

NOTES AND BIOGEOGRAPHIC COMMENTS ON ANOLES FROM BRASIL

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ABSTRACT

1. *Anolis chrysolepis brasiliensis* has been found in a mesic enclave of the xerophytic caatingas of northeastern Brasil. This disjunct population is not morphologically differentiated. 2. *Anolis ortonii* has been collected in the Atlantic forest, from which it was previously unknown, in the states of Pernambuco, Sergipe and Bahia. 3. New materials of *Anolis nasofrontalis* and *pseudotigrinus* permit improved descriptions of the species. 4. Recent collections of *Anolis punctatus* from Brazilian Amazonia indicate that the character "keeled ventrals" has an irregular geographical distribution, and does not characterize a subspecies, *boulengeri*, as formerly thought, but rather a morph of *punctatus* proper.

1. *Anolis chrysolepis brasiliensis* in a mesic enclave within the caatingas

Between July 24 and August 3, 1978, one of us made a collection of reptiles at Arajara (07°21'S, 39°24'W) in the region of northeastern Brasil known as "the Cariri". Among the lizards were 20 specimens of *Anolis chrysolepis brasiliensis* Vanzolini and Williams, 1970.

The find is important for several reasons. The Cariri is a well irrigated and relatively fertile enclave in the great morphoclimatic domain of the caatingas (Ab'Saber, 1977; Vanzolini, 1970). The nearest localities from which *Anolis chrysolepis* is known are (Vanzolini and Williams, 1970): Loreto, Maranhão, about 650 km to the west; Barra dos Taipapés, Mato Grosso, 1300 km to the west-southwest; Cana Brava, Goiás, 1100 km to the southwest; Belém, 1250 km to the northwest. Some of these distances will be reduced by further collecting, but it seems certain that the Cariri population is broadly disjunct from the rest of the species and surrounded by xerophytic areas that it cannot inhabit.

The collection made at Arajara numbered 729 specimens and 26 species.

These were:

Iguanidae: *Anolis chrysolepis brasiliensis* Vanzolini and Williams, 1970; *Platynotus semitaeniatus* (Spix, 1825); *Polychrus acutirostris* (Spix, 1825); *Tropidurus torquatus* (Wied, 1820).

Gekkonidae: *Coleodactylus meridionalis* (Boulenger, 1888); *Gymnodactylus g. gekkoides* Spix, 1825; *Phyllopezus p. pollicaris* (Spix, 1825).

Scincidae: *Mabuya heathi* Schmidt and Inger, 1951; *Mabuya* sp., related to *M. bistriata* (Spix, 1825).

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Teiidae: *Ameiva ameiva* (L., 1758); *Cnemidophorus ocellifer* (Spix, 1825); *Micrablepharus maximiliani* (Reinhardt and Luetken, 1826).

Anguidae: *Diploglossus lessonae* Peracca, 1890.

Amphisbaenidae: *Amphisbaena pretrei* Duméril and Bibron, 1839; *Leposternon polystegum* (A. Duméril, 1851).

Colubridae: *Dromicus reginae* (L., 1758); *Dromicus poecilogyrus* (Wied, 1825); *Liophis joberti* (Sauvage, 1884); *Lygophys lineatus* (L., 1758); *Oxybelis aeneus* (Wagler, 1824); *Oxyrhopus trigeminus* Duméril, Bibron and Duméril, 1854; *Philodryas olfersii* (Lichtenstein, 1823); *Sibynomorphus mikanii* (Schlegel, 1837); *Waglerophis merremii* (Wagler, 1824).

Elapidae: *Micrurus ibiboboca* (Merrem, 1820).

Viperidae: *Bothrops* sp.

In judging the faunistic affinities of Arajara we shall not take certain species into consideration, because they are too euryoecious and have very wide distributions, including the caatingas: *Tropidurus torquatus*, *Ameiva ameiva*, *Dromicus poecilogyrus*, *Lygophis lineatus*, *Oxybelis aeneus*, *Oxyrhopus trigeminus*, and *Waglerophis merremii*. On certain others — *Leposternon polystegum*, *Diploglossus lessonae*, and the unidentified *Bothrops* — we do not have sufficient data.

The remaining 16 species can be grouped according to their distribution as follows (the lizards have been discussed by Vanzolini, 1974, 1976):

Ten are widespread in the open formations around the enclave of the Cariri: *Gymnodactylus g. geckoides*, *Phyllopezus p. pollicaris*, *Platynotus semitaeniatus*, *Polychrus acutirostris*, *Cnemidophorus ocellifer*, *Micrablepharus maximiliani*, *Mabuya heathi*, *Amphisbaena pretrei*, *Philodryas olfersii*, *Micrurus ibiboboca*.

Dromicus reginae, *Liophis joberti* and *Sibynomorphus mikanii* occur both in forested and open formations, but certainly not in the caatingas that surround the Cariri.

The remaining three species have forest affinities. *Mabuya* sp. is a member of the "*Mabuya mabouya*" complex (at present being reviewed by Regina Rebouças-Spieker) related to *M. bistrinata*, which occurs all over Amazonia and in the northern part of the Atlantic Forest. *Anolis chrysolepis brasiliensis* occurs from southern Pará through Goiás and Mato Grosso to São Paulo, in forests. *Coleodactylus meridionalis* was formerly thought to have an enormously disjunct distribution, in northeastern Brasil and on the Brasil-Guyana border. It is now known (Vanzolini, 1980) that it occurs only in the Northeast, both in the Atlantic Forest and in forested enclaves in the open formations.

It can thus be said that the Arajara reptiles may be divided into three groups: a larger one (17 species) of forms that are either broadly distributed or are open formation (including caatinga) forms; one small group contains three species that are characteristic of open formations but do not occur in caatingas; finally, another group of three species has definite forest connections.

The two groups with mesic connotations indicate that there was in the recent past direct continuity between a Cariri forest and, on one side, the Amazonian forests (*Anolis chrysolepis*) and, on the other, the Atlantic Forest (*Coleodactylus*).

The Cariri is in fact a hybrid locality, with a formerly wholly mesic fauna now heavily invaded by and partly submerged by the fauna from the surrounding open formations. Such a phenomenon is certainly to be expected when, in the cyclic change of climates, some portion of moist forest becomes reduced in area, is deprived of its connections with other like formations and is itself climatically deteriorating. The Cariri is in effect and at the moment a refugium for a few forest species, but it is clearly a vanishing refugium.

The species living in such a refugium, continuously deteriorating over time, will obviously have two alternatives, extinction or adaptation. In the present case, one of the forest species, the new species of *Mabuya* (119 specimens) appears to be an excellent example of the alternative of adaptation — of speciation in a "vanishing refuge." However, we reserve this form for description by Regina Rebouças-Spieker. The *Coleodactylus*,

represented by one specimen, cannot be usefully discussed; we cannot even be sure which of the alternatives it is taking. The *Anolis*, however, are represented by 20 specimens (MZUSP 51691-51710) and we can provide full data.

We have identified this population as *Anolis chrysolepis brasiliensis*. Is it perhaps more differentiated than this identification would imply — on its way to the species status that the *Mabuya* has already achieved?

We subjected the Arajara population to a detailed comparison with the original type series of *brasiliensis* as described and discussed in Vanzolini and Williams (1970). Our answer to the question of heightened differentiation is negative: there are no morphological grounds for splitting the Arajara population off from the remainder of *brasiliensis*. However, this recently collected sample, well-preserved and with notes on habitat and color in life, enables us to provide here a better perspective on *A. chrysolepis brasiliensis*.

Morphology

This subspecies of *Anolis chrysolepis* can be distinguished from *A. c. planiceps* (red dewlap) and *A. c. scypheus* (dewlap skin black — or dark blue — with a red edge) by its possession of a dewlap with wholly black skin, and from the other black-dewlapped form (nominate *A. c. chrysolepis*) by differences in scale counts (modally lower number of scales across the snout, modally higher counts of fourth toe lamellae, lower ventral counts) and by having a shorter tibia.

The Arajara population falls within this definition. We have carefully compared its differences as against other samples of *brasiliensis*. Variation does occur within *brasiliensis*: for example, Arajara and Cana Brava share still shorter tibias than other *brasiliensis*. However, the variation within *brasiliensis* is mosaic; we can discover no complexes of shared characters that would justify subdivision of *brasiliensis*. Table 1 compares the most useful characters in black-dewlapped populations of *Anolis chrysolepis*.

Table 1
Comparison of the black-dewlapped populations of *Anolis chrysolepis*.

| | | <i>brasiliensis</i> * | Arajara | <i>chrysolepis</i> * |
|---------------------|---------|-----------------------|---------|----------------------|
| scales across snout | males | 8-11 | 9-11 | 10-13 |
| | females | 8-11 | 8-11 | 10-15 |
| fourth toe lamellae | males | 16-19 | 17-18 | 13-15 |
| | females | 15-18 | 16-18 | 12-15 |
| ventrals | males | 43-53 | 45-52 | 50-65 |
| | females | 40-50 | 47-53 | 50-62 |

*composite: all specimens in Vanzolini and Williams, 1970.

Color in life

Color in *brasiliensis* has previously been known from the living animal only for the holotype (figured in the frontispiece of Vanzolini and Williams, 1970). Field descriptions of color in life by Vanzolini are, however, now available for Arajara individuals. Comments in brackets have been added, regarding the preserved specimens, where applicable:

Males: 51692: Dewlap: skin black, scales yellow. 51697: Back blackish, flanks reticulate. A suggestion of sacral coffee beans. Dewlap with black skin, dark yellow scales. 51698: Flanks quite tigerish. [Dewlap skin black.] 51699: Tigerish flanks, sacral coffee beans distinct. Thin but well marked head lines. [Dewlap skin black.] 51700: Flanks strongly marbled with black and tan, becoming darker toward the groin. Dewlap with black skin and tan scales. [Melanophores are conspicuous on the scales, any yellow pigment is gone.] 51708: Dewlap with purplish black skin and rusty scales. [A reddish tinge

is still visible on the edge scales; red pigment was presumably also responsible for the purplish cast of the dewlap skin.]

Females: 51691: Back dirty yellow, sooty on the sacrum, slightly darker when in the sun. Sacral coffee beans poorly defined. Dewlap small, very light rust-colored. 51709: Dewlap with light purple skin, scales rusty yellow. [Presumably again red pigment plus melanin results in purple.] 51710: Small dewlap and throat rusty red. [Faint reddish tinge on throat still visible.]

Ecology and habitat

The circumstances in which the Arajara anoles survive are unusual, especially so for forest anoles:

The floor of the valley of Cariri is 400 m above sea level. The top of the mesa (Chapada do Araripe) is ca. 900 m on the east side, in the vicinity of Arajara. From the valley (Arajara is at 600-700 m) the slope is steep to about 740 m, at which point the walls rise sheer. Here there is a series of springs in sandstone caves from which flow small but perennial creeks.

The water of these creeks is diverted into ditches that irrigate the slope, which is under almost total cultivation. Rainfall in the area (1000 mm, Nimer, Filho and Amador, 1971) is above the 800 mm maximum for caatinga but not by much, and is not by itself sufficient for natural forest. The springs, however, make the soil wet enough for sugar cane (even at the altitude of Arajara), and sugar cane indicates a degree of humidity and soil quality equal to forest situations. In fact, it was said in 1860 that "it is these waters that maintain there, in a belt 2 to 3 leagues wide, a luxuriant vegetation, and the admirable fertility of this blessed district" (Freire-Allemão, apud Braga, 1962: 263; translated by P.E.V.). Nowadays there is no remnant forest, only second growth, occasional trees, avocado orchards and small stands of palms (including coconut palms, introduced).

In these conditions the *Anolis chrysolepis brasiliensis* do the best they can: they have been found on the ground and low on trees in the palm stands and once in a banana grove.

Peculiar as the conditions at Arajara are, they are merely an extreme example of the conditions under which all *A. c. brasiliensis* are compelled to live. All populations of *brasiliensis* are relictual, and the forest remnants (or alternatives to forest) in which they persist are under the stress of increasing desiccation. The climatic phase in which we now live is one of decreasing humidity; forest animals are under the pressure of this natural phenomenon, which is, of course, compounded by the destructive action of man.

2. *Anolis ortonii* in the Atlantic Forest

A number of lizards of the Amazonian Forest extend, after a wide gap in their range in the zone of open formations, into the Atlantic Forest. Others have appeared to terminate their range at the edge of the open formations.

One of the examples of the latter has been *Anolis chrysolepis*. As documented above, this species has now been found in a mesic enclave within the caatingas, the driest of the Brazilian open formations. For another of the supposedly Amazonia-limited anole species — *Anolis ortonii* — we can now report extension into the Atlantic Forest as far south as Espírito Santo. The new specimens are as follows:

MZUSP 40731, Recife (Parque Dois Irmãos), Pernambuco, J. F. Jackson coll. 16.x.1975. Parque Dois Irmãos is a zoobotanical garden with an area of much disturbed Atlantic Forest behind it. *Anolis punctatus* and *A. fuscoauratus* have also been collected in the park.

MZUSP 49376-82, Santo Amaro das Brotas (Arauaris), Sergipe, P. E. Vanzolini and N.M.B. Gomes coll. 25.iii.78. Arauaris is the name of a ranch (fazenda). The seven specimens were collected in a very disturbed and small (4 to 5 hectares) remnant of Atlantic

Forest surrounded by a completely cleared area. Sixteen *Anolis punctatus* were brought in at the same time.

MNRJ, not catalogued, Rio do Braço (Fazenda São Pedro), Bahia, J.G. Santos coll. 26-31.v.44.

MZUSP 39578-79, Linhares, Espírito Santo, C. Elias coll. vi. 1974. These specimens came from a professional insect collector, and the locality is not to be taken literally as the city of Linhares or its immediate vicinity but as the remnants of Atlantic Forest (more strictly the "matas do Rio Doce") within a radius of perhaps 30-50 km of Linhares.

This scattering of new specimens of *A. ortonii*, like the surprising discovery of *Anolis chrysolepis* in Ceará, are warnings that statements of absence from the Atlantic Forest (e.g. Vanzolini, 1974) cannot be taken as factual at the present time. Collections are insufficient, information inadequate and, worse, the forest endangered. Not only do we not know the real present distributions, for many animals we will never know.

However, attention should be called to the fact that restriction of forest area tends to concentrate the numbers of certain species. The 23 specimens of *Anolis* brought in by one man in one day from the 4 to 5 hectares forest at Arauaris will seem very remarkable to anyone who has searched for *Anolis* in natural forest in mainland South America. This phenomenon has been called the "Belém Park effect" by one of us (Williams, 1977) after the Bosque Municipal in Belém where he first saw it. Tolerance of man, restriction of predators may be factors in this phenomenon. Cultivated areas, e.g. cacao groves, banana groves, may show a similar heightening of numbers of certain species, but here the species are not original inhabitants of the areas but colonists from adjacent natural situations (K. Miyata, 1977 and in preparation).

In spite of the incompleteness of the evidence, there is excellent reason to believe that restricted ranges within the Atlantic Forest can be real, and that the factors circumscribing these ranges can in certain cases be identified. There are certainly latitudinal restrictions on certain species and a resulting zonation within the Atlantic Forest. However, not all climatic restriction is a matter of isotherms; other effects of the general dynamics of the atmosphere (Vanzolini and Rebouças-Spieker, 1976) are unquestionably of high importance. Additionally the distribution of certain species (e.g. *A. nasofrontalis* and *A. pseudotigrinus*) is related to past refugia from which they have not entirely escaped.

Patterns within the Atlantic Forest are related also to directions and timing of migrations. Some species (no *Anolis*) appear to have come into the Atlantic Forest from the south, some (all *Anolis*?) from the north.

With the proviso that current information is preliminary, the following statements may be set up regarding the penetration of *Anolis* into the Atlantic Forest: *A. punctatus* has penetrated deepest — to São Paulo; *A. ortonii* has got to Espírito Santo; *A. fuscoauratus* has done the same, although the specimens (in the Hamburg Museum, ZMH 01148-52) have only state, not definite localities. *A. chrysolepis* has not reached the Atlantic Forest at all. *A. nasofrontalis* and *A. pseudotigrinus* are endemics confined to Espírito Santo, with no close relatives nearer than northern Venezuela and Colombia.

Timing of entrance (or timing of the approach to the entrance) into the Atlantic Forest may be the explanation of the distributions of *A. ortonii*, *A. fuscoauratus* and *A. chrysolepis*. But *A. nasofrontalis* and *A. pseudotigrinus* seem to be one extreme of an ancient continuous distribution. *A. punctatus* might also have an old distribution.

3. New material of *Anolis nasofrontalis* and *A. pseudotigrinus*

Anolis pseudotigrinus Amaral, 1933, has until now been known only from the unique female type without exact locality. Its close relative, *Anolis nasofrontalis*, described in the same paper, has been known from only three specimens (Amaral, 1933; Myers and Carvalho, 1945).

The recent acquisition of a male of *Anolis pseudotigrinus* (MZUSP 36718) with the locality Santa Teresa, Espírito Santo (J. F. Jackson coll. February 2, 1974) plus discovery

of a third (female) specimen in the Hamburg Museum permits a more nearly adequate knowledge of this species and comparison with its sympatric relative. Comments on the wider relationships of these two Espírito Santo endemics are also offered.

We provide first a standard description of *A. pseudotigrinus* based primarily on the male but with variation shown by the female holotype and the second female within parentheses:

A. pseudotigrinus. Head: Elongate, tapering strongly anteriorly. Head scales large, smooth, pavementose except at end of snout where they are more swollen. Four scales across snout between second canthal. Scales in frontal depression but little smaller than those surrounding them. Eight (six) scales in contact with rostral posteriorly. Nasal scale anterior to canthal ridge, in contact with rostral (and with the first labial in the Hamburg specimen). Four scales between nasals dorsally. Snout swollen, protuberant in male (not swollen, not protuberant in female).

Supraorbital semicircles broadly in contact with each other and with the supraocular disk. Seven to nine (10) smooth scales in the supraocular disk. One (one to two) short supraciliary continued by granules. Canthus blunt, canthal scales seven (8-9), the first and second (second and third or third and fourth) largest, then diminishing gradually forward. Loreal rows three (three or four). Temporal and supratemporal scales granular, those nearest the interparietal rather abruptly enlarged. Interparietal large, very much larger than the small obliquely oval (round) ear, in contact with the supraorbital semicircles. Scales lateral to the interparietal larger than any posterior to it. Two (three to four) rows of enlarged scales intervene between the interparietal and dorsals.

Suboculars smooth, in contact with the supralabials which narrow very sharply posteriorly. Seven (7-9) supralabials to the center of the eye.

Mental divided, each part about as long as wide. Two granules in contact with the mentals between the very large sublabials. Three (two or five) sublabials in contact with the infralabials. Central throat scales small, abruptly increasing in size laterally toward the sublabials.

Trunk. Middorsals granular, flat, smooth, not larger than flank scales, which may be weakly keeled. Ventrals larger than dorsals, smooth, imbricate (subimbricate), slightly swollen.

Dewlap. Large in male, extending onto first third of belly (vestigial in female). Scales, somewhat larger than ventrals, in rows separated by wrinkled skin.

Limbs and digits. Scales of limbs and digits smooth. Eighteen to twenty-three lamellae under phalanges ii and iii of fourth toe.

Tail. Compressed, scales weakly keeled above, more strongly keeled below. Verticils not evident. Scales behind vent smooth. Postanals enlarged, round, not transversely elongate ovals. (Postanals absent in female.)

Color. Gray brown with oblique rows of black spots on flanks (especially anteriorly) and on shoulders. Belly lighter. Dewlap skin and scales light. (Female holotype faded; Hamburg female with bold dark middorsal blotches and narrower oblique flank stripes.)

In addition to the already reported specimens of *A. nasofrontalis*, the type and allotype (Amaral, 1933), and the third specimen reported by Myers and Carvalho (1945), four additional specimens are now known: one from the Hamburg Museum and three from Vienna. Of the latter, three are adult females, one a juvenile. It now seems worthwhile to provide a standard description of this species for comparison with its near relative. The new specimens are better preserved than the type and allotype; we have therefore included the characters of the type specimens merely as part of the variation of the sample:

A. nasofrontalis:

Head moderately elongate, but bluntly or very bluntly rounded anteriorly. Head scales smooth, pavementose. Scales in the shallow frontal depression as large as or smaller than those anterior to them. Four to seven scales across the snout between the second canthals. Five to six scales in contact with rostral posteriorly. Nasal scale in contact with rostral (separated by one small scale on one side in one Vienna specimen). Four to six

scales between the nasals dorsally. Snout not protuberant, not overhanging lower lip in either sex.

Supraorbital semicircles broadly in contact with each other and broadly or narrowly in contact with the supraocular disk, 2-3 scales of which are especially enlarged. One to several short supraciliaries continued by smooth scales. Canthus blunt, composed of five to six scales, the first and second or second and third largest, diminishing gradually forward. Loreal rows 2-3. Temporal and supratemporal scales flat, smooth, those nearest the interparietal enlarged. Interparietal large, larger than the ear, in contact with the supraorbital semicircles or separated by one scale. Four to six enlarged scales, tending to decrease in size posteriorly, between interparietal and dorsals.

Suboculars smooth, in contact with supralabials. Seven supralabials to center of eye.

Mental partly divided, each part a little wider than long. one to two smooth scales in contact with mental between the large sublabials. Three to five sublabials on each side in contact with infralabials. Central throat scales small, smooth, increasing in size laterally and anteriorly.

Trunk. Middorsal scales flat, smooth, not or very little larger than flank scales. Ventrals larger than dorsals, smooth, subimbricate or juxtaposed.

Dewlap. Not large in male, only indicated in female, scales in rows, rather closely packed, larger or smaller than those of the belly.

Limbs and digits. Scales of limbs and digits smooth. Seventeen to 21 scales under phalanges ii and iii of fourth toe.

Tail. Compressed. Scales smooth above, keeled below. Scales behind vent smooth. Enlarged postanals broken up in male, absent in female.

Color. Light gray obliquely streaked with darker or more irregular, lichenate.

Table 2 lists the most important differences between *nasofrontalis* and *pseudotigrinus*. These are striking differences and greater than the differences between *Anolis solitarius* and *A. tigrinus*, the species pair with which Williams (1976) has united them as the *tigrinus* species group.

A. solitarius in northern Colombia and *A. tigrinus* in northern Venezuela are so far as known allopatric. This is another difference from the Brazilian pair which are not only from the same general region but have been reported from the same specific locality — Santa Teresa. It is tempting to invoke character displacement, evolved because of competition in sympatry, as the possible explanation of the heightened differences between *A. nasofrontalis* and *A. pseudotigrinus*.

However, for neither the northern nor the southern species are there any detailed ecological notes. A competitive relationship of any sort is only inferred for the Brazilian pair because of their similar size and similarity in most structural features. The functional significance of the differences is again quite unclear.

One character of *A. pseudotigrinus* is unique within the *tigrinus* group: the protuberant snout of the male. This is a feature well known in *Anolis punctatus* and erratically occurring within the *punctatus* group. A derived character within *Anolis*, it may be an indication of affinity¹ — hence it might imply that *A. pseudotigrinus* is closer to *A. punctatus* than it is to the other members of the putative *tigrinus* group. Alternatively, it may be a feature primitive for the *punctatus* group and lost erratically within that group and in more highly evolved derivatives of that group. The *tigrinus* group by one interpretation would be a dwarf lineage evolved out of the *punctatus* group; a monophyletic assemblage in which *A. pseudotigrinus* with a protuberant snout in the male has retained a primitive character. On the other hand, it is entirely possible that the *tigrinus* group characters are ecological adaptations without phyletic significance. Seeming to support this hypothesis is the immense geographic gap between *solitarius-tigrinus* and *pseudotigrinus*-

¹But the protuberant snout can be evolved convergently. The rather remotely related *carolinensis* group *s. str.* in the West Indies shows the same character. On the other hand, the proboscis anoles (Williams, 1979) appear to be only direct and extreme derivatives of the *punctatus* group.

Table 2

| <i>nasofrontalis</i> | <i>pseudotigrinus</i> |
|--|--------------------------------------|
| snout blunt | pointed |
| snout not protuberant in male | protuberant |
| interparietal not much larger than ear | greatly larger |
| dewlap in male moderate | large |
| scales in close packed rows | in widely spaced rows |
| postanal scales poorly defined in male | distinct, largest round, not oval |

nasofrontalis. There would, of course, be neither on geographic nor morphological grounds any substantive evidence that *solitarius* and *tigrinus* are not close relatives. On the other hand, it is consonant with both geography and morphology that *pseudotigrinus* is related neither to *nasofrontalis* nor *solitarius-tigrinus* and possible on the geographic cum morphological evidence that *nasofrontalis* is related to none of the others.

We raise these issues only to make clear that no firm decision is possible on the evidence. The hypothesis of monophyly for the *tigrinus* group retains its plausibility despite its extraordinary disjunction because there is a case in the Gekkonidae that is parallel and shows an intermediate disjunction: *Coleodactylus meridionalis*, as said above, was thought (Vanzolini, 1968) to consist of disjunct populations, on one side in northeastern Brasil, on the other on the Brasil-Guyana border. It is now evident (Vanzolini, 1980) that there are two species involved, but that nonetheless they are very close and strikingly different from, and more primitive than the intervening *Coleodactylus amazonicus*; the hypothesis of monophyly remains plausible.

4. *Anolis Boulengeri* O'Shaughnessy: morph or species

Anolis Boulengeri was described in 1881 from Canelos, Ecuador. Its describer noted its strong resemblance to *A. punctatus* but the possession of keeled rather than smooth ventrals was regarded as an adequate species distinction. Subsequent study has revealed no other differences between *Boulengeri*, and the apparent restriction of keeling to populations in western Amazonia (Peru, Ecuador and Colombia), plus variability in the strength of the keeling that seemed to imply intermediacy has resulted in the general acceptance of subspecies status for *Boulengeri*.

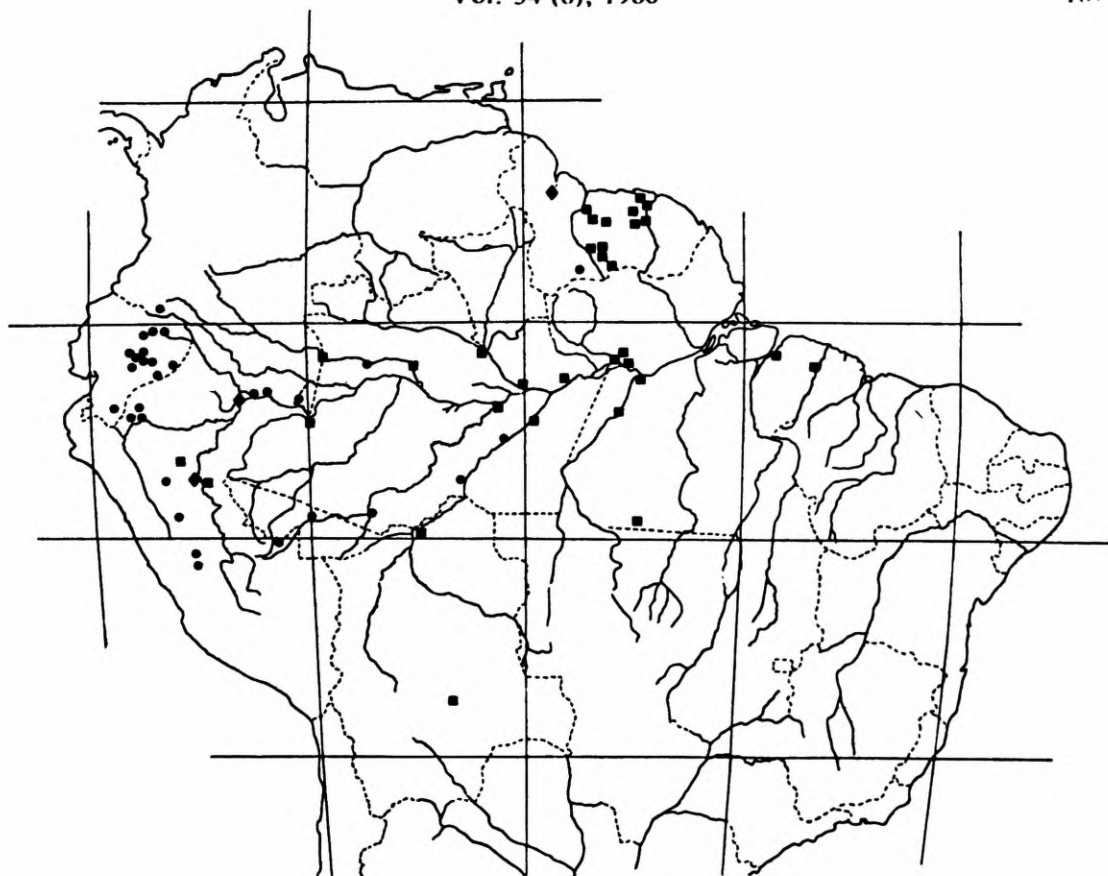
Distributional information, however, has never been sufficiently detailed to permit description of the precisely delimited intergrade zone expected in classical subspecies.

Recent acquisition of new material from the Amazon and its tributaries inside Brasil has provided information on the distribution of the character "keeled ventrals" in Brazilian *punctatus*-like populations. Map 1 reports the new data and integrates it with museum records compiled by one of us as well as recently published reports (Dixon and Soini, 1975; Hoogmoed, 1973).

It is clear from the map that extreme western populations have all keeled ventrals and that eastern populations have only smooth ventrals. In between, however, are populations that are mixed or intermediate.

There are also sequential localities along rivers that show erratically either keeled or smooth ventrals. There is no obvious association with any ecological or geographic factors. The specimens from the Rio Japurá are recently collected by one of us and are all from the same type of environment (edge of forest in *varzea*). The material from the Madeira is similarly well-documented; these specimens are all from *terra firme*.

We see no presently apparent broad explanation for these mixed localities and erratic distributions. However, very obviously we are not dealing with classical subspecies. Therefore, we limit ourselves at this time to the simple statement that *Boulengeri* O'Shaugh-



Map. 1. *Anolis punctatus*, geographic distribution of the type of ventral scales. Circles: keeled scales ("boulengeri"). Squares: smooth scales. Diamonds: mixed or intermediate populations.

nessy is not taxonomically recognizable and is at best available as an informal name ("boulengeri" — unitalicized and with quotation marks) for populations or individuals of *punctatus* that have keeled ventrals.

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