ECOLOGICAL ASPECTS OF POROID FUNGI (*HYMENOCHAETALES* AND *POLYPORALES*) IN AREAS OF THE AMAZONIAN FOREST, PORTO VELHO, RONDÔNIA, BRAZIL.

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INTRODUCTION

Species of poroid fungi play a particularly important role in various ecosystems, due to their ability of degradation of wood, promoting the nutrient cycling in arboreous environments. Despite the importance of this group of organisms, no studies on their ecological aspects have been previously developed in the Amazonia and little is known about these fungi in tropical forests in the Neotropics.

The composition and distribution of poroid fungi are related to various factors such as the influence of altitude, humidity and rainfall, as observed in studies in areas of tropical forest in Costa Rica (Núñez, 1996; Lindblad, 2000). The occurrence of fungi in primary and secondary forests, and the relationship of such occurrence to the size and level of decomposition of the substrate were also studied (Lindblad, 2001a - b).

The specificity of poroid fungi not been proven in researches about the fungal relationship to the host substrate in tropical forests in Panama, as confirmed Gilbert & Sousa (2002) and Gilbert *et al.*, (2002, 2008). In the same area, Ferrer & Gilbert (2003) studied the species richness related to the decomposition of wood in the three most common plant species in this region.

The relationship between the preference of the poroid fungi to living or dead host substrate and to their size was observed by Urcelay & Robledo (2004) in studies in forests in the Argentinean Andes. Gibertoni *et al.*, (2007) studied the effect of collection period, growth habit, light intensity, stage of decomposition of the substrate, and interaction between these factors on the diversity of poroid fungi and the factors that influence the similarity of 13 reserves in Northeast Brazil.

OBJECTIVES

This study aimed to investigate the diversity of poroid fungi in two Amazon forest reserves, Porto Velho, Rondônia, Brazil, according to seasonality and parameters of size and level of decomposition of the substrate.

MATERIAL AND METHODS

The study area

The Amazonia covers an area of 4.196,943 km ^{2} out of which approximately 50% belongs to Brazil (Capobianco *et al.*, 001), in the states of Acre, Amapá, Amazonas, Pará, Roraima, Rondônia, half of Mato Grosso (54%), and part of Maranhão (34%) and Tocantins (9%) (IBGE 2003).

The state of Rondônia has an area of 237.576 km ^{2}, nearly 98.8% covered by the Amazonian forest, and plays a particularly important role in biodiversity conservation because of its several reserves. The areas of study are located in the city of Porto Velho (08º45’ S and 63º54’ W), capital of the state: Estação Ecológica de Cuniã - ESEC (08º04’ S and 63º31’ W) and Parque Natural Municipal de Porto Velho - PNM (08º45’ S and 63º54’ W). The former has an area of 53.221.27 ha, while the latter has an area of 390.82 ha. Both areas are mostly covered by open ombrophilous forest and transition forest with savannahs.

Collection and analysis of data

In two areas of study, three transects of 20 x 1.000 m were delimited in the open ombrophilous forest ("terra firme"). All trunks wider than 10 cm and longer than 2 m were marked in PNM, and then the area and volume were calculated. The stage of decomposition of the substrate was evaluated according to a scale from 1 to 3 defined by Nordén & Paltto (2001), modified from Renvall (1995): in stage 1 the timber is rigid and a knife penetrates no more than 2 mm with a grip; in stage 2 the knife easily penetrates 2 - 20 mm with a grip and 3 wood is fragile and knife penetrates easily through the wood. The analysis of multiple tables of x2 (chi - square) was used to assess the diversity of poroid fungi according to seasonal variation and the level of decomposition of the substrate (Gibertoni *et al.*, 007). All poroid fungi found in the substrate were collected using a knife and put in paper bags. They were subsequently placed in oven at 45 - 50 ºC for drying, between two and seven days (Fidalgo & Bononi, 1989). The specimens were examined macro - and microscopically. Microscopical observations were made from slide preparations with 5% KOH, stained with 1% of aqueous phloxine, and Melzer's reagent (Ryvarden, 1991). Colour designation followed Watling (1969).The specimens were deposited in the Herbarium Dr. Ary Tupinambá Penna Pinheiro (HFSL) Faculdade São Lucas Ltda, Rondônia, and in the Herbarium Padre Camille Torrend (URM) of the Universidade Federal de Pernambuco.

RESULTS AND DISCUSSION

In each area of study four field trips were undertaken, and the three transects were surveyed. The trips were held twice in the rainy season (February 2007 and 2008) and two in dry season (July 2007 and 2008), totalizing 24 samples. A total of 61 species of poroid fungi were collected, four of them new to science, while seven are new records for Brazil, 12 for the Amazonia region and 34 to Rondônia, and 67 trunks were labeled in PNM.

3.1 - Diversity of poroid fungi according to the seasonality

One hundred and thirty - four specimens of poroid fungi were recorded during the dry season, representing 19 species (31.15%); one hundred and twenty - six specimens were recorded in rainy season, and also represented 19 (31.15%) species. There was no significant difference in total species and specimens collected in the two seasons. Twenty - three species (37.70%) were observed during both dry and in rainy season. Lindblad (2001a - b) found larger number of species during the rainy season in three types of forests in Costa Rica.

The two areas of study, although close and with the same ecosystem, have several exclusive species, 22 to PNM and 12 ESEC. The analysis of similarity (ANOSIM) showed that there is difference in the composition of species between the two areas (RGlobal = 0526, the number of permutations = 35, p = 0.029), apparently due to the time of collection. However, this observation could not be statistically proved (RGlobal = 0359, the number of permutations = 35, p = 0.086).

The composition and distribution of poroid fungi are related to various factors such as the influence of altitude, humidity and the influence of rainfall, as observed in studies of forest in Costa Rica (Núñez, 1996; Lindblad, 2000). The diversity found is comparable with those observed by some authors in neotropical forests. Eighty - six and 69 species were collected respectively in three and two types of forest in Costa Rica, where they were nine and four plots were surveyed in four field trips (Lindblad, 2001a - b). Fourty - three species were collected in five transects (500 x 10 m) in one field trip in a forest in Panama (Gilbert *et al.*, 002) and 107 species of polyporoid were found in 13 reserves of the Atlantic Forest in Brazil, collected in transects of different sizes (Gibertoni *et al.*, 007), data that are relatively similar to those found in this study. Despite the diversity of poroid fungi observed in this study be considered high, the species cumulative curve showed no tendency to stability, as observed by Lindblad (2001a - b) and Gilbert *et al.*, (2002), suggesting more samples to be done to a better assessment of the total species richness.

According to the result obtained with the index of Bray - Curtis similarity (Krebs, 1989), there was similarity of 0.57 between the areas of study, a value considered high. Lindblad (2001a) considered as high values of similarity above 0.60 in areas of primary and secondary tropical forest in Costa Rica while Gibertoni *et al.*, (2007) found similarities higher than 0.40 between 51 pairs of areas, for a total of 91 possible pairs, when surveying 13 reserves in the Atlantic Rain Forest in Northeast Brazil. In this case, the similarity is directly related to the distance between areas, therefore tending to decrease with the increase of the distance between them.

3.2 - Diversity of poroid fungi according to the substrate

Of the analysis of the 67 labled trunks in the PNM, it was observed that the number of occurrences of species was related to the quality (level of decomposition) and quantity (radius, diameter, length, area and volume) of wood.

The ocurrence were observed more than expected on stage for decomposition 2 and lower than expected at the stage of decomposition 1 ($x2 = 50.45$, df = 2, $p < 0.01$). The same pattern was observed for the number of species, but it was not statistically significant ($x2 = 4{:}35$, df = 2, $p > 0.01$). Similar data on the level of stage of decomposition were observed in studies in boreal forests in Sweden (Bader *et al.*, 1995) and Norway (Lindblad 1998). The preference for intermediate to advanced stage of decomposition was observed by Gibertoni *et al.*, (2007), differing from that of Lindblad (2001a) in tropical forests of Costa Rica, where there was a preference for substrate in the initial stage of degradation or the poroid fungi showed no preference for degree of degradation.

Number of occurrences and number of species were observed more than expected in radius class 8 (0.475 to 0.51 m) [$x2 = 20{:}09$, df = 8, $p < 0.01$, using a = 0.01 to avoid errors of type I according to the Bonferroni method (Zar, 1996)]. Similar data on the preference for substrates with larger diameters were observed in studies in Costa Rica (Lindblad, 2001), while Urcerlay & Robledo (2004) observed the occurrence of some species in decomposed wood of large (49.1 - 30.7 - 29.3 cm) and intermediate (13.8 - 11.1 cm) diameter and less frequently in smaller diameters in forests of the Argentinean Andes. The preference for larger diameter substrates may be related to the amount of nutrients in these substrates.

CONCLUSION

Researches related to ecological aspects of the fungi studied are missing in Amazonian forest, which makes difficult the comparison of the results. In general, it can be said that the two areas of study, although quite similar, close and with the same ecosystem, have several exclusive and/or new species, suggesting that both areas are of great importance for the conservation of these fungi in Amazonia.

REFERENCES

Bader, P., Jansson, S. & Jonsson, B.G. 1995. Wood - inhabiting and substratum decline in selective logged boreal spruce forests. *Biol. Conserv.* , 72: 355 - 362.

Capobianco, J.P.R., Veríssimo, A., Moreira, A., Sawyer, D., Santos, I.P. & Pinto, L.P. 2001. *Biodiversidade na Amazônia brasileira: avaliação e ações prioritárias para a conservação, uso sustentável e repartição de benefícios.* São Paulo, Estação Liberdade.

Ferrer, A. & Gilbert, G.S. 2003. Effect of tree host species on fungal community composition in a tropical rain forest in Panama. *Diversity and Distributions*, 9: 455 - 468.

Fidalgo, O. & Bononi, V.L.R. 1989. Fungos e liquens macroscópicos. *In*: Fidalgo O, Bononi VLR. (coords.). *Técnicas de coleta, preservação e herborização de material botânico.* São Paulo, Instituto de Botânica, p. 24 - 26.

Gibertoni, T.B., Santos, P.J.P. & Cavalcanti, M.A.Q. 2007. Ecological aspects of *Aphyllophorales* in the Atlantic rain forest in northeast Brazil. *Fung. Diversity* 25: 49 - 67.

Gilbert, G.S. & Sousa, W.P. 2002. Host specialization among wood - decay polypore fungi in a Caribbean mangrove forest. *Biotropica*, 34(3): 396 - 404.

Gilbert, G.S., Ferrer, A. & Carranza, J. 2002. Polypore fungal diversity and host density in a moist tropical forest. *Biodiversity Conserv.* , 11: 947 - 957.

Gilbert, G.S., Gorospe, J. & Ryvarden, L. 2008. Host and habitat preferences of polypore fungi in Micronesian tropical flooded forests. *Mycol. Res.*, 112: 674 - 680.

IBGE. 2003. *Mapa de Biomas.* Disponível em: http://www.ibge.gov.br/home/presidencia/noticias/.

Krebs, C.J. 1989. *Ecological Methodology.* New York, Harper Collins Publishers, 654p.

Lindblad, I. 1998. Wood - inhabiting fungi on fallen logs of Norway spruce: relations to forest management and substrate quality. *Nord. J. Bot.* , 18: 243 - 255.

Lindblad, I. 2000. Host specificity of some wood - inhabiting fungi in a tropical forest. *Mycologia*, 92: 399 - 405.

Lindblad, I. 2001a. Wood - inhabiting fungi in primary and secondary seasonally dry tropical forest, Costa Rica. *In*: Lindblad, I. *Diversity and distribution of wood - inhabiting* Basidiomycetes *on decomposing logs - examples from tropical and boreal forests.* Doctoral Thesis, University of Oslo, p.1 - 23.

Lindblad, I. 2001b. Diversity of poroid and some corticioid wood - inhabiting fungi along the rainfall gradient in tropical forests, Costa Rica. *J. Trop. Ecol.* , 17: 353 - 369.

Nordén, B. & Paltto, H. 2001. Wood - decay fungi in hazel wood: species richness correlated to stand age and dead wood features. *Biol. Conserv.* , 101: 1 - 8.

Núñez, M. 1996. Fructification of *Polyporaceae s.l.* (*Basidiomycotina*) along a gradient of altitude and humidity in the Guanacaste Conservation Area (Costa Rica). *J. Trop. Ecol.* , 12: 893 - 898.

Renvall, P. 1995. Community structure and dynamics of wood - rotting *Basidiomycetes* on decomposing conifer trunks in northern Finland. *Karstenia*, 35: 1 - 51.

Ryvarden, L. 1991. *Genera of Polypores - Nomenclature and Taxonomy.* Oslo, Fungiflora, 365 p.

Urcelay, C. & Robledo, G. 2004. Community structure of polypores (*Basidiomycota*) in Andean alder wood in Argentina: Functional groups among wood - decay fungi? *Austral Ecology*, 29: 471 - 476.

Watling, R. 1969. *Colour identificantion chart.* Edinburgh, Her Majesty's Stationery Office.

Zar, J.H. 1996. *Biostatistical analysis.* New Jersey, Prentice - Hall International Editions.