Effects of Sun vs Shade and Leaf Age on Leaf Morphology, Herbivory, and Physical Defenses in the Swiss Cheese Plant (*Monstera adansonii*)

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The following is an excerpt from a longer piece. For the full text, please visit https://scholar.colorado.edu/concern/undergraduate_honors_theses/d791sh621 or scan the QR code.

Abstract

One important structural defense of plants is calcium oxalate crystals or raphides. In this project, I studied one species in the plant family Araceae, *Monstera adansonii*, a widely distributed plant in the tropics, that is known to contain raphides. Plants of this species were sampled in sun or shade locations. For each plant, three leaves were sampled, the first fully expanded leaf on a plant (leaf 1) and two more leaves below it, leaf 3 and leaf 5. For each leaf, I measured: leaf area, number of fenestrations (naturally occurring holes in the leaf), amount of herbivory, and density of raphides. I compared these measures on leaves of different ages from sun versus shade plants. Results showed that: 1) older leaves were significantly larger than younger leaves ($P < 0.001$), but there was no effect of light environment ($P = 0.199$); 2) density of raphides was not significantly affected by sun ($P = 0.147$) and density of raphides decreased with leaf age ($P = 0.0097$); 3) the number of fenestrations was significantly higher in plants in the sun ($P = 0.01$), but did not differ with leaf age ($P = 0.702$); 4) herbivory was not affected by sun exposure ($P = 0.29$) but was marginally significantly affected by raphide density ($P = 0.06$). There was a significant interaction between raphide density and light exposure on herbivory, in that in the shade there was a negative relationship where herbivory decreased as raphides increased, but in the sun, a positive relationship where herbivory increased as raphides increased ($P = 0.04$).

Lay Summary

Deforestation poses significant threats to the fragile ecosystem of tropical rainforests. Costa Rica's Monteverde Cloud Forest, known for its rich biodiversity, relies on canopy tree cover for habitat protection and the maintenance of ecological balance. Tree loss can have a cascading effect on the ecosystem, which may negatively affect many species. When this balance is disrupted through deforestation, understory plants, such as *Monstera adansonii*, or the well-known "Swiss cheese" houseplant, are exposed to direct sun and harsh environmental elements. They may be initially ill-equipped to handle these conditions, but plants can physically adapt to their surrounding environment.

To understand how plants may adapt to new conditions, I studied physical differences in *Monstera adansonii* between shaded understory areas and sunny exposed areas, which are created by forest clearing. I examined its physical differences, including the concentration of calcium oxalate crystals within its leaves. Among others, my results showed that the plants in the sun experienced more damage by herbivores than the plants in the shade. Through this study, I have "shed light" on the effects of deforestation and what this plant and many other understory plants may face as the rate of deforestation increases.