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Community Structure of Epiphytic Liverworts of Pico Laurel Forest

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BACKGROUND

The evergreen forests of the Azores are complex ecosystems, owing to their particular climatic conditions (humidity, temperature) and high diversity of microhabitats available for colonization. Trees are important substrate for bryophytes (Fig. 1), these phorophytes bear abundant colonies of bryophytes, which represent an important part of the local ecosystem. The forest fragments between 600 m and 1000 m in Pico Island are some of the best Azorean Laurisilva representatives and their study allow us to respond to ecological questions, using bryophytes as model organisms namely, nestedness, richness and turnover.

Figure 1

OBJECTIVES

The main purpose of this study is to describe and analyze the epiphytic liverworts communities at the mid-elevation gradient of native forest in Pico Island and to answer the following questions in community ecology:

1. Are the liverworts' communities of *laurisilva* forest **similar** among plots in the 3 studied mid-elevations?
2. Do those communities present a **nested** structure?
3. What is the relative contribution of **species replacement** and **species richness** to **Beta (β) diversity** in the bryophytes species?

METHODOLOGY

Field Work in the *laurisilva* forest of Pico Island

- 2 plots of 10 m X 10 m at three elevational steps (Ah-Peng *et al.*, 2012):
  - 600 m (Chão Verde), 800 m (Caiado) and 1000 m (Caveiro);
  - 3 quadrats of 2 m X 2 m randomly chosen in each plot;
    - 9 microplots of 5 cm X 10 cm of bryophytes collected in three tree trunks of the most abundant native forest species, at 3 different heights between 0 – 2m.

Lab Work

Bryophytes were identified in the laboratory, and their presence, abundance and sociability were estimated.

Data Analysis

Data sets were analyzed using SDR 4.0 (2006), CAP 4.0 (2007) and NODF 2.0 (2012).

RESULTS

162 microplots were collected on 7 different native phorophytes, registering 28 genera and 50 liverwort' species (41,3% of all liverworts registered to Pico Gabriel *et al.*, 2010).

Based on Jackknife estimator, which predicts a maximum of 56 species, a completeness of 90%, was achieved, with the curve almost saturating (Fig. 2).

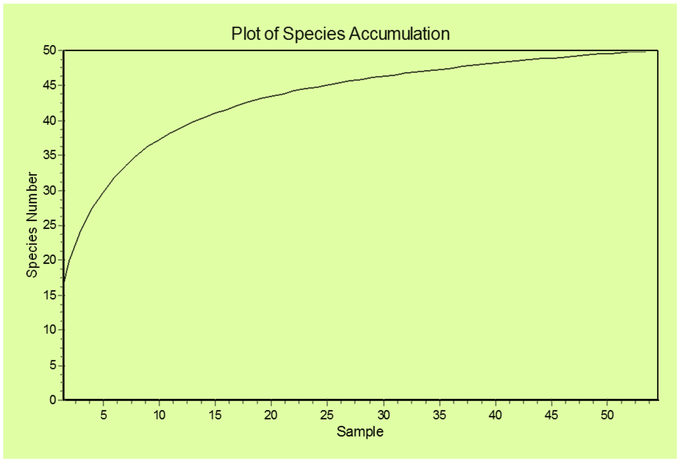

Figure 2. Species accumulation curve for the samples collected in Pico Laurel Forest.

Laurisilva forest

Similarity among the three elevational levels

The epiphytic liverwort' communities are almost equally distributed among these three elevational levels (Fig.3).

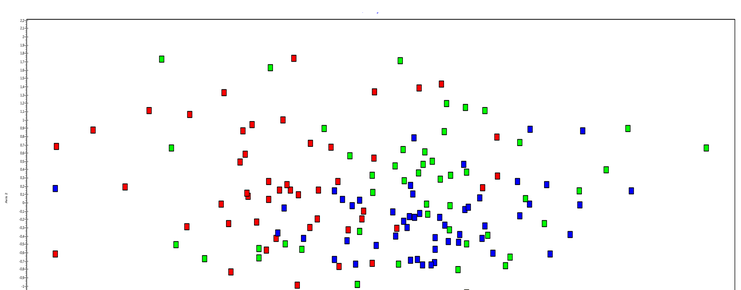

Figure 3. Non-metric multi-dimensional scaling plot, expressing the similarity among microplots collected in different phorophytes of three altitudinal levels of Pico island (blue: 600 m; green: 800 m and red: 1000 m). Rotated, Bray-Curtis.

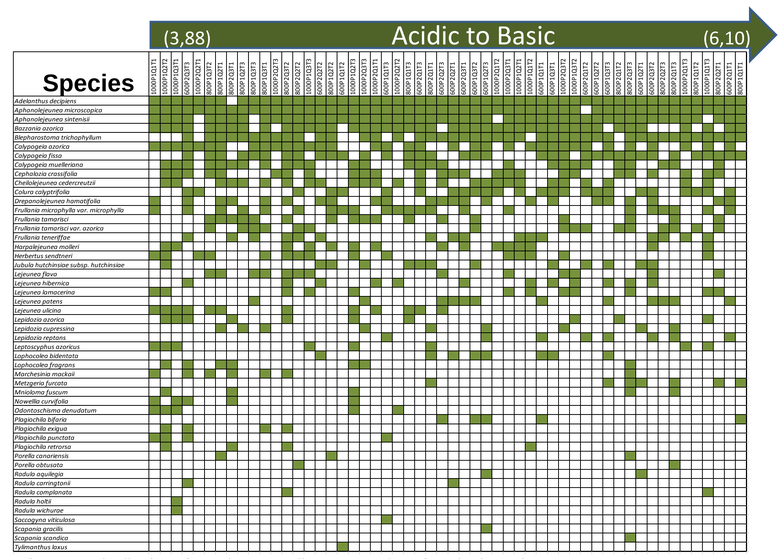

Figure 5. Distribution of species according to pH value of each phorophyte.

Nestedness occurs when species-poor assemblages contain a subset of the species that occur in more species-richer communities.

As far as we could test using the NODF algorithm, the liverworts' data did not show a nested structure, neither for the elevational gradient (a surrogate of climatic values) (p=0,5), nor for the phorophyte (p=0,45), and nor for the pH of the bark (a chemical feature) (p>0,05) (Fig. 5).

CONCLUSIONS

The *laurisilva* forest of Pico island, represented by the 3 fragments, supports nearly half of the liverworts known from this island.

- Species richness in *laurisilva* does not show nestedness, which suggests a random association of liverworts on tree barks.
- Beta diversity among the elevational sites is low and mainly due to species replacement, rather than differences in species richness, which means that there is a large number of species that may occur on a wide range of substrata within the *laurisilva* forest.

- Future works undergo analysis of another portion of native forest as substrate Ericaceae to observe if the distribution of epiphytic liverworts will change.

Beta diversity

One of the most interesting features of the natural assemblages is the variation of β diversity, which accounts for the differences in species richness and replacement of species (Fig. 4).

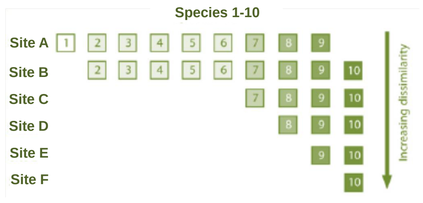

Figure 4. Hypothetical gradient of increasing dissimilarity (Carvalho *et al.* 2012).

Table 1. Comparison of β_{cc} (overall beta diversity), β_{-3} (species replacement) and β_{rich} (species richness) values between the differents altitudes.

Sites	β_{cc}	β_{-3}	β_{rich}
600 - 800	**0,30**	0,26	0,04
600 - 1000	**0,36**	0,34	0,02
800 -1000	**0,24**	0,18	0,07

The β diversity (β_{cc}) of the epiphytic communities of *laurisilva* in Pico is low (Tab. 1) and, using the method proposed by Carvalho *et al*., 2012, that makes the partition of the overall β diversity into species replacement (β_{-3}) and species richness (β_{rich}), it is obvious that species replacement is the main driver of β diversity.

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