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Herbivory in a Bromeliad of the Peruvian Rainforest Canopy

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Very few accounts of herbivory in bromeliads of tropical rain forest canopies have been reported in the literature. Whether this accurately reflects a truly low frequency of herbivory or is simply a consequence of the difficulty of making observations in the upper canopies of tall trees, is not known. Benzing (1992) states that “extensive defoliation is rare in neotropical epiphytes”, and our observations (that collectively span over 20 years of tree-climbing and canopy access) agree with this statement. Bromeliads are renowned for their tough and sclerophyllous leaves, below average nutritive qualities of foliage, and in some cases, their mutualistic relationships with ants that protect the plants from predators. All of these features serve to minimize their susceptibility to herbivory.

Over the last ten years, many new and innovative techniques for canopy access have been developed or adapted from other disciplines, such as spelunking and rock climbing. These techniques now enable scientists to spend extended periods of time, both safely and comfortably, studying epiphytes and other canopy organisms (Lowman and Nadkarni 1995). Due to these logistic advancements, more comprehensive *in situ* observations of epiphytes and their ecology are now possible. We have recently initiated canopy studies to document herbivory among bromeliads and other epiphytes as part of the research program at the Marie Selby Botanical Gardens. In this article, we report the first occurrence of a significant amount of herbivory in a bromeliad population. This population was found growing in the tropical rain forest canopy of the Amazon basin, in northeastern Peru (latitude 3° 15' S, longitude 72° 54' W) near the Sucasari tributary of the Napo River.

Access to the treetops was facilitated by a canopy walkway built as part of a joint venture to promote tourism as well as tropical research in the area. A consortium called ACEER (Amazon Center for Environmental Education and Research) has provided unparalleled canopy access to scientists and eco-tourists along a series of bridges and platforms built using the trees themselves as major supports. This canopy walkway extends over 400 meters in length ranging from ground level up to the top of the forest canopy at a height of 30 meters.

The bromeliad, *Aechmea nallyi* L.B. Smith, is a relatively rare epiphyte found only in patches of rain forest within the northeast corner of Peru (Luther, personal communication). It grows as a rosette of sclerophyllous leaves, and produces a

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Figure 1.

Aechmea nallyi in flower, during April 1995 at approximately 28 m along the ACEER walkway, Peru.



Figure 2.

Aechmea nallyi with its characteristic herbivory, as observed in the canopy of northeastern Peru during July–August 1995.

brilliant pink and yellow inflorescence from March–May (Figure 1). Due to its proximity to the ACEER walkway, a population of approximately 15 individuals of this species was discovered and easily observed for extended periods of time. This was possible despite the fact that they were approximately 20–25 meters above the ground and virtually invisible to ground-based observers.

By using visual estimates to approximate leaf area lost, herbivory was measured for 10 leaves on each of 5 different plants. This sampling technique is described in detail elsewhere (Lowman 1992, 1995). In a manner similar to leaf miners, a herbivore consumed parts of the foliage, creating the characteristic linear “trails” of damage that either removed the uppermost cells of leaf tissue or in some cases chewed through the entire leaf. Although staff from Selby Gardens made periodic observations of *A. nallyi* during the months of April, July, August, September, and October, the responsible herbivore was never seen. We hypothesize that they are most likely to be active during the time prior to flower formation when more of the plant’s resources are allocated to the foliage and not being diverted to reproduction.

Herbivory of this bromeliad averaged 10.4% foliage loss. The damage was very distinctive, composed of intermittent long patches parallel to the leaf venation and of uniform width, as shown in Figure 2. The proportions of foliage lost are shown in Table 1. This is the highest amount of herbivory estimated among replicated individuals of one epiphyte species that we have found in the literature, although isolated individuals have been observed with damage levels

Table 1.
The percentage of foliage lost on *Aechmea nallyi*.

Leaf #	Plant #				
	1	2	3	4	5
1	15	12	15	10	10
2	5	15	10	20	25
3	5	15	5	10	18
4	10	10	5	5	15
5	2	25	4	4	20
6	3	20	15	4	5
7	2	5	20	6	20
8	0	5	8	10	25
9	5	8	2	5	—
10	5	5	5	10	—
Average	5.3	12	8.9	8.4	17.3
Total Average = 10.4%					

ranging from 0–21% in the canopies of subtropical rain forests in Belize (Lowman and Bouricius 1995).

We welcome the report of additional observations of herbivory in bromeliads growing in natural conditions, and plan to conduct future studies on the possible defense mechanisms of bromeliads against herbivores.

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