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Ecological distribution of the Puerto Rico Crested Anole, *Anolis cristatellus cristatellus*, in Cahuita, Costa Rica

Introduction

Anolis cristatellus, the crested anole of Puerto Rico and the Virgin Islands, was designated a “minor colonizer” by E. E. Williams in his classic paper on the ecology of colonization (1969. The ecology of colonization as seen in the zoogeography of anoline lizards on small islands. *Quarterly Review of Biology* 44:345-389). From its Puerto Rican home, it has colonized the Mona and Monito Banks in the Mona Passage and, considerably farther away, several banks in the Turks and Caicos and southern Bahamas. It has also been successfully introduced into Costa Rica, the Dominican Republic, and twice into south Florida (A. Schwartz and R. Thomas. 1975. A check-list of West Indian amphibians and reptiles. *Carnegie Museum of Natural History Special Publication* 1; Jason J. Kolbe, Richard E. Glor, Lourdes Rodriguez



Fig. 1. Distribution of *Anolis cristatellus* in Costa Rica (pins) after Savage (2002). Map from Google Earth.

Schettino, Ada Chamizo Lara, Allan Larson, and Jonathan B. Losos. 2007. Multiple sources, admixture, and genetic variation in introduced *Anolis* lizard populations. *Conservation Biology* 21:1612-1625).

In Costa Rica, the initial establishment was at Limon, with the earliest record being in 1970 (J.M. Savage, pers. comm. 2009). Crested anoles have since spread to several other localities (Fig. 1; J.M. Savage. 2002. *The Amphibians and Reptiles of Costa Rica*. University of Chicago Press; pers. comm. 2009). The furthest they have reached is Turrialba in the Central Valley, about 90km by road from Limon. Here I report on observations made on the population in Cahuita.

Study Site and Methods

Cahuita is a small town on the Caribbean coast of Costa Rica, separated from Cahuita National Park by Kelly's Creek, which is crossed by a foot bridge (Fig. 2). The seaward edge of the town is a littoral forest dominated by coconut palm, seagrape, and almond (all common West Indian species; Fig. 3). The national park is much more floristically diverse (Fig. 4). The trees which dominate the littoral woodland in town are present but much less common, and no species dominates the flora.

Anoles were captured and examined in order to identify them to subspecies. Local residents were queried about their knowledge of the crested anoles. Rand censuses were conducted July 12-13, 2006 in the littoral woodland, and on July 13, a brief survey of the adjacent part of the National Park was made with the assistance of Park personnel.



Fig. 2. Aerial view of Cahuita and vicinity (Google Earth).



Fig. 3. Littoral woodland with coconut palms and almond; a small seagrape is at the base of the most seaward palm. Photo by Sean Murphy.

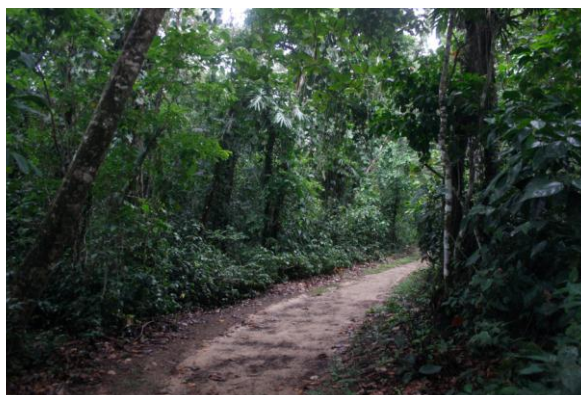


Fig. 4. Diverse forest along trail just landward of the beach in Cahuita National Park. Photo by Sean Murphy.

Results

Identity

The anoles present were *Anolis cristatellus cristatellus*, the Puerto Rican subspecies, with pale orangish dewlaps with pale green centers. The Virgin Island subspecies, *A. c. wileyae*, is easily distinguished by its deeply colored red dewlap with distinctly green center (Fig. 5; H. Heatwole. 1976. Herpetogeography of Puerto Rico. VII. Geographic variation in the *Anolis cristatellus* complex in Puerto Rico and the Virgin Islands. *Occasional Papers of the Museum of Natural History, University of Kansas* 46:1-18).



Fig. 5. *Anolis cristatellus cristatellus* from Cahuita, Costa Rica. Photo by Sean Murphy.

Chronology

Cahuita is about 35km from Limon. Sr. Guillermo Mora, owner of the hotel at which we stayed, recalled that the crested anoles had been present for about 20 years (i.e. arriving ca. 1986), and he observed that the tail crest, not found in any local anoles, made them distinctive and noteworthy.

Macrohabitat Distribution

Crested anoles were abundant north of Kelly's Creek (the town side). Of 119 lizards encountered during Rand censuses, 113 were crested anoles; the remainder were *Ameiva quadrilineata* (5) and *Gonatodes albogularis* (1). In addition, two species of introduced geckos (*Hemidactylus frenatus* and *Lepidodactylus lugubris*) were observed north of Kelly's Creek, but not seen during the censuses. East of Kelly's Creek, in the National Park, no crested anoles were found. Although it was a brief visit, 16 lizards of seven species were observed: *Hemidactylus* sp. (4), *Gonatodes albogularis* (2), *Anolis limifrons* (2), *Iguana iguana* (1), *Basiliscus plumifrons* (1), *B. vittatus* (1), and *Ameiva quadrilineata* (5).

Mesohabitat Distribution

Within Cahuita town, anole perch sites were classified as littoral woodland, yard, or hotel. Anoles were much more abundant in the littoral woodland than in the other, highly human-modified areas (Fig. 6). This is not due to sampling bias; considerable time was spent in the town proper looking for anoles.

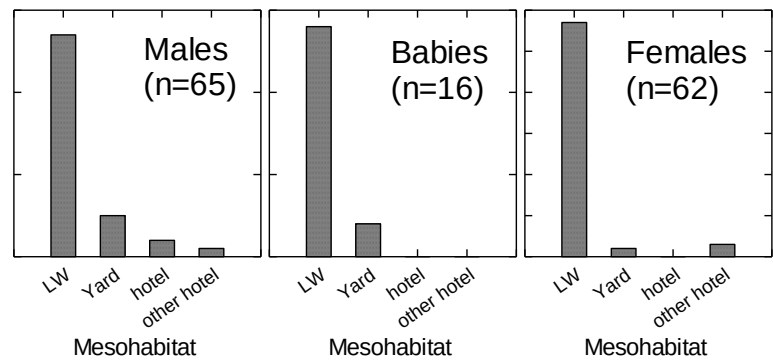


Fig. 6. Mesohabitat distributions of *Anolis cristatellus* at Cahuita, Costa Rica. LW=littoral woodland.

Microhabitat distribution

Perch height distributions were broadly overlapping for males and females, but male perches were on average about twice as high as female perches (Fig. 7). For both sexes the modal and median class for perch diameter was 1-10 cm (Fig. 8). Baby anoles perched lower than females, and had a distinctly bimodal perch diameter distribution, occurring either on very thin perches, or flat surfaces (which have 'infinite' diameter; Fig. 9).

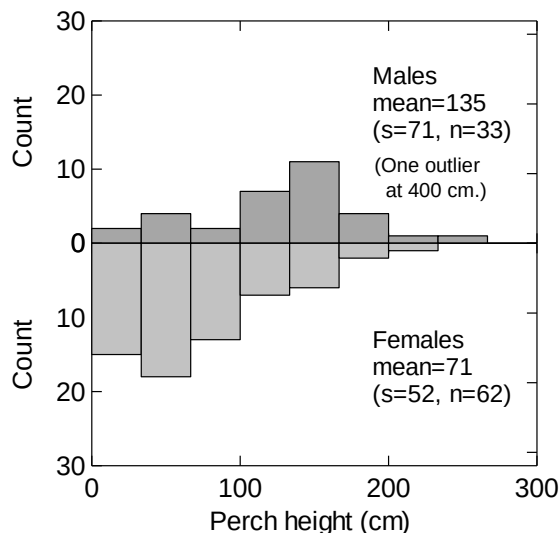


Fig. 7. Perch height distributions of *Anolis cristatellus* at Cahuita, Costa Rica.

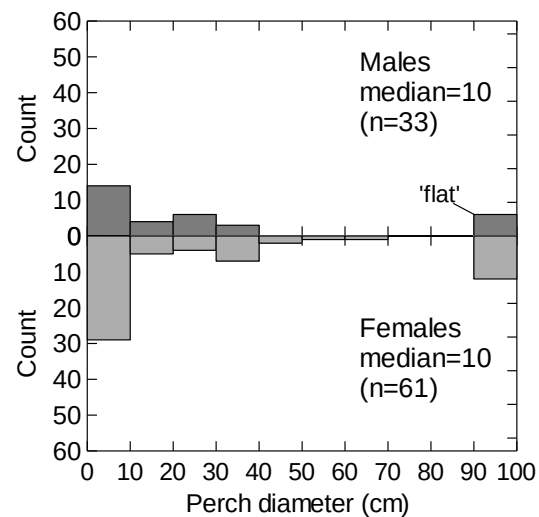


Fig. 8. Perch diameter distributions of *Anolis cristatellus* at Cahuita, Costa Rica. Flat = infinite diameter, arbitrarily plotted as 90-100cm.

Perch type distributions were similar for males and females, the three most frequent types being the same for both sexes; babies were more frequently found on the ground than adults (Fig. 10). Within the arboreal perch types, tree species differed little between the sexes (coconut and almond being most frequent), while babies were again distinctive (Fig. 11).

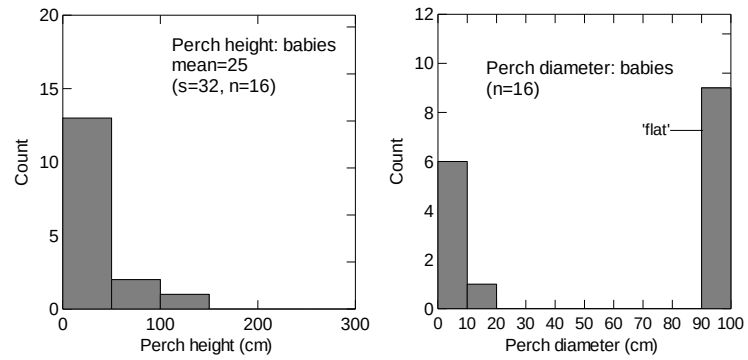


Fig. 9. Perch height and diameter distributions of baby *Anolis cristatellus* at Cahuita, Costa Rica.

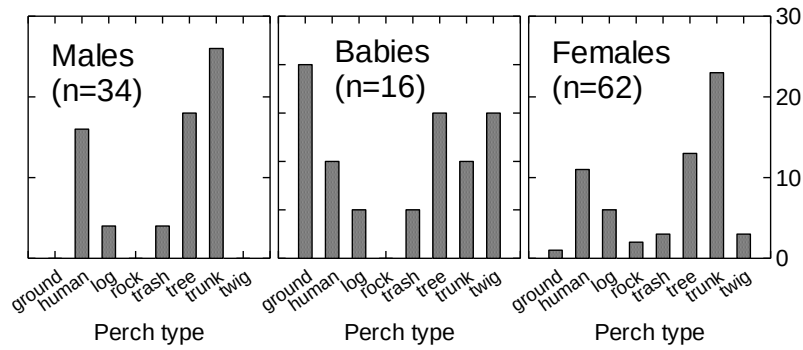


Fig. 10. Perch type distributions of *Anolis cristatellus* at Cahuita, Costa Rica.

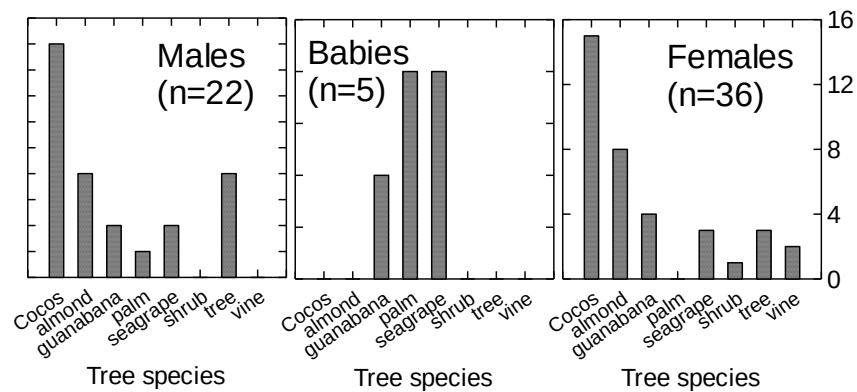


Fig. 11. Tree species distributions of *Anolis cristatellus* at Cahuita, Costa Rica.

Discussion

In Cahuita town, *Anolis cristatellus* is well established and abundant. Its microhabitat distribution is exactly what would be expected in its native range in Puerto Rico or the Virgin Islands (Rand, A.S. 1964. Ecological distribution in anoline lizards of Puerto Rico. *Ecology* 45:745-752; Schoener, T. and A. Schoener. 1971. Structural habitats of West Indian *Anolis* lizards II. Puerto Rican uplands. *Breviora* 375:1-39; Mayer, G. 1989. *Deterministic Aspects of Community Structure in West Indian Amphibians and Reptiles*. Ph.D. thesis, Harvard University). The impression of being in the West Indies is strengthened by the flora, and by the fact that many of the residents of Cahuita are of English-speaking West Indian ancestry.

Upon crossing Kelly's Creek from Cahuita town into the National Park, I felt much as I think Wallace must have felt when crossing between Bali and Lombok. It was like entering another biogeographic region. And, indeed, in many ways it was. In Cahuita town there is a low diversity, high abundance lizard fauna, three of whose five members are introduced. The woodland flora also shows low diversity with dominance of a few common species. It seems just like the West Indies. In the national park, there is a more diverse, but less abundant, lizard fauna: seven species were observed during a minimal survey, only one of which is introduced (and that one, *Hemidactylus*, was found only in the park buildings). That just a small creek separates town and national park is notable, and suggests that the natural forest is difficult for the crested anole to invade. The success of this introduced anole in Cahuita is confined to the anthropogenic environment in the immediate vicinity of the town itself. The close proximity of the town and the national park in Cahuita provides a particularly good test case of whether introduced anoles thrive only in anthropogenic environments, or whether they can insert themselves into natural communities. In this case, it is clearly the former, and not the latter.