of their movements. Further studies should take into account jacana preferences for time of day and the frequency and structure of their movements.

The next step is to determine the reason(s) lilies limit jacana abundance. The lily pads may serve as a structure on which jacanas can easily forage. The lily plants themselves (the ovules) may be a food source. Or, alternatively, the lilies may provide a habitat in which invertebrate prey can live. Jacana preference for invertebrate versus plant food source could be investigated. Artificial lilypads with and without invertebrate food could be added to environments to distinguish between these three alternative hypotheses. Also, all three factors could play a role in making lilies important for jacana abundance.

Jacanas seem to require lilies for a foraging substrate in this environment. Our results indicate that lilies may be a limiting resource for jacanas at Palo Verde National Wildlife Refuge.

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ABUNDANCE OF INSECT LARVAE AND OSTRACODS IN TANK BROMELIAD COMMUNITIES

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ABSTRACT (DKS)

We examined the relationship between ostracod and insect larva abundances in tank bromeliads. These two taxa have similar diets and co-occur in a potentially resource limited environment. We counted the numbers of ostracods and larvae in water samples from 25 bromeliads and found no significant relationship between abundances. As bromeliad size increased, total number of organisms also increased. This suggests that either (1) both taxa are using the same, non-limiting resource, and recruitment is higher in larger bromeliads, or (2) ostracods and larvae use different, limited resources and lower population numbers in smaller bromeliads are due to reduced survival.

Key Words: tank bromeliads, ostracods, insect larvae, competition, resource partitioning, recruitment

INTRODUCTION (DJG)

Tank bromeliads are abundant throughout montane areas of Costa Rica. The plant is composed of overlapping leaf bases that form a rosette with the middle portion functioning as a central water reservoir (Utley & Burt-Utley, 1983). Within this central reservoir, a food web exists based on accumulated detritus and periphytic algae. Many organisms (insects, crustaceans, and vertebrates) use this microcosm, some as a site for larval development and some for their entire life cycle. These organisms may function as herbivores, detritivores, or carnivores.

Two types of detritivores/bactivores that co-occur in this system are insect larvae and ostracods. We hypothesized that these two taxa compete for limited resources within tank bromeliads, and predicted that ostracod abundance would be inversely proportional to insect abundance. In addition, we predicted that total organism abundance (of both taxa) is directly proportional to tank size.

METHODS (DKS)

We examined tank bromeliads from an elfin forest on the ridge facing west, 2km northeast of the field station at Cerro Cacao, Guanacaste, Costa Rica, on 19 January, 1994.

We haphazardly selected 25 tank bromeliads growing at breast height within an area of approximately 10m x 2m. Exposure to wind, rain and sun was similar within the area. We extracted the contents of the central reservoir from each bromeliad, measuring volume and reservoir diameter as indicators of bromeliad size. We counted number of insect larvae and ostracods in each sample. Data were analyzed by linear regressions.

RESULTS (DML)

We found no significant relationship between the number of larvae and the number of ostracods per bromeliad ($r = 0.16$; $p > 0.05$; Figure 1). The total number of individuals per bromeliad increased with increasing bromeliad

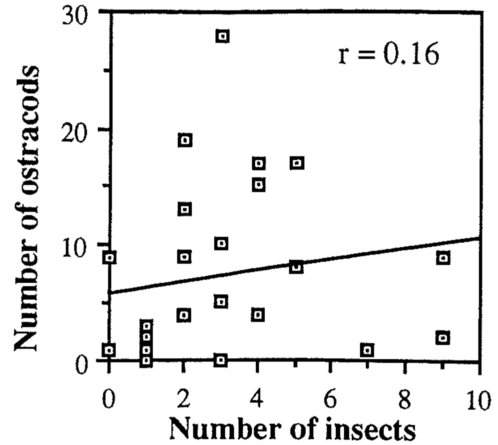

Figure 1. Relationship between number of insect larvae and number of ostracods per bromeliad.

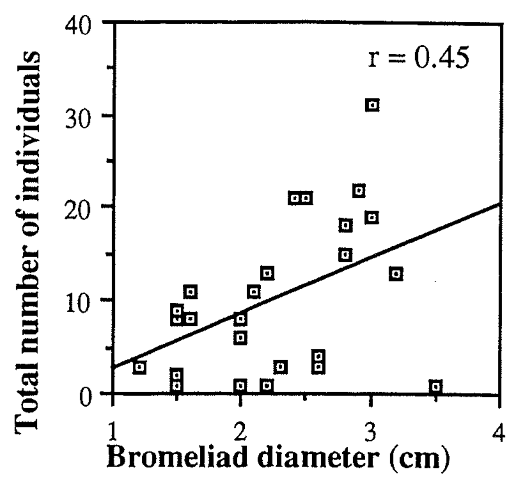

Figure 2. Relationship between bromeliad central reservoir diameter and total number of individuals (larvae and ostracods).

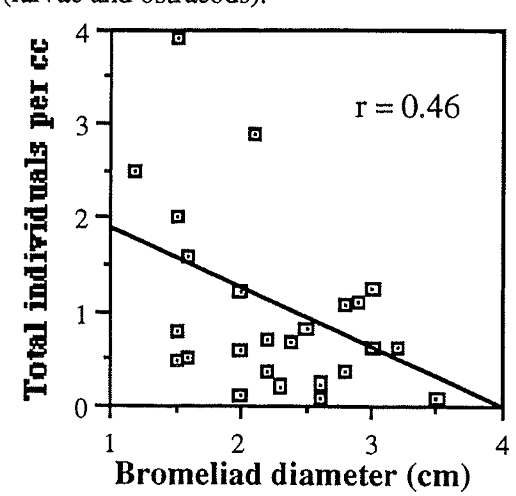

Figure 3. Relationship between bromeliad central reservoir diameter and total number of individuals (larvae and ostracods) per unit volume.

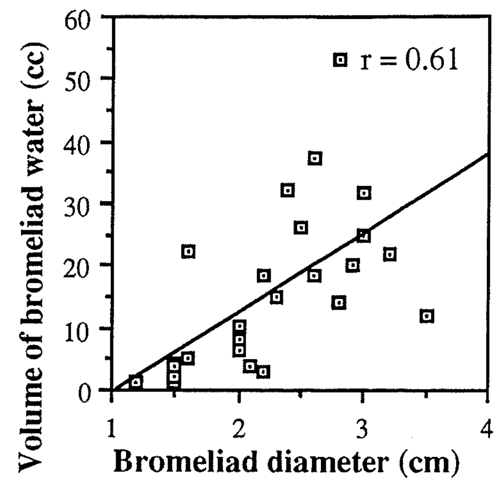

Figure 4. Relationship between bromeliad central reservoir diameter and volume of bromeliad water.

size as measured by central reservoir diameter ($p < 0.05$; Figure 2). However, the density of individuals per bromeliad decreased with increasing central reservoir diameter ($p < 0.05$; Figure 3). Bromeliads with larger reservoir diameters contained significantly greater volumes of water ($p < 0.01$; Figure 4).

DISCUSSION (DML)

Our results did not support the hypothesis that insects and ostracods are competing for the same limited resource. However, our findings did support the corollary that total number of individuals per bromeliad is positively related to bromeliad size.

We suggest two possible explanations for our results. The first is that insects and ostracods may be utilizing the same unlimited resource. In this case, higher total numbers of individuals in larger versus smaller bromeliads may simply be due to higher recruitment. Alternatively, the larvae and ostracods may be utilizing different limited resources. If this is true, then the direct relationship between bromeliad size and total number of individuals per bromeliad may be due to decreased survival in smaller bromeliads with lower resource availability.

Several further studies could be done in order to distinguish between the above two explanations. These include examining: a) recruitment rates for different sized bromeliads; b) larval vs. ostracod food preferences; and c) growth and survival of individuals in different sized bromeliads and in bromeliads with experimentally manipulated resource levels.

Determining resource densities for different sized bromeliads could also be helpful in explaining our results. From our observations, we would expect that the amount of resources per unit volume is approximately constant regardless of bromeliad size. If so, then the inverse relationship found between bromeliad size and the density of individuals per bromeliad could suggest stiffer resource competiton in smaller bromeliads. This would support the explanation that bromeliad community size is determined by differential survival and not differential recruitment.

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