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# FIELD NOTES ON ANOLIS LINEATUS IN CURAÇAO

by

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Several recent papers have described ecological differences between sympatric species of *Anolis* in the Greater Antilles (RUIBAL 1961, COLLETTE 1961, RAND 1962, 1964, 1966). A three day visit to Curaçao in September, 1962, provided an opportunity to make field observations on a species of *Anolis* that occurs with no congeners. These observations suggest that it occupies a microhabitat somewhat broader than most of the Antillean species.

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Curaçao, off the north coast of Venezuela, is about 60 by 10 km (425 km²). Mostly flat, it has a number of low limestone hills (up to 230 m), and a few non-calcareous higher tops (372 m). The island is strongly exposed to the tradewinds, from the east, and is very dry. The rain falls chiefly in heavy, short-lived showers, which are often only of local importance. The average annual temperature is about 27.5 °C; the mean rainfall about 550 mm. The vegetation is largely thorn scrub and cactus, but some hills are completely bare and there are also some groves of quite large trees near the shores or in irrigated areas.

## Anolis lineatus

*Anolis lineatus* Daudin, 1802; cf. WAGENAAR HUMMELINCK 1940, p. 78, pl. 14 [Vernacular name: waltaka, kako, ragadiesjie di paloe; commonly occurring on Curaçao and Aruba.]

This is a medium sized anole with moderate sexual dimorphism in size. The larger males were about 70–75 mm in snout-vent length,



the large females about 60 mm. In life the lizards are light brown, sometimes greyish, above usually with distinct lateral stripes, pale grey, cream or tan and edged above and below with black or dark brown. The top of the head has an orange cast. There are usually several indistinct light vertical bars on the body, particularly in the males. The females may have a middorsal series of indistinct light diamonds. The tail is barred. The venter is whitish; the throat more or less mottled with brown. There is little color change except from lighter to darker.

The dewlap is large in the male; extended it has a wide border with bright orange skin around a black central spot. The spot is crossed by several widely separated rows of white scales. The border on one side is closely set with yellow or whitish scales, on the other side the scales are rudimentary and colored like the skin. About half the males have the scales well developed on the right side of the dewlap, about half on the left. From several feet away the asymmetry is still apparent, one side of the dewlap appears to have a bright orange border, the other side a yellow orange border. The females have a much smaller dewlap, but colored like the males' and also asymmetrical, though less conspicuously so.

Anoles were collected in the northwest (Knip, Barber, Savonet) and southeast (near Choloma) ends of the island and in the center near the south (Willemstad, Groot Davelaar) and north (near Brievengat) coasts. We found no evidence of geographical variation though it has been reported from islands as small as Curaçao (Grand Cayman, GRANT 1940; and Dominica, LAZELL 1962).

Anoles were found at most places where we stopped to collect. They were least common in the more open thorn scrub and cactus where there were no larger trees, but at one locality we found 6 or 7 in an area of a few square yards which was part of a fence made of organ pipe cactus and thorny mimosa-like trees. None were seen in the surrounding scrub and apparently their distribution is spotty in such habitats. In the small groves of larger trees and in fruit orchards examined, anoles were much more common than they were in the adjacent scrub. In these localities the majority of the larger trees had anoles on them. The densest population seen was in a densely planted and well watered garden in Willemstad where every tree was inhabited and there were lizards on fences, trellises, etc. Here one morning in half an hour we counted 32 individuals.

Most of the anoles seen were on the trunks and branches of moderate to large trees. Two or three were seen on rocks and two on walls. Few were seen in bushes, mostly small individuals, and none in the low patches of cactus.

To provide more detailed information on the perches preferred by *Anolis lineatus*, we examined a well watered garden in Willemstad on three different days and

TABLE 3. Structural niche of *Anolis lineatus*.

Number of individuals seen.

| Perching height \ Perch diameter | Adult male | | | | Smaller individuals | | | | *Total* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | >3 | ½–3 | <½″ | Tot | >3 | ½–3 | <½″ | Tot | >3 | ½–3 | <½″ | Tot |
| > 10′ | 2 | | | 2 | 5 | 1 | | 6 | 7 | 1 | | 8 |
| 6–10 | 9 | 8 | 1 | 18 | 7 | 4 | | 11 | 16 | 12 | 1 | 29 |
| 3–5 | 12 | 6 | | 18 | 15 | 3 | | 18 | 27 | 9 | | 36 |
| < 3 | 7 | 3 | | 10 | 15 | 9 | 1 | 25 | 22 | 12 | 1 | 35 |
| Total | 30 | 17 | 1 | 48 | 42 | 17 | 1 | 60 | 72 | 34 | 2 | 108 |

recorded the height above the ground and the diameter of perch of every anole seen. The same data was recorded for almost every other *lineatus* seen outside of this garden. These data for 108 lizards are given in Table 3.

All of the lizards seen were perched above the ground though we saw two come to the ground briefly. Most were below 10 feet though we saw one as high as 20 feet. The distribution below 10 feet is quite evenly divided among the three categories used in Table 3. The large majority of the lizards were on perches greater than 3 inches in diameter and very few on very slender perches. The adult males and the smaller individuals, mostly adult females, show very similar perch preferences, both in diameter and height, though more smaller than larger lizards were seen close to the ground. Only five very small individuals were seen, they were all within 3 feet of the ground and four of them on perches 1½ inches in diameter or less.

In comparing sympatric species of *Anolis* on Puerto Rico (RAND 1964) and Jamaica (RAND MS), I have discussed perch preferences in terms of structural niche, using perch diameter and perching height to describe it. Table 4 compares the perch diameter and perching height of certain of these Greater Antillean species with those of *lineatus*.

On Puerto Rico, a trio of species lives on slender perches near the ground, contrasting with the other four common species that use moderate to large perches. In Jamaica no species specializes in slender perches.



TABLE 4. A comparison between *Anolis lineatus* of Curaçao and the common *Anolis* of Puerto Rico and Jamaica.

Percent of number of individuals of each species seen.

| | Perch height | | | | Perch diameter | | |
|---|---|---|---|---|---|---|---|
| | < 3 ft | 3–5 ft | 6–10 ft | > 10 ft | > 3 in | ½–3 in | < ½ in |
| Puerto Rico | | | | | | | |
| *stratulus* | 15% | 33% | 37% | 14% | 73% | 23% | 3% |
| *evermanni* | 18% | 44% | 27% | 11% | 85% | 14% | 1% |
| *gundlachi* | 46% | 40% | 13% | 0% | 50% | 41% | 8% |
| *cristatellus* | 47% | 40% | 11% | 1% | 65% | 27% | 7% |
| Curaçao | | | | | | | |
| *lineatus* | 32% | 33% | 27% | 7% | 67% | 31% | 2% |
| Jamaica | | | | | | | |
| *lineatopus* | 43% | 33% | 20% | 4% | 45% | 38% | 16% |
| *opalinus* | 11% | 26% | 39% | 24% | 53% | 41% | 6% |
| *grahami* | 10% | 25% | 32% | 33% | 62% | 30% | 7% |

Though slender perches are available on Curaçao, *A. lineatus* occurs only rarely on them and then apparently primarily when small. (A similar difference in structural niche between young and adult has been described by COLLETTE 1962, for *A. porcatus* on Cuba.) In perch diameter its structural niche is much like the majority of the Puerto Rican and the three most common Jamaican species.

On both Puerto Rico and Jamaica the moderate to large diameter perches are occupied by two sets of species, one set occurring higher than the other. *Anolis lineatus* is not as closely restricted to near the ground as are *cristatellus* and *gundlachi* on Puerto Rico or *lineatopus* on Jamaica, nor is it seen on the ground as frequently. On the other hand, it is less frequently seen above 10 feet and more frequently seen below 3 feet than are *stratulus* and *evermanni* on Puerto Rico and *grahami* and *opalinus* on Jamaica.

On Curaçao the single species present does not spread evenly over the available perching heights, though its height distribution seems broader than that of at least some of the Greater Antillean

species. It is more striking that its greatest concentration occurs at heights which correspond to the zone of overlap between the sympatric species; speculation on the significance of this must be postponed until the structural niches of additional anoles have been described, but it does suggest that this may be a particularly favorable perching height.

In the Greater Antilles, species with similar structural niches differ in their distribution with respect to sun and shade and those living in sunnier places usually have higher body temperatures than those living in shady places.

*Anolis lineatus* occurs most commonly in the more shaded parts of Curaçao but since these are also those places with most trees and the species seems to prefer trees as perches, it is difficult to evaluate the importance of shade and temperature without data on lizard temperatures.

The most frequent position for these lizards was head downwards on a vertical surface, but many were seen head up or at a wide angle from the vertical.

Almost all of the anoles seen were adult males and adult females. Some young males of adult female size were taken, but very small individuals were seen only in the well watered garden in Willemstad. This suggests seasonal breeding. However, we saw one copulation and one female laid a fully formed egg in the collecting bag. It was ovoid, 8 × 16 mm, white with a flexible skin.

The lizards were not particularly shy and we caught almost all of those we tried to noose. When disturbed, a lizard usually spiraled up its tree. In denser vegetation one sometimes retreated horizontally. Only a very few that were found on short posts ran down to escape.

A single female was found asleep, on the topmost leaves of a 4 foot high bush.

On twenty-three occasions more than one anole was seen on the same perch, accounting for 51 of the 108 lizards for which these data were recorded. Of these 23 perches, 14 had one adult male and one smaller lizard, probably a female; two had an adult male and two smaller anoles; four had two smaller lizards only; two had two adult males; and one had two adult males and two smaller anoles. Two adult males or two smaller anoles occurred together less frequently and one adult male and one smaller lizard more frequently than would be expected by chance. This suggests that adult males and probably smaller lizards as well are intolerant of others of their size and sex and that some, at least transient, pair formation occurs.

Both male and female anoles sometimes bobbed after shifting position, presumably an advertisement or assertion display. Males also sometimes displayed their dewlaps after moving. A male began by bobbing, moving his head up and down a short distance rapidly and uniformly. Then the dewlap was extended fully and relaxed several times in succession. Bobbing continued during and for a short time after dewlap flashing.

One male was seen displaying at another. He oriented laterally to him with his dorsal and nuchal crests raised and his sides flattened. He gave a short series of



push-ups and then displayed his dewlap as described above. No other fighting was seen between males but we saw one female chase another.

We saw one copulation. A female had been tethered to a long slender stick and placed about 8 inches from an adult male. He bobbed and flashed his dewlap, then reversed his position so that the other side of his dewlap was towards her and repeated the display. At this point, the female escaped from the stick and ran about a foot away from the male. He approached her and straddled her from behind. After about 1/2 minute, he took a bit of loose skin on the nape of her neck in the tips of his jaws and walked with her for several inches, then bobbed several times, moving her head and neck up and down with his. Several times he attempted to copulate, but as he twisted his body to bring his vent forward to hers she took a couple of steps and straightened him out again. Between these attempts the male bobbed. Finally he succeeded in copulating and when one hemipenis had been inserted, he released his hold on her neck and they remained still until they separated 3 3/4 minutes later.

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