



ECOLOGICAL ASPECTS OF POROID *HYMENOGYSALES* (*BASIDIOMYCOTA*, *FUNGI*) IN ATLANTIC FOREST REMAINS OF THE STATE OF PERNAMBUCO, NORTHEAST BRAZIL.

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INTRODUCTION

The order *Hymenochaetales* groups species of fungi with smooth, lamellate or mainly poroid hymenial surface. The majority of species inhabit dead wood, but some species may be found on soil. Recently it was confirmed that some species of *Coltricia* and *Coltriciella* are capable to establish ectomycorrhizal associations (Tadersoo *et al.*, 007).

These fungi occur in almost all ecosystems of the world, where play an important role due to their capability to decay dead wood. With other species previously classified in the order *Aphyllphorales* they are among the few organisms able to decompose lignin, playing an essential role in the nutrient cycle (Alexopoulos *et al.*, 996).

There are few ecological studies about this group of fungi, and all of them treat *Hymenochaetales* species with other species of *Aphyllphorales* in their analysis. Some of the biological features of these organisms raise difficulties to carry out ecological studies. They have an inconspicuous somatic phase and there are problems to isolate them directly from the environment and to identify the species based only on the cultures.

Despite these problems there is already some knowledge about the ecology of *Aphyllphorales*. The endemism rate of these fungi seems to be low, but more studies are necessary since most authors believe that only about 5 - 7 % of the real diversity of fungi is already known (Hawksworth, 2001; Mueller *et al.*, 006).

It is also known that some features of the substrate influence the richness and diversity of species and the community composition (Urcelay & Robledo, 2004). There is an agreement that the substrate size is an important factor; however different studies found both positive and negative relation to the substrate length, diameter or volume (Lindblad, 2001). The amount of wood is negatively related with species richness, and the reason of this may be the covering of greater variation of microclimates and edaphic conditions by the high quantity of dead wood (Nordén & Paltto, 2001).

The decay level of the substrate also influences the wood-inhabiting fungi community. However the results are contradictory. While Nordén & Paltto (2001) found a preference of fungi for advanced levels of decay in boreal forests, Lindblad (2001) found preference for intermediate levels in a same kind of forest. For tropical forests, this same author did not find a relation between these factors, while Gibertoni *et al.*, (2007) found preference for intermediate levels of decay.

OBJECTIVES

The objective of this work is to investigate the diversity of poroid *Hymenochaetales* in four Atlantic forest remains, analyzing the similarities between areas and parameters of substrate size and decomposition level.

MATERIAL AND METHODS

The study area

This study was carried in four Atlantic Forest remains located in the state of Pernambuco, Northeast Brazil. Two of them are low land areas near to the Atlantic Ocean coast, known as Pernambuco Centre, and two are Caatinga forest enclaves, also termed “brejos de altitude” (Santos *et al.*, 007).

One of the Caatinga forest enclaves is the João de Vasconcelos Sobrinho Ecological Park, locally known as “Brejo dos Cavalos” (BC). It is located in Caruaru municipality between 800 and 950 m above the sea level and has an area of 90.41 km². This Park is one of the conservation units on the Borborema Plateau (Locatelli *et al.*, 004).

The other Caatinga forest enclave studied is located in São Vicente Ferrer municipality and is locally known as “Siriji” or “Mata do Estado” (ME). It has an area of 41.40 km² and is located between 512 and 552 m above sea level (Santos

& Tabarelli, 2004). As “Brejo dos Cavalos”, this area also is located on the Borborema Plateau.

The Dois Irmãos State Park (DI) is a low land area located in Recife municipality and has an area of 374 ha. Although this area is located near to the Recife’s urban zone, it is in an advanced stage of regeneration.

The other low land area studied is the Carnijó Ecological Reserve (CA), a private reserve located in Moreno municipality, around 28 km far from Recife. Despite the distance from the coast, it is located on the sea level, and has an area of 126.5 ha.

Collection and analysis of data

Each studied area was visited eight times from June 2008 to March 2009. One transect of 20 x 500 m was delimited in each area of study. All logs wider than 10 cm and longer than 2 m were labelled, and their length and diameter were measured to calculate the volume. 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 χ^2 (chi - square) was used to assess the diversity of poroid fungi according to substrate size and decomposition level (Gibertoni *et al.*, 2007).

All poroid specimens of *Hymenochaetales* found were collected using a knife and put in a paper bag. They were subsequently placed in oven at 45 - 50 °C for drying, between two and seven days (Fidalgo & Bononi, 1989). The specimens were examined macro - and microscopically and the identification of the species was carried out based on specialized literature. Basidiomata were cut by hand for microscopical studies and sections were mounted in 5% KOH with 1% aqueous phloxine solution or Melzer’s reagent (Ryvarden, 1991). The specimens are kept in the herbarium URM and O (Holmgren & Holmgren, 1998).

RESULTS AND DISCUSSION

A total of 220 specimens of poroid *Hymenochaetales* were collected during this study, corresponding to 20 species. One of them is a new species to science, one is a new record for Brazil, two are new records to the Northeast region of Brazil and five are new records to the state of Pernambuco. A total of 294 logs were labelled in the four studied areas (DI = 93; CA = 60; BC = 64; ME = 77).

Among those species nine were collected on labelled logs and five on soil and/or on roots or litter. Six species had dead wood as substrate, but were not found on labelled logs. Only two specimens, *Cyclomyces* cf. *iodinus* (Mont.) Pat. and *Phylloporia chrysitae* (Berk.) Ryvarden, were found in living trees.

Diversity of poroid *Hymenochaetales* species and similarity among the studied areas

The Dois Irmãos State Park has the highest richness of poroid *Hymenochaetales* species among the studied areas with 12 species. Six species were found in each of the Caatinga forest enclaves and only four species were found in Carnijó Ecological Reserve.

Although the four areas share similar vegetation, DI has the highest number of logs, which could explain the highest number of species found. In the same way, CA has the lowest number of species and logs. The conservation degrees of the areas positively affect the diversity of poroid fungi, with more species being collected in less disturbed areas (Gibertoni *et al.*, 2007), which can explain the higher diversity in DI (the less disturbed area) and the lower diversity in CA (the most disturbed area). This was also observed for wood - inhabiting fungi by Bader *et al.*, (1995), and Lindblad (1998, 2001).

The highest similarities values were found among CA and BC (0.6) and BC and ME (0.5), which are considered high values for poroid fungi (Gibertoni *et al.*, 2007). Other similarities values were below 0.5 (DI and CA = 0.25; DI and BC = 0.22; DI and ME = 0.11; CA and ME = 0.2). The high similarity between the two Caatinga forest enclaves was expected, since they have similar vegetation features. The highest similarity between CA and BC might be explained by the low number of species found in the former. For this reason, it is not possible trace a similarity pattern among low land and Caatinga forest enclaves’ areas.

Diversity of poroid *Hymenochaetales* according to the substrate

It was observed that the number of occurrences of species was related to the quantity of wood (volume of the logs). It also has a disposition to be related to the quality of the wood (level of decomposition).

Of the 15 volume classes, the number of occurrences was observed more than expected on class 14 ($\chi^2 = 30.06$, $df = 14$, $p < 0.01$), with logs between 0.84 and 1.82 cm³. The same pattern was observed on class 15 ($\chi^2 = 4.86$, $df = 14$, $p < 0.01$). These data show a preference by logs with more quantity of wood. The class 15, which has the largest logs, had a low number of occurrences of poroid fungi (four) probably due to the low number of logs in this class (eight). Lindblad (2001) had similar results in Costa Rica for substrates with larger diameters, which is positively related to volume, and Urcelay & Robledo (2004) observed a higher occurrence of species in logs of large and intermediated diameter in Argentinean Andean Forests.

There was a higher number of occurrences on the level of decomposition 3 than the other levels ($\chi^2 = 5.98$, $df = 2$, $p < 0.01$) and a higher number of species on the level 1 ($\chi^2 = 3.82$, $df = 2$, $p < 0.01$), but these values were not statistically significant. However, we suppose this pattern may occur because logs have higher quantities of nutrients in the initial levels of decomposition, and a higher number of species are capable to colonize the wood. Later, in advanced levels of decay, a lower number of more specialized species are capable to colonize the wood, and then produce a higher number of fruit - bodies. The results found in this work are similar to those of Gibertoni *et al.*, (2007) for other Atlantic Forest areas, who found a preference of wood - inhabiting fungi to colonize decomposed to more decomposed substrates. Lindblad (2001) found a slightly tendency of the same fungi for initial stages of decomposition in Costa Rica forests, which is similar to results for boreal forests (Bader *et al.*, 1995; Lindblad, 1998). As the results related on literature are divergent, it is not possible

to trace a pattern of preference for level of decomposition for tropical forests.

CONCLUSION

There are few studies about poroid fungi ecology in the tropics, which makes difficult the comparison of our results. However the number of new data on taxonomy and distribution found in this work shows how important is to preserve this areas and developing researches there. A deeper study in the same areas considering all poroid fungi is necessary to assert if the substrate size and quality affect the diversity of these organisms. Then also will be possible to know if the study of only a group, i.e. *Hymenochaetales*, is enough to access the ecological data about poroid fungi.

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