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TWO FURTHER NEW SPECIES OF *AMPHISBAENA* FROM THE SEMI-ARID NORTHEAST OF BRASIL (REPTILIA, AMPHISBAENIA)

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ABSTRACT

Two small to medium-sized new species of Amphisbaena *are described from the semi-arid caatingas of Bahia in northeastern Brasil.*

A. frontalis *(known from 10 specimens), from the great field of fossil dunes traversed by the Rio S. Francisco between the parallels of 11.° and 10°S, is characterized by: preanal pores 4; body annuli 252-272; tail annuli 23-29, autotomy level on 6-7; segments to a midbody annulus 14-16/14-16; no fusion of head scales; frontals the longest scales on top of the head, characteristically elongate, tapering behind; parientals barely differentiated; three upper labials, second by far the largest; symphysial narrow, wedge-shaped; postsymphysial irregular, octagonal to elliptic.*

A. arenaria *(only the holotype known), from the wastes of the Raso da Catarina is characterized by: preanal pores 4, separated on the midline by two scales; body annuli 285; tail annuli 23, autotomy level on 6; segments to a midbody annulus 14/14; three upper labials; lateral sulcus noticeable on the neck as an area of broken up segments.*

Both species are compared in detail with A. vermicularis, *a medium-sized, four-pored species widespread in the caatingas.*

INTRODUCTION

The great field of fossil dunes crossed by the Rio São Franscisco between the parallels of 11° and 10°S harbours a very peculiar herpetofauna, for several years now under study by Miguel T. Rodrigues, Department of Zoology, University of S. Paulo, and his students (Rodrigues, 1991 a-c). The resulting materials are deposited in this Museum; from them I have already described two new species of *Amphisbaena* (Vanzolini, 1991). Since 1987 another new form of the same genus has been known to be present in the collection. Some of its important characters, however, seemed to be morphometric, and it was decided to wait until further exploration of the area produced additional specimens. This has duly happened, and the species is herein described. In the process of comparing the new form with *Amphisbaena vermicularis*, one specimen, from the desert of the Raso da Catarina, previously identified as *vermicularis*, revealed itself as representing a further new species. Its is so far the only specimen, but the context makes it advisable to describe it at once.

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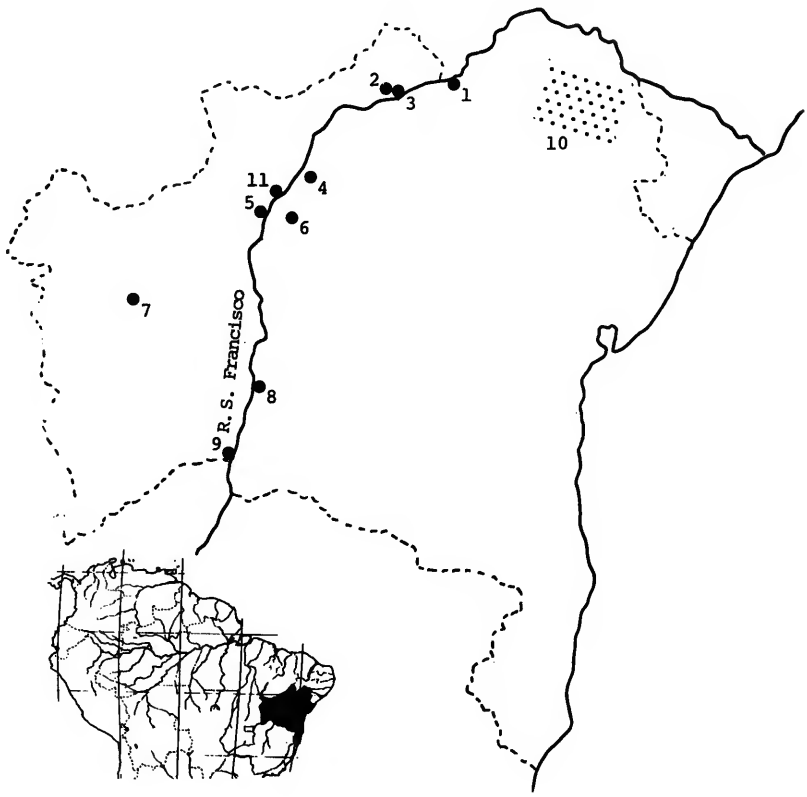


Map 1. Approximate situation of localities in the state of Bahia. 1, Juazeiro and Barrinha. 2, Alagoado. 3, Caraíba dos Bragas. 4, Vacaria. 5, Barra. 6, Santo Inacio. 7, Barreiras. 8, Bom Jesus da Lapa. 9, Carinhanha. 10, Raso da Catarina 11. Ibiraba,

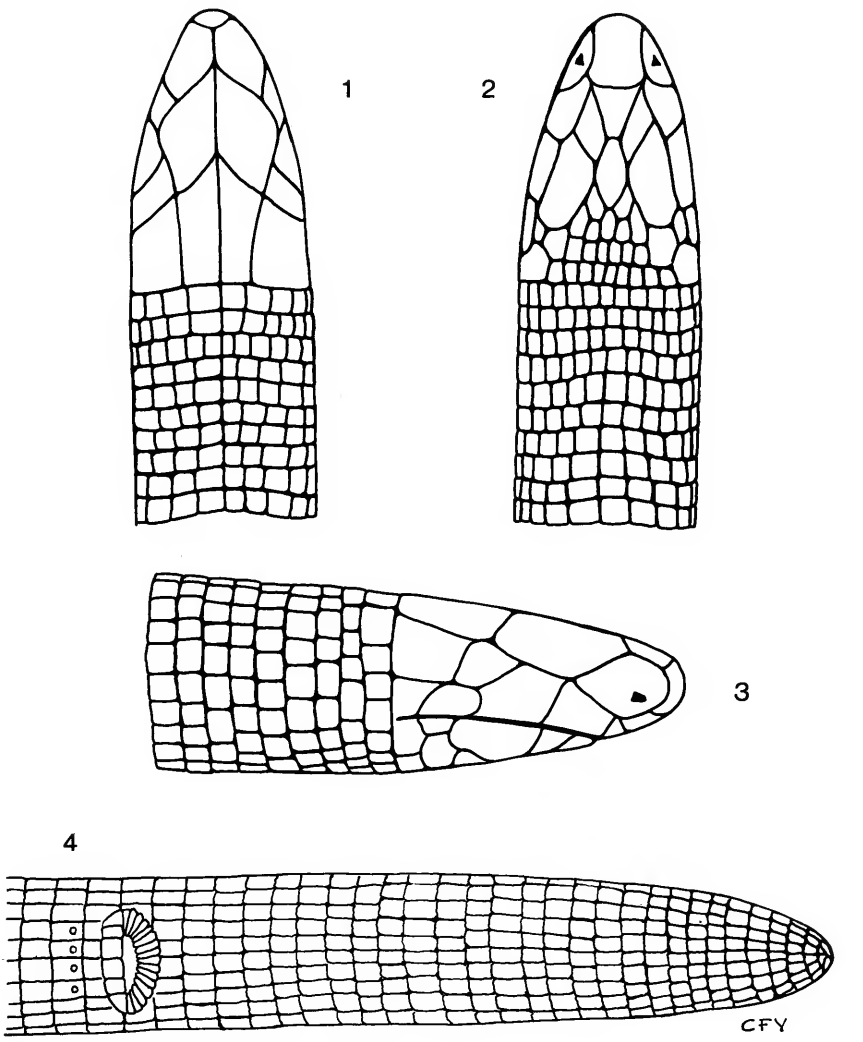
In the following descriptions I adopt the nomenclature for head scales proposed by Gans and Alexander (1962), with a few modifications explained in Vanzolini (1991) and, anyway, self-evident.

Amphisbaena frontalis, sp.n.
(Figs. 1-4, Table 1)

Holotype MZUSP 72989, from Alagoado, state of Bahia, Brasil, 18 October 1990, M. T. Rodrigues field number 90.6992. Paratypes MZUSP 72990-72997, same data as holotype, field numbers 90.6990, 6991, 6993-6996, 7036-7037.

DIAGNOSIS

Preanal pores 4. Body annuli 252-272; tail annuli 23-29; autotomy level 6-7; segments to a midbody annulus 14-16/14-16. No fusions of head scales. Frontals the longest scales on top of



Figs. 1-4. *Amphisbaena frontalis*, sp.n., holotype.

the head, characteristically elongate, tapering behind. Parientals inconspicuous. Three upper labials, the second by far the largest. Symphysial wedge-shaped, narrow. Post-symphysial irregular, octagonal to elliptic.

ETYMOLOGY

The name refers to the very characteristic shape of the frontal scales of the new form.

DESCRIPTION

A medium sized species (maximum body length, 10 specimens, 284 mm). Head convex, narrow, snout seen from the top rounded, from the side spatulate.

Median sutures of the head in the following order of decreasing length: frontal, prefrontal, nasal. Frontals a little asymmetrical, with arcuate front edges converging forward, forming an obtuse angle; meeting the oculars below; with lateral edges, slightly bowed laterally, converging behind, truncate. Parietals very slightly enlarged. Three upper labials, the second very large, touching the postero-inferior corner of the prefrontal. Ocular irregularly trapezoid, followed by a very large squarish postocular, the largest scale on head or slightly smaller than the prefrontal; below this a large square postlabial, in contact with the first body annulus. Nostril near the lower angle of the nasal.

Symphysial relatively narrow, with sides converging behind; posterior tip truncate. Postsymphysial varying from polygonal (octagonal or heptagonal, always with irregular sides and angles) to elliptic, with one or both ends pointed. Three lower labials, the second very large, the third minute. Lateral genials short, broad, irregular, on one side reaching the oral rim behind the third lower labial. Scales behind the postsymphysial very variable, the most regular pattern comprising a row of six small genials and, between these and the postsymphysial, two other rows; the anterior one made of two scales that embrace the postsymphysial, their pointed tips extending forward, insinuated between the postsymphysial and the second labial; the next row with five scales pointed in front. All these elements subject to variation and disorganization.

On the body, no dorsal or ventral sulci. Lateral sulci conspicuous from about annulus 44 back. Dorsal and ventral segments poorly aligned longitudinally; sulci between annuli deep and regular. Segments a little longer than wide.

Anal flap with six scales, the lateral wider. Four preanal pores, placed against the hind edge of the segments, small, in some specimens ill-formed, practically cicatricial. Postanal rim prominent, forming a broad palisade with 15-16 narrow, irregular segments.

Tail relatively long, in one specimen slightly clavate, well segmented to the tip, the segments still less well aligned than those on the body.

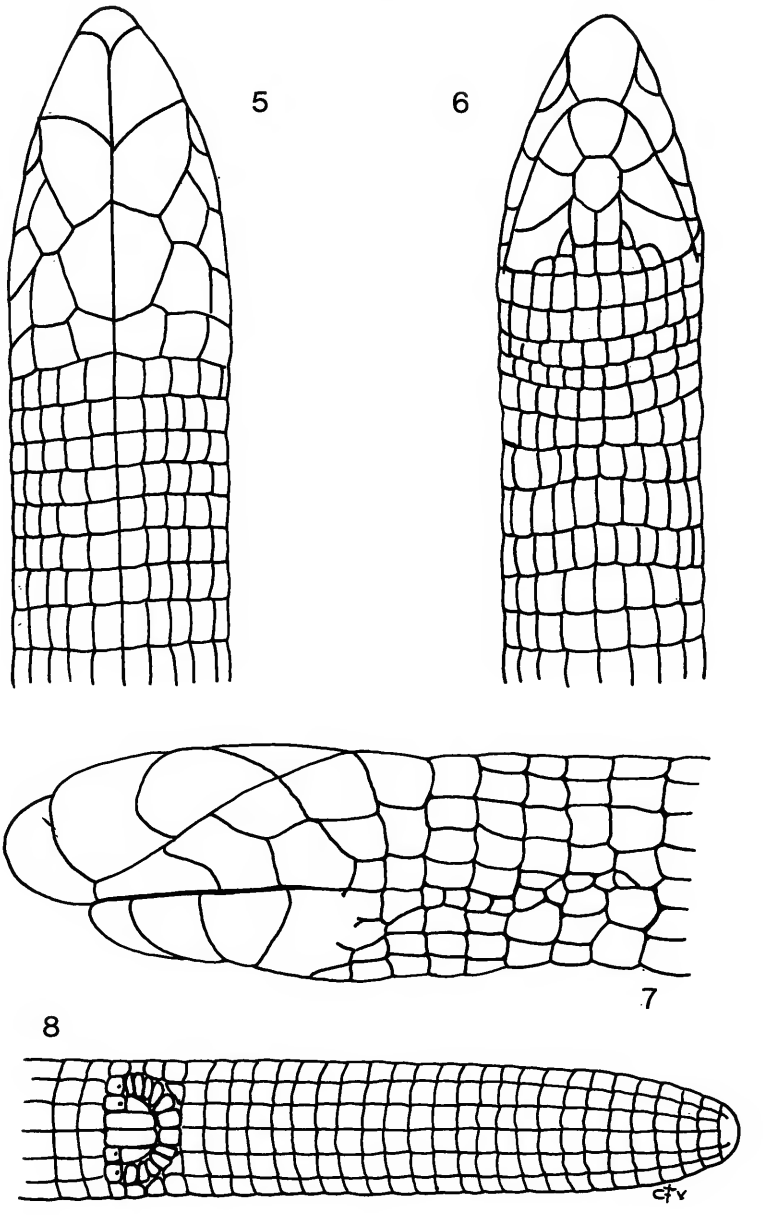
Color pattern: dorsally, head smudged with dark brown; body brown, center of segments a little darker, the contrast increasing laterally; segment edges lighter, forming with the sulci between annuli a checkerboard pattern. Lateral sulcus lighter that the dorsum, with groups of melanophores. Anteriorly (from the neck to approximately annulus 20) the segments below the sulcus dark, turning lighter ventrally, the belly throughout light yellow, immaculate; behind this level, one to five segments below the sulcus light brown with dark centers. Tail dorsally patterned as the body, ventrally more or less heavily smudged.

Amphisbaena arenaria, sp.n.
(Figs. 5-8, Table 1)

Holotype, MZUSP 65817, Raso da Catarina, state of Bahia, Brasil, 13-14 September, 1984, M. T. Rodrigues field number 84.6251.

DIAGNOSIS

Preanal pores 4, separated on the middle by two segments, fused with those immediately behind, which are part of the anal flap. Body annuli 195; tail annuli 27, autotomy level at 6; segments to a midbody annulus 14/14. Four upper, three lower labials.



Figs. 5-8. *Amphisbaena arenaria*, sp.n., holotype.

ETYMOLOGY

The name refers to the eminently sandy habitat of the species.

DESCRIPTION

An apparently small species (only specimen known 195mm body length).

Head acuminate, curved in profile, maximum curvature on the nasal scales. Sutures between prefrontals very short, due to the suture between these scales and the nasals being S-shaped and converging behind on the midline. Frontals very broad, with all sutures rounded. Parientals large, trapezoidal, the medial side short.

Ocular four-sided, the posterior sides short, forming an obtuse angle, the anterior ones elongate, forming an acute angle; touching the frontal above. Four upper labials, second largest but not by much, fourth very small, second and third relatively narrow and high, nestling the ocular above; the second labial touching the prefrontal. One very large postocular: behind this another large squarish trapezoidal scale, resting on the fourth labial. Nostril near the naso-frontal suture.

Symphysial roughly anvil-shaped, broader in front, with transverse posterior margin. Postsymphysial roughly polygonal, between 5- and 7-sided. Three lower labials, first large, subtriangular; second a little larger still; third low and elongate, fused with the lateral genial on the left side. Lateral genials very large. Anterior medial genials two, large, embracing the postsymphysial; lateral medial genials two, small, posteriorly on a level with the medial scales, but reaching forward only about halfway. Postgenials 8, behind them 4 rows of scales of which the 2-4 median elements are irregular, swollen.

Body without dorsal or ventral sulci. Lateral sulci beginnig about 4 annuli behind the head, as an area of 4-6 badly broken up segments; this extends for some 15-20 annuli, after which the disappears, to become evident again at about the 60th annulus, with normal morphology. Dorsal sulcus disappears, segments slightly longer than wide, poorly aligned. Ventral segments wider than the dorsals, better aligned.

Anal flap with 8 scales, progressively larger toward the middle; the two central elements fused with the correponding segments of the last body annulus, resulting in two elongate scales separating the pore-bearing scales, 2 on each side. Pores on the hind margin of the segments, small but rounded and well defined. Postanal rim with 10-12 swollen short scales.

Tail cylindrical, with well marked annuli and segments, except at the tip, which is smooth, acuminate. The sixth caudal annulus is slightly shorter than the others, indicating the level of autotomy.

Color pattern uniform light yellow.

DISCUSSION

An attempt to identify the species here described through Gans and Mathers's (1977) key to New World amphisbaenians will lead to *A. vermicularis* in both cases. In fact, the holotype of *A. arenaria* had been thus misidentified in our collection; the mistake was recognized only when its measurements were plotted for comparison with *A. frontalis*. It should, logically, be compared with *A. vermicularis*.

A. frontalis, contrariwise, is in every respect — pholidosis, scale counts, body proportions — a very distinctive species. It should, however, be also compared with *A. vermicularis*, given the broad resemblances in body size and in counts of body annuli and preanal pores.

Other species in or near the same range of counts present no problem. *A. frontalis* has 252-272 body annuli, 27-29 tail annuli and 14-16/14-16 segments to a midbody annulus. *A. arenaria* has respectively 285,23 and 14/14. *A. angustifrons* Cope (3-6 pores, 190-253 body annuli) and *A. plumbea* Gray (4, 210-282) have much larger numbers of segments to a midbody annulus, respectively 41-61 and 38-57. *A. steindachneri* Strauch (4, 256-266, 30-33) has a vertical keel on the tail tip.

Geographically, *A. vermicularis* is again the relevant species for comparison with both new forms, as it is the most widespread species in the caatingas of northeastern Brasil. This is, as will be discussed below, a large area, encompassing over 800,000 sq km, semi-arid, very homogeneous ecologically. We have specimens of *A. vermicularis* from the same dune field where *A. frontalis* occurs. *A. pretrei* Duméril and Bibron, a species not common but also widespread in the caatingas, has 231-255 annuli, but 5-9 pores and 42-49 segments. *A. heathi,* from eastern Rio Grande do Norte, also in the northeast but not in the caatingas, has fewer than 190 annuli.

Of the two species recently described from the dune field, *A. hastata* Vanzolini has 4 pores and 266-273 annuli, but is an exceedingly small and slender species, with a peculiar arrangement of annuli on the anterior dorsum, a very long tail (40 annuli) and distally placed autotomy level (12-18). *A. ignatiana* is equally small and slender, has 6 pores and 32-36 tail annuli.

I shall then compare jointly the two new species with *A. vermicularis* Wagler. This comparison will aim not only at validating the new species and making their recognition easier, but also at bringing into better focus some of their very interesting peculiarities.

The comparison, it should be noted, is not quite straightforward. *A. vermicularis*, reviewed by Gans and Amdur (1966) with basis on excellent materials, shows signs of geographical differentiation. Thus I concentrate my comparison on specimens of *vermicularis* from the caatingas of Bahia, from which we have 8 specimens (Table 1). Since this series comprises only 3 examples with intact tails, it was complemented by the data from Bahia specimens cited by Gans and Amdur (1966). Additionally, in order to make present the geographic differentiation of *A. vermicularis* and to give a better inductive basis to the morphometric comparisons, I used a sub-sample of the extensive materials collected by L. J. Vitt in 1977 at Exu, in the caatingas of Pernambuco.

All the specimens used in this study are listed on Tables 1 and 2.

MERISTIC CHARACTERS (Table 3).

Since scale counts are, in this case, perfectly diagnostic, I'll start by discussing them. A preliminary precaution, as usual in this type of study, was to ascertain that the characters studied are nor correlated among themselves; they are not.

Considering initially *A. vermicularis*, it is seen in Table 3 that it exhibits considerable geographic variation, even on the very limited scale of this study. As seen on Table 2 and on the map, the samples studied differ in composition: one (Exu) is geographically homogeneous; the other two (MZ-Bahia and Gans & Amdur) include several localities in the S. Francisco valley; the former contains 8 specimens from the fossil dune field proper, and one from the other side of the river. This arrangement obviously does not permit even an approximate analysis of the geographic differentiation of the species, but permits one to sense the presence of significant variation.

Statistical treatment shows that in two cases the three samples agree among themselves: number of tail annuli (Kruskal-Wallis test) and total number of segments on a midbody annulus (analysis of variance).

The agreement to be more readily expected, that between the two Bahia samples, was found to occur only in the cases of dorsal and ventral segments (chi-square), but failed to appear in the number of body annuli (analysis of variance). The Exu sample agrees with MZ-Bahia in number of body annuli; with the Gans & Amdur sample in no other character than the two cited above. It seems clear that it is indeed advisable to compare the new forms with *vermicularis* from the caatingas of the S. Francisco valley. The respective differences are very large: in number of body annuli both *A. arenaria* and *A. frontalis* exceed amply *A. vermicularis*, the contrary happening in the case of segments, dorsal and ventral, to a midbody annulus. The two new species differ between themselves in number of body and tail annuli.

PHOLIDOSIS

A. arenaria resembles *A. vermicularis* in the scutellation of the head. On top, the main difference lies in the naso-prefrontal sutures, which are transverse or nearly so in the latter, and

converge backward in the former, which, as a result, has a much shorter prefrontal median suture. On the sides of the head the main difference is in the shape of the ocular, much elongated toward the front in *arenaria*, shorter in *vermicularis*. On the ventral aspect both species show the configuration most common in *Amphisbaena*: an anvil-shaped symphysial and a polygonal postsymphysial. The former scale has usually a rectangular shape, with two pointed side projections on the lip edge, and a transverse or rounded back side. The postsymphysial has two chopped up front corners meeting the first lower labials, straight sides meeting the second labial, and a rounded or angular hind edge meeting the scales of the genial region.

A. frontalis strongly differs from this pattern. Its frontals are elongate, with arcuate front edge and tapering sides, narrow and clipped behind; in the other species the frontals are short and broad, practically isodiametric. The parietals, which in the majority of species are clearly enlarged, trapezoid, are inapparent in *frontalis*. On the side of the head, *frontalis* has three upper labials, against four in the other species; especially, its second labial is very large. This does not seem due, however, to any fusions of scales, as in all forms the ocular rests between the second and third labials, which indicates that the latter scales are homologous. In addition, the scales behind the level of the eye are much larger in *frontalis*.

The largest differences are found, however, on the chin and throat. The symphysial of *Amphisbaena*, as said, is usually anvil-shaped, more or less rectangular, with two small lateral processes on the edge of the lip. In *frontalis* this scale is elongate, tapering, without any labial processes. The postsymphysial of *arenaria* and *vermicularis* has also been described above as typical of *Amphisbaena*. That of *frontalis* varies from irregularly polygonal, with uneven sides and angles, to frankly elliptic, with pointed front and back tips.

Finally, important differences are found among the three species with regard to the pore-bearing row of scales, and to the pores themselves. In *vermicularis* is found the situation normal for the genus, i.e., square segments bearing, on their hind half, a continuous row of round, well formed pores. In the two new species diverse patterns are found. In *arenaria* there are, on each side, two pores of normal shape and position, but the row is interrupted on the middle by two elongate scales resulting from the fusion of one poreless scale from the pore-bearing row with one from the preanal flap. In *frontalis* the pores vary from evident, but small, ill-shaped, to frankly cicatricial, placed on the hind edge of the scale.

Body proportions

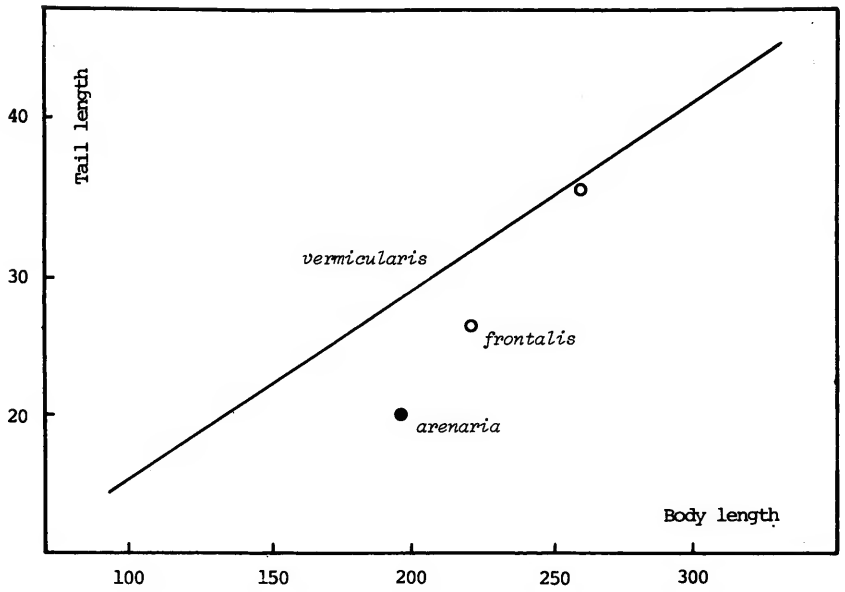
The study of body proportions in amphisbaenids, as in serpentiform reptiles in general, centers essentially on head width and tail length, as proxies for elongation and attenuation of general body shape. Unfortunately, autotomy, both pre- and postmortem, reducing the number of intact tails, makes for difficulty in studying tail length and total (body plus tail) length.

In what follows, the relevant body proportions are studied by means of linear regression (Table 4). In all cases the regressions are highly significant, although the coefficients of determination do not reach the values observed in other species of *Amphisbaena* (Vanzolini, 1991).

Tail length (Graph 1). In the present materials we have a fine sample from Exu; combining our materials from Bahia with Gans and Amdur's data for specimens from the caatingas of the São Franscico in Bahia we manage to have a standard of comparison for the tail length of the new species.

The three *vermicularis* samples agree closely among themselves, and are combined into a single sample, with a reasonable coefficient of determination (.9270), not much lower than that of .9579 for the geographically homogeneous Exu series. Against this line (Graph 1) are plotted the data for the only *arenaria* and for the two *frontalis* specimens with intact tails. Taking the difference (t test) between these observed tail lengths and the calculated tail length for *vermicularis* with the same body lengths, it is seen that, although one frontalis specimen closely agrees with *vermicularis*, the two new species may be said to have shorter tails than the latter.

Head width. As said, the regression of head width on total length (Schmidt, 1977) is theoretically the best way to study body attenuation. The presence of autotomy, however, makes



Graph 1. Regression of tail length on body length.

it necessary to analyze first the regression of head width on body length and then, with the available materials, to extend the results to regression on total length.

In the present case the joint *vermicularis* regression (Graph 2) affords a fair fit (coefficient of determination .8704, against .9353 for Exu); the regression for *frontalis* widely differs from it.

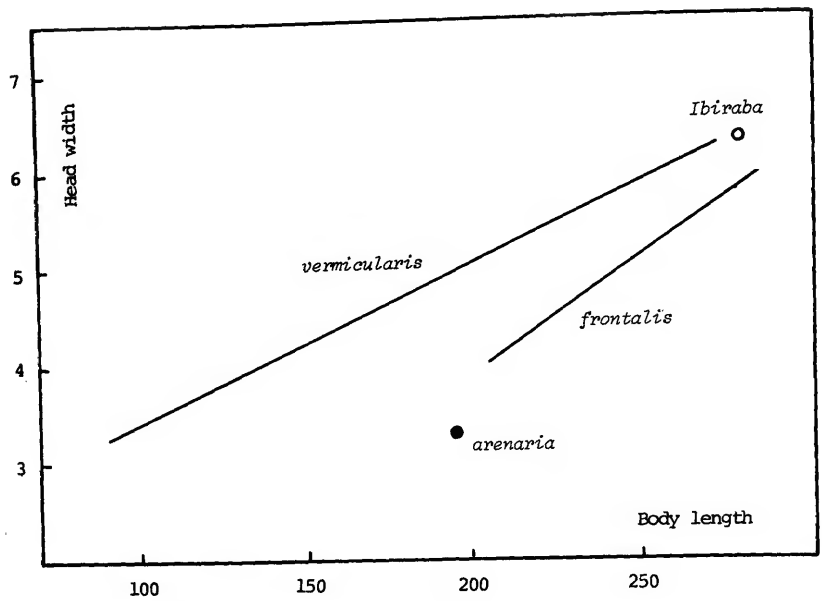
The regression of head width on total length (Graph 3) confirms these data: the two new species and specially so *A. arenaria*, are much more slender than *A. vermicularis*.

The regression of head width on head length (Graph 4) shows a very different picture: the two *vermicularis* samples broadly disagree, the Exu specimens having decidedly narrower heads than the MZ-Bahia ones. *A. frontalis* has a still narrower head, and *A. arenaria* agrees closely with it, as can be seen from the improvement of the fit when the two species are added together (Table 4).

Head length. Finally, the regression of head length on trunk (body minus head) length (Graph 5) shows again disagreement between the two vermicularis samples, with Exu having relatively longer heads. *A. frontalis* and *A. arenaria* agree in having very short heads.

A REFERRED SPECIMEN OF *A. FRONTALIS*

The first specimen of *A. frontalis* to reach our collection, MZUSP 68505, from Ibiraba, Bahia, in the same area as the type series, has not been included in the hypodigm. This is due to its peculiar head measurements. It will be seen in Graphs 3, 4 and 5 that it differs somewhat markedly from the remainder of the series. I believe these differences to be due to individual variation, rather than to a real taxonomic difference. A final decision will depend, however, on additional materials, and I think it would be unwise at present to include a questionable specimen in an otherwise geographically and morphologically homogeneous series.



Graph 2. Regression of head width on body length.

Distribution

Localities

As is usually the case in systematic studies of South American reptilles, the localities involved in this study are not simple and straightforward. We adopt as our standard gazetteers, even in the case of Brasil, those published by the American CIA under the guise of "U.S. Board on Geographic Names"; next, in the case of Brasil, comes Vanzolini and Papavero's (1968) index to the toponyms contained in the official 1:1,000,000 map of Brasil. The following four localities are not found in these sources:

Alagoado: located by the collector at 09°29'S, 41°21'W.

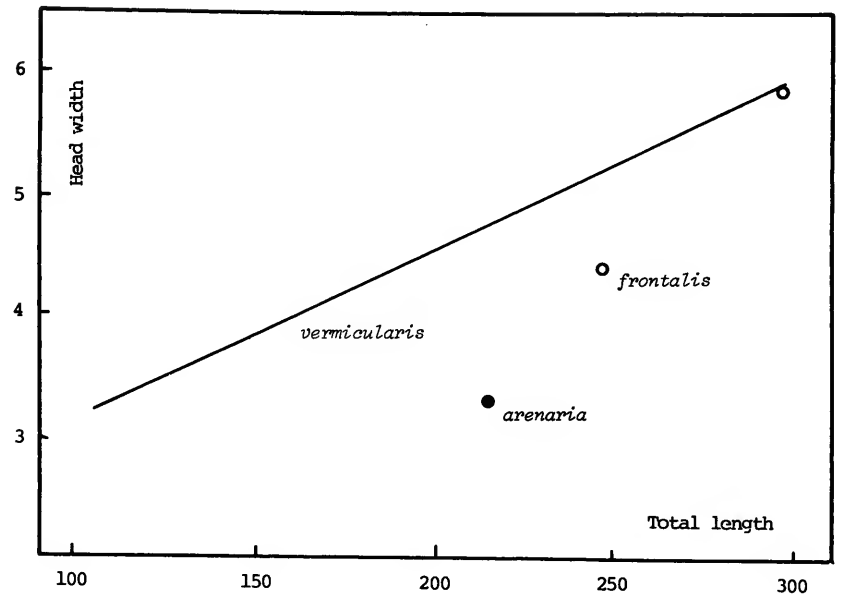
"Barra, Cobre de Cabezas, Joazeiro" (Gans and Amdur, 1966, specimen Vienna 12). Cobre de Cabezas in only a rendition of "cobra de duas cabeças" (two-headed snake), the common Brasilian name for amphisbaenians. Barra is the well known locality at 11°05'S, 43°09'W.

"Barinha", near Joazeiro (Gans and Amdur, 1966, specimens Vienna 20A-20C), is Barrinha, actually close to Joazeiro (present spelling Juazeiro), at 09°58'S, 40°14'W.

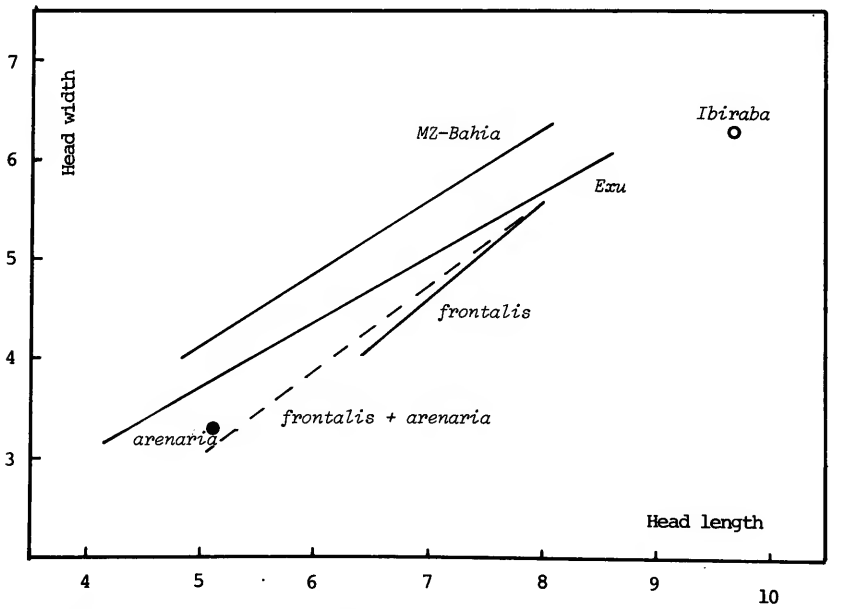
Caraíba dos Bragas: located by the collector at 09°39'S, 41°20'W.

Ecology

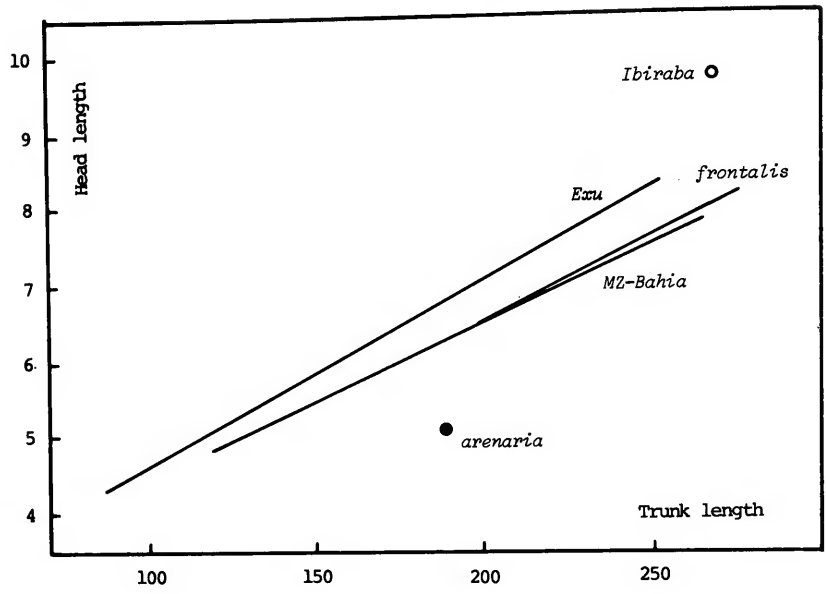
All localities discussed in this paper are in the core area of the morphoclimatic domain of the caatingas (Ab'Saber, 1977). This is a polygonal area some 800,000 sq km in area, stretching roughly between 4° and 16°S, from about the meridian of 47° eastward to within 50-100 km of the coast. The relief is mostly constituted by intermontane and interplateau depressions. The



Graph 3. Regression of head width on total length.



Graph 4. Regression of head width on head length.



Graph 5. Regression of head length on trunk length.

climate (Nimer, 1979) is semi-arid: hot (yearly average temperature around 24°C), with low (300-800 mm a year), poorly distributed rainfall: there are 4-9 months of hydric deficit, and frequent years of severe drought. The drainage, except for a few large permanent rivers, such as the São Francisco, is intermittent; it is, however, overwhelmingly exorrheic, so that there are no areas with extensive salt deposition, or other desertic features consequent to endorrheic drainages (but see below). The soils are not infertile, but usually shallow, many times with exposed rock floors, less frequently with extensive sandy areas. In consonance with this constellation of semi-arid conditions, the vegetation is the very characteristic caatinga, which lends its name to the general area. Its most evident adaptations are against loss of water: there is an abundance of thorns, waxes and leaf hairs, of tuberous roots and succulent stems — especially cacti. Stomata are geared to open in a rhythm conductive to water conservation, and the whole plant formation is summer-deciduous.

Within this large continuous domain, our localities are found in two large, specifically sandy areas. Alagoado, Vacaria, Ibiraba and Santo Inacio are in a great field of fossil dunes crossed by the São Francisco. This was first identified by Ab'Saber (1969) and later well described and discussed by Tricart (1974). The latest general geomorphologic and ecologic treatment of the region (Projeto Radambrasil, 1983), deals with the fossil dunes (p. 390) under the name "sand fields of the Middle São Francisco". The sands are made from Tertiary and Quaternary alluvial and colluvial deposits, reworked in situ during a dry Pleistocene episode, when the São Francisco ended in an endorrheic delta.

The other sandy area in our study is the Raso da Catarina. A "raso", in the regional parlance of northeastern Brasil, is a sizable area covered with pure fine sand, so porous that infrequent downpours cause not even minor gullying. This, the best known of all the rasos, extends for some 70 (east-west) by 60 km; it is uninhabited, but the federal governmemt maintains an ecological station there.

Table 1. *Amphisbaena frontalis* and *A. arenaria*, measurements and scale counts.

MZUSP	Locality	Body length	Tail length	Head length	Head width	Annuli Body	Annuli Tail	Segments
Holotype *A. frontalis*								
72989	Alagoado	259	37	7.9	5.9	252	27	16:16
Paratypes *A. frontalis*								
72995	Alagoado	205		6.4	4.0	268	(6)	16:14
72990	"	220	27	6.9	4.4	271	29	16:15
72992	"	236		6.9	4.4	265	(6)	15:16
72994	"	240	-	7.4	4.6	265	(7)	15:16
72996	"	251	-	7.9	5.1	261	(7)	14:14
72997	"	252		7.4	5.5	264	(7)	14:14
72991	"	270	-	7.9	5.5	272	(7)	16:16
72993	"	284		8.0	5.6	266	(6)	14:16
Referred specimen *A. frontalis*								
68505	Ibiraba	278		9.7	6.3	259	(7)	16:16
Holotype *A. arenaria*								
65817	Raso da Catarina	195	20	5.1	3.3	285	23	14:14

Table 2. *Amphisbaena vermicularis*, measurements and scale counts.

MZUSP	Locality	Body length	Tail length	Head length	Head width	Annuli Body	Annuli Tail	Segments
Bahia								
66478	Santo Inacio	238	-	6.7	6.1	233	(6)	21:22
72610	"	225	35	7.2	5.3	231	27	22:22
73000	Vacaria	120	16	4.6	3.6	241	29	22:22
73001	"	160	26	5.5	4.9	244	29	19:22
73002	"	243		7.3	6.2	237	(7)	20:20
72998	"	263	-	8.1	6.4	238	(7)	20:20
72999	"	273		7.5	5.5	242	(6)	20:21
68835	Caraíba dos Bragas	123	18	4.8	3.6	245	27	24:25
Pernambuco								
50186	Exu	92	13	4.5	3.2	238	27	21:23
50199	"	140	20	5.7	4.0	243	27	22:24
50184	"	150	21	5.3	3.7	246	28	20:24
50198	"	166	-	6.2	4.4	240	(5)	22:24
50180	"	173	23	6.4	4.5	248	28	21:23
50188	"	173	27	5.7	4.5	247	28	21:24
50192	"	217	29	7.6	5.7	248	28	22:24
50182	"	229	32	6.7	5.2	238	28	21:24
50205	"	235	36	8.6	5.5	250	29	20:24
50181	"	239	36	7.2	5.2	240	26	21:23
50200	"	249	38	8.1	6.0	244	27	21:24
50190	"	250	34	8.0	5.9	246	30	22:24
50176	"	261	37	8.4	5.8	250	28	22:22

Table 3. *Amphisbaena frontalis*, *A. arenaria* and *A. vermicularis*, meristic characters.

	Annuli				Segments					
	Body		Tail		Dorsal		Ventral		Sum	
	N	Range	N	Range	N	Range	N	Range	N	Range
A. frontalis	9	252-272	2	27-29	9	14-16	9	14-16	9	28-32
A. arenaria	1	285	1	23	1	14	1	14	1	28
A. vermicularis										
MZUSP, Bahia	8	231-245	3	27-29	8	19-24	8	20-25	8	40-49
Bahia, Gans & Amdur	15	213-245	9	23-30	15	19-24	15	20-25	15	39-49
MZUSP, Exu	14	238-250	13	26-30	14	20-22	14	22-24	14	44-46

Table 4. *Amphisbaena frontalis* and *A. vermicularis* (MZ-Bahia and Exu): regression analyses.

	N	R(x)	R(y)	b	a	r^2
Tail length x body length						
Exu	13	92-261	13-38	.15±.0095	-1.2±4.03	.9579
vermicularis	25	92-325	13-45	.14 .0082	1.3 .69	.9270
Head width x body length						
Exu	14	92-261	3.2-5.9	.017 .00128	1.6 .27	.9353
MZ-Bahia	7	123-273	3.8-6.4	.014 .00352	2.3 .79	.7675
vermicularis	21	92-273	3.4-6.4	.016 .00144	1.8 .31	.8704
frontalis	9	205-284	4.0-5.6	.024 .00462	-.9 1.14	.7942
Head width x total length						
Exu	12	105-298	3.2-6.0	.015 .00120	1.6 .29	.8968
vermicularis	16	105-298	3.2-6.0	.014 .00116	1.7 .27	.9144
Head width x head length						
Exu	14	4.2-8.5	3.3-5.9	.66 .0583	.4 1.00	.9138
MZ-Bahia	8	4.6-8.1	3.6-6.4	.76 .140	.3 .92	.8323
frontalis	9	6.4-8.0	4.0-5.6	1.02 .201	-2.5 1.70	.7858
frontalis + *arenaria*	10	5.1-8.0	3.3-5.6	.84 .121	-1.2 1.35	.8569
Head length x trunk length						
Exu	14	87.5-252.6	4.5-8.5	.024 .00263	2.2 .53	.8763
MZ-Bahia	7	118.2-265.5	4.8-8.1	.021 .00272	2.4 1.82	.9201
frontalis	9	198.6-276.0	6.4-8.0	.022 .00354	-2.1 .85	.8471

It should be noted that our four new species of *Amphisbaena* are not the only (not even the first) peculiar species to be described from these sandy wastes. Miguel T. Rodrigues, who has collected the specimens under description, has described one *Tropidurus* (Rodrigues, 1987) from the Raso da Catarina, as well as (Rodrigues, 1991 a-d) three new lizard genera, with five new species, and one new species of snake from the sand fields of the Middle São Francisco. He is working on the patterns of speciation in this most interesting area.

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