BREVIORA

Museum of Comparative Zoology

CAMBRIDGE, MASS. 31 MARCH, 1967 NUMBER 261

THE *MONTICOLA* GROUP OF THE LIZARD GENUS *ANOLIS* IN HISPANIOLA

By

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In 1962, Williams summarized the then available data on three allied species of Hispaniolan anoles: *A. monticola* Shreve, *A. christophei* Williams and *A. etheridgei* Williams (= *A. darlingtoni* Cochran). Of the three species, *monticola* was named on the basis of a single male from "the northern and eastern foothills, Massif de la Hotte, 1000-4000 feet, Haiti." Additional specimens of this species were reported by Williams from the general region about and to the north of Camp Perrin and from Ile Grande Cayemite off the north coast of the Tiburon Peninsula of southwestern Haiti. The third species (described as *A. darlingtoni* by Cochran, but later changed to *A. etheridgei* by Williams [1962], for nomenclatural reasons) was named from seven specimens collected by P. J. Darlington at four localities in the Cordillera Central of the República Dominicana. Finally, *A. christophei* from the Citadelle Laferrière in northern Haiti was based upon two females, both of which had been rather long in preservative. Williams (1962) reported on the coloration and pattern in life of *A. monticola,* and described the males of *A. christophei.* The latter species was still known only from the vicinity of the type locality. As for *A. etheridgei,* the coloration and pattern of this species were still unknown, and its range remained as delimited by the original holotype and paratypes.

The three species in the *monticola* group share a community of scale characteristics; those that distinguish them from other Hispaniolan anoles are the ventrals in transverse rows plus the

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subocular scales separated from the supralabials by a row of intervening scales (Williams, 1962:6). There is also agreement in other and more minor details of scalation, but the limits given by Williams (1962) for these data have been somewhat expanded by our examination of far more material than was available to him at the time of that paper.

Perhaps the most significant observation on the *monticola* group is that of Williams (1962:7), who stated that, "Whether there are any more members of this small sub-group of Hispaniolan anoles will have to be determined by more thorough search of the island . . . If related species are equally local in distribution, they may well have been missed." In the spring of 1966, Thomas secured a series of still another member of the *monticola* group in north-central Haiti, rather close to the type locality of *A. christophei.* Since we now have large series of the members of this group and much additional information on variation, distribution, and natural history, it is appropriate to summarize all of our data in the present paper and to describe the new northern Haitian species.

We are very grateful to Miss Patricia A. Heinlein, Donald W. Buden, Ronald F. Klinikowski and David C. Leber for assistance in the field in the República Dominicana. It also gives us very great pleasure to acknowledge Mr. Leber's work on our behalf in the careful execution of the color portraits reproduced herein; with three exceptions (the races of *A. monticola* and the new species) these were done in the field from living lizards. We most readily acknowledge the assistance of Ernest E. Williams in the present endeavor, not only for suggesting that we name the new species and for the loan of recently accumulated material in the Museum of Comparative Zoology of a group in which he is personally interested but also for his guiding our way through the at times impenetrable mass of Hispaniolan anoles. We have followed his techniques in taking of data and in description, so that the present information may be more readily compared with his own descriptions of several Hispaniolan anoles. Finally, Dr. Williams has graciously allowed that portions of a projected paper by himself and Schwartz be withdrawn and utilized herein, so that information on all the members of the *monticola* group might be more compactly available.

Our data are based primarily on specimens in the Albert Schwartz Field Series (ASFS), but we have also borrowed material from the Museum of Comparative Zoology (MCZ), the Field Museum of Natural History (FMNH), and the American Museum

of Natural History (AMNH); for the courtesy extended us in these matters, we wish to thank Ernest E. Williams, Robert W. Inger, Hymen Marx, Charles M. Bogert, and Richard G. Zweifel. Dr. Zweifel's assistance in supplying copies of pertinent field notes is also much appreciated. William G. Hassler kindly allowed us to examine his photographs and field sketches of some of the anoles concerned.

This study has been supported in part by National Science Foundation grant GB 2444 to Dr. Ernest Williams.

ANOLIS CHRISTOPHEI Williams

The apparently most primitive member of the *christophei-etheridgei-monticola* trio of Hispaniolan anoles, *A. christophei,* was described from two female specimens from the Citadelle Laferrière, Dépt. du Nord, Haiti (Williams, 1960). Later, this description was amplified by a series of 20 additional specimens from the type locality (Williams, 1962). The species has thus been known only from topotypical specimens and its distribution has otherwise been unknown. In March 1963, four of these lizards were taken at Paraje La Palma, La Vega Province, República Dominicana, by C. E. Ray and R. Allen; the species was thus known to inhabit the eastern Cordillera Central as well as the Bonnet-a-l'Evêque in

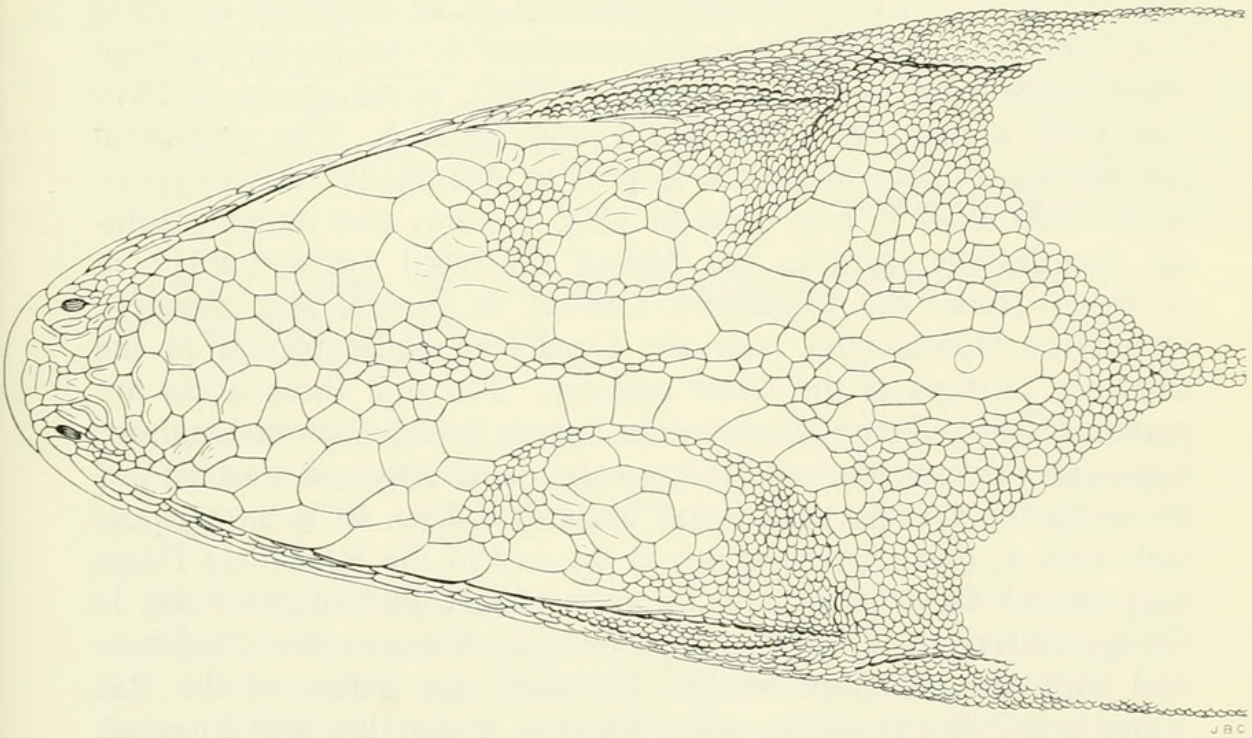


Figure 1. Dorsal view of head of *Anolis christophei,* ASFS X9193. Snout-vent length 45 mm.

the Chaine de Marmelade in the north. The elevation of the type locality is 2840 feet (865 meters); the elevation of the La Palma specimens is unknown. The coloration and pattern of *christophei* have not been described from living specimens; additional material collected by ourselves and associates in 1963, 1964 and 1966, and in 1964 by J. D. Lazell, Jr. has contributed information not only on these characters but also on the ecology and habits of the species.

A. christophei is now known to occur in four regions, and doubtless is distributed in the intervening areas, with one probable exception. It is a fairly common lizard in the Cordillera Central in the República Dominicana. Specimens have been collected from the northeast of Jarabacoa, south to west of Constanza, but not in the Valle de Constanza itself. Not only does the species occur in the uplands, but it is also to be found on the steep eastern escarpment of the Cordillera between El Río and Jayaco. Elevations of occurrence in this general area vary between about 2000 feet (610 meters) and 4250 feet (1296 meters) (Fig. 14). A second major area of occurrence is in San Cristóbal Province, near El Cacao. This locality lies on the southern slopes of the Cordillera Central; the lizards were taken at elevations of 1200 to 1400 feet (366 to 427 meters). The third area of occurrence is in the Cordillera Septentrional; at only one locality in this range, *A. christophei* was collected at an elevation of 2200 feet (671 meters). The final region whence *A. christophei* has been taken is the Chaine de Marmelade in Haiti, at elevations of 2840 feet (865 meters) to 3500 feet (1068 meters). The altitudinal distribution of the species is known to encompass elevations of from 1200 to 4250 feet (366 to 1296 meters) and its geographical distribution includes the Massif du Nord (presumably) in northern Haiti, the Cordillera Central in central and southern República Dominicana, and the Cordillera Septentrional in the northern portion of the latter country. The first three areas are presumably confluent, whereas the lizards in the Septentrional are apparently completely cut off from their southern and western relatives by the arid portion of the Valle de Cibao. It is barely possible that *A. christophei* occurs to the east in the República Dominicana and thus circumvents the inhospitable part of the Valle de Cibao, thereby bridging the apparent gap between the Cordillera and Septentrional populations. Certainly the valley of the Río Yuna is sufficiently mesic, and even now reasonably well forested, to support *A. christophei*. However, we consider it unlikely that these wet lowlands are presently inhabited by such a confirmedly montane lizard.

A. christophei, although observed with some frequency during the day, is much more readily collected at night. Most specimens were taken sleeping on ferns (especially tree-ferns), herbs, and shrubs along the margins of streams in gallery forest in the pine-clad uplands of the Cordillera Central. The greenish brown dorsal coloration renders them relatively inconspicuous under such circumstances, but the long dark almost filamentous tail often reveals their presence. The hindlimbs are flexed in the sleeping posture, and the lizards sleep more often across the leaflets and/or leaves rather than aligning themselves along the stems of branchlets; often they give the appearance of having been suddenly overtaken by the lowering temperatures of nightfall and of having stopped abruptly in their tracks. They give the impression of being draped across the greenery rather than having deliberately chosen a resting place for the night. This posture is in direct

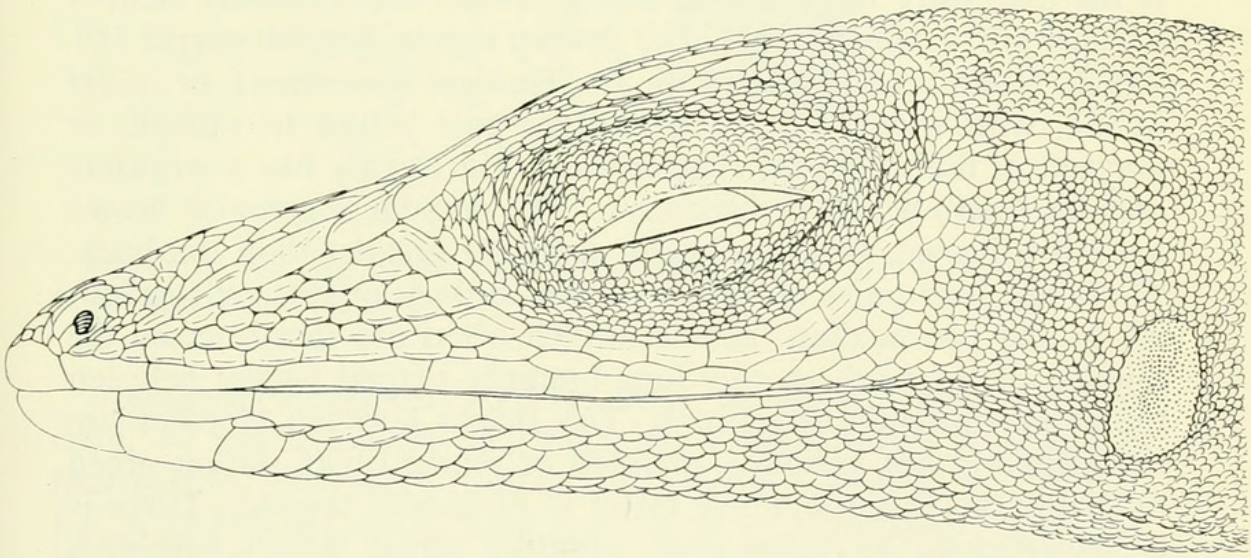


Figure 2. Lateral view of head of *Anolis christophei,* ASFS X9193. Snout-vent length 45 mm.

contrast to that of such larger anoles as *A. cybotes, A. distichus,* and *A. ricordi* which are encountered with them, but is quite similar to that of *A. etheridgei* which occupies similar situations at night.

The habitat of this anole is moist, shady, montane woods, particularly stream-associated forests and mesic ravines. During the day *A. christophei* was observed on tree trunks (four to six feet above the ground) along wooded edges of the Río Jimenoa below Paso Bajito, and on tree trunks and fallen but sloping logs near Paso Bajito itself. One was found on a fence post in riparian

woods near El Río. The Haitian specimens were collected in dense second-growth woods, where they were found on small trees, two to five feet above the ground. At night along a very narrow rivulet adjacent to a *platanal* east of El Río, *A. christophei* occupied the usual stream-side plants, and was not encountered on larger shrubs and trees nor on the banana plants themselves. The specimens from near El Cacao in the southern Cordillera Central were collected at night as they slept on bushes and ferns along the roadside in a region of coffee and cacao plantations. In the Cordillera Septentrional, specimens were also taken at night from stream-side shrubs and vines (the only place where they were encountered on the latter type of plants); on the vines, the lizards slept on the leaves and not on the woody stems. In no instance was there any attempt at concealment.

Perhaps the most noteworthy characteristic of *A. christophei* is the extremely large dewlap for so small and relatively slender a lizard (Pl. 1, *upper left*). The dewlap is pale, grayish purple (Pl. 47E2, Maerz and Paul, 1950, for Haitian specimens) or violet in life, with widely separated rows of pale yellow to whitish, or grayish, or bluish scales. The dewlap skin usually has a strangely metallic lustre which is distinctive. The dorsum is greenish brown to yellow-brown, with the heads distinctly greener than the back. There are four pairs of darker brown, bronzy or distinctly greenish brown paramedian blotches which often are fused across the midline of the back to give four butterfly-shaped figures between the shoulders and the sacrum. The spaces between blotches are not clear but are variously marbled or marked with darker green or brown, so that the whole effect is extremely cryptic. There is a yellow-green to yellow-buff shoulder stripe which continues down the sides as a vague, paler, lateral stripe. There is a yellow to greenish yellow subocular semicircle and a black to very dark brown postocular smudge. The chin and throat are dark gray; the ventral color is yellow to greenish yellow, and the tail is terminally black. In the dark phase, the dorsal ground color is dark gray with a purplish tinge, and the markings are very dark gray (nearly black) with a reddish or bronzy tinge. There is neither sexual dichromatism nor ontogenetic change in coloration or pattern; a single tiny juvenile (snout-vent length 21 mm) is colored and patterned like adults. The iris is blue. Although *A. christophei* is a small anole, it is not obviously slim and attenuate; the long tail adds to the impression of attenuation.

A. christophei is not strongly sexually dimorphic in size, although males reach a slightly larger size (49 mm snout-vent

length; ASFS X8835) than females (45 mm snout-vent length; ASFS V1957). There are 6 to 10 (mode 8) scales across the snout at the level of the second canthal, and 4 to 8 (mode 6) rows of loreals. The supraorbital semicircles are separated by one or two scales (mode 1), and there are 3 to 7 (mode 4) scales between the interparietal and the semicircles. Fourth toe lamellae on phalanges II and III vary from 18 to 25 (mode 22, with 16 specimens, but 15 specimens have 23 lamellar scales).

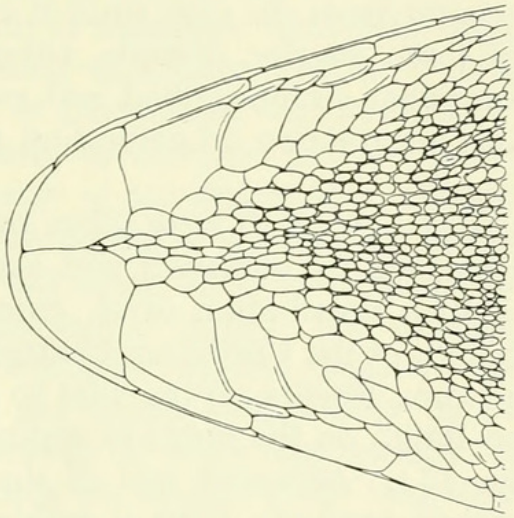


Figure 3. Mental region of head of *Anolis christophei,* ASFS X9193. Snout-vent length 45 mm.

Specimens examined: HAITI, *Dépt. du Nord,* Citadelle Laferrière, 20 (MCZ 66900-19); *Dépt. de l'Artibonite,* 8 to 9 km W Marmelade, 3500 feet (1068 m), 13 (ASFS V9900-12); REPUBLICA DOMINICANA, *La Vega Province,* Municipio Constanza, Paraje La Palma (not mapped), 15 (MCZ 75142-43, 79349-51, 79353-62); 6 km W Constanza, 4250 feet (1296 m), 2 (ASFS X8834-35); 11 km NE Jarabacoa, *ca.* 2000 feet (610 m), 6 (ASFS V4198-201, V4326-27); 10 km NE Jarabacoa, 1 (ASFS V4216); 4 km E Paso Bajito, Río Jimenoa, 2700 feet (724 m), 10 (ASFS X8850-57, V1866-67); 4 km SW El Río, 4000 feet (1220 m), 5 (ASFS X8552-55, X8737); 4 km SW El Río, 3500 feet (1068 m), 3 (ASFS X8886-88); 6 km E El Río, 3600 feet (1098 m), 7 (ASFS X9205-11); 7.1 mi. (11.4 km) E El Río, 3500 feet (1068 m), 1 (ASFS X8113); 23 km E El Río, 3050 feet (930 m), 3 (ASFS X9193-95); *Espaillat Province,* 2 km N Puesto Grande, 2200 feet (671 m), 6 (ASFS V1956-61); *San Cristóbal Province,* 15.5 km SE El Cacao, 1400 feet (427 m), 2 (ASFS V2498-99); 2.1 km SE El Cacao, 1200 feet (366 m), 6 (ASFS V2492-96, V2502).

ANOLIS ETHERIDGEI Williams

Anolis etheridgei Williams (= *Anolis darlingtoni* Cochran, 1939) was described from four localities in the Cordillera Central in the República Dominicana: Loma Vieja, south of Constanza; Loma Rucilla; Valle Nuevo; and Constanza. The included elevations for these four localities are from 3000 feet (915 meters) to 8000 feet (2440 meters). The type series comprised a total of seven specimens. From this it might be assumed that *A. etheridgei* is uncommon; this is far from the case since it is one of the more abundant anoles of these interior uplands, although its total distribution is still somewhat circumscribed and surely incompletely known. No previous information on coloration and pattern in life has been reported.

New specimens (three of which were taken by J. D. Lazell, Jr., in 1964, and the balance by ourselves and associates in 1963) indicate that the known distribution of *A. etheridgei* is confined to the interior highlands of the Cordillera Central in the República Dominicana, from Loma Rucilla on the west to east of El Río on the east, from Paso Bajito on the north to southeast of Constanza on the south (Fig. 14). Although one of the paratypes is recorded from Constanza (and this town is within the limits of the range of *etheridgei* as noted above), no additional specimens have

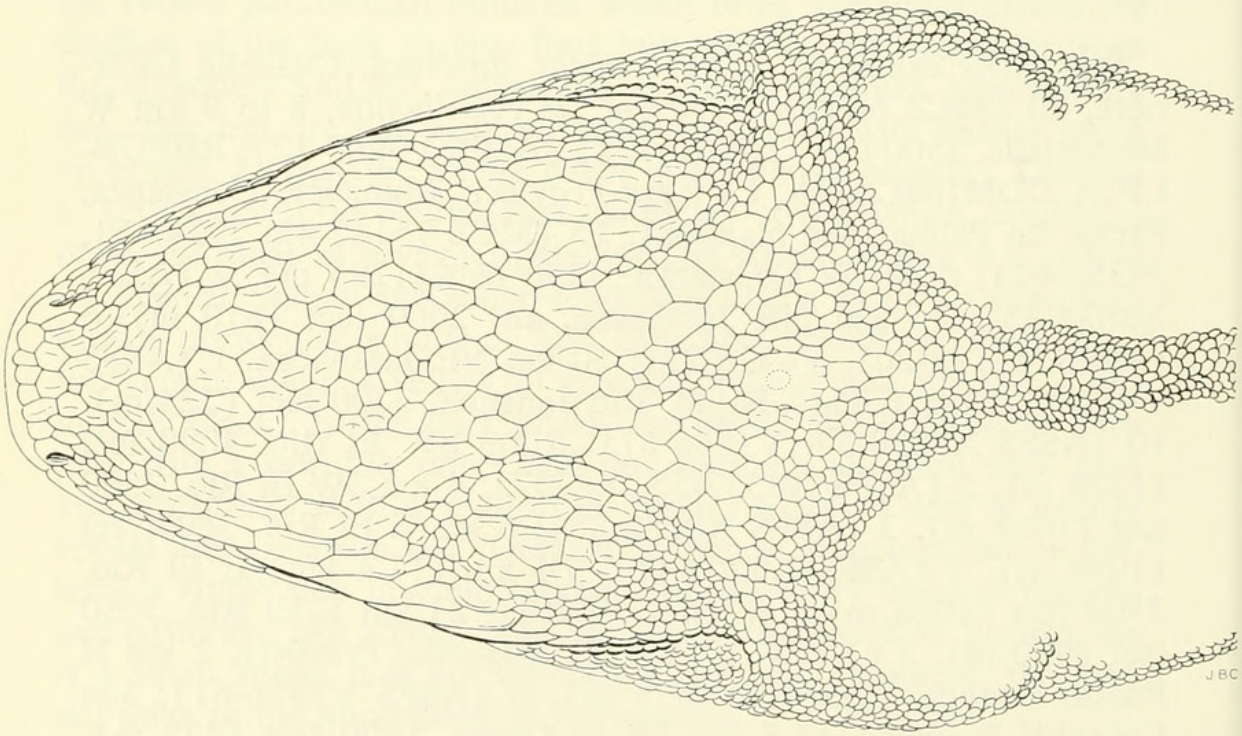


Figure 4. Dorsal view of head of *Anolis etheridgei*, ASFS X9146. Snout-vent length 42 mm.

been taken from the Valle de Constanza, despite careful search for it there. Recently collected specimens indicate an altitudinal range of 3050 feet (930 m) to 6100 feet (1890 m); these elevations are embraced by the data for the type series, although in almost every case of the latter, the elevation for each locality is an inclusive range.

A. etheridgei is similar to *A. christophei* in habitat preferences, and although it was encountered frequently sleeping on tree ferns, shrubs and herbs in gallery forest at night, it is not confirmedly restricted to this sort of situation. Specimens were collected in a protected and secluded depression (about 7 meters in diameter) in rainforest north of Constanza; the depression was protected by a dense thicket along its margins, and the lizards were sleeping on bushes in the center of the depression. During the day occasional specimens were encountered in forest on bushes or small trees adjacent to paths, but many more were observed and collected with facility while sleeping at night. The discussion of the sleeping habits of *A. christophei* applies equally well to *A. etheridgei.* Sleeping lizards are found draped over the leaflets of ferns and tree-ferns, the leaves of herbs and shrubs, and are not aligned along the branches or twigs. Their long tails reveal their presence with ease. None was encountered sleeping on vines, and usually the lizards were seen within two feet of the ground surface. The legs are flexed in the sleeping posture.

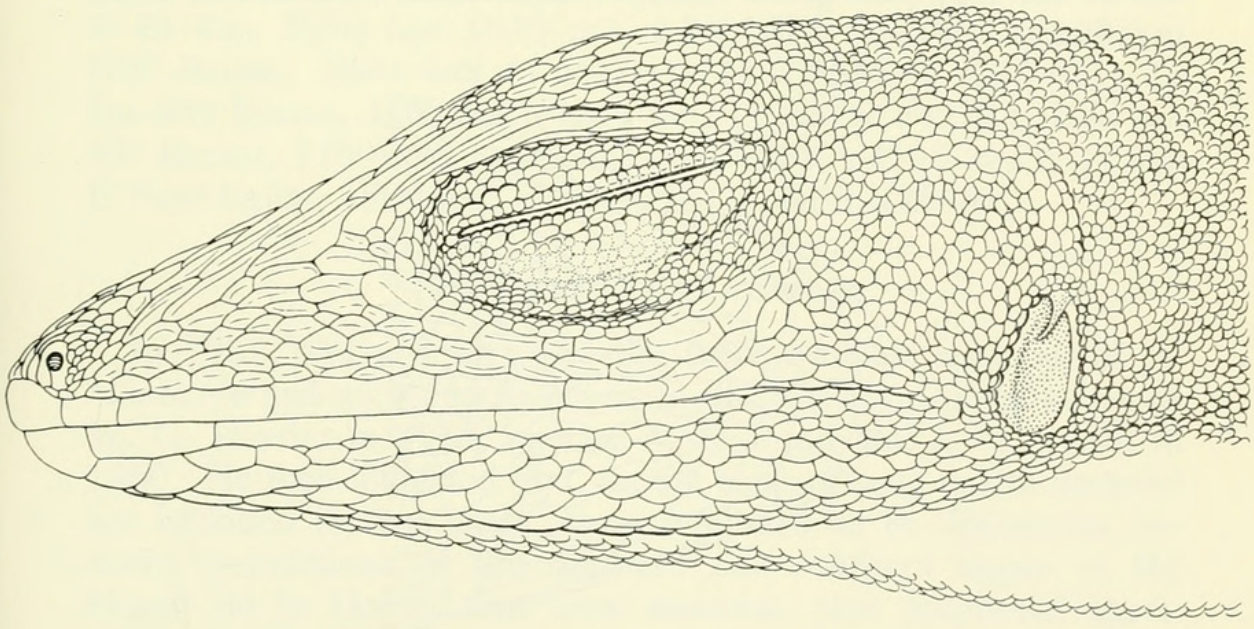


Figure 5. Lateral view of head of *Anolis etheridgei,* ASFS X9146. Snout-vent length 42 mm.

A. etheridgei, in contrast to *A. christophei,* is sexually dichromatic. Males are transversely crossbanded with four darker crossbands between the neck and sacrum. These bands may be fairly prominent or much obscured due to interband pigmentation. The neck is brown to bronzy above, with bright pea-green on the sides of the head and neck, blending into a duller green on the sides. The back is some shade of tan to brown, always dull in hue. The sides of the head and neck may be pale powder-blue rather than green. The ventral color is tannish opalescent to opalescent. The general coloration of males is a combination of tans, browns, and greens of varying hues. The dewlap is small, all white or white with a grayish basal area (Pl. 1, *upper right*). Females have a dorsal longitudinal bronzy zone, bordered dorsolaterally by rich dark brown longitudinal bands which extend onto the postorbital area. The dorsal bronzy band expands on the head and forms a U-shaped bronzy nuchal figure which abuts against the upper eyelids. Females at times have a series of four or five middorsal diamonds superimposed on the dorsal band; the halves of each diamond may be staggered to give a more complex dorsal pattern. The sides of the neck are white, and often females lack green or any greenish tints at all. The venters are like those of males except that occasional specimens have the venter light brown with a pinkish tinge. Both sexes have a cream subocular spot (which is more prominent in males) and the iris is blue. The chin and throat are very pale green in males and cream with brown striae in females.

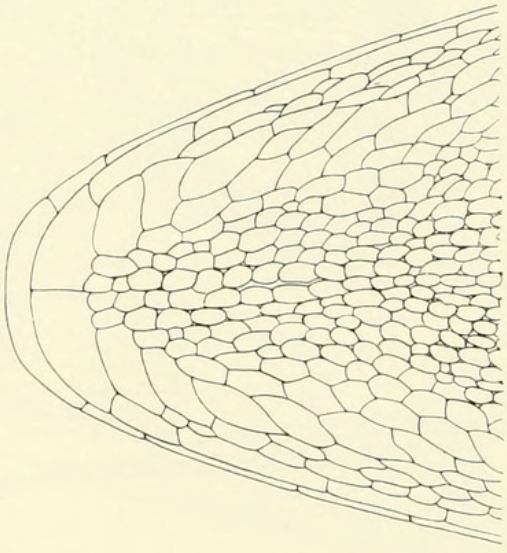


Figure 6. Mental region of head of *Anolis etheridgei,* ASFS X9146. Snout-vent length 42 mm.

Of the seventy-eight lizards available to us, the two largest males and the largest female (all with snout-vent lengths of 43 mm) come from a series of four lizards from 9.1 mi. (14.6 km) N of Constanza. Despite the long series from elsewhere in the Cordillera, strangely the three largest lizards are from the same small series; the difference in bulk of animals in this small lot of lizards, compared to those from elsewhere, was rather striking in life as well.

There are from 8 to 15 (mode 10) scales across the snout, and there are 5 to 10 (mode 6) rows of loreals. The scales between the supraorbital semicircles vary from 0 (semicircles in contact) to 4 (mode 2), and there are from 3 to 6 (mode 4) scales between the interparietal scale and the semicircles. Fourth toe lamellae on phalanges II and III vary from 15 to 21 (mode 18).

Specimens examined: REPUBLICA DOMINICANA. *La Vega Province,* Municipio Constanza, Paraje La Palma (not mapped), 3 (MCZ 79345-47); 7.2 mi. (11.4 km) S Constanza, 5000 feet (1525 m), 1 (ASFS X8241); Loma Vieja, 6000 feet (1830 m), south of Constanza, 1 (FMNH 73378); 12.6 mi. (20.2 km) SE Constanza, 6100 feet (1891 m), 1 (ASFS X9146); 16 km N Constanza, 6000 feet (1830 m), 1 (ASFS X8950); 9.1 mi. (14.6 km) N Constanza, 3500 feet (1068 m), 4 (ASFS X8791-94); 4 km SW El Río, 4000 feet (1220 m), 30 (ASFS X8522-51); 4 km SW El Río, 3500 feet (1068 m), 3 (ASFS X8889-91); 6 km E El Río, 3600 feet (1098 m), 1 (ASFS X9212); 23 km E El Río, 3050 feet (930 m), 14 (ASFS X9179-92); 22 km NW Bonao, 3900 feet (1189 m), 11 (ASFS V4282-92); 23 km NW Bonao, 4100 feet (1251 m), 1 (ASFS V4272); 19.6 km NE Bonao, 3300 feet (1007 m), 6 (ASFS V4296-301); 11 km E Paso Bajito, 4500 feet (1372 m), 1 (ASFS X8849).

ANOLIS MONTICOLA Shreve

In 1962 Williams reviewed the then available material of *A. monticola* and recorded its colors in life, based on notes taken by W. G. Hassler in 1935, and by A. S. Rand and J. D. Lazell in 1960. He then indicated that, on the basis of very recent material not included in that study, there appeared to be differences between populations of the northern and southern slopes of the Massif de la Hotte. Our own material, plus additional specimens (MCZ 74866-70), shows that there are indeed two forms of *monticola*: one possessing the four prominent dark ocellar patches as shown by Williams (1962: fig. 2), and one lacking the pair of nape patches.

Williams (1962) cited five specimens collected by W. G. Hassler (AMNH 49818, 49845, 50108-09, MCZ 65139, formerly AMNH 50110) with the locality given as "25 miles north of Aux Cayes on Jeremie Road" and MCZ 56140 from "mountains on Jeremie road about 8 miles from Camp Perrin." Reference to the map of Haiti published by the Service de Géodésie et Cartographie 1:100,000 shows that 25 miles north of Les Cayes lies well onto the northern slope, as does the locality 8 miles from Camp Perrin. We have consulted Hassler's original field notes and find that the true situation is otherwise: AMNH 49845 is in actuality listed as being from "high Mts. on Jeremie road 32 miles from Aux Cayes 2000-3000′ approx."; AMNH 49818, 50108-10 are said to be from "about 4 miles from Camp Perrin." It is thus evident that these localities have suffered in the transcription to the catalogue.

The specimens from 4 miles north of Camp Perrin are from the south slope, if the distance is accurate; the Tombeau Cheval specimens cited by Williams, 1962, are apparently from south of the high point on the Jérémie road but near it. The specimens of these two series agree in having the four ocellar patches.

Recent material from farther west, obtained by Thomas, lacks the nape ocellar patches and agrees in this respect with MCZ 74866-70 from Trou Bois, 1½ miles south of Beaumont on the Les Cayes-Jérémie road, and with AMNH 49845 from 32 miles from Les Cayes on the Jérémie Road (which is probably in the vicinity of the locality for the Trou Bois series). The type specimen of *monticola,* although with the color pattern obscured by preservation and age, lacks the pair of nape patches (the neck patches and dorsal dark bands can still be seen), and thereby agrees with the material just mentioned. The locality for this specimen is not precisely known, but "northern and eastern foothills of the Massif de la Hotte" is in reality the northern and eastern foothills of Pic Macaya (P. J. Darlington, pers. comm. to E. E. Williams), the highest peak of the range, which lies to the west of the Tombeau Cheval region (Fig. 10). We are convinced that two distinct populations of *Anolis monticola* have been sampled: one, of the northwestern and western extreme of the Massif de la Hotte, and another farther to the east (and possibly to the south).

We regard the Grande Cayemite record for *monticola* (MCZ 58026, a female, collected by W. J. Eyerdam) as dubious. Thomas has visited this island and the habitat is for the most part very arid, not at all similar to habitats occupied elsewhere by *monticola.*

This is not in itself incontrovertible evidence against the occurrence of the species on that island, and it may be noted that *Diploglossus sepsoides* Gray, normally an inhabitant of distinctly moist situations, does occur there. However, the single Eyerdam specimen of *Sphaerodactylus copei* Steindachner was noted as being indistinguishable from *S. copei picturatus* Garman from the nearby mainland (Schwartz and Thomas, 1964:326), yet the recently obtained series of *S. copei* from Grande Cayemite is undeniably a distinctive new subspecies. The Eyerdam collection is also responsible for the aberrant locality of the Citadelle Laferrière for specimens of *Anolis hendersoni* Cochran (Williams, 1963), a trenchantly south island species. We will not be apodictic but regard the Grande Cayemite specimen with suspicion.

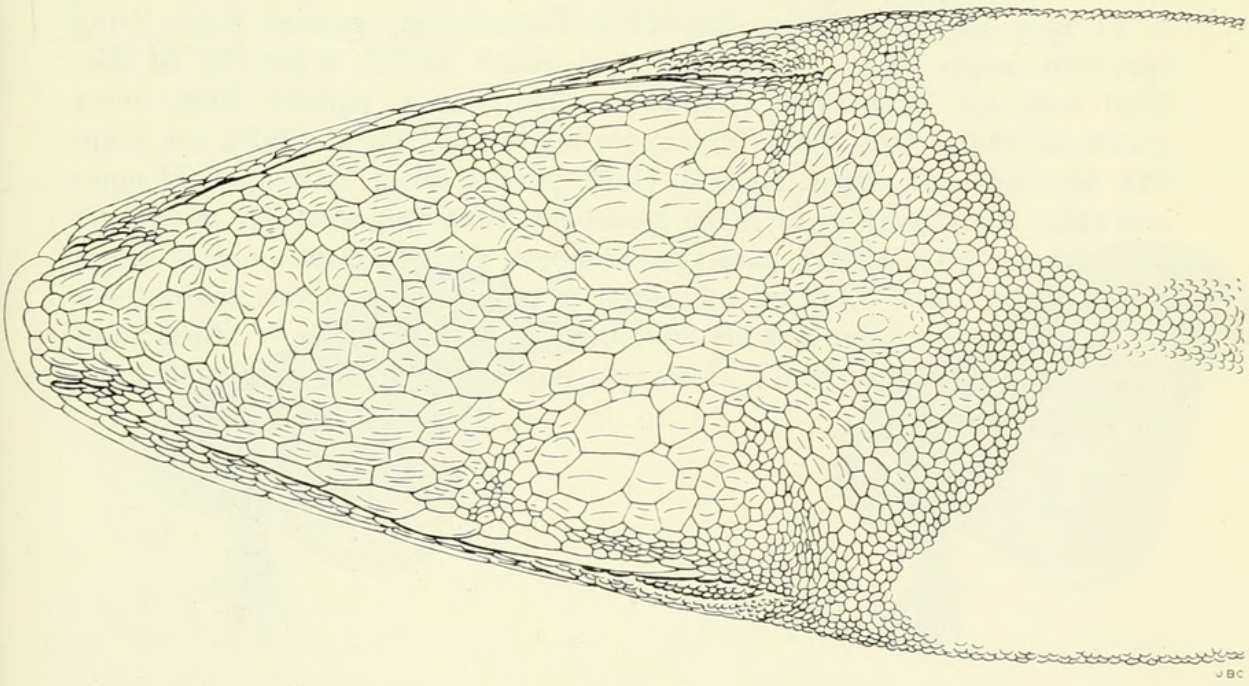
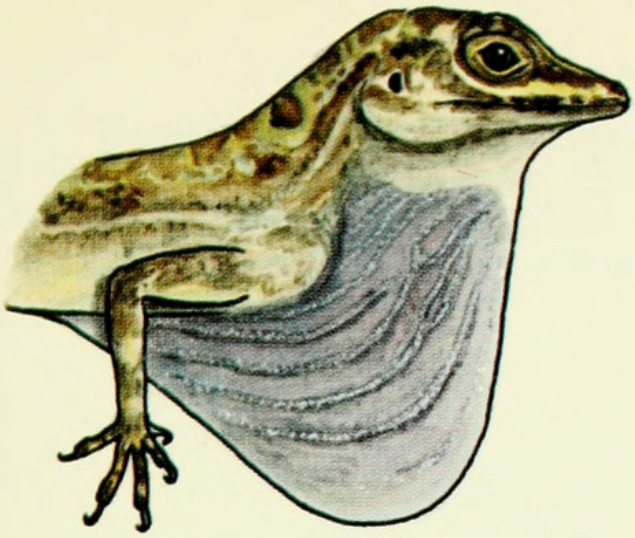
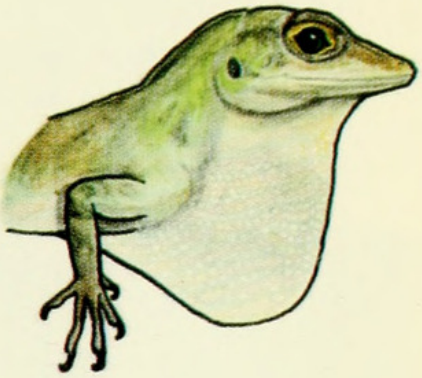


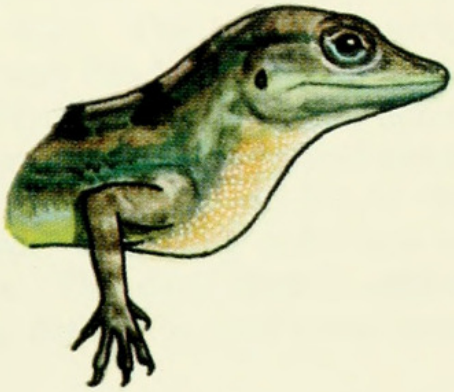
Figure 7. Dorsal view of head of *Anolis monticola quadrisartus,* type, MCZ 62998. Snout-vent length 43 mm.

Anolis monticola shows strong sexual dimorphism in size; males reach a maximum of 55 mm and females 39 mm. There are 7-11 (mode 9) scales across the snout at the level of the second canthal and 6-9 (mode 7) loreal rows. The supraorbital semicircles are separated by 2-4 (mode 3) scales, and there are 3-6 (mode 4) scales between the interparietal and the semicircles. Fourth toe lamellae in phalanges II and III vary from 17-21 (mode 18 or 19).

Plate 1. Lateral views of heads of males of four species of Hispaniolan *Anolis*, as follows: *upper left, Anolis christophei,* ASFS X8113, 7.1 mi. E El Río, La Vega Prov., República Dominicana, painted from living specimen; *upper right, Anolis etheridgei,* ASFS X8522, 4 km SW El Río, 4000 feet, La Vega Prov., República Dominicana, painted from living specimen; *center left, Anolis monticola monticola,* ASFS V9624, *ca.* 5 km SSE Marché Léon, Dépt. du Sud, Haiti, painted from Thomas' field notes and color transparencies of living specimens; *center right, Anolis monticola quadrisartus,* MCZ 63004, paratype, Tombeau Cheval, Dépt. du Sud, Haiti, painted from color noted by collectors, as quoted by Williams (1962:3-4); *lower, Anolis rimarum,* AMNH 96469, paratype, 8 to 9 km W Marmelade, Dépt. de l'Artibonite, Haiti, 3500 feet, painted from Thomas' field notes on living specimens.







ANOLIS MONTICOLA MONTICOLA Shreve

Diagnosis: A subspecies of *Anolis monticola* characterized by the absence of paired, large, black, light-centered ocelli on the nape, and by a yellow to reddish orange dewlap; females have a relatively straight-sided (in contrast to wavy or scalloped) middorsal zone.

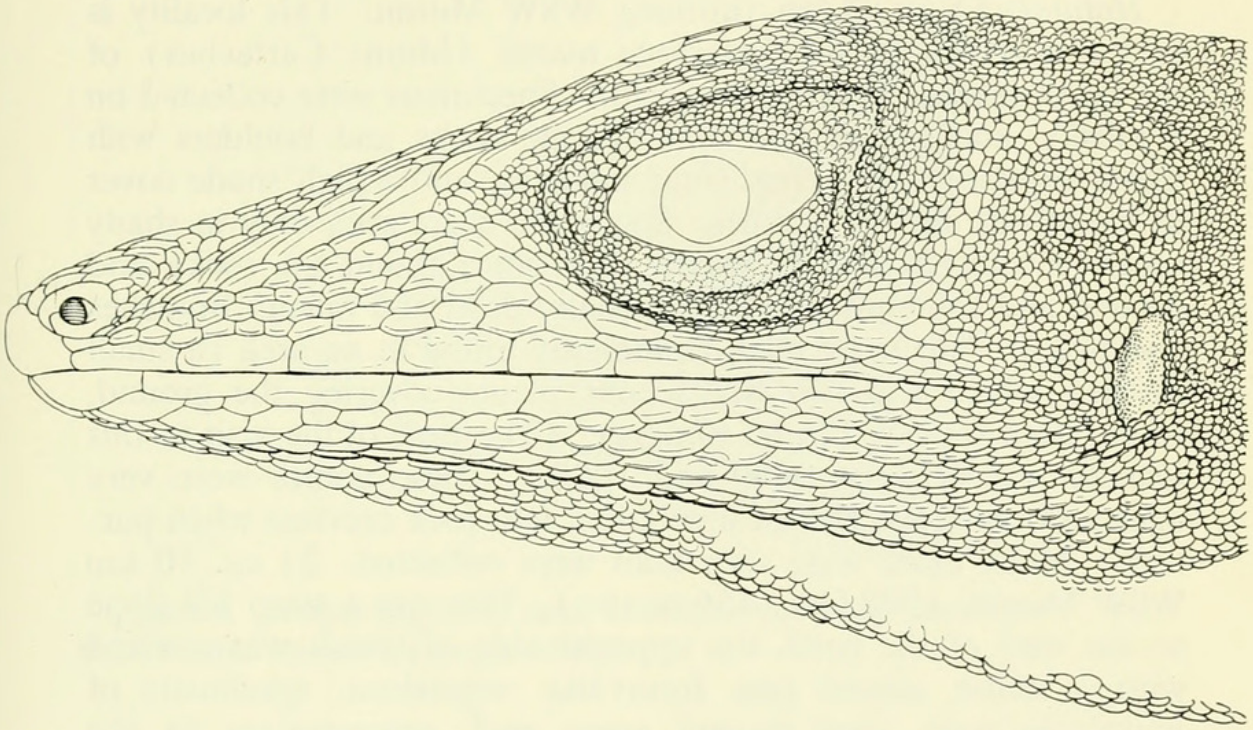


Figure 8. Lateral view of head of *Anolis monticola quadrisartus,* type, MCZ 62998. Snout-vent length 43 mm.

Color in life: The dorsal ground color of males is dull greenish yellow middorsally; the sides are brighter yellow-green to yellow-brown. The labials and the sides of the neck have an indistinct pastel blue to blue-green stripe. The saddles and the nuchal spots are black, and the ocelli in the nuchal spots are bright blue. The venter is faintly greenish yellow. The throat is blue to blue-green, becoming yellowish centrally. The dewlap is yellow to reddish orange (Pl. 1, *center left*). The limbs are greenish yellow with some brown suffusion and banding, and the tips of the digits, and palmar and plantar surfaces, are black. The nominate form is also known to assume a gray to brown ground color phase dorsally, with black markings and little or no bright dorsal color. The ground color of the sides below the middorsal zone may also be pale translucent green. The dark dorsal saddles continue diagonally and posteriorly below the middorsal zone and are much

invaded by light color, to the extent of appearing split longitudinally and giving the effect of trailing off. The ocelli in the black patches may be single and relatively large or multiple and smaller. The color portrait was executed from this information.

Females are duller than males and have a simpler zonate pattern of a light (brown), relatively straight-edged middorsal zone (usually with only one or two small undulations), and darker sides.

Habitat: 1) *ca.* 7 km (airline) WSW Moron. This locality is in the foothills of the limestone massif (Monts Cartaches) of the northwestern Tiburon Peninsula. Specimens were collected on a hillside and ravine side of limestone rocks and boulders with mesic vegetation of coffee, some bananas, and a high shade cover of breadfruit and other trees. Specimens were seen only in shady areas, mostly in coffee, where they were found on rocks and ground and sometimes on low (usually dead and fallen) branches and twigs. They were most abundantly found in an area (a small ravine) which had low herbaceous plants covering the ground, where they appeared to be foraging. (The time of the visit to this locality was between 0900 and 1000.) These anoles were very agile and retreated, almost invariably, into rock crevices when pursued. Many more were seen than were collected. 2) *ca.* 10 km WSW Moron, 1500 feet (456 meters). This was a steep hill slope to the west of the road, the opposite side of which was covered with a dense almost rain forest-like vegetation; specimens of *monticola* were seen around some rock outcroppings in the wooded area. Five were collected. 3) *ca.* 5 km (airline) SSE Marché Léon, 2600 feet (793 meters). Specimens were collected in a ravine filled with a jumble of limestone boulders and overgrown with mesic vegetation; the surrounding area was much cut over. 4) *ca.* 8 km (airline) S Marché Léon, 3000 feet (915 meters) (Castillon). No specimens of *monticola* were collected but many individuals were seen along the base of a hillside covered with slabs and fragments of limestone; the area was relatively open and without heavy shade, although with some ground vegetation, in contrast to other localities where this species was seen. An adjacent hillside on the opposite side of a ravine and stream had no extensive outcroppings of rock, and nowhere on this hillside, even in a few places where vegetation was moderately thick, were examples of *A. monticola* seen.

Specimens examined: HAITI, *Dépt. du Sud:* ASFS V9196-211, *ca.* 7.5 km (airline) WSW Moron; ASFS V9270-74, *ca.* 10 km (airline) WSW Moron, 1500 feet (456 m); ASFS V9624-26, *ca.* 5

km (airline) SSE Marché Léon, 2600 feet (793 m); MCZ 74866-70, Trou Bois, about 1½ km S of Beaumont, on Jérémie road; MCZ 38296 (type), northern and eastern foothills, Massif de la Hotte (= Pic Macaya), 1000-4000 feet (305-1220 m); AMNH 49845, high in mountains on Jérémie road 32 miles from Les Cayes, 2000-3000 feet (610-915 m) approx.; MCZ 65026, "Grande Cayemite."

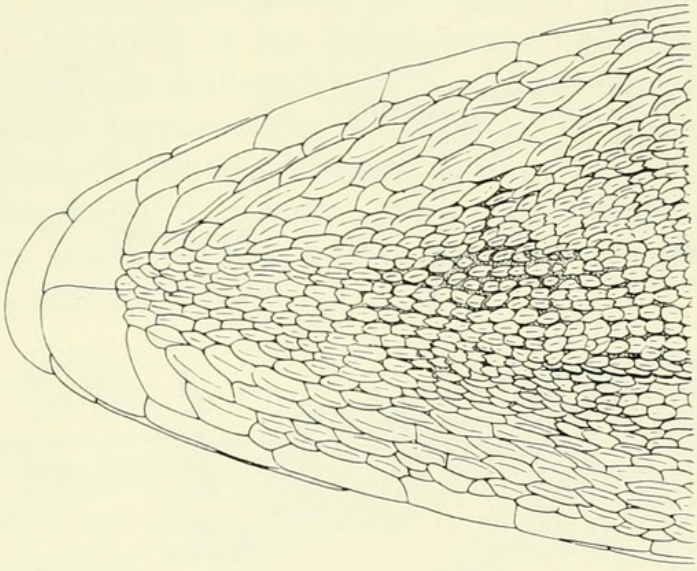


Figure 9. Mental region of head of *Anolis monticola quadrisartus,* type, MCZ 62998. Snout-vent length 43 mm.

ANOLIS MONTICOLA QUADRISARTUS[1] new subspecies

Holotype: MCZ 62998, collected at Tombeau Cheval between Camp Perrin and Beaumont, Dépt. du Sud, Haiti, by A. S. Rand and James D. Lazell, Jr., 7 August 1960.

Paratypes: MCZ 62999, 63001-04, same data as type; AMNH 50108-09, AMNH 49818, MCZ 65139, about 4 miles from Camp Perrin, Dépt. du Sud, Haiti.

Diagnosis: A subspecies of *A. monticola* characterized by a pair of black, light-centered ocelli on the nape in addition to the pair on the neck, and a blue to bright yellowish green dewlap (Pl. 1, *center right*). Females have edges of middorsal zone undulating and scalloped.

Coloration: Like that of the nominate race except for the diagnostic characters noted above. See Williams (1962) for color notes from specimens in life on the type series of *quadrisartus;* these notes also served as the source for the color portrait.

[1] From the Latin, meaning "patched four times."

Range: Known definitely only from the type locality (see discussion under the species above); possibly it is a race of the eastern La Hotte, or possibly of the southern slopes, although the present data do not indicate the latter (Fig. 10).

Habitat: Apparently identical to that of the nominate race; see Williams (1962) for habitat notes on the type series.

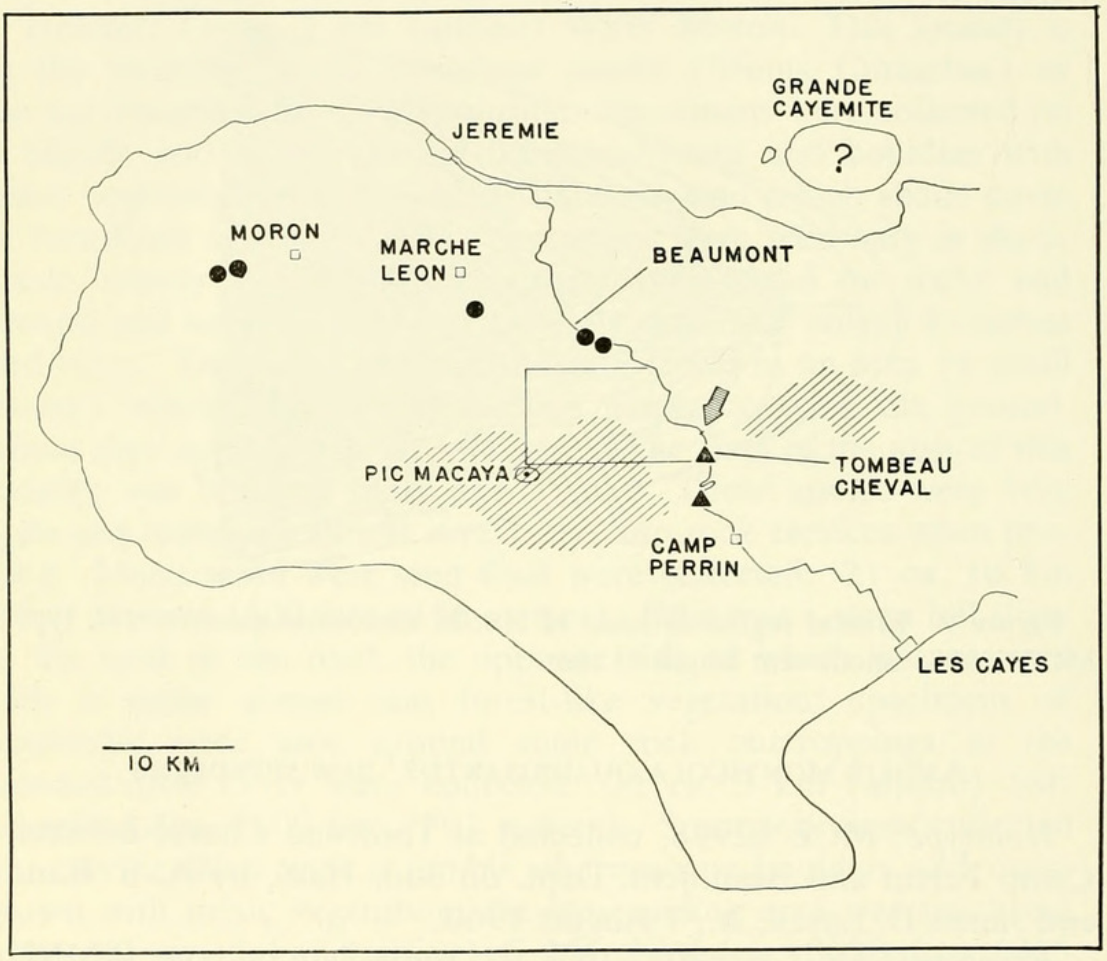


Figure 10. Tip of the Tiburon Peninsula, Haiti, showing distribution of the subspecies of *A. monticola,* as follows: circles indicate locality records for *A. m. monticola;* triangles, locality records for *A. m. quadrisartus.* Line connecting Les Cayes and Jérémie indicates road. Arrow indicates highest point (840 meters) along road. Hatched areas approximate regions above 1000 meter line. Large rectangle indicates northern and eastern foothills, Pic Macaya.

ANOLIS RIMARUM[1] new species

Holotype: MCZ 81128, an adult male, one of a series collected 8 to 9 km (airline) W of Marmelade, Dépt. de l'Artibonite, Haiti, at an elevation of 3500 ft. (1068 m), 2 April 1966, by Elie Cyphale and Richard Thomas. Original number ASFS V9896.

Paratypes: AMNH 96469-70, ASFS V9886-91, ASFS V9898, MCZ 81129, USNM 157914-16, same data as type.

Diagnosis: An anole of the Hispaniolan *christophei-etheridgei-monticola* assemblage distinguished by: smooth dorsal head scales; smooth, squarish supraoculars; a "window" of enlarged squarish palpebral scales; a nearly vestigial dewlap; smooth, juxtaposed ventrals arranged in transverse rows; transversely enlarged anterior femoral scales; somber coloration (browns, yellow-browns, dull greens); and black digits.

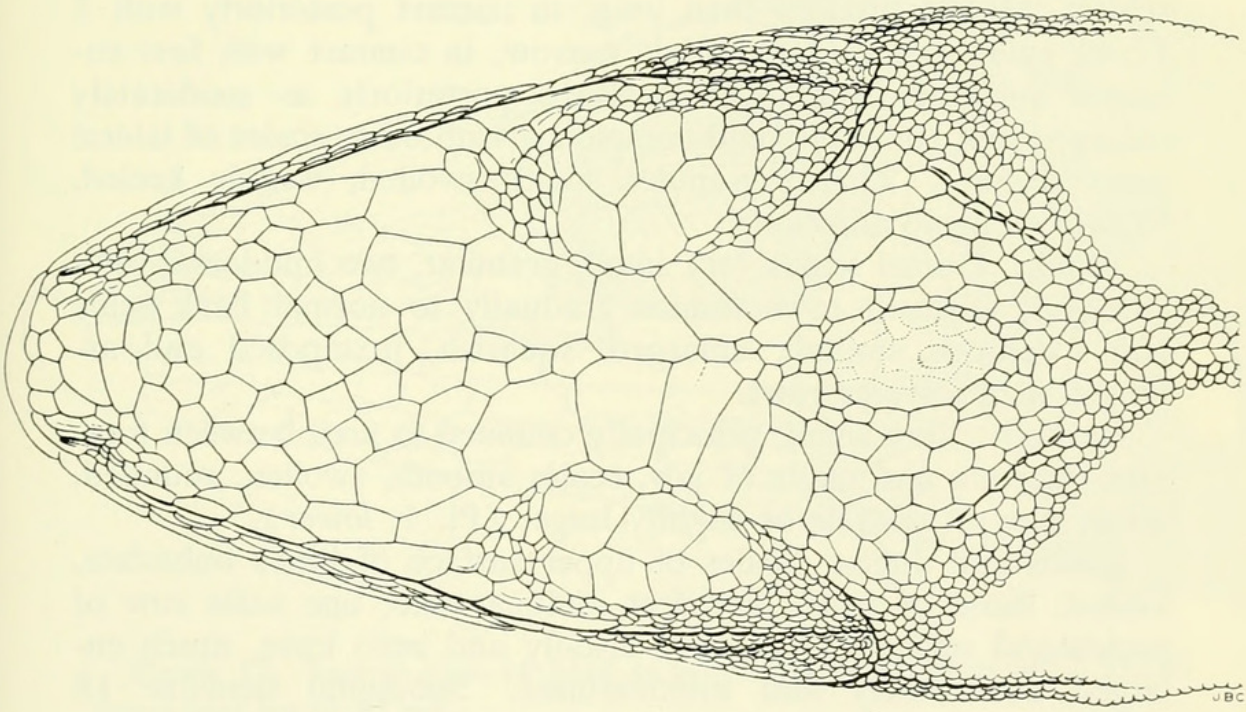


Figure 11. Dorsal view of head of *Anolis rimarum*, type, MCZ 81128. Snout-vent length 43 mm.

Description of type (variations of paratypes in parentheses): Head moderate, not especially elongate, snout pointed, slightly concave. Head scales smooth, at most with feeble keels; 7 (7-10) scales across snout at level of second canthal. Frontal depression

[1] From the Latin, *rima,* a crevice.

shallow. Anterior nasal scale in contact with rostral. Supraorbital semicircles narrowly in contact (also in six paratypes; separated in seven), separated from supraocular disks by one row of granules (rarely in narrow contact). Supraocular disks composed of about 7 enlarged, smooth, or only very faintly keeled scales and separated from supraciliary scales by 3 (3-4) rows of granules. Supraciliaries end at level slightly posterior to mid-eye, continued posteriorly by double row of slightly enlarged granules. Canthus rostralis distinct, sharp-edged, canthal scales 5-7. Loreal rows 5 (4-6), lower row largest. Temporals granular, supratemporals only slightly enlarged and with small granules between them and enlarged scales around interparietal. Interparietal large, about size of ear opening, separated from supraorbital semicircles by 2 (2-3) scales. Suboculars in contact with supralabials. Five supralabials to center of eye. Lower eyelids with window of enlarged squarish scales. Mental broader than long, in contact posteriorly with 3 (2-4) gular scales. Infralabials narrow, in contact with first enlarged sublabial; sublabials continue posteriorly as moderately enlarged row (or may blend completely with other scales of lateral gular region). Throat granules small, swollen, weakly keeled, slightly elongate anteriorly.

Trunk: Dorsal scales very small, granular, two middorsal rows enlarged; adjacent rows reduce gradually to normal flank scale size. Ventrals smooth, enlarged, squarish, juxtaposed and arranged in transverse rows.

Dewlap: Very small, principally confined to area between forearm insertion and angle of jaw, scales smooth, swollen, rounded, about size of ventrals or slightly larger (Pl. 1, *lower*).

Limbs and digits: Scales of upper surface of limbs imbricate, keeled; those of hands and feet multicarinate; one scale row of prefemoral surfaces, especially distally and onto knee, much enlarged transversely and multicarinate. Subdigital lamellae 18 (16-23).

Tail: Compressed, 4 middorsal scales per verticil. One pair of postanal scales well developed in males.

Size: Holotype, a male, 43 mm snout-vent (largest male 45 mm; largest female 40 mm).

Color in life: The dorsal ground color is gray-brown with a pattern of four gray to black middorsal butterfly markings or wide transverse bands that fade out on the lower sides; a coppery tinge is present on the middorsal line. The head is gray-brown dorsally with olive-green temporal stripes that meet on the occiput; another more ventral olive-green postocular stripe proceeds onto

the neck and fades out. The ground color of the lower sides of the head, neck and flanks is pale yellow-green with olive-green markings, including dark edges to the longitudinal flank stripes and other small dashes and vermiculations which may be present. The chin is whitish, as is the retracted dewlap (due to crowding of scales); the venter is pale metallic yellow-green. The dewlap skin is dull greenish orange (about pl. 13 L7, Maerz and Paul, 1950). The tail is dull yellow to orange, sometimes greenish on its basal half to two-thirds, and black distally. The digits of both hands and feet are black. The iris is pale blue and the lower eyelid is blue. Sexual dichromatism is not pronounced; the middorsal light stripe of females is broader and more conspicuous than that of males, and the lateral stripe is also more prominent. These color data were employed in making the portrait of *A. rimarum.*

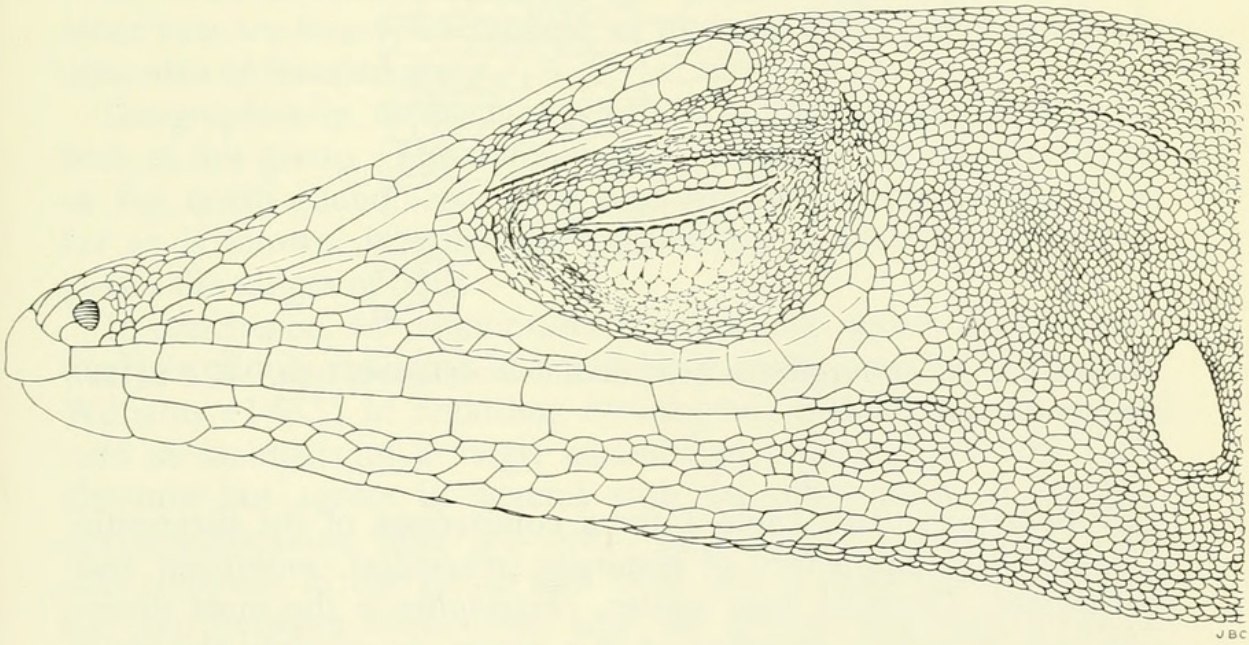


Figure 12. Lateral view of head of *Anolis rimarum,* type, MCZ 81128. Snout-vent length 43 mm.

Habits and habitat: The type series of *A. rimarum* was collected in a steep, limestone boulder jumble, a talus formation near the crest of the Chaine de Marmelade. The area (only a few acres in extent) was covered with a dense, natural, second-growth woods, mostly of small trees, brush and viny tangles but also with some moderately large trees. The specimens were found on rocks, low twigs and branches, and occasionally near the ground on the trunks or exposed roots of trees. They were seen most abundantly in areas where there was little thick undergrowth but

where there was considerable shade from taller plants. When approached, the lizards retreated with agility into rock crevices; many more were seen than were collected. The situation and habits of these anoles were virtually identical to those of *A. monticola.*

At precisely the same locality, *A. christophei* was also taken; specimens were found on the trunks of small trees about 2 to 5 feet above the ground. Less than half a kilometer to the west, *A. christophei* was taken from trees along the banks of a small ravine; the area was not rocky, and no examples of *A. rimarum* were seen.

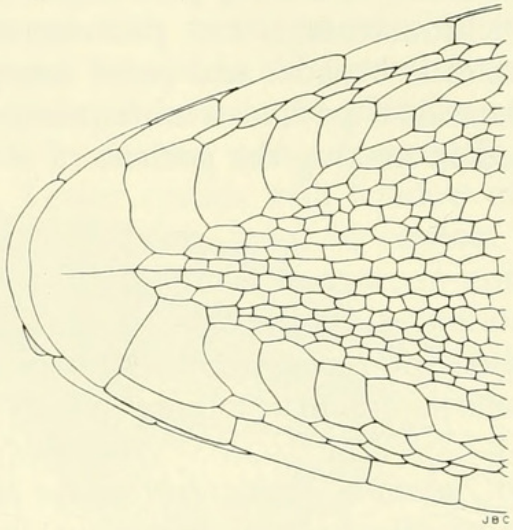


Figure 13. Mental region of head of *Anolis rimarum,* type, MCZ 81128. Snout-vent length 43 mm.

Comparisons: See Table 1 for a comparison of the diagnostic morphological characters of *rimarum, etheridgei, monticola* and *christophei.* Of these four anoles, *christophei* is the most divergent and, if truly a member of this group, is possibly the most primitive (Williams, 1962:7). Among the other three (*rimarum, etheridgei,* and *monticola*), there is nothing in the way of clear-cut alliances; any two share certain characters, and each species has certain peculiarities of its own. *Rimarum* seems to have more scale characters special to itself than *etheridgei* or *monticola* (Table 1:6, 8, 11, 12, 13, 14). All four species show certain similarities in body coloration, the basic pattern being that of dark crossbands or butterfly markings on a brown or gray ground color. *A. rimarum* may have either solid crossbars or butterfly markings; *christophei* has butterfly markings only. *Christophei* and *rimarum* are also similar in lacking strong sexual dichromatism (*rimarum* is slightly dichromatic; *christophei* is not); *monticola* and *etheridgei* are both

strongly dichromatic and dimorphic in size. In dewlap color, although not in dewlap size, *rimarum* and *monticola* are similar, both having some shade of orange as part of the variation; *etheridgei* has a whitish dewlap. The dewlap of *christophei,* which is altogether different from those of the others in size and scalation, has a purplish color. *Rimarum* and *monticola* are additionally similar in coloration in having black fingers and toes. *Monticola* is the most distinctive chromatically of the lot in having brighter colors and large, bold ocellar patches on the neck; *etheridgei* is next to *monticola* in brightness of coloration. The two agree further in the type of body banding: solid middorsally but trailing off into hollowed and punctulate bands on the sides.

In habits, however, *monticola* and *rimarum* appear identical in being inhabitants of boulder jumbles overgrown with low vegetation, where the lizards seek refuge in crevices. In contrast, the other two are tree (*christophei*) or tree and bush (*etheridgei*) anoles, also of forested areas.

Geographically, *monticola* is quite isolated from the other members of this group. The remaining three species are all inhabitants of the north island, *etheridgei* and *rimarum* being allopatric as far as is known, whereas the distribution of *christophei* encompasses the ranges of both.

In conclusion, we cannot offer a reasonable certain evolutionary analysis of this radiation of small Hispaniolan anoles. We follow Williams (1962) in regarding *christophei, etheridgei,* and *monticola* as members of a single assemblage; *christophei* is the most aberrant but agrees in general with the other three in habitus, dorsal coloration, blue iris color, and ventral squamation. We add *rimarum* to the group and note that it does little to bridge the gap between *christophei* and the others, although in some characters *christophei* and *rimarum* are slightly more similar to one another than to *etheridgei* and *monticola* (lack of sexual dichromatism, enlarged second canthal scale, generally smooth head scales.)

Williams (1962:7) pointed out the inverse relationship between dewlap prominence and boldness of dorsal pattern in male *monticola,* and remarked on the possible significance of this in maintaining species recognition. We do not deny that there may be such causal connection between boldness of dorsal pattern and prominence of dewlap in some cases, but we note that *rimarum* has the smallest dewlap (albeit brightly colored) of this group of anoles and also a relatively dull pattern. *A. etheridgei* has a somewhat brighter coloration than *rimarum* and

a larger but much less brightly colored dewlap. *A. christophei* has a dull dorsal coloration and a relatively dull dewlap (purplish) which is nonetheless distinctive because of its isolated rows of scales and its metallic hue. The presence of an incipient "window" of flattened translucent scales in the lower eyelid of *rimarum* and, to a lesser extent, in *monticola* supports the "sunglasses" theory proposed by Williams and Hecht (1955) to explain similar but more highly developed structures in two Cuban anoles (*A. argenteolus* and *A. lucius*). Both *rimarum* and *monticola* are inhabitants of shaded areas and, additionally, are associated with rocky crevices — conditions that may well be favorable to the development of a protective filter for the eyes.

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(Received 2 August, 1966.)

Anolis christophei

1. Snout most elongate, most concave.
2. Canthus pronouncedly sharp-edged.
3. Scales 6-10 (mode 8) across snout at level of second canthal.
4. Loreal rows 4-8 (mode 6).
5. Scales in frontal depression numerous, polygonal to rounded, smooth or slightly rugose.
6. Supraoculars moderate to small in size, somewhat elongate, weakly keeled, *ca.* 9-11 in number.
7. Supraorbital semicircles keeled, separated by 1-2 scales (Fig. 1).
8. Lower eyelid covered with granules, without "window" of squarish scales.
9. Anterior canthal scales abruptly smaller.
10. Ventrals rounded to squarish, smooth, slightly imbricate and arranged in transverse rows.
11. Dewlap very large, extending from mid-gular region to mid-venter; scales at edge of dewlap smooth, imbricate, larger than ventrals.
12. Anterior femoral scales keeled, imbricate, not tranversely enlarged.
13. Interparietal small, *ca.* ½ or less size of ear opening.
14. Scales between interparietal and supraorbital semicircles 3-7.

Anolis etheridgei

1. Snout bluntest, not pronouncedly concave.
2. Canthus distinct but not prominently sharp-edged.
3. Scales 8-15 (mode 10) across snout at level of second canthal.
4. Loreal rows 5-10 (mode 6).
5. Scales in frontal depression numerous, polygonal, keeled.
6. Supraoculars small to moderate, slightly elongate, keeled, *ca.* 11 in number.
7. Supraorbital semicircles keeled, separated by 0-4 scales (Fig. 4).
8. Lower eyelid covered with granules, without "window" of squarish scales.
9. Anterior canthal scales not abruptly smaller.,
10. Ventrals rounded to squarish, subimbricate, smooth and in transverse rows.
11. Dewlap, small, extending from mid-gular region onto chest, scales keeled.
12. Anterior femoral scales keeled, imbricate, only slightly enlarged distally.
13. Interparietal small, less than ½ size of ear opening.
14. Scales between interparietal and supraorbital semicircles 3-6.

Anolis monticola	*Anolis rimarum*
1. Snout elongate, somewhat concave.	1. Snout elongate, somewhat concave.
2. Canthus sharp-edged.	2. Canthus sharp-edged.
3. Scales 7-11 (mode 9) across snout at level of second canthal.	3. Scales 7-10 (mode 8) across snout at level of second canthal.
4. Loreal rows 6-9 (mode 7).	4. Loreal rows 4-6 (mode 5).
5. Scales in frontal depression numerous, polygonal, keeled.	5. Scales in frontal depression reltively few, polygonal, pavimentous.
6. Supraoculars moderate in size, elongate, prominentaly keeled, *ca.* 9 in number.	6. Supraoculars large, not elongate, smooth or only faintly keeled, *ca.* 5-7 in number.
7. Supraorbital semicircles prominently keeled, separated by 2-4 scales (Fig. 7).	7. Supraorbital semicircles smooth or feebly keeled, in contact or separated by one scale only (Fig. 11).
8. Lower eyelid with "window" of small flat granules.	8. Lower eyelid with "window" of enlarged squarish scales.
9. Anterior canthal scales not abruptly smaller.	9. Anterior canthal scales abruptly smaller.
10. Ventrals acute to rounded, imbricate, keeled, and in transverse rows but not so diagrammatically as in others.	10. Ventrals squarish, juxtaposed to subimbricate, smooth and in transverse rows.
11. Dewlap small, extending from mid-gular region onto chest, scales keeled.	11. Dewlap very small, occupying only the region between the angle of the jaw and the chest, scales smooth, imbricate.
12. Anterior femoral scales imbricate, multicarinate but not transversely enlarged.	12. Anterior femoral scales transversely enlarged, feebly multicarinate.
13. Interparietal usually small, *ca.* ½ size of ear opening but may be equal to ear opening in size.	13. Interparietal large, about size of ear opening.
14. Scales between interparietal and supraorbital semicircles 3-6.	14. Scales between interparietal and supraorbital semicircles 2-3.

Table 1. Comparison of the four species of the *monticola* group of Hispaniolan anoles.

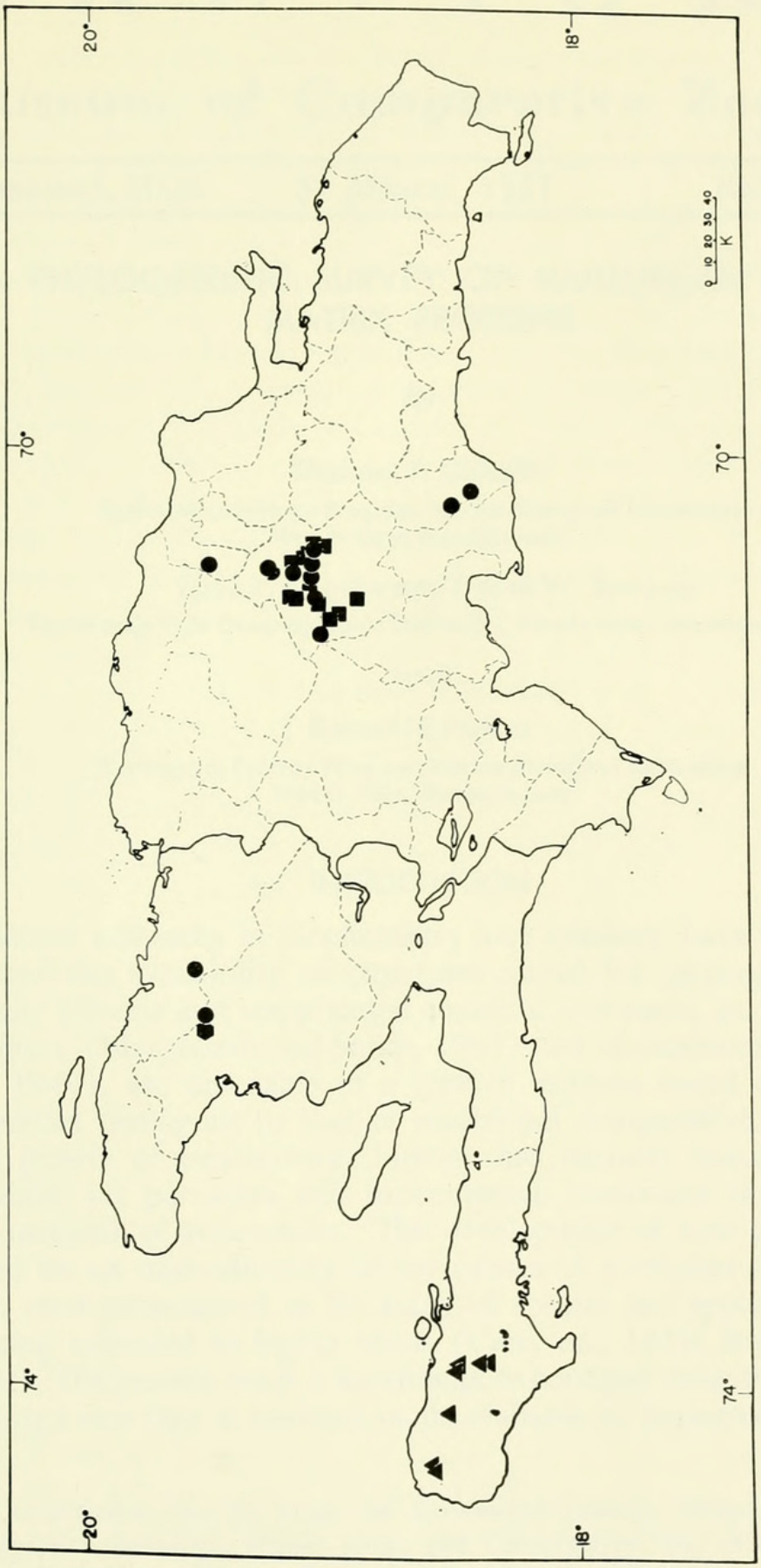

Figure 14. Hispaniola, showing locality records for the four species of the *Anolis monticola* group, as follows: *A. christophei*, circles; *A. etheridgei*, squares; *A. monticola*, triangles; *A. rimarum*, hexagon.