

be helpful. Further comparative studies between forest edge, secondary growth, and primary forest would be of interest, including various height ranges.

#### LITERATURE CITED

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#### DIFFERING FORAGING STRATEGIES OF DENDROBATES PUMILIO AND ELEUTHERODACTYLUS SPP.

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#### ABSTRACT (BME)

We examined foraging behaviors of Dendrobates pumilio and Eleutherodactylus spp. in a lowland tropical rain-forest in Costa Rica. We hypothesized that D. pumilio, as an active forager, would consume more prey items with greater selectivity than Eleutherodactylus spp., which are "sit and wait" predators. Our behavioral observations supported the classification of D. pumilio as an active forager and Eleutherodactylus as a sit and wait predator, although our sample size was insufficient to reveal any trends in prey consumption.

Key Words: Dendrobates pumilio, Eleutherodactylus spp., foraging behavior.

#### INTRODUCTION (PSW)

In general, tropical frogs use two strategies to capture prey, "sit and wait" predation and active foraging. In the former, the frog remains motionless in the leaf litter waiting for prey to pass by. In the latter, the frog actively searches for and pursues prey.

It has been suggested that the genus Eleutherodactylus spp. is a "sit and wait" predator and that Dendrobates pumilio is an active forager (Limerick, 1976). Both frogs are very common in the lowland rainforests of Costa Rica where they prey upon small arthropods.

In this study, we initially examined whether the two frogs' foraging strategies were as suggested. We then hypothesized that the diversity and quantity of arthropods eaten by frogs is related to their foraging strategy. We predicted that D. pumilio will specialize on a few prey species because it can seek out those most palatable, while Eleutherodactylus spp. will be a generalist. We further predicted that D. pu-

milio would consume greater quantities of prey than Eleutherodactylus spp. in order to offset the increase in energy costs associated with searching for and pursuing prey. We examined their foraging strategies by a combination of in situ observations and laboratory manipulations.

#### METHODS (BME)

Research was conducted at La Selva Biological Station, Heredia, Costa Rica. On 13-14 February, 1994, we collected 8 Dendrobates pumilio and Eleutherodactylus spp. frogs from the forest and leaf litter surrounding La Selva's primary laboratories. The majority of the Eleutherodactylus were E. bransforolis. Frogs were stored together in a 40 liter container. The frogs were collected and starved at least 6 hours prior to experimental manipulations. We collected prey items (ants, termites and orthopterans) from the same areas that we collected frogs.

We constructed two experimental arenas from 50cm by 25cm sections of tabletop co-

vered with 6cm high clear ABS plastic covers. Corners of the cover were taped down to prevent prey from escaping. A 3.5cm hole cut through the cover allowed transfer of frogs and prey.

Each trial consisted of 5 individuals of each prey type in each of the two arenas. One *D. pumilio* and one *Eleutherodactylus* spp. each were added to each of the arenas for each trial. To control for size related increases in prey consumption, we measured the mass of all frogs prior to the trials. This data was not analysed because of the frogs' low prey consumption. Trials lasted for 30 minutes, with behavioral data being recorded in 5 minute bouts, starting at 5 minutes, 15 minutes and 25 minutes of the trials' elapsed time. Behavior was classified as either hopping or attempting to escape, and the total number of each type was recorded for each sampling period. Total activity (hopping plus escaping) were used in analyses. After 30 minutes we removed the frogs and counted the remaining prey terms. Those missing were assumed to have been consumed.

We conducted *in situ* observations on 6 *D. pumilio* and 6 *Eleutherodactylus* spp. When a frog was discovered, the observer backed ≈6m away, and then watched the frog for 13 minutes. The first three allowed frogs to resume normal behavior. Number of hops were recorded for the last 10 minutes.

Activity levels were analyzed using a Mann-Whitney U-test.

## RESULTS (PSW)

In the arena experiments, *D. pumilio* hopped, on average, five times more often than *Eleutherodactylus* spp., showing a strong difference in activity levels ( $U = 60$ ,  $n_1 = n_2 = 8$ ,  $p < 0.001$ ; Figure 1). Over 50% of this activity was directed toward escaping the arena. In the *in situ* observation, *D. pumilio* hopped 5 times more often than *Eleutherodactylus* spp. ( $U = 36$ ,  $n_1 = n_2 = 6$ ,  $p < 0.005$ ; Figure 1), suggesting that *D. pumilio* arena activity reflects natural levels. These data are consistent with the hypothesis that *D. pumilio* and *Eleutherodactylus* spp. are active foragers and "sit and wait" predators respectively.

In the arenas, *D. pumilio* consumed three ants, five termites, and no orthopterans over the eight trials. *Eleutherodactylus* spp. consumed one ant, six termites, and one orthopteran.

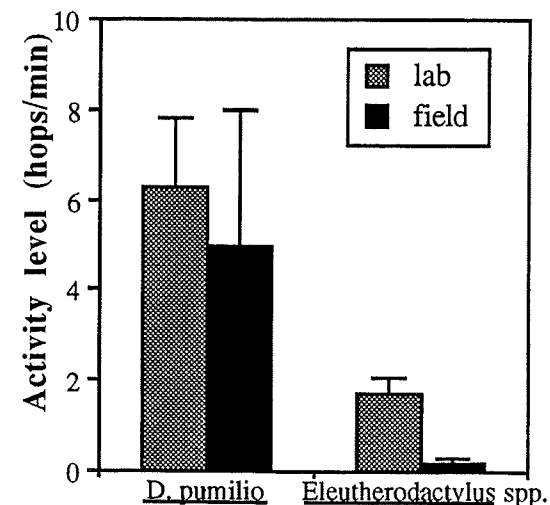


Figure 1. Laboratory and field activity levels for *D. pumilio* and *Eleutherodactylus* spp.

We were unable to demonstrate any differences in foraging selectivity or number of consumed prey due to the low number of insects eaten.

## DISCUSSION (BME)

*D. pumilio* were much more active in both the laboratory and field portions of this experiment. The activity measured in the lab manipulations, although not true foraging activity, was similar to the activity level measured in the field. Because of this similarity we conclude that *D. pumilio* actively forage, while *Eleutherodactylus* spp. are sit and wait predators. *Eleutherodactylus*' cryptic coloration is possibly an adaptation for sit and wait predation, while *D. pumilio* bright red coloration is consistent with

its active foraging. *D. pumilio*'s poisonous skin allows it to actively search for prey without fear of predation, an advantage *Eleutherodactylus* spp. do not have.

Because of small sample size, our total prey consumption and prey selectivity showed no trend. It is possible that the frogs had not acclimated to arenas in the 30 minute trials, causing reduced foraging activity.

## LITERATURE CITED

- Limerick, S. 1976. "Dietary differences of two sympatric Costa Rican frogs." MS Thesis, University of Southern California, Los Angeles, CA.