and French Guiana. Approximately 80% of the basin is forested, with both open and dense evergreen (ombrophilous) forests on the uplands (terra firme) and in the major floodplains (várzea). The rest is a mosaic of savannas (cerrado), white-sand scrub (campinas), open swamps (pântanos) and forested stream swamps (igapó), and other less common ecosystems (Veloso *et al*. 1991). Although numerous species of fungi have been found in Amazonia, studies involving gasteroid mycobiota are still emerging, with few species recorded for this region to date.

This study contributes to the expansion of knowledge about gasteroid fungi in Central Amazonia, and is based on both molecular and morphological data. We describe a new species, *Geastrum inpaense sp. nov.*, and register *Mutinus fleischeri* Penzig (1899:137) as a first record for the American continent, *Phallus atrovolvatus* Kreisel & Calonge (2005:6) as a new record for Brazil and *Geastrum lloydianum* Rick (1906:27), *G. schweinitzii* (Berk. & M.A. Curtis) Zeller (1948:649), *Phallus merulinus* (Berk.) Cooke (1882:57) and *Staheliomyces cinctus* E. Fischer (1921:142) as new records for Central Amazonia.

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TABLE 1. Genbank accession numbers for the *Geastrum* and *Myriostoma* species used in this phylogenetic analysis to position *G. inpaense* within the genus. Sequences generated in this study are in bold.

Species	Herbarium Voucher	ITS	LSU	atp6
Geastrum albonigrum	UFRN-Fungos 1989	**KJ127026**	**KJ127019**	**KJ127015**
Geastrum coronatum	S:F-34813	JN845092	JN845210	JN845335
Geastrum entomophilum	UFRN-Fungos 1233	**KJ127032**	**KJ127022**	
Geastrum fimbriatum	L:837179	JN845093	JN845211	JN845336
Geastrum fimbriatum	TENN:61511	JN845094	JN845212	JN845337
Geastrum hirsutum	UFRN-Fungos 1214	**KJ127029**	JQ683662	JQ683670
Geastrum hungaricum	TNS:TKG-GE-90502	JN845096	JN845214	JN845339
Geastrum inpaense	INPA239990	**KJ127023**	**KJ127017**	**KJ127013**
Geastrum inpaense	INPA255834	**KJ127024**	**KJ127018**	**KJ127014**
Geastrum inpaense	INPA240011	**KJ127025**		
Geastrum javanicum	UFRN-Fungos 1215	**KJ127031**	JQ683663	**KJ127016**
Geastrum javanicum	TNS:TKG-GE-90902	JN845100	JN845218	JN845342
Geastrum minimum	K:154623	JN845105	JN845223	JN845347
Geastrum mirabile	TNS:KH-JPN10-711	JN845108	JN845226	JN845350
Geastrum mirabile	TNS:KH-JPN10-675	JN845106	JN845224	JN845348
Geastrum morganii	UFRN-Fungos 1794	**KJ127028**	**KJ127020**	
Geastrum parvistriatum	JCZ 285	JN943161	JN939571	
Geastrum pectinatum	S:F-46074	JN845116	JN845234	JN845358
Geastrum quadrifidum	TNS:TKG-GE-91002	JN845118	JN845236	JN845360
Geastrum saccatum	TENN:61141	JN845120	JN845238	JN845362
Geastrum schweinitzii	UFRN-Fungos 1741	**KJ127030**	JQ683664	JQ683671
Geastrum sessile	TENN:39858	JN845123	JN845241	JN845365
Geastrum setiferum	UFRN-Fungos 803	**KJ127027**	**KJ127021**	
Geastrum striatum	S:F-46048	JN845124	JN845242	JN845366
Geastrum triplex	TENN:61723	JN845168	JN845292	JN845399
Geastrum velutinum	PDD:REB2886	JN845173	JN845297	JN845404
Myriostoma coliforme	TNS:TKG-GE-50801	JN845203	JN845328	
Myriostoma coliforme	QCNE:M3353		JN845327	JN845434

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