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ON *ANOPS* (REPTILIA: AMPHISBAENIA: AMPHISBAENIDAE)

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ABSTRACT

Anops kingii *Bell, 1833 and* Anops bilabialatus *Stimson, 1972 are compared from the viewpoints of scutellation, body proportions, osteology of the skull and ecology. The literature and distribution of* A. kingii *are reviewed as well.*

KEYWORDS: *Anops,* Reptilia, Amphisbaenia, Amphisbaenidae

INTRODUCTION

Some specimens of *Anops bilabialatus*, species hitherto known only from the type series, were collected by a University of São Paulo field party, participating in a zoological survey of the state of Mato Grosso. The survey is part of a socio-economic-ecological diagnosis of the state (PRODEAGRO), promoted by the state's Secretariat of Planning (SEPLAN), financed by The World Bank (International Bank for Reconstruction and Development) and contracted to the São Paulo firm of consultants Consorcio Nacional de Engenheiros Consultores (CNEC).

The new materials permit amplification of the original description, as well as an improvement of the comparison between the present species and the previously described *Anops kingii* Bell, 1833.

Anops kingii Bell, 1833

Anops kingii Bell, 1833: 99. "America Australi".
Anops kingii, Wiegmann, 1834: 21. Generic diagnosis.

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Anops kingii, Bell, 1835: 391, fig. Description and illustration of the type.
Anops kingii, Wiegmann, 1836: 158. Classification.
Amphisbaena kingii, Duméril & Bibron, 1839: 496. Description based on specimens.
Anops kingii, Gray, 1844: 72. From the literature.
Amphisbaena kingii, Duméril & Duméril, 1851: 148. Cite specimens in the Paris Museum.
Amphisbaena kingii, Lichtenstein, 1856: 17. Specimen from Montevideo in Berlin.
Amphisbaena kingii, Jan, 1857: 41. Specimen from Buenos Aires in Milan.
Amphisbaena kingii, Burmeister, 1861: 526. Ecology at Paraná, Entre Rios, Argentina.
Anops kingii, Gray, 1865: 444, 450. Comments, based on the literature.
Anops kingii, Steindachner, 1867: 55. Wrong citation of one specimen from Caiçara, Mato Grosso; later made the type of *Amphisbaena steindachneri* Strauch, 1881.
Amphisbaena kingii, Hensel, 1868: 343. A good description; Porto Alegre.
Anops kingii, Gray, 1872: 38. Repetition of Gray, 1865.
Amphisbaena kingii, Weyenbergh, 1876: 150. List, Argentina.
Amphisbaena kingii, Strauch, 1881: 418. Revision, based on specimens.
Amphisbaena kingii, Bocourt, 1882: 493. List, South America.
Amphisbaena kingii, Berg, 1884: 94. Mention for La Tinta, Buenos Aires, Argentina.
Anops kingii, Boulenger, 1885b: 451. Revision, based on specimens. Generic concept (fuses *Baikia*).
Anops kingii, Boulenger, 1885c: 193. Report on a Rio Grande do Sul collection forwarded by Hermann von Ihering: eggs and myrmecophyly.
Anops kingii, Cope, 1885: 187. Specimen from Montenegro, from H.H. Smith.
Anops kingii, Boulenger, 1885a: 295. A critique of Cope's Twelfth Contribution (above); agrees in what regards *Anops kingii.*
Amphisbaena (*Anops*) *kingii*, F. Müller, 1885: 701. Specimen from Bahia Blanca at Basel.
Anops kingii, Smalian, 1885: 136, fig. Comparative anatomy within the family (skeleton, including limb rudiments, musculature); eggs and embryos.
Anops kingii, Boulenger, 1886: 428. In a synopsis of Rio Grande do Sul reptiles.
Anops kingii, Boulenger, 1887: 508. Supplement to the Catalogue of Lizards; one specimen from São Lourenço, Rio Grande do Sul.
Anops kingii, Koslowsky, 1898: 187. Distribution in Argentina (by provinces).
Anops kingii, Goeldi, 1902: 556. Vulgarization.
Amphisbaena kingii, Rojas, 1903: 37. List, Argentina.

Anops kingii, Bertoni, 1913: 25. List, Paraguay (no specimens).
Anopsibaena kingii, Stejneger, 1916: 85. *Anopsibaena*, replacement for *Anops* Bell, 1833, *nec Anops* Oken, 1815. See Gans & Rhodes, 1964.
Anops kingii, Marelli, 1924: 591. Distribution, Argentina, province level.
Anops kingii, Devincenzi, 1925: 14. Copied from Boulenger, 1885.
Anopsibaena kingii, Burt & Burt, 1930: 41. Specimen from "Cordoba", Argentina.
Anopsibaena kingii, Burt & Burt, 1931: 241. Specimen from "Cordoba", Argentina.
Anopsibaena kingii, Burt & Burt, 1933: 82. List, South America.
Anopsibaena kingii, Amaral, 1938: 200. List, Brasil.
Anopsibaena kingii, Freiberg, 1939: 20. Localities Entre Rios, Argentina.
Anopsibaena kingii, Liebermann, 1939: 80. List, Argentina.
Anopsibaena kingii, Parker, 1942: 57. Skull; classification.
Anopsibaena kingii, Zangerl, 1945: 778, fig. Post-cranial skeleton.
Anopsibaena kingii, Vanzolini, 1951: 115, fig. Classification.
Anops kingii, M.A. Smith, Bellairs & Miles, 1953: 266. Dentition.
Anopsibaena kingii, Birabén, 1953: 390, fig. Fine anatomy of the eye.
Anops kingii, Gatti, 1955: 96. Name in the Guarany language.
Anopsibaena kingii, Vaz-Ferreira, 1956: 11. Specimen from Cabo Polonio, Uruguay.
Anopsibaena kingii, Lynn & Komorowsky, 1957: 167. Anatomy of the thyroid.
Anopsibaena kingii, Ringuelet & Aramburu, 1957: 30. List, Argentina.
Anopsibaena kingii, Hellmich, 1960: 98. Specimen from Maria Eugenia, Santa Fe, Argentina.
Anopsibaena kingii, Vaz-Ferreira & Sierra de Soriano, 1960: 24. List, Uruguay (Department level).
Anops kingii, Gans & Rhodes, 1964: 3, fig. Full revision. Revival of *Anops*.
Anopsibaena kingii, Esteban, 1965: 243. Anatomy of the tongue.
Anops kingii, Gallardo, 1966: 27. Localities in Argentina (Provinces of Buenos Aires and La Pampa).
Anopsibaena kingii, Ruschi, 1966: 3. List, state of Espirito Santo, Brasil; totally unrealiable (see Vanzolini, 1978: 217).
Anops kingii, Gans, 1967: 76. Check-list of the family.
Anops kingii, Rosenberg, 1967: 353, fig. Hemipenis.
Anops kingii, Gallardo, 1969: 78. Localities in Argentina.
Anops kingii, Dely, 1970: 231, fig. Description, with emphasis on variability.
Anops kingii, Gallardo, 1970: 68. Sierra de la Ventana, Argentina.
Anops kingii, Peters & Donoso-Barros, 1970: 70. Catalog.
Anops kingii, Huang & Gans, 1971: 12, fig. Karyotype.

Anops kingii, P. Müller, 1971: 11. Distribution Rio Grande do Sul, Brasil.
Anops kingii, Orrego, 1971: 58. Distribution La Pampa, Argentina.
Anops kingii, Stimson, 1972: 207, fig. Comments, on the occasion of the description of *A. bilabialatus*.
Anops kingii, Gorman, 1973: 394. Karyotype, discussion based on Huang & Gans, 1970.
Anops kingii, Gilboa, 1975: 205. Bibliography of karyotypes.
Anops kingii, Achaval, 1976: 27. List, Uruguay.
Anops kingii, FZB (Fundação Zoo-Botânica do Rio Grande do Sul), 1976: (117). Distribution Greater Porto Alegre.
Anops kingii, Gans & Mathers, 1977: 37. Identification key.
Anops kingii, Gallardo, 1977: 145. Repetition of localities.
Anops kingii, Lema & Fabián-Beurmann, 1977: 73. Distribution Rio Grande do Sul and Uruguay.
Anops kingii, Gallardo, 1979: 302. Distribution Argentina, very broad terms.
Anops kingii, Orrego-Aravena, 1979: 682. Localities La Pampa, Argentina.
Anops kingii, Daciuk & Miranda, 1980: 110. Localities in the Peninsula de Valdés, Chubut, Argentina.
Anops kingii, Lema et al., 1980: 29. Repetition of Fundação Zoo-Botânica, 1976, above.
Anops kingii, Laurent & Teran, 1981: 12. Distribution through plant formations of northwestern Argentina.
Anops kingii, Gallardo, 1982: 82. Occurrence at the National Park El Palmar de Colón, Entre Rios, Argentina.
Anops kingii, Lema, Vieira & Araujo, 1984: 209. Repetition of Lema et al., 1980, above.
Anops kingii, Gallardo, Tio-Vallejo & Miranda, 1985: 100. Localities in Santiago del Estero, Argentina.
Anops kingii, Riley, Stimson & Winch, 1985: 40. A review of myrmecophyly; no new data.
Anops kingii, Cei, 1986: 340. General review.
Anops kingii, Peters & Donoso-Barros, 1986: 70. Catalog.
Anops kingii, Achaval, 1987:2. List, Uruguay.
Anops kingii, Gallardo, Miranda & Tio-Vallejo, 1987: 91. Distribution, province of Entre Rios, Argentina.
Anops kingii, Achaval, 1989: 5. List, Uruguay.
Anops kingii, Meneghel, Melgarejo & Achaval, 1989: 4. Key, Uruguay.
Anops kingii, Williams & Wichmann, 1989: 12. Reproduction; myrmecophyly; province of Buenos Aires.

Anops kingii, Brygoo, 1990: 1. Possible syntype in the Paris Museum.
Anops kingii, Vega & Bellagamba, 1990: 11. Collections from the eastern part of the province of Buenos Aires.
Anops kingii, Cabrera, 1993: 23. Distribution in Argentina in terms of biogeographic provinces.
Anops kingii, Cei, 1993: 443, fig. Broad review.
Anops kingii, Lema, 1994: 68. List, Rio Grande do Sul. Comment on the possibility of the name comprehending a composite of two species.
Anops kingii, Montero, 1994: 45. Rio Negro, Argentina
Anops kingii, Montero, 1996: 43. Distribution in Argentina at the province level.

History

The generic concept. Bell (1833:99), in a Latin diagnosis, characterized his new genus *Anops*, very adequately, as being limbless, having a produced ("porrectus") snout, covered with an arcuate rostral shield (to this character he gave special prominence) and lacking differentiated scales on the anterior ("thoracic") region of the trunk. He also recorded hidden eyes, a lateral sulcus and no preanal pores (this last point a mistake).

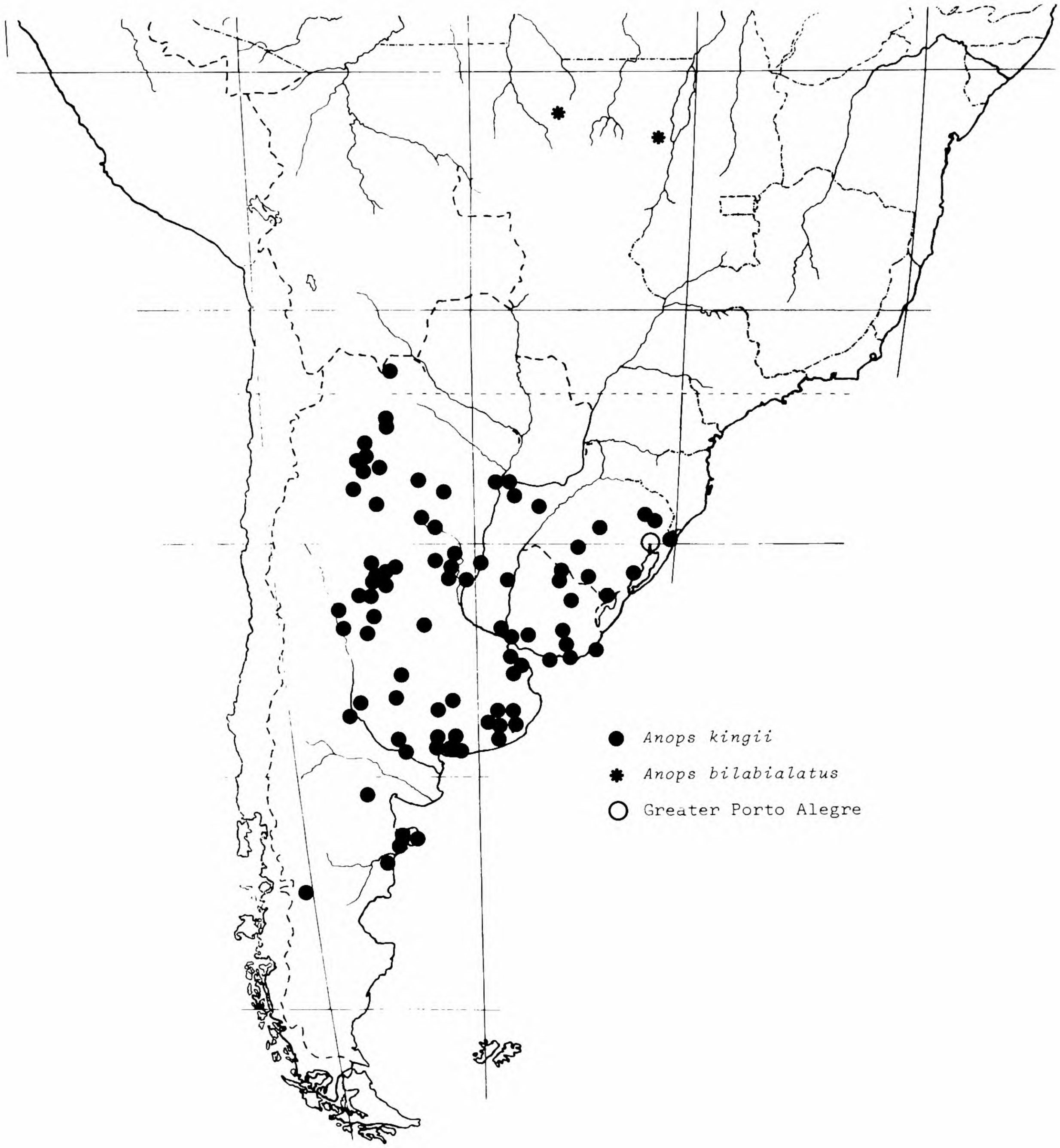
No other species was described or included in the genus until Boulenger (1885b: 452), in the British Museum catalogue, reduced the genus *Baikia* Gray, 1865 (only species *B. africana* Gray, 1865, from West Africa) to the synonymy of *Anops*. Stejneger (1916: 85), in the paper in which he proposed the new generic name *Anopsibaena* to substitute *Anops* (thought to be preoccupied), commented that, on geographical grounds, it was improbable that South American and African species should belong to the same genus. In spite of this, Scortecci (1931: 6) described *Anops somalicus*, from the Somali Republic.

Parker (1942: 56), studying the skulls of the three forms, placed them in three distinct genera, *Anops*, *Baikia* and *Ancylocranium* (new, for *somalicum*). This is the currently accepted scheme; however Gans (1967: 76) has commented that the great variability of the skull of *Ancylocranium* might lead to the invalidation of the genus, *Baikia* only remaining for all the African forms. The point is immaterial in the present context.

I myself (Vanzolini, 1951), reporting on the systematic results of my unpublished doctoral thesis on the evolution, adaptation and distribution of the amphisbaenians, also diagnosed the genus, based mostly on the features of the skull.

Gans & Rhodes (1964), in their generic revision, did not change the extant status.

External morphology. As often happens in the case of monotypic genera,



Map. 1 Distribution of *Anops kingii* and *Anops bilabialatus*. "Greater Porto Alegre" includes the neighboring localities Porto Alegre, Campo Bom, Montenegro, São Leopoldo, Viamão and Guaíba.

Bell's (1833) diagnosis applies to both the genus and the species. In addition to the characters cited above as generic (my own distinction) he only remarked that the body was dark above and whitish below. In 1835 (p. 391, fig.) Bell elaborated (this time in English) on the original description, illustrating the head and giving details of the perianal scutellation. There has never been any doubt about identification, nor have any synonyms ever been described.

Duméril & Bibron (1839: 496), based on one specimen from "Buenos Aires" contributed by Alcide d'Orbigny, gave a good description of the head, counts of body and tail annuli, and mentioned the presence of 4-6 small pores; they stated that the snout and tip of the tail were white. They where the first and, for a long time, the only, to mention the dentition. Hensel (1868: 343) gave also a detailed description of the head, counts of annuli, and for the first time, of segments on an annulus. Strauch (1881: 418), with 17 specimens on hand from Argentina, Brasil and Uruguay, gave an excellent description, with scale counts. He settled the matter of the presence (and number) of preanal pores, that, being very small and poorly marked, are easy to overlook. Boulenger (1885b: 451), in the British Museum catalogue, gave final shape to the description, in his usual concise manner. Gans & Rhodes (1964), using a very large sample from the entire area of the species, published a meticulous revision, lacking only morphometric data.

After this, the only ponderable contribution to the external morphology of *Anops kingii* was Dely (1970: 231), who detailedly analyzed and illustrated the marked variability of the head shields. Cei's reviews, in faunistic works (1986: 340; 1993: 443) are good compilations, but include no new information.

Hemipenes. The only work on hemipenial morphology of *Anops kingii* is Rosenberg (1967); this line of work has not been further pursued. As described and figured by Rosenberg, the hemipenis of *A. kingii* is quite peculiar. As in all amphisbaenids, it has a cylindrical base and a bilobed apex. The distal ends of the terminal lobes are covered with a system of parallel ridges. There is on each lobe, near the base, a large papilla turned forward.

Anatomy. Subterranean life, naturally accompanied by complete or near limblessness, has attracted the attention of anatomists to the study of limb reduction and to the fossorial mechanics of the skull. Along these lines, there are four fundamental papers on the anatomy of *Anops*. Smalian (1885), in his well-known monograph, studied comparatively the musculature, especially in relationship with locomotion, and the limb rudiments. Zangerl (1944, 1945) described, also comparatively, the skull and the post-cranial skeleton, dealing again with the limb rudiments. Alexander & Gans (1966) studied the very important matter of the correspondence beween body annuli and vertebrae. Stimson (1972) commented on the osteology of the trunk and tail as seen in X-rays.

Of incidental interest are Birabén (1953) on the morphology of the eye; Smith, Bellairs & Miles (1955) on the egg tooth, replaced by one premaxillary tooth; Lynn & Komorowsky (1957) on the structure of the thyroid; and Esteban (1963) on gustatory papillae.

Karyotype. Amphisbaenians are better known from the karyological view point than might be guessed. The latest review (Cole & Gans, 1987) lists 24 species of Amphisbaenidae, among which *Anops kingii*. This species has the least number, 2n=26, of chromosomes in the family. Cole and Gans (1987) did not decide whether this would be an independent derivation from the ancestral condition (2n=36), or the result of common descent with a group of species of southern *Amphisbaena* (*angustifrons*, *darwini*, *heterozonata* and *trachura*), which also show reduction in chromosome number, albeit less extreme.

Ecology. Specific data on the ecology of *Anops kingii* are few and scattered. Laurent & Teran (1981) and Cabrera (1993) analyzed its distribution in terms of Argentinian plant formations, without any noteworthy conclusions. Gallardo (1970: 68) and Vega & Bellagamba (1990) noted its remarkable abundance in certain areas of the province of Buenos Aires. A striking characteristic of the species is its myrmecophyly, first noted by Boulenger (1885), who reported eggs collected by Hermann von Ihering in ants' nests in Rio Grande do Sul. A second case was reported by Williams & Wichmann (1989), from the province of Buenos Aires.

In general a consideration of the distribution of *A. kingii* indicates that it is present in a variety of open plant formations, but never in forest; in fact, among the many specimens from Rio Grande do Sul, none comes from the Atlantic Forest, a well-collected area. It is also clear that it is adapted to sub-tropical and temperate climates.

Nomenclature. *Anops* was properly diagnosed and named as a monobasic genus by Bell (1833). Stejneger (1916) proposed a substitute name, *Anopsibaena*, since *Anops* had been previously used by Oken in 1815 for a crustacean. Gans & Rhodes (1964) restored *Anops*, as all of Oken's names were made unavailable by the International Commission on Zoological Nomenclature.

Diagnosis

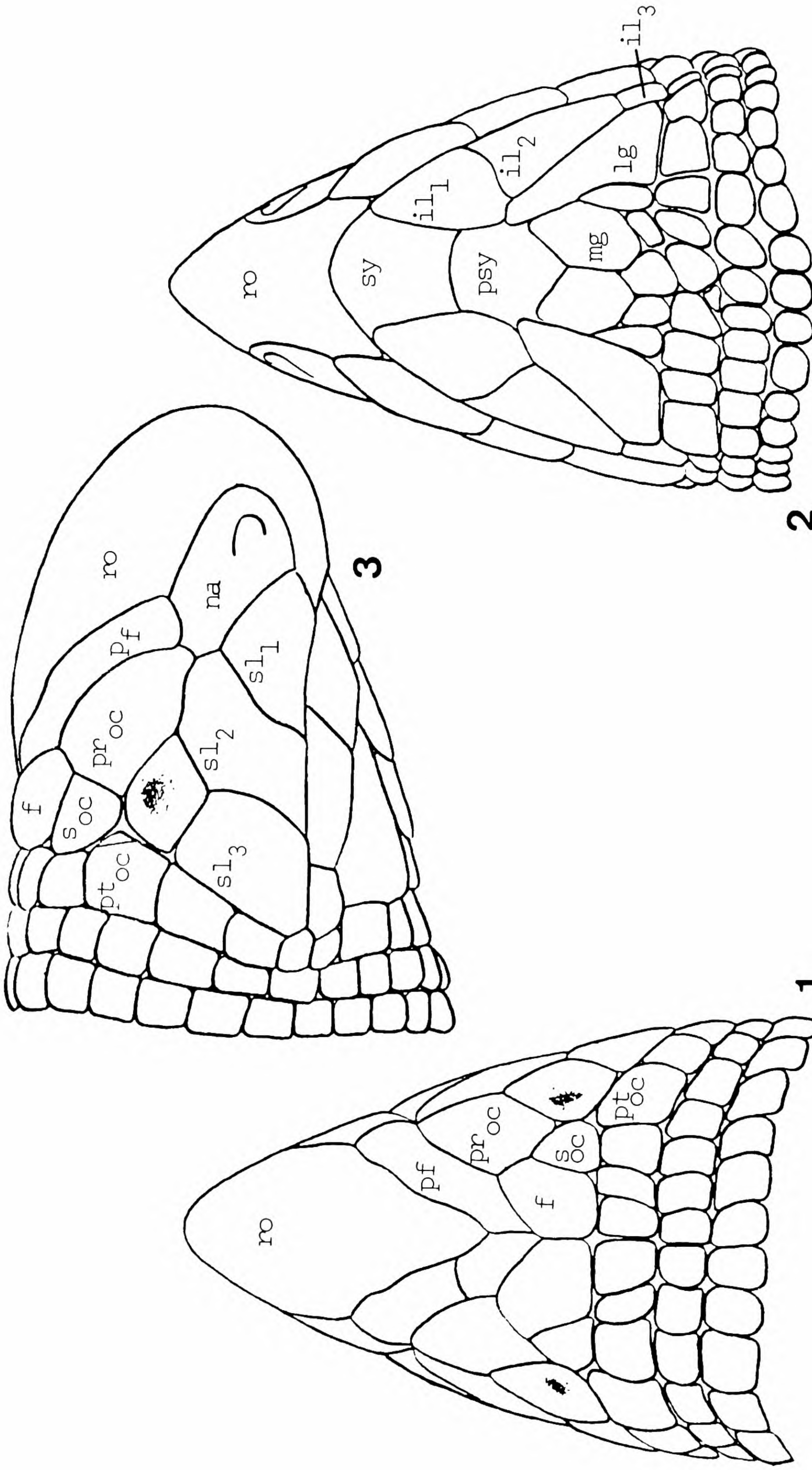
A small amphisbaenid (maximum total length 250 mm), body stocky, short-tailed, head laterally compressed, a little narrower than the body. Rostral scale high, arcuate, forming a cutting edge, variously keratinized. Mandibular symphysis reaching the level of the nostril. Lateral sulci apparent. Dorsal sulcus varying from entirely obsolete to well-expressed. Ventral sulcus inconstant. Tail cylindrical to the autotomy level, clavate behind that. Tip of tail rounded. Body annuli 214-244, with frequent irregularities. Tail annuli 15-23. Dorsal segments (12-19), narrow, ventral (14-22) squarish, all reasonably well aligned. Preanal pores usually four, contiguous, in some cases inapparent, if visible varying from slight impressions to small but well defined and pigmented orifices.

Description (Figs. 1-3)

Rostral very large, arcuate, with prominent cutting edge, reaching dorsally the level of the eye, its hind margin roughly parallel to the edge, variously but never much indented. Supporting the rostral from behind two arches of scales. The anterior one abuts in front and below against the upper half of the nasal. It is constituted by up to 3 elements, that may be all fused in a single prefrontal. The uppermost scales touch or closely miss each other on the midline; they may be fused there. The second arch supporting the rostral begins behind in a large polygonal, salient scale, that may be called a frontal, in front of which there are usually two polygonal scales, in the position of pre-and supra-oculars. These scales may be occasionally fused or split. Ocular irregularly polygonal; the eye appears as a diffuse spot. Nasals narrow and elongate; nostril pierced near the front edge. Three large supralabials, the first the longest, the second the highest. The first labial is more or less coterminous with the nasal; the second supports the preocular; the ocular rests on the angle between the second and the third supralabials. Behind the latter a row of scales, not showing on the top differentiated parietals or occipitals, but including a large polygonal scale in the position of a postocular; under this a vertical row of three segments, continuing behind the third labial as a body annulus.

Symphysial anvil-shaped, squarish. Post-symphysial pentagonal, often irregular. Three infralabials, the second the largest. Genial region extremely variable. On one extreme a regular pattern of normally shaped medial and lateral genials, followed by a row of 8 post-genials; fusions and splittings are frequent, however.

Lateral body sulci consisting, as usual in amphisbaenids, of a succession of X-shaped wrinkles, beginning between the 15th and 30th body annuli and extending to the last body annulus. A dorsal sulcus is not apparent in about one fifth of the specimens examined. When present it consists of irregularities on the edges of the median segments; in fact, it is never a proper sulcus. The ventral



Figs. 1 - 3. Head of *Anops kingii*, after Dely (1970). f, frontal; il1, il2, il3, infralabials; lg, lateral genial; mg, median genial; na, nasal; pf, prefrontal; pr oc, preocular; psy, postsymphysial; pt oc, post-ocular; ro, rostral; sl1, sl2, sl3, supralabials; soc, supraocular; sy, symphysial.

sulcus, absent in one half of the specimens, is, when present, similar to the dorsal one. The conditions of the two sulci are not statistically associated.

Body annuli 214-244, with many irregularities, especially incomplete annuli and spiral confluences. Dorsal segments 12-19, longer than wide. Ventral segments 14-22, squarish. Preanal pores usually 4, widely variable in expression, from very slight impressions to definite rounded, pigmented orifices. In one specimen, and in cases in the literature, no pores could be discerned. The anal flap is composed of 6 scales in palisade. The posterior rim of the anus has 10-12 scales, larger on the middle.

Tail cylindrical to the autotomy level (in all specimens examined the seventh annulus) which is irregular in extent and outline. Distally the tail is moderately but distinctly clavate; the tip is round, smooth or segmented.

There are mentions in the literature of the presence of white spots on the snout and tail. I saw none. All my specimens were gray, somewhat darker on the dorsum, as if countershaded.

Distribution

Data are abundant in the literature on the occurrence of *Anops kingii*. A few, however, are either clearly unreliable or at least suspect, and have been excluded from present consideration. The worst is Ruschi (1966), a paper that should be expunged from the literature (Vanzolini, 1978: 217). Bertoni (1913) is another irresponsible list (Vanzolini, 1978: 24).

"Buenos Aires" and "Montevideo" have meant, in the XIX Century, either actual localities or shipping ports. Fortunately, there are reliable mentions of both localities, and the questionable references may be dismissed without harm.

Finally, the sufficiency of precise data makes unnecessary the use of references restricted to administrative units (provinces, departments) only.

The following papers (besides of course Gans & Rhodes, 1964) contain specific and reliable information on localities of *Anops kingii* and have been used here.

Argentina: Berg, 1884 (Prov. Buenos Aires); Burmeister, 1861 (Entre Rios); Daciuk & Miranda, 1980 (Chubut); Dely, 1970 (Córdoba); Freiberg, 1939 (Entre Rios); Gans & Rhodes, 1964 (general); Gallardo, 1966 (Buenos Aires; La Pampa), 1970 (Buenos Aires), 1971 (Chubut); Gallardo, Miranda & Tio-Vallejo, 1987 (Entre Rios); Gallardo, Tio-Vallejo & Miranda, 1985 (Santiago del Estero; Chubut); Hellmich, 1960 (Santa Fé); Montero, 1994 (Rio Negro); F. Müller, 1885 (Buenos Aires); Orrego, 1971 (La Pampa); Strauch, 1881 (Entre Rios; Córdoba); Vega & Bellagamba, 1990 (Buenos Aires); Williams & Winchmann, 1989 (Buenos Aires); Montero, 1996 (a full compilation).

Brasil (all in the state of Rio Grande do Sul): Hensel, 1868; Strauch, 1881; Boulenger, 1887; FZB, 1976; Gans & Rhodes, 1964; Lema & Fabián-Beurmann, 1977; Lema, Vieira & Araujo, 1984; Strauch, 1881.

Uruguay: Lema & Fabián-Beurmann, 1977; Vaz-Ferreira, 1956; Vaz-Ferreira & Sierra de Soriano, 1960.

All localities taken into account for the preparation of the map are listed on the Appendix.

Type locality

The matter of a definite type locality for *Anops kingii* would (or perhaps will) be relevant only in the event of a study of geographical differentiation, which is not the present case. Thus I am making no formal recommendations, only assembling the available evidence.

Bell (1835: 391) states unambiguously that the type and then only specimen of *Anops kingii* had been collected in South America (no further data) by the "indefatigable Captain King". This is beyond doubt Captain Philip Parker King, R.N., F.R.S., who participated signally in the geographical exploration of the southern coasts of South America undertaken by the English Admiralty in the early XIX Century.

King might have collected the specimen while an officer of the *Beagle*, commanded by Capt. R. Fitzroy and having as naturalist the young Charles Darwin, or when commanding himself the *Adventure*, on the same enterprise. The *Beagle* reptiles were published by Bell (1843); there is no mention of *Anops*. The collections made by the *Adventure* were not the subject of a specific report. There is, as an appendix to the narrative of the voyage (King, 1839), a list of mammals, birds and shells collected; no reptiles are mentioned. We are forced, thus, to have recourse to the narrative itself in order to find out where, in the range of *Anops kingii*, Capt. King might have made a landing during his explorations.

In Brasil *Anops kingii* occurs only in inland Rio Grande do Sul. There King never was, his only Brasilian ports having been Rio de Janeiro, Santos and Florianópolis, all well outside the area of occurrence. In coastal Argentina the southernmost record of *Anops kingii* is Punta de Lobos, in Chubut, at 43° 47' S. The northernmost point touched by the *Adventure* was Puerto Santa Elena (44° 32' S, 65° 21' W), a stop on the way to the Strait of Magellan. Coastal Argentina seems also out of question.

In Uruguay, on the contrary, there were many oportunities for collecting the animal, that is common there. Montevideo was used as a revictualling base (King, 1839: 105, 107, 189) and geographical exploration was conducted for one month (King, 1839: xix) on the coast between Cabo Santa Maria (34° 40' S, 54°

10' W) and Montevideo, including Isla Gorriti (34° 57' S, 54° 58' W), in front of Maldonado, where astronomical observations were made (King, 1839: 189).

It thus seems that should a definite type locality be needed for *Anops kingii*, it should be selected in coastal Uruguay, between Cabo Santa Maria and Montevideo. This is how far I find it sensible to go at present.

Anops bilabialatus Stimson, 1972

Anops bilabialatus Stimson, 1972: 205, figs. Brasil: Mato Grosso: Base Camp of the Royal Society-Royal Geographical Society Xavantina-Cachimbo Expedition (12° 49' S, 51° 46' W).
Anops bilabialatus, Gans & Mathers, 1977: 36. Key.
Anops bilabialatus, Kluge, 1984: 4. List, one paratype in Michigan.
Anops bilabialatus, Vanzolini, 1981: 257. List.

Comments

The original description of *A. bilabialatus*, based on 5 specimens from one locality, has been to date the only substantive contribution to its knowledge.

Stimson (1972: 211) states that the name is derived from the "new Latin" word *labiala*. This word in fact does not exist, but the name, in all its awkwardness, is still valid under the provisions of the International Code of Zoological Nomenclature.

Diagnosis

A small to medium-sized amphisbaenid (maximum total length 390 mm); body moderately slender, head laterally compressed, a little narrower than the body. Rostral scale high, arcuate, forming a cutting edge, more or less keratinized. Mandibular symphysis reaching the level of the suture between prefrontal and nasal.

Lateral and ventral sulci present. A short anterior dorsal sulcus, disorganized, at times contracted into a low crest.

Tail cylindrical to the level of the autotomy annulus (seventh), from then on moderately clavate. Tail tip a blunt process, vertically elongate. Autotomy level marked by an incomplete ventral annulus, between the 7th and 8th tail annuli.

Preanal pores none or two, variable in expression, separated by four segments.

Body annuli 354-372, with frequent irregularities; tail annuli 15-17.

Dorsal segments to a midbody annulus 12-16, ventral segments 16-20.
Description (Figs. 4-6)

In spite of many significant differences, the general plan of head scutellation of *A. bilabialatus* is very similar to that of *A. kingii*. In general there are in the former fewer and relatively larger scales, but their relationships and mechanical functions are clearly the same.

Rostral supported behind by the prefrontals which are very large, occupying most of the side of the head, in contact on the midline, not fused in the specimens seen. Frontals small but distinct, oblong, placed between the prefrontals and a subsequent row of scales, made of four median squarish elements in contact with the frontals, and, laterally, of a series of elongate vertical scales, behind the ocular and the labials, variously divided, continuing ventrally into the row of post-genials. This row of scales, which I call the post-frontal annulus, separated from the next one by a deep sulcus, lined with wrinkled skin (not proper granules), ending a little below the level of the angle of the mouth. Ocular scale very small, sub-triangular, fitting between the prefrontal, the second supralabial and the post-frontal annulus. Eye inapparent. The only other scale on the face is the nasal, which deeply indents the rostral, rests on the first supralabial and narrowly meets the second one. Nostril pierced well in front. Supralabials two, the second by far the largest. Symphysial somewhat irregular, with small anvil-shaped processes. Postsymphysial elongate, pentagonal, also somewhat irregular, narrowly meeting the first infralabial in front. Genials, medial and lateral, rather regular. One single post-genial row, merging into the post-frontal annulus.

Dorsal segments squarish, ventral ones a little wider. Longitudinal sutures approximately but not precisely aligned. Lateral sulci normal for amphisbaenids, shallow, consisiting of a succession of X-shaped wrinkles, beginning at the level of body annulus 70 extending to the last body annulus. Ventral sulcus simply a sharp angle along the line of median segment sutures. The dorsal sulcus may appear only as a short sequence of misaligned irregular segments, or this area may be raised (probably by muscular contraction) in a sort of low crest, some 10 annuli long.

The large button on the tip of the tail is not segmented.

Preanal flap formed by 10 segments, the central pair largest. Post-anal rim formed by 15-17 segments, squarish on the middle, becoming wrinkled on the sides.

Hemipenis

One mutilated specimen, MZUSP 81776, has had the hemipenis almost

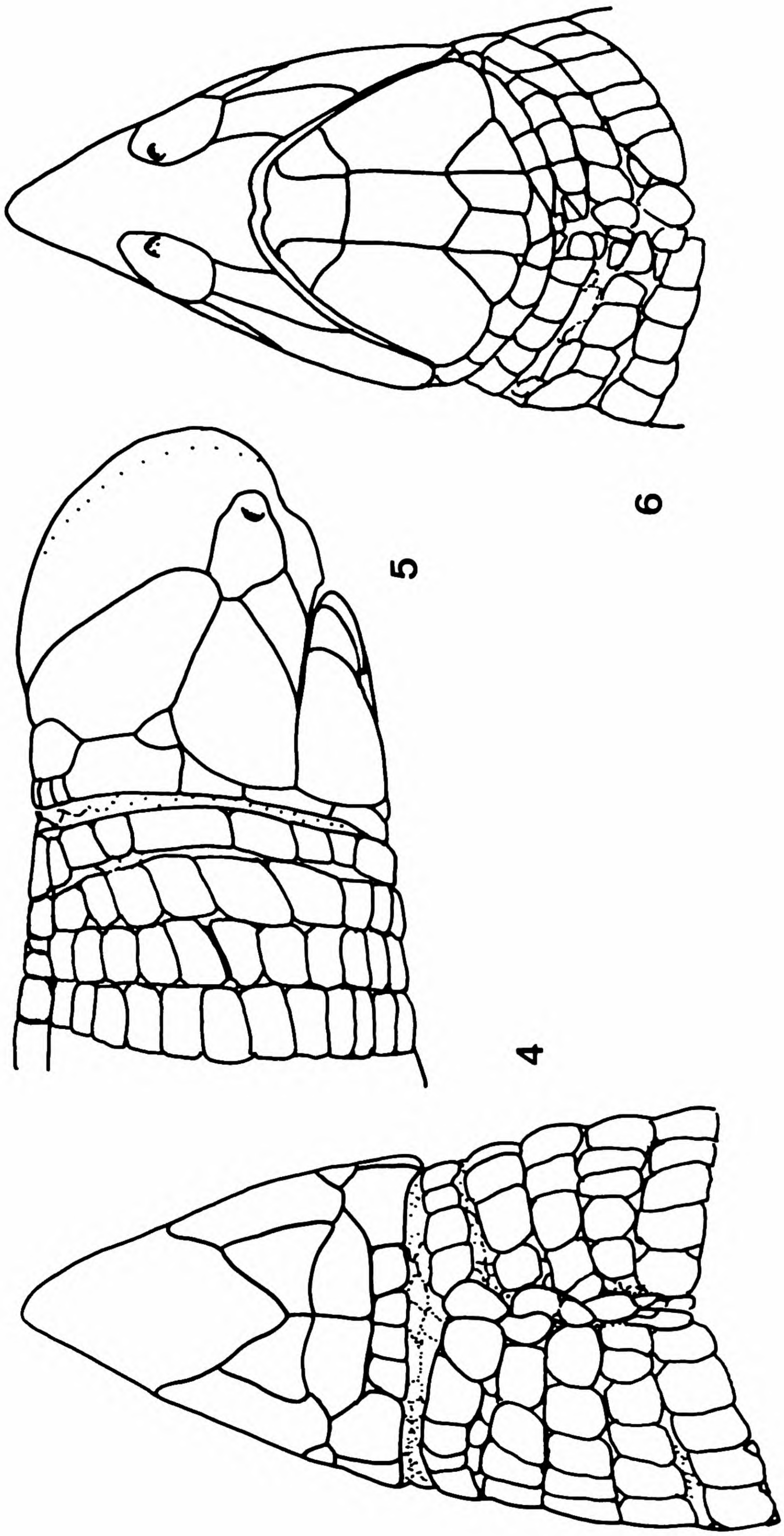


Fig 4 - 6. Head of the holotype of *Anops bilabialatus*.

fully everted by the collector. It has the cylindrical base and the bilobed apex of the amphisbaenids. The terminal lobes are relatively longer than in the other forms figured. They are confusedly wrinkled, and definitely lack the papillae described by Rosenberg (1967) for *A. kingii*.

Ecology

It would be futile to generalize on the ecology of a fossorial animal known from a handful of specimens. On the other side, given the very difficulty of direct observation, it is advisable to set down the available information. In the specific case of *A. bilabialatus*, it is known from two localities about 360 km apart (Plate 2), but differing little in latitude; a comparison of their ecological features is likely to be rewarding.

All our specimens were collected inside forest, in a large (ca. 5,000 m^2) quarry, at 11° 30' S, 55° 07' W, some 25 km west of the town of Claudia, where a thick bed of hardpan (laterite, plinthite) was being strip-mined for use as gravel (Plate 1). The animals were exposed by a tractor removing the overburden, about 1.5 m deep; this of course caused mutilations.

In broad geographical terms, the locality lies in an area that Projeto Radambrasil (1980) calls, in its highly idiosyncratic but nevertheless official

Plate 1. Quarry where *A. bilabialatus* was collected. Photo by Myriam E.V. Calleffo, (Instituto Butantan), July 1997.

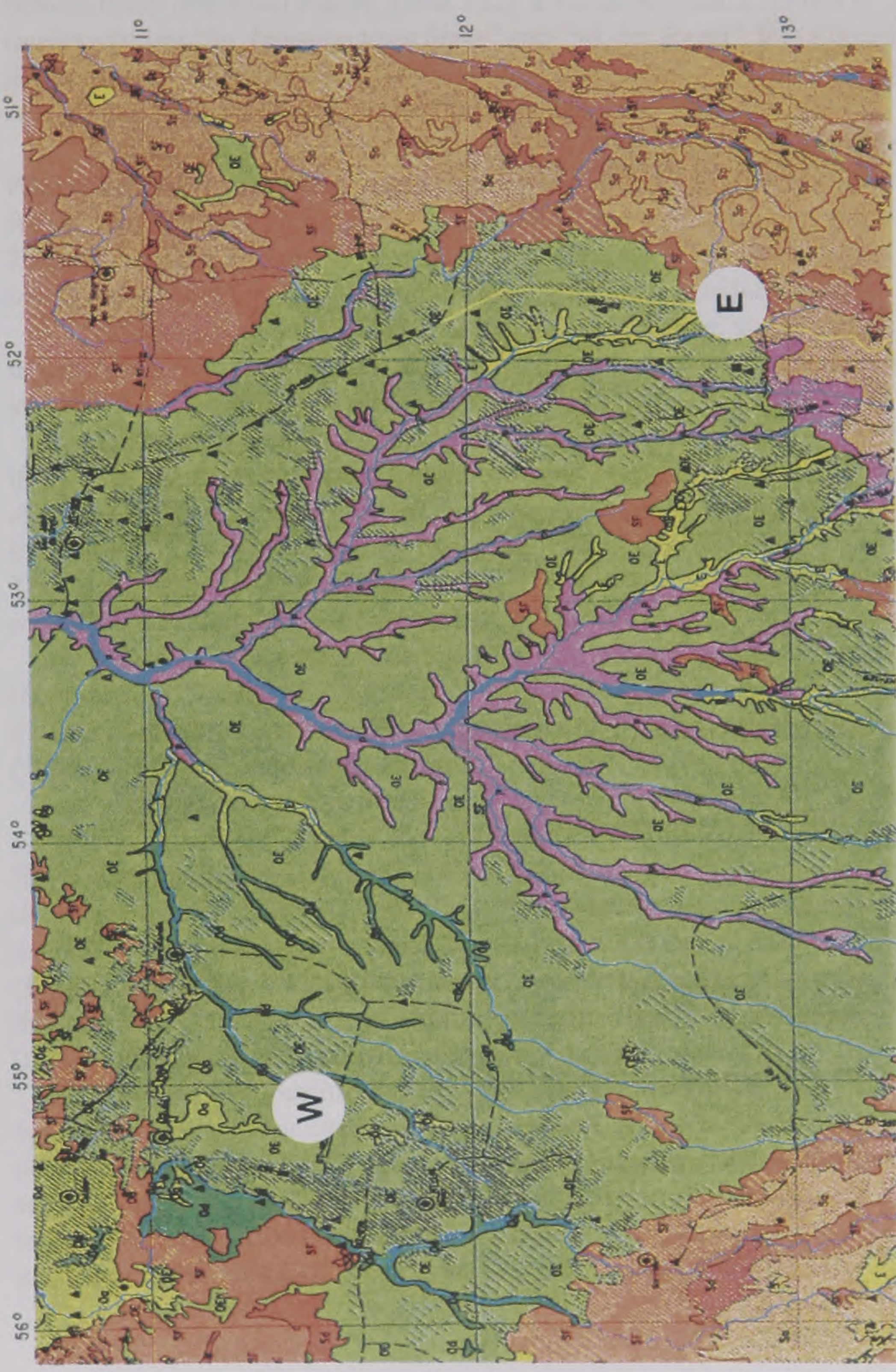


Plate 2. The two localities of *Anops bilabialatus* ont he background of the plant formation (adapted from Projeto Radam Brasil, 1980, 1981). E, the type locality, W, the new one.

Cerrados of diverse sub-type

Amazonian-type forests

Seasonal (mesophyl) forests

Pioneer (river bottom) forests

Areas of ecological tension

Cerrado/forest

Amazonian/seasonal forests

Cerrados/seasonal forests

Plate 3. Key to Plate 2.

terminology, "contato floresta ombrófila/floresta estacional". In an alternative nomenclature (Pires and Prance, 1980: 112), it would be called a contact between forests of types "3a, forest on terra firme" and "5d, dry forest". It is a broad belt geographically intermediate between the morphoclimatic domains of the Amazonian hylaea and the Central Brasilian cerrados (Ab'Saber, 1977).

The locality proper is within a large (ca. 64,000 km2) area identified in Projeto Radambrasil's (1980) vegetation map and text (p. 352) as semi-deciduous forest with emergent trees, growing on yellow-red clayey soils of the Upper Tertiary Araguaia Formation. Rizzini & Heringer (1962: 35) describe this type of vegetation as "floresta seca semidecídua" (dry semi-decidous forest).

Bringing together the information in the literature, some preliminary botanical data of our own group and principally my personal observation of the site, the forest there may be characterized as follows:

There are two distinct strata (stories), the upper one pierced by emergent trees. This upper story constitutes the canopy, about 20-25 m high; average diameter of the tree trunks is ca. 20 cm; there are scattered deciduous trees. The lower story is constituted mainly by young individuals of the canopy species. The emergent trees (*Bertholletia excelsa*, Brasil nut, is prominent) may reach over 40 m in height; their average diameter is about 56 cm.

There is a conspicuous scarcity of palms. Among species to be expected there are no *Orbignya* ("babaçu"), *Oenocarpus* ("bacaba") or *Jessenia* ("patauá"). *Euterpe oleracea* ("açaí da terra firme") is also absent and *Mauritia* ("buriti") scarce even on hydromorphic soils.

The type locality of *A. bilabialatus*, a base camp of the British "Xavantina-Cachimbo Expedition" (undertaken in 1967 jointly by the Royal Society and the Royal Geographical Society), at 12° 49' S, 51° 46' W, falls, in the vegetation map of Projeto Radambrasil (1981), exactly on the contact between cerrado ("savanna") and seasonal semi-deciduous forest. The area proper is described by Ratter et al. (1974) and by Askew et al. (1970a, b, c). It is clear that we have here essentially the same type of forest as in the Claudia region, growing on "sandy clayey loams" (Askew et al., 1970 a: 225); that is, again, not on sandy soils.

Thus the two localities of *A. bilabialatus* are in areas of contact between vegetation zones; in one case, rain forest/seasonal semi-deciduous forest, in the other cerrado/seasonal semi-deciduous forest. The element in common is the seasonal semi-deciduous forest; the forest at the quarry in which we collected the species, as described above (Plate 1), is decidedly of this type. I take this to be the preferred habitat of *Anops bilabialatus*; the alternatives are too extreme.

Biometrical notes

Meristic characters

On Table 1, I present the data on specimens in our collection, which complement those, much more numerous, of Gans & Rhodes (1964).

Body and tail annuli (Table 2). I have two sets of scale counts of *Anops kingii*, Gans & Rhodes's (1964) Table 1 and specimens in our collection. In the case of *A. bilabialatus* I used our specimens and Stimson's (1972) data.

A first caution taken was to check the eventual presence of geographic differentiation, which Gans & Rhodes (1964) touched upon in a somewhat impressionistic way. I assembled their materials in four fairly homogeneous geographical samples, similar in area and with a reasonable number of specimens each (Rio Grande do Sul, Uruguay, and the Argentinian provinces of Córdoba and Buenos Aires) and submitted the respective scale counts to an analysis of variance. In the case of body annuli, the result was equivocal: the analysis of variance proper indicated heterogeneity ($F= 9.136$ for 1 and 50 degrees of freedom, $p<.001$), but Tukey's test failed to discriminate among the samples. This is not an unusual situation, given the different sensitivities of the two tests (Zar, 1984). I think the prudent attitude is to take geographic differentiation as present (thus my attitude towards the type locality), and to avoid assembling specimens from disparate areas.

A second point checked was the appropriateness of combining Gans & Rhodes's (1964) and our own scale counts. Gans and Rhodes used in their revision 14 MZUSP (then "DZ") specimens, but these were not included in their Table 1. I cannot thus compare two independent counts of one same specimen, as it has been possible on other occasions (Vanzolini, 1997). Compatibility of scale counts must then be evaluated through comparison of geographic samples. I compared the data in theirs and ours Rio Grande do Sul samples (Table 2). In the case of both counts there was disagreement. In number of body annuli $t= 2.014$, for 46 degrees of freedom, a result on the threshold of significance: $t\,(.05) = 2.021$ for 40 d.f.. In the case of tail annuli, the difference was highly significant: $t= 3.7258$ for 43 d.f., $p<.001$.

It is thus clearly not advisable to combine Gans & Rhodes's (1964) and our data, even if the differences are not large, 1.5% of the combined mean in the first case and 7.2% in the second. For diagnostic purposes I use Gans & Rhodes's broadest ranges, 214-244 for body annuli, 15-23 for tail annuli.

As for *Anops bilabialatus*, Stimson and ourselves counted one same specimen, MZUSP 21276, the holotype. He counted 370 + 16 annuli, we counted 372 + 15; seems agreement enough.

Thus the difference in number of body annuli between the two species

TABLE 1. *Anops*, *MZUSP, measurements and scale counts.*

		Length		Head	Annuli		Segments	Pores
		body	tail	width	body	tail		
	Anops kingii							
6407	Rosario, RS	155	17	3.5	234	20	14/16	4
6589		134	14	3.0	235	19	12/16	4
6590		-	-	-	232	19	-	4
6625		160	18	3.1	226	20	14/16	4
6627		152	-	3.1	231	20	14/16	4
6628		147	-	3.5	234	(8)	14/16	4
6629		156	17	3.6	225	19	16/16	4
6630		161	21	3.7	230	20	14/16	4
6631		132	15	3.5	227	19	12/16	4
6678		145	-	3.1	227	(8)	12/14	4
6679		103	10	-	231	21	16/16	4
6658	São Leopoldo, RS	182	19	4.0	230	19	16/16	4
12239		145	16	3.9	227	19	16/18	4
12240		251	22	4.2	222	19	18/16	4
3253	Porto Alegre, RS	147	17	3.6	222	19	14/16	4
60457		205	22	4.0	227	19	16/18	-
60458	Viamão, RS	-	-	-	221	19	13/16	4
60459		-	-	-	221	19	13/16	4
1276	Rio Grande do Sul	168	20	3.5	220	20	16/16	5
	Anops bilabialatus							
21276	Holotype	250	15	3.3	370	15	17/30	2
21277	Paratype	-	-	-	-	-	17/18	2
81776	Claudia, Mt	-	-	-	-	17	-	-
81777	Claudia, Mt	307	20	4.0	354	16	15/17	2

of *Anops* is enormous: 354-372 against 214-244, a minimum gap of 128 annuli. Among the 48 species of *Amphisbaena* occurring in South America, the difference between the highest count I have (*A. plumbea*, 282) and the lowest (*A. silvestrii*, 151) is 131, the same magnitude.

The number of tail annuli is not diagnostic.

Segments to a midbody annulus. This, generally one of the strong props of amphisbaenid systematics at the species level, shows itself very feeble in *Anops*. The general morphology of the annuli is very irregular, and this includes the segments.

I tried several statistical approaches on Gans & Rhodes's (1964) data and came out with practically nothing useful: only that there exists a significant positive correlation (r^2=.60) between the number of ventral and dorsal segments, and that the latter number is on the average 4 more than the former. As ranges, we may take 12-19/14-22 for *A. kingii* and 16/20 for *A. bilabialatus*, a datum at present not important.

Body proportions

In the study of amphisbaenid systematics I have found very useful a consideration of body shape, which is obviously associated with fossorial life and shows different degrees of advancement in this respect. In the present exercise, the more relevant, and tractable, characters are the regressions of tail length on total length and of head width (a proxy for body thickness) on total length. In practice, when a sufficient number of specimens with intact tails is not available (as in the present case), the regression of head width on body length has to suffice.

Tail length (Table 3, Graph 1). I have used the measurements of our specimens, as well as those published by Gans & Rhodes (1964). Initially I computed separate regressions for Gans & Rhodes's data and for our own; they closely agreed, and a joint regression was computed and used in further comparisons.

To broaden the context I introduced into the comparisons three similar sized species of *Amphisbaena* (data from Vanzolini, 1996).

From Graph 1 it easy to see that the two species of *Anops* are shorter-tailed than the species of *Amphisbaena* with which they are compared, and that *A. bilabialatus* has by far the shortest tail.

Head width. In the genus *Amphisbaena* this is a fine morphometric character, an excellent proxy for body girth (the animals being practically cylindrical), and representing besides the first point of attack of the animal on

TABLE 2. Scale counts, statistics of the distributions of frequencies.

		N	R	M	s	V
Body annuli						
A. kingii						
Gans & Rhodes,	all	58	214-244	225.7 ± 1.04	7.9	3.5
	RS	31	215-238	224.5 ± 1.03	5.7	2.6
MZUSP, RS		19	220-235	227.4 ± 1.08	4.7	2.i
A. bilabialatus		6	298-372	351.3 ± 10.97	26.9	7.7
Tail annuli						
A. kingii						
Gans & Rhodes,	all but RS	40	18-23	19.5 ± 0.20	1.2	6.3
	RS	29	15-20	18.2 ± 0.25	1.3	7.4
MZUSP, RS		16	19-21	19.6 ± 0.18	0.7	3.7
A. bilabialatus		6	15-17	16.0 ± 0.26	0.6	4.0

N, individuals in sample. R, range. M, mean ± its standard deviation. s, sample standard deviation. V, coefficient of variation.

TABLE 3. Body proportions, statistics of the regressions

Tail length x body length	N	R (x)	R (y)	b	a	F	r^2
Anops kingii							
Gans & Rhodes	71	102-223	11-26	0.11 ± 0.0042	-0.06 ± 0.420 ns	712.804***	0.9117
MZUSP	10	103-205	10-22	0.13 0.0165	-1.99 1.144 ns	57.206***	0.8782
Joint	81	102-223	10-26	0.11 0.0040	-0.19 0.389 ns	770.993***	0.9071
A. bilabialatus	5	131-307	10-20	0.05 0.00070	2.30 1.5973	61.077***	0.9532
Head width x body length							
Anops kingii MZUSP	14	103-205	3.0-4.3	0.0088 0.00018	2.16 0.084***	231.645***	0.9507

N, individuals in sample. R(x), R(y), ranges of the variables. b, coefficient of regression (slope). a, regression constant (intercept). F, Fisher's (significance of the regression. r^2, coefficient of determination.

the substrate. Not quite so in *Anops*, whose head is a little narrower than the anterior part of the body. Anyway, it is a good character inside the genus, and coincidentally, turned out to be interesting from a higher viewpoint: *Anops kingii* (Table 3, Graph 2), has a relatively thicker head than any of the forms with which it was compared. It is apparently a clumsy creature. *Anops bilabialatus* has the narrowest of all heads, which probably places its body girth approximately on a par with the amphisbaenas.

In conclusion it must be said that the differences in body proportions between the two species of *Anops*, although not reaching the proportions of the difference in number of body annuli, are still remarkable.

Comments

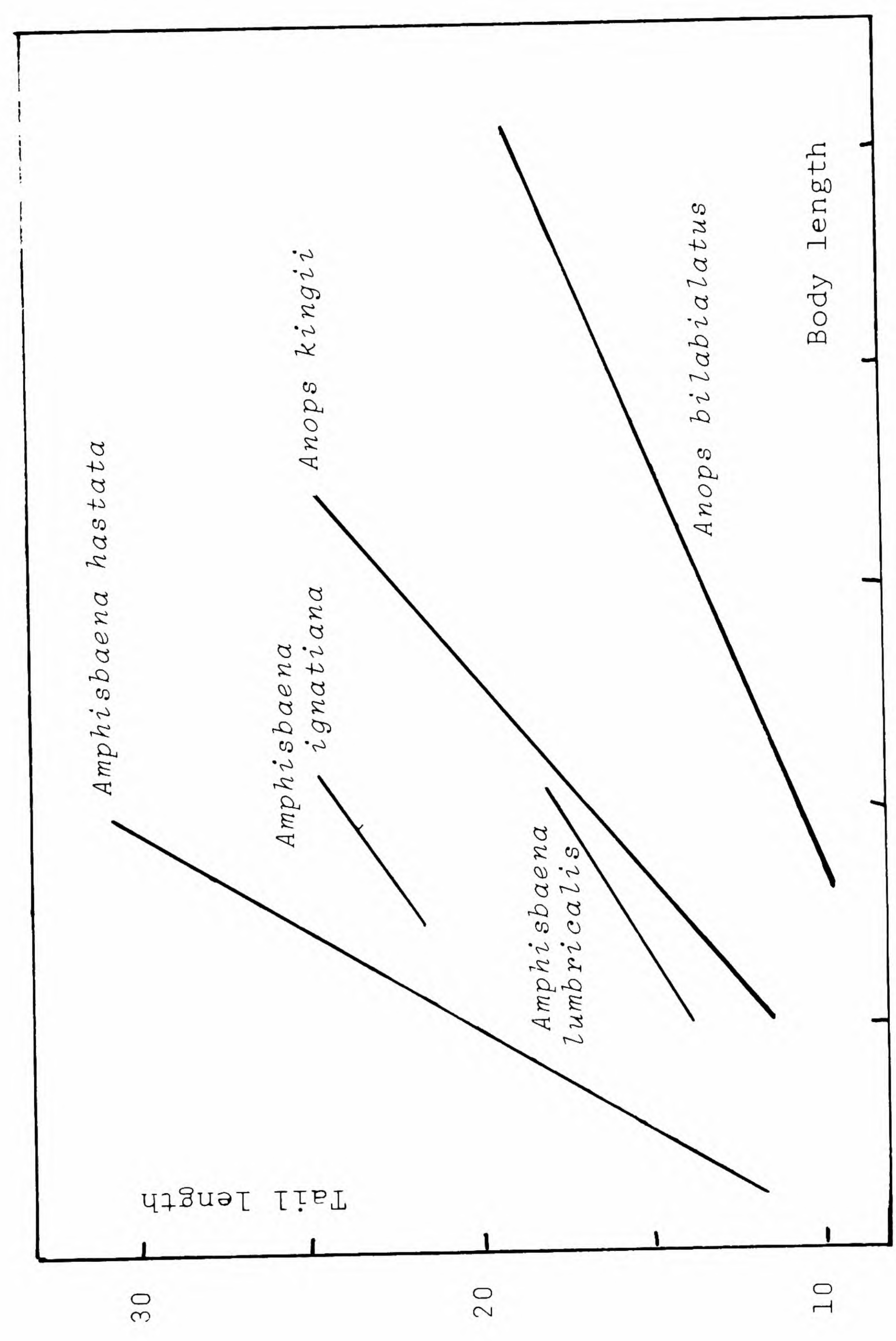
The following comparisons are made with the only intention of better understanding the genus, since there is no problem in telling apart two species which differ enormously in number of body annuli and also in number of supralabials. Additionally, then:

A. bilabialatus is assuredly a larger species. It reaches 390 mm maximum length, while none of the close to one hundred specimens of *A. kingii* measured surpasses 250 mm. It is shorter-tailed than *A. kingii* and than the slender amphisbaenas with which it has been compared. At the generic level there is no shared biometrical feature between the two *Anops* that would differentiate them from similar-sized *Amphisbaena*.

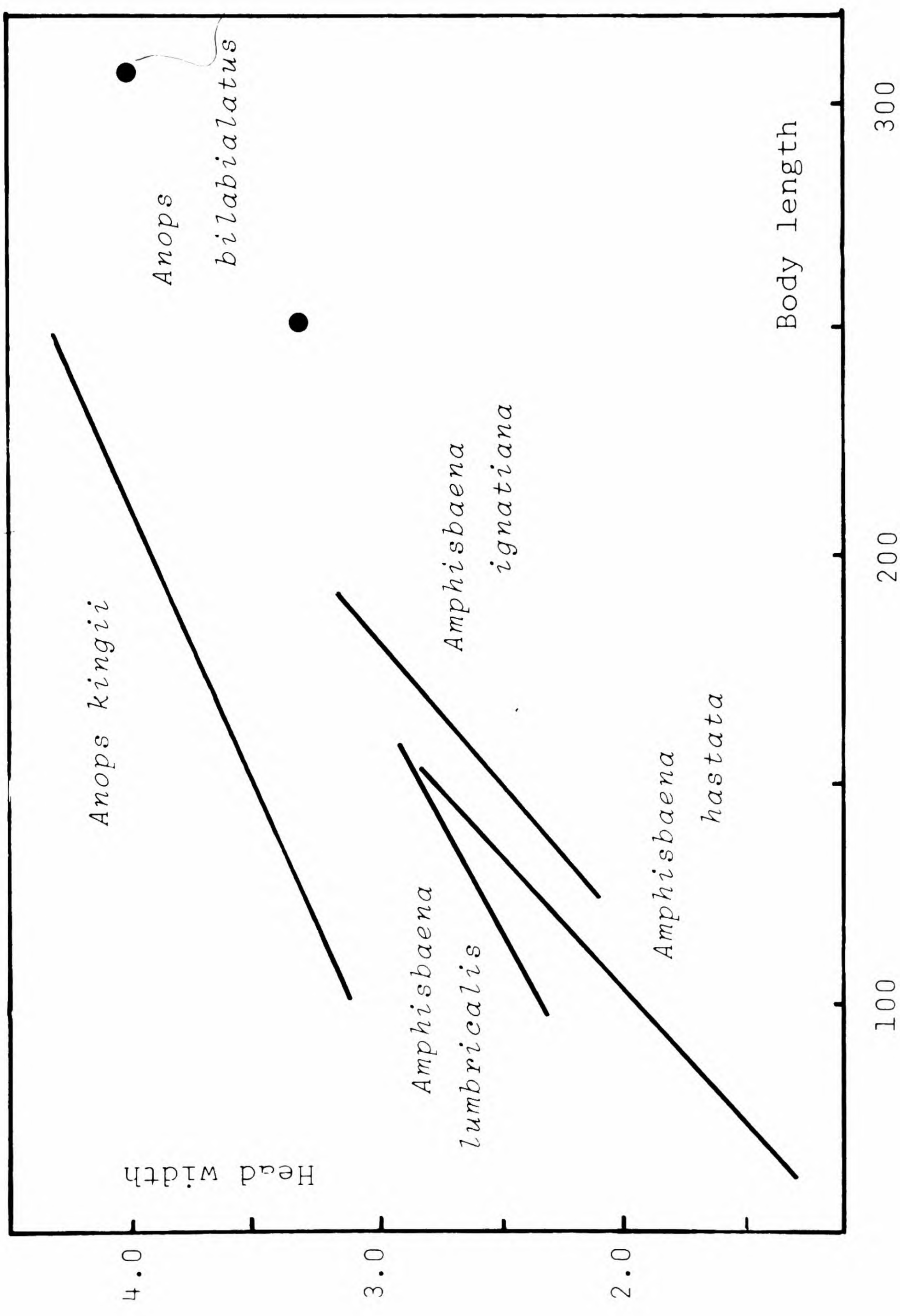
With regard to scutellation, the pattern of head shields is of primary importance. Of course one has to start with the outstandingly produced rostral, which has from the beginning served to diagnose the genus. There are interesting points of resemblance and disagreement. Taking the rostral hatchet as the main determinant, the two *Anops* agree in the fashion in which it is shored up by the cephalic scales. This I consider a very important feature, as there are alternative mechanical solutions to the problem, as will be discussed below.

Among the differences, there is a reduction in the number of sutures in the head of *bilabialatus* (whence the reduction in the number of labials). This is somewhat surprising, because, being the larger species, it should be less dependent on reduction of friction on the attack surfaces of the head. I take this, together with the narrowness of the head and the peculiarities of the dorsal sulcus (below), to indicate that *bilabialatus* is the better fossorial machine.

Lateral sulci are a constant feature of amphisbaenids, presumably because they are involved in respiratory mechanics. They vary little, and the two present species do not differ in this respect.



Graph 1. Regression of tail length on body length: *Anops kingii*, *Anops bilabialatus* and three slender species of *Amphisbaena*.



Graph 2. Regression of head width on body length: *Anops kingii*, *Anops bilabialatus* and three slender species of *Amphisbaena*.

Dorsal sulci, in *Anops* restricted to the anterior part of the body, are involved in fossorial progression (Gans, 1968: 351, fig. 31). From this viewpoint, the two species of *Anops* are similar; the sulcus is actually an arrangement of segments permitting tunnel-extending and tunnel-widening strokes. The fact that in some specimens of *A. bilabialatus*, and never in *A. kingii*, the region is found contracted in a sort of low keel adds significance to the fact.

Ventral sulci, also functional in locomotion (Gans, 1974) do not differ in the two species, and are at times inconspicuous.

Speciation

I am at a loss to propose a plausible and parsimonious geographical scenario to explain speciation in the genus *Anops*, in spite of two species only being involved.

The main elements for consideration seem to be:

1. The two species show ample morphological differences, in number of body annuli, in body proportions and in hemipenial morphology.
2. Their ecological preferences are strikingly different.
3. Their areas of distribution are separated by approximately 1,800 km; this distance is unlikely to be reduced by further collecting, as both species as presently known reach practically the geographical limits of their preferred environments.

In fact, keeping in mind the independent evolution in Africa of hatchet-shaped rostrals, and the difference in hemipenial morphology, I think it prudent preliminarily to inquire whether convergence and not descent might explain the shared features of the two species.

Turning first to the characteres hitherto discussed, I find relevant information in the scutellation of the head. In *Baikia* (Loveridge, 1941: 368) there are behind the rostral two transverse pairs of scales, resting on two large supralabials. In *Ancylocranium* (Gans & Kochva, 1965: plates) there are two vertical rows of scales backing the rostral. These are very different designs from that found in the two *Anops*, in which two parallel arches of scales back the rostral, anchored on the body annuli.

Another pertinent element in the context is of course the morphology of the skull. Parker (1942: 57, fig. 7) distinguished the skulls of the three genera as follows:

Anops: "the whole skull laterally compressed with a median crest extending from the premaxilla to the occiput; premaxilla extending backwards, separating the nasals completely and the frontals anteriorly; extracolumella not dilated anteriorly".

Baikia: "The skull compressed anteriorly only, the median ridge extending from the premaxilla to the parietal only, the upper surface of the latter being quite flat; premaxilla small, the nasals forming a median suture; extra-columella not dilated anteriorly."

Ancylocranium: "The skull compressed anteriorly, only the parietal being flat above; nasals forming a median suture, compressed anterior elements of the skull forming a high crest which extends backwards over the parietal region as a pronounced hook; columella dilated anteriorly to form a large, thickened pad attached to the lower labial."

The skull of *A. kingii* (Fig. 8) is similar in general proportions to that of the species of *Amphisbaena* of the *darwinii* species group. It differs from all other South American amphisbaenians in having a median dorsal crest. The snout (not all the skull as said by Parker) is strongly compressed, and the ascending process of the premaxilla forms a keel, separating the nasals and, shortly, the frontals. This crest, slightly serrated, continues, less sharp, along the suture between the frontals. In the three skulls I saw the crest was pronounced but low, and did not extend beyond the frontals. In this my materials disagree, at least in degree, with Parker's. There is a bend at the level of the suture between maxilla and premaxilla, so that the dental plane of the latter is almost vertical, and its palatine process strongly bent. The frontals are elongate and have an anterior process inserted between the nasal and the premaxilla, almost reaching the nostril. The prefrontals are elongate, and indent the upper edge of the maxilla. In this fashion there are on the face four finger-like, interlocking processes, which add solidity to the snout.

The sphenoidal plate has distinct basipterygoidal angles; the pterygoids, rather wide to this level, become narrow and curve outwards to embrace the quadrates; their anterior medial process is short.

A. bilabialatus (Fig. 7) has a somewhat more compressed snout. Its median crest is more pronounced and more distinctly serrated than of *A. kingii*; the maxillo-premaxillary bend is less sharp. The frontals are decidedly shorter. Otherwise the agreement is good.

A. kingii has 5-7 premaxillary, 3-4 maxillary and 7 mandibular teeth. *A. bilabialatus* respectively 7, 3 and 6.

I think evidence from the skull is coherent with the other indications: the species markedly differ, but are certainly congeneric.

As to the matter of a scenario for speciation, I believe the best explanation that can be offered at present is that the two forms are end products of an old and complex radiation, accompanied by widespread extinction.

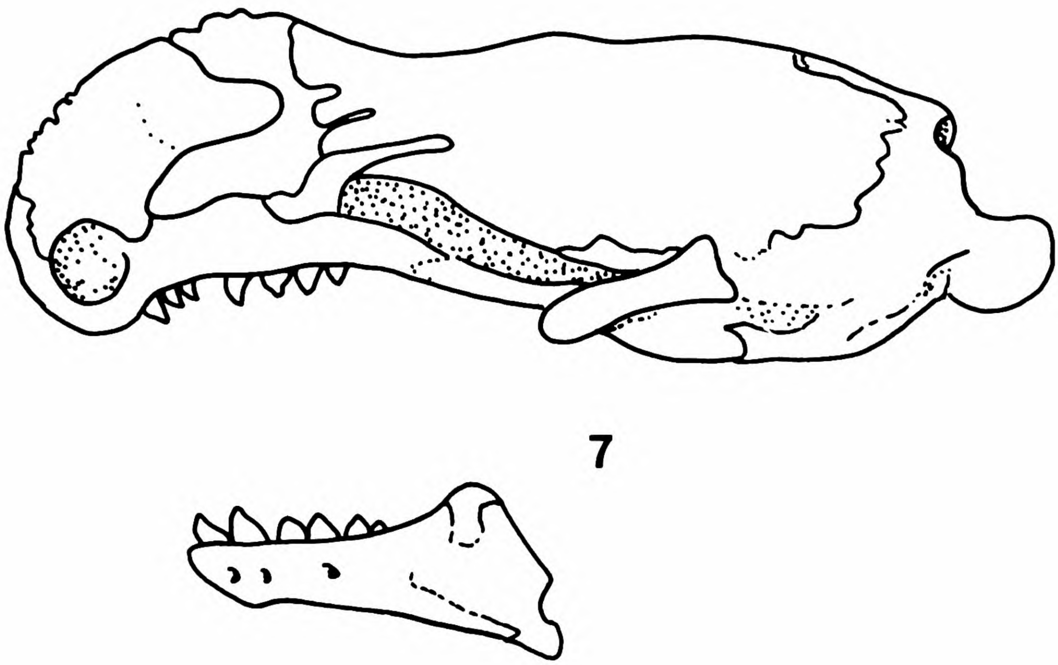


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Fig 7. Skull of *Anops bilabialatus*, MZUSP 82324.

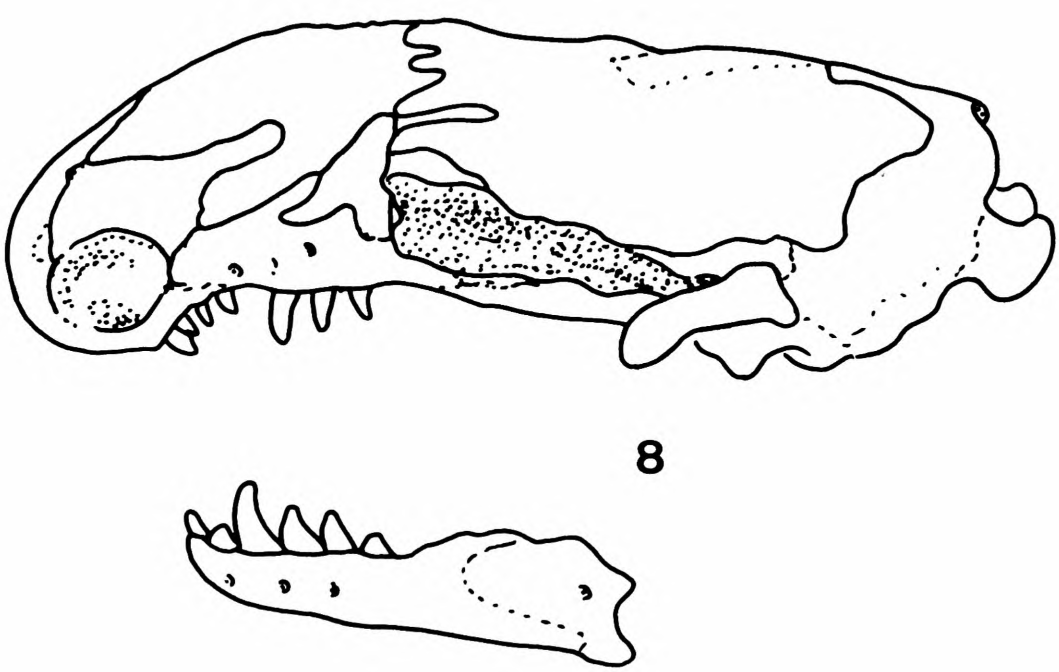

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Fig. 8 . Skull of *Anops kingii*, MZUSP 60457.

Generic definition

Snout laterally compressed, with a keel formed by the vertical process, of the premaxilla, which entirely separates the nasal bones. An angle between maxilla and premaxilla. Basiperygoid processes and partes posteriores choanarum absent. Quadrate rod-like. Premaxillary teeth 5-7, maxillary 3-4, mandibular 6-7; pleurodont. Rostral scute produced into a vertical blade. No differentiated segments on the body annuli.

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References

Ab'saber, A.N., 1977. Os domínios morfoclimáticos na América do Sul. Primeira aproximação. Geomorfologia (Inst. Geogr. Univ. S. Paulo) 52: 21 p.

Achaval, F., 1976. Reptiles, p. 26-29 in A. Langguth, Lista de las especies de vertebrados del Uruguay.

Achaval, F., 1987. Lista de las especies de vertebrados del Uruguay. Reptiles. Montevideo: Facultad de Humanidades y Ciencias. ii + 15 p.

Achaval, F., 1989. Lista de las especies de vertebrados del Uruguay. Parte 2: Anfibios, reptiles, aves y mamiferos. Montevideo. Facultad de Humanidad y Ciencias, 41'p.

Alexander, A.A. & C. Gans, 1966. The pattern of dermal-vertebral correlation in snakes and amphisbaenians. Zool. Med. Leiden 41 (11): 178-190.

Amaral, A., 1938. Estudos sobre lacertilios neotropicos. 4. Lista remissiva de lacertilios do Brasil. Mem. Inst. Butantan 11 (1937): 167-204.

Askew, G.P., D.J. Moffatt, R.F. Montgomery & P.L. Searl, 1970. Soil landscapes in north eastern Mato Grosso. Geogr. J. 136 92): 211-227.

Askew, G.P., D.J. Moffatt, R.F. Montgomery & P.L. Searl, 1970. Interrelationships of soils and vegetation in the savanna-forest boundary zone of north-eastern Mato Grosso. Geogr. J. 136 (3): 370-376.

Bell, T., 1833. "Mr. Bell exhibited specimens of two *Reptiles*, forming part of his collection, which he regarded as the types of two genera hitherto undescribed" Proc. Zool. Soc. London 1833 (1): 98-99.

Bell, T., 1835. Description of a new genus of the family of the Amphisbaenidae. Zool. J. 5: 391-393.

Bell, T., 1842-1843. Zoology of the voyage of H.M.S. Beagle. Part V. Reptiles. London: Smith and Elder. vi + 51 p, atlas.

Berg., C., 1884. Reptiles, in C.L. Holmberg, Viajes al Tandil y a La Tinta. Act. Acads. Cordova 5: 93-96.

Bertoni, A. W., 1913. Fauna Paraguaya. Catálogos sistemáticos de los vertebrados de Paraguay, 86 pp. in M.S. Bertoni (Helvetius), Descriptión física y económica del Paraguay. Asunción.
Birabén, M., 1953. El ojo anópsico de Anfisbénidos argentinos. Physis 20 (59): 390-396.
Bocourt, M.F., 1882. Livraison 8, p. 489-528, in A. Duméril, M.F. Bocourt and F. Mocquard, Mission scientifique au Mexique et dans l'Amérique Centrale ... Recherches zoologiques. Troisième partie. Première section. Études sur les Reptiles. (See Vanzolini, 1977: 115).
Boulenger, G.A., 1885a. Remarks on a paper by Prof. E.D. Cope on the reptiles of the Province Rio Grande do Sul, Brazil. Ann. Mag. Nat. Hist. (5) 16: 294-298.
Boulenger, G.A., 1885b. Catalogue of the lizards in the British Museum (Natural History). Second edition. Vol. 2. London: Trustees of the British Museum. xiii + 497 p., pls.
Boulenger, G.A., 1885c. A list of reptiles and batrachians from the Province Rio Grande do Sul, Brazil, sent to the Natural-History Museum by Dr. H. von Ihering. Ann. Mag. Nat. Hist. (5) 15: 191-196.
Boulenger, G.A., 1886. A synopsis of the reptiles and batrachians of the Province Rio Grande do Sul, Brazil. Ann. Mag. Nat. Hist. (5) 18: 423-445.
Boulenger, G.A., 1887. Catalogue of the lizards in the British Museum (Natural History). Second edition. Vol. 3: xii + 575 p. London: Trustees of the British Museum.
Brygoo, E., 1990. Les types d'Amphisbaenidés, Pygopodidés, Xantusiidés (Reptiles, Sauriens) du Muséum National d'Histoire Naturelle. Catalogue critique. Bull. Mus. Nat. Hist. Nat. Paris (4) 12 (A) 3-4, suppl.: 3-18.
Burmeister, H., 1861'. Reise durch die La Plata Staaten mit besonderer Rücksicht auf die physische Beschaffenheit un den Culturzustand der Argentinische Republik. Ausgeführt in den Jahren 1857, 1858, 1859 und 1860 ... Vol. 2, iv + 538 p. Halle: W. Schmidt.
Burt., C.E. & M.D. Burt, 1930. The South American lizards in the collection of the United States National Museum. Proc. U.S. Nat. Mus. 78 (6): 1-52.
Burt., C.E. & M.D. Burt, 1931. South American lizards in the collection of the American Museum of Natural History. Bull. Amer. Mus. Nat. Hist. 61: 227-395.
Burt., C.E. & M.D. Burt, 1933. A preliminary check list of the lizards of South America. Trans. Acad. Sci. St. Louis 28 (1-2): 1-104.
Cabrera, M.R., 1993. Los saurios del Espinal y su presencia en provincias biogeográficas vecinas. Rev. Mus. Argent. Ci. Nat. "Bernardino Rivadavia" (Ecol.) 4 (2): 17-34.
Cei, J.M., 1986. Reptiles del centro, centro-oeste y sur de la Argentina. Monogr. Mus. Reg. Sci. Nat. Torino 4: 527 p.
Cei, J.M., 1986. Reptiles del noroeste, nordeste y este de la Argentina. Monogr. Mus. Reg. Sci. Nat. Torino 14: 949 p.
Cole, C.J. & C. Gans, 1987. Chromosomes of *Bipes*, *Mesobaena*, and other amphisaenians (Reptilia), with comments on their evolution. Amer. Mus. Novit. 2869: 1-9.
Cope, E.D., 1885. Twelfth contribution to the herpetology of Tropical America. Proc. Amer. Phil. Soc. 22: 167-194.
Daciuk, J. & M.E. Miranda, 1980. Notas faunísticas y bioecológicas de Península Valdés y Patagonia. XXV. Neotropica 26 (75): 99-115.
Dely, O.G., 1970. Untersuchungen über die Ringelechse *Anops kingii* Bell, 1833 (Reptilia: Amphisbaenidae). The scientific results of the Hungarian Svil Zoological Expeditions to South America, 16. Opusc. Zool. Budapest 10 (2): 231-239.
Devicenzi, G.J., 1925. Fauna erpetológica del Uruguay. An. Mus. Hist. Nat. Montevideo (2) 2 (1): 1-65.
Duméril, A.M.C., & G. Bibron, 1839. Erpétologie générale ou Histoire Naturelle complète des reptiles. Tome V. Paris: Librairie Encyclopédique de Roret. viii + 854 p.
Duméril, C., & A. Duméril, 1851. Catalogue méthodique de la collection des Reptiles (Muséum d'Histoire Naturelle de Paris). Paris: Gide et Baudry. iv + 224 p.
Esteban, C.J. de la S. de, 1965. Anatomia microscópica comparada de la lengua de algunos saurios argentinos. An. II Congr. Lat.-Amer. Zool. (S.Paulo, 1962) 2: 235-245.

Freiberg, M.A., 1939. Enumeración sistemática de los reptiles de Entre Rios y lista de los ejemplares que los representan en el Museo de Entre Rios. Mem. Mus. Entre Rios (Zool.) 11: 28 p.

FZB (Fundação Zoobotânica do Rio Grande do Sul), 1976. Preceituação ecológica para a preservação de recursos naturais na região da Grande Porto Alegre. Porto Alegre: Fundação Zoobotânica do Rio Grande do Sul, Liv. Sulina. 153 p.

Gallardo, J.M., 1966. *Liolaemus lentus* nov. sp. (Iguanidae) de La Pampa y algunas observaciones sobre los saurios de dicha provincia argentina y del oeste de Buenos Aires. Neotropica 12 (37): 15-29.

Gallardo, J.M., 1969. Las especies de saurios (Reptilia) de la Provincia de Santa Fe, Argentina, y consideraciones sobre su ecologia y zoogeografia. Neotropica 15 (47): 73-81.

Gallardo, J.M., 1977. Reptiles de los alrededores de Buenos Aires. Buenos Aires: Eudeba/Laetores. 213 p.

Gallardo, J.M., 1979. Composición, distribución y origem de la herpetofauna chaqueña, p. 299-307 in W.E. Duellman, ed., The South American herpetofauna: its origin, evolution, and dispersal. Monogr. Mus. Nat. Hist. Univ. Kansas 7: 485 p.

Gallardo, J.M., 1982. Anfibios y reptiles del Parque Nacional El Palmar de Colón, provincia de Entre Rios. An. Parques Nacionales 15: 65-75.

Gallardo, J.M., M.E. Miranda & M. Tio Vallejo, 1987. Evaluación de la saurofauna de la provincia de Entre Rios (Republica Argentina). Rev. Mus. Argent. Ci. Nat. "Bernardino Rivadavia" (Zool.) 14 (5): 87-94.

Gallardo, J.M., M. Tio Vallejo & M.E. Miranda, 1985. Estudio sobre la distribución de los saurios de Santiago del Estero, Republica Argentina (Reptilia: Sauria). Hist. Nat., Corrientes, 5 (13): 97-103.

Gans, C., 1967. A check list of Recent amphisbaenians (Amphisbaenia, Reptilia). Bull. Amer. Mus. Nat. Hist. 135 (2): 61-106.

Gans, C., 1968. Relative success of divergent pathways in amphisbaenian specialization. Amer. Nat. 120 (926): 345-362.

Gans, C., 1974. Biomechanics. Philadelphia, Toronto: J.B. Lippincot Co. x + 261p.

Gans, C., 1986. Locomotion of limbless vertebrates: pattern and evolution. Herpetologica 42 (1): 33-46.

Gans, C. & E. Kochva, 1965. A systematic review of *Ancylocranium* Parker (Amphisbaenia, Reptilia). Israel J. Zool. 14: 87-121.

Gans, C. & S. Mathers, 1977. *Amphisbaena medemi*, an interesting new species from Colombia (Amphisbaenia, Reptilia) with a key to the Amphisbaenians of the Americas. Fieldiana (Zool.) 72 (2): 21-46.

Gans, C. & C. Rhodes, 1964. Notes on amphisbaenids (Amphisbaenia, Reptilia). 13. A systematic review of *Anops* Bell, 1833. Amer. Mus. Novit. 2186: 25 p.

Gatti, C., 1955. Vocabulario herpetológico guarani latin de las especies paraguayas de las familias Anguidae Amphisbaenidae. Rev. Med. Paraguay 1: 96-100.

Gilboa. I., 1975. Karyotypes of amphibians and reptiles: a bibliographic review, p. 91-156 in H.G. Dowling, ed., 1974 Yearbook of Herpetology. New York: Herpetological Information Search Systems.

Goeldi, E., 1902. Lagartos do Brasil. Bol. Mus. Paraense 3: 499-560.

Gorman, G.C., 1973. The chromosomes of the Reptilia, a cytotaxonomic interpretation, p. 349-424 in A.B. Chiarelli & E. Capanna, eds., Cytotaxonomy and vertebrate evolution. London, New York: Academic Press.

Gray, J.E., 1844. Catalogue of the tortoises, crocodiles, and amphisbaenians in the collection of the British Museum. London: Trustees of the British Museum. viii + 72 p.

Gray, J.E., 1865. A revision of the genera and species of amphisbaenians, with the descriptions of some new species now in the collection of the British Museum. Proc. Zool. Soc. London 1865: 442-455.

Gray, J.E., 1872. Catalogue of shield reptiles in the collection of the British Museum. Part 2. Emydosaurians. Rhynchocephalia, and Amphisbaenians. London: Trustees of the British Museum. 41 p.

Hellmich, W., 1960. Die Sauria der Gran Chaco und seiner Randgebiete. Abh. Bayer. Akad. Wiss. (N.F.) 101: 1-131.

Hensel, R., 1868. Beiträge zur Kenntniss der Wirbelthiere Süd-Brasiliens. (Fortsetzung). Arch. Naturg. 34 (1): 323-375.

Huang, C.C. & C. Gans, 1971. The chromosomes of 14 species of amphisbaenians (Amphisbaenia, Reptilia). Cytogenetics 10 (1): 10-22.

Jan, G., 1857. Cenni sul Museo Civico di Milano ed indice sistematico dei rettili ed amphibi esposti nel medesimo. Milano: Museo Civico. 61 p.

King, P.P., 1839. Narrative of the surveying voyages of H.M.S. Adventure and Beagle between the years 1826 and 1836... Vol. I, Proceedings of the first expedition 1826-1830, under the command of Captain P. Parker King, R.N., F.R.S. London: Henry Colburn. xxviii + 597 p.

Kluge, A.G., 1984. Type-specimens of reptiles in the University of Michigan Museum of Zoology. Misc. Publ. Mus. Zool. Univ. Michigan 167: 1-85.

Koslowsky, J., 1898. Enumeración sistemática y distribución geográfica de los reptiles argentinos. Rev. Mus. La Plata 8: 161-200, pls.

Langguth, A., 1976. Lista de las especies de vertebrados del Uruguay. Montevideo: Museo Nacional de Historia Natural, Facultad de Humanidad y Ciências. 53 p.

Laurent, R.F. & E.M. Teran, 1981. Lista de los anfibios y reptiles de la provincia de Tucumán. Miscelanea Fund. Miguel Lillo 71: 1-15.

Lema, T., 1994. Lista comentada dos répteis ocorrentes no Rio Grande do Sul, Brasil. Comun. Mus. Ci. Tecnol. Pontif. Univ. Rio Grande do Sul (Zool.) 7: 41-150.

Lema, T. & M.E. Fabián-Beurmann, 1977. Levantamento preliminar dos répteis da região da fronteira Brasil-Uruguai. Iheringia (Zool.), 50: 61-92.

Lema, T., M.E. Fabián-Beurmann, M.L. Araujo, M.L.M. Alves & M.I. Vieira, 1980. Lista de répteis encontrados na região da Grande Porto Alegre, estado do Rio Grande do Sul. Brasil. Iheringia (Zool.) 55: 27-36.

Lema, T., M.I. Vieira & M.L. Araujo, 1984. Fauna reptiliana do norte da Grande Porto Alegre, Rio Grande do Sul, Brasil. Rev. Brasil. Zool. 2 (4): 203-227.

Lichtenstein, H., 1856. Nomenclator Reptilium et Amphibiorum Musei Zoologici Berolinensis. Namenverzeichniss der in der Zoologischen Sammlung der Königlichen Universität zu Berlim aufgestellten Arten von Reptilien und Amphibien nach ihren Ordnungen, Familien und Gattungen. Berlim: Königl. Akad. Wiss. ix + 48 p.

Liebermann, J., 1939. Catálogo sistemático y zoogeografico de los lacertilios argentinos. Physis 16: 61-82.

Loveridge, A., 1941. Revision of the African lizards of the family Amphisbaenidae. Bull. Mus. Comp. Zool. 87 (5): 351-451.

Lynn, W.G., & L.A. Komorowsky, 1957. The morphology of the thyroid gland in lizards of the families *Pygopodidae* and *Amphisbaenidae*. Herpetologica 13 (3): 163-173.

Marelli, C.A., 1924. Batracios y Reptiles, p. 584-598 in Elenco Sistemático de la Fauna de la Província de Buenos Aires (Procordados y Vertebrados). Buenos Aires: L.J. Rosso.

Meneghel, M.D., A.R. Melgarejo & F. Achaval, 1989. Clave para determinación de los reptiles del Uruguay. Montevideo: Facultad de Humanidads y Ciências. 42 p.

Montero, R. 1994. Distribución de los Amphisbaenidae en la Republica Argentina. Bol. As. Herp. Argent. 10 (1): 43-46.

Montero, R., 1996. Lista de las localidades de los Amphisbaenidae de la Republica Argentina. Cuad. Herp. 10 (1-2): 25-45.

Müller, F., 1885. Vierter Nachtrag zum Katalog der herpetologischen Sammlung des Basler Museums. Verh. Nat. Ges. Basel 7: 668-717.

Müller, F., 1971. Herpetologische Reiseeindrücke aus Brasilien. Salamandra 7 (1): 9-30.

Orrego, A., R., 1971. Reptiles de La Pampa. Bibl. Pampeana (Folhetos) 14: 68 p.

Orrego, A., R., 1979. Reptiles de la provincia de La Pampa. Acta. Zool. Lillo. 35 (2): 679-682.

Parker, H.W., 1942. The lizards of British Somaliland. Bull. Mus. Comp. Zool. 91 (1): 1-115.
Peters, J.A. & R. Donoso-Barros, 1970. Catalogue of the Neotropical Squamata Part II. Lizards and amphisbaenians. Bull. U.S. Nat. Mus. 297: viii + 293 p.
Peters, J.A. & R. Donoso-Barros, 1986. Catalogue of the Neotropical Squamata Part II. Lizards and amphisbaenians. Originally published as Bull. U.S. Nat. Mus. 297. Revised edition, with new material by P.E. Vanzolini: 25 + (v-viii) + 293 p.
Pires, J.M. & G.T. Prance, 1980. The vegetation types of the Brazilian Amazon, p.109-145 in G.T. Prance & T.E. Lovejoy, eds., Key environments: Amazonia. Oxford, etc.: International Union for Conservation of Nature and Natural Resources; Pergamon Press.
Projeto Radambrasil, 1980. Levantamento de recursos naturais. Volume 20. Folha SC.21 Juruena. Rio de Janeiro: Departamento da Produção Mineral. 456 p.
Projeto Radambrasil, 1981. Levantamento de recursos naturais. Volume 25. Folha SD.22 Goiás. Rio de Janeiro: Departamento da Produção Mineral: 636 p.
Riley, J., A.F. Stimson & J.M. Winch, 1985. A review of Squamata ovipositing in ant and termite nests. Herp. Rev. 16 (2): 38-43.
Ringuelet, R.A. & R.H. Aramburu, 1957. Enumeración sistemática de los vertebrados de la Provincia de Buenos Aires. La Plata: Ministerio de Asuntos Agrarios nº 119: 94 p.
Rizzini, C.T. & E.P. Heringer, 1962. Preliminares acêrca das formações vegetais e do reflorestamento no Brasil Central. Rio de Janeiro: Serviço de Informação Agrícola. 79 p.
Rojas, A., N., 1903. Fauna argentina (Enumeración escogida de Mamíferos, Aves, Reptiles, Batracios y Peces). p. 31-38 in Analectas Cientificas sobre Historia Natural Argentina. Corrientes: T. Heinecke, 39 p.
Ruschi, A., 1966. Lista dos répteis do estado do Espírito Santo. Bol. Mus. Biol. Prof. Mello-Leitão (Zool.) 26A: 1-6.
Scortecci, G., 1931. Contributo alla conoscenza dei rettili e degli anfibi della Somalia, dell'Eritrea e dell'Abissinia. Boll. Mus. Zool. Univ. Torino (3) 41 (10): 1-26.
Smalian, C., 1885. Beiträge zur Anatomie der Amphisbaeniden. Z. wiss. Zool. 42: 126-202.
Smith, M.A., A. d'A. Bellairs & A.E.W. Miles, 1953. Observations on the premaxillary dentition of snakes with special reference to the egg-tooth. Linn. Soc. J. (Zool.) 42 (285): 260-268.
Steindachner, F., 1867. Reise der Österreichischen Fregatte Novara um die Erde in den Jahren 1857, 1858, 1859. Zoologischer Theil. Erster Band (Wirbelthiere) -3. Reptilien. 98 p., pls. Wien: K.-K. Hof- und Staatsdruckerei.
Stejneger, L., 1916. Notes on amphisbaenian nomenclature. Proc. Biol. Soc. Washington 29: 85.
Stimson, A.F., 1972. A new species of *Anops* from Mato Grosso, Brazil (Reptilia: Amphisbaenia). Bull. Brit. Mus. Nat. Hist. (Zool.) 24 (3): 205-212.
Strauch, A., 1881. Bemerkungen über die Eidechsenfamilie der Amphisbaeniden. Mél. Biol. Acad. Sci. St. Petersbourg 11: 355-479.
Vanzolini, P.E., 1951. A systematic arrangement of the family Amphisbaenidae, Herpetologica 7: 113-123.
Vanzolini, P.E., 1977. An annotated bibliography of the land and fresh-water reptiles of South America. Vol. 1 (1758-1900). São Paulo: Museu de Zoologia da Universidade de São Paulo. iv + 186 p.
Vanzolini, P.E., 1978. An annotated bibliography of the land and fresh-water reptiles of South America. Vol. 2 (1901-1975). São Paulo: Museu de Zoologia da Universidade de São Paulo. 316 p.
Vanzolini, P.E., 1981. Reptilia, p. 246-261 in S.H. Hurlbert, G.Rodriguez & N.D. Santos, eds., Aquatic Biota of South America. Part 2. Anarthropoda. San Diego, California.
Vanzolini, P.E., 1996. On slender species of *Amphisbaena*, with the description of a new one from northeastern Brasil (Reptilia, Amphisbaenia). Papéis Avulsos Zool., S.Paulo, 39 (16): 293-305.

Vanzolini, P.E., 1997. The silvestrii species group of *Amphisbaena*, with the description of two new Brasilian species (Reptilia, Amphisbaenidae). Papéis Avulsos Zool., S.Paulo, 40 (3): 65-86.
Vaz-Ferreira, R., 1956. Características generales de las islas uruguayas habitadas por lobos marinos. Trabajos sobre islas de lobos y lobos marinos 1. Montevideo: Servicio Oceanográfico y de Pesca. 21 p.
Vaz-Ferreira, R. & B. Sierra de Soriano, 1960. Notas sobre reptiles del Uruguay. Rev. Fac. Human. Ci. Montevideo 18: 133-206.
Vega, L. & P. Bellagamba, 1990. Lista comentada de la herpetofauna de las Sierras Balcarce y Mar del Plata. Cuad. Herp. 5 (2): 10-14.
Weyenbergh, H., 1876. The Argentine Fauna, p. 137-174 in The Argentine Republic, written in German by Richard Napp, assisted by several fellow-writers for the Central Argentine Comission on the Centenary Exhibition at Philadelphia. Buenos Aires: Sociedad Anonima. iii + 563 p.
Wiegmann, A.F.A., 1834. Herpetologia Mexicana, seu descriptio amphibiorum Novae Hispaniae quae itineribus comitis de Sack, Ferdinandi Deppe et Chr. Guil. Schiede in Museum Zoologicum Berolinense pervenerunt. Pars prima, Saurorum species amplectens, adiecto Systematis Saurorum Prodromo, addistique multis in hunc amphibiorum ordinem observationibus. Berlin: C.G. Lüderitz. vi + 54 p., pls.
Wiegmann, A.F.A., 1836. Ueber die fusslosen Amphisbänen mit Brustchildern (*Lepidosternon* Wagl.). Arch. Naturg. 2 (1): 152-158.
Williams, J.O. & S. Wichmann, 1989. Nueva localidad para *Anops kingii* Bell (Reptilia: Amphisbaenidae) y *Philodryas aestivus* (Dumeril, Bibron & Dumeril) (Reptilia: Colubridae) en el este de la provincia de Buenos Aires. Bol. Asoc. Herp. Argent. 5 (1-2): 12-13.
Zangerl, R., 1944. Contributions to the osteology of the skull of the Amphisbaenidae. Amer. Midl. Nat. 3 (12): 417-45.
Zangerl, R., 1945. Contributions to the osteology of the post-cranial skeleton of the Amphisbaenidae. Amer. Midl. Nat. 33 (3): 764-780.

Appendix

Localities of *Anops kingii*

(Note: coordinates abbreviated: 2852, 5126 stands for 28° 52' S, 51° 26' W).

Brasil. *Rio Grande do Sul*: 87, Santana (2852, 5126).88, Campo Bom (2941, 5103) .89, Santa Maria (2942, 5348). 90, São Leopoldo (2947, 5110). 91, Novo Hamburgo (2951, 5108). 92, Montenegro (2942, 5128). 93, Gravataí (2957, 5059). 94, Tramandaí (2959, 5010). 95, Porto Alegre (3000, 5110). 96, Guaíba (3006, 5119). 97, Viamão (3005, 5102). 98, Rosário (3016, 5455). 99, Bagé (3120, 5436). 100, São Lourenço (3122, 5158). 101, Jaguarão (3226, 5323).

Uruguay. *Rivera*: 102, Rivera (3054, 5531). 103, Sierra de los Chivos (3104, 5533). *Treinta y Tres*: 104, Santa Clara de Olimar (3255, 5458). *Florida*: 105, Nico Pérez (3329, 5509). *Lavalleja*: 106, Cerro del Penitente (3420, 5507). 107, Aguas Blancas (3431, 5522). *Rocha*: 108, Cabo Polonio (3424, 5346). *San José*: 109, Sierra Mahoma (3405, 5703). 110, Mal Abrigo (3409, 5657). *Montevideo*: 111, Malvin (3454, 5606). 112, Montevideo (3455, 5610). *Maldonado*: 113, Punta del Este (3458, 5457).

Argentina. *Salta*: 1, Capiazuti (2215, 6347). 2, Rio del Valle (2438, 6416). 3, Joaquin V. Gonzalez (2505, 6411). Finca San Javier (2505, 6410). 4, La Población (2526, 6424). Rio Juramento (2535, 6457). *Tucumán*: 6, El Tala (2607, 6517). 7, San Pedro de Colalao (2614, 6529). 8, Tapia (2636, 6518). 9, Embalse El Cadillal (2637, 6512). 10, Rumi Punco (2800, 6534). *Santiago del Estero*: 11, Pampa Pozo (2629, 6431). 12, Weisburd (2719, 6236). 13, Beltrán (2835, 6425). 14, Bandera (2854, 6216). *Chaco*: 13, Santa Silvina (2749, 6109). *Santa Fé*: 16, Antonio Pini (2924, 6144). 17, Estancia "La Prusia" (3017, 6052). 18, Laguna Paiva (3119, 6039). 19, Santo Tomé (3140, 6046). *Corrientes*: 20, Capital (2728, 5850). 21, Manantiales (2756, 5806). 22, Laguna Sanchez (2827, 5650). *Entre Rios*: 23, Isla Ella (2722, 5831). 24, Arroyo Hondo (3050, 5940). 25, Paraná (3144, 6032). 26, Aguas Corrientes (3145, 6035). 27, El Palmar de Colón (3159, 5818). 28, Concepción del Uruguay (3229, 5814). 29, Paranacito (3343, 5838). *San Luis*: 30, Rio Luján (3212, 6555). 31, Sierra del Gigante (3255, 6654). 32, Alto Pencoso (3326, 6656). 33, Las Isletas (3348, 6533). *Córdoba*: 34, Mar Chiquita (3040, 6207). 35, Capilla del Monte (3052, 6432). 36, Jesus Maria (3059, 6406). 37, Sierras de Córdoba (3100, 6505). 38, Villa Giardino (3102, 6429). 39, La Falda (3105, 6430). 40, Valle Hermoso (3107, 6429). 41, Cabana (3113, 6422). 42, Cosquin (3115, 6428). 43, Tala Cañada (3121, 6428). 44, Montecristo (3121, 6357). 45, Tanti (3122, 6436). 46, Córdoba (3124, 6411). 47, Ambul (3129, 6503). 48, Alta Gracia (3140, 6426). 49, Bañado de Paja (3155, 6512). 50, El Sauce (3159, 6433). 51, Yacanto Chico (3207, 6445). 52, Achiras, (3310, 6500). 53, Estancia Los Molles (3341, 6229). *La Pampa*: 54, General Pico (3540, 6346). 55, Santa Rosa (3637, 6417). 56, Toay (3640, 6423). 57, Médano Leoncito (3652, 6628). 58, Estancia "La Vizcaína" (3655, 6623). 59, El Odre (3658, 6612). 60, Limay Mahuida (3711, 6641). 61, Lihuel Calel (3802, 6533). 62, Cerro Los Viejos (3829, 6423). 63, Caleu caleu (3859, 6404). *Buenos Aires*: 64, Isla Martin Garcia (3411, 5815). 65, Buenos Aires (3438, 5828). 66, Lanús (3443, 5824). 67, Magdalena (3505, 5731). 68, Estancia Gandara (3532, 5807). 69, El Tordillo (3639, 6131). 70, Bonifacio (3649, 6213). 71, Tandil (3720, 5908). 72, La Tinta (3736, 5931). 73, Sierras (3750, 5840). 74, Sierra del Volcán (3752, 5804). 75, Sierra de los Padres (3757, 5748), 76, Abra de la Ventana (3804, 6159). 77, Sierra de la Ventana (3809, 6109). 78, Quequén (3831, 5845). 79, Bahia Blanca (3844, 6216). 80, Pehuen Có (3900, 6137). *Rio Negro*: 81, Valcheta (4041, 6608). *Chubut*: 82, Golfo de San José, south bank (4220, 6418). 83, Istmo Carlos Ameghino (4228, 6430). 84, Puerto Madryn (4246, 6503). 85, Punta de Lobos (4347, 6519). 86, Punta Barranca (4459, 7018).

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