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Fruiting Body Density of Mychorrihzal and Wood Rot Fungal Species In Lambir National Park

Abstract: As the tropics are a largely ignored ecosystem division in mycology, I decided to conduct a experiment using available methods to determine the relative lifestyle prevalence for fungal species in Lambir National Forest. The analysis used a simple count of visible fruiting bodies in two 10m x 10m plots and organized them by the substrate that they were consuming. The results showed a much higher percentage of wood rot consuming rather than mychorrhizal species.

Introduction: Historically, ecological analyses of forest dynamics have largely ignored the influence of the fungal community. The decomposition and symbiotic actions that fungi perform are difficult to ignore, but the phylogeny and diversity of the responsible species often escape mention in ecological research. As a result, especially in the relatively understudied ecosystems of the tropics, the fungal community makeup and its dynamics are not well known. Given this state of affairs, I endeavored to create a observational analysis of the fungi in the Lambir Hills National Park, Borneo.

Any thorough study of fungal phylogeny and species composition within a community requires extensive soil disturbance and a large scale analysis of hundreds of samples using both sequence data and microscopic observations. Without these techniques, a study would miss the bulk of fungal specimens which reside under the ground and rarely or never produce any above ground appendages. Given the lack of such ecological tools, the best that any individual researcher can do is make an observation of the most visible parts of the forest's fungal community: the fruiting bodies. These structures give a fair approximation of the percentage composition for the species present, if not the actual numbers of individuals there.

Given these constraints on the individual fungal researcher, the questions that I hope to address are based on the observed density of fungal fruiting structures on defined plots of tropical forest land in Lambir Park. (1)First, I hope to determine if the fungal community is dominated by fungi with either a mychorrhizal or wood rot lifestyle. (2) With cooperative weather, I can determine what the tropical fungal community's response to increased precipitation is, if that response involves the production of fruiting bodies.

Hypotheses:

(1)I believe that a survey of the forest floor in selected areas of Lambir will show that mychorrhizal fungi represent the dominant lifestyle for the visible fruiting bodies. This is based on the strong (predicted at around 80%) ratio of tropical tree species that form symbiotic relationships with mychorrhizal fungi.

(2)The response of fungi to sudden intensive rain in Lambir will be negligible, since the environment in the forest is subjected to constant rain which fulfills all the hydrologic needs of those species. Increased rain will do little to improve the ability of fungi to produce fruiting bodies.

Methods: To determine if my hypothesis was correct, I conducted surveys of two separate plots at separate locations in Lambir National Forest. A third plot was attempted but a heavy rain appeared to have severely affected the density and composition of the visible fungal fruiting bodies. After the rain storm, a secondary survey of both the first and second plots revealed only a small fraction of the fungi that were visible on the previous days, so a third plot would have been statistically irrelevant in comparison.

To determine the composition of fungi on these plots, I marked out a 10m x 10m plot and surveyed the area for all visible fungal fruiting bodies. Plot 1 was on sandy soil at the bottom of a valley, very near both a major forest trail and a stream. The ground was covered almost entirely in fallen leaves and had . a few trees with possible mychorrhizal associations. Plot 2 was chosen because it represented a very different soil type and plant species composition: the plot was at the top of a sizable ridge, and included many palms and large Dipterocarp species. A significant amount of fallen timber and rotting logs also provided a diversity of habitat for fungal species.
For each plot, I conducted a complete observation analysis of the visible fungi. I moved the leaf litter in both plots and checked for visible fruiting bodies underneath. For each fruiting structure found, I recorded the substrate that it was growing from, any closely associated living trees, its color, shape, orientation of spore producing surfaces and the color of the spores produced. Additionally, I took pictures of each unique species found so that I could reference them while I had access to a taxonomic guide back at camp and also recorded the coordinate position of each observed fruiting body within the plot.

Using these pictures and my recorded plot data, I was able to address the second hypothesis and observe the changes in fungal composition in both plots after a large rainstorm on the night of July 30th.

Results:

The results of my data collection from the two plots is shown in the tables below. On table 1, the different species found in both plots are shown with the number of times they were found on each substrate.

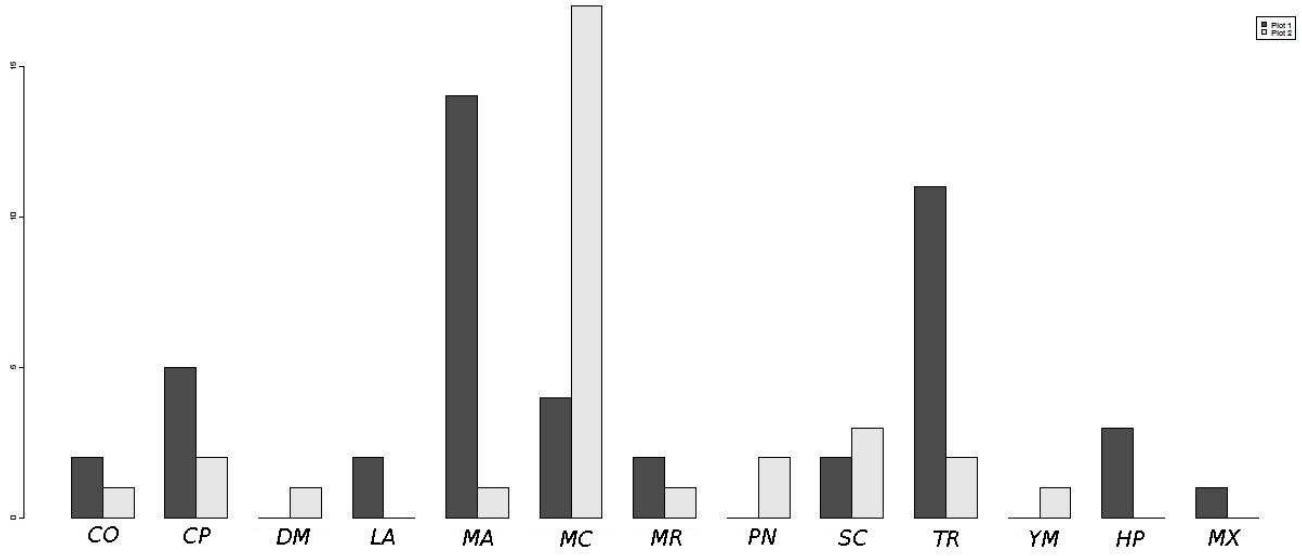
Table 1:

	Charcoal	Fallen Fruit	Leaf	Living Tree	Rotting Wood
Cookeina	0	0	0	0	3
Coprinus	0	0	0	4	3
Dead Man's Fingers	0	0	0	0	1
Lactaris	0	0	0	0	0
Marasmiellus	0	0	0	0	15
Marasmius crinisequi	0	0	12	0	9
Marasmius rotalis	0	0	1	0	2
Penicillium	1	1	0	0	0
Scytinopogon	0	0	2	0	3
Trametes	0	0	0	0	12
Yellow Mat	0	0	0	0	1
Hypholoma	0	0	0	0	3
Myxomycete	0	0	0	0	0

Graph 2 is a chart of the relative abundances of each species observed plotted in histograms from both plots. Plot 1 is in black, Plot 2 in White.

The taxa names are marked as follows: Cookenia-CO, Coprinus-CP, Dead Man's Fingers-DM, Lactaris-LA, Marasmiellus-MA, Marasmius crinisequi-MC, Marasmius rotalis-MR, Penecillium-PN, Scytinopogon-SC, Trametes-TR, Yellow Mat-YM, Hypholoma-HP, and Myxomycetes-MX.

Graph 2:



Discussion: The results of the survey plots are definitive in what they show about the dominant lifestyle for fungi in the Lambir forest. In the two plots, only two mychorrhizal species were observed. Both of these were in the Lactaris genus and were found within 2m of each other in Plot 1. Plot 2 contained no visible mychorrhizal species. Some of the fungi in both plots were found living on healthy trees, but they were all confirmed wood rot species that were most likely consuming the dead bark on the buttresses of Dipterocarp trees. The total accumulation of data showed that of the 73 observed individual fruiting bodies, 2 were mychorrhizal, 69 were consuming some form of rotting cellulose, and 2 were fruiting on other substrates. These findings resoundingly refute my first hypothesis. The reasons for this could arise from a variety of sources. The factors that determine when mychorrhizal fungi produce their fruiting bodies in this forest are almost entirely unknown to myself or my colleagues. Anecdotal evidence suggests that, unlike in temperate climates, fungal fruiting in the tropics is linked to the mass fruiting events of the plant species. Such an event was certainly not occurring during this project, so the environment would be expected to have a high proportion of wood rot species that have no associations with living plants.

Likewise, my second hypothesis was observed to be incorrect due to my own lack of knowledge regarding the factors that cause fungal fruiting. The rain storm merely seemed to wash away fungi that were rooted in soil that was already water saturated. A return to the same two plots showed that both mychorrhizal specimens were completely gone as were more than half of the wood rot examples. The ground was also highly disturbed by the hard rainfall and the flow of that rainwater over the ground. Because of these disturbances I concluded that the rain caused the removal of many fruiting body specimens.

The best course of action for future research would most likely be to begin a study of the percentage of forest trees that associate with Mychorrhizal fungi. To achieve this, a detailed analysis of soil composition and fungal hyphae content in the area surrounding tree roots would have to be undertaken. The root hairs from the Diptrocarps would also

Citations:

Pegler, David N. *The Larger Fungi of Borneo.* Natural History Publications: Kota Kinabalu. 1997.