Project Jekti : Proportion of Predation

Comparison of Seed Predation of *Parashorea malaononan* between Logged and Unlogged Forest in Maliau Basin National Park, Malaysia

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ABSTRACT

In this study, we sought to make a comparison of multiple types of predation between logged and unlogged forest in Maliau Basin National Park during a dipterocarpaceae mast fruiting event. The viability of *Parashore malaanonan* seeds despite mammalian, fungal and insect predation was examined to reveal that: (1) Mammal and insect predation were greater in the logged forest, but (2) the greatest threat to seed viability is fungal predation, which primarily affected the primary forest.

Introduction

Dipterocarpaceae exhibit highly synchronous fruiting events known as masts. Janzen (1974) postulated that this mast-fruiting evolved to satiate seed predators by high seed volume. During this mast, we analyzed the relative success of seed volume preventing predation in the primary forest of Maliau Basin, previously designated as a Class I Conservation Area, contrasting with the logged forest nearby, processed approximately 15 years ago. In a comparison between primary forest and secondary forest, logged 8 years prior, during the 1991 mast-fruiting event of West Kalimantan, Indonesia, the logged forest lost a greater percentage of dipterocarp seed to predators (Curran and Webb, 2000).

We hypothesized that post dispersal seed predation will be greater in logged forest due to low regional seed production resulting in greater predation by unsated nomadic vertebrate predators, demonstrating greater seed survival in primary forest. However, the high volume of seeds in the primary forest, dispersed close to the parent tree and in close proximity to others, will be more susceptible to fungal infection. Additionally, we thought that the high diversity of insects as retained by the canopy (Sutton, 22-Aug-07) in the primary forest would lead to greater insect predation.

Methods

To monitor mammalian predation, we selected twenty 1 meter square plots in both logged and unlogged forest along established trails within the Maliau Basin National Park at 4 meter distance intervals. Within each plot, we placed ten marked seeds of *Parashorea malaanonan.* Over the course of three days, the marked seed samples were monitored daily for predation.

Due to a perceived lack of predation in both the logged and unlogged forest sites in the first day of our study, we modified our methods and expanded our observations to include insect and fungal types of predation. We additionally selected three *Parashorea malaanonan* parent trees in the logged and unlogged forest. At each tree, three 2 by 2 meter plots were established, with a minimum distance of 5 meters between each, starting with a random plot near the tree's base. All seeds within each plot were sampled, then sorted according to viable, insect-predated or fungi-predated.

We then analyzed our data with the statistical software suite, R. The mammalian predation data from our first set of plots was tested for significance using Pearson's Chi-squared Test for Count Data, then the fungi and insect predation data from the second set of plots was analyzed using Binomial Tests in a Generalized Linear Model.

Results

Our data revealed that mammalian and insect predation was significantly greater in the logged forest by p-values of 0.003805 (Appendix, fig.1) and 1.26e-05 (App., fig. 2), respectively. Despite

these two forms of predation, the most viable seeds were found in the logged forest and this was also significant (p=9.92e-13, App., fig. 4). Finally, fungal predation was greater in the primary forest by a p-value <2e-16 (App., fig. 3).

Discussion

In accordance with our hypothesis and supporting earlier work by Curran and Webb in Kalimantan, mammalian predation was greater in logged forest. The seeds in the logged forest may have been more easily accessible, and thus easily predated, by existing in reduced understory, as well as being isolated by reduced seed volume in a mast event. The mammalian predators may not have been sated by an overall abundance within the forest region, and without nearby seed populations, and therefore tended to stay within the sample plot populations to feed.

Interestingly, insect predation was also greater in the logged forest, which is not in line with the results of the Kalimantan study nor our hypothesis. Again, perhaps it was the seeds' isolation and limited abundance in an open area that allowed them to be easily preyed upon.

We can further infer from our results that fungi is the greatest threat to seed viability, as it was the greatest form of predation in the primary forest, and destroyed the viability of the largest number of seeds. Despite having two forms of predation, and a lower volume of sampled seeds initially, the logged forest retained the greatest number of viable seeds by the close of our study. Perhaps the greater number of adjacent seeds and moisture from increased canopy cover create a more ideal environment for fungal infection in the primary forest, thus inversely correlating seed survival with seed density. This is further compounded by the poor dispersal methods of dipterocarpaceac, as the winged seeds usually fall within the shadow of the parent tree (Whitmore, 1975).

Despite the discovery of significant results, our mammalian study only lasted the duration of three days. Different patterns of mammalian predation, as well as the effect of germination, may have been discovered with a longer observation time. Also, more information regarding insect seed predation could be derived by insect species identification as an extension of this study. Perhaps different species are predating the forest types or in different proportions. Due to the rarity of masting events and relatively little existing study of seed dispersal, there are many open areas for further investigation.

Appendix

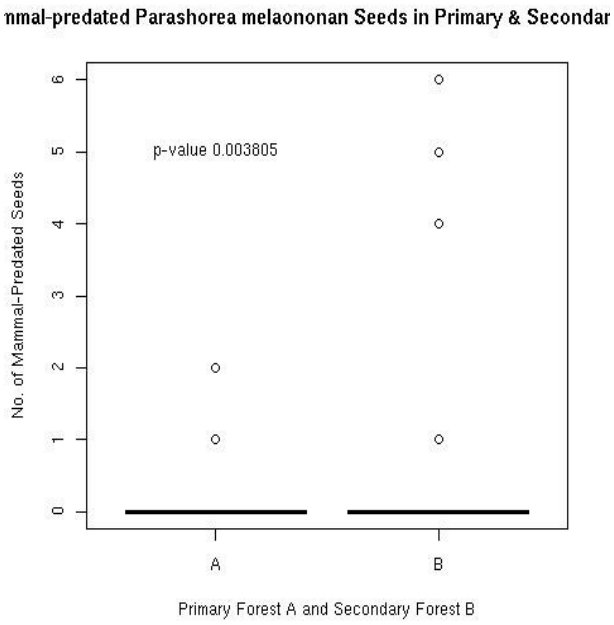

figure 1: Mammal-predated Parashorea melaononan Seeds in Primary & Logged Forest.

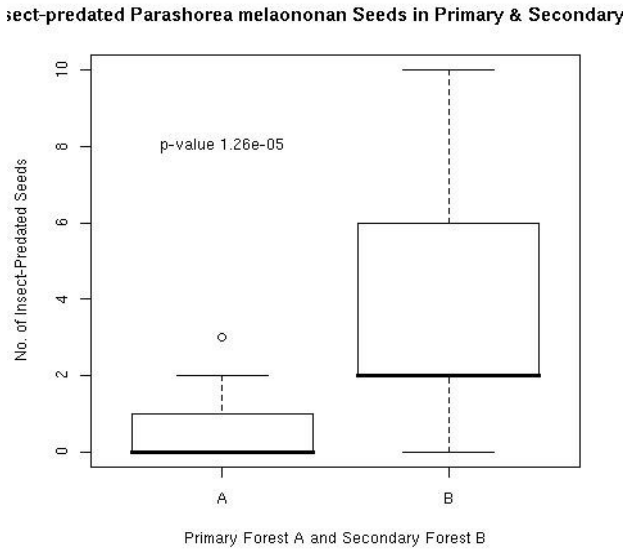

figure 2: Insect-predated Parashorea melaononan Seeds in Primary & Logged Forest.

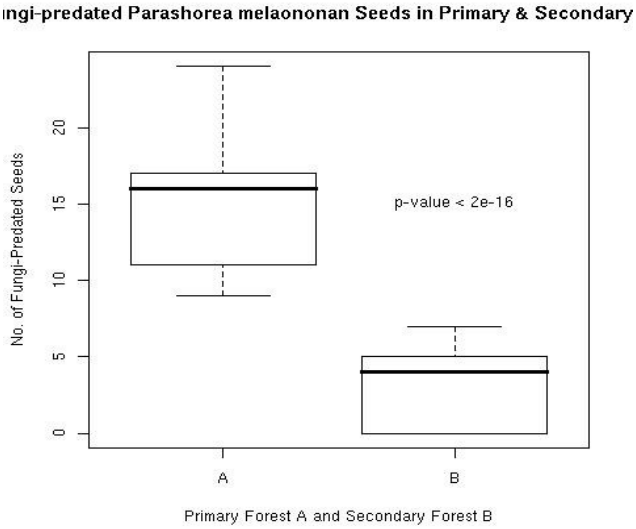

figure 3: Fungi-infected Parashorea melaononan Seeds in Primary & Logged Forest.

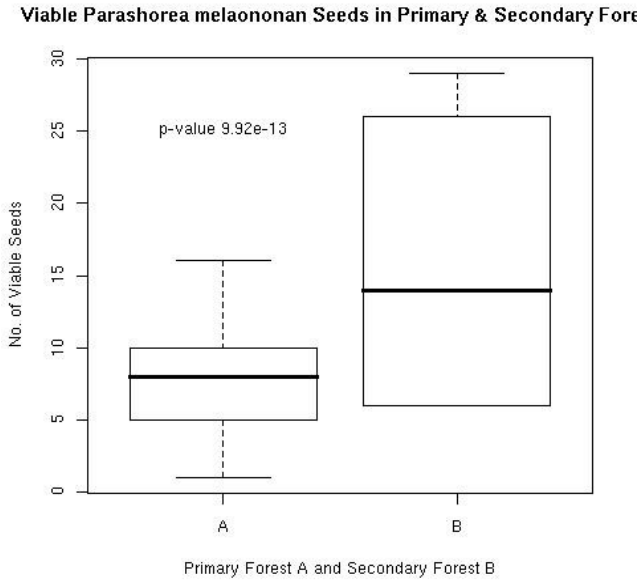

figure 4: ViableParashorea melaononan Seeds in Primary & Logged Forest.

Works Cited

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