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LEPOSOMA PERCARINATUM, A UNISEXUAL
SPECIES RELATED TO *L. GUIANENSE*; AND
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FROM PACIFIC COASTAL COLOMBIA
(SAURIA, TEIIDAE)

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**LEPOSOMA PERCARINATUM, A UNISEXUAL SPECIES RELATED TO
L. GUIANENSE; AND LEPOSOMA IOANNA, A NEW SPECIES FROM
PACIFIC COASTAL COLOMBIA (SAURIA, TEIIDAE)**

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ABSTRACT

Two distinct populations of *Leposoma* occur in the Guianan highlands area of northern South America. *Leposoma percarinatum* Müller is distinguished from *L. guianense* Ruibal by a higher number of transverse rows of dorsal scales (36–39, mean 37.5 in *L. percarinatum*; 31–35, mean 32.6 in *L. guianense*) as well as by more transverse rows of ventral scales and more scales around the midbody region. In *L. percarinatum*, the third and especially the fourth pairs of chin shields are much reduced compared to the conditions in *L. guianense*; the scale behind the longest supralabial is as small as the temporal scales, rather than larger as in *L. guianense*. *L. percarinatum* usually has a light line from the hindlimb insertion along the tail; this is absent in *L. guianense*. The interparietal scale in *L. percarinatum* is much larger than in *L. guianense*, but the head is relatively narrower. The distinctive long middle preanal scale noted by Ruibal is not a constant feature of *L. guianense*.

All 30 specimens of *L. percarinatum* are female. We have examined 17 specimens of *L. guianense*; seven are male, 10, female. *L. percarinatum* is probably a unisexual taxon. Male specimens reported are probably *L. guianense*.

In coloration, *L. percarinatum* seems to be intermediate between *L. guianense* and *L. parietale*, a species found on the Amazonian slopes of Peru, Ecuador and Colombia. In scale counts, size of fourth pair of chin shields, and head width, *L. parietale* and *L. guianense* are alike. The interparietals of *L. percarinatum* and *L. parietale* are both large. Geographically and morphologically, it seems likely that *L. parietale* and *L. guianense* hybridized to give

rise to *L. percarinatum*. If this is so, these bisexual forms are probably distinct species, although the distributions and general similarities suggest that they represent subspecies of a single species.

Leposoma ioanna, new species, is closely related to *L. parietale*. The two known specimens come from near Buenaventura, Valle del Cauca, on the Pacific coast of Colombia. *L. ioanna* is distinguished from *L. parietale* by having the third pair of chin shields separated from the infralabials by two small scales, and by a much reduced fourth pair. It may have a larger body size and lower mean numbers of dorsal scale rows, transverse ventral scale rows, and scales around midbody region.

Two Chocóan specimens reported previously as *Alopoglossus copii* are *Leposoma southi*. Both *L. ioanna* and *L. southi* are species of *Leposoma* from the Pacific coast of Colombia, whence no species has been reported previously. *L. southi* also occurs in Costa Rica and Panamá east as well as west of the Canal Zone.

Hemipenes of *Leposoma* have two characteristic rows of calcareous spines in each half. Features of the hemipenis of *L. parietale* are also seen in the hemipenis of *Arthrosaura kockii*, supporting the relation of the genera suggested on other bases.

Evidence of past hybridization of *L. parietale* with *L. guianense* (the unisexual *L. percarinatum*) and the disjunct *L. ioanna*, which is related to *L. parietale*, indicate considerable changing of distributions of the genus *Leposoma*. Dates of changes in distribution are unknown.

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The senior author alone is responsible for the abstract and sections I, III, IV, and V.

I. INTRODUCTION

The small teiid lizards of the genus *Leposoma*, a member of Boulenger's (1885) group II of the family Teiidae, were reviewed by Ruibal in 1952. Ruibal examined 19 females but no males of *L. percarinatum*, and 2 females but no males of *Leposoma guianense*, a taxon that he described as new. Recently, considerable material of these two taxa was assembled to investigate their relations to each other and to *L. parietale*. The material includes all that Ruibal saw, and some additional specimens. The additional material consists of 11 additional specimens of *L. percarinatum* (all females), and 15 additional specimens of *L. guianense* (7 males and 8 females).

Although the feature of the preanal scales described as diagnostic for *L. guianense* does not distinguish the taxon, several additional characters, including features of the interparietal mentioned by Ruibal, do distinguish it.

Among the specimens examined are 11 from the Pacific lowlands of Colombia, whence *Leposoma* has not previously been recorded. Two of these, while rather similar to *L. parietale* of the Amazonian slopes of the Andes in Ecuador, Colombia and Peru, show certain distinctive features. Because there probably has been no recent contact between the lowland Pacific coast population and the lowland Amazonian population, the coast form is described as a distinct species. The other specimens are *L. southi*, heretofore known only from Costa Rica and adjacent Panamá east into the Canal Zone.

ABBREVIATIONS

AMNH	American Museum of Natural History, New York
ANSP	Academy of Natural Sciences of Philadelphia
BMNH	British Museum (Natural History), London
FMNH	Field Museum of Natural History, Chicago
MCZ	Museum of Comparative Zoology, Harvard University
MLS	Museo de La Salle, Bogotá
MNHN	Muséum National d'Histoire Naturelle, Paris
SMF	Senckenberg Museum, Frankfurt-am-Main
UKMNH	University of Kansas Museum of Natural History
USNM	United States National Museum
UMMZ	University of Michigan Museum of Zoology

II. *Leposoma percarinatum*, A UNISEXUAL SPECIES RELATED TO
*Leposoma guianense*¹

By Thomas Uzzell and John C. Barry

Unisexual species of lizards have been reported on many occasions since Darevsky and Kulikova (1961), Maslin (1962), Minton (1958), Tinkle (1959), and Zweifel (1965) first drew attention to them. At present more than 20 different unisexual taxa of lizards are known with some degree of assurance,

1. Our study parallels one by Marinus S. Hoogmoed, Rijksmuseum van Natuurlijke Historie, Leiden, who has independently come to essentially the same conclusions.

and others doubtless will be reported as additional refined variational studies of lizards are undertaken.

The unusual sex ratio of *Leposoma percarinatum* was noted by Ruibal in 1952 when unisexual vertebrates were almost unknown. The closely related *L. guianense* Ruibal (1952) was only known from 2 females. We have examined additional material of both taxa and we can demonstrate that in the Guianan highlands region of South America (Venezuela, the Guianas, and adjacent Brazil and Colombia) there exist 2 separable populations of females. One of these (*L. percarinatum*) is known only from females. Both males and females are known for the other (*L. guianense*).

Leposoma guianense and *Leposoma percarinatum* may be distinguished by the following characteristics.

1. *Leposoma guianense* has relatively fewer body scales than *L. percarinatum*. Table 1 summarizes data on the number of transverse rows of ventral

TABLE 1. MAXIMUM LENGTHS AND RANGES AND MEANS FOR THREE SCALE COUNTS IN FIVE SPECIES OF *Leposoma*

	Maximum body length (mm)	Dorsal scale rows	Transverse rows of ventrals	Scales around midbody
<i>L. guianense</i>				
7 ♂ ♂	35	32-34 (32.9)	22-24 (23.0)	23-25 (24.0)
10 ♀ ♀	38	31-35 (32.4)	21-23 (22.5)	23-26 (24.4)
<i>L. percarinatum</i>				
30 ♀ ♀	35	36-39 (37.5)	24-27 (25.5)	23-28 (25.4)
<i>L. parietale</i> ¹				
25 ♂ ♂	36	29-35 (32.9)	20-24 (22.4)	21-25 (23.6)
22 ♀ ♀	39	31-36 (33.2)	21-24 (22.4)	22-26 (23.7)
<i>L. ioanna</i>				
2 ♀ ♀	41	28, 30	20, 21	21, 22
<i>L. southi</i>				
3 ♂ ♂	40	27-29 (27.7)	19-20 (19.7)	21-23 (21.7)
6 ♀ ♀	37	28-29 (28.5)	20-21 (20.3)	21-22 (21.3)

¹Based on AMNH 56260-62, 106635-37, ANSP 25507-08, FMNH 45477, MCZ 61156, UKMNH 98601-03, 121784-85, 121789-97, 121799-803, 121807-08, 121811-26.

scales between the collar and the preanal scales, on scale rows around the midbody region, and on the number of dorsal scale rows between interparietal and posterior margin of hind limbs. Each of these characteristics alone suffices to identify most of the specimens examined.

2. *Leposoma guianense*, as noted by Ruibal (1952), has a very large interparietal. The length of the interparietal, of each parietal, and the width of the interparietal at its anterior and posterior corners were measured (Fig. 1).

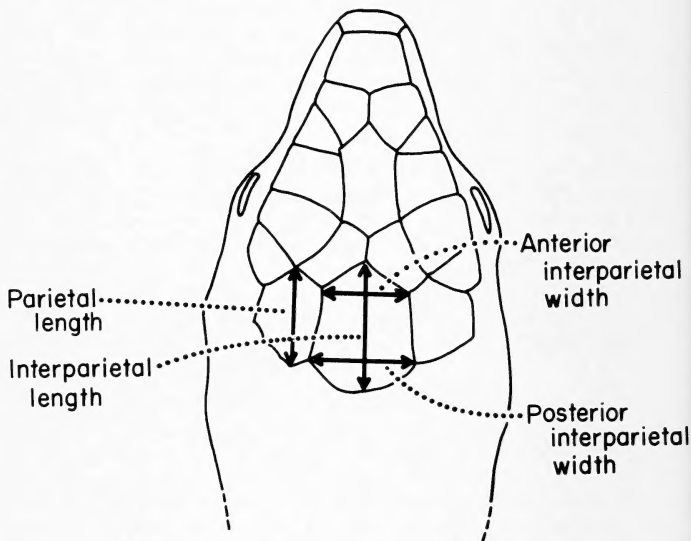


FIG. 1. Sketch of head scales of *Leposoma*, showing dimensions measured.

The relative lengths of the parietal and interparietal are compared in Figure 2. The area of the interparietal was estimated as the mean of anterior and posterior widths times the length. The area of the interparietal changes with body length. Interparietal area relative to body length for *L. guianense* and *L. percarinatum* is compared in Figure 3. The number of transverse rows of dorsal scales and the relative interparietal area distinguish the same individuals (Fig. 4).

3. Both *Leposoma guianense* and *L. percarinatum* usually have 6 supralabials. In both, the last supralabial is the longest. Following the longest supralabial in *L. guianense*, there is a scale on the lip line that is larger than the

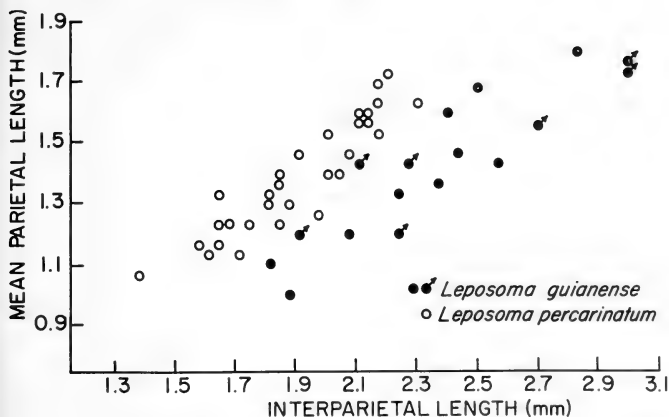


FIG. 2. Mean parietal length as a function of interparietal length in *Lepsosoma guianense* and *L. percarinatum*.

adjacent temporal scales (Fig. 5); all of the specimens separated by number of dorsal scale rows and relative interparietal area are also separated by this character.

4. Both *Lepsosoma guianense* and *L. percarinatum* have a median unpaired chin shield followed by two pairs of chin shields that are in contact with each other medially and with the infralabials laterally. Both also have a third pair of chin shields that are separated on the midline, and that are separated from the infralabials by a single small scale (Fig. 6). In *L. guianense*, the third pair of scales is followed by a fourth, smaller pair of chin shields, separated from each other by a scale and from the infralabials by 3 to 4 scales counted along the posterior margin of the third pair of chin shields. In *L. percarinatum*, the largest scale behind the third pair of chin shields (and indeed, the third pair of chin shields themselves) is considerably reduced (Fig. 6). All specimens distinguished by the preceding characters are also distinguished by this character.

5. Specimens of *Lepsosoma percarinatum* have relatively narrower heads than specimens of *L. guianense* (Fig. 6).

6. Specimens of *Lepsosoma percarinatum* usually have a distinct light line along the side of the tail posterior to the insertion of the hind limb. This line is usually absent in *L. guianense*.

The suite of characters above show a high degree of concordance. Several of the characters (numbers of dorsal and ventral scales, number of scales around the midbody region, approximate interparietal area relative to body

length, mean parietal length relative to interparietal length, and parietal width relative to body length) were used in a canonical analysis (BMD07M; Dixon, 1968). The distribution of individuals of *L. guianense* and *L. percarinatum* along the first and second canonical axes confirms the morphological distinctness of these two forms (Fig. 7).

The specimens examined come from generally sympatric areas (Map 1). Specimens have been collected together at few localities, but in Guyana, for instance, where both species are known, there is no greater similarity than elsewhere. For this reason, we believe that the above characters delimit two distinct biological populations.

Of the specimens examined, all assigned to *L. percarinatum* are females, whereas 7 out of 17 assigned to *L. guianense* are males. Since even moderate samples of other species of the genus *Leposoma* contain both males and females, we feel that their absence in the known sample of *L. percarinatum* (30

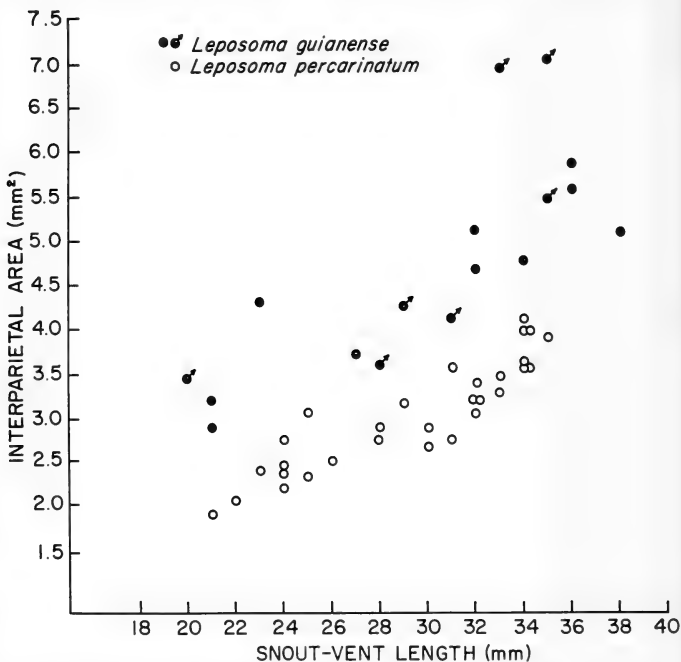


FIG. 3. Approximate interparietal area as a function of body length in *Leposoma guianense* and *L. percarinatum*.

specimens) is strong evidence that males do not occur in this taxon. This belief is reinforced by the numerous individual collections that have been drawn together to form the known sample.

The following general taxonomic accounts describe the two Guianan species.

Leposoma percarinatum (MÜLLER)

Hylosaurus percarinatus Müller, 1923, Zool. Anz. 57: 146.

Leposoma taeniata Noble, 1923, Zoologica 3: 303.

Hylosaurus muelleri Mertens, 1925, Senckenbergiana 7: 76.

DESCRIPTION. Head narrow; dorsal head scales longitudinally striate. Frontonasal single, wider than long, separated from anterior supraoculars. Nasal divided, elongate posteriorly. Loreal divided; lower segment small. Prefrontals small. Frontal elongate, hexagonal. Frontoparietals short, joined by a relatively long suture. Interparietal large, hexagonal, about as wide as long.

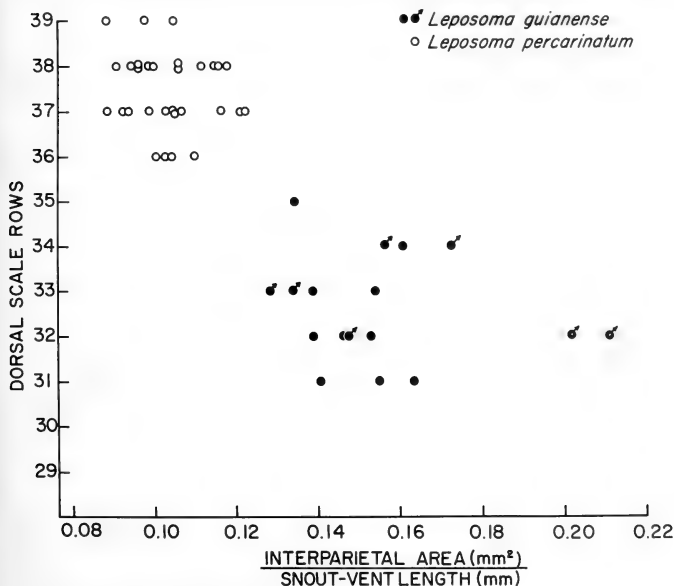


FIG. 4. Number of dorsal scales along midline between occiput and hind limb margin as a function of interparietal area relative to body length for *Leposoma guianense* and *L. percarinatum*.

Parietals smaller and shorter than interparietal; anteriormost part of each parietal usually projecting farther forward than anteriormost part of the interparietal. Supraoculars 4; superciliary series complete; suboculars 4-6. Temporals small, keeled. Upper labials 6, the last longest; next posterior scale as small as adjacent temporals. A mental followed by one unpaired and three paired chin shields; two anterior pairs in contact medially, third pair separated by a small scale; two anterior pairs in contact with lower labials; third

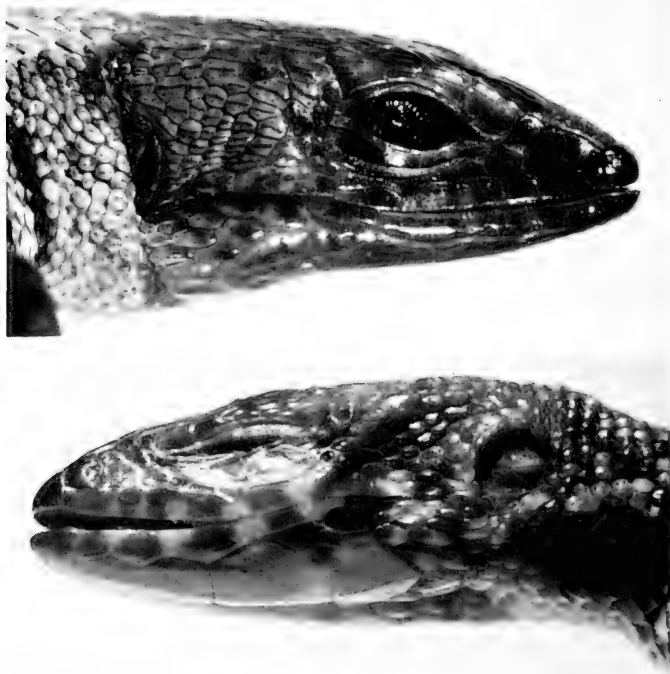


FIG. 5. Lateral view of the heads of *Leposoma guianense* and *L. percarinatum* ($\times 10$). Above, UMMZ 46770, adult female, holotype of *L. guianense*; below, AMNH 21266, adult female, holotype of *L. taeniata*. In *L. guianense*, the scale along the lip line behind the longest supralabial is markedly larger than the adjacent temporal scales; in *L. percarinatum*, this scale is nearly coequal in size with the adjacent temporal scales.

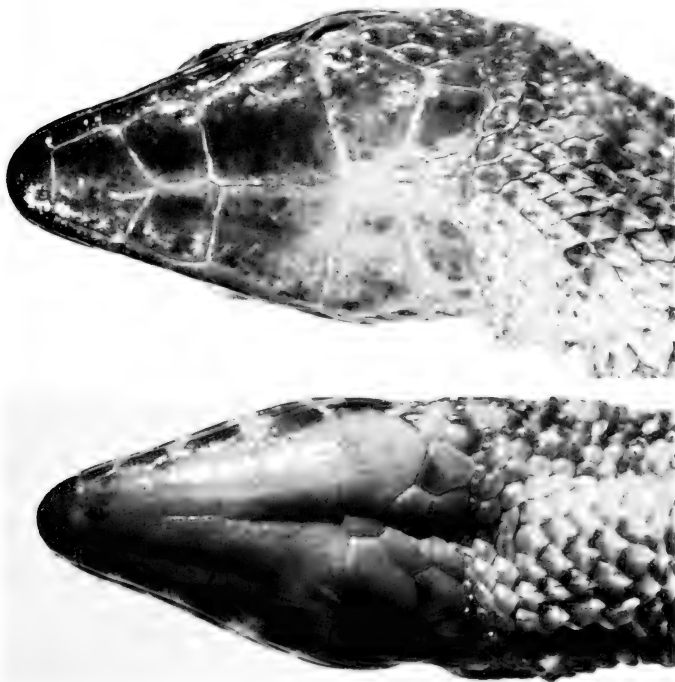


FIG. 6. Ventral view of the heads of *Leposoma guianense* and *L. percarinatum* ($\times 10$). Above, UMMZ 46770, holotype of *L. guianense*; below, AMNH 21266, holotype of *L. taeniata*. In *L. guianense*, the third and especially the fourth pair of chin shields are considerably larger than in *L. percarinatum*. The head is relatively wider in *L. guianense* than in *L. percarinatum*.

pair separated from lower labials by a single small scale. Pregulars (Ruibal, 1952) flat, of variable sizes and shapes.

A granular gular crease. Gulars in 9–10 transverse rows. Ventrals imbricate, in longitudinal and 24–27 (mean 25.5) transverse rows between collar and preanals. Dorsals leaf-shaped, keeled, imbricate, in 36–39 (mean 37.5) transverse rows. Caudals in longitudinal and transverse rows. Six preanal scales; two on midline, of which one is anterior and the other marginal, these flanked by two large marginal scales, which in turn are flanked by two smaller marginal scales. Adult females usually with 2 preanal pores; no femoral pores.

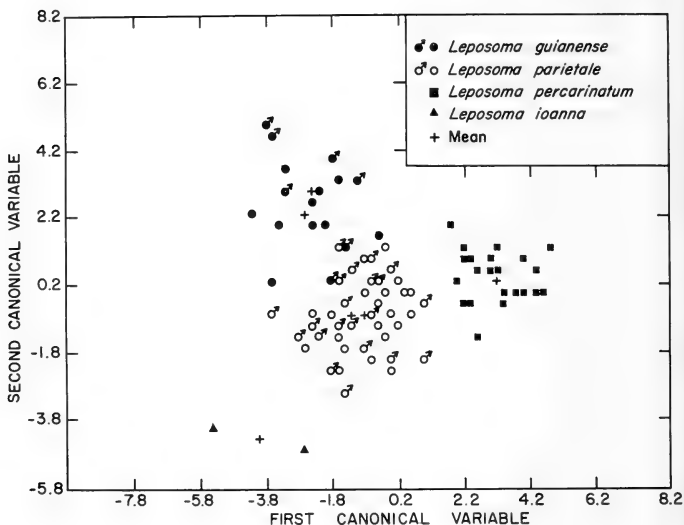
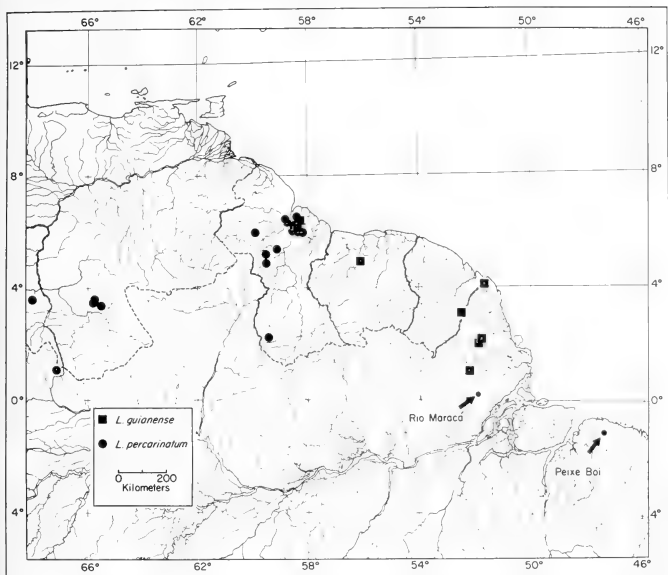


FIG. 7. Distributions and means for individuals of four species along the first and second canonical variates. The characters on which the analysis was based include the number of dorsal and ventral scales, the number of scales around the midbody region, the length of parietals relative to interparietal length, the approximate area of the interparietal relative to body length, and the width of the interparietal relative to body length. The first canonical variate (x axis) represents primarily number of body scales; the second (y axis) primarily features of the interparietal. Together, these two canonical variates account for more than 95% of the total variance.

Ranges for males and females of the two species represented by both sexes overlap considerably, and the means are quite close. *L. percarinatum* is quite distinct, on both axes, from *L. guianense* and *L. parietale*. The two specimens of *Lepsosoma ioanna*, new species, are most like specimens of *L. parietale*, but rather markedly set off from them.

Body color varies from light brown to reddish brown. Two thin, irregular, dark dorsolateral bands; these markings fade with age. The markings are most conspicuous anteriorly.

REMARKS. The holotype of *Hylosaurus percarinatus* was collected by Lorenz Müller, probably in 1910, in Peixe Boi, Pará, Brazil (Map 1). It was catalogued as 140/1911 in the Zoologische Staatssammlung, Munich. Uzzell was unable to locate the specimen in Munich in 1968; it probably was destroyed during World War II. A question mark in Müller's original description may refer to maturity or to sex. Müller reported that the type was 34 mm snout-to-vent, and that it lacked femoral pores. Since in *L. guianense*, males 34 mm



MAP 1. The Guianan region of northern South America, showing localities for specimens of *Leposoma guianense* and *L. percarinatum*. Certain localities discussed in the text are indicated.

snout-to-vent have striking femoral and preanal pores, the specimen apparently was a female. At 34 mm body length, it was certainly mature, since specimens of this body length often contain oviducal eggs, one per oviduct.

Characteristics of the holotype of *L. percarinatum* that identify it as a member of the taxon to which we apply the name include the number of dorsal scale rows, the number of scales around the midbody area, and the number of ventral scale rows (Table 2). The large scales behind the third pair of postmentals and behind the longest supralabial, characteristics of *L. guianense*, possibly would have been mentioned by Müller had they occurred. The sex is appropriate for the present assignment. We have not examined specimens of this taxon from Pará.

The holotype (AMNH 21266) and three paratypes (UMMZ 58420; AMNH 21263, 21268) of *Leposoma taeniata* each show the distinctive features we ascribe to *L. percarinatum*. All four specimens of the type series examined are from Kartabo, Guyana. Three other paratypes, one at the British Museum (Natural History) and two at the Museum of Comparative

TABLE 2. CHARACTERISTICS OF SEVERAL HOLOTYPES IN THE GENUS *Leposoma*

	<i>L.</i> <i>percari-</i> <i>natum</i>	<i>L.</i> <i>taeniata</i> ¹	<i>L.</i> <i>muelleri</i>	<i>L.</i> <i>guianense</i> ¹	<i>L.</i> <i>parietale</i>	<i>L.</i> <i>ioanna</i>
Sex	♀	♀	♀ ¹	♀	♂	♀
Snout-vent length (mm)	34	35	30	36	32	41
Dorsal scale rows	36	38	39 ¹	31	—	28
Transverse rows of ventrals	25	26	25	21	—	20
Scales around mid- body region	26	24	27	23	—	21

¹Our data.

Zoology, have not been examined. Noble (1923) mentioned 8 paratypes, but we have traced only 7.

Although the holotype of *Hylosaurus muelleri* (SMF 11754, formerly 5385a) was described as possibly an adult male, femoral and preanal pores are absent; the specimen is an adult female (Uzzell, personal observation, 1968). The scale counts (Table 2) indicate that the specimen is *L. percari-natum*. The distinctive characteristics of the scale behind the longest upper labial and behind the third pair of postmentals have been compared for us with photographs of the holotypes of *L. guianense* and *L. taeniata* by Konrad Klemmer. The holotype of *L. muelleri* resembles *L. taeniata* in both features.

The type locality given by Mertens (1925) as Inirida, southern Venezuela. In the 1890s southern Venezuela extended west beyond the Río Orinoco to about 69° W. It thus would include the lower reaches of the Río Inirida, presently in Colombia (Map 1). This is apparently the area from which the specimen came (Burt and Burt, 1931; Ruibal, 1952).

Da Cunha (1961) reported 35 specimens including 18 males of *L. percari-natum*, all from the upper Rio Maracá, Amapá, Brazil (Map 1). We have seen none of these specimens. The close similarity of *L. guianense* and *L. percarinatum* makes us believe that da Cunha's series included predominantly or entirely *L. guianense*, rather than *L. percarinatum*. Da Cunha reported that his specimens had 33 to 38 transverse rows of dorsal scales, and averaged 27 scales around the midbody region. These values suggest a mixture of specimens, but may be due in part to different ways of counting the scales.

SPECIMENS EXAMINED. Brazil: Amazonas: near Salto da Huá (100–200 m) USNM 83573. Guyana: Demerara: Dunoon (0–100 m) UMMZ 46769; near MacKenzie (0–100 m) BMNH 1934.11.1.102; Wismar (0–100 m) AMNH 58981; Essequibo: Aishalton (Ishertun; 100–200 m) AMNH 61418 (3 specimens), 61419 (4 specimens); 15–20 miles above Bartica, upper Cuyuni River, Camp 1 (0–100 m) BMNH 1934.11.103; Chenaponu River (450 m) BMNH

1905.11.1.6; Kamakusa (0–100 m) AMNH 25082–83; Kartabo (0–100 m) AMNH 21266 (holotype of *Leposoma taeniata*), AMNH 21263, 21268; UMMZ 58420 (paratypes of *Leposoma taeniata*), AMNH 46433–35; Kuyuwini Landing (200 m) AMNH 57455; Potaro (0–100 m) BMNH 1970.720–21; Tukeit Falls (Tuheit Hills; 0–100 m) UMMZ 63050; Winiperu (0–100 m) BMNH 1968.878. Venezuela: Amazonas: Camp La Culebra (200–500 m) MCZ 58347, 101884; 12 miles N of Esmeraldas (100–200 m) AMNH 39320; Río Pescada, Mt. Duida (100–200 m) AMNH 36637.

Leposoma guianense Ruibal

Leposoma guianense Ruibal, 1952, Bull. Mus. Comp. Zool. 106: 489.

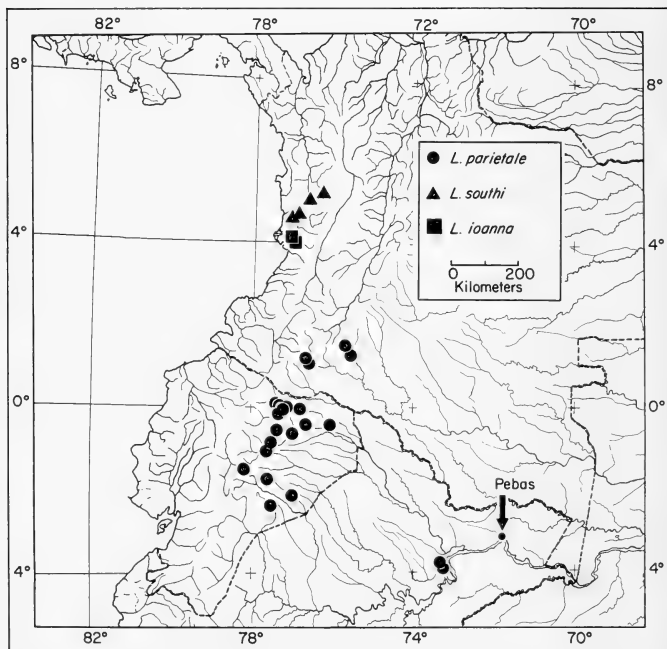
DESCRIPTION. Head broad; dorsal head scales longitudinally striate. Frontonasal single, wider than long, separated from anterior supraoculars. Nasal usually undivided, only slightly elongate posteriorly. Loreal divided; lower segment large. Prefrontals shorter than frontonasal. Frontal long, hexagonal. Frontoparietals elongate back along posterior supraoculars, joined by a relatively short suture. Interparietal long and wide, hexagonal. Parietals smaller, barely more than half as long as interparietal; anteriormost part of interparietal projecting farther forward than anteriormost part of each parietal. Supraoculars 4; superciliary series complete; suboculars 4–6. Temporals small, keeled. Upper labials 6, the last the longest; an enlarged scale following the longest supralabial. Lower labials 5–6, the third the longest. A mental followed by one unpaired and three paired chin shields; two anterior pairs in contact medially, posterior pair separated by a small flat scale; two anterior pairs in contact with lower labials, third pair separated by a single flat scale. Pregulars (Ruibal, 1952) flat, of various sizes and shapes. Two, larger than the others, can be considered a fourth pair of chin shields.

A granular gular crease. Gulars in 9–10 transverse rows. Collar weak. Ventrals imbricate, keeled, in longitudinal and 21–24 (mean 22.7) transverse rows. Dorsals imbricate, leaf-shaped, keeled, in diagonal rows and 31–35 (mean 32.6) transverse rows. Six preanal scales; two on midline, of which one is anterior and the other is marginal; these flanked by two large marginal scales; occasionally, only a single elongate, median preanal scale rather than two. Adult males with 2–2 preanal pores and 10–14 (mean 11.7) total femoral pores. Adult females with 2 faint preanal pores but no femoral pores.

Color and markings much like those of *L. percarinatum*. Body very light brown, with two thin, irregular, dark dorsolateral bands on neck, shoulders, and back, bordered above by distinct white stripes in young individuals and adult males. Dark bands and white stripes both fade in mature females. *L. guianense* lacks the distinct white stripe on the tail found in *L. percarinatum*, although some specimens have faint traces of it. Labials and chin shields with light brown spots; ventral surface white, side of neck with several faint white spots; only a faint white spot on frenoocular.

REMARKS. The holotype (UMMZ 46770) and paratype (UMMZ 46768) were collected by Alexander G. Ruthven at Dunoon, Demerara, Guyana on 27 July 1914. Ruibal (1952: fig. 1) emphasized the arrangement of the preanal scales as diagnostic of *Leposoma guianense*. Only five of the specimens examined show this arrangement (UMMZ 46768, 46770, BMNH 1930.10.10.168, 1968.877, MNHN 99.70). In FMNH 30935, the middle preanal is elongate but not as long as the paramedian preanals; there is only one median scale, however. In general, the preanal scales in *L. guianense* are relatively longer than the preanal scales of *L. percarinatum*. A long median preanal scale occurs in some specimens of *L. parietale* (USNM 166351, UKMNH 121815) although it has not been observed in *L. percarinatum*.

SPECIMENS EXAMINED. Brazil: Amapá: Ponta dos Indios (0–100 m) BMNH 1938.3.2.2; upper Rio Calçoene (Rio Carsevenne) (100–200 m) MNHN



MAP 2. Northwestern South America showing localities for specimens of *Leposoma parietale*, *L. ioanna*, new species, and Colombian records for *L. southi*. Certain localities discussed in the text are also indicated.

98.182; upper Rio Lunier, Tumuc-Humac (Tumucumaque; 100–200 m) MNHN 99.68, 99.69, 99.70 (2 specimens); Serra do Navio (100 m) UKMNH 97868. French Guiana: Inini: Camopi (100–200 m) MNHN 02.261–264. Guyana: Demerara: Dunoon (0–100 m) UMMZ 46768, 46770 (paratype and holotype of *Leposoma guianense*); Essequibo: Morabali Creek (0–100 m) BMNH 1930.10.10.168; Winiperu (0–100 m) BMNH 1968.877. Surinam: Nickerie: Frederick Willem IV Falls (112 m) FMNH 30935; Saramacca: near Coppename River, Camp 1 (0–100 m) BMNH 1946.4.3.99.

DISCUSSION. Ruibal (1952) considered the possibility that *L. percarinatum* and *L. parietale* (a species from the Amazonian slopes of the Andes in Peru, Colombia, and Ecuador; Map 2) are conspecific. If *L. percarinatum* is a unisexual species, this seems an unlikely possibility.

Unisexual species usually arise as a result of hybridization (Uzzell, 1970a). What two species may have hybridized to produce *L. percarinatum*? *Leposoma guianense* and *L. parietale* seem likely candidates. In Figures 8 and 9 and in Table 1, certain features of *L. parietale*, *L. guianense*, and *L. percarinatum* are compared. In some of these (number of dorsal scale rows, number of scales around midbody, size of third and fourth pairs of chin shields) *L. parietale* and *L. guianense* are very similar. In contrast, the relative size of the interparietal in *L. percarinatum* and *L. parietale* is very similar. The

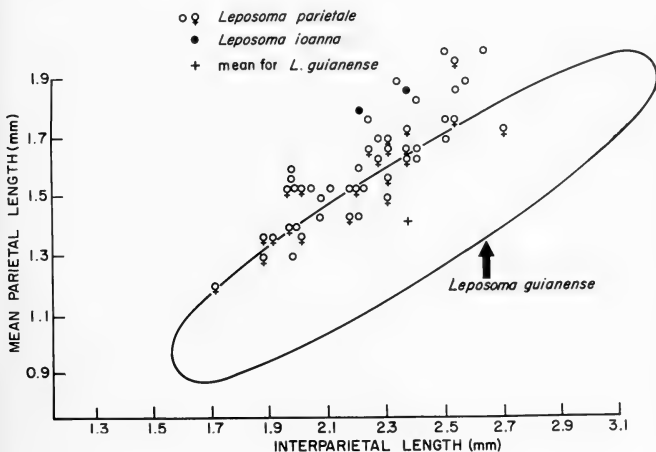


FIG. 8. Mean parietal length as a function of interparietal length in *Leposoma parietale*. The confidence ellipse includes 95% of measurements of *L. guianense*.

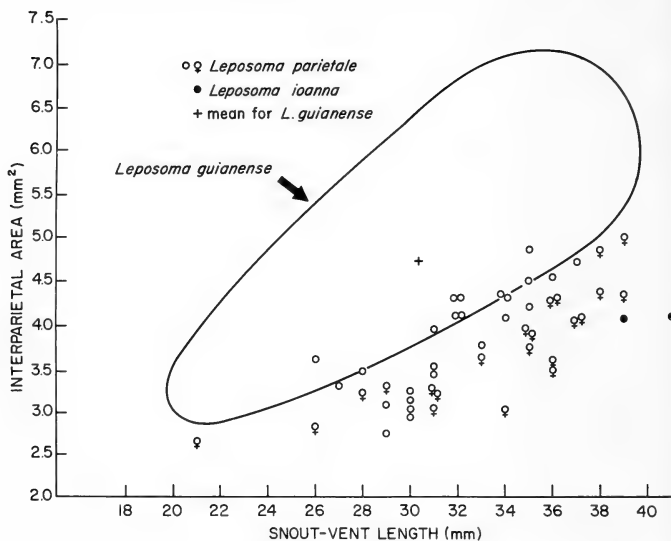


FIG. 9. Approximate interparietal area as a function of body length in *Leposoma parietale*. The oval includes all measurements of *L. guianense*.

size of the scale behind the longest supralabial in *L. parietale* is intermediate between the conditions seen in *L. percarinatum* and *L. guianense*.

These data do not prove that *L. percarinatum*, if truly a unisexual species, arose as a result of hybridization of *L. guianense* and *L. parietale*, but the data suggest this to us. The mean for the specimens of *L. percarinatum* is intermediate between the means for *L. guianense* and *L. parietale* for the second canonical variate, which reflects primarily features of the interparietal scale (Fig. 8). The mean is closer to that for *L. parietale*, even though *L. percarinatum* is sympatric with *L. guianense*. In the first canonical variate, *L. percarinatum* is unlike either bisexual species. Other combinations (for instance, the possibility that *L. rugiceps* is a parental species) seem less likely on both geographic and morphological grounds. We would argue that a clear demonstration (through karyotypes or through electrophoretic markers) that *L. percarinatum* represents a hybrid of *L. guianense* and *L. parietale* would be a compelling argument that *L. guianense* and *L. parietale* are not conspecific. That hybrids between the two are so imbalanced genetically that one sex is repressed and the meiotic mechanism is modified, as it appears to be in all unisexual species (Uzzell, 1970a), would be, we feel, strong

evidence that *L. parietale* and *L. guianense* are so distinct genetically that antihybridization mechanisms (Remington, 1968) would be selected for if the two were in contact. Morphological differences, whether on a gross or a molecular level, cannot usually support this judgment for allopatric populations.

The distribution of unisexual taxa provides additional evidence about the localization of areas of extensive recent hybridization to supplement the summary offered by Remington (1968).

The following description of *L. parietale* is provided for comparison with the descriptions of *L. guianense* and *L. percarinatum*.

Leposoma parietale (Cope)

Mionyx parietalis Cope, 1885, Proc. Amer. Philos. Soc. 23: 96.

DESCRIPTION. Head broad; dorsal head scales longitudinally striate. Frontonasal single, wider than long, separated from anterior supraoculars. Nasal divided, slightly elongate posteriorly. Loreal divided; upper segment higher than long; lower segment large. Prefrontals shorter than frontonasal. Frontal long and hexagonal. Frontoparietals elongated back along posterior supraoculars, joined by a moderately long suture. Interparietal large, hexagonal, generally long and narrow. Parietals smaller and shorter than interparietal; anteriormost part of each parietal usually projecting forward to about the same level as anteriormost part of interparietal. Supraoculars 4; superciliaries 4; suboculars 4-6. Temporals small, keeled. Upper labials 6-7, the sixth the longest, the seventh small, but larger than adjacent temporals. Lower labials 5-6, the third the longest. A mental followed by one undivided and four paired chin shields; two anterior pairs of chin shields in contact medially, posterior two pairs separated by several small scales; two anterior pairs in contact with lower labials.

Gulars in 9-10 transverse rows, the first row separated from chin shields and preulars (Ruibal, 1952) by a row of granular scales. Collar indistinct. Ventrals imbricate, keeled, in longitudinal and 20-24 (mean 22.3) transverse rows between collar and preanal scales. Dorsals imbricate, leaf-shaped, in diagonal and 29-36 (mean 33.1) transverse rows between interparietal and posterior margins of hind limbs. Caudals imbricate, in longitudinal and transverse rows. Six preanal scales; usually two on midline, of which one is anterior and the other marginal, these flanked by two large marginal scales, which in turn are flanked by two smaller scales, also marginal. Males with 2-2 preanal and 11-17 (mean 14.4) total femoral pores. Many (56%) females with 2 preanal pores; no females with femoral pores. Limbs slender, digits also. First digit smallest, fourth largest, second and fifth shorter than third. On pes the fifth is longer than second.

Dorsum usually brown, rather dark in some individuals; sides of neck and

body heavily peppered with dark concentrations of pigment. Ventral surface cream. Side of neck with several white spots; labials with dark spots on their centers; lower part of loreal with white spot. Juvenile specimens and many adults with a series of white spots in two dorsolateral rows beginning on neck just behind head and continuing down over shoulders to base of tail; these spots may fuse into dorsolateral streaks. The streaks are usually most marked anteriorly, but some specimens have only faint traces of them.

VARIATION. There is some variation in coloration. The main differences are in intensity, rather than distribution. The dark color of certain areas is the result of small dots of pigment set in the white epidermis. Variations in intensity are related to the density of dots of pigment underneath the scales. The brown color is in certain of the scales, rather than the epidermis. White areas, such as the ventral surfaces and dorsolateral stripes, are covered by whitish, translucent scales.

Ranges of counts of dorsal and ventral scales and scales around midbody region in *L. parietale* are given in Table 1. Certain individuals have a combination of high dorsal and high ventral scale counts. None of these individuals (MCZ 86644; USNM 166343, 166353; UKMNH 109771, 112208, 121819, 121822, 121825) shows any special affinities with *L. percarinatum*, however.

Two specimens (USNM 166351; UKMNH 121815) have the distinctive five-scale anal shield described by Ruibal (1952) for *L. guianense* and thought by him to be characteristic of that species. Except for the number and arrangement of their preanal scales, both USNM 166351 and UKMNH 121815 are very similar to the other specimens referred to *L. parietale*.

Among the 106 specimens examined there were 62 males and 39 females.

REMARKS. The holotype of *L. parietale* was collected at Pebas, Loreto, Peru, by John Hauxwell sometime between 1870 and 1885. Pebas remains the easternmost locality for the species. The holotype was probably in the Academy of Natural Sciences of Philadelphia. If so, it has apparently been lost (E. V. Malnate, personal communication). The specimens examined agree with Cope's description except that the holotype had smooth head scales, a straight rudimentary claw on the first digit of the manus, and a fifth digit on the pes that was smaller than the second. As noted by Ruibal (1952) these differences may be based in part on the poor condition of the holotype reported by Cope.

SPECIMENS EXAMINED. Colombia: Caquetá: Morelia (500 m) ANSP 25507-8; Villa Maria, 45 km S of Florencia (200-500 m) MCZ 61156; Putumayo: 10 km S of Mocoa (7-800 m) AMNH 106635-36; 7 km SE of Mocoa (700 m) AMNH 106637. Ecuador: Morona-Santiago: Lagarto Cocha (200-500 m) USNM 166355-56; Taisha (510 m) USNM 166357; Napo: Braga Cocha MCZ 93416-17; SE foot of Cordillera de Galeras, upper Río

Napo (600 m) USNM 166347; Limon Cocha (200–500 m) UKMNH 98601–03; Loreto (500–1000 m) USNM 166344–46; Puerto Libre, Río Aguarico (570 m) UKMNH 121826, 121852–54; 121784–808; Puerto Ore, Río Aguarico (420 m) UKMNH 121810; Río Llushin, N of Arapicos (500–1000 m) USNM 166348; Río Pucuno (500–1000 m) USNM 166343; San Francisco, Río Napo (200–500 m) UMMZ 84740–41; San José Viejo de Sumaco (\pm 1100 m) USNM 166349–50; Santa Cecilia (340 m) UKMNH 105368–69, 107035–36, 109767–72; 112205–16, 121811–25, 121827–31; near Tena (500 m) UMMZ 84739; 15 km ENE of Umbaqui (530 m) UKMNH 121809; Pastaza: Montalvo (314 m) USNM 166351–53; Sarayacu (400 m) MCZ 38442; USNM 166354. Peru: Loreto: Iquitos (117 m) AMNH 56260; FMNH 45477; near Iquitos, Río Itaya (100–200 m) AMNH 56261–62.

III. *Leposoma ioanna*, A NEW SPECIES FROM PACIFIC COASTAL COLOMBIA, AND RECORDS FOR *Leposoma southi*, NEW TO THE FAUNA OF COLOMBIA

Eleven specimens of *Leposoma* have been examined from the Pacific lowlands of Colombia. Two of these resemble *L. parietale* of the Amazonian slopes of Peru, Ecuador, and Colombia. Although the morphological distinctness of these two specimens is slight, they have probably been isolated from the Amazonian population by the Andes for sufficiently long so that they would develop antihybridization mechanisms (Remington, 1968) were contact to be renewed. I therefore name them as a distinct species.

Leposoma ioanna, new species

HOLOTYPE: FMNH 165798, an adult female from a lumber camp, "Carton de Colombia," 7 km W of Río Calima, Valle del Cauca, Colombia, on road to Buenaventura; 0–500 m above sea level; collected August 1963 by Isidoro Cabrera; original number 44.

PARATYPE: FMNH 165804, an adult female from 22 km on road from Buenaventura to Río Calima, Valle del Cauca, Colombia; 0–500 m above sea level; collected April 1962 by Isidoro Cabrera; original number 82.

DIAGNOSIS: A member of the genus *Leposoma* characterized by a single frontonasal, ventrals arranged in longitudinal rows, and conical rather than leaf-shaped scales on the side of the neck. The first feature distinguishes *L. ioanna* from *L. southi*, *L. scincoides* and *L. annectans*; the second distinguishes it from *L. scincoides* and *L. annectans*, and the third distinguishes it from *L. rugiceps* (Fig. 10).

Leposoma ioanna is most closely related to *L. percarinatum*, *L. guianense*, and especially *L. parietale*. It differs from *L. percarinatum* in having an



FIG. 10. Ventral view of the heads of specimens of *Lepsosoma parietale* and *Lepsosoma ioanna*, new species ($\times 10$). Above, UKMNH 121825, adult female *L. parietale*; below, FMNH 165798, adult female, holotype of *L. ioanna*. In *L. ioanna*, the third pair of chin shields is much reduced, the fourth pair is absent; the third pair is relatively large and a fourth pair is present in *L. parietale*.

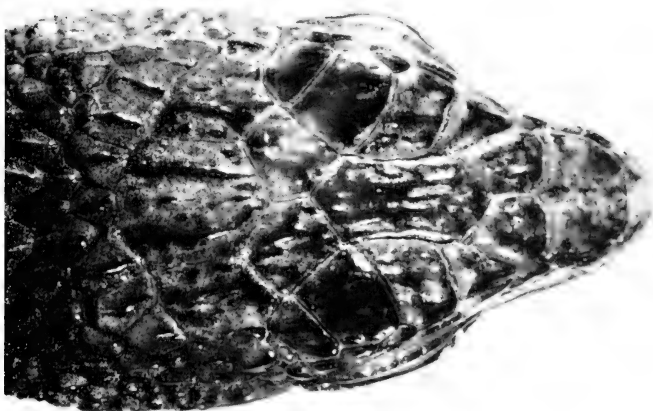


FIG. 11. Dorsal and oblique ventral views of the head of *Leposoma ioanna*, new species ($\times 10$). The oblique view shows the two small scales separating the much reduced third paired chin shield from the infralabials.

enlarged scale behind the longest supralabial; in having fewer (28–30) transverse dorsal scale rows (36–39 in *L. percarinatum*), and the third pair of chin shields much reduced and separated from the infralabials by two small scales (Figs. 10, 11). It differs from *L. guianense* in having the third pair of chin shields much reduced and separated from the labials by 2 small scales, a relatively shorter interparietal compared to the parietal length, and fewer transverse dorsal scale rows (31–35, mean 32.6 in *L. guianense*). It is most like *L. parietale*, from which it differs in having the third pair of chin shields much reduced and separated from the infralabials by two scales, and a somewhat reduced dark band (approximately two scales wide) along the sides of the body (4–5 scales wide in *L. parietale*). It may also average fewer transverse dorsal scale rows (29–36, mean 33.5 in *L. parietale*) and a larger maximum size (largest female of *L. parietale* measured was 38 mm snout-to-vent; holotype and paratype of *L. ioanna* are 41 and 39 mm snout-to-vent, respectively).

DESCRIPTION OF HOLOTYPE: (Figs. 10, 11). Rostral in contact with first supralabial, nasal, and single frontonasal. Frontonasal wider than long, in contact with rostral, nasal, loreal (narrowly) and paired prefrontals. Frontal approximately twice as long as broad, followed by paired frontoparietals. Interparietal longer than broad. Interparietal length 1.25 times parietal length. Supraoculars 4–4, the third largest, the first and fourth smaller. Superciliary series complete. Nasal divided into two parts behind the nostril. Loreal divided, the upper part small, in contact with lower part, nasal, frontonasal, prefrontal, large first superciliary, and a minute frenoocular; lower part in contact with second and third supralabials. A complete series of very small infraorbital scales. Supralabials 6–6, the last longest and highest, almost completely behind the orbit. Scale behind 6th supralabial along lip line noticeably larger than adjacent temporal scales. Temporal region covered with small scales. Scales of dorsal surface of head with longitudinal striations except for rostral and frontonasal. Scales of side of head smooth anterior to orbit, with longitudinal ridges posterior to orbit.

Infralabials 5–5. A mental; a single unpaired chin shield, followed by two large paired chin shields that contact each other across the midline and that contact the infralabials. Third pair of chin shields much reduced, separated from each other by small scales and from infralabials by two small scales (Figs. 10, 11). A gular fold with granules; pregulars (Ruibal, 1952) weakly keeled, obtusely angled. Gulars strongly keeled, long pointed, in diagonal and 7 longitudinal rows, including the weakly developed collar.

Dorsal scales immediately behind parietals and interparietal irregular; narrow, elongate, and strongly keeled on neck; becoming leaf-shaped and strongly keeled on dorsal surface of body; imbricate, in 28 irregular transverse rows between interparietal and posterior margin of hind limbs. Scales on side of neck conical; in axilla and groin, granular. Along sides of body, scales like dorsals but smaller and more strongly keeled. Lateral scales

grading into ventral scales, which are keeled and mucronate. Twenty-one scales around the midbody region. Between the arms, the imbricate ventral scales are in diagonal and transverse rows; behind this, in longitudinal and transverse rows. There are 20 transverse rows between the collar and the two rows of preanal scales. Five weakly keeled scales along the posterior margin of the vent, the paramedian larger; anterior to these, another row with a large median scale and two smaller, more anterior paramedian scales. Scales of tail in complete rings, those on dorsal and lateral surfaces more strongly keeled. Preanal pores represented by one minute chink on each side.

Scales of limbs keeled, overlapping, smallest on ventral surface of upper forelimb and on posterior surface of thigh. Scales at base of palm slightly enlarged; other palmer and plantar scales small, conical. Subdigital lamellae apparently doubled.

Coloration. The dorsal surface of the head is heavily mottled with dark brown. Anterior dorsal surface of snout lighter. Side of head dark but with light areas at sutures between supralabials. Infralabials dark spotted, but chin shields only lightly sprinkled with dark pigment, so that midventral area of head is light. Ventral surface of body generally light. Underside of tail with some dark pigment posteriorly. Laterally, an irregular dark brown dorsolateral line about two scales wide extending onto the tail. Above this a much lighter tan dorsal area, sprinkled middorsally with dark brown pigment. A dorsolateral light line above sacrum. No evidence of a light line along side of tail from hind limb insertion.

Body length 41 mm; total length (tail tip regenerated) 95 mm.

Variation. The paratype is similar in most respect, although with generally darker coloration. The paratype has 20 transverse rows of ventral scales between the collar and the preanal scales, 22 scales around the midbody region, and 30 transverse rows of dorsal scales. It is 39 mm snout-to-vent. The tail is missing.

The area of interparietal, estimated as mean of anterior and posterior widths times length, is 4.1 mm for the holotype, 3.9 mm for the paratype.

Several features of the holotype and paratype of *L. ioanna* were used in a canonical analysis along with specimens of closely related species (Fig. 7). This analysis confirms the distinctness of *L. ioanna* as far as it is possible on this sample.

The name *ioanna* is from the Greek *ιωαννα*; it is feminine and used in apposition to the generic name.

Leposoma southi Ruthven and Gaige

Alopoglossus copii, Boulenger, 1913, Proc. Zool. Soc. London, p. 1033.

Two specimens (BMNH 1913.11.12.35-36) collected by H. G. F. Spurrell at Peña Lisa (120 m elevation), near Condoto, Chocó, Colombia, were re-

ported by Boulenger (1913) as *Alopoglossus copii*. Each has the surface of the tongue covered with diamond-shaped papillae, rather than with the oblique folds that characterize *Alopoglossus*. Boulenger's identification emphasizes the morphological similarity of *Leposoma* and *Alopoglossus* (Ruibal, 1952; Uzzell, 1969b).

In addition to the two British Museum specimens, several other specimens not distinguishable from *Leposoma southi* have been examined (Table 1). They resemble *L. southi* and differ from *L. rugiceps* in having a divided frontoparietal and in having conical rather than leaf-shaped, imbricate scales on the side of the neck (Fig. 12). There is no light line along the side of the tail beginning at the hind limb insertions; such a light line is present in *L. rugiceps*. In other respects, the specimens fall in or near the limits of variation reported by Ruibal (1952). There are 19–21 (mean 20.1) transverse rows of ventral scales between the collar and preanal pores, 27–29 (mean 28.2) dorsals between the parietal and the posterior margin of the hind limbs, and 21–23 (mean 21.6) scales around the midbody region. The third pair of postmentals are separated from the labials by two small scales, and are not in contact on the midline. The three males have 2–2 preanal pores



FIG. 12. Side of the neck of *Leposoma rugiceps* (MLS 716) showing imbricate scales resembling dorsals ($\times 11$).

and 10–11 (mean 10.3) total femoral pores. The six females have only a single preanal pore on each side. The longest male is 40 mm snout-to-vent, the longest female, 37 mm. BMNH 1913.11.12.35 has 7 rather than 6 supralabials on the left side. The scale posterior to the long, last supralabial is relatively large, as in *L. guianense* (Fig. 5).

Ruibal (1952) considered the possibility that *L. southi* and *L. rugiceps*, which appeared to have allopatric ranges, are conspecific. He found no evidence of hybridization in the areas where the ranges of the two species appeared to approach each other. *L. southi* previously was known only from southern Costa Rica and in Panamá east to Barro Colorado in the Canal Zone. Specimens have since been collected in eastern Panamá (William E. Duellman, personal communication). *L. rugiceps* is known from the Canal Zone (but not Barro Colorado) east to the Santa Marta region of Colombia, and south in the valley of the Río Magdalena (Ruibal, 1952).

Taylor (1955, 1956) recognized two subspecies of *L. southi* in Costa Rica. Their relations to each other, to Panamanian populations, and to the Colombian specimens are not clear.

SPECIMENS EXAMINED. Colombia: Chocó: Peña Lisa, Condoto (300 m) BMNH 1913.11.12.35–36; 2 km above Playa de Oro, upper Río San Juan (210 m) AMNH 107264–65; Quebrado Docordó, ca. 10 km above junction with Río San Juan (100 m) AMNH 107263; Quebrado Vicordo, ca. 5 km above Noanamá, Río San Juan (80–110 m) AMNH 107259–62.

DISCUSSION. Discovery of populations of two species of *Leposoma* on the Pacific coast of Colombia reveals how much has yet to be learned about the herpetofauna of South America. The discovery of *L. ioanna* and the interpretation of *L. percarinatum* as a possible hybrid between *L. guianense* and *L. parietale* both suggest considerable shifting of the ranges of these lizards during their history.

Leposoma ioanna clearly shares a common ancestor with *L. parietale*. On the other hand, these two species are presently separated by the Andes, and the lowland area at the north end of the Andean ranges is occupied by *L. rugiceps*. It does not seem possible that they could recently have been connected by continuous populations. The events that account for the present separation, which is surely real, are not known.

If *L. percarinatum* is correctly interpreted as a species resulting from hybridization of *L. parietale* and *L. guianense*, then those two species, which appear very similar, must have been in contact at some time in the past. The most plausible history for these forms is disjunction of an ancestral population, probably across the lowlands between the Guianan Highlands and the Amazonian Andean slopes, followed by speciation. After some interval, the two daughter species again came into contact and, as a result of hybridization, produced the species *L. percarinatum*. At present, however, *L. parietale* and *L. guianense* seem no longer to be in contact.

Although these events are speculative, it would be of great interest to establish them more firmly, and then to establish probable dates for the various events. The persistence of many unisexual species would seem to be prolonged by a fixed heterozygosity that to some extent vitiates the absence of recombination, but unless sexuality can be restored, such species appear to be doomed in an evolutionary sense.

IV. A KEY TO THE SPECIES OF *Leposoma*

The following key is modified from Ruibal's 1952 key in light of the specimens reported here:

1. Frontonasal longitudinally divided 2
 Frontonasal single 4
2. Pregulars flat and quadrangular; ventrals in longitudinal rows; range: Costa Rica, Panamá, and Pacific Colombia *L. southi*
 Pregulars convex, posteriorly pointed; ventrals not in longitudinal rows 3
3. Interparietal neither longer nor broader than the parietals; third postmental in contact with the lower labials; range: Brazil
 *L. scincoides*
 Interparietal longer and broader than parietals; third postmental separated from the lower labials by a small scale; range: Baia, Brazil
 *L. annectans*
4. Scales on side of neck keeled, imbricate, shaped like dorsals; 27-31 scales from parietals to posterior margin of hind limbs *L. rugiceps*
 Scales on side of neck not shaped like dorsals; 28-39 scales from parietals to posterior margin of hind limbs 5
5. An irregular dorsolateral dark stripe 1 or 2 scales wide, extending onto tail where it is bordered below by a white stripe originating at insertion of hind limb; 36-39 scales from parietals to posterior margin of hind limbs; fourth pair of chin shields very small; no males known; Guianas, adjacent Venezuela and Brazil *L. percarinatum*
 Dorsal scales 28-36; fourth pair of chin shields very small or moderately large 6
6. Dark lateral stripe 4-5 scales wide; fourth pair of chin shields moderately large; Amazonian slopes of Ecuador and adjacent Colombia and Peru *L. parietale*
 Dark lateral stripe 1-2 scales wide; fourth pair of chin shields moderate or reduced 7
7. Fourth pair of chin shields moderately large; Guianas and adjacent Brazil *L. guianense*
 Fourth pair of chin shields very small; Pacific Colombia
 *L. ioanna*

V. THE HEMIPENIS OF SPECIES OF *Leposoma*

Hemipenes of three species of *Leposoma* have been examined. The left organ was removed from the lizard, washed overnight in distilled water, and stained with alizarin red S in 1% KOH. The hemipenes were slit along the sulcus spermaticus.

In *Leposoma rugiceps* (Fig. 13) the inverted organ has almost no median welt. The right and left halves contain well marked W-shaped flounces. At each apex of the W, there is a single large calcareous tooth. In both the right (medial) and left (lateral) halves of the organ, there are thus two striking rows of teeth; these number about 9 on each half. The distal part of the organ is marked by fleshy lobes. There are no calcareous spines in the basal part of the organ. No everted organs have been observed.

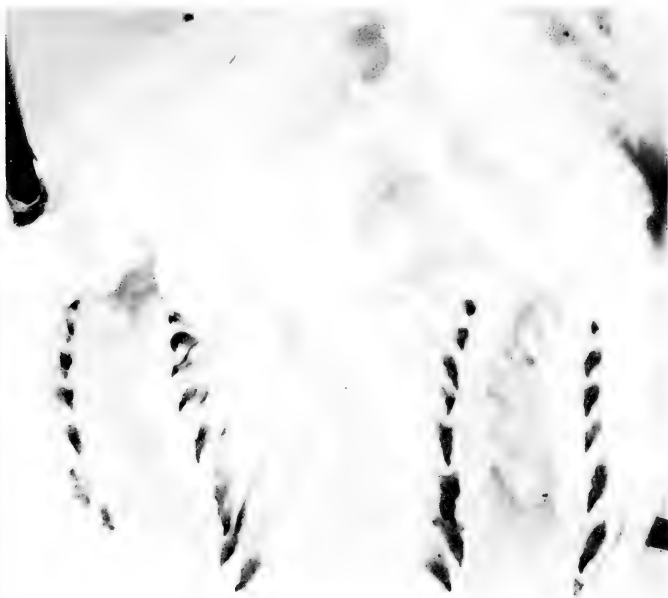


FIG. 13. Structure of the left hemipenis of *Leposoma rugiceps* (BMNH 1929.6.1.84). The inverted organ has been slit along the sulcus spermaticus and laid open, showing two rows of calcareous spinules in both lateral (left) and medial (right) pockets ($\times 32$).

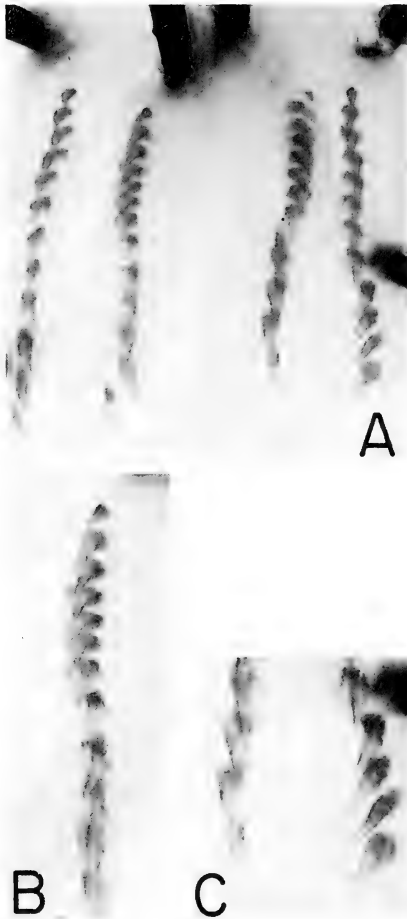


FIG. 14. Hemipenis of *Leposoma guianense* (BMNH 1698.877). A, left organ slit along sulcus spermaticus and laid open, showing two rows of calcareous teeth in each pocket ($\times 25$). B, C, details of teeth ($\times 36$).

The hemipenis of *L. guianense* is similar in many respects to that of *L. rugiceps*. The median welt is poorly developed, and there are weak W-shaped flounces in both medial and lateral halves of the organ. At the two apices of each flounce, there is a single large calcareous tooth (Fig. 14.) The teeth, which number between 12 and 14, are unicusate, although some of them have broad bases (Fig. 14B, C) and development of cusps on these teeth in some individuals is easy to imagine.

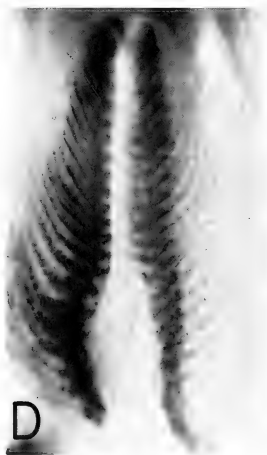
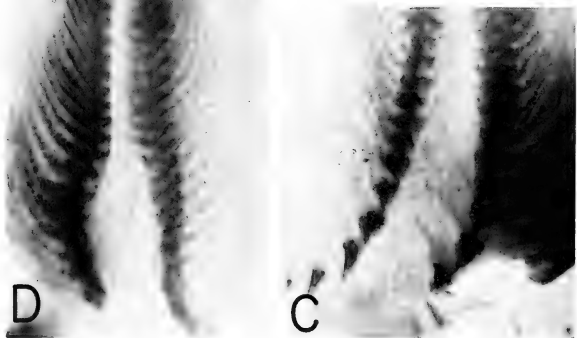
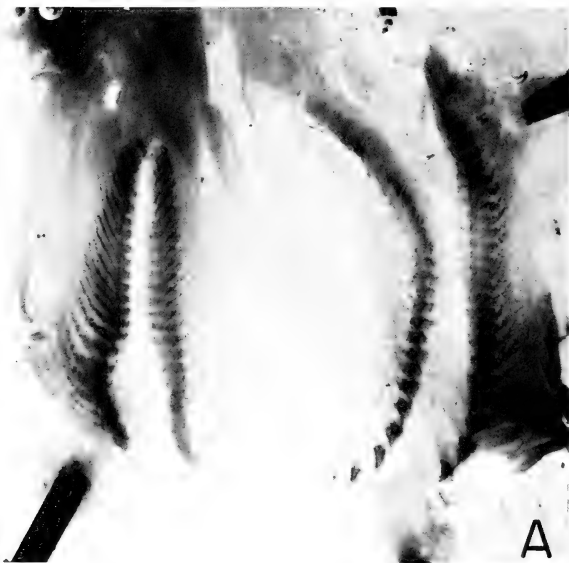
The hemipenis of *L. parietale* (Fig. 15) also has a reduced median welt and W-shaped flounces in both medial and lateral halves. The two apices of each W bear a single large unicusate tooth, although many of these have broad bases. There are more teeth (23–26) per row of apices than in *L. rugiceps* and *L. guianense*. In marked contrast to the hemipenes of *L. rugiceps* and *L. guianense* the flounces of the hemipenis of *L. parietale* contain series of denticles extending out from the apical tooth towards the median welt and towards the sulcus spermaticus. These denticles decrease in size with greater distance from the apical tooth (Fig. 15B). Denticles seem to be absent between the two apical teeth of a single W. These denticles lack the orderliness seen in the calcareous spinules in the flounces of many species of group II of the family Teiidae (cf. Uzzell, 1969a: figs. 2,3; 1970b: figs. 3–5).

The hemipenes of the three species that have been examined show certain common features. The median welt is reduced, and both the medial and lateral lobes of the organ have W-shaped flounces. Large teeth on the two apices of each W are common to all three species; this is the condition reported previously (Uzzell, 1969b). The hemipenis of *L. parietale* shows, in addition to these two rows of teeth, numerous denticles in each flounce. In this respect, the hemipenis shows a marked similarity to the hemipenis of *Arthrosaura kockii* (Figs. 16, 17). These flounces number about 20–23. On each flounce, extending from the enlarged tooth towards the median welt or from the other enlarged tooth towards the sulcus spermaticus, there is a long row of denticles. Such denticles also occur on some of the flounces between the large teeth, but are fewer and less well developed (Fig. 17).

On the basis of numerous features of scalation, *Arthrosaura* and *Leposoma* appear to be related (Uzzell, 1969b). The similarity of the hemipenial spines and flounces of *L. parietale* and *A. kockii*, especially the weak median welt, the W-shaped flounces in each half of the organ, the well developed teeth at the two apices of each W, and the numerous denticles adjacent to these strong teeth support the relationships of these two genera.

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FIG. 15. Hemipenis of *Leposoma parietale* (USNM 116351). A, left organ slit along sulcus spermaticus and laid open ($\times 24$). B, C, details of large teeth on apices of flounces ($\times 33$). D, detail of enlarged teeth and of denticular series extending along edges of flounces away from enlarged teeth ($\times 33$).



FIG. 16. Left hemipenis of *Arthrosaura kockii* (USNM 154269) slit along sulcus spermaticus and laid open to show lateral (left) and medial (right) pockets ($\times 23$).



FIG. 17. Medial pocket of left hemipenis of *Arthrosaura kockii* (USNM 159269), showing details of the enlarged, uni- to tricuspid teeth and the denticular rows along the edges of the flounces ($\times 38$).

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