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US ISSN 0006-9698

CAMBRIDGE, MASS.

30 JULY 1976

NUMBER 437

ANOLIS ALUMINA, NEW SPECIES OF GRASS ANOLE FROM THE BARAHONA PENINSULA OF HISPANIOLA

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ABSTRACT. A new species, *Anolis alumina*, from the Barahona Peninsula of Hispaniola is described on the basis of two scale characters and dewlap color in males. Electrophoretic and morphological analyses show that *alumina* is more closely related to *A. semilineatus* than to *A. olsoni*. Limited distributional data suggest that the new species is more eurytopic than either of the other two species of Hispaniolan grass anoles, occurring in habitats ranging from lowland desert scrub to high elevation pine savannah.

During 1973 and the winter of 1974, I initiated an electrophoretic study of the grass anoles of Hispaniola, using material that had been collected by various researchers in the Harvard *Anolis* group; the results, though incomplete, suggested that animals found south of the Massif de la Selle—Sierra de Baoruco mountain chain are taxonomically differentiated from the white-dewlapped *A. semilineatus* Cope of the northern part of Hispaniola.

While collecting in the Dominican Republic during the summer of 1974, Raymond B. Huey and I journeyed to the south slopes of the Sierra de Baoruco to look for grass anoles. We were fortunate to enjoy the hospitality of the Alcoa Exploration Company at their bauxite mining operation at Cabo Rojo, Pedernales Province, while we explored the mine area and surrounding countryside.

As we drove up to the mine one morning, Huey spotted a small animal dart across the road in front of our vehicle. After

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perhaps ten minutes of frantic searching and chasing the elusive lizard in the pine savannah into which it fled, I succeeded in grabbing the animal which promptly exhibited his displeasure by erecting his pale greenish-yellow gular fan. I suspected at once that we had captured a previously undescribed species of *Anolis* which, in honor of our hosts, I name

Anolis alumina, new species

Holotype. 31.5 km north of Cabo Rojo, Pedernales Province, Dominican Republic (elevation 1150 m), MCZ 143824, P. E. Hertz and R. B. Huey collectors, 8 July 1974.

Paratypes. *Dominican Republic*: Pedernales Province: Pedernales: ASFS V2816, R. Thomas collector, 3 July 1964; 5 km north of Pedernales: ASFS V2544-V2545, R. Thomas collector, 25 June 1964; 9 km north of Pedernales: ASFS V21496, R. Thomas collector, 27 July 1969; 6 miles north of Pedernales: ASFS V30118-V30127, D. C. Fowler and A. Schwartz collectors, 23 August 1971; 21 km north of Cabo Rojo: ASFS V30058, D. C. Fowler collector, 21 August 1970; 23.5 km north of Cabo Rojo: MCZ 143849-143851, P. E. Hertz and R. B. Huey collectors, 8 July 1974; 28 km north of Cabo Rojo: MCZ 143822-143823, P. E. Hertz and R. B. Huey collectors, 7 July 1974; 30 km north of Cabo Rojo: MCZ 146632-146633, W. E. Haas collector, 20 July 1975; 31.5 km north of Cabo Rojo: MCZ 143825-143827, P. E. Hertz and R. B. Huey collectors, 8 July 1974; MCZ 146627-146631, W. E. Haas and E. E. Williams collectors, 19 July 1975; 7 km north, 17.6 km southeast of Cabo Rojo: ASFS V30079-V30083, D. C. Fowler and A. Schwartz collectors, 22 August 1971; 5 miles northeast of Oviedo: ASFS V289, R. Thomas collector, 7 August 1963; 13.1 miles southwest of Enriquillo: ASFS X9966, A. Schwartz collector, 30 July 1963. *Barahona Province*: southern outskirts of Barahona: ASFS V30980, B. R. Sheplan collector, 12 September 1971; MCZ 106995, E. E. Williams, A. S. Rand, and E. Marcano collectors, 28 July 1968; 5 km south of Barahona: ASFS V20552, R. Thomas collector, 22 June 1969; 7 km southwest of Barahona: ASFS V23423, A. Schwartz collector, 4 January 1971; 4.1 miles southwest of Barahona: ASFS V30407-V30415, D. C. Fowler, A. Schwartz, and B. R. Sheplan collectors, 9 December 1971; 4 km northwest of Naranjal:

ASFS V20954; R. Thomas collector, 4 July 1969; 1 km south of Cabral: MCZ 140011-140012, T. P. Webster collector, 4 November 1973; 4.9 miles northwest, 0.3 miles west of Cabral: ASFS V30815, D. C. Fowler collector, 8 September 1971; Polo: AMNH 50320, W. G. Hassler collector, no collecting date. *Haiti*: Département de l'Ouest: Belle-Anse: MCZ 140104-140111, T. P. Webster collector, September 1973.

Diagnosis. An *Anolis* closely related to *A. semilineatus* and *A. olssoni* Schmidt, distinguished from both by smooth scales in the frontal depression (Fig. 1), enlarged middorsal scales grading into the granular scales of the flank (rather than abruptly distinct) (Fig. 2), and a pale greenish-yellow gular fan in males (rather than white or orange).

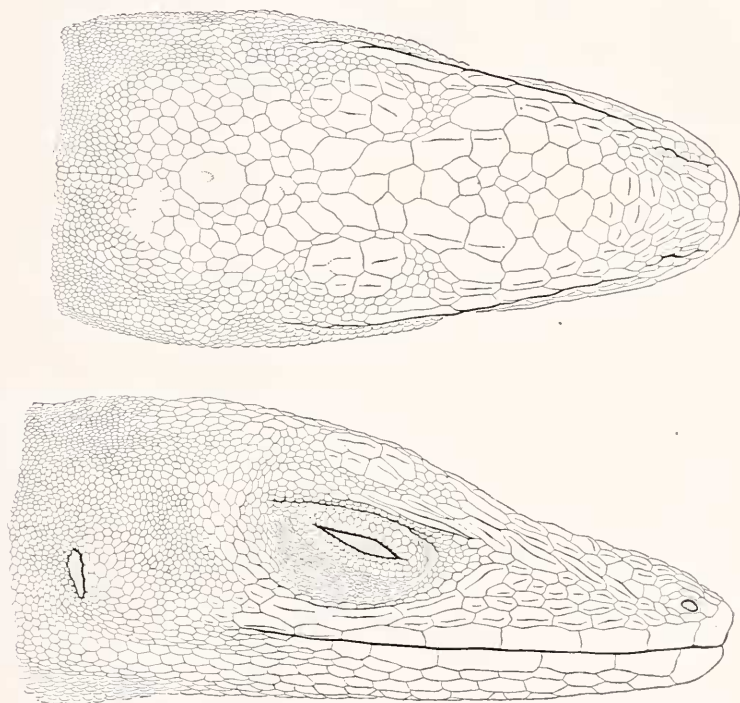


Figure 1. Dorsal and lateral views of the head of holotype of *Anolis alumina* (MCZ 143824).

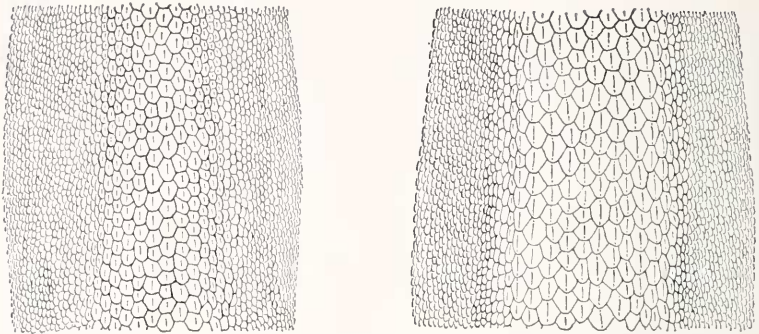


Figure 2. Enlarged middorsal scales of (left) *Anolis alumina* (MCZ 143824) and (right) *A. semilineatus* (ASFS V8093).

Head. Most head scales keeled. Six to eight scales across head between second and third canthals. Frontal depression extremely shallow (except in one specimen), its scales smooth and varying in size but never larger than the anterior supra-orbital.

Supraorbital semicircles usually separated by one scale row (separated by two scales in one specimen, in contact in two specimens) and separated from supraocular disc by one row of small scales or in contact with supraocular disc (two specimens). Supraocular disc consists of two to five large keeled scales and zero to three smaller keeled scales, usually surrounded by granular scales. Supraocular disc separated from elongate supraciliary by one to three rows of granular scales and/or a small elongate scale at anterior side of contact.

Canthus distinct, canthal scales four to five, second largest, diminishing in size anteriorly. Naris anterior to canthal ridge. Anterior nasal scale small, in contact with rostral scale. Four to five vertical loreal rows.

Temporal scales subgranular. Two to four rows of granular supratemporals (larger than temporals), grading into subgranular scales which grade dorsally into the larger scales surrounding the interparietal. Interparietal about as large as the ear, separated from supraorbital semicircles by two to three scales (four in one specimen). Suboculars keeled (sometimes markedly so) and in contact with supralabials. Four to six supralabials from rostral to center of the eye. Rostral scale markedly rounded on dorsal surface.

Mentals wider than long, two small elongate scales inserted between posterior tips. One to five (usually three) sublabials on each side contact infralabials. Central throat scales keeled, elongate. Gular fan large in males, absent in females. Scales of gular fan singly keeled, elongate or oval, about the same size as ventrals, not clearly arranged in rows.

Trunk. Unicarinate middorsal scales, arranged in longitudinal rows, about-as broad as long, grading laterally into small keeled or granular flank scales. Seventeen to 24 middorsals in standard distance (tip of snout to center of eye) in males, 15 to 19 in females. Ventrals in longitudinal rows, unicarinate, imbricate, and in some specimens slightly mucronate. Fifteen to 24 ventrals in standard distance in males, 11 to 18 in females. Enlarged postanal scales present in males.

Limbs and digits. Hand and foot scales multicarinate. Largest arm and leg scales unicarinate, about as large as enlarged middorsals. Fifteen to 18 lamellae under phalanges two and three of fourth toe.

Tail. Oval to circular in cross section two and one-half to three times snout-vent length.

Size. Largest male 40 mm snout-vent length. Largest female 37 mm snout-vent length.

Color in life. Dorsal surface of head tan to chestnut. Flanks chestnut. Middorsal stripe (or series of elongate blotches which meet medially) a peppered off-white, bordered on either side by a narrow tan stripe. Venter and mandible of both sexes and throat of females white with moderate brown peppering. Conspicuous white lateral stripe on maxilla from tip of snout along flank to hind leg, extending in some specimens to base of tail. Scales of gular fan (in males only) white with brown peppering. Skin of gular fan pale greenish-yellow. Iris blue.

Distribution. *Anolis alumina* appears to be widely distributed on the Barahona Peninsula and on the south slopes of the Sierra de Baoruco-Massif de la Selle mountain range (Fig. 3). Most specimens from this area which had been previously assigned to *semilineatus* are now designated as paratypes of *alumina* on the basis of the two diagnostic scale characters.

Preliminary observations suggest that the habitat preferences of *Anolis alumina* are similar to those of other Hispaniolan grass anoles. The type series was collected in the undergrowth of a pine savannah at middle elevations; the animals were

spotted while perching below two feet in the vegetation, and usually fled by dropping to the ground and scurrying into dense clumps of grass or between rocks. Other collectors have reported the animals sleeping on living and dead desert shrubs, on dead *Acacia* in and along the margins of cleared fields, and on dead grass and twigs in or near meadows. Albert Schwartz (personal communication) has collected three specimens at night from under rocks in hammock woods, a sleeping habit previously unreported for members of the *semilineatus* group. D. C. Fowler collected a single specimen asleep at a height of four feet on the leaf of a tree.

COMPARISONS WITH OTHER SOUTHERN ISLAND POPULATIONS IN THE *SEMILINEATUS* COMPLEX

Comparison of *alumina* with neighboring populations of grass anoles on the south island of Hispaniola supports the distinction of *alumina* as a full species. *A. alumina* and *semilineatus* are easily distinguished from *olssoni* on the basis of the size of the throat scales in females and the gular fan scales in males: in the latter species, throat scales are greatly enlarged and are much larger than the ventrals. We can then refer to *alumina* and *semilineatus* as members of the more primitive *semilineatus* complex within the *semilineatus* species group, and consider the enlarged throat scales of *olssoni* a derived character (Williams, 1961). *A. olssoni* can then be ignored (as unambiguously distinct) in morphological comparisons of southern island grass anoles because the only confusion of *alumina* and *olssoni* appears to have arisen from the fact that both species have pigmented (as opposed to "white," as in *semilineatus*) dewlaps.

Cope (1864) lists the type locality of *semilineatus* as "Hayti." The type specimen (BMNH 1946.8.5.85) resembles the Petionville *semilineatus* series in its keeled head scales and its dorsal standard distance counts. Since the Port-au-Prince area was, and still is, the most travelled part of Haiti, one is tempted to suggest that the type locality of *semilineatus* may plausibly be restricted to Petionville.

A series of *semilineatus* (ASFS V16698-V16707) geographically close to *alumina* was collected at the top of the road to the Alcoa mine near Cabo Rojo at an elevation of 4400 feet, approximately eight road kilometers above the type locality of *alumina*. The two diagnostic scale characters indicate that the

ASFS series is unquestionably *semilineatus*. In addition, their maxillary-lateral stripes are considerably darker than those on the nearest *alumina*, though this may be the result of different preservation techniques. These animals are smaller than their geographically closest Haitian conspecifics, but several males are larger than any of the specimens of *alumina* that we have at hand. It is possible that *semilineatus* replaces *alumina* at high elevations in the Sierra de Baoruco and Massif de la Selle, but much more material is needed to establish this point.

Because of inadequate collecting, our knowledge of the fauna on the dry north slopes of the Sierra de Baoruco is scant. *Semilineatus* is unknown in the Valle de Neiba and Plaine du Cul-de-Sac except at its westernmost edge near Port-au-Prince. *A. olssoni* is somewhat better represented in the valley itself, but there are few records of its presence on the north slopes of the Sierra de Baoruco. Based upon our limited knowledge of this area, it appears that *alumina* is restricted to the lowlands in the southeastern corner of the Valle de Neiba near Barahona and Cabral.

To the west of the range of *alumina*, in the central section of the southern island, there are a series of populations here regarded as *semilineatus*, characterized by large body sizes (snout-vent length of largest adult male is 46 mm), very distinct mid-dorsal stripes, markedly keeled head scales (including those of the frontal depression), and distinctly enlarged middorsal scales which do not grade into the granular flank scales. The following are the south island specimens so characterized:

HAITI: 5 km south of Dufort, MCZ 63046-63047; Ça-Ira, MCZ 64841, 64844-64846, 64850, 64852, 64857, 64858; 4 miles southwest of Gressier, ASFS V8335; 10 miles north of Jacmel, ASFS V37867; 4 miles northwest of Jacmel, ASFS V9804; 3 miles east of Jacmel, ASFS V9759-V9760; Bascap Rouge, MCZ 65024; 3 miles east of Cayes Jacmel, ASFS V9723-V9725; 2 miles west of Marigot, ASFS V9770; 9.7 miles southwest of Seguin, ASFS V38159-V38160; 3.8 miles southwest of Seguin, ASFS V38187; 10 miles north-northeast of Marigot, ASFS V9732-V9735; mountains south of Gasseleine River at Marbial, AMNH 69036; Peneau, ASFS X1354, X1550; Obléon, MCZ 60015-60016; Basin Bleu, MCZ 60017-60020; Furcy, MCZ 58011, 59553, 60025-60027, 63417-63426, ASFS X1596, X1905, V8357-V8366; 4.8 km south of Pétionville, ASFS V8083-V8116; Boutilliers Road, MCZ

60021-60024, 60028-60029, 63038-63039, 112099-112100, ASFS V36199, V36231-V36232, V36551; 6 miles west of Pétionville, ASFS V8347; Pétionville, ASFS X3340-X3345.

In addition, we have a single specimen of *semilineatus* (MCZ 131150), which had been mistakenly included in a series of *olssoni*, from Savanne Zombi, a high elevation (1500 meters) locality in eastern Haiti. Since *olssoni* is otherwise known to occur only in relatively xeric lowlands (and along some middle elevation roadsides on the north island), I consider the locality data for these specimens doubtful and have omitted them from the range maps (Fig. 3) for these species.



Figure 3. Locality records for (top) *Anolis alumina* (solid circles), *A. semilineatus* (open circles), and (bottom) *A. olssoni*. Locality records from collections in American Museum of Natural History, Museum of Comparative Zoology, United States National Museum of Natural History, and Albert Schwartz Field Series. Dotted lines indicate the Massif de la Selle and Sierra de Baoruco.

A. semilineatus specimens from localities at the western end of the Tiburon Peninsula (near Duchity, Carrefour Zaboka, Jérémie, and Les Platons) are similar to, though smaller than, those just described. The most variable characters in these lizards are dorsal scale size and body size which, as in populations on the north island, appear to vary clinally with elevation (Hertz, in preparation). It seems reasonable to regard these as *semilineatus*, at least *provisionally*.

ELECTROPHORETIC STUDIES

As a check on the taxonomic status of *alumina*, I have analyzed eleven samples of grass anoles using starch gel electrophoresis; sample sizes varied between six and 42 animals (Fig. 4). Five of these populations are white-dewlapped animals from the north island of Hispaniola. Constanza (population A) is the type locality of *A. cochranæ*, which Williams and Rand (1961) described as distinct from *semilineatus*, but which I consider an altitudinal variant of *semilineatus*. In addition, I have grouped the Pétionville sample with those from the north island because the animals there are morphologically and electrophoretically indistinguishable from north island *semilineatus*. [Williams (1965) has reported that *Anolis aliniger*, a north island green anole, has been found near Pétionville, and Schwartz (1974) noted that several other northern island lizard species are known from southern island localities in the area. Thus, the western side of the Cul-de-Sac Plain appears to be an area of "faunal leakage" from the north island to the south island, and Pétionville may, at least for my purposes in this description, be considered a north island locality.]

I used material from two *alumina* populations in the electrophoretic analysis: animals from the type locality (28–31.5 km north of Cabo Rojo) and those from Belle-Anse, Haiti. The latter population exists on the south coast of Haiti at the western boundary of the Barahona Peninsula, cut off on the north from the rest of the island by the Massif de la Selle, the Haitian analogue of the Sierra de Baoruco.

Three populations from the north island were available to represent *olssoni*. Since both *olssoni* and *semilineatus* are without question good species, electrophoretic comparison of them provides a means of assessing the significance of various degrees of genic differentiation within the species group.

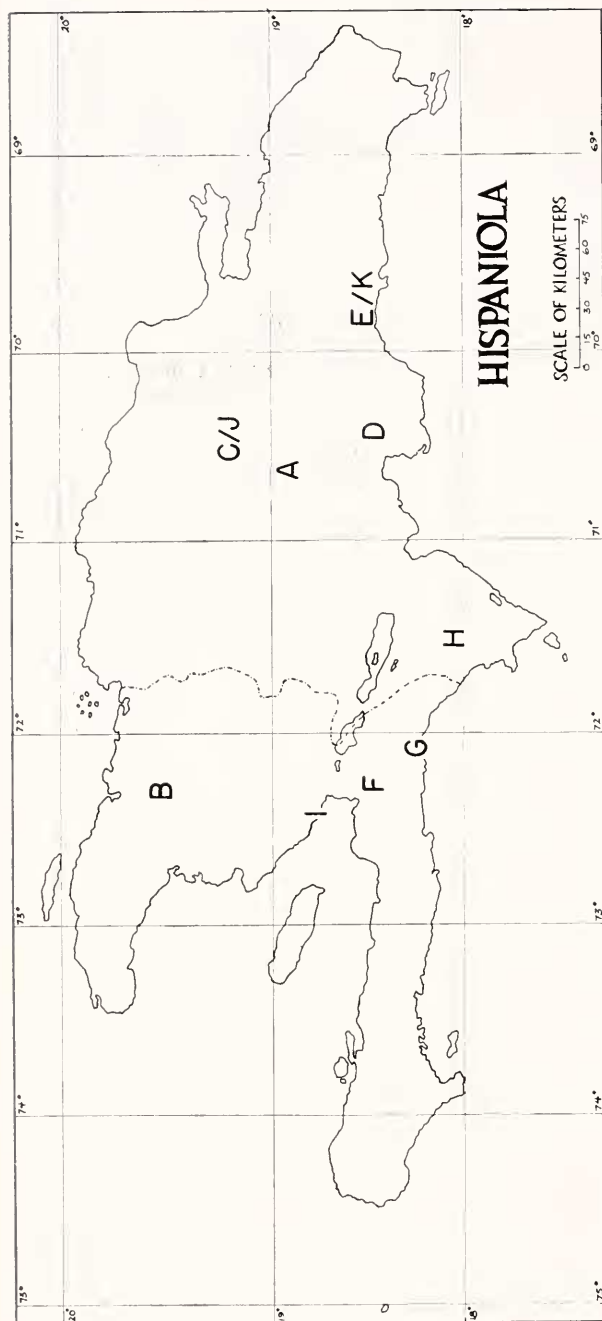


Figure 4. Animals from the following localities were used in the electrophoretic analysis:

- | | | | |
|------------------------|--|-------------------|--|
| <i>A. semilineatus</i> | | <i>A. alumina</i> | |
| A: | Constanza, La Vega, D. R. (N = 6) | G: | Belle-Anse, l'Ouest, Haiti (N = 18) |
| B: | Marmelade, Artibonite, Haiti (N = 6) | H: | 28 km N Cabo Rojo, Petenales, D. R. (N = 20) |
| C: | Hotel Montaña, La Vega, D. R. (N = 12) | I: | Source Matelas, l'Ouest, Haiti (N = 10) |
| D: | San José de Ocoa, Peravia, D. R. (N = 42) | J: | Hotel Montaña, La Vega, D. R. (N = 12) |
| E: | Riviera del Caribe, Dist. Nac., D. R. (N = 10) | K: | Riviera del Caribe, Dist. Nac., D. R. (N = 12) |
| F: | Pétionville, l'Ouest, Haiti (N = 7) | | |

The methods of sample preparation and horizontal starch gel electrophoresis are adapted from techniques described by Selander et al. (1971). All proteins were extracted from tissue and water homogenates prepared from material which was frozen in the field. (The less-than-ideal freezing conditions in the field resulted in some protein denaturation; two proteins, Indophenol oxidase and an Isocitrate dehydrogenase, were eliminated from consideration because of their lability.) Buffer systems and assays used in this study are similar to those used in previous *Anolis* studies (e.g., Webster 1975); details of the technique and assay formulas are available from the author upon request.

TABLE 1

Proteins assayed in the electrophoretic survey

Albumin	Alcohol dehydrogenase
Protein A	α -Glycerophosphate
Protein B	dehydrogenase
Protein C	Glutamic oxaloacetic
Leucine aminopeptidase	transaminase
Phosphoglucose isomerase	6-Phosphogluconate
Lactate dehydrogenase-	dehydrogenase
1 and 2	Phosphoglucomutase-1 and 2
Isocitrate dehydrogenase-2	Peptidase
Malate dehydrogenase-1 and 2	Fumarase

Nineteen proteins produced consistently scorable bands in all individuals (Table 1); allele frequencies for these proteins are used for the calculation of indices of electrophoretic similarity of pairs of populations. Webster (1975) has argued that Nei's (1972) normalized identity of genes, I , is the preferred index of genetic similarity of two populations. When $I = 0$, the populations share no alleles; when $I = 1$, all gene frequencies in the two populations are identical. I use Nei's I as an index of genetic similarity here and assume in the calculation of I values that each polypeptide is the product of one gene.

I present I values for paired localities in Table 2. It is readily apparent that the populations fall into three distinct groups which correspond to the three species recognized on the basis of scale characters. The average similarity value for paired comparisons of six *semilineatus* populations from the north island

is 0.96 (range 0.90–0.99), for the three *olssoni* populations $\bar{I} = 0.96$ (range 0.95–0.97), and for two *alumina* populations $I = 0.99$.

Average similarity values between paired populations of the different species are much lower: *semilineatus* to *alumina*, $\bar{I} = 0.80$ (range 0.75–0.85); *semilineatus* to *olssoni*, $\bar{I} = 0.84$ (range 0.81–0.87); and *alumina* to *olssoni*, $\bar{I} = 0.70$ (range 0.64–0.73).

Only one of the 19 proteins assayed is completely differentiated in animals from the topotypic sample of *Anolis alumina*, a fast variant (i.e., one that migrates further from the origin) of albumin which is also the dominant albumin variant in the animals from Belle-Anse. However, the topotypic *alumina* population is fixed for an allele of Isocitrate dehydrogenase–2 which appears in only two other populations: 94 per cent at Belle-Anse (also *alumina*) and 7 per cent at Pétionville (*semilineatus*). Similarly, a slow variant of 6-Phosphogluconate dehydrogenase is the only 6-PGD allele in topotypic *alumina* and the predominant (89 per cent) 6-PGD allele at Belle-Anse, but only occurs at a maximum frequency of 20 per cent in other populations. Finally, the topotypic sample of *alumina* had a low frequency (5 per cent) of a slow allele of Malate dehydrogenase–1, a protein that was monomorphic for a faster allele in all other populations surveyed.

The electrophoretic data provide support for the species status attributed to *alumina* on the basis of external morphological characters. Mayr (1970) and Selander and Johnson (1973) have noted the dangers in attempting to differentiate species on the basis of the number of protein differences between them: we have no independent method for assessing just how much genetic differentiation is involved in speciation even within a rather narrowly-defined taxon. It is, however, permissible to use Nei's index of genetic similarity to compare the distinctiveness of populations of *alumina*, *olssoni* and *semilineatus*. Paired comparisons of *alumina* and *semilineatus* populations (Table 2) show that, on average, populations of these species are less similar electrophoretically than are *olssoni* and *semilineatus*; on the other hand, *alumina* and *olssoni* are much less similar to each other than either is to *semilineatus*.

The fact that only one of the nineteen proteins assayed can be called diagnostic of *alumina* is not an argument against the designation of *alumina* as a full species (see Lewontin, 1974: 180–182, for a discussion of electrophoretic evidence of introgression in closely related species). Ayala and Powell (1972) and Prakash (1969) have demonstrated that closely related species of *Drosophila* share many alleles, but that each species carries a particular allele at a different frequency. We find a similar situation with respect to three other proteins in *alumina* and *semilineatus*: IDH-2, 6-PGD, and MDH-1.

RELATIONSHIPS WITHIN THE SPECIES GROUP

Williams (1961) has proposed a model for speciation within the *semilineatus* species group which is based upon the Pleistocene division of Hispaniola into northern and southern islands. He suggested that *semilineatus* is the autochthonous grass anole of the south island and that *olssoni* is the autochthon of the northern component. Williams then suggested, on the basis of somewhat limited distributional data, that *semilineatus* invaded the north, while *olssoni*, probably restricted by the absence of suitable habitat, did not successfully extend its range throughout the south.

Our current knowledge about the distributions of the Hispaniolan grass anoles, summarized in Figure 3, shows *olssoni* with a rather limited south island distribution. In fact, *olssoni* appears to be restricted on the south island to lowland areas within the currently known range of *alumina* on the Barahona Peninsula. The occurrence of *olssoni* on the Barahona Peninsula, however, does not invalidate Williams' scheme for differentiation within the group and subsequent invasion of the north by *semilineatus*. *A. olssoni* probably originated on the north island and then invaded the south, after the recession of a Pleistocene seaway, through the relatively dry lowland corridor at the eastern edge of the Valle de Neiba near what is now the city of Barahona. Movement southward along the relatively mesic coast and westward across the deserts of the Barahona Peninsula and foothills of the Sierra de Baoruco probably followed its initial invasion of the southern island from the northeast.

The differentiation of *semilineatus* from *alumina* can be attributed to a classical allopatric speciation phenomenon that requires only minor modification of Williams' (1961) scheme.

The range of *alumina* is separated from the western portion of the southern island by the Sierra de Baoruco-Massif de la Selle mountain range which comes close to the sea west of Belle-Anse, Haiti. The north slopes of these mountains appear to be sufficiently dry to limit the contact of the two species today; if the climate was similar during the Pleistocene, the arid areas may have limited genetic exchange between the animals on either side of the mountains and established a sufficient reproductive barrier to allow speciation. The presence of *alumina* at two localities near Cabral on the north side of the Sierra de Baoruco can be attributed to a very limited northward invasion through the same corridor through which *olssoni* moved south into the Barahona Peninsula.

The Barahona Peninsula and particularly the south slopes of the Sierra de Baoruco are becoming well known as a center of differentiation of the Hispaniolan saurofauna. Williams (1962, 1963) recognized the biogeographic importance of the region with reference to *Anolis barahonae* and *A. hendersoni*. Schwartz (1964, 1967a, b, 1974), and Schwartz and Klinikowski (1966) have further documented differentiation there for the *Anolis ricordi* complex and the lizard genera *Leiocephalus*, *Ameiva*, and *Diploglossus*.

On the electrophoretic evidence, *alumina* is genetically less similar to *semilineatus* than is *olssoni*. If the degree of electrophoretic dissimilarity of two species can be taken as an index of either their time of divergence or the magnitude of environmental difference between their ranges, one can suppose that *alumina* and a "proto"-*semilineatus* diverged before Pleistocene seaways isolated the ancestors of *semilineatus* and *olssoni* or that the selective regimes of the Barahona Peninsula at the time of differentiation of *alumina* and *semilineatus* were perhaps more different from those on the rest of the southern island than were conditions on the northern island. Both suggestions are plausible and not incompatible.

The less enlarged middorsal scales suggest that *alumina* is the most primitive of the three species in the *semilineatus* species group. A plausible and conservative model of evolution within the group would suggest that *olssoni* evolved from a "proto"-*semilineatus* stock which had already diverged from an ancestral *alumina*-like grass anole (lacking distinctly enlarged middorsal scales). The subsequent enlargement of dewlap scales in *olssoni*

may have accompanied the dramatic change in dewlap color as a reproductive isolating mechanism to limit its hybridization with *semilineatus*. The repeated changes in Pleistocene sea level would probably have allowed such sequential derivations to occur.

Perhaps *alumina* and *olssoni*, species which may be evolutionarily one step removed from each other, were different enough to allow ecological segregation and sympatry as *olssoni* invaded the eastern section of the south island. In contrast, an invasion by *olssoni* across the western end of the Cul-de-Sac Plain may have been inhibited by either unsuitable habitat or by competitive interactions with resident populations of *semilineatus*. Although *semilineatus* and *olssoni* are syntopic at a number of localities on the northern island (Hertz, in preparation), there is no reason to suggest that reciprocal invasions in either direction should have equal probabilities of success. *A. semilineatus* may have undergone an ecological shift as it invaded the northern island, thereby allowing sympatry with *olssoni*. But individuals of *olssoni* invading in the other direction may have been swamped by competition from the resident *semilineatus*. Clearly, we must know the ecology of both species in much greater detail before we can draw any firm conclusions about competitive patterns that may have shaped their current distributions.

The description of a third species of Hispaniolan grass anole does not provide us with a necessarily complete analysis of the systematics of the *semilineatus* species group. There are several issues about which I must withhold final judgment pending the collection of additional data. Although I feel that I can with some confidence align the holotype of *semilineatus* with series of specimens from the Pétionville area, I cannot confidently comment upon the systematic status of the grass anoles from the western portion of the southern island. The electrophoretic evidence tells us that populations of *semilineatus* near Pétionville probably have had recent gene exchange with or are derived from populations on the north island; data from other studies (Williams, 1963; Schwartz, 1974) suggest that faunal leakage in this part of the Cul-de-Sac Plain may, in fact, be a common phenomenon. In fact, the animals found near Pétionville may be directly derived from north island *semilineatus* and may not be conspecific with some other south island populations for which we have no electrophoretic data.

We cannot yet fully assess the possibility that north and south island populations of *semilineatus* differentiated after the *semilineatus* invasion of the north through the western end of the Cul-de-Sac. Pleistocene sea level rose and fell a number of times, reseparating and rejoining the two component islands of Hispaniola with each creation and recession of the seaway. If *semilineatus* invaded the north during an early oceanic recession, subsequent inundation of the low elevation plain may have split the range of *semilineatus* into two portions, allowing differentiation. North island animals may then have reinvaded the south near Pétionville and Furcy, and may be distinct from animals at the distal end of the Tiburon Peninsula. Electrophoretic data from *semilineatus* on the western end of the Tiburon Peninsula should clarify this point.

ACKNOWLEDGMENTS

This study could never have been completed without the assistance and generosity of W. M. Smit and Alfredo Lebron of the Alcoa Exploration Company in the Dominican Republic.

I thank Robert Holt, Ernest Williams, and especially Raymond B. Huey for assistance in the field. Ronald Crombie, Albert Schwartz, and Ernest Williams made suggestions during the course of the study. The late T. Preston Webster is responsible for a substantial portion of the electrophoretic data and for teaching me electrophoretic techniques. Raymond B. Huey, Kenneth Miyata, Albert Schwartz, and Ernest Williams provided useful criticisms of drafts of the manuscript.

Specimens examined in this study were borrowed from the American Museum of Natural History (AMNH), British Museum of Natural History (BMNH), Museum of Comparative Zoology (MCZ), Albert Schwartz Field Series (ASFS), and the United States National Museum (USNM). I thank the curators of these collections for allowing me to examine specimens in their care.

Support for this study was provided by the Richmond Fund of the Department of Biology, Harvard University and National Science Foundation Grant GB-37731X to Ernest Williams. Specimens in the Albert Schwartz Field Series were collected under National Science Foundation Grants G-7977 and B-023603.

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