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THE ANIMAL COMMUNITY ASSOCIATED WITH CANOPY BROMELIADS OF THE LOWLAND PERUVIAN AMAZON RAIN FOREST

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ABSTRACT. The role of Bromeliaceae as a canopy microhabitat was investigated in the Yacumama Lodge Reserve in Peru in the summer of 1998. Many bromeliad species have leaves spirally arranged in the shape of a rosette, forming a phytotelma (tank) that holds water and detritus and creates a microhabitat for plants and animals. By using single-rope-technique, the author collected and examined canopy bromeliads, selecting a range of sizes and leaf numbers to sample leaf architectural variation. Results of the study showed a bromeliad community dominated by arthropods (primarily insects and arachnids) in various stages of development, although Gastropoda and Annelida were also present. Canopy bromeliads provide a microhabitat for larval forms of many animal species. The function of bromeliad tanks as a canopy microhabitat is indicated by the abundance and diversity of fauna found in phytotelmata.

Keywords: Bromeliaceae, canopy, community, Peru, Amazon

INTRODUCTION

The Bromeliaceae family is comprised of approximately 50 genera with more than 2500 species in neotropical forests. Peru has 17 genera and 420 species of bromeliads, of which 239 are endemic (Brako & Zarucchi 1993). Leaves of many species are spirally arranged in the shape of a rosette forming a cistern, tank, or vase that holds water and detritus. This stored water contains varying amounts of nutrients, created by the decomposition of trapped detritus from outside sources, such as leaves, twigs, spent flowers, animal fecal material, and live organisms residing in the phytotelmata (Benzing & Renfrow 1974). Nutrients are absorbed by the plant

Figure 1. Tank bromeliad (*Vriesea* sp., YB8) in natural habitat.

TABLE 1. Summary of contents of canopy bromeliads in Amazonian Peru.

			Bromeliad sample (no. leaves)						
Phylum	Class	Order	YB5 (13)	YB11 (18)	YB18 (18)	YB4 (21)	YB9 (22)	YB16 (25)	YBl7 (26)
Annelida			1	—	—	3	—	—	—
Arthropoda									
	Arachnida		2	4	—	13	6	3	1
	Chilopoda		—	2	1	8	3	2	—
	Diplopoda		—	2	—	—	3	—	1
	Insecta								
		Blattodea	1	6	—	16	4	16	2
		Coleoptera	—	9	3	2	2	52	7
		Collembola	3	—	1	3	—	—	2
		Diptera	11	4	2	1	5	7	5
		Hemiptera	—	2	—	—	1	2	—
		Homoptera	1	—	—	—	—	2	—
		Hymenoptera	4	243	—	16	3	425	37
		Isoptera	—	—	—	—	—	—	—
		Lepidoptera	—	2	—	—	3	—	—
		Odonata	—	—	—	—	—	—	—
		Orthoptera	—	2	—	2	2	—	—
		Phasmodea	—	—	—	—	—	—	—
		Psocoptera	—	—	—	—	—	—	—
		Thysanura	—	1	—	—	—	—	—
		Trichoptera	—	—	—	—	—	—	—
		Zoraptera	—	—	—	—	6	—	—
		unidentified	—	—	—	1	—	—	—
Mollusca									
	Gastropoda		—	—	—	—	—	—	—
	Malacostraca		—	12	—	13	1	4	—
		Total	23	288	7	78	37	513	55
		excluding Hymenoptera	19	45	7	62	34	88	18

through trichomes found on the leaves, which allow the plant to use its phytotelmata as a nutrient resource. The function of phytotelmata as a microhabitat for many organisms has long been studied (Picado 1913), both for plants and for animals (vertebrate and invertebrate).

In addition to the aquatic environment formed in the center rosette of the bromeliad, a significant leaf-surface area is not submerged. Many bromeliads do not have phytotelmata because of plant geometry, age, or physical location, but various animals use these bromeliads as well. In addition to benefiting from the bromeliad as a habitat, several animal species use the leaves as a source of food.

Tree frogs, mosquitoes. flatworms, snails, salamanders, and even crabs complete their life cycles in the aquatic habitat provided by the phytotelmata of bromeliads (Zahl 1975, Frank 1983, Wilson 1991, Oliveira et al. 1994). Some small birds even use bromeliads as nesting sites (Kricher 1997). Considering the density and range of bromeliads, the magnitude and extent of the role they play as a microhabitat is evident.

STUDY SITE

The study was conducted in the transitional forest along the Río Yarapa, the first tributary of the Amazon River in Peru. Sampling took place at the Yacumama Lodge Reserve (73º24'W, 4º28'S) at 110-125 m elevation. Bromeliads were sampled from three host trees of different species in a section of the reserve not often visited by people. The sampling took place over a 2-month period from mid-June to early August 1998 during the low-water season. Rainfall, though infrequent, fell heavily when it did occur. The temperature during the study period ranged from 17ºC at night to 30ºC during the day. The canopy averaged 24-30 m tall with emergent trees reaching 35-40 m.

METHODS

Single-rope technique (Padgett & Smith 1987) was used to climb to canopy bromeliads. A tape measure was then dropped to the ground, establishing the height of a

TABLE 1 Extended.

											Total Insecta	
YB3 (29)	YB12 (29)	YB1 (30)	YB8 (31)	YB2 (32)	YB13 (32)	YB6 (34)	YBI5 (34)	YB10 (40)	YB14 (42)	YB7 (68)	Adults	Larvae
—	—	—	—	—	—	—	—	—	—	—	—	—
3	8	2	—	2	1	1	3	1	3	8	—	—
—	—	1	—	—	—	—	—	—	—	1	—	—
1	1	—	1	—	1	—	4	1	1	1	—	—
5	5	—	6	—	—	—	8	5	5	6	2	83
2	9	—	—	2	8	10	9	3	6	21	90	55
6	—	—	—	3	2	—	—	—	—	—	20	—
7	3	—	5	4	3	8	2	—	3	13	4	79
1	—	—	—	—	2	1	2	—	1	4	7	9
—	—	—	—	1	—	—	1	—	1	—	2	4
11	133	1	142	—	121	2	86	40	9	370	1518	125
—	—	—	—	2	—	—	—	—	1	—	3	—
1	1	—	1	—	1	—	—	—	1	10	—	20
—	—	—	—	—	—	—	—	—	—	2	—	2
—	1	48	1	14	—	12	—	—	—	—	—	82
—	—	—	—	—	—	—	—	1	—	—	—	1
—	—	—	—	—	—	—	—	—	—	1	1	—
—	—	—	—	—	—	—	—	—	—	—	1	—
—	—	—	—	1	—	—	—	—	—	—	—	1
—	—	—	—	—	—	—	—	—	—	—	6	—
10	—	—	—	1	—	—	—	—	—	3	15	—
—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	1	—	—	—	2	—	—	—
1	2	—	—	—	2	2	1	4	1	3	—	—
48	163	52	156	30	146	36	16	55	34	443	1669	461
37	30	51	14	30	25	34	30	15	25	73	151	336

plant. Tree height was measured by climbing as high as reasonable to facilitate an estimate of the height above the climber, which was then added to the climber's height. Each bromeliad was removed intact from its attachment point and placed immediately in a large plastic sampling bag. During the collecting, every effort was made to minimize disturbance of the bromeliad and its inhabitants. The collection bag, with a single bromeliad inside, was then labeled, sealed, and lowered to the ground. Bromeliads of different sizes and number of leaves were collected to sample a range of leaf architecture variation.

Bromeliad dimensions were measured and recorded. The plant was cut back to facilitate visual inspection of leaf surfaces. Individual leaves were peeled back and cut off one at a time and inspected for fauna. A solution of *75%* alcohol and *5%* lanolin was used to immobilize the tank inhabitants and preserve them for later identification.

Each bromeliad was tilted within its bag to empty out most of the tank water, which was decanted from the bag to an observation dish. Of the 18 bromeliads sampled, one (collection number YBl) did not contain any water at the time of collection. This bromeliad was a seedling and although it had collected some detritus, no standing water was present. All of the other bromeliads contained water at the time of collection. Organisms visible to the unaided eye (>2 mm) were collected. Individual leaves were removed and inspected and the newly exposed meristem was examined. Leaves showing damage from leaf miners were cut open to locate the animals responsible. Soft tweezers and a camel's-hair brush were used to remove inhabitants and place them in a vial containing the alcohol solution. Contents of each bromeliad were placed in a separate vial labeled with the collection number of that plant.

By collecting the entire bromeliad intact from canopy within a sealed bag and by carefully examining the leaf surface area and inside of the collection bag, the author collected all of the inhabitants visible to the naked eye. However, some of those individuals capable of flight may have escaped during the removal of the bromeliad from the host tree. Observations during collections showed that those capable of escape were more likely to hide in the recesses of the leaf axils rather than flee from the bromeliad.

Each bromeliad was recorded on digital videotape for later identification and to document its natural environment (FIGURE 1). In addition to recording in situ, the author took additional macro images of leaf shape and structure. Based upon these images, the bromeliads have been identified as *Tillandsia adpressiflora* (YB1 and YB2). *Guzmania* sp. (YB3—YB5), and *Vriesia* sp. (YB6—YB18). Host trees were marked, and voucher specimens were collected for the herbarium at the Universidad Nacional de la Amazonia Peruana in Iquitos, Peru (UNAP). Animal specimens are presently in the author's collection pending return to the Biology Department at UNAP.

RESULTS

Preliminary data show bromeliad-tank communities in the forest canopy dominated by arthropods (primarily insects and arachnids) in various life-cycle stages (TABLE 1). Gastropoda and Annelida were present in some bromeliads. Numerically, ants were the dominant animal in most (61%) bromeliads surveyed and were found primarily in the adult form. Some bromeliads served as nest sites and contained ant eggs, pupa, and winged reproductives. Successful partitioning of even small spatial resources was evidenced by the presence of several species of ants in a single bromeliad. Leaf miners made use of tough sclerophyllous leaves in some bromeliads, as observed in other locations (Lowman et al. 1996, Windsor et al. 1997). No clear relationship was found between the number of leaves and the number or type of arthropods present. Further study across a broader range of bromeliad shapes and leaf numbers is warranted.

With Hymenoptera (primarily represented by Formicidae) excluded from the data set, it became evident that bromeliads were serving as a nursery for many species in larval form. Coleoptera and Diptera were abundant within the phytotelmata of these canopy bromeliads. Orthoptera (eggs) were found in the meristem, and Blattodea nymphs were numerous in outer axils.

The role of bromeliads and their tanks as a microhabitat in the rain forest canopy is supported by the abundance and diversity of fauna found.

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