



A new genus and species of eyelid-less and limb reduced gymnophthalmid lizard from northeastern Brazil (Squamata, Gymnophthalmidae)

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Abstract

Scriptosaura catimbau, a new genus and species of elongate, fossorial, sand swimming eyelid-less gymnophthalmid lizard is described on the basis of specimens obtained at Fazenda Porto Seguro, municipality of Buíque, State of Pernambuco, in the Caatingas of northeastern Brazil. The type locality is entirely included within the area of the recently created Parque Nacional do Catimbau. The new lizard lacks external forelimbs, has rudimentary styliiform hindlimbs and is further characterized by the absence of prefrontal, frontal, frontoparietal and supraocular scales, and by having one pair of chin shields. A member of the Gymnophthalmini radiation, the new genus is considered to be sister to *Calyptommatius* from which it differs externally by the absence of an ocular scale and absence of an enlarged temporal scale.

Key words: *Scriptosaura catimbau*, new genus, Gymnophthalmidae, taxonomy, Catimbau Nacional Park, Pernambuco State, Brazil, Caatingas

Resumo

Scriptosaura catimbau, um novo gênero e espécie arenícola de lagarto gimnofthalmídeo fossorial com corpo alongado e sem pálpebra é descrito com base em espécimes obtidos na Fazenda Porto Seguro, município de Buíque, estado de Pernambuco, nas Caatingas do nordeste brasileiro. A localidade tipo está inteiramente incluída no recentemente criado Parque Nacional do Catimbau. O novo lagarto, sem membros anteriores e com membros posteriores reduzidos a apêndices estiliformes caracteriza-se pela ausência de prefrontal, frontal, frontoparietal e supraocular e por apresentar um único par de escudos pós-mentais. O novo gênero pertence à tribo Gymnophthalmini e é considerado irmão de *Calyptommatius* do qual difere externamente pela ausência de escama ocular e de uma escama temporal muito aumentada, características do último gênero.

Palavras chave: *Scriptosaura catimbau*, gênero novo, Gymnophthalmidae, taxonomia, Parque Nacional do Catimbau, Estado de Pernambuco, Brasil, Caatingas

Introduction

In recent years the systematics of microteiid lizards, family Gymnophthalmidae, has been living a period of intense research. Several new genera (see for example Kok 2005; Myers & Donnelly 2001; Rodrigues 1991a,b,c; Rodrigues et al. 2005, 2007a), and new species (for example Cunha et al. 1991; Doan & Castoe 2003; Doan et al. 2005; Donnelly et al. 1992; Esqueda 2005; Köhler et al. 2004; MacCulloch & Lathrop 2001; Myers & Donnelly 2008; Rodrigues 1996a, 1997; Rodrigues & Avila-Pires 2005; Rodrigues & Borges 1997;

Rodrigues et al. 2001, 2002a,b, 2007b; Soares & Caramaschi 1998) have been described; genera have been reviewed and or redefined (Doan 2003; Doan & Castoe 2005; Harris 1994; Kizirian 1996), and new hypotheses of phylogenetic classification of the family have been proposed on the basis of molecular and morphological characters (Pellegrino et al. 2001; Castoe et al. 2004; Rodrigues et al. 2005, 2007a, in press). In Brazil, one of the most surprising discoveries of this phase was the addition of several new genera to a radiation of skink-like microteiids formerly known only from *Tretioscincus*, *Gymnophthalmus* and *Micrablepharus*. Five eyelid-less new genera were described for this radiation, most of them sand adapted to and living in or near the sandy areas of the middle course of Rio São Francisco in state of Bahia: *Calyptommatius* (Rodrigues 1991a), *Nothobachia* (Rodrigues 1984), *Psilophthalmus* (Rodrigues 1991b), and *Procellosaurinus* and *Vanzosaura* (Rodrigues 1991c); all new, except for the latter, formerly included in *Gymnophthalmus*. This radiation has been recognized as monophyletic and referred to as the tribe Gymnophthalmini of the Gymnophthalminae which also includes the Heterodactylini (Pellegrino et al. 2001; Rodrigues et al. 2005, 2007). The Gymnophthalmini includes all eyelid-less Gymnophthalmidae plus *Tretioscincus* (Pellegrino et al. 2001; Castoe et al. 2004; Rodrigues et al. 2005, 2007) and involves adaptations to fossoriality unexpected in South American microteiids. For example, the elongate sand swimming *Calyptommatius* is nocturnal, has the eye entirely covered by an ocular scale, lacks external forelimbs and hindlimbs are reduced to rudimentary appendages. This is in sharp contrast with *Nothobachia*, its diurnal sister genus, which, although also elongated, sand swimming and limb reduced, retains a distinct eye and a rudimentary forelimb, and has two digits on the hindlimb (Rodrigues 1991a; Pellegrino et al. 2001; Rodrigues et al. 2007).

In a recent trip to a sandy area resulting from the erosion of an extensive sedimentary plateau in the State of Pernambuco, Brazil, we were surprised to collect in the sandy soils another undescribed eyelid-less and sand swimming lizard of the same radiation. Like *Calyptommatius* and *Nothobachia*, the new taxon is limb reduced and has an elongate body but differs from both genera in several important characters. Due to these morphological gaps and to its autapomorphies, herein we describe it as a member of a new genus, which we consider most closely related to *Calyptommatius*.

Material and methods

Length measurements were taken after fixation to the nearest millimeter with a ruler or caliper. Scale counts and observations of other external morphological characters were performed with a stereomicroscope (Zeiss STEMI SV6). Scale nomenclature and scale counts follow Rodrigues et al. (2001). All material used for comparison is housed at the MZUSP (Museu de Zoologia da Universidade de São Paulo) herpetological collection.

Results

Taxon Description

Scriptosaura, gen. nov.

Definition: An elongate and short tailed gymnophthalmid lacking an ear opening and eyelid. Forelimbs absent, hindlimbs rudimentary, styliform, ending in a short apical scale; nail absent. Frontonasal single; prefrontals, frontal, frontoparietals, supraoculars, and loreal absent. Parietals longer than wide, contacting frontal. Nostril in the center of nasal. Collar fold absent. One pair of chin shields. Dorsal scales cycloid anteriorly, posteriorly smooth, hexagonal, keeled and slightly mucronate, in regular transverse series; lateral scales enlarged, smooth. Ventral scales smooth, in four regular transverse series, the external ones wider. Males with

four preanal pores, absent in females.

Etymology: From the Latin “scriptor” = writer, and “saura” = lizard in reference to the sand tracks left by this sand swimming species. The tracks are in the origin of its popular name (escrivão = public writer) which is also attributed to other similar sand swimming lizards like those of the related genera *Calyptommatus* and *Nothobachia*.

Content: *Scriptosaura catimbau*, new species, monotypic.

Comparisons: Externally, the absence of eyelids immediately leads us to associate the new genus with the Gymnophthalmini radiation of Gymnophthalmidae. Within the tribe the most similar genera are *Nothobachia* and *Calyptommatus*. Like *Scriptosaura* both are elongate, fossorial lizards lacking eyelids and an external ear opening. In external attributes *Scriptosaura* differs from *Nothobachia* by the absence of frontal and supraocular scales, by the fusion between first supraciliary and loreal (both scales distinct in *Nothobachia*), by having one pair of chin shields (two in *Nothobachia*), by the absence of forelimb (present in *Nothobachia* as a distinctive styliiform appendage), by the presence of a rudimentary styliiform appendage in the hind limb (leg distinctive with two clawed toes in *Nothobachia*) and a tail shorter than body (longer than body in *Nothobachia*).

Scriptosaura shares with *Calyptommatus* the absence of frontal and supraocular scales, the fused condition of first supraciliary and loreal, the absence of forelimbs, the rudimentary condition of hindlimb, and the short tail, although in *Scriptosaura* the tail is longer than in *Calyptommatus*. Nevertheless, externally *Scriptosaura* lacks two of the most characteristic synapomorphies of *Calyptommatus*: the ocular scale and the presence of an enlarged temporal on the lateral face of head. The eye in *Scriptosaura* is much larger than in *Calyptommatus* and is never covered by an ocular scale. Likewise the extremely enlarged temporal scale present in all species of *Calyptommatus* is absent in *Scriptosaura* whose narrow temporal scale resembles much more the condition observed in *Nothobachia*. Considering the other Gymnophthalmini, *Scriptosaura* differs from *Tretioscincus* by the absence of eyelid (present in the latter) and from *Tretioscincus*, *Micrablepharus*, *Gymnophthalmus*, *Procellosaurinus*, *Vanzosaura* and *Psilophthalmus* by its elongate body and limb reduced and short tail conditions (lizard-like body form with tail longer than body in the other genera), absence of an external ear opening, absence of frontal, supraocular and loreal scales and the presence of one pair of chin shields (two or three). From *Tretioscincus*, *Gymnophthalmus*, *Procellosaurinus*, *Vanzosaura* and *Psilophthalmus* it further differs by the absence of prefrontal scales, as well as from *Tretioscincus*, *Micrablepharus* and *Procellosaurinus* by the presence in these genera of frontoparietal scales, absent in *Scriptosaura*. Among the Gymnophthalmini, *Scriptosaura* is unique in having one pair of chin shields.

Scriptosaura differs from all other genera included in the Gymnophthalminae (*Heterodactylus*, *Colobodactylus*, *Alexandresaurus*, *Iphisa*, *Colobosaura*, *Acratosaura* and *Stenolepis*—tribe Heterodactylini, according to Pellegrino et al., 2001) among other characters by the absence of eyelid, absence of frontal, supraocular, and loreal scales, and, except for *Heterodactylus*, by the absence of external ear opening.

***Scriptosaura catimbau*, sp. nov.**

(Figs. 1, 2, 3)

Holotype: MZUSP 98059, an adult male from Fazenda Porto Seguro (08°29'13''S, 37°16'52''W), municipality of Buíque, Parque Nacional do Catimbau: State of Pernambuco: Brazil; collected on 7th March 2008 by Miguel T. Rodrigues and Ednilza Maranhão dos Santos, field number MTR 15401.

Paratypes: Males: MZUSP 98060, 98061, 98063, 98065, 98068–71, 98075, 98076; females: MZUSP 98062, 98064, 98066, 98067, 98072–4; collected between 7–8th March 2008 by Miguel T. Rodrigues and Ednilza Maranhão dos Santos; all other data as for the holotype.

Etymology: A noun in apposition, in reference to the type locality, Parque Nacional do Catimbau.

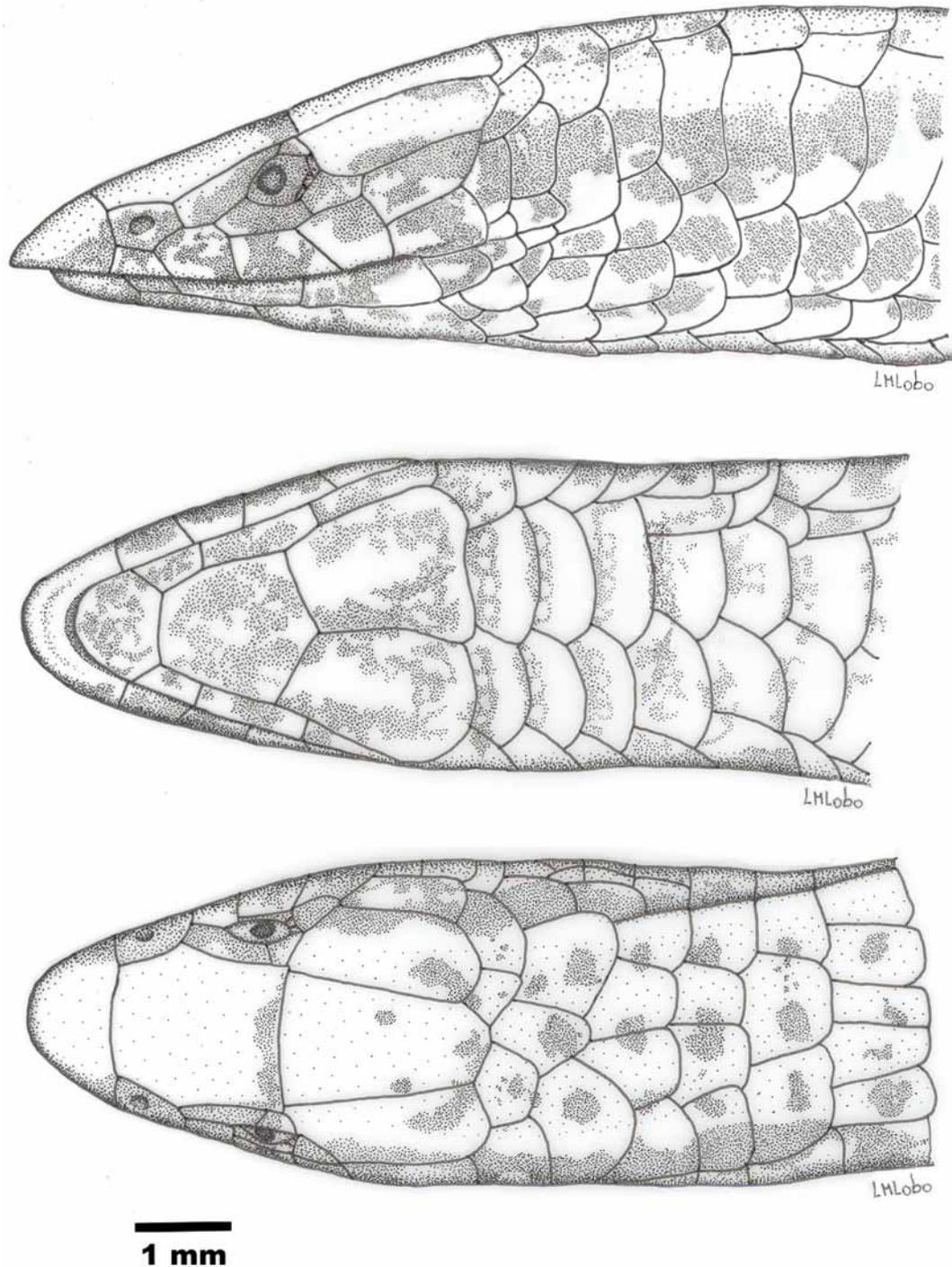


FIGURE 1. Lateral, ventral, and dorsal views of the head of the holotype of *Scriptosaura catimbau* (MZUSP 98059).

Diagnosis: A small elongate gymnophthalmid (maximum SVL 53 mm) with a prominent snout and body slightly longer than tail. Forelimbs absent, hindlimbs rudimentary, styliform, ending in a small apical scale. Ear opening and eyelid absent. Frontonasal single, contacting parietal; prefrontals, frontal, frontoparietals, supraoculars, and loreal absent. Parietals longer than wide. Nostril in the center of nasal. Two supraciliaries, the anterior one larger, diagonally disposed, contacting subocular. Collar fold absent. One pair of chin shields. Dorsal scales cycloid, smooth anteriorly, posteriorly hexagonal, keeled, in 39–41 regular transverse series; lateral scales enlarged, smooth. Ventral scales smooth, in 32–34 transverse rows and four regular longitudinal series, the external ones wider; 15–19 scales around body. Males with four preanal pores, absent in females.

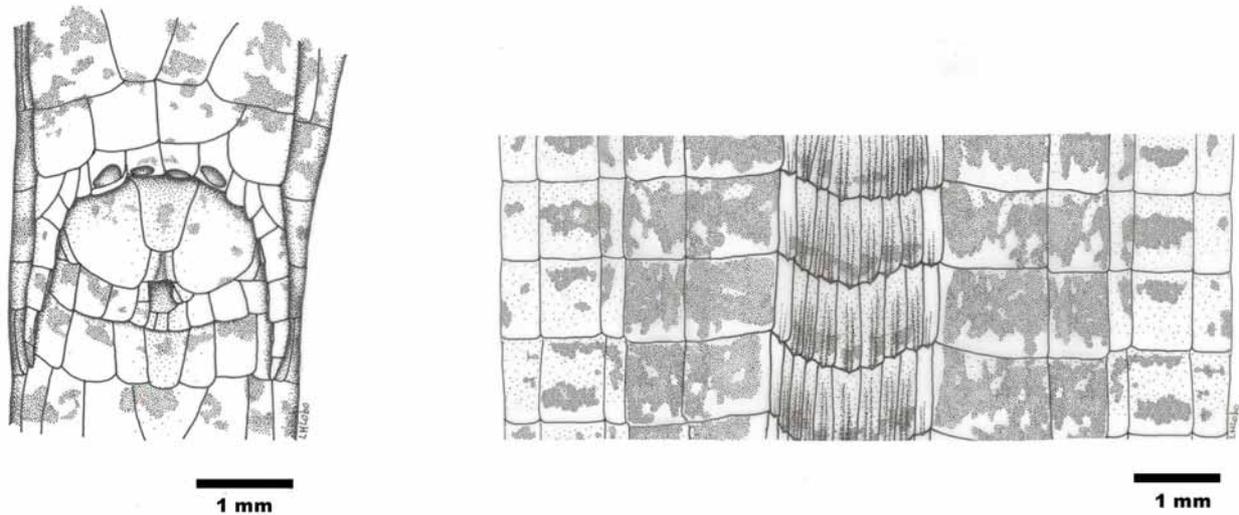


FIGURE 2. Ventral view of the hindlimbs and preanal region, and a schematic view of the midbody sculation of the holotype of *Scriptosaura catimbau* (MZUSP 98059).



FIGURE 3. Living specimen of *Scriptosaura catimbau* from Parque Nacional do Catimbau.

Description of the holotype (Figs. 1, 2): Body long, snout prominent, without pronounced constrictions in neck or base of tail; no evidence of collar fold. Rostral broad, broadly projecting over symphyisial; slightly wider than high, contacting first supralabial, nasal and frontonasal. In lateral view, the rostral forms an acute angle, with about 3/4 of its total length visible from above, the other quarter extends straight ventrally, in the same plane with the symphyisial. Frontonasal hexagonal, longer than wide, reaching the level of posterior margin of the eye, wider posteriorly, in contact with rostral, nasal, first and second supraciliaries, parietal, and

interparietal. Sutures with rostral and interparietal, broad and straight, that of first supraciliary concave, and those of second superciliary and parietal smaller. Prefrontals, frontals, supraoculars, and frontoparietals absent. Interparietal about twice as long as wide, as long as frontonasal and slightly longer than parietals; wider and straight anteriorly, posteriorly rounded; its lateral margins straight, converging posteriorly; separated from second supraciliary by parietal-frontonasal contact. Parietals irregularly hexagonal, longer than wide, contacting frontonasal, second supraciliary, a small postocular granule, an enlarged postocular, an enlarged elongate temporal, interparietal, and first dorsal row. A diagonally directed, postero-anterior oriented and polygonal supraciliary is longer than wide; anteriorly wider and contacting nasal, second supralabial, subocular, frontonasal and second supraciliary; longest suture with frontonasal. Second supraciliary small, contacting first supraciliary, frontonasal, parietal, and a small postocular. Subocular mostly above third supralabial, longer than wide, smaller than first supraciliary, contacting first supraciliary anteriorly and an enlarged postocular posteriorly which separates parietal and fourth supralabial. Eye small, as large as second supralabial, inserted between subocular, supraciliaries and three small postocular granules. Eyelids absent; eyeball round. Nasal pentagonal, above first and second supralabials, longer than wide, wider anteriorly, contacting additionally rostral, frontonasal and first supraciliary; nostril in center of nasal. Loreal and frenocular absent, probably fused with first supraciliary and corresponding to its wider portion. Five supralabials in the following order of increasing size of their base: first, fourth, second, third, and fifth; third below eye, fourth the highest. A longer than wide diagonally disposed temporal above fourth and fifth supralabials followed posteriorly by a series of dorso-ventrally oriented and imbricate higher than wide scales which cover tympanum; external ear opening absent.

Symphysial broad, with convex anterior border and straight posterior margin, slightly wider than long, contacting first infralabial and postmental, and situated clearly posterior to ventral edge of rostral. Postmental single, roughly pentagonal, longer than wide, contacting first and second infralabials. A single pair of genials in broad contact at midline and contacting second and third infralabials. Four infralabials, first the smallest, second and third the largest and with the same approximate size. All head scales smooth and juxtaposed, with irregularly distributed small sensorial organs. Two longitudinal series of transversally enlarged gular scales, smooth, imbricate, disposed in seven rows and extending from genials to the interbrachial region. Gular scales separated from lateral neck scales by a series of much smaller and longitudinally elongated and diagonally disposed scales. Interbrachial region with four longer than wide transversally disposed scales, the central ones larger. Ventrals in four longitudinal rows, the external one larger, the others longer than wide, imbricate, smooth, quadrangular; 33 transverse rows between gulars and preanal region.

Anterior dorsal scales cycloid, smooth and imbricate, wider than long or irregular in size, becoming longer than wide and rounded posteriorly at the level of fifth row and then progressively changing to hexagonal, slightly keeled and mucronate until the level of leg insertion; 40 regularly transverse rows between interparietal and posterior level of leg insertion; 19 scales around midbody. Lateral neck scales smooth, cycloid, imbricate; the uppermost rows being larger and higher than long; other lateral neck scales smaller, irregular in size and shape and disposed in two irregularly longitudinal rows. Flanks with a ventrolateral row of smooth, imbricate and elongate scales with approximately the same size as dorsals. Above it, two irregularly longitudinal rows of subrectangular enlarged scales.

Preanal region with four scales (Fig. 2), the two lateral ones larger than and separated on the midline by centrals, which are longitudinally in contact. Four preanal pores. Dorsal part of tail with slightly smaller scales than posterior dorsals but keeled and strongly imbricate. Other parts of tail identical to their corresponding parts of the body. Differences between dorsal, lateral, and ventral scales of tail disappear gradually towards tip of tail.

Forelimbs absent. Hindlimbs reduced to a needle-shape vestigial leg bud covered by five scales from the base to the tip; nail absent.

Dorsal surface of body and tail light brown with a regular series of transverse darker dots corresponding

to the posterior part of dorsal scales. A wide lateral dark brown stripe, formed by a highly irregular reticulate pattern and decreasing ventrally in conspicuity, extends along head, body, and tail from nasal to tip of tail. Ventral parts of head and gular region cream with an irregular dark brown reticulum. Ventral parts of body cream with a transverse series of dark brown dots, larger than dorsal ones. Tail color identical to body except ventrally where occasionally there are some dark spots, all the rest immaculate. Limb buds light brown dorsally with a reticulate pattern identical to that of lateral stripe; ventrally immaculate.

Measurements of the holotype: snout-vent length 45 mm; tail 19 mm (broken); diameter at midbody 4,2 mm; right leg bud 2,2 mm.

Variation: Males are slightly smaller and have slightly longer tails than females: maximum SVL for males and females were 48 mm and 53 mm, respectively. SVL varied respectively in males and females from 1.04 to 1.15 and 1.06 to 1.36 times tail length (r^2 males 0.99, $n = 4$; r^2 females 0.84, $n = 4$). No sexual differences were found in squamation. Variation in meristic characters ($n = 19$) was the following (mean and standard deviation, respectively, in parenthesis): dorsal rows, 39–41 (40.1 ± 0.65); ventrals 32–34 (33 ± 0.66); scales around midbody 15–19 (17.7 ± 1.04). Like the holotype, all specimens have two supraciliaries and one subocular, except for MZUSP 98074, with two suboculars. Likewise all the specimens have five supralabials, four infralabials, and seven gular rows, except for MZUSP 98075 which has eight. Four preanal pores are present in all males examined; they are absent in females. The styliform hindlimb is covered by five scales in all specimens. The color pattern of males and females is very similar except in adult males where ventral surfaces are characteristically reticulated with dark brown whereas in adult females and juveniles ventral surfaces are immaculate.

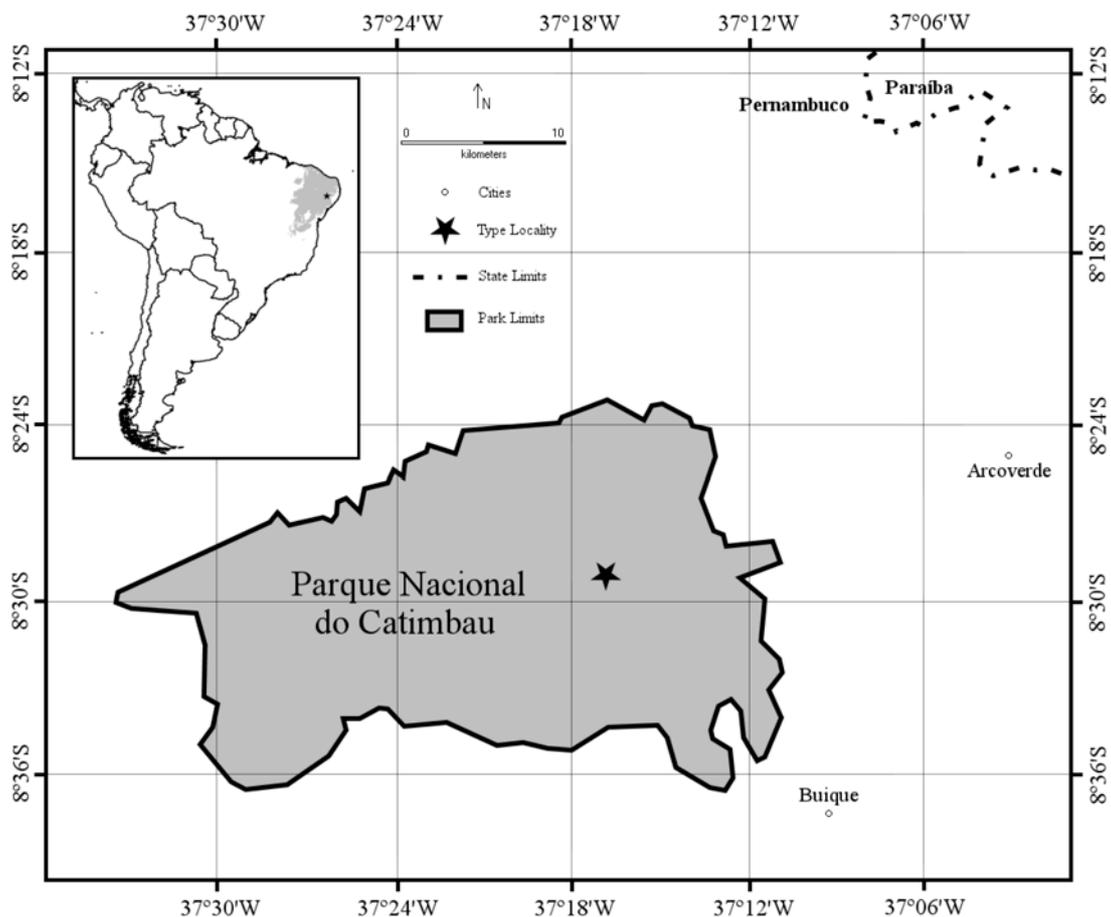


FIGURE 4. Type locality of *Scriptosaura catimbau* in the context of the Caatingas of northeastern Brazil (gray) and that of Parque Nacional do Catimbau.

Distribution and natural history: The Parque Nacional do Catimbau (Fig. 4) was recently created to protect the habitats included in or surrounding the highly eroded plateau of Silurian-Devonian sedimentary deposits of Tacaratu formation (Projeto RADAMBRASIL 1983; CPRM 2005) in the Caatingas of State of Pernambuco. The area, with about 62,000 hectares, consists of extensive arenitic and conglomerate outcrops of the plateau and areas of accumulation of sandy soils resulting from its erosion (RADAMBRASIL 1983). Sandstones are irregularly capped with conglomerates which gives some protection from erosion. The plateau, with elevations varying between 700 and about 1000 m, is highly dissected at the borders (Fig. 5A) and predominantly covered by a xeromorphic Caatinga vegetation. Plant families dominant in the area are the Euphorbiaceae, Caesalpinaceae, Myrtaceae, Mimosaceae, Fabaceae and Cactaceae (Gomes et al. 2006). Although less abundant, the Bromeliaceae are also characteristic either in the outcrops or in the sandy soils; in the latter habitat the caroá (*Neoglaziovia* sp.) is particularly frequent (Fig. 5B). On sandy areas vegetation cover consists basically of scattered thickets of variable size with a dry, and thin leaf litter generally concentrated at the basis of trees and bushes and separated by spaces of bare sand (Fig. 5B). At some places near the lower slopes of the highly eroded plateau where water is more abundant vegetation is higher and evergreen, and a denser and humid leaf litter is present. Annual mean temperatures and precipitation in the area are 26°C and 600 mm, respectively; most of the rain falls between April and June (Nimer 1979; Gomes et al. 2006).

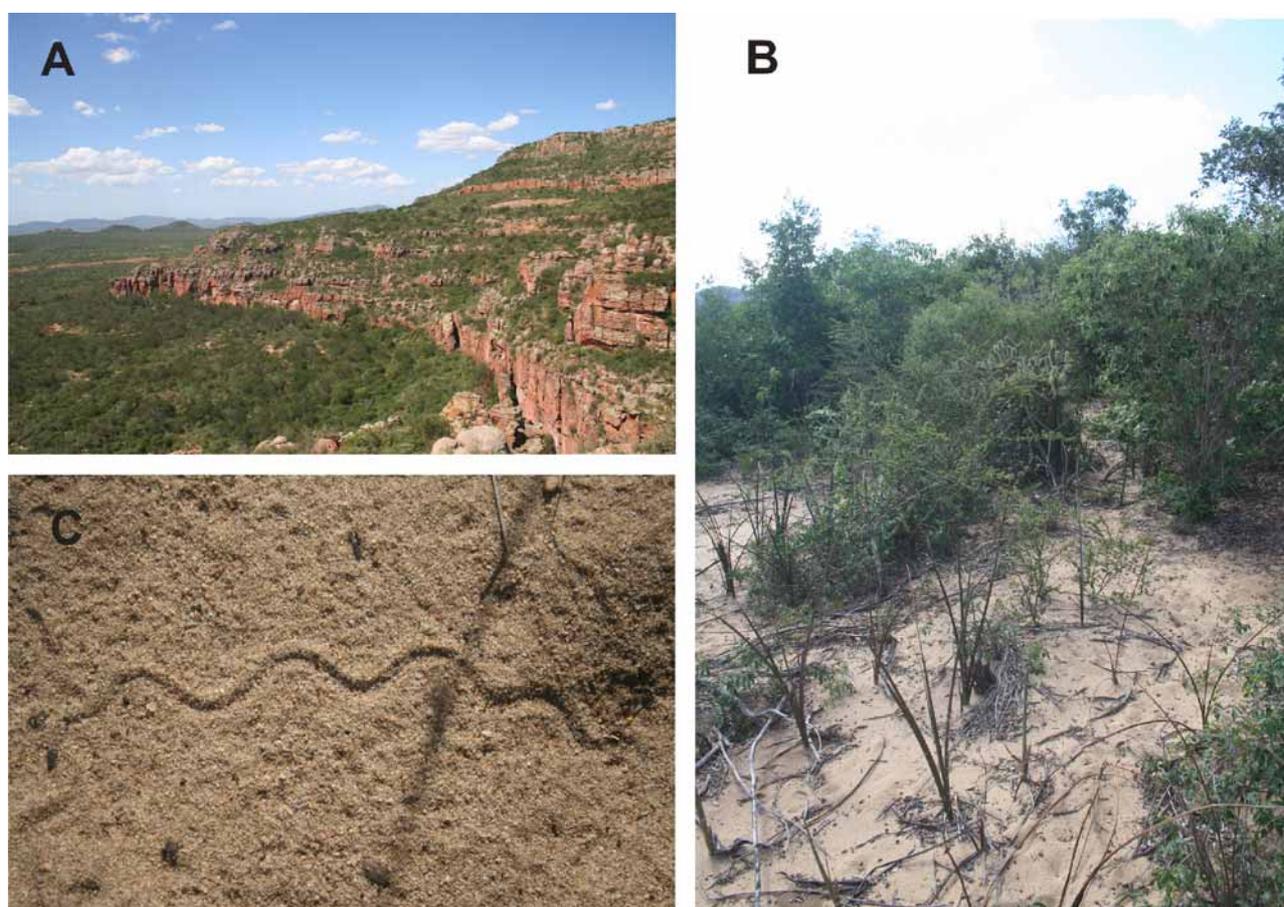


FIGURE 5. General aspect of the eroded border of the sandstone Silurian Devonian plateau at Parque Nacional do Catimbau, type locality of *Scriptosaura catimbau* (A); typical sandy habitat of *Scriptosaura catimbau*, note the abundance of the “caroá” (*Neoglaziovia* sp.), the thin bromeliad (B); track of *Scriptosaura catimbau* (C).

All specimens of *Scriptosaura catimbau* were found on the slopes of the northern border of the plateau, while searching among the leaf litter around vegetation thickets in the sandy areas. They were always found buried in the sand a few centimeters below surface. When exposed they always tried to escape with fast sand

swimming movements below sand. Although we obtained only 19 specimens, several escaped; the characteristic tracks left in the sand (Fig. 5C) suggest that the species is very abundant in the area. The presence of recent tracks during the day in areas previously searched for specimens and where tracks had been absent suggest diurnality. The presence of several small juveniles in our sample indicates their recent eclosion. Other lizards obtained in the area were the tropidurids *Tropidurus cocorobensis*, *Tropidurus hispidus*, and *Tropidurus semitaeniatus*, the iguanid *Iguana iguana*, the gymnophthalmids *Acratosaura mentalis*, *Anotosaura vanzolinia*, *Micrablepharus maximiliani*, and *Vanzosaura rubricauda*, the teiids *Ameiva ameiva*, *Cnemidophorus ocellifer* and *Tupinambis merianae*, the gekkonids *Hemidactylus brasilianus*, *Phyllopezus pollicaris*, and *Phyllopezus periosus*, and the scincid *Mabuya agmosticha*.

Discussion

The discovery of a new genus of a sand adapted gymnophthalmid lizard is not unexpected. Several sandy areas in the semiarid Caatingas of northeastern Brazil harbor endemic lizards and snakes and particularly gymnophthalmid lizards (Rodrigues 1996b; Rodrigues 2004; Rodrigues & Juncá 2002). This also seems to be the case for some sandy habitats in the Cerrado from where were recently reported endemic species of the snake-like gymnophthalmid genus *Bachia* (Rodrigues et al. 2007). With the progress of faunal surveys in Brazil it becomes more and more evident that endemic psammophilous squamates are present in several isolated sandy habitats in open areas. Among these regions, the sand dune region of the middle Rio São Francisco sticks out as the richest one. The fact that several species of *Calyptommatus*, *Nothobachia*, *Psilophthalmus*, and *Procellosaurinus* are restricted to that small region, suggests its historical importance (Rodrigues 1996b). Nevertheless, sand endemism in other areas indicates that sandy soils originated from sedimentary deposits of distinctive origins and ages, and by different processes, play a major role in maintaining and increasing biological diversity of fossorial squamates. For the endemic psammophilous squamate fauna from the sand dunes of middle Rio São Francisco, it has been suggested that speciation mechanisms involving ancestor stocks previously adapted to live on sand were possibly provoked by the river (Rodrigues 1996b; Rodrigues & Juncá 2002; Benozzatti & Rodrigues 2003; Passoni et al. 2008). Although our data, based only on external morphological characters, suggest that *Calyptommatus* and *Scriptosaura* are sister taxa we prefer to wait for an explicit and strongly supported phylogeny, based also on internal and molecular characters, to speculate on the mechanisms responsible for their origin. For now we can only say that the type locality of *Scriptosaura catimbau* is not far from the sand dune area of the middle Rio São Francisco. The arenitic plateau where *Scriptosaura catimbau* occurs is situated in the southern part of the State of Pernambuco, 130 km north of the left bank of the Rio São Francisco, about 300 km northeast of the sandy areas characterized by high endemism and where *Calyptommatus* and *Nothobachia* occur. We still know very little about the geological and geomorphological history of these sandy areas but it is clear that their origin, expansion, retreats, and disappearance have played an important role in the history of its sand adapted fauna. Considering that similar arenitic deposits of the Tucano-Jatobá basin are present at the Raso da Catarina, on the opposite side of Rio São Francisco we strongly suggest a careful investigation for the existence of fossorial gymnophthalmids in that area.

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