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TWO NEW SUBSPECIES OF *AMPHISBAENA* (AMPHISBAENIA, REPTILIA) FROM THE BARAHONA PENINSULA OF HISPANIOLA

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As a result of collecting sponsored and led by Dr. Albert Schwartz during the summers of 1963 and 1964 in which I was fortunate to be able to participate, 33 specimens of *Amphisbaena* were collected in the low areas on and near the Barahona Peninsula of the Dominican Republic. The general affinities of these specimens are with *Amphisbaena innocens* Weinland. Comparison of the Barahona Peninsula specimens with representatives of the forms assigned to the species *innocens* shows them to be distinct in themselves, but to resemble most closely *A. i. gonavensis* Gans and Alexander. These authors, in their recent study of West Indian amphisbaenids (1962), examined the available Hispaniolan specimens and reviewed the forms. The combination *Amphisbaena innocens caudalis* Cochran was first used by them, and the new name *Amphisbaena innocens gonavensis* was proposed for the population on Gonave Island. Fourteen additional specimens of *gonavensis,* recently acquired by Dr. Ernest Williams, allow a better comparison of the Gonave and Barahona populations than was possible previously. Although the differences between the two populations are perhaps on a level of specific separation, their relationship with one another is obvious. I feel that relationships are best expressed by regarding these two as conspecific and distinct from *A. innocens.* These related amphisbaenids of Gonave Island and the Barahona Peninsula should therefore be known as *Amphisbaena gonavensis* Gans and Alexander.

In lacking major fusion of the head scales, *Amphisbaena gonavensis* is separable from all other West Indian *Amphisbaena* except *innocens* Weinland, *caeca* Cuvier, *bakeri* Stejneger

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and *fenestrata* Cope. From *fenestrata* and *bakeri* it is immediately separable on the basis of lower number of body annuli, 199-225 for *gonavensis* versus 236-249 for *fenestrata* and 239-254 for *bakeri;* from *fenestrata* it is additionally different in lacking the backward penetration of the rostral between the

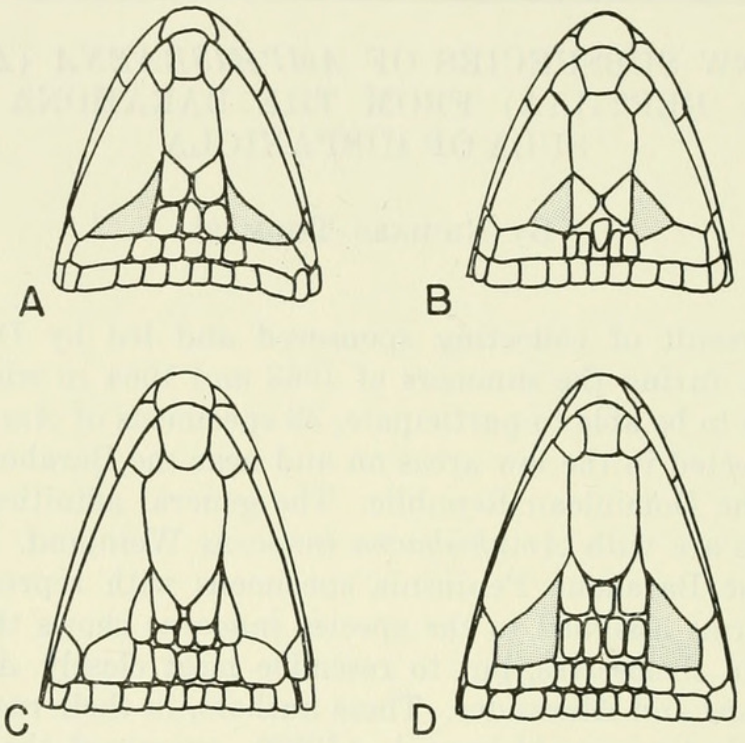

FIG. 1. Ventral views of the heads of four forms of *Amphisbaena.* The malar scales are stippled for points of reference. *A, A. g. gonavensis* (MCZ 80296), note three rows of postgenials and anterior penetration of first postgenials between genial and second infralabial; *B, A. g. leberi* (ASFS V2596), note two rows of postgenials and lack of anterior penetration of first postgenials (position of first two postgenials in *hyporissor* is intermediate between A and B); *C, A. innocens* (ASFS X3114); *D, A. caeca* (ASFS X7382).

nasals. From *A. caeca, A. gonavensis* may be distinguished in the possession of two scales in the first and second rows of postgenials (versus three for *caeca*). *Gonavensis* also differs from *caeca* in having enlarged precloacal scales forming a distinct convex flap as opposed to the relatively undifferentiated precloacals of *caeca,* and in hemipenial structure (see discussion).

Employing the concept of accessory dorsal half-annuli in the nuchal region, as expressed by Gans and Alexander (1962: 79-80), the first two body annuli in *innocens, gonavensis* and *caeca* typically correspond to three dorsal half-annuli (Fig. 2). *Gonavensis* (and *innocens,* typically) has the first complete annulus including (continuous with) the anteriormost of the first three dorsal half-annuli (temporals, postoculars, frontals) (Fig. 2, B-D). Exceptionally, the condition depicted in Figure 2 A occurs in *innocens.* Examination of 49 specimens of *A. caeca* shows the anteriormost half-annulus to appear split off from, instead of continuous with, the first complete body annulus (i.e. first ventral half-annulus) (Fig. 2, E-F).

A. gonavensis differs from its neighbor species *A. innocens* in the possession of a malar scale[1] (related to this are differences in shape and arrangement of the ventral head scales, Fig. 1), and in the condition of the first pair of parietal scales which normally are in contact apically (thus only narrowly) with one another at the midline or may even be slightly separated from contact by the second pair of parietals (Fig. 2, C-D). In *innocens* by contrast there are typically two or four large squarish parietals (there may be other small supernumerary scales present, but these do not alter the basic appearance) formed by the median scales of the second and third dorsal half-annuli (Fig. 2, A, B). *Gonavensis* is additionally distinguished from *innocens* in the shape of the tail which is rounded rather than tapered (Fig. 3, A, B), in the precloacal scales which form a more prominently convex flap, and in hemipenial structure (see below).

A. gonavensis is broader and shorter headed, has a less sharply pointed snout, and is distinctly smaller than *innocens.* The largest of 55 specimens of *gonavensis* measures 242 mm; of 73 *innocens* 17 measure more than 242 mm, the

[1] The malar scale as defined by Gans and Alexander is a major and obvious difference between those *Amphisbaena* which possess it and those which do not. With respect to the species discussed here, the malar, possessed by *A. gonavensis,* seems at least in part homologous to the two end scales of the second row of postgenials of *A. innocens.* The advisability of denoting this scale with a separate name seems somewhat dubious inasmuch as it implies an all-or-nothing difference where there is really one of degree. Further, the designation of the row of scales behind the malar (the row just in front of the first body annulus) as postmalars in contrast to this row being merely the third row of postgenials in forms having no malar seems also inadvisable and misleading. The term "malar," however, is a very convenient one in description, and its usage is retained with the above comments duly noted. The postgenials are here used to apply to all rows of small scales between the genial and the first body annulus, including the "postmalar row" used by Gans and Alexander.

largest being 279 mm. Gans and Alexander noted that a single specimen from Petite Gonave (MCZ 25549) was at that end of the range of values (Gonave population) of several characters which was closest to the Cul-de-Sac sample of *innocens*. On the basis of the new material, this specimen falls within the range of the Gonave population in those characters for which the trend was most noticeable (body annuli, dorsal segments, postcloacals). Numerical data used in above comparisons and in "Comparisons

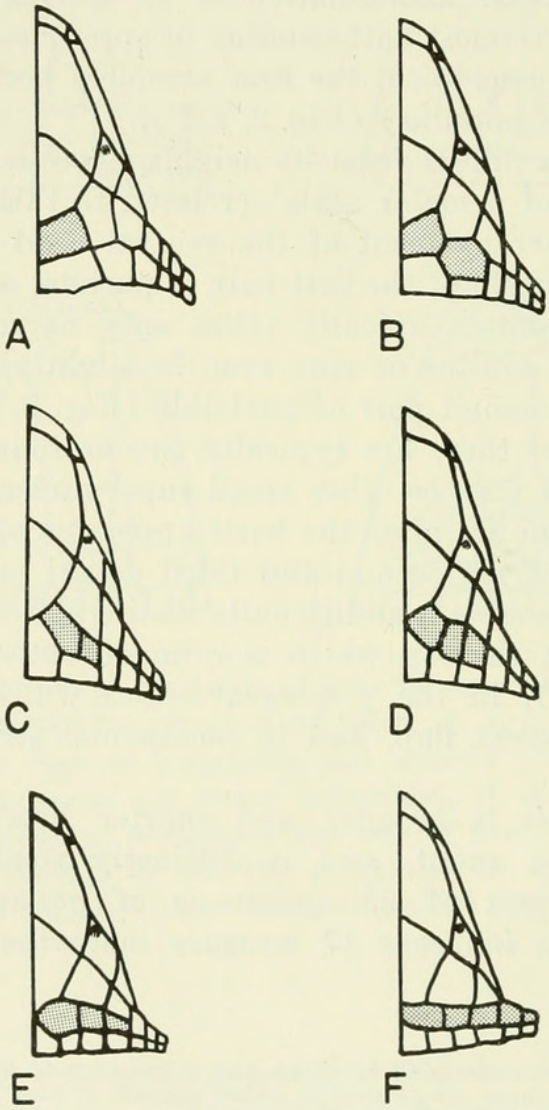

FIG. 2. Diagrammatic illustrations of *Amphisbaena* heads (dorsal view, half-heads) showing scalation differences. First two body annuli are shown "peeled out" from heads. *A*, atypical *A. innocens* (Camp Perrin); *B*, typical *A. innocens* (Camp Perrin); *C* and *D*, alternative common conditions of *A. gonavensis; E* and *F*, *A. caeca*. Stippled scales are second dorsal half-annuli (complete annulus in *F*). In *A-D* the second half-annuli are "accessory"; in *E* and *F* the first are "accessory."

and Discussion'' below are in part obtained from Gans and Alexander's paper and in part from personal observation (see ''Specimens Examined'').

AMPHISBAENA GONAVENSIS HYPORISSOR new subspecies

Holotype: MCZ 77149, an adult male, collected 13.1 mi. (20.9 km) SW of Enriquillo, Pedernales Province, República Dominicana, 30 July 1963, by David C. Leber and Richard Thomas.

Paratypes: KU 79824-25, same locality as type, 22 July 1963, Richard Thomas; ASFS X9974-76, AMNH 92792-95, RT 754-55, UIMNH 55600-02, same data as type; MCZ 77150, República Dominicana, Pedernales Province, 5 mi. (8 km) NE Oviedo, 30 July 1963, Richard Thomas.

Diagnosis: A subspecies of *Amphisbaena gonavensis* characterized by lack of fusions of head scales, a high number of caudal annuli, more than six precloacals; an occasional caudal autotomy; and a mottled but faded coloration.

Range: Presently known from the southeastern portion of the Barahona Peninsula of Hispaniola.

Description of type (Fig. 4): (Methods of counting and terminology follow Gans and Alexander, except for differences in terminology already noted). Head scales not fused; prefrontals as broad or slightly broader anteriorly than posteriorly. First two body annuli correspond to three dorsal half-annuli. First pair of parietals border anteromedially on frontals and are occluded from apical contact by an anterior extension of the left second parietal. Genial .81 times as broad as long. Three rows of postgenials present; first row with two enlarged scales (an abnormal, minute middle scale is present), apex of each scale projecting slightly beyond malar-second infralabial suture between genial and second infralabial; second row with three scales not including the two large triangular malars at each end; third row with four scales not including the two enlarged, terminal ''postmalars.'' Body annuli 213, four laterals on each side, and 20 caudal annuli. Sixteen dorsal segments and 24 ventral segments to an annulus counted at midbody. Four cloacal pores; 8 precloacal scales and 13 postcloacals, including 2 median, rectangular postcloacals. Snout-vent length 200 mm; tail 20 mm. Overall coloration tan, becoming darker and slightly mottled dorsally due to increasing amount of central dark pigmentation on more dorsal segments; four ventralmost segment rows without dark pigment spots.

Variation: The paratypes are similar to the type in the configuration of the first pair of parietals. Two have the first parietals in broad contact and squarish; in six they do not meet at the midline, the second pair of parietals contacting the frontals (Fig. 2C); in the balance of the paratypes the first pair of parietals are in apical or only narrow contact. Considerable asymmetry occurs in the degree of contact of the first pair of parietals with the midline. In all specimens of *hyporissor* the two scales of the first row of postgenials project not at all or only slightly beyond the malar-second infralabial suture and thus between the genial and second infralabial (Fig. 1). All paratypes have three rows of postgenials, the modal count being 2 + 3 + 4 but with variants of four and five in the second row and five in the third row. Body annuli vary from 199 to 221; laterals two to five (mode four), most permutations of these counts occurring except 2/2, 5/5, 4/5, and 5/2; caudal

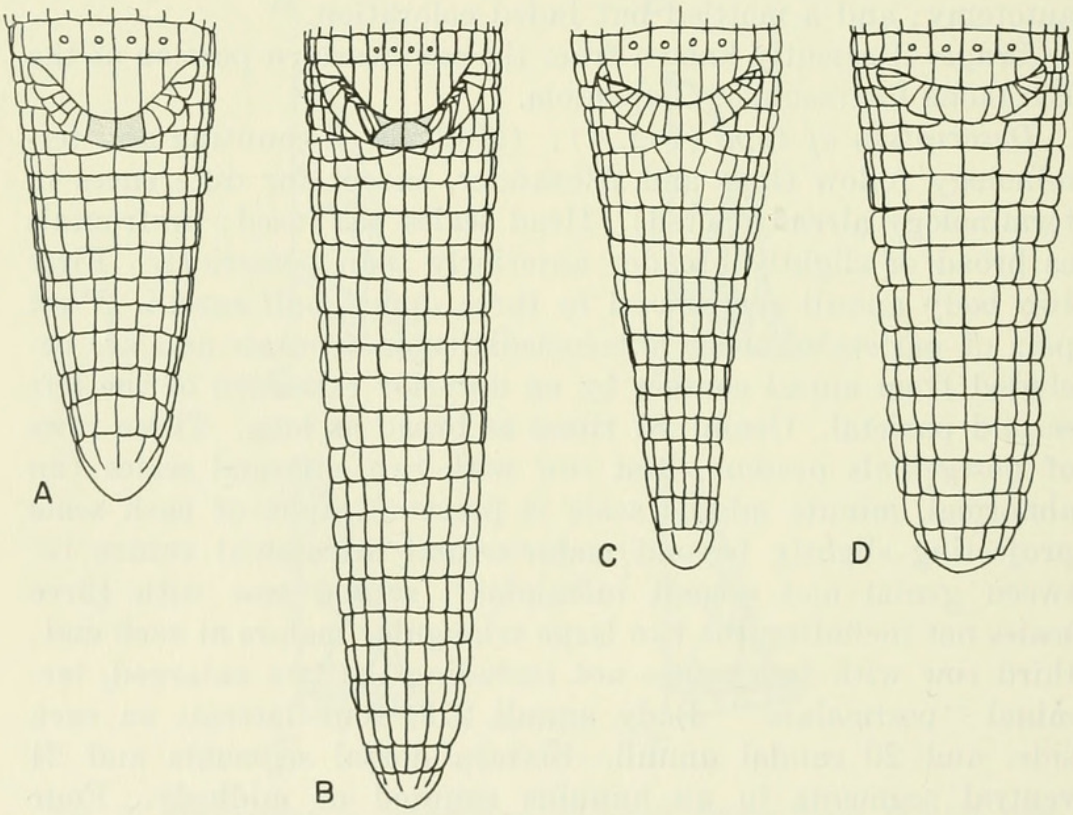

FIG. 3. Ventral views of the caudal and cloacal region of four forms. *A*, *A. g. gonavensis* (MCZ 80291); *B*, *A. g. leberi* (ASFS V2596, except for median postcloacals, is also typical of *hyporissor*); *C*, *A. innocens* (ASFS X3111); *D*, *A. caeca* (ASFS X940). Median postcloacals of *A* and *B* are stippled; those of *A* are typical of *gonavensis* and *hyporissor;* those of *B* are diagnostic of *leberi*.

annuli vary from 19 to 21 (mode 19). Dorsal segments of a midbody annulus are 16 (mode), 17 or 18; ventral segments are 22 (mode), 23 or 24; totalled midbody segments 38-42. Precloacal scales range from eight to eleven; postcloacals from 12 to 14; totalled cloacals 20-24. There are two enlarged, median postcloacals; these are typically straight-sided (Fig. 3A). Cloacal pores are four in every specimen. The smallest specimen measures 106 mm total length (tail 10 mm), the largest 231 mm (tail 20 mm). Apparent caudal autotomy constrictions are evident between the fifth and sixth annuli of the tails of some of the juvenile specimens; adults do not possess obvious autotomy constrictions. One medium size specimen possesses a broken tail, presumably autotomized, missing beyond the fifth annulus. The coloration is pale tan, darker dorsally and with some scattered dark mottling; some specimens were noted as being purplish dorsally in life.

Specimens collected in the vicinity of the town of Pedernales in the northwestern section of the Barahona Peninsula represent a subspecies distinct from the other two known populations of this species. This form is named in honor of Mr. David C. Leber, for his enthusiastic participation in collecting in the Dominican Republic.

Amphisbaena gonavensis leberi new subspecies

Holotype: MCZ 77218, an adult male, collected 5 km N of Pedernales, Pedernales Province, República Dominicana, 25 June 1964 by Richard Thomas.

Paratypes: MCZ 77219, same data as type; ASFS V2595-96, 8 km N of Pedernales, 26 June 1964, Richard Thomas; KU 79855-56, UIMNH 55627-28, ASFS V2676-78, AMNH 92827-28, Pedernales, 29 June 1964, Richard Thomas; RT 985, same locality as previous series, 3 July 1964, Richard Thomas. All specimens from Pedernales Province, República Dominicana.

Diagnosis: A subspecies of *Amphisbaena gonavensis* most closely related to *A. g. hyporissor* in the possession of a high number of caudal annuli, but differing from that form in contact of first pair of parietals with one another, in having typically two rows of postgenials, and in the configuration of the median postcloacals.

Distribution: Known presently from the low elevations of the northwestern portion of the Barahona peninsular region of Hispaniola.

Description of type: Head scalation much like that described for the type of *hyporissor*. First pair of parietals in broad contact across the midline giving a squarish appearance to the parietals. Two rows of postgenials present, two scales in the first row and five in the second. Anterior penetration of first two postgenials between the genial and second supralabial very slight. Body annuli 212; four laterals on each side; 16 caudal annuli. Sixteen dorsal segments and 22 ventral segments to an annulus counted at midbody. Four cloacal pores, nine precloacal scales and 14 postcloacal scales. Enlarged median postcloacal scales four. On each side of the midline, two median postcloacals separated by a transverse suture which curves posteriorly and laterally giving a rounded outline to the posterior two of these four scales (Fig. 3B). Total length 223 mm, tail 19 mm. Coloration generally like that of the type of *hyporissor*, but the tan is more uniform with less dark mottling.

Variation: Head scalation of the paratypes is much like that of the type. The first pair of parietals are in broad contact medially in all but one specimen in which the contact is slightly more than apical. First two postgenials typically have none or only slight anterior penetration between the genial and the second infralabial; the characteristic condition is that illustrated in Figure 1 B. Body annuli vary from 207 to 220; laterals two to five with the same variation noted for *hyporissor;* caudal annuli range from 16 to 19 (mode 19). Many specimens have the tips of their tails scarred; were this not so, higher caudal counts would probably be obtained. Dorsal segments of a midbody annulus are 15 (two specimens) or 16; ventral segments 22-25 (mode 24); totalled midbody segments 38-41. Precloacal scales range from 9 to 11; postcloacals 11-14; total cloacals 20-24. Median postcloacals are essentially the same as described for the type in all except one specimen in which they are very abnormal and frgamented and another in which the posterior scales reach the cloacal border between the two anterior scales which are reduced. Apparent caudal autotomy is found in one of the paratypes of *leberi* (UIMNH 55628) and in another specimen from Pedernales which is currently being kept alive. In both the tail is missing beyond the fifth annulus. Coloration is generally darker and more uniform than that of *hyporissor*. Hemipenes are everted or partially everted in four specimens; the organs are attenuated and naked; apparently they are only slightly bilobed (the most completely everted organs are not

bilobed, but terminal bifurcation of the dissected retractor penis indicates that they may be slightly bilobed when completely everted).

Comparisons and discussion: To facilitate comparisons of the three races of *A. gonavensis* the following table showing scale count data is presented.

TABLE 1. Scale count ranges for the three races of *A. gonavensis*

	Body annuli	Caudal annuli	Total midbody segments	Pre-cloacals	Post-cloacals	Total cloacals
gonavensis	207-225	10-12	36-41	6-7	11-14	16-20
hyporissor	199-221	19-21	38-42	8-11	12-14	22-24
leberi	207-220	16-19	38-41	9-11	11-14	20-24

As shown by the table, *gonavensis* differs strikingly from the Barahona populations in the low number of caudal annuli. It further differs in scalation in the low number of precloacals (the condition of seven precloacals occurs in only one specimen), and in total cloacals. The specimens of *gonavensis* examined by me (18) and the type (not seen by me but illustrated by Gans and Alexander) are rather uniformly characterized by the first pair of parietals meeting in apical contact at the midline; in but three specimens was there a short suture between the parietals. As described above, *hyporissor* is generally, but much more variably, characterized by narrow contact of the first pair of parietals, while in *leberi* the parietals with one exception are in comparatively broad contact with one another. *Gonavensis* and *hyporissor* uniformly have three rows of postgenials, while *leberi* is typically missing a segment in the gular region and consequently has only two rows. Of the three exceptions noted, one is abnormal in having the "missing" segment partly intercalated between the second postgenial row and the first body annulus, a postgenial count of 2 + 4 + 2 being the result. The two scales of the first row of postgenials penetrate very far forward between the genial and the second infralabial in *gonavensis* (with 35 to 69 per cent of the length of the scale lying anterior to the malar-second infralabial suture); in *hyporissor* the penetration is less (10-30 per cent, four scales have no penetration); and in *leberi* even less (6-18 per cent, 11 scales have no penetration). The corresponding differences in the configuration of these scales can be seen in Figure 1 A, B. In the condition of the median postcloacals, *gonavensis* and *hyporissor*

agree in having but two roughly rectangular, undivided scales (small marginal scales which are normally folded inside the cloaca are not considered). The condition which characterizes *leberi* and the one exception have already been noted. One specimen (ASFS V2507) from approximately 10 km NW of Oviedo

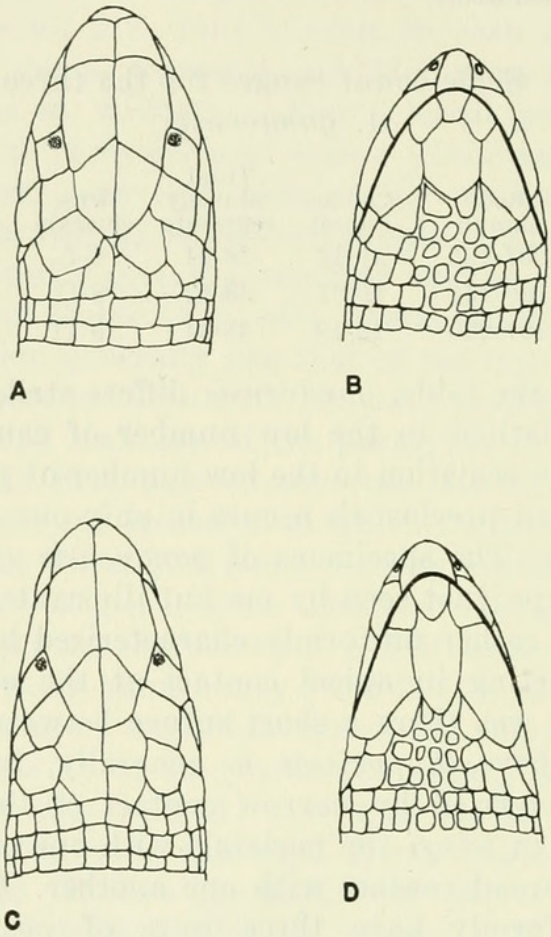

FIG. 4. *A* and *B*, dorsal and ventral views of the head of the type of *A. g. hyporissor* (MCZ 77149); *C* and *D*, dorsal and ventral views of a specimen of *A. innocens* from Camp Perrin (ASFS X3123).

on the road to Pedernales has the *leberi* configuration of the median postcloacals; it also agrees more with *leberi* in the condition of the parietals, while in having three rows of postgenials it agrees more with *hyporissor*. More specimens are necessary from intermediate regions before the status of this specimen can be determined.

The presumed caudal autotomy noted for some specimens of *hyporissor* and *leberi* has not been observed in *gonavensis*, nor does it occur in *A. innocens* (both have relatively short tails).

Gans and Alexander noted that caudal autotomy is variable in some forms, e. g. *A. caeca.*

If the hemipenial structure noted for *leberi* holds true for the species as a whole, this will serve as an additional distinction from *A. innocens* and *A. caeca.* In contrast to the simple, naked structure of *leberi,* the hemipenis of *innocens* is strongly bilobed, very heavy and fleshy; the sulcus spermaticus bifurcates at the fork of the organ and each branch proceeds to the non-sulcate side and thence to the apices of the lobes which are flattened and disk-like. Proceeding from each branch of the sulcus spermaticus over each lobe and onto the distal sulcate surface of the organ are very fine but regular flounces. The non-sulcate surface is naked (from ASFS X3112). The hemipenes of *caeca* are of the same general appearance as those of *innocens,* but the sulcus spermaticus is much more prominent (thick edged) and forks slightly before the bifurcation of the organ itself; the apices are rounded not flattened, and there is no evidence of flouncing (from ASFS X937, X4111).

The distribution of the races of *Amphisbaena gonavensis* appears zoogeographically a bit strange at first glance (see Fig. 5). The possibility exists that it is in reality not so strange. The Cul-de-Sac plain, a channel (in places below sea level) between the north and south "islands" of Hispaniola (Williams, 1961) bordered on both sides by mountainous regions, debouches to the west at the angle between the Tiburon Peninsula and the main part of the island and to the east at the northeastern corner of the Barahona Peninsula just east of the Sierra de Baoruco. *A. gonavensis* may occur (or have occurred in the recent geologic past) up the eastern coastal fringe of the Barahona (presently almost nonexistent in places) and into the Cul-de-Sac plain. This being so, the island of Gonave would not be an unlogical extension of its range. The close affinities of *hyporissor* with *gonavensis* seem to support such a distribution. It is interesting to note that at least two other Hispaniolan lizards have a similar distribution. *Anolis brevirostris* Bocourt occurs along the eastern Barahona into the Cul-de-Sac, east to the Golfe de Gonave and on Gonave. *Diploglossus curtissi* Grant, though of wider distribution to the east and north (Schwartz, in press), also occurs along the eastern Barahona coast and is channelled to the west through the Cul-de-Sac (locality records not continuous) and occurs on Gonave.

It is interesting to note that despite the geographic continuity of the Sierra de Baoruco with the mountain mass of the Tiburon Peninsula, *Amphisbaena innocens* is not known from the Baoruco. On the contrary it is *A. manni*[1] which has been collected there. Gans and Alexander record four specimens of *manni* from near Paraiso at 1800 feet (about 600 m) (Fig. 5). In the summers of 1963 and 1964 we obtained four additional specimens (ASFS X9907-09, V2911) from the eastern end of the Sierra de Baoruco (see Fig. 5) at an elevation of 2600 feet. (790m). Although further collecting may prove otherwise, it appears that *manni* is geographically the nearest *Amphisbaena* to *hyporissor*, possibly even interposed between it and *innocens*. Comparable geographic relationships are seen in the species mentioned above as having distributions similar to the one predicated for *A. gonavensis*. *Diploglossus curtissi* and *Anolis brevirostris* are "replaced" in the highlands of the Sierra de Baoruco by other related species (*Diploglossus costatus* Cope and *Anolis distichus* Cope).

The type and most of the paratypes of *A. g. hyporissor* were collected in one of those occasional but not altogether rare situations where fossorial creatures such as *Amphisbaena* and *Typhlops* are found concentrated near the surface. Such localities are generally but not invariably characterized by a rather friable soil, a scattering of moderate to large sized trees, a covering of plant litter, and an abundance of rocks. This particular locality is a region of xeric woods inland from the western mangrove margin of the Laguna de Oviedo. The locality generally satisfied the above conditions; an abundance of limestone rocks was present. Aside from the amphisbaenids, two species of *Typhlops* were found in this region, *Typhlops* cf. *sulcatus* and another species (Thomas, MS). The localities to the north of Pedernales where *A. g. leberi* was collected were similar to the locality just described, at least in degree of aridity. The locality at Pedernales, however, was somewhat more xeric; the tree cover was primarily *Acacia* with an undergrowth of scattered clumps of *Opuntia* growing among outcroppings of limestone rock; the soil was sandy. *Typhlops haitiensis, Typhlops*

[1] A further note of comparison between *gonavensis* and *manni* may be in order. *A. manni*, though distinct from *gonavensis* in having the nasals fused with the rostral, differs further in having the condition of the half-annuli in the nuchal region as described for *caeca* (*vide supra*), 6-9 (versus 4) cloacal pores, a comparatively stout tail with a very prominent autotomy constriction, and a deeply bilobed hemipenis. In meristic characters there are no striking differences.

sp. and *Leptotyphlops* sp. (Thomas, MS) were found in the same macrohabitat with *A. g. leberi* in the Pedernales region. In both of the localities where the two largest series were obtained, numbers of shed skins of these amphisbaenids were seen while collecting. Little can be said about the habits of these lizards from our encounter with them. They were mostly collected under rocks; their passageways were frequently evident. One grasped and held onto a rootlet with its mouth in a possible attempt to resist capture. None were found above ground in the open, and their abundance did not seem to be correlated with any weather phenomena.

Specimens examined

Amphisbaena gonavensis hyporissor: As listed for type and paratypes.

Amphisbaena gonavensis leberi: As listed for type and paratypes.

Amphisbaena gonavensis hyporissor x *leberi:* República Dominicana; Pedernales Province, *ca.* 10 km NW Oviedo, ASFS V2507.

Amphisbaena gonavensis gonavensis: Haiti: Gonave Island: Pointe-à-Raquette, PM 3385 (allotype), PM 3386, 3388 (paratypes), MCZ 80289; Ti Palmiste, 6 km from Pointe-à-Raquette, MCZ 80290-302.

Amphisbaena innocens innocens: Haiti: Department de l'Ouest, Manneville, MCZ 62511, MCZ 8748; Thomazeau, MCZ 37595-97; Furcy, MCZ 51417, ASFS X3862; Department du Sud, Camp Perrin, ASFS X3109-34, X3240-41, DRP 2403.

Amphisbaena innocens caudalis: Haiti, Grande Cayemite Island, MCZ 25550 (type), MCZ 25551 (paratype).

Amphisbaena caeca: Puerto Rico: Isla Verde, ASFS X937-43, X4104-25, X7381-98; 2.2 mi. SW Sabana, ASFS X7433-34.

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Types and paratypes designated herein now reside in the following collections: Museum of Comparative Zoology at Harvard (MCZ), American Museum of Natural History (AMNH),

University of Kansas Museum of Natural History (KU), University of Illinois Museum of Natural History (UIMNH), Albert Schwartz Field Series (ASFS), Richard Thomas private collection (RT).

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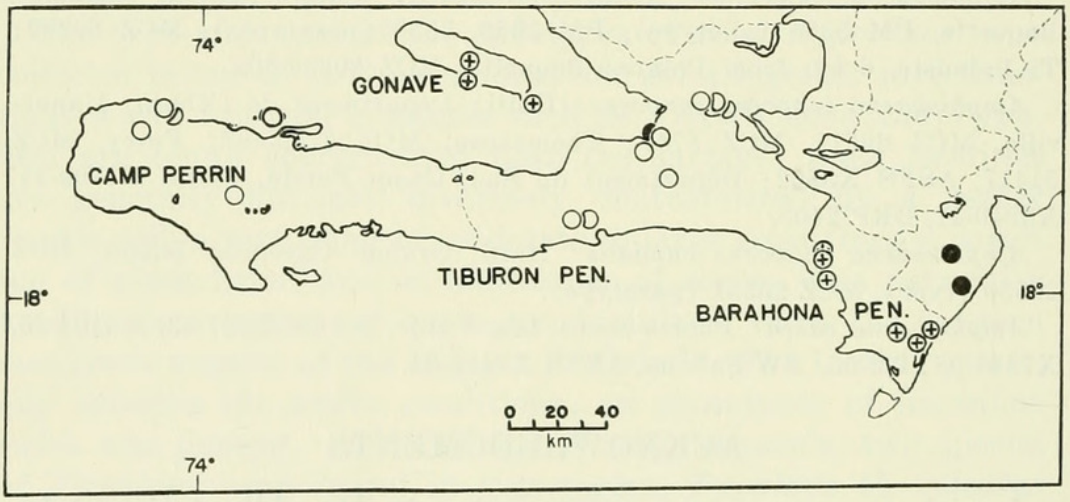

FIG. 5. Map of southwestern Hispaniola showing Gonave Island, the Tiburon Peninsula and the Barahona Peninsula with localities for the species of *Amphisbaena* (some localities are from Gans and Alexander, 1962). Hollow circles, *A. innocens;* circles with crosses, *A. gonavensis;* solid circles, *A. manni.*