



The distribution of polypore fungi in endemism centres in Brazilian Amazonia



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ABSTRACT

Amazonia is covered by the largest, best-preserved tropical forest in the world, almost 50% of which is in Brazil. The Amazonian region has the highest biodiversity of the planet, distributed, at least for the fauna and flora communities, in eight distinct centres of endemism. However, there is little information about the fungal distribution in the region. In this study, the abundance, species richness and composition of species of poroid fungi were investigated in three Amazonian centres of endemism in order to test the hypothesis whether these centres also have distinct fungal communities. One hundred and twenty four unit samples in three centres of endemism were visited from 2006 to 2011, resulting in 2303 collections representing 153 species of poroid fungi. The fungal communities did not form distinct groups in relation to the centres of endemism when the Analysis of Similarity (ANOSIM) was used and the hypothesis was rejected.

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1. Introduction

Amazonia is a unique territory spread through nine countries of South America (Brazil, Guiana, Suriname, French Guiana, Venezuela, Peru, Bolivia, Ecuador and Colombia), covering an area of around 6 million km², almost 50% of which is in Brazil. It is cut by the largest fluvial system in the world, which forms the major fresh water mass of the planet, and is covered by the largest, best-preserved pluvial tropical forest in the world, which represents 53% of what is left of the tropical forest on the planet (Junk, 1997; Fonseca and Silva, 2005). The Amazonian region has the highest biodiversity of the planet, with the highest number of plant and animal species in absolute values (gamma diversity) as well as the

number of species that live in the same area (alpha diversity). At least for animal and plant communities, Amazonia is not homogeneous. It is a mosaic of eight distinct areas of endemism (Napo, Imeri, Guiana, Inambari, Rondônia, Tapajós, Xingu and Belém) separated by the largest rivers, each with their own evolutionary relationships and biotic assemblages (Nelson and Ferreira, 1990; Silva et al., 2005). Of this biodiversity and its distribution, however, just a small fraction is known, especially concerning fungi.

The polypores or poroid fungi (Basidiomycota, Agaricomycetes) are macroscopic fungi known as bracket fungi. They are characterised by the production of holobasidia, i.e. basidia without septa, in a well-defined, generally tubular hymenium, being the hymenial surface, thus, usually poroid. They represent an assembly with little evolutionary relation regarding the poroid condition since it seems to have developed many independent times during basidiomycete evolution (Hibbet and Donoghue, 1995).

Species of poroid fungi are mostly saprobes on dead wood and are considered the major wood decomposers (Alexopoulos et al.,

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1996; Deacon, 2006). Therefore, they play a crucial role in nutrient cycling, releasing among other things carbon originally removed from the atmosphere by autotrophic organisms in arboreous and shrubby ecosystems (Alexopoulos et al., 1996; Deacon, 2006). Despite their importance, little is known about factors affecting polypore distribution in the Neotropics, being the characteristics of the substratum (e.g., quality and quantity of wood) and precipitation the most evident factors at a local level (Gibertoni et al., 2007; Gibertoni, 2008; Lindblad, 2001a; Núñez, 1996; Schmit, 2005). At a large scale, polypore distribution is related to latitude, altitude, precipitation and habitat diversity (Lodge and Cantrell, 1995).

The present work is, thus, an effort to assess the distribution patterns of poroid fungi by comparing the richness, abundance and composition of the species among five areas of “terra firme” ecosystem in Brazilian Amazonia located in three different endemism centres. The differences found in polypore diversity will support the hypothesis that, as reported for animals and plants, the endemism centres also support distinct polypore communities.

2. Materials and methods

2.1. Site description and data collection

Among the forest types in Amazonia, the “terra firme” forests represent 70% of the vegetation of the region and they are found in non-flooded areas (Pires, 1973). The major physiognomy is characterised by vegetation with trees higher than 35 m, dense canopy, open understory, and high biomass. The main tree species are *Dinizia excelsa* (Fabaceae), *Manilkara huberi* (Sapotaceae) and *Vouacapoua americana* (Fabaceae). In the understory, the lianas are more abundant and among the palms, *Oenocarpus bataua* is more frequent (Amaral et al., 2009).

In this study, five areas of “terra firme” in Brazilian Amazonia located in three States in three endemism centres (Table 1) were selected. A total of 124 transects (sampling units) were visited, 55 during the rainy and 69 during the dry season (Table 1).

The basidiomata of each morphospecies found in the transects were collected, placed in paper bags, dried and then identified

according to the usual methodology for the group (Fidalgo and Bononi, 1989; Gilbertson and Ryvarden, 1986, 1987; Larsen and Cobb-Poule, 1990; Núñez and Ryvarden, 1995, 2000, 2001; Ryvarden, 1991, 2004, 2005; Ryvarden and Johansen, 1980; Stalpers, 1993, 1996; Teixeira, 1995; Watling, 1969). After identification, the specimens were incorporated in the herbaria HFSL (Faculdade São Lucas), MG (Museu Paraense Emílio Goledi), O (University of Oslo) and URM (Departamento de Micologia, Universidade Federal de Pernambuco).

2.2. Statistical analyses

A species accumulation curve and, since most species were rare, a curve for estimator Jackknife 1 were generated for the total sampling and for each area using EstimateS 9.1.0. The Analysis of Similarities (ANOSIM), using Bray–Curtis, tested if richness and abundance among endemism areas presented significant differences considering polypore associations (Clarke and Warwick, 1994). The permutation number to estimate probabilities was 10,000. The Similarity Percentage test (SIMPER) was used to identify the species primarily providing the discrimination between two observed sample clusters among transects and endemism areas. Additionally, a Venn diagram was generated with Venny (Oliveros, 2007). The χ^2 test evaluated if the occurrence of polypores was different between collecting season (dry and rainy) (Krebs, 1989). Unless otherwise indicated, 0.05 was used as significance level for statistical analysis.

3. Results and discussion

From a total of 124 visits (sampling units) to the areas, 2303 collections representing 153 species of polypores were documented (Supplementary Material). Of these species, 15 (9.8%) are reported only for Brazil (13 of them only for Brazilian Amazonia): *Amauroderma albotipitatum* ined., *Amauroderma floriforme* ined., *Amauroderma laccatostipitatum* ined., *Amauroderma lemoniforme* ined., *Amauroderma minimum* ined., *Amauroderma ovisporum* ined., *Amauroderma paraelegantissimum* ined., *Amauroderma subsessile*

Table 1
Selected areas, location, size of the transects, and number and months of visits to the areas. Floresta Nacional do Amapá (FNA), Estação Científica Ferreira Penna (EFCP), Site of the Programa em Pesquisa em Biodiversidade da Amazônia Oriental (PPBio), Estação Ecológica de Cuniã (EEC), Parque Natural Municipal de Porto Velho (PNM), Rainy season (●), Dry season (■).

Area	State/endemism area	Coordinates	Altitude	Transects	Date (number of transects visited in that month)	Number of sampling units
FNA	Amapá (AP)/Guiana (Gn)	00°57'49.8"N 51° 36' 31.3"W	100 m	10 × 250 m	● July 2009 (10) ■ December 2009 (10) ■ June 2010 (10) ■ September 2011 (10 ^b)	40
EFCP	Pará (PA)/Xingu (Xg)	1°42'24.09"S 51° 27'34.35"W	62 m	20 × 1000 m	■ July 2006 (6) ■ March 2007 (6) August 2007 (6) ● February 2008 (6)	24
^a PPBio	Pará (PA)/Xingu (Xg)	01°57'36"S 51° 36'55"W	47 m	4 × 800 m	■ December 2009 (10) ● February 2009 (10) ■ June 2009 (18)	38
ESEC	Rondônia (RO)/Rondônia (RO)	8°10'55"S 63°32'13"W	70 m	20 × 1000 m	■ January 2007 (1), 2008 (1), 2009 (1) ■ July 2007 (1) ● February 2009 (1), 2010 (1), 2011 (1) ■ June 2009 (1), 2011 (1) ■ August 2008 (1), 2010 (1)	11
PNM	Rondônia (RO)/Rondônia (RO)	8°40'18"S 63°51'47"W	83 m	20 × 1000 m	● January 2007 (1), 2009 (1) ■ July 2007 (1), 2008 (1) ● February 2008 (1), 2009 (1), 2010 (1), 2011 (1) ■ June 2009 (1), 2011 (1) ■ August 2010 (1)	11

^a Located in the Floresta Nacional de Caxiuanã (PA).

^b Different from the other 30 transects.

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