

Diel differences in leaf-litter abundances of several species of reptiles and amphibians in an abandoned cacao grove in Costa Rica

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Resumen: En nuestros diurnos y nocturnos de la herpetofauna de las hojas secas en una selva tropical de tierra baja en Costa Rica, tres especies, *Dendrobates pumilio*, *Norops humilis*, y *Norops limifrons* aparecen en cantidades significativamente mayores en la noche. Esta es evidencia indirecta de un movimiento vertical. Sugerimos que durante el día los animales se mueven verticalmente, saliendo de la capa de hojas, a donde regresan al anochecer. Esta hipótesis es consistente con lo que ya se sabe de éstos organismos.

Accumulated leaf-litter of tropical forest floors forms an important microhabitat for many species of reptiles and amphibians; the layers of dead and decomposing leaves provide shelter, food, breeding and oviposition sites (Scott 1976). Many leaf-litter amphibians and reptiles are not restricted to the two dimensions of the forest floor but may move vertically into the vegetation. Miyamoto (1982) found that at several Costa Rican sites, certain frogs of the genus *Eleutherodactylus* occurred diurnally on the ground but often were found on vegetation above the ground at night. He invoked an hypothesis of physiological constraints during the day with selection for call sites at night to explain this behavior.

We sampled nineteen litter plots, 10 during the day and 9 at night, in the Las Vegas cacao grove of the La Selva Biological Station, Heredia Province, Costa Rica, between 18 July and 11 September 1985. The site has been fallow for approximately one year. The original cacao trees form most of the canopy, while *Cnidocolus urens*, an herbaceous, urticating plant, forms most of the understory. Few other plant species occur in the grove. Dead leaf accumulation from the cacao trees is extensive (mean depth = 3.8 cm). All amphibians and reptiles

(to a height of 0.5 m in the vegetation) were identified, weighed, and measured (SVL). We used the Mann-Whitney U-test to test for significant differences between day and night samples. One-tailed tests were used in all comparisons. We defined "night" as between 1800 and 0600 hours.

Norops limifrons, *N. humilis*, and *Dendrobates pumilio* were significantly more abundant at night (Table 1). *Lepidoblepharis xanthostigma* tended to be more abundant at night, but the difference was not significant. *Eleutherodactylus bransfordii* occurred in nearly equal numbers in day and night plots. Five species were found in too low numbers to allow statistical treatment (*Gastrophryne pictiventris* = 1, *Ninia maculata* = 1, *Ameiva festiva* = 1, *Mabuya unimarginata* = 4, *Bufo haematiticus* = 1).

Our results agree with those of Lieberman (1982) for *N. limifrons*, *N. humilis*, and *D. pumilio*. She found these species to be more abundant at night at a different cacao grove on the La Selva Reserve. However, she also found this to be true for *E. bransfordii*, in contradiction to our results. One logical interpretation is that the proportion of individuals of each species occupying sites above the sampling zone is greater during the day, but drops at night as

TABLE 1

Numerical distribution of individuals of 5 species of reptiles and amphibians sampled in forest litter plots in Costa Rica. * = significant at = 0.05, ** = significant at = .005.

Species	Daytime plot number										Night time plot number										Us	P	
	1	2	3	4	5	6	7	8	9	10	T	1	2	3	4	5	6	7	8	9			T
<i>Dendrobates pumilio</i> *	1	2	3	1	3	2	1	2	4	2	21	3	7	5	2	9	3	2	2	3	36	69	<.031
<i>Lepidoblepharis xanthostigma</i>	0	0	2	0	0	0	1	1	1	0	5	0	5	1	0	2	2	4	0	1	15	57	<.158
<i>Norops humilis</i> *	1	0	0	1	0	1	2	2	0	0	7	0	2	2	2	1	2	1	1	2	13	70	<.025
<i>Norops limifrons</i> **	0	0	0	1	0	0	0	0	1	1	3	0	2	9	2	3	3	2	1	4	26	82	<.001
<i>Eleutherodactylus bransfordii</i>	1	1	3	0	1	2	4	2	0	2	16	1	1	3	2	3	0	2	0	2	14	46	<.200

animals move down into the litter. We think that this is a realistic explanation for the two *Norops* species considering what is already known about their behavior (Talbot 1979).

Our hypothesis of diel vertical movements may also explain the results for *D. pumilio*; both males and females of this diurnally-active species are known to move vertically into trees to deposit tadpoles into bromeliads and males are often known to utilize call sites off the ground (Starrett 1960).

Our suspicion is that our results have some generality with respect to tropical reptile and amphibian leaf litter assemblages; these animals are not restricted to the layers of dead leaves but will move vertically on a diel basis according to physiological constraints, social requirements, or procreative functions.

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